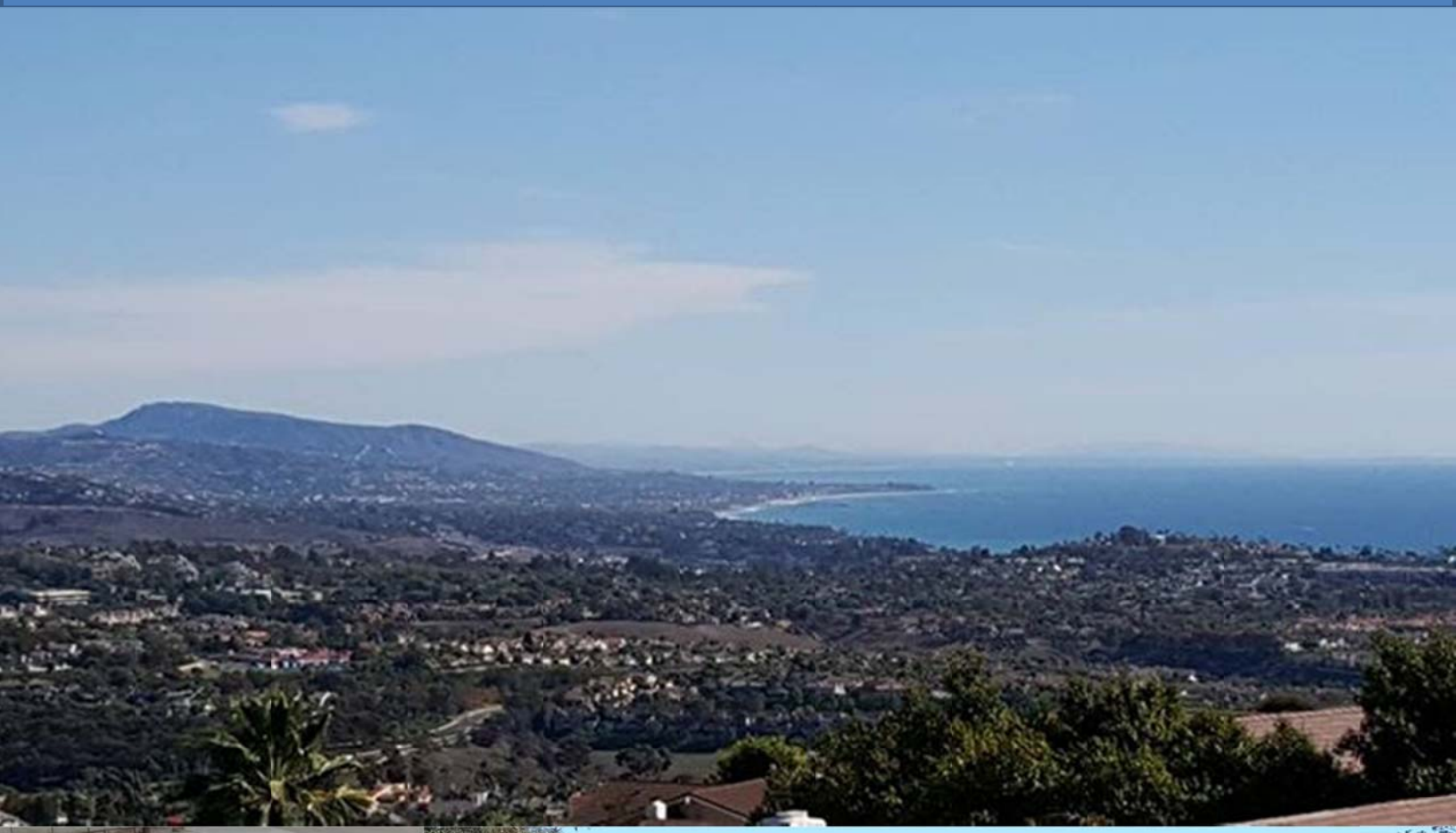
CITY OF LAGUNA NIGUEL WATER QUALITY LOCAL IMPLEMENTATION PLAN







January 2019

LOCAL IMPLEMENTATION PLAN
FOR THE
CITY OF LAGUNA NIGUEL

Version 1: February 2003
Revised November 2003
Revised November 2004
Revised November 2005
Revised December 2010
Revised March 2017

Current Revision: January 2019
Updated based on the approved WQIP and updated TGD and Model WQMP

TABLE OF CONTENTS

A-1.0 INTRODUCTION
A-1.1 BACKGROUND
A-1.2 REGULATORY REQUIREMENTS
A-1.3 OBJECTIVES OF THE LOCAL IMPLEMENTATION PLAN
A-1.4 PERMITTEE COMMITMENTS
A-1.5 DAMP/LIP COVERAGE
A-1.6 DESCRIPTION OF DRAINAGE AREA AND CLIMATE
A-1.7 PROGRAM ASSESSMENT AND MODIFICATION

A-2.0 PROGRAM MANAGEMENT
A-2.1 INTRODUCTION
A-2.2 MAJOR MANAGEMENT ACTIVITIES

A-3.0 PLAN IMPROVEMENT AND WATERSHED PLANNING
A-3.1 INTRODUCTION
A-3.2 PLAN DEVELOPMENT
A-3.3 FUNDING OF STRUCTURAL CONTROLS
A-3.4 EMPLOYEE TRAINING AND OUTREACH

A-4.0 LEGAL AUTHORITY
A-4.1 INTRODUCTION
A-4.2 REGULATORY REQUIREMENTS
.A-4.3 AUTHORITY TO CONTROL POLLUTANT DISCHARGES
A-4.4 ENFORCEMENT
A-4.5 ASSESSMENT

A-5.0 MUNICIPAL ACTIVITIES COMPONENT
A-5.1 INTRODUCTION
A-5.2 MODEL MUNICIPAL ACTIVITIES PROGRAM DETAILS
A-5.3 MODEL INTEGRATED PEST MANAGEMENT, PESTICIDES AND FERTILIZER GUIDELINES
A-5.4 TRAINING AND EDUCATION

A-6.0 PUBLIC EDUCATION
A-6.1 INTRODUCTION
A-6.2 REGULATORY REQUIREMENTS
A-6.3 MODEL PUBLIC EDUCATION PROGRAM
A-6.4 CITY EDUCATION PROGRAM

A-7.0 NEW DEVELOPMENT/SIGNIFICANT REDEVELOPMENT COMPONENT
A-7.1 Introduction
A-7.2 General Plan Assessment
A-7.3 CEQA Environmental Review Process
A-7.4 DEVELOPMENT PROJECT REVIEW, APPROVAL AND PERMITTING
A-7.5 PROJECT WATER QUALITY MANAGEMENT PLAN (WQMP) PREPARATION
A-7.6 EDUCATION AND TRAINING

A-8.0 CONSTRUCTION COMPONENT
A-8.1 INTRODUCTION
A-8.2 MODEL CONSTRUCTION PROGRAM
A-8.3 EDUCATION AND TRAINING

A-9.0 EXISTING DEVELOPMENT
A-9.1 INTRODUCTION
A-9.2 INDUSTRIAL/COMMERCIAL PROGRAM
A-9.3 FOOD SERVICE FACILITIES INSPECTION PROGRAM
A-9.4 MOBILE BUSINESS PROGRAM
A-9.5 RESIDENTIAL PROGRAM
A-9.6 COMMON INTEREST AREAS/HOMEOWNERS ASSOCIATION ACTIVITIES PROGRAM
A-9.7 RETROFITTING EXISTING DEVELOPMENT PROGRAM
A-9.8 TRAINING PROGRAM

A-10.0 ILLEGAL DISCHARGES/ILLICIT CONNECTIONS COMPONENT
A-10.1 INTRODUCTION
A-10.2 ILLEGAL DISCHARGES/ILLICIT CONNECTIONS PROGRAM
A-10.3 EDUCATION AND ENFORCEMENT
A-10.4 TRAINING

Acronyms

303(d)	EPA List of Impaired Waters
ACL	Administrative Civil Liability
ACO	Administrative Compliance Order
AI	Authorized Inspector
APWA	American Public Works Association
AMAL	Average Monthly Action Level
ASBS	Area of Special Biological Significance
AQMD	Air Quality Management District
BAT	Best Available Technology
BCT	Best Conventional Technology
BIA	Building Industry Association
BMP	Best Management Practice
BPJ	Best Professional Judgement
Basin Plan	Water Quality Control Plan for the San Diego Basin
CAP	Household Hazardous Waste Community Awareness Program
CAR	Critical Aquatic Resources
CASC	Countywide Areas Spill Control Program
CASQA	California Stormwater Quality Association
CC&Rs	Covenants, Codes & Restrictions
CDFW	California Department of Fish & Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CGP	Construction General Permit
CHP	California Highway Patrol
CIA	Common Interest Areas
CUPA	Certified Unified Program Agency
CWA	Clean Water Act
CWC	Clean Water Code
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
DA	District Attorney
DAMP	Drainage Area Management Plan
DCIA	Directly Connected Impervious Area
DHS	Department of Health Services
DMV	Department of Motor Vehicles
DOT	Department of Transportation
DTSC	Department of Toxic Substance Control
EA	Enforcing Attorney
ECG	Enforcement Consistency Guide
EHS	Environmental Health Services
EOC	Emergency Operations Center
EMC	Event Mean Concentration
EPA	Environmental Protection Agency
EPR	Environmental Performance Reporting
ERP	Enforcement Response Plan

Acronyms

ESA	Environmentally Sensitive Area
FC	Fecal Coliform
FIM	Fecal Indicator Bacteria
GIS	Geographic Information System
GPM	Gallons per Minute
GPS	Global Positioning System
GRBOD	Geomorphically-referenced Basis Of Design
HAZMAT	Hazardous Materials
HCA	Health Care Agency
HHW	Household Hazardous Waste
HMI	Hazardous Materials Incident
HOA	Homeowner's Association
HPWQC	Highest Priority Water Quality Conditions
HSA	Hydrologic Sub Area
HU	Hydrologic Unit
HWI	Hazardous Waste Inspector
IBI	Index of Biological Integrity
IC	Incident Commander
IDDE	Illicit Discharge Detection and Elimination
ID/IC	Illegal Discharge/Illicit Connection
IPM	Integrated Pest Management
IRWD	Irvine Ranch Water District
IRWMP	Integrated Regional Water Management Plan
IWMD	Integrated Waste Management Department
JPA	Joint Powers Authorities
JRMP	Jurisdictional Runoff Management Plan
LID	Low Impact Development
LIP	Local Implementation Plan
LC	LIP Coordinator
MDAL	Maximum Daily Action Level
MEP	Maximum Extent Practicable
MOU	Memorandum of Understanding
MPN	Most Probable Number
MRP	Monitoring and Reporting Programs
MS4	Municipal Separate Storm Sewer System
NAL	Non-Stormwater Action Level
NAICS	North America Industry Classification System
NEPA	National Environmental Policy Act
NNC	Notice of Non-compliance
NCCP	Natural Community Conservation Planning Program
NOA	Notice Of Applicability
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NSE	Natural Source Exclusion
OC	Orange County

Acronyms

OCC	Orange County Code
OCFA	Orange County Fire Authority
OCFCD	Orange County Flood Control District
OCP	OC Planning
OCPW	OC Public Works
OCSD	Orange County Sanitation District
OCTA	Orange County Transportation Authority
OES	Office of Emergency Services
O&M	Operations & Maintenance
OWTS	On-site Waterwater Treatment System
PDSD	Planning & Development Services Department
PEA	Program Effectiveness Assessment
PNIR	Pollution Notification/Investigation Request
PPE	Personal Protective Equipment
PWQC	Priority Water Quality Conditions
QA/QC	Quality Assurance/Quality Control
RAA	Reasonable Assurance Analysis
RCRA	Resource Conservation and Recovery Act
RMV	Rancho Mission Viejo
ROMP	Runoff Management Plan
ROWD	Report of Waste Discharge
RP	Responsible Party
SAL	Stormwater Action Level
SAR	Santa Ana Region
SAMP	Special Area Management Plan
SBPAT	Structural BMP Prioritization and Analysis Tool
SCAG	Southern California Association of Governments
SCCWRP	Southern California Coastal Water Research Project
SDR	San Diego Region
SDRWQCB	San Diego Regional Water Quality Control Board
SEEP	SmarTimer Edgescape Evaluation Project
SIC	Standard Industrial Classification Code
SOC	South Orange County
SOCWA	South Orange County Wastewater Authority
SOCWMA	South Orange County Watershed Management Area
SR	Spill Responder
SSMP	Sewer System Management Plans
SSO	Sanitary Sewer Overflow
SUSMP	Standard Urban Storm Water Mitigation Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TLR	Target Load Reduction
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids

Acronyms

UCI	University of California, Irvine
UHWM	Uniform Hazardous Waste Manifest
USEPA	United States Environmental Protection Agency
WAP	Watershed Action Plan (Formerly Watershed Urban Runoff Management Plan)
WDR	Waste Discharge Requirement
WDID	Waste Discharge Identification Number
WDR	Waste Discharge Requirements
WLA	Water Load Allocation
WMA	Watershed Management Area
WMAA	Watershed Management Area Analysis
WQBEL	Water Quality Based Effluent Limitation
WQIP	Water Quality Improvement Plan
WQMP	Water Quality Management Plan
WQO	Water Quality Objective
WSPA	Western States Petroleum Association
WY	Water Year

Glossary

Best Management Practice (BMP)

A technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of stormwater runoff in the most cost-effective manner.

Clean Water Act and Amendments

The Federal Pollution Control Act (Public Law 92-500), as amended (33 U.S.C. 1251 et seq.). Federal regulation mandating a National Pollutant Discharge Elimination System permit for discharges into the Waters of the United States. The goals of the act are to restore and maintain the chemical, physical and biological integrity of the nation's waters.

Construction General Permit

The NPDES general permit for stormwater discharges associated with construction activity. SWRCB Order No. 2009-0009-DWQ DWQ, NPDES General Permit No. CAS000002 or its subsequent replacement.

Control Measures

Major groupings of the specific BMPs that are developed and implemented for a program element. There are typically several control measures for each program element.

Effectiveness Assessment

The process that is used to evaluate if the programs are resulting in desired Outcomes.

First Term Permits

The Regional Boards issued Municipal Stormwater Permits No. CA 8000180 and No. CA 0108740 to the Permittees in 1991 for the period from 1990 – 1996.

Fifth Term Permit

The Regional Board re-issued the Municipal NPDES Stormwater Permit as San Diego Region Order No. R9-2013-0001 as amended by Order Nos. R9-2015-0001 and R9-2015-0100, NPDES Permit No. CAS0109266

Fourth Term Permit

The Regional Board re-issued the Municipal NPDES Stormwater Permit in 2009 as San Diego Region Order No. R9-2009-0002

General Industrial Permit

The NPDES general permit for stormwater discharges associated with industrial activity. SWRCB Order No. 2014-0057-DWQ, NPDES General Permit No. CAS000001 or its subsequent replacement.

Glossary

General Permittee Committee

The committee made up of a representative from each of the Permittees that provides the overall guidance for the NPDES Stormwater Program.

Headline Indicator

A sub-set of measures that reflect, in simple terms, how a stormwater program is progressing towards its goals and are easily understandable.

Hydromodification

Hydromodification is the alteration of natural flow characteristics.

Illegal Discharge

Any discharge to a municipal separate storm sewer that is not composed entirely of stormwater and that is not covered by an NPDES permit or identified in the NPDES Stormwater permit as an allowed discharge.

Illicit Connection

Any man-made conveyance or drainage system, pipeline, conduit, inlet or outlet, through which the discharge of any pollutant to the stormwater drainage system occurs or may occur.

Implementation Agreement

The agreement underpinning County and city cooperation which establishes the responsibilities of each Permittee and a funding mechanism for the shared costs of the Program.

Implementation Assessment

The analysis of the effectiveness of a program element or control measure at meeting desired programmatic Outcomes or goals.

Integrated Assessment

The process of evaluating whether stormwater program implementation is resulting in the protection or improvement of water quality.

Iterative Approach

A stormwater program is developed, implemented, and assessed in repeated cycles. In each cycle the program is implemented and then refined based on the effectiveness assessment results.

Local Implementation Plan (LIP)/Jurisdictional Runoff Management Plan (JRMP)

The Permittee specific document that details how the stormwater programs within the DAMP are implemented within their local jurisdictions (synonymously referred to as a LIP in the Santa Ana Region and a JRMP within the San Diego Region).

Low Impact Development (LID)

LID is an approach to land development (or re-development) that works with nature to manage storm water as close to its source as possible by using

structural and non-structural best management practices to reduce environmental impacts.

Orange County Stormwater Program

The program designed by the Orange County Permittees for compliance with the NPDES permits.

Outcomes

Outcomes are the results of implementing a stormwater control measure, program element or overall program. Outcomes defined by the California Stormwater Quality Association are categorized in terms of six Outcome Levels, which can have implementation or water quality endpoints.

Outcome Levels

Outcome Levels help to categorize and describe the desired results or goals of programs and control measures.

National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit

A provision of the CWA, section 402, that identifies municipal stormwater as a point source subject to regulation under the NPDES Permits.

Permittees

The cities of Aliso Viejo, Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, Mission Viejo, Rancho Santa Margarita, San Clemente, San Juan Capistrano; the County of Orange; and the Orange County Flood Control District and any subsequently incorporated cities that become subject to the NPDES permit. Each Permittee is individually responsible for the implementation of the program elements within its jurisdiction.

Point Source

Any discernable, confined, and discrete conveyance, including any conduit pipe, ditch, channel, sewer, tunnel, vessel, or other floating craft from which pollutants are or may be discharged.

Principal Permittee

The County of Orange is the Permittee designated with the responsibility to manage the NPDES Municipal Stormwater Program on behalf of the Permittees.

Regional Water Quality Control Boards

The Santa Ana and San Diego Regional Water Quality Control Boards are agencies that implement and enforce Clean Water Act Section 402(p) NPDES permit requirements, and are issuers and administrators of these permits on behalf of EPA within Orange County.

Report of Waste Discharge (ROWD)

Constitutes the application to the RWQCB for the NPDES permit. The ROWD presents the compilation of data from the current and previous permit terms and describes the proposed plan for future activities.

San Diego Regional Board

The Regional Board that issues the NPDES Municipal Stormwater Permit for Orange County from approximately El Toro Road down southward to the San Diego County border. The Permittees in the San Diego Regional Water Quality Control Board jurisdiction include the County of Orange, the Orange County Flood Control District and the eleven (11) incorporated cities of Aliso Viejo, Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, Mission Viejo, Rancho Santa Margarita, San Clemente, and San Juan Capistrano.

Second Term Permits

The Regional Boards re-issued the Municipal NPDES Stormwater Permits in 1996, San Diego Region CAS618030, which covered the time period from 1996-2002.

State Water Resources Control Board

State agency that sets statewide policy for the nine Regional Water Quality Control Boards.

Total Maximum Daily Loads (TMDL)

A written, quantitative analysis and plan for attaining and maintaining water quality standards in all seasons for a specific waterbody and pollutant.

Third Term Permits

The Regional Boards re-issued the Municipal NPDES Stormwater Permits in 2002, San Diego Region Order No. R9-2002-0002, which covers the time period from 2002-2007.

Water Quality Assessment

The use of environmental data and related information to characterize the quality of stormwater discharges and the water bodies that receive these discharges.

Water Quality Planning Process

Systematic and detailed evaluation of the impacts of urban water quality on beneficial uses to determine or validate that actual impairments exist that warrant corrective action.

A-1.0 INTRODUCTION

This document constitutes the City of Laguna Niguel's Local Implementation Plan (LIP) prepared as part of a compliance program pursuant to the California Regional Water Quality Control Board, San Diego Region, Order No. R9-2013-0001 as amended by Order Nos. R9-2015-0001 and R9-2015-0100, NPDES Permit No. CAS0109266 (termed *Fifth Term Permit*). the LIP contains all the information specified for Provision E, Jurisdictional Runoff Management Program (JRMP), and should, for purposes of compliance be considered to a JRMP.

This plan describes the activities that the City is undertaking to meet the requirements of the Fifth Term Permit and to protect and improve the quality of the creeks, streams and coastal waters within the urban areas of the San Juan Hydrologic Unit, also referred to as the South Orange County Watershed Management Area (WMA) to which the city contributes runoff. Although the LIP is intended to serve as the basis for City compliance during the entire period of the Fifth Term Permit, the LIP is subject to modifications and updates as the City determines necessary, or as directed by the Regional Board.

A-1.1 BACKGROUND

This plan addresses the impacts to creeks, rivers, streams and coastal waters that can arise from the imprint of urban development on the landscape. Urbanization creates impervious surfaces such as rooftops, driveways, roads and parking lots, which can (1) increase the timing and volume of rainfall runoff (compared to pre-development conditions) and (2) provide a source of pollutants that are flushed or leached by rainfall runoff or dry weather runoff into surface water systems.

The environmental consequences of urban area runoff can be loss or impairment of aquatic beneficial uses due to:

- Water quality degradation from increased loadings of sediment, nutrients, metals, hydrocarbons, pesticides, and bacteria;
- Reduced biotic richness, with increased dominance of tolerant species;
- Changes in channel morphology and habitat loss from increased severity and frequency of runoff events;
- Loss of groundwater recharge, and
- Increased water temperatures from solar energy absorption by urban surfaces and elimination of riparian shading.

These impacts have been referred to by Walsh (2005[1]) as the symptoms of "urban stream syndrome" and while these impacts are often mostly attributed to urban stormwater runoff delivered to streams by constructed drainage systems, other stressors, including sanitary sewer overflows, authorized wastewater discharges, and legacy pollutants can also be important

[1] Christopher J. Walsh,1,* Allison H. Roy,2,† Jack W. Feminella,3,‡ Peter D. Cottingham,4,§ Peter M. Groffman,5,‖ and Raymond P. Morgan II6,#, "The urban stream syndrome: current knowledge and the search for a cure," Journal of the North American Benthological Society 24, no. 3 (September 2005): 706-723.

determinants of urban stream system condition.

The stormwater pollution control effort, of which this LIP is a part, is the result of four decades of legislative effort beginning with the 1972 Federal Water Pollution Control Act, subsequently known as the Clean Water Act (CWA). In 1987, the Water Quality Act brought stormwater discharges into the National Pollutant Discharge Elimination System (NPDES) program and United States Environmental Protection Agency subsequently issued implementing regulations on November 16, 1990.

In response to these regulations, the City of Laguna Niguel, County of Orange, the Orange County Flood Control District and the other incorporated cities of Orange County (collectively referred to as Permittees[2]) have obtained, renewed and complied with NPDES Stormwater Permits from the Santa Ana and San Diego Regional Water Quality Control Boards. Each permit renewal has required the Permittees to continue to implement stormwater quality management programs, and update and develop additional programs at countywide and watershed scales of implementation to control pollutants in dry and wet weather urban runoff.

The City's stormwater quality management program reduces pollutant discharges through the implementation of a variety of measures commonly referred to as Best Management Practices (BMPs). BMPs are integral to the city's construction and maintenance of its urban municipal infrastructure. Regulatory oversight ensures BMP implementation at locations of businesses, commerce and construction activity and public education and outreach encourages adoption of practices protective of water quality in residential areas. When land is developed or re-developed, preparation of a Project Water Quality Management Plan (WQMP) is required for all projects meeting Priority Development Project (PDP) criteria.

Since 1990, the City has cooperated with the County of Orange, the Orange County Flood Control District and the other cities in Orange County (collectively the Orange County Stormwater Program or "Program"). The result of this cooperation has been the development of a series of model stormwater program elements that comprise the county-wide Drainage Area Management Plan (DAMP). In developing this LIP, the City of Laguna Niguel has used the DAMP as the foundation for its program development and the two documents and a watershed management plan (see discussion in **Section A-1.2** regarding Water Quality Improvement Plan)), in effect, act as companion parts of the City's compliance program.

A-1.2 REGULATORY REQUIREMENTS

Section 402(p) of the CWA, as amended by the Water Quality Act of 1987, requires that municipal NPDES Permits include:

1. A requirement to effectively prohibit non-stormwater discharges into municipal storm sewers; and
2. Controls to reduce the discharge of pollutants from municipal storm drains to the maximum extent practicable (MEP), including management practices, control techniques

[2] The terms Copermittee and Permittee are synonymous. Permittee is used for countywide consistency

and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants.

Regulations promulgated by EPA on November 16, 1990 (40 CFR 122.26 (d)(2)(iv)) require municipal NPDES permit applicants to develop a management program to effectively address these requirements. According to these regulations the management program, , "*shall include a comprehensive planning process which involves public participation and where necessary intergovernmental coordination, to reduce the discharge of pollutants to the maximum extent practicable using management practices, control techniques and system, design and engineering methods, and such other provisions which are appropriate*."

The Fifth Term Permit retains the prescribed program elements of the prior permits and places additional regulatory emphasis on watershed planning with new requirements for the development and implementation of a Water Quality Improvement Plan (WQIP). This plan is intended to guide jurisdictional efforts toward achieving the outcome of improved water quality in discharges and receiving waters by enabling management resources to be directed toward priority water quality constituents of concern and/or underlying priority water quality conditions thereby providing a regulatory basis for addressing both the symptoms and underlying causes of urban stream syndrome.

Currently, some of the Copermittees including the City are pursuing a subvention of funds from the State to pay for certain activities required by the Order No. R9-2009-0002, including some of the activities in the LIP. Nothing in this LIP should be viewed as a waiver of those claims or as a waiver of the rights of the City to pursue a subvention of funds from the State to pay for certain activities required by the Fifth Term Permit, including the implementation of certain activities in this LIP. In addition, several Copermittees, including the City, have filed petitions with the SWRCB challenging some of the requirements of the Fifth Term Permit. Nothing in this LIP should be viewed as a waiver of those claims. Because the SWRCB has not issued a stay of the Fifth Term Permit, Copermittees must comply with the Fifth Term Permit's requirements while the SWRCB process is pending.

A-1.3 OBJECTIVES OF THE LOCAL IMPLEMENTATION PLAN

The main objective of this LIP is to fulfill the commitment of the City to present a plan that satisfies the requirements of its NPDES Permit. This document outlines all of the strategies the City will implement to reduce the discharge of pollutants from its storm drain system in accordance with the Fifth Term Permit and therefore identifies both DAMP/LIP and WQIP strategies.

1) DAMP/LIP strategies – These strategies are the baseline programs developed on a Countywide or regional basis and focused on reducing pollutant discharges from the municipal storm drain system to the MEP.

2) WQIP strategies – These strategies go beyond the City's baseline strategies and represent a focus on south Orange County's Highest Priority Water Quality Conditions (HPWQC).

This LIP includes the following programs in subsequent sections:

1. **Section A-2.0 –** Framework for program management activities;

2. **Section A-3.0 – F**uture plan development;

3. **Section A-4.0 –** Legal authority for prohibiting unpermitted discharges to the storm drain system and for requiring BMPs in new development and significant redevelopment ();

4. **Section A-5.0 –** Municipal activities for pollution prevention and treatment to further reduce the amount of pollutants entering the storm drain system;

5. **Section A-6.0 –** Educational program to communicate with the public about urban stormwater and non-stormwater pollution and obtain their support in implementing pollution prevention BMPs;

6. **Section A-7.0 –** New development and significant redevelopment controls to incorporate appropriate and required post construction nonstructural and structural BMPs into the environmental planning and development review process;

7. **Section A-8.0 –** Construction site controls that address appropriate and required practices for erosion and sediment control and on-site hazardous materials and waste management;

8. **Section A-9.0 –** Existing development programs to prioritize, inspect and implement programs for commercial and industrial facilities; and

9. **Section A-10.0 –** Illegal discharges/illicit connections (ID/IC) program to detect and eliminate unpermitted discharges and unauthorized connections to the municipal storm drain system.

The list of strategies the city will implement to address the HPWQC identified in the WQIP and meet numeric goals is provide in **Exhibit A-1.I** of this LIP. These strategies include the City's baseline programs as well as the additional commitments necessary to meet the goals within the timelines specified in the WQIP. The LIP is the City's primary mechanism for WQIP strategy implementation and Fifth Term Permit compliance.

A-1.4 PERMITTEE COMMITMENTS

The Permittees are committed to maintaining the integrity of the receiving waters and their ability to sustain beneficial uses. As such, the Permittees have designed and implemented a countywide baseline stormwater management program in order to be able to periodically re-assess the conditions of the waters within Orange County and help determine the impact, if any, of urban stormwater discharges to the beneficial uses of those waters.

This baseline effort is complemented by the WQIP, which focuses resources on the highest priority water quality constituents and conditions. The HPWQC are: pathogen health, unnatural water balance and flow regime in inland waters and channel erosion and associated

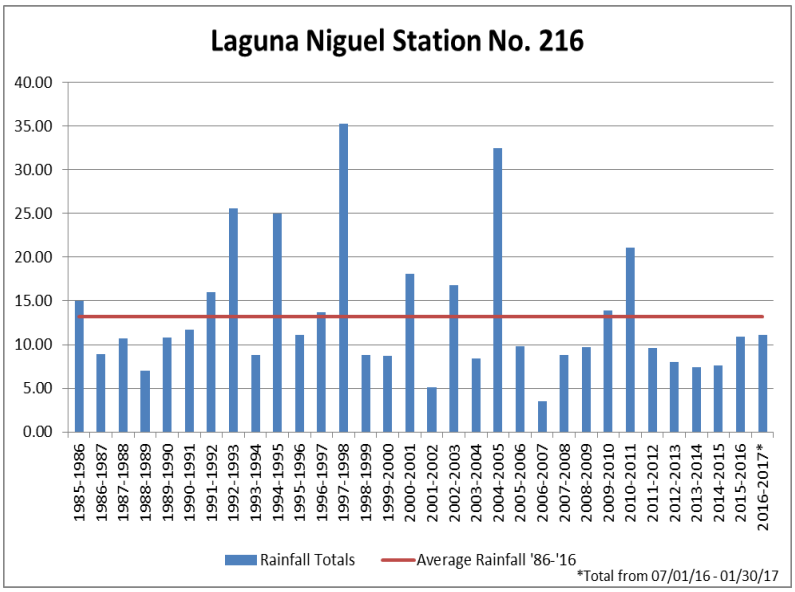
geomorphic impacts for inland waters. By applying an adaptive management approach, the City will continue to analyze and evaluate the appropriateness of the prioritization.

A-1.5 DAMP/LIP COVERAGE

This LIP is applicable to the area of the City of Laguna Niguel within the jurisdiction of the San Diego Regional water Quality Control Board. The non-topographic boundary of some cities in Orange County have resulted in certain Permittees being subjected to separate NPDES municipal stormwater permits issued by the Regional Boards.

A-1.6 DESCRIPTION OF DRAINAGE AREA AND CLIMATE

A-1.6.1 Geography and Climate



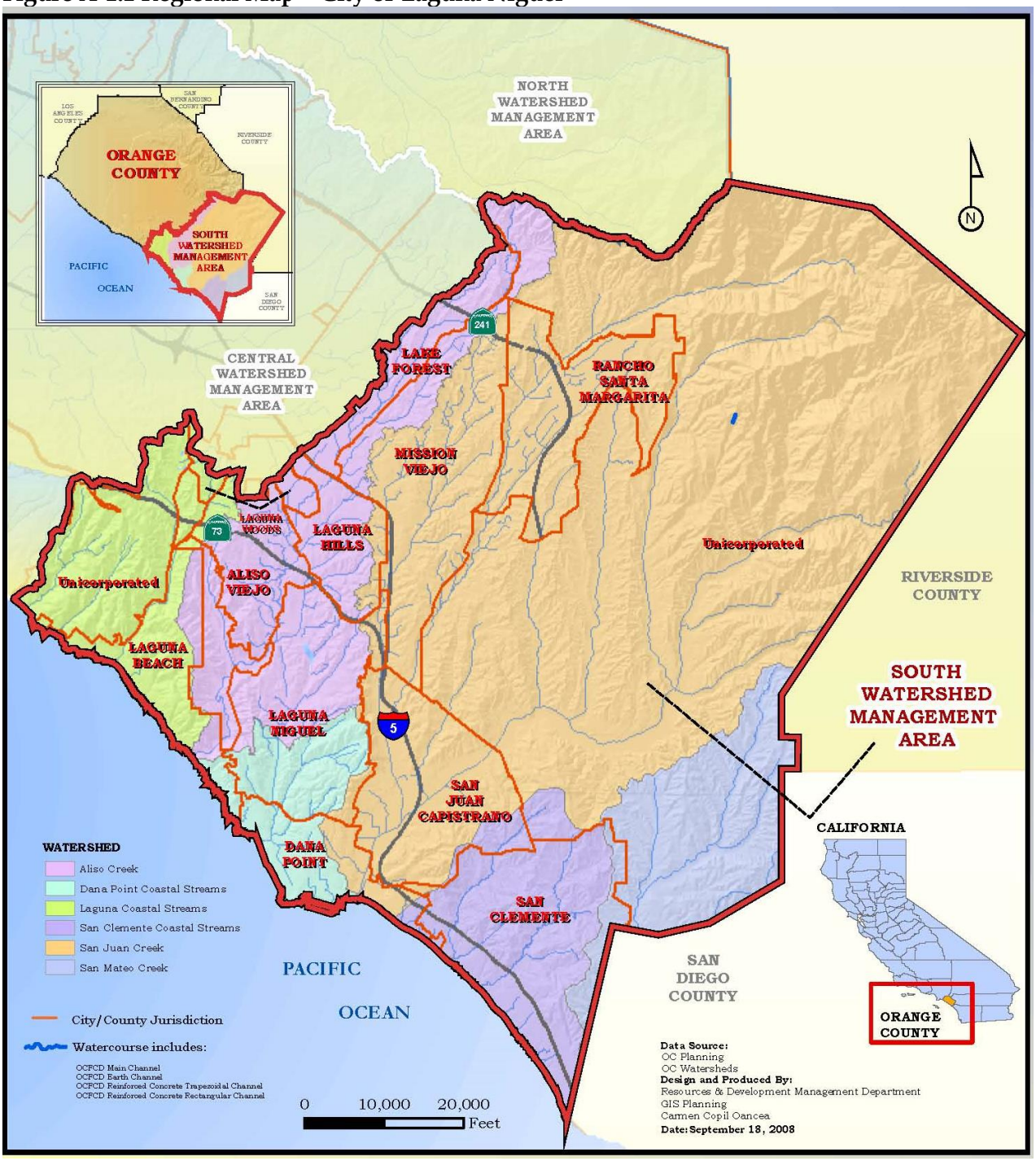
Orange County's climate has hot, dry summers and mild winters. Nearly all the annual precipitation falls in only a few storm events between October and April. During times of drought, it is not unusual for years to pass between major rainfalls. It is also common for successive storms of varying durations and intensities to compound their effects, with the heavy rainfall of the second or third storm creating the most severe flood conditions. On average, Orange County only receives a 12 to 13 inches of rain per year.

A-1.6.2 Watersheds

A watershed is an area of land where water drains through a series of creeks, rivers and bays into a common body of water often termed receiving water. The City of Laguna Niguel drains into three major watersheds within the County's South Orange County Watershed Management Area: Sulphur Creek in the northerly part of the City, which is tributary to Aliso Creek and considered part of the Aliso Creek Watershed Management Area; Salt Creek, in the southerly part of the City and within the Dana Point Coastal Streams Watershed Management Area; and Oso Creek in the easterly part of the City, which is tributary to San Juan Creek and is part of the San Juan Creek Watershed Management Area. The individual watersheds are shown in Figure A-1.1.

Sulphur Creek within Laguna Niguel is mostly modified and vegetated soft-bottomed channel. Oso Creek is mostly a lined channel, while Salt Creek is mostly natural. Sulphur Creek Reservoir, constructed in the County-operated Laguna Niguel Regional Park in the 1965, serves flood control and recreational functions.

Figure A-1.1 Regional Map – City of Laguna Niguel



A-1.6.3 Environmentally Sensitive Areas (ESAs)/Impaired Waters

Environmentally Sensitive Areas (ESAs)

The San Diego Regional Board defines ESAs as those areas that include, but are not limited to:

- All CWA Section 303(d) impaired waters;
- Areas designated as Areas of Special Biological Significance by the SWRCB in the Water Quality Control Plan for the San Diego Basin Plan;
- Water bodies designated with the RARE Beneficial Use category by the SWRCB in the Basin Plan (RARE);
- Areas designated as preserves or their equivalent under the Natural Communities Conservation Planning Program (NCCP); and
- Any other ESAs identified by the city.

The ESAs identified in the City are listed in **Table A-1.1.**

CWA Section 303(d) Water Quality Limited Segments of Receiving Waters

Under Section 303(d) of the CWA, states are required to develop lists of water quality limited segments of receiving waters (impaired waters). These impaired waters do not meet water quality standards or support designated water uses. The 2014 303(d) list of water quality limited segments is provided in **Table A-1.1**.

Table A-1.1
303(d) Listed Waterbodies Potentially Affected By Activities in the City of Laguna Niguel

Hydrologic Unit	ESA	303(d) Pollutant / Stressor
Aliso Creek	Aliso Creek	Indicator Bacteria, Phosphorous, Selenium, Total Nitrogen as N, Toxicity
Aliso Creek	Aliso Creek mouth (estuary)	Indicator Bacteria
Aliso Creek	Pacific Ocean Shoreline at Aliso Creek Mouth	Total Coliform[1], Fecal Coliform & Enterococcus
Aliso Creek	Pacific Ocean Shoreline at Aliso Beach - Middle	Total Coliform[1], Enterococcus
Aliso Creek	Sulphur Creek	Indicator Bacteria
Dana Point	Pacific Ocean Shoreline at Salt Creek Outlet at Monarch Beach	Total Coliform[1]
San Juan Creek	Lower San Juan Creek (approx. 1 mile of stream	DDE, Indicator Bacteria, Phosphorous, Selenium, Total

Hydrologic Unit	ESA	303(d) Pollutant / Stressor
	beginning at shoreline)	Nitrogen as N, Toxicity
San Juan Creek	Oso Creek (lower 4 miles)	Selenium, Toxicity
San Juan Creek	Arroyo Trabuco Creek	Diazinon, Phosphorus, Total Nitrogen as N & Toxicity
San Juan Creek	San Juan Creek mouth (estuary)	Indicator Bacteria
San Juan Creek	Pacific Ocean Shoreline at North Beach Creek	Total Coliform[1], Fecal Coliform & Enterococcus
San Juan Creek	Pacific Ocean Shoreline at San Juan Creek	Total Coliform[1], Fecal Coliform & Enterococcus
San Juan Creek	Pacific Ocean Shoreline at North Doheny State Beach Campground	Total Coliform[1] & Enterococcus
San Juan Creek	Pacific Ocean Shoreline at South Doheny State Beach Campground	Enterococcus

[1] 303(d) listing is for shellfish harvesting Total Coliform objective and not for water contact recreation.

Other ESAs identified in the City are shown in Table A-1.2 and are included in the map in Exhibit A-1.II, along with the 303(d) listed impaired waters.

Table A-1.2
Other Environmentally Sensitive Areas Potentially Affected By Activities in the City of Laguna Niguel

Name	Hydrologic Unit	Reason for listing as ESA
NCCP Coastal/buffer zone	Dana Point	NCCP area
NCCP Coastal/buffer zone	Aliso Creek	NCCP area
NCCP Coastal/buffer zone	San Juan Creek	NCCP area

A-1.7 PROGRAM ASSESSMENT AND MODIFICATION

The Program Effectiveness Assessment is the foundation for the Annual Progress Report that is submitted each year to the Regional Boards. This report presents an evaluation of this LIP, which is used to determine where modifications within the program may be necessary. It also ensures that an adaptive management process is applied to each of the program components and is used as an effective management tool (See **Section A-3.0**).

Exhibit A-1.I
Strategies to Address WQIP HPWQC

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in LIP
Municipal Activities	Trash and Debris Control Drainage Facility Maintenance – MS4 Inspections/Cleaning Street Sweeping Structural BMP Maintenance at Municipal Projects Pesticide & Fertilizer Management Municipal Staff Training and Education	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Oil & Grease •Sediment	Citywide	LIP Section 5
Training and Public Education	Nonpoint Source Pollution Awareness Household Hazardous Waste Collection Absorbent Landscaping/Impervious Area Dispersion Incentive Program	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime •Channel Erosion/ Geomorphic Impacts	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Oil & Grease •Sediment	Citywide	LIP Section 6

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in LIP
Development Planning	Water Quality Management Plan Review & Post Construction BMP Inspection	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime •Channel Erosion/ Geomorphic Impacts	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Oil & Grease •Sediment	Citywide	LIP Section 7
Construction	Construction BMPs – Plan Check & Inspection	•Pathogen Health Risk Unnatural Water Balance/Flow Regime •Channel Erosion/ Geomorphic Impacts	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Turbidity Other Pollutants •Metals •Oil & Grease •Sediment	Citywide	LIP Section 8
Existing Development	Industrial Facility Inspections	•Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Non-stormwater discharges •Nutrients •Trash •Toxicity Other Pollutants •Metals •Oil & Grease	Not Applicable (There are currently no industrial facilities within the City)	LIP Section 9

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in LIP
	Commercial/Food Facility Inspections	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	<u>WQIP Priority Pollutants</u> •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Pesticides •Toxicity <u>Other Pollutants</u> •Metals •Oil & Grease	Commercial/ Food Facilities within the City	LIP Section 9
	Mobile Business Program	•Unnatural Water Balance/Flow Regime	<u>WQIP Priority Pollutants</u> •Non-stormwater discharges •Nutrients •Toxicity <u>Other Pollutants</u> •Metals •Oil & Grease	Citywide	LIP Section 9
	Residential/HOA Inspections	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	<u>WQIP Priority Pollutants</u> •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Pesticides •Turbidity •Toxicity <u>Other Pollutants</u> •Metals •Oil & Grease •Sediment	City Residential Management Areas	LIP Section 9

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in LIP
Illegal Discharges/ Illicit Connections	Illicit Connection Inspections Illegal Discharge Investigations, Spill Response	• Pathogen Health Risk • Unnatural Water Balance/Flow Regime	<u>WQIP Priority Pollutants</u> • Bacteria/Pathogens • Non-stormwater discharges • Nutrients • Trash • Pesticides • Turbidity • Toxicity <u>Other Pollutants</u> • Metals • Oil & Grease • Sediment	Citywide	LIP Section 10

Environmentally Sensitive Areas

303d Listed Water Body
(200' Buffer)

Natural Community Conservation Planning Area

(NCCP - 200' Buffer)

General Map Information

Watershed Boundaries

Oso Creek

Sulphur Creek

Aliso Creek

Arroyo Trabuco Creek

Pacific Ocean Shoreline at Salt Creek

Pacific Ocean Shoreline at Aliso Creek Mouth

Aliso Creek mounth (estuary)

Pacific Ocean Shoreline at Aliso Beach - Middle

Lower San Juan Creek

San Juan Creek mouth (estuary)

Pacific Ocean Shoreline at North Beach Creek

Pacific Ocean Shoreline at San Juan Creek

Pacific Ocean Shoreline N Doheny State Beach Camp

Pacific Ocean Shoreline S Doheny State Beach Camp

EXHIBIT A-1.II

Environmentally Sensitive Areas

: 03/15/2017

D:\GISProjects\NPDES\NDSPermit MXDs\esa.mxd

A-2.0 PROGRAM MANAGEMENT

A-2.1 INTRODUCTION

Program management activities conducted by the City of Laguna Niguel to implement the LIP involve the following activities:

- Coordination with the Principal Permittee and other Permittees on program development through the DAMP; common program implementation (such as monitoring, public education and watershed programs); fiscal resources for shared budgets under the Implementation Agreement; and overall program direction.

- Coordination with the Principal Permittee and other Permittees on program development through the WQIP;

- Coordination with internal City departments to implement the LIP.

- Fiscal analysis in preparing, approving and tracking shared cost budgets prepared by the Principal Permittee and individual cost budgets prepared by the City.

- Data management and compliance reporting based on common practices specified in the DAMP and WQIP.

This section addresses these issues.

A-2.2 MAJOR MANAGEMENT ACTIVITIES

Implementation of the LIP and related DAMP programs and WQIP strategies is overseen by both the Public Works Department and the Community Development Department. The Public Works Department coordinates the development, implementation and administration of the stormwater program for the City overall. In this capacity the Public Works Department is the lead department responsible for LIP, DAMP and WQIP development, implementation, compliance, fiscal analysis, and reporting with the Community Development Department's contribution mostly focused on implementation and compliance.

In addition to managing internal implementation, Public Works Department also participates with the County of Orange, Orange County Flood Control District, and other Orange County cities in the Program.

A-2.2.1 Management Framework

Management of the Program is performed through a committee structure with responsibilities and chairing assigned selectively to the Principal Permittee and the Permittees. These committees are as follows:

- City Manager's Water Quality Committee: provides budget and overall program review and governance direction; comprised of several City Managers and is attended by County staff.

- City Engineer's Technical Advisory Committee (TAC): serves in a program advisory role to the Permittees and implements policy previously established by the permittees. The TAC is comprised of a City Engineer, or selected representative, from one city in each of the County Supervisorial Districts and a representative from the County of Orange.

- Technical Advisory Committee/Planning Advisory Committee (TAC/PAC) serves in a program advisory role to the Permittees and implements policy previously established by the permittees pertaining to land development. The TAC/PAC is comprised of a City Engineer, or selected representative and a Planning Director or selected representative, from one city in each of the County Supervisorial Districts and a representative from the County of Orange.

- General Permittee Committee: provides a countywide forum to update designated representatives from each Permittee on program development.

- WQIP Committee: provides a watershed management area forum to engage Permittees in WQIP development, implementation, assessment and adaptive management.

- Sub-Committees/Task Forces/Advisory Groups:

    - Inspection Sub-Committee
    - Legal/Regulatory Authority Task Force
    - Local Implementation Plan/Program Effectiveness Assessment (LIP/PEA) Sub-Committee
    - Public Education Sub-Committee
    - Trash and Debris Task Force
    - Trash Provisions Sub-Committee

The City participates in these committees through the representatives shown in **Table A-2.1**:

Table A-2.1
City of Laguna Niguel Participation in Countywide Program

Committee/Task Force	City Department/Division
City Manager Water Quality Committee	City Manager
TAC	Public Works
TAC/PAC	Public Works/Community Development
General Permittee Committee	Public Works
WQIP Committee	Public Works/Community Development
Inspection Sub-Committee	Community Development
Legal/Regulatory Authority Task Force	Public Works/Community Development
LIP/PEA Sub-Committee	Public Works/Community Development
Public Education Sub-Committee	Public Works
Trash and Debris Task Force	Public Works
Trash Provisions Sub-Committee	Public Works

The responsibilities of the City departments for the internal coordination of LIP activities are shown in **Table A-2.2**.

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
Section A-2 - Program Management	Public Works	Serves as City LIP manager	Prepares annual compliance reports
			Reviews shared budgets and prepared internal City budgets
			Coordinates with Principal Permittee and other Permittees for development and implementation of countywide program
			Coordinates/ensures implementation of LIP by City departments; administers program
			Responds to phone, e-mail, and other input to the City on water quality issues and dispatches appropriate personnel; records responses
			Follows up on problems with City compliance
Section A-3 - Plan Development	Public Works	Oversees development of new DAMP/WQIP programs	Coordinates between City departments and the Principal Permittee in the development of new programs and BMP effectiveness studies
Section A-4 - Legal Authority	City Attorney	Certification of adequate legal authority	Reviews legal authority/modifications of ordinances/ legal certification
Section A-5 - Municipal Activities	Public Works	Manages storm drain inventory/atlas	Updates or provides Geographic Information System (GIS) with updates to storm drain atlas

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
	Public Works	Operates and maintains storm drains and flood control facilities	Implements applicable model BMPs, including BMPs to comply with the Trash Provisions, and reports actions taken to LIP Management
			Reports to LIP Manager with changes in flood control maintenance program and facilities
	Public Works	Operates and maintains corporate/municipal yards	Implements applicable model BMPs, reports actions taken to LIP Management
			Reports to LIP Manager with changes in corporate/municipal yards
	Public Works	Maintains catch basin stenciling program	Implements stenciling program, reports actions taken to LIP Management
			Reports to LIP Manager with changes in stenciling program
	Orange County Fire Authority	Generates emergency and non-emergency fire fighting discharges	Implements applicable model BMPs, reports actions taken to LIP Management
	Orange County Fire Authority	Operates and maintains fire stations	Implements applicable model BMPs, reports actions taken to LIP Management
			Reports to LIP Manager with changes in fire facilities operated
	Public Works	Operates parks, community centers, and recreational facilities	Implements applicable model BMPs, reports actions taken to LIP Management operated
			Reports to LIP Manager with changes in parks facilities
	Orange County Sheriff's Department	Operates and maintains police facilities	Implements applicable model BMPs, reports actions taken to LIP Management

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
			Updates LIP Manager with changes in police facilities operated
	Public Works	Operates and maintains parking lots	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Manager with changes in parking facilities operated
	South Orange County Wastewater Authority (Not a City Department)	Operates wastewater facilities	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes in wastewater facilities operated
	Moulton Niguel Water District (Not a City Department)	Operates water facilities	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes in water facilities operated
	Public Works	Maintains city facilities	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes to City-owned facilities
	Public Works	Manages and maintains city vehicle programs	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes to city vehicle programs
	Public Works	Manages and implements street sweeping	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes to street sweeping

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
	Public Works	Manages and implements IPM Policy	Implements IPM Policy, reports actions taken to LIP Management
			Updates LIP Management with changes to pesticide and fertilizer programs for conformance with IPM Policy
	Public Works	Manages and implements landscape maintenance programs including lakes	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes to landscape maintenance programs
	Public Works	Manages and implements waste recycling and litter control programs	Implements applicable model BMPs, reports actions taken to LIP Management
			Updates LIP Management with changes to waste recycling and litter control programs
Section A-6 - Public Education	Public Works	Manages education/outreach program	Attends public meetings
	Public Works, Community Development Parks and Recreation		Provides training and guidance materials to private developers, public, and City staff
	Public Works, Community Development Parks and Recreation		Disseminates information in the City
	Public Works		Develops City versions of countywide education materials as appropriate

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
	Public Works, Community Development Parks and Recreation		Participates in one City event per year
	Public Works, Community Development Parks and Recreation	Distribution of public education materials	Provides information to the public at City counters
Section A-7 - New Development	Community Development	Manages General Plan	Reviews the General Plan for water quality protection
	Community Development	Manages environmental planning review	Implements use of CEQA checklist to review water quality issues on proposed projects
			Reviews development for water quality issues
	Community Development	Processes building/grading permits	Advises applicants of water quality requirements
			Verifies plan compliance with water quality requirements
			Coordinates with Public Works Department for project tracking and inspection of water quality requirements
	Public Works	Interacts with public	Provides information to permit applicants on water quality requirements
	Public Works, Community Development	Manages public works projects	Verifies plan compliance with water quality requirements in public works projects
			Coordinates with Public Works Inspectors for project tracking and inspection of water quality requirements in public works projects
Section A-8 - Construction	Community Development	Processes building/grading permits	Advises applicants of water quality requirements

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
			Verifies plan and NOI compliance with water quality requirements, reports actions taken to LIP Management
	Community Development	Manages oversight of construction inspection inventory, prioritization and inspection program	Inventories, prioritizes and maps construction sites
			Implement inspections, requires corrective actions to be taken, reports actions taken to LIP Management
	Public Works	Manages Public works projects and Capital Improvement Project (CIP) projects	Verifies plan compliance with water quality requirements in public works projects and CIPs
			Coordinates with Public Works Inspectors for project tracking and inspection of water quality requirements in public works projects and CIPs, reports actions taken to LIP Management
Section A-9 - Existing Development	Community Development	Manages oversight of the commercial, industrial, residential inspection program	Inventories, prioritizes and maps facilities
			Implement inspections, require corrective actions to be taken, report actions taken to LIP management
			Provides commercial and industrial information for the inventory to LIP Manager
		Interacts with businesses and the public	Provides information to industrial and commercial businesses and the public
Section A-10 – ID/IC	Public Works	Operates field activities	Reports dumped materials and/or undocumented connections

Table A-2.2
City of Laguna Niguel Internal Implementation of the LIP

Program Element	Department	Activity	Responsibility Under the Order/2003 DAMP
	Public Works, Community Development	Manages education/outreach program	Distributes public education materials to encourage the reporting of problems
	Public Works, Community Development	Implements construction site inspections	Reports violations of and/or enforce the water quality ordinance
	Community Development	Implements the existing development inspections	Report violations of and/or enforces the water quality ordinance
	Community Development	Processes notifications/response requests for water pollution problems	Detects and eliminates illegal discharges and illicit connections
	Community Development	Responds to water pollution complaints	Responds to water pollution complaints in a timely manner and enforce all applicable ordinances
	Community Development	Responds to water pollution complaints, assesses site, makes notifications, oversees clean-up operations and enforces water quality ordinance	Responds to water pollution complaints in a timely manner and enforces all applicable ordinances
	Public Works	Manage water quality data received from countywide program	Initiates source investigations through ID/IC program for problems identified through the water quality monitoring program
	City Attorney	Assists with the enforcement of violations of applicable ordinances	Enforces against violators of stormwater related ordinances

A-2.2.2 Agreement for Program Implementation

An Implementation Agreement among the 36 Permittees defines the roles, responsibilities, and cost sharing formulas governing the program. The City executed the updated cooperative agreement in 2002.

A-2.2.3 NPDES Permit Responsibilities

The responsibilities of the County of Orange as the Principal Permittee and Permittees as a whole are defined within the Implementation Agreement, the NPDES Permits, or as otherwise identified within separate funding agreements.

The County of Orange as Principal Permittee is responsible for:

1. Serving as liaison between the Copermittees in the Watershed Management Area and the San Diego Water Board on general permit issues, and when necessary and appropriate, representing the Permittees in the Watershed Management Area before the San Diego Water Board;

2. Facilitating the development of the WQIP in accordance with the requirements of Provision B of the Fifth Term Permit;

3. Coordinating the submittal of the deliverables required by Provisions F.1, F.2, F.3.a, and F.3.b of the Fifth Term Permit; and

4. Coordinating and developing, with the other Principal Watershed Permittees, the requirements of Provisions F.3.c, F.4, and F.5.b of the Fifth Term Permit.

The Principal Permittee is not responsible for ensuring that the other Permittees within the Watershed Management Area are in compliance with the requirements of this Order.

A-2.2.4 NPDES Reporting Requirements

(1) **Permittees**: The City completes a Jurisdictional Runoff Management Program Annual Report Forms (**Attachment A-2-1**) covering implementation of its jurisdictional activities from July 1 to June 30, during the annual reporting period. Each Annual Report verifies and documents compliance with the Fifth Term Permit and are due annually on January 31.

(2) **Principal Permittee**: The Principal Permittee is responsible for preparing the Water Quality Improvement Plan Annual Report which is due annually on January 31.This report will include:

1. The receiving water and MS4 outfall discharge monitoring;

2. The progress of the special studies and the findings, interpretations and conclusions of a special study, or each phase of a special study, upon its completion;

3. The findings, interpretations and conclusions from the assessments required pursuant to Provision D.4;

4. The progress of implementing the WQIP, including, but not limited to, the following:
    - The progress toward achieving the interim and final numeric goals for the highest priority water quality conditions for the Watershed Management Area;

- The water quality improvement strategies that were implemented and/or no longer implemented by each of the Permittees during the reporting period and previous reporting periods;
- The water quality improvement strategies planned for implementation during the next reporting period;
- Proposed modifications to the water quality improvement strategies, the public comments received and the supporting rationale for the proposed modifications;
- Previous modifications or updates incorporated into the Water Quality Improvement Plan and/or each Copermittee's jurisdictional runoff management program document and implemented by the Copermittees in the Watershed Management Area; and
- Proposed modifications or updates to the Water Quality Improvement Plan and/or each Copermittee's jurisdictional runoff management program document;

A-2.2.5 Fiscal Analysis

The stormwater program funding needs are principally driven by:

The Fifth Term Permit, including the baseline requirements of Provision E and the WQIP requirements of Provision B

The Bacteria TMDL which is incorporated in to the Fifth Term Permit and which is addressed in the WQIP

The activities necessary to comply with these requirements are described in this LIP. Examples include, but are limited to, street sweeping, storm drain cleaning, development processing and inspections of facilities used for commerce and business. The City uses the reporting format shown in **Tables A-2.3, A-2.4 and A-2.5** to report on costs (capital, operations and maintenance) and funding sources for these activities.

Table A-2.3
Fiscal Analysis for City Capital Costs

City of Laguna Niguel	**CAPITAL COSTS**	
Fiscal Analysis Summary	**(land, large equipment, and structures)**	
DAMP Program Elements	**Current FY Costs**	**Projected FY Costs**
Public Projects – BMPs	This information will be collected annually	This information will be collected annually
Construction BMPs for Public Construction Projects		
Other Capital Projects/Major Equipment Purchases		
TOTALS		

Table A-2.4
Fiscal Analysis for City Operations and Maintenance Costs

<table>
<tr><td colspan="2">City of Laguna Niguel
Fiscal Analysis Summary</td><td colspan="2">OPERATIONS AND MAINTENANCE</td></tr>
<tr><td colspan="2">DAMP Program Elements</td><td>Current FY Costs</td><td>Projected FY Costs</td></tr>
<tr><td colspan="2">Supportive of Program Administration (DAMP Section 2.0)</td><td rowspan="13">This information will be collected annually</td><td rowspan="13">This information will be collected annually</td></tr>
<tr><td rowspan="8">MUNICIPAL ACTIVITIES (DAMP Section 5.0)</td><td>Litter Control</td></tr>
<tr><td>Recycling</td></tr>
<tr><td>Drainage Facility Maintenance</td></tr>
<tr><td>Catch Basin Stenciling</td></tr>
<tr><td>Street Sweeping</td></tr>
<tr><td>Environmental Performance</td></tr>
<tr><td>Public Property & Street Chemical Spill Response</td></tr>
<tr><td>Pesticide & Fertilizer Management</td></tr>
<tr><td rowspan="2">PUBLIC INFORMATION (DAMP Section 6.0)</td><td>Nonpoint Source Pollution Awareness</td></tr>
<tr><td>Household Hazardous Waste Collection</td></tr>
<tr><td colspan="2">REQUIRING NEW DEVELOPMENT BMPS (Supportive of Planning, etc.)</td></tr>
<tr><td colspan="2">REQUIRING CONSTRUCTION BMPS (Supportive of Plan Check & Inspection)</td></tr>
<tr><td rowspan="2">ILLICIT CONN./ DISCHARGE ID & ELIMINATION (DAMP Sec. 10.0)</td><td>Facility Inspection</td></tr>
<tr><td>Other Efforts to Identify & Eliminate Illicit Connections</td></tr>
<tr><td colspan="2">BMPS INCORPORATED INTO PUBLIC WORKS CAPITAL PROJECTS</td></tr>
<tr><td colspan="2">TOTALS</td></tr>
</table>

Table A-2.5
Fiscal Analysis for City Funding Sources

City of Laguna Niguel Fiscal Analysis Summary	**FUNDING SOURCES**	
DAMP FUNDING SOURCES	**FUNDING PERCENTAGES**	
	Current FISCAL YEAR	**Next FISCAL YEAR**
GENERAL FUND	This information will be collected annually	This information will be collected annually
UTILITY TAX/CHARGES		
SEPARATE UTILITY BILLING ITEM		
GAS TAX		
SPECIAL DISTRICT FUND		
OTHERS (Specify)		
Sanitation Fee		
Benefit assessment		
Fleet Maintenance Fund		
Community Services District		
Water Fund		
Sewer & Storm Drain Maintenance Fee		
Grants		
TOTALS (must add up to 100%)		

A-2.2.6 Program Representation

The Principal Permittee represents the Permittees on the California Stormwater Quality Association (CASQA), the Stormwater Monitoring Coalition, Southern California Coastal Water Research Project (SCCWRP), and other stormwater forums.

A-3.0 PLAN IMPROVEMENT AND WATERSHED PLANNING

A-3.1 INTRODUCTION

This Section describes the approach being taken by the City in developing and updating the Local Implementation Plan (LIP) to maintain a responsive compliance program. Program updates are informed by an adaptive management process focused on addressing high priority water quality issues by revising, adding or deleting BMPs and activities in response to performance assessment and research. This feedback loop forms the framework for revision and improvement of the Program and its documentation.

A-3.2 PLAN DEVELOPMENT

A-3.2.1 Approach to Plan Development and Improvement

The Principal Permittee, in conjunction with the City and the other Copermittees, have developed a comprehensive framework for stormwater management, described in the Drainage Area Management Plan (DAMP) and Water Quality Improvement Plan (WQIP), which are updated as appropriate in conjunction with the Report of Waste Discharge and each new Municipal Permit's findings and requirements. There is now a programmatic countywide approach for urban stormwater management on two levels:

- Implementing a baseline set of source control BMPs and activities that are considered proven and cost-effective, and are recommended for inclusion or reference in the Co-Permittees' LIPs at the *local jurisdictional MS4 level*. The LIP primarily addresses non-structural and pollution prevention controls applicable to on-site or in the MS4, as well as localized structural BMPs, as required by Provision E of the Fifth Term Permit and as further determined appropriate by the City.

- A framework for collective action at the *multi-jurisdictional watershed level*, focusing on solving the highest priority water quality conditions, and documenting issues and progress through the WQIP reporting compiled by the Principal/Lead Permittee with input by the Copermittees.

A-3.3.2 Methodology for Examining Retrofit Opportunities

The Fifth Term Permit requires the City to develop an approach to identify potential retrofit and stream, channel, or habitat projects for existing development. Section A-9.7 describes the City's approach to identifying and implementing retrofit opportunities.

A-3.2.3 BMP Selection and Effectiveness Assessment

The Reports of Waste Discharge, the region-wide Annual Unified Reports, the City's Annual LIP PEA Reports, JRMP Annual Reports, and WQIP Annual Reports provide a history of program and BMP activities implemented and progress in meeting water quality standards. The City's current baseline BMPs to reduce, eliminate or mitigate pollutant impacts are

summarized in **Sections A-5.0** through **A-10.0**. Planned inter-jurisdictional and jurisdictional BMP efforts are summarized in **Exhibit A-3.1.**

New or modified BMPs may be considered on a localized basis or for broader scale implementation. In order to assure that resources for pollution prevention and removal BMPs are strategically expended, the City typically evaluates any potential new structural or preventative BMP technologies or practices on a limited scale, or consults evaluations conducted by others, before considering broader-scale implementation. Implementation is pursued in a prioritized manner on a schedule consistent with available resources. After pilot and/or broader implementation, local effectiveness is assessed to determine if further adjustments or modifications are needed to the BMP implementation or program priorities. These iterative efforts are discussed and reported in the Annual Jurisdictional Work Plan progress updates submitted with the WQIP Annual Report.

BMP effectiveness assessment may be characterized via direct or indirect evidence at one or more of the six California Stormwater Quality Association (CASQA) outcome levels described in **Section A-3.3.3**. The BMP selection and effectiveness assessment process may include, but is not limited to, input from the following factors and information sources, as available and applicable:

- A review of technical literature (such as the ASCE/EPA databases)
- A review of existing control programs
- Demonstration or research projects by City or other entities
- Input from vendors, consulting firms, other municipalities, or other agencies
- Water quality and flow data and modeling,
- User and operational/maintenance staff feedback
- Opinion surveys
- Beneficial Use assessment
- Cost and cost/benefit
- Technical feasibility
- Acceptability by the community
- Ease or difficulty of implementation
- Maintenance requirements
- Pollutant prevention/removal performance
- Multiple resource benefits or impacts

The program evaluation framework that is based on the CASQA (CASQA, 2015[1]) method, which presents a hierarchy of potential outcomes at six levels:

- Outcome Level 6: Receiving Water Conditions
- Outcome Level 5: MS4 Contributions
- Outcome Level 4: Source Conditions
- Outcome Level 3: Target Audience Actions
- Outcome Level 2: Barriers & Bridges to Action
- Outcome Level 1: Stormwater Program Activities

[1] A Strategic Approach To Planning For And Assessing The Effectiveness Of Stormwater Programs, CASQA, 2015

A-3.2.4 Plan Revision

Annual progress updates to the LIP are submitted with the WQIP Annual Report. Program assessment and iterative BMP findings, as well as any modifications to the program or to programmatic assessment methods, are reported, along with any corresponding revisions made to the LIP, as appropriate. The LIP is intended to be a dynamic document plan that is evaluated on at least an annual basis by the City or as directed by the Regional Board.

A-3.3 FUNDING OF STRUCTURAL CONTROLS

Expenditures of structural controls include jurisdictional, watershed, and regional WMA activities. Implementation of these structural controls may be funded through the City's General Fund.

Additionally, the City can apply to secure funding for structural controls through the following grant and loan programs:

1. Grant Funding Programs:

    a. OC Go (Measure M) Environmental Cleanup Program
    b. Proposition 1 – Stormwater Grant Program and IRWM
    c. Proposition 68 – Parks and Water Bond
    d. Metropolitan Water District of Southern California Future Supply Action Funding Program (Through partnership with member agencies)

2. Financial Assistance (Loan) Funding Programs:

    a. Clean Water State Revolving Fund (CWSRF)
    b. Drinking Water State Revolving Fund (DWSRF) (Through partnership with local water agencies)

A-3.4 EMPLOYEE TRAINING AND OUTREACH

For an effective stormwater program to be efficiently implemented, its staff must have sufficient knowledge, experience, and skills. The City will provide or require educational activities and training for its direct employees as described in subsequent sections for each baseline program. he Principal Permittee will coordinate, develop and present a number of different training modules in accordance with the *Orange County Stormwater Program Training Program Framework: Core Competencie*s. The City will support this effort by requiring the appropriate employees attend training sessions and conduct applicable train-the-trainer sessions, if necessary.

Exhibit A-3.1

Planned Inter-jurisdictional and Jurisdictional BMPs

Exhibit A-3.I
Summary of Inter-Jurisdictional and Jurisdictional BMPs

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
Multi-Jurisdictional /Regional WQIP Strategies	Control Activities for Pathogen Health Risk •Comprehensive Human Waste Source Reduction Program	•Pathogen Health Risk	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients	South Orange County Watershed Management Area	WQIP Chapter B.3
	Control Activities for Unnatural Water Balance •Expanded transitional monitoring observations •Detailed flow monitoring at priority outfalls •High-resolution imagery analysis •Flow regime characterization •Outfall prioritization •Outfall capture feasibility studies •Incentives for low water use landscaping and/or irrigation source controls	•Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Trash •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Oil & Grease •Sediment	South Orange County Watershed Management Area	WQIP Chapter B.3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Control Activities for Channel Erosion •Restoration Alternatives and Feasibility Studies •Finalize Conceptual Geomorphically-Referenced Basis of Design (GRBoD) Guidelines •Programmatic Permitting Framework for Geomorphically-Referenced Basis of Design Projects •LiDAR Data Acquisition and Analysis •Coordination with upland controls proposed for Pathogen Health Risk and Water Balance HPWQCs •Aliso Creek Mainstem Ecosystem Restoration Project •Watershed Management Area Analysis Coarse Sediment Supply Analysis	•Channel Erosion/ Geomorphic Impacts	WQIP Priority Pollutants •Bacteria/Pathogens •Nutrients •Turbidity •Toxicity Other Pollutants •Sediment	South Orange County Watershed Management Area	WQIP Chapter B.3
Jurisdictional Non-structural WQIP Strategies	Recreational Vehicle Waste Disposal Education Program	•Pathogen Health Risk	WQIP Priority Pollutants •Bacteria/Pathogens	Citywide	LIP Section 3
	Permitted Discharge and Water Impoundment Inventory	•Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Non-stormwater discharges	Citywide	LIP Section 3
	Unauthorized Encampment Program	•Pathogen Health Risk	WQIP Priority Pollutants •Bacteria/Pathogens •Trash	Citywide	LIP Section 3

	Strategy	High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
Jurisdictional Structural WQIP Strategies	Wetland Capture and Treatment @ J03P02 Description: 3 treatment wetlands Drainage Area: 538 acre drainage area within the City of Laguna Niguel Construction Schedule: Completed 2002-2004 Construction Costs: $469,400	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Sediment	J03P02 Subwatershed (Aliso Creek Watershed)	LIP Section 3
	Upper Sulphur Creek Restoration Description: 1.7 mile stream restoration on Home Owner Association properties (Crowne Royale, Niguel Ridge, Rancho Niguel Areas) Drainage Area: 1,149 acres (1,322 acres within City of Laguna Niguel and 114 within City of Laguna Hills) Construction Schedule: Completed in 2007 Construction Costs: $1.4 million	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Sediment	Sulphur Creek Subwatershed (Aliso Creek Watershed)	LIP Section 3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Middle Sulphur Creek Restoration Description: 2,000 linear foot stream restoration project Drainage Area: 2,300 acres Construction Schedule: Phase I completed Spring 2006. Phase II work completed in Fall 2008. Construction Costs: $2 million	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Sediment	Sulphur Creek Subwatershed (Aliso Creek Watershed)	LIP Section 3
	J03P01 Stream Channel Restoration Description: 700-foot channel restoration. Drainage Area: Drainage Area is 1,099 acres within the City of Laguna Niguel Construction Schedule: Completed in 2002 Construction Costs: $75,000	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Sediment	J03P01 Subwatershed (Aliso Creek Watershed)	LIP Section 3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Narco Channel Restoration Description: 800-foot stream restoration of Narco Channel downstream of La Paz Road Drainage Area: Drainage Area is 517 acres within the City of Laguna Niguel Construction Schedule: Planting completed in September 2007 Construction Costs: $1 million	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Sediment	Narco Channel Subwatershed (Aliso Creek Watershed)	LIP Section 3
	Crown Valley Park Master Plan Implementation – J03P01 Channel Entry Improvements Project Description: Treatment wetland receives water diverted from low-flow channel within J03P01 flood channel Drainage Area: 1,200 acres of mixed land uses, primarily residential, all draining to MS4 J03P01 system Construction Schedule: 2015-2016 Construction Costs: $3 million	•Pathogen Health Risk	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients •Pesticides •Turbidity •Toxicity Other Pollutants •Metals •Sediment	J03P01 Subwatershed (Aliso Creek Watershed)	LIP Section 3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Sulphur Solution "GreenBack" Water Conservation and Pollution Prevention Project Description: Implementation of pollution prevention low impact design projects on 16 acres. Drainage Area: 16 acres Construction Schedule: Completed September 2006 Construction Costs: $342,000	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients Other Pollutants •Sediment	Aliso Creek Watershed	LIP Section 3
	SmarTimer Edgescape Evaluation Project (SEEP) – Laguna Niguel Sites Description: BMP implementation at two neighborhoods LNH15 (Village Niguel) and LNH14 (Yosemite/El Acampo) within the City of Laguna Niguel Drainage Area: 1.36 acres retrofitted out of 16.6 irrigated acres within 43.6-acre total drainage area in Laguna Niguel Construction Schedule: Completed in April 2008 Construction Costs: Rebate $2,000/property = $46,000	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients Other Pollutants •Sediment	Aliso Creek Watershed	LIP Section 3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Crown Valley Parkway Median Retrofit Description: Retrofitting five miles of street median areas with drought tolerant plants and low flow sprinklers Drainage Area: Affected area 0.4 acre in Aliso Creek Watershed and 0.2 acre in Dana Point Coastal Streams Watershed Construction Schedule: Fall 2012 Construction Costs: Construction cost $800,000	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients Other Pollutants •Sediment	Aliso Creek Watershed and Dana Point Coastal Streams Watershed	LIP Section 3
	Crown Valley Parkway Landscaped Median Retrofits, Phase V Description: Retrofit low-precipitation irrigation and irrigation setback strips along 2000 lf of existing street median Drainage Area: 0.6 acres Construction Schedule: 2014 Construction Costs: $200,000	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients Other Pollutants •Sediment	San Juan Creek Watershed	LIP Section 3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Water District "Smart Landscape" Rebate Programs Description: Continuation of voluntary Smart Landscape rebate programs on residential and commercial properties Drainage Area: Citywide Construction Schedule: Rebate offers planned to continue through 2021, subject to Metropolitan Water District funding Construction Costs: Typically rebated at $9 per residential irrigation valve, although program offerings vary	•Pathogen Health Risk •Unnatural Water Balance/Flow Regime	WQIP Priority Pollutants •Bacteria/Pathogens •Non-stormwater discharges •Nutrients Other Pollutants •Sediment	Citywide	LIP Section 3
	Sulphur Solution "Control" Subproject Description: 60 catch basins retrofitted within the Aliso Creek Watershed in Laguna Niguel Drainage Area: Approximately 2 acre/basin = 120 acres Construction Schedule: Completed 2008 Construction Costs: $1,500/site = $90,000	•Pathogen Health Risk	WQIP Priority Pollutants •Bacteria/Pathogens •Nutrients •Trash Other Pollutants •Metals •Oil & Grease •Sediment	Aliso Creek Watershed	LIP Section 3

Strategy		High Priority Water Quality Conditions (HPWQC) Targeted	Target Pollutants	Geographic Extent of Implementation	Location in WQIP
	Catch Basin Debris Gates (M2 Tier 1 Project) <u>Description:</u> Installation of debris gates at 48 locations in Aliso Creek Watershed <u>Drainage Area:</u> Average drainage area of 2 acres/catch basin (96 acre total drainage area) Construction Schedule: Spring 2012 <u>Construction Costs:</u> $72,000	• Pathogen Health Risk	<u>WQIP Priority Pollutants</u> • Bacteria/Pathogens • Nutrients • Trash <u>Other Pollutants</u> • Metals • Oil & Grease • Sediment	Aliso Creek Watershed and San Juan Creek Watershed	LIP Section 3

A-4.0 LEGAL AUTHORITY

A-4.1 INTRODUCTION

The City of Laguna Niguel establishes, maintains, and enforces adequate legal authority within its jurisdiction to control pollutant discharges into and from its storm drain system. Laguna Niguel Municipal Code (LNMC) Article 5, Section 6-3-400 through 6-3-599, is the City's Stormwater and Urban Runoff Pollution Controls Ordinance (aka Water Quality Ordinance) which is the underpinning of the City's water quality/pollution prevention program. The updated ordinance was adopted on November 16, 2010. The most current and up-to-date version of the Ordinance and the entire Laguna Niguel Municipal Code is available online at www.cityoflagunaniguel.org.

A-4.2 REGULATORY REQUIREMENTS

The Fifth Term Permit, Directive E.1, requires the City to establish, maintain, and enforce adequate legal authority to control pollutant discharges into and from its MS4 through ordinance, statue, permit, contract or similar means.

A-4.3 AUTHORITY TO CONTROL POLLUTANT DISCHARGES

The City's Water Quality Ordinance is the principal legal foundation of the City's water quality/pollution prevention program. This legal authority enables the city to:

- Control the contribution of pollutants in discharges of runoff associated with industrial and construction sites;
- Prohibit all identified illicit discharges not otherwise allowed;
- Prohibit and eliminate illicit connections to the MS4;
- Control the discharge of spills, dumping or disposal of materials other than stormwater into its MS4;
- Require compliance with conditions in City's ordinance, permits, contracts or orders;
- Utilize enforcement mechanisms to require compliance with stormwater ordinances, permits, contracts, or orders;
- Control the contribution of pollutants from one portion of the MS4 to another portion of the MS4 through interagency agreements among other MS4 owners;
- Carry out all inspections, surveillance, and monitoring necessary to determine compliance and noncompliance with local ordinance and permits and with this Order, including the prohibition on illicit discharges to the MS4;
- Require the use of BMPs to prevent or reduce the discharge of pollutants into the MS4s from stormwater to the maximum extent practicable (MEP); and

- Require documentation on the effectiveness of BMPs implemented to reduce the discharge of stormwater pollutants to the MS4 to the Maximum Extent Practicable (MEP).

A-4.3.1 Other City of Laguna Niguel Pollution Prevention Codes/Ordinances

In addition to the City's water quality ordinance, other sections of the City's municipal code also address water quality protection and pollution prevention and contribute to a comprehensive water quality/pollution prevention program. These complementary codes are noted below.

1. The City's Solid Waste Management Ordinance regulates where solid waste and liquid waste, including hazardous and industrial wastes, may and may not be deposited or discharged. This Ordinance was enacted as part of Ordinance No. 90-11 and is codified as Sections 6-3-17 through 6-3-137 of the Laguna Niguel Municipal Code.

2. The Uniform Fire Code, which has been adopted into the codified ordinances of the City and prohibits the discharge of any waste liquid containing crude petroleum or its products "into or upon" any drainage canal or ditch, storm drain, sewer, or upon the ground.

3. The California Vehicle Code, which has been adopted into the codified ordinances of the City and prohibits the throwing, depositing or dumping of wastes, dirt, or offensive matter onto highways or any portion of the highway right-of-way.

4. The City's General Plan, which provides policy guidance for City land use decisions, has been reviewed and amended as needed in conjunction with each new NPDES Permit to ensure that the policies provided therein reflect general water quality and watershed protection principles including implementation of effective water quality protection measures for all development projects.

5. The City's environmental review process includes use of the most recent California Environmental Quality Act (CEQA) initial study checklist, which requires thorough consideration and disclosure of potential water quality impacts prior to final discretionary approval of development projects.

6. The City's Building Code, which substantially conforms to the California Building Code, has been adopted into the codified ordinances of the LNMC, and provides authority to the Building Official to enforce building regulations, including those contained in the Grading and Excavation Code.

7. The City's Grading and Excavation Code regulates excavation, grading and construction; and establishes administrative requirements for the issuance of Grading Permits in accordance with the requirements in the California Building Code. This Code was enacted as part of Ordinance No. 90-11 and it is codified as Sections 8-1-800 through 8-1-845 of the Laguna Niguel Municipal Code. Project-specific grading permits include detailed conditions and requirements for erosion prevention, slope stabilization, seasonal restrictions, phasing of grading, and sediment/construction

waste management, as activities of concern specifically during the period of actual grading.

8. The City Zoning Code regulates site planning for development projects and requires City discretionary review and approval for significant development projects, to include review and approval of conceptual Water Quality Management Plans (referred to in the Permit as Standard Stormwater Mitigation Plans (SSMPs)). As part of the discretionary review process, and in addition to any Mitigation Requirements resulting from the City's environmental review process, the City imposes Standard Water Quality Conditions of Approval on proposed development projects. These conditions require approval of a final WQMP, including implementation and long-term maintenance of BMPs, and other water quality controls and management measures in accordance with Permit requirements.

9. The City's Landscape Water Use Efficiency Regulations and Guidelines, adopted as Ordinance 2016-180 in January 2016, to incorporate into the LNMC Article 3, Sections Sec. 6-5-40 through 6-5-45, new requirements for planning, design, installation and maintenance of water efficient landscapes for new construction and redevelopment, with runoff prevention as a focus. The City's ordinance requires that irrigation of all existing landscaped areas comply with the Water Waste Prohibitions in Moulton Niguel Water District's *Water Conservation and Drought Response Regulations* applicable to potable water, and to MNWD's *Design Standards and Regulations Governing Users of Recycled Water.* LNMC Article 2, Sections 7-1-56 through 7-1-57 make it unlawful for any person to place, track, deposit or allow the flood of clay, mud, oil, petroleum, irrigation water or other waste-water onto the street.The detection, elimination and enforcement activities undertaken by the City are described further in Section 10. In addition to prohibiting unpermitted discharges, the Water Quality Ordinance also provides the legal authority for requiring BMPs in new development and significant redevelopment, as described in Section 7.

A-4.3.2 Roles & Responsibilities Beyond City Jurisdiction

Although the City has a robust regulatory and enforceable framework in place, there are agencies, industries and programs that may have either complimentary and/or conflicting authority that may extend beyond the authority of the City. The City believes that collaboration with the following agencies, industries and programs will be necessary for a comprehensive and effective water quality program. The City is not responsible for discharges regulated under separate NPDES permits or where the City has no authority. The following list includes some agencies and programs that are beyond City authority that may affect receiving water quality:

- Pesticides used in the state are registered by the Department of Pesticide Regulation (DPR).*
- Air contaminants, including fugitive dust, are regulated by the Air Quality Management District (AQMD).

- Leaking Underground Storage Tanks (LUST), Landfills, regulations on water reuse, Restaurant Inspections, Ocean Water Protection - Beach Closures & Warnings Monitoring Program (per AB411), Used Oil Recycling, etc. are overseen by Orange County Health Care Agency.
- Hazardous Waste Inventory and Emergency Planning is regulated by the Orange County Fire Authority as the Administering Agency (AA).
- Hazardous Waste Transport, Treatment, Storage & Disposal are regulated by the Department of Toxic Substances Control (DTSC).
- Caltrans is regulated by Order 2012-0011-DWQ (As amended by 2014-0006-EXEC, 2014-0077-DWQ and 2015-0036-EXEC) which is administered by the State Water Resources Control Board and enforced by the Regional Boards.
- Construction projects impacting one acre or greater are regulated by the Construction General Permit under Order 2009-0009-DWQ (As amended by 2010-0014-DWQ and 2012-0006-DWQ), which is administered by the SWRCB.
- Industrial sites are regulated under the Industrial General Permit under Order 2014-0057-DWQ, which is administered by the SWRCB.
- Discharges from utility vaults and underground structures are regulated under Order 2014-0174-DWQ, which is administered by the SWRCB.
- Reclaimed water use is regulated under a separate permit (Order 97-52) administered by the SDRWCB.
- Hydrostatic Test & Potable Water is regulated under Tentative Order R9-2010-0003. This order is regulated by SDRWQCB.
- The South Orange County Wastewater Authority discharges through the San Juan Creek Ocean outfall is regulated by SDRWQCB under Order R9-2012-0012.
- Phase II MS4s, is regulated by SWRCB and the Regional Boards under Order 2013-0001-DWQ.
- On-site disposal systems (OSDS), agricultural & nursery discharges, animal operations and aerially discharged wastes over land are each regulated under one of twelve (12) conditional "waivers" administered by SDRWQCB.

*In California, DPR, SWRCB and RWQCB have mandates and authorities bearing on pesticides and water quality. In order to promote cooperation to protect water quality from the adverse effects of pesticides, DPR and the SWRCB signed a Management Agency Agreement (MAA). The MAA, and its companion document, "The California Pesticide Management Plan for Water Quality," strive to coordinate interaction, facilitate communication, promote problem solving, and ultimately assure the protection of water quality. The agreement, along with a companion implementation plan, was developed to coordinate interaction, facilitate communication, promote problem solving, and ultimately assure the protection of water quality. In 2003, additional guidance was developed to provide a framework to cooperatively respond to the presence of pesticides in surface water. An executive charter was developed in 2012 to improve communication at the management level. The City looks forward to seeing additional outcomes

of this MAA coordination and implementation, as pesticides have been noted as a pollutant of concern in water bodies within Orange County.

A-4.4 ENFORCEMENT

The City's Water Quality Ordinance includes adequate legal authority, to the extent permitted by California and Federal Law and subject to the limitations on municipal action under the constitutions of California and the United States, to enter, inspect and gather evidence (pictures, videos, samples, documents, etc.) from industrial, construction and commercial establishments. Sanctions are in place to allow the City to progressively and decisively take enforcement actions against any violators of their Water Quality Ordinance. The City intends to use the Enforcement Response Plan (previously, Enforcement Consistency Guide For Water Quality Ordinance Implementation (**DAMP Exhibit 4.I**)) and follow the guidelines and procedures included therein.
The detection, elimination and enforcement activities undertaken by the City are described further in **DAMP Section 10.0**. Authorized Inspector(s) (AI) are assigned to investigate compliance with and detect incidences of violations of the City's Water Quality Ordinance. In addition to prohibiting unpermitted discharges, the Water Quality Ordinance also provides the legal authority for requiring BMPs in new development and significant redevelopment found in **DAMP Section 7.0**.

The City of Laguna Niguel has key departments and staff responsible for overseeing, implementing, and enforcing City ordinances. These departments and staff members are identified in Section 2, **Table A-2.2**.

A-4.5 ASSESSMENT

The City has concluded that the City's ordinances grant the City the adequate legal authority necessary to implement and enforce the requirements of the permit and a Statement of Legal Authority (**Exhibit A-4.2**) signed by legal counsel, was completed to certify that the City of Laguna Niguel has the legal authority to implement and enforce the requirements in 40 CFR 122.26(d)(2)(i)(A-F).

Exhibit A-4.I

Enforcement Response Plan

CITY OF LAGUNA NIGUEL

STORM WATER MANAGEMENT AND URBAN RUNOFF

ENFORCEMENT RESPONSE PLAN

I. INTRODUCTION

The City of Laguna Niguel (City) controls pollutant discharges into and from its storm drain system within its jurisdiction through enforcement of its Water Quality Ordinance, which is Article 5 of Division 3 of Title 6 of the Laguna Niguel Municipal Code (Sections 6-3-400 through 6-3-410, inclusive), its Grading Ordinance, which is Article 8 of Division 1 of Title 8 of the Laguna Niguel Municipal Code (Sections 8-1-800 through 8-1-845, inclusive), and certain other complimentary Municipal Code provisions identified in Section 4 of the City's Jurisdictional Urban Runoff Plan/Local Implementation Plan (referred to collectively as the City ordinances).

Unless otherwise defined in this Enforcement Response Plan (ERP), all capitalized terms used in this ERP are defined in the Water Quality Ordinance or the LIP.

This ERP works in conjunction with the City's Ordinances as part of the City's efforts to effectively administer the storm water quality control programs described in the Drainage Area Management Plan (DAMP), the LIP, and the South Orange County Water Quality Improvement Plan (WQIP), and is intended to be consistent with these programmatic documents.

This ERP describes the applicable approaches and options the City takes to investigate and enforce violations of the City's Ordinances in order to achieve compliance with the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit (Permit) with respect to Illicit Discharge Detection and Elimination, Development Planning, Construction Management, and Existing Development. It is intended to provide guidance to Authorized Inspectors, Enforcing Attorneys, and other City personnel responsible for implementing the Water Quality Ordinance and the City's storm water quality control programs in order to assist them to take appropriate, adequate, consistent, and timely enforcement actions for the protection of the environment and public health, safety and welfare.

This ERP was developed in support of the City's Ordinances, and is not intended to support the enforcement of requirements under the State General Industrial and General Construction Permit Programs, which are subject to enforcement by other state and regional authorities.

II. OVERVIEW OF ENFORCEMENT OPTIONS AND APPROACHES TO RESPONDING TO NONCOMPLIANCE

The goals of the City's enforcement program include the following:

- To educate the regulated community.
- To achieve compliance with the laws and regulations within the regulated community.

- To return violators to compliance in a timely manner and eliminate any threats due to noncompliance.
- To initiate and conclude enforcement activities in a timely manner.
- To provide consistency in responding to violations.

In selecting enforcement options, the City strives to ensure that violations of a similar nature are subjected to similar-types of enforcement remedies. Nonetheless, a more severe enforcement option may be selected when a violator has either a history of noncompliance or has failed to take good faith actions to eliminate continuing violations or to meet a previously imposed compliance schedule. Authorized Inspectors should review enforcement options with the Enforcing Attorney to insure that evidence is collected and delivered in a timely fashion.

The City typically employs a tiered, escalating enforcement system. However, the City reserves the right to use whatever tools it deems most appropriate for a given situation, as dictated by the specifics of each case. The use of a progressively more severe enforcement option is referred to in this ERP as "Escalated Enforcement." Whether a particular method of enforcement constitutes "Escalated Enforcement" is specified below.

A. Criteria for Determining Appropriate Response to Noncompliance

The enforcement approach taken by the City in response to a specific incident of noncompliance is determined on a case-by-case basis and depends on a variety of factors, including the severity of the violation and the knowledge or intent, level of cooperation, and compliance history of the responsible party.

1. Severity of the Violation

Violations are evaluated against the severity of the noncompliance and the potential or actual threat to public health or the environment created by the noncompliance. The severity of a violation is generally the most important factor in determining the appropriate level of enforcement response. The severity of a violation will depend on a number of factors, including the duration and frequency of the event, the type and amount of the pollutants discharged, and the impact on public health and the environment. Violations that do not pose an immediate or significant threat to public health or the environment, are isolated or infrequent, and/or are short in duration will typically be addressed initially through lower level enforcement actions, such as Verbal Warnings, Notices of Violation (also referred as Notices of Noncompliance), or Administrative Compliance Orders. However, higher level Escalated Enforcement responses will be utilized for violations that pose an immediate and significant threat to human health or the environment or which are continuous, frequent, and/or of a long duration.

2. Knowledge or Intent of the Responsible Party

The responsible party's knowledge of a violation or regulations being violated are also taken into account when evaluating the appropriate enforcement approach to take. Where a violation is not severe and has occurred unknowingly, the initial enforcement response will typically consist of an Education Letter, Verbal Warning, or Notice of Noncompliance. However,

negligent or willful noncompliance will warrant higher level administrative or civil Escalated Enforcement action or Criminal Enforcement.

3. Level of Cooperation

A responsible party's willingness to cooperate and to undertake good faith efforts to maintain compliance or eliminate noncompliance may also be considered when determining the appropriate enforcement response. "Good faith" means that the responsible party has an honest intention to remedy its noncompliance, coupled with actions that give support to this intention. While a responsible party's good faith and willingness to cooperate may be taken into account in determining the appropriate type of enforcement response, it does not eliminate the need for enforcement action, and should not be used to mitigate an enforcement response to such an extent as to permit actual or threatened harm to public health or the environment.

4. Compliance History

When evaluating the level of enforcement action to be taken for a violation, the City reviews and considers the compliance history of the responsible party. If a pattern of recurring violations is observed, or if a responsible party has failed to correct violations noted in a prior enforcement action, the City will use Escalated Enforcement.

B. Initial Methods of Achieving Voluntary Compliance

1. Education Letters

In certain limited circumstances, the City will issue an Educational Letter advising a property owner, business, or resident of their legal obligations prior to, or in lieu of, pursuing administrative, civil, or criminal enforcement. An Educational Letter provides information regarding the requirements of City's Ordinances and the steps that need to be taken to comply with them. An Educational Letter may be appropriate under the following circumstances:

- Where an Authorized Inspector receives a complaint or information concerning noncompliance that the Authorized inspector believes to be valid, but the Authorized Inspector does not have sufficient evidence to substantiate that a violation of the City's Ordinances has occurred.

- Where a violation has been caused by a contractor hired by a property owner, business, or resident without the knowledge or consent of the property owner, business, or resident, and the City may pursue enforcement against the contractor.

In these circumstances, the Authorized Inspector will document that the Educational Letter has been provided, and this documentation can be used as evidence to support enforcement action in the event of continued or future similar violations at the same site.

2. Verbal Warnings

A Verbal Warning is often the initial method used by the City to request corrective action and enforce compliance with the City's Ordinances. A Verbal Warning may be utilized where there is no history of noncompliance and the violation or noncompliance is relatively minor and can be quickly and easily corrected. In such cases, a Verbal Warning may be sufficient to achieve immediate correction of a violation. Where an Authorized Inspector issues a Verbal Warning, he/she will document the violation and the name and position of the person(s) notified in the inspection file. A specific time frame for correcting the problem and a follow-up inspection date will also be documented by the Authorized Inspector. In cases, where the issue is immediately abated while the Authorized Inspector is present on site, a case may not be created as no follow-up will be necessary. In other instances, where the issue was observed as part of a designated inspection, and the issue was immediately addressed, the issue and abatement actions will be noted as part of the inspection, and a separate case will not be created.

C. Administrative Enforcement Responses

1. Notice of Noncompliance/Notice of Violation

After a verbal warning, the Notice of Noncompliance/Notice of Violation is the least severe administrative enforcement response utilized by the City for violations of the Water Quality Ordinance. A Notice of Noncompliance/Notice of Violation constitutes a basic written request that a contractor, facility operator, property owner, or resident rectify a condition causing or threatening to cause noncompliance with the City's Ordinances. A Notice of Noncompliance/Notice of Violation is the appropriate enforcement tool in the following circumstances:

- The violation or threat is insignificant and short in duration.
- The violation or threat is an isolated incident.
- The violation or threat does not affect and will not harm human health or the environment.
- The responsible party is cooperative and has indicated a willingness to readily correct the violation.
- The violation occurred unknowingly.
- A prior Verbal Warning was given, but the deficiency that was noted in a prior Verbal Warning has not been corrected within the specified timeframe or by the next inspection.

A Notice of Noncompliance/Notice of Violation (a) identifies the provision(s) of the City's Ordinances and/or relevant permit that has been violated, (b) describes the violation/deficiency to be corrected and corrective action(s) required, (c) includes a compliance date by which the violation must be corrected, (d) sets a date for a follow-up inspection (if applicable), and (e) states that continued noncompliance may result in additional enforcement actions.

A responsible party may appeal a Notice of Noncompliance/Notice of Violation and request an administrative hearing before a hearing officer in accordance with the procedures set forth in the Water Quality Ordinance.

Generally, a Notice of Noncompliance/Notice of Violation will be given to a responsible party prior to the use of other progressively severe enforcement options. However, a Notice of Noncompliance/Notice of Violation will not be the first enforcement method used if egregious or unusual circumstances indicate that a stronger enforcement tool is needed.

2. Administrative Compliance Order

An Administrative Compliance Order is a progressively more severe enforcement response than a Notice of Noncompliance/Notice of Violation. The Administrative Compliance Order is an appropriate enforcement tool in the following circumstances:

- The violation or threat is not significant and short in duration.
- The violation or threat is infrequent.
- The violation does not pose an immediate threat to human health or the environment.
- An actual condition of noncompliance exists, but the condition cannot be remedied within a relatively short period of time.
- The responsible party has indicated willingness to come into compliance by meeting milestones established in a reasonable schedule.
- The violation is not willful.
- A prior Verbal Warning and/or Notice of Noncompliance/Notice of Violation has been insufficient to achieve compliance.

An Administrative Compliance Order may include the following terms and requirements:

- Specific steps and time schedules for compliance as reasonably necessary to eliminate an existing prohibited discharge or prevent the imminent threat of a prohibited discharge;
- Specific steps and time schedules for compliance as reasonably necessary to discontinue any illicit connection;
- Specific requirements for containment, cleanup, removal, storage, installation of overhead covering, or proper disposal of any pollutant having the potential to contact stormwater runoff; and
- Any other terms or requirements reasonable calculated to prevent imminent threat of or continuing violations, including, but not limited to, requirements for implementation of, and compliance with, appropriate BMPs.

An Administrative Compliance Order may constitute Escalated Enforcement in those instances where a previously issued Verbal Warning or Notice of Noncompliance/Notice of Violation has failed to achieve compliance.

3. Cease and Desist Order

A Cease and Desist Order may be issued to obtain immediate compliance with the Water Quality Ordinance and may order immediate cessation of any Illegal Discharge, Illicit Connection, or other violation; immediate containment or diversion of any impermissible flow of water off the property; and/or immediate cleanup of any area affected by a violation. The Cease and Desist order may also be appropriately issued as a first step in ordering the removal of nuisance conditions that threaten to cause an unauthorized discharge of Pollutants if exposed to rain or surface water runoff. The Cease and Desist Order is an appropriate enforcement tool in the following circumstances:

- The violation or threat is immediate in nature and may require an emergency spill response or immediate nuisance abatement if left unattended.
- The violation or threat exhibits a potential situation that may harm human health or the environment.
- The Authorized Inspector's contacts with the responsible party indicate that further authority of the City may need to be demonstrated before remedial action is forthcoming.
- The Authorized Inspector's prior enforcement actions have not obtained a favorable response.

A person issued a Cease and Desist Order is entitled to an administrative hearing before a hearing officer within 5 business days in accordance with the procedures set forth in the Water Quality Ordinance.

A Cease and Desist Order constitutes Escalated Enforcement in those instances where a previously issued Notice of Noncompliance/Notice of Violation and/or Administrative Compliance Order has failed to achieve compliance.

4. Administrative Nuisance Abatement

In instances where Escalated Enforcement actions fail to achieve compliance and there is a continuing threat to water quality, the City may itself enter the property, abate the condition(s) causing the violation, and restore the area. Before pursuing Administrative Nuisance Abatement, the City will notify the property owner and/or occupant and seek their consent. Where consent is not given or cannot be obtained, the City generally must obtain an inspection / abatement warrant from a court in accordance with State law before entering private property. However, where a nuisance condition on private property constitutes imminent danger to public safety or the environment and deemed a nuisance pursuant to Government Code Section 38771, the City is authorized to take any and all enforcement action to abate said nuisance.

Administrative Nuisance Abatement constitutes Escalated Enforcement.

5. Invoice For Costs

The Water Quality Ordinance authorizes an Authorized Inspector to deliver an Invoice for Costs to any responsible party for the actual costs incurred by the City in issuing and enforcing any Notice of Noncompliance/Notice of Violation, Administrative Compliance Order, Cease and Desist Order, or Administrative Abatement order. A responsible party may appeal an Invoice for Costs and request an administrative hearing before a hearing officer in accordance with the procedures set forth in the Water Quality Ordinance. If the responsible party fails to either pay or successfully appeal the Invoice for Costs, then the Enforcing Attorney may institute collection proceedings in accordance with State law.

Delivery of an Invoice for Costs does not constitute Escalated Enforcement.

6. Stop Work Orders

A Stop Work Order is an Escalated Enforcement tool for active land development projects. A Stop Work Order is a written order prohibiting further construction or site development activity until compliance has been achieved. The Stop Work Order is an appropriate enforcement tool in any of the following circumstances:

- If prior written notices or orders have failed to result in compliance or correction of identified violations.
- If the developer/contractor has not complied with the requirements of their building and/or grading permit.
- If an observed violation poses a significant threat to water quality (such as a failure of BMPs resulting in a significant release of sediment or other pollutants off site).

A Stop Work Order will be issued by the inspector or the appropriate official. Stop work orders prohibit further construction activity until the problem is resolved and provide a time frame for correcting the problem.

The Stop Work Order will describe the violation and specify what corrective action must be taken. A copy of the Stop Work Order will be given to the contractor's project supervisor and placed in the active inspection file. For a private construction project, a copy of the Stop Work Order will also be sent to the owner/developer. To restart work once a Stop Work Order has been issued, the contractor's project supervisor must request the City's inspector to re-inspect the project and verify that the deficiencies have been satisfactorily corrected. If the City inspector is satisfied with the corrections, the inspector may sign off on that phase of the project, and work may proceed.

A Stop Work Order constitutes Escalated Enforcement.

7. Permit Revocation or Denial

Violations of the City's Ordinances may be grounds for the suspension or revocation of City issued permits, licenses or other approvals after notice and an opportunity for hearing. For

instance, in severe cases of noncompliance, or significant discharges relating to development and/or construction activities, the City revoke grading and/or building permits or other approvals for a development project that a contractor/developer is working under for the project or deny future permits on the project. The responsible party would then have to re-apply for permits and meet any requirements that the City may place on the project. Suspension or revocation of permits or other approvals must be conducted in accordance with the procedures described in the City's Municipal Code. City Staff should consult with the Enforcing Attorney before proceeding with the suspension, revocation or denial of a permit or development approval.

Suspension or revocation of a permit constitutes Escalated Enforcement.

8. Enforcement of Contracts

If a contractor is performing work for the City, then the City may use the provisions within the contract for enforcement of noncompliance. Such contract provisions may allow the City to withhold payment(s), require bonds, apply monetary penalties, order work stopped (without time penalties), or terminate the contract if the contractor performing the work does not comply with all appropriate permits, laws, regulations and ordinances.

Enforcement of Contracts constitutes Escalated Enforcement.

9. Administrative Citations

The City's authorized enforcement staff may issue administrative citations imposing administrative fines for specified violations of the City's Ordinances in accordance with Article 2 of Division 3 of Title 1 of the City's Municipal Code. The fine amount for an initial violation may be relatively small for a first offense, but repeated violations of the same type will result in escalated fines, up to a maximum of $500 per violation per day. When an Administrative Citation is issued, the responsible party may request a hearing to contest the determination that a violation has occurred in accordance with Chapter 1.3-20 of the City's Municipal Code.

D. Criminal Enforcement

In addition to the administrative enforcement actions described above, the Enforcing Attorney is authorized to file criminal actions to enforce the City's Ordinances. Criminal prosecution is generally the last step taken to stop a condition of noncompliance; however, in some limited cases, criminal enforcement may be appropriate as a first step in enforcement if the facts indicate that the violation is severe, willful and egregious. Criminal prosecution will be appropriate if information or events indicate that noncompliance is (i) willful, (ii) fails to comply with the best management practices imposed on a New Development or Significant Redevelopment project, (iii) continues after notice of noncompliance is received, or (iv) is a direct attempt to conceal a violation of the City's Ordinances. Criminal prosecution may also be utilized for egregious violations which are the result of negligent rather than willful conduct.

Circumstances indicating that criminal, rather than administrative, enforcement measures should be considered include the following:

- There is strong evidence that the responsible party has willfully violated the City's Ordinances and/or has intentionally disregarded legal requirements.
- There is a significant threat of environmental harm as a result of the violation.
- There is actual sustained environmental harm as a result of the violation.
- The discharge or event of noncompliance is continuing or has been long in duration.
- No immediate remedy for the violation is available.
- There have been numerous previous violations by the same responsible party.

Where it is determined that the available facts warrant criminal enforcement in a particular case, additional evidence will often need to be collected to support a criminal prosecution, and the City may need to obtain a criminal inspection warrant from a court. City staff should consult with the Enforcing Attorney early in the process to ensure proper procedures are followed. Where criminal enforcement is indicated, authorized City personnel may cause issuance of a criminal citation to the offending party pursuant to Penal Code §853.5, §853.6, and §853.9. The citation shall include: (i) the name and address of the violator; (ii) the provisions of the City's Ordinances violated; and (iii) the time and place of required appearance before a magistrate. The responsible party must sign the citation thereby promising to appear. If the cited party refuses to sign the citation, the enforcement official may cause the arrest of the discharger with the assistance of law enforcement personnel, or may refer the matter to the Enforcing Attorney for issuance of a warrant for arrest.

At the discretion of the Enforcing Attorney, criminal violations of the City's Ordinances may be charged as either misdemeanors or infractions. Factors that the Enforcing Attorney may use in determining whether the misdemeanor is more appropriately treated as an infraction, rather than a misdemeanor, may include:

- The duration of the violation or threatened violation.
- The compliance history of the person, business or entity.
- The effort made to comply with an established compliance schedule.
- The existence of prior enforcement actions.
- The actual harm to human health or the environment from the violation.

Criminal Enforcement constitutes Escalated Enforcement.

E. Civil Judicial Enforcement

In addition to the administrative and criminal enforcement options discussed above, the City may also pursue civil judicial enforcement of violations where appropriate.

1. Civil Injunction/Nuisance Abatement Action

Violations of the City's Ordinances that constitute a threat to the public health, safety and welfare are deemed a public nuisance, and the Enforcing Attorney may file a civil judicial action seeking preliminary or permanent injunctive relief to enjoin and/or abate a nuisance or other threatened or continuing noncompliance. Such an action may be appropriate where a continuing or emergency nuisance exists, and administrative and/or criminal enforcement options are insufficient to remedy the nuisance condition. In any such action, the City may seek recovery of its actual enforcement and abatement costs.

A Civil Injunction / Nuisance Abatement Action constitutes Escalated Enforcement.

2. Civil Damages Action

Pursuant to the Water Quality Ordinance, the City may bring an action for civil damages against a responsible party to recover (i) enforcement costs incurred by the City; (ii) costs incurred by the City in mitigating harm to the environment or reducing the threat to human health; (iii) damages for irreparable harm to the environment; and/or (iv) damages resulting from any trespass or nuisance occurring on public land or to the Stormwater Drainage System as a result of a violation of the Water Quality Ordinance.

III. Illicit Discharge Detection and Elimination Enforcement Component

This Section of the ERP describes the City's approaches to investigating, responding to, and enforcing noncompliance with the City's Ordinances related to Illegal Discharges and Illicit Connections.

A. Overview

The City's Water Quality Ordinance expressly prohibits Illegal Discharges and Illicit Connections (ID/ICs), and the City implements a comprehensive program for actively detecting, responding to, investigating and eliminating ID/ICs in an efficient and timely manner (ID/IC Program). The City's ID/IC Program is described in more detail in LIP Section 10.

An Illicit Connection is an undocumented and/or unpermitted physical connection from a facility to the Stormwater Drainage System. Illicit Connections are often associated with Illegal Discharges. Constructed (i.e., man-made) Illicit Connections include pipelines, conduits, inlets or outlets, connected impervious areas, channels or swales. Practical examples of constructed Illicit Connections include: (i) pipes that discharge onto adjacent property or into a water runoff area; (ii) facilities constructed adjacent to construction areas that allow dewatering runoff to flow to the storm water drainage system; or (iii) storm drain inlets that drain from outside wash areas directly into the Stormwater Drainage System.

An Illegal Discharge (or "Prohibited Discharge") is any discharge to the Stormwater Drainage System that is not composed entirely of stormwater and that is not covered by an NPDES permit. An Illegal Discharge refers to the disposal of non-stormwater materials such as paint or waste oil into the storm drain or the discharge of waste streams containing pollutants to the storm drain. Illegal Discharges typically are generated from poorly managed on-site

operations, illegal dumping, contaminated stormwater discharges, and/or sewage or other materials spills.

Various site operations may produce Illegal Discharges, including releases of (i) process waters such as boiler blow down, rinse water, or chlorinated pool discharges; (ii) waste materials such as manufactured floatable materials, animal wastes from kennels or riding stables, or vehicle fluids (oils, coolants, etc.); and (iii) sand/gravel, cement, fertilizers, or pesticides from raw materials unloading and storage areas. Practical examples of problematic site operations include: (i) pressurized washing and steam cleaning areas; (ii) auto repair shops where operations occur out of doors in unprotected areas and no provision is made for preventing contamination from leaving the site; (iii) non-retail fueling areas where vehicle washing also occurs and runoff flows to storm drain areas; (iv) manufacturing storage yards for concrete materials where materials are uncovered and wash off flows directly to the storm drain; (v) construction locations where debris, materials, and silt flows off the construction site; and (vi) trauma scene clean-up.

Illegal dumping activities include intentional dumping of: (i) household wastes such as home, garden or yard debris, trash or rubbish, or household hazardous wastes; (ii) commercial wastes such as landscape debris or soil, trash or rubbish, or hazardous wastes in drums or canisters; and (iii) animal or agricultural wastes such as manure, stock wastes, fruit and vegetable materials and animal carcasses. Practical Examples of illegal dumping activities could include: (i) home/yard debris dumped near a curb inlet to the stormwater drainage system; (ii) trash, drums or discarded materials left on creek or wash area banks; (iii) used oil dumped on the ground or into storm drains; and (iv) paint waste dumped on the ground or into storm drains.

Stormwater pollution can also occur as rain water is contaminated running off of impervious surfaces. Though the runoff is due to storm events, Illegal Discharges can occur from the following:

- Construction work on an exposed site where soils are being tracked onto the street and washed down the gutter.
- Construction or work on an exposed site where materials, such as sand, are migrating into the street gutter area either through non-concentrated exposure to water, such as sprinkler systems, or by actual contact with other runoff water.
- Petroleum contained soils in equipment servicing areas, which are exposed to gutter areas through tracking.
- Uncovered areas of stockpiled construction demolition materials.
- Outside storage of unsealed paint and solvent containers.
- Exposed truck loading docks with uncovered materials.
- Equipment storage yards without runoff controls.

Sewage spills may be the result of an accidental or irregular discharges of sewage from a

sanitary sewer system or from private property tributary to a public sewerage system. Pursuant to the Statewide General Waste Discharge Requirements for Sanitary Sewer Systems (State Water Resources Control Board, Order No. 2006-0003) and San Diego Regional Board Order No. R9-2007-0005, Moulton Niguel Water District is responsible for responding to, containing, and cleaning up sewage spills/incidents originating from their wastewater and sanitary systems, including systems that collect and convey wastewater to publicly owned treatment facilities. It is this agenciy's standard operating policy to respond to all sewage spills/incidents from private systems as well. MNWD has implemented an overflow emergency response plan that is used during sewage spills/incidents.

In addition, the City's Plumbing and Building Codes and Ordinances require that private sewer laterals and septic systems be designed and operated in accordance with industry standards and require the proper maintenance of these facilities in order to minimize possible spills, breakages, and failures. The City enforces these requirements if a sewage spill from private property or another private source is, or cannot be, effectively remedied by the owner or other responsible party. The City may also issue enforcement actions pursuant to this ERP to any party responsible for a prohibited discharge into the City's MS4.

B. Investigating and Responding to Noncompliance

The City may become aware of potential Illegal Discharges or Illicit Connections through field observations, facility or construction site inspections, Water Quality Monitoring Program results, or complaints. The protocols the City follows for investigating, documenting, and responding to Illegal Discharges and Illicit Connections are described in more detail in Section 10 of the LIP.

If a complaint or information is received that indicates a potential ID/IC, an Authorized Inspector will conduct a field investigation. If evidence of an actual or threatened ID/IC is found as a result of an inspection, every effort is made to identify the responsible party and resolve the situation quickly.

Any Illicit Connection identified by the City during routine inspections is investigated. Appropriate actions are then taken to either approve undocumented connections by permit procedure or to pursue removal of those connections that are determined to be Illicit Connections and not permissible. If evidence of an Illegal Discharge is detected and the source does not appear to be evident, a source investigation may be conducted to determine if the discharge is being conveyed through an Illicit Connection.

Parties found to be responsible for an Illegal Discharge are required to clean up and remove Pollutants to the maximum extent practicable. Where a responsible party is cooperative and responds in a timely manner, lower level enforcement actions may be sufficient to ensure compliance. The failure of a responsible party to cooperate and/or perform required clean-up will result in immediate Escalated Enforcement action.

Sewage spills and spills of other types of harmful Pollutants may require immediate remedial action. In cases where a spill presents an immediate threat to the Stormwater Drainage System or to human health or the environment, and the City knows who the responsible party is, the

City will direct the responsible party to immediately contain and commence clean-up of the spill. For all sewer spills, the City will contact the appropriate sewering agency to respond. For spills other than sewer spills, where the City is unable to identify the responsible party, or the responsible party is able to effectively respond to contain and clean-up the spill immediately, the City will respond through Control One and the Water Implementation Agreement to secure resources to ensure the spill is contained and mitigated, and will conduct a source investigation to identify the responsible party.

C. Enforcement Response Approaches

The nature of the City's enforcement response approach for ID/ICs is determined on a case-by-case basis and is based on factors such as severity of the violation or threat to human health or the environment, site-specific circumstances, and past compliance history. If the situation is determined to pose an immediate risk to public health or the environment, higher level Escalated Enforcement responses may be used immediately and, if needed, the City will respond itself to ensure the threat is eliminated in a timely and efficient manner.

If a non-sewage spill, illegal dumping, or other Illegal Discharge is determined to pose a threat to human or environmental health, the City will report this information to the Regional Board by phone or e-mail within 24 hours of the discovery followed by a written report within 5 days, as required by the NPDES Permit. The sewering agency will do all reporting relating to sewage spills, including to the Orange County Health Care Agency in accordance with California Health and Safety Code Section 5411.5, and reports all sewage spills of 1,000 gallons or more from a public sewer system to the State Office of Emergency Services pursuant to California Water Code Section 13271 and the 23 CCR § 2250.

The City seeks to abate actual Illegal Discharges and hazardous materials spills as soon as reasonably possible. As required by the NPDES Permit, the City seeks to resolve all incidents of observed noncompliance within at least 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where more than 30 days are required to resolve a violation and achieve compliance, the reasons why additional time is needed is documented and kept on file. If Escalated Enforcement is not used when compliance is not achieved within the required compliance period, the rationale for why Escalated Enforcement actions were not used will also be documented.

The following table provides a general overview of the City's enforcement response approach for ID/ICs. The descriptions in the Table as to when specific enforcement responses are used and appropriate timeframes for compliance are intended to be illustrative in nature and to provide general guidance to City enforcement staff, and are not intended to be exclusive or exhaustive. The City reserves the right to use whatever tools deemed most appropriate for a given situation, as dictated by the specifics of each case, and taking into account the factors described in Section II.A of this ERP.

Illicit Discharge Detection and Elimination Enforcement Approach

Enforcement Action	Use	Time Schedule to Achieve Compliance

Enforcement Action	Use	Time Schedule to Achieve Compliance
Education Letter	• If suspect noncompliance, but lack sufficient evidence to substantiate it. • Use for business/resident where violation is by contractor and there is no history of noncompliance by business/resident.	Goal is to correct the situation and behavior.
Verbal Warning	• Use for threatened Illegal Discharges from poorly managed on-site operations, illegal dumping, contaminated water runoff, or spilled materials where there is no history of noncompliance and the violation is relatively minor and can be quickly and easily corrected.	Goal is to correct the violation immediately, if possible. If not, the compliance timeframe should be short and will depend on the nature of the potential threat to water quality. At a minimum, violation should be corrected within 30 calendar days or before the follow-up inspection or next predicted rain event, whichever is sooner.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Notice of Noncompliance/Notice of Violation	• Use where a prior Verbal Warning was given, but the deficiency that was noted in a prior Verbal Warning has not been corrected within the specified timeframe or by the next inspection. • Use for threatened Illegal Discharges from Illicit Connections, poorly managed on-site operations, illegal dumping, contaminated water runoff, or spilled materials where the threat level is insignificant, there is no environmental harm, and the responsible party is cooperative and has already corrected, or is willing to readily correct, the condition causing the violation. • Use to order correction of conditions causing or contributing to an actual Illegal Discharge that has already ceased where the discharge occurred unknowingly, was an isolated incident, and was short in duration; the threat level is insignificant; there was no environmental harm; and the responsible party is cooperative and has shown a good faith effort to correct the condition causing the violation and to come into compliance.	Require immediate containment of spilled materials or Illegal Discharges, with a goal of completion of correction/cleanup within 24 hours. Conditions causing or contributing to an actual or threatened Illegal Discharge should be corrected within 30 calendar days or before the follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Administrative Compliance Order	• Use where a prior Verbal Warning and/or Notice of Noncompliance has been insufficient to achieve compliance. • Use for threatened Illegal Discharges from Illicit Connections, poorly managed on-site operations, illegal dumping, contaminated water runoff, or spilled materials where the violations are not willful, the threat level is not significant, there is no immediate threat of environmental harm, and the responsible party has shown a good faith willingness to correct the condition causing the violation. • Use to order correction of conditions causing or contributing to an actual Illegal Discharge that has already ceased where there is no immediate threat to human health or the environment; the discharge was not willful, was not significant, and was infrequent or short in duration; the conditions causing or contributing to the Illegal Discharge cannot be remedied within a relatively short period of time; and the responsible party has indicated willingness to come into compliance by meeting milestones established in a reasonable schedule.	Require immediate containment of spilled materials or Illegal Discharges, with a goal of completion of correction/cleanup within 24 hours. Conditions causing or contributing to an actual or threatened Illegal Discharge should be corrected within 30 calendar days or before the follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Cease and Desist Order	• Use to order immediate cessation of an Illegal Discharge or Illicit Connection. • Use to order immediate containment or diversion of any impermissible flow of water off of a site that poses a significant and/or immediate threat to water quality. • Use to order immediate cleanup of an area affected by an Illegal Discharge, sewage or materials spill, illegal dumping, or other violation. • Use to order immediate removal of nuisance conditions on property that threaten to cause an Illegal Discharge of Pollutants if exposed to rain or surface water runoff. • Use where lower level enforcement actions have not resulted in compliance and/or available information indicates that further authority of the City may need to be demonstrated before remedial action is forthcoming. • Use for recurring violations.	Generally, immediate. Where used other than to order immediate cessation of an actual or threatened ID/IC, the time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis. In these circumstances, noncompliance should be corrected within 30 calendar days or before follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.
Nuisance Abatement / Spill Response	• Use for sewage or hazardous materials spills where there is a significant and immediate threat to human health or the environment. • Use where the responsible party has continually failed to comply with a previously issued compliance schedule.	Goal is immediate containment of spilled materials or Illegal Discharges, with a goal of completion of correction/cleanup within 24 hours.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Administrative Citation	• May be used in addition to an Administrative Compliance Order or Cease and Desist Order where monetary sanctions will deter future violations. • May be used in lieu of an Administrative Compliance Order or Cease and Desist Order where a compliance schedule is unnecessary and will help deter future violations. • Use where an actual Illegal Discharge occurred, but ceased prior to other enforcement action. • Use where a prior Verbal Warning, Notice of Noncompliance, and/or Administrative Compliance Order has been insufficient to achieve compliance. • Use for recurring violations.	Time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis. Conditions causing or contributing to an actual or threatened Illegal Discharge should be corrected within 30 calendar days or before the follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.
Enforcement of Contracts	• Use to address actual or threatened Illegal Discharges or Illicit Connections caused by City contractors.	Time schedule for compliance will be determined on a case-by-case basis.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Stop Work Order	• Use to order immediate cessation of construction or development activities where prior written notices or orders have failed to result in compliance or correction of identified violations. • Use to order immediate cessation of construction or development activities where a developer/contractor has not complied with the requirements of its building and/or grading permit. • Use to order immediate cessation of construction or development activities where if an observed violation at the site poses a significant threat to water quality (such as a failure of BMPs resulting in a significant release of sediment or other pollutants off site).	Effective immediately, all work, except work to remedy non-compliant situation, must cease.
Permit Revocation / Denial	• Use in severe cases of noncompliance or significant Illegal Discharges relating to development and/or construction activities.	NA
Civil Action	• Use for violations that cause significant harm. • Use when response to administrative enforcement actions is inadequate or the responsible party fails to respond.	Time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Criminal Action	• Use in cases where the actual or threatened environmental harm from the violation is significant and there is strong evidence of willfulness or intentional disregard for legal requirements. • Use in cases where an Illegal Discharge, Illicit Connection, or related violation is frequent, ongoing, or long in duration and the responsible party has failed to respond to administrative enforcement actions. • Use where there is a history of repeated prior violations by the same responsible party. • Use where there has been a direct attempt to conceal an Illegal Discharge, Illicit Connection, or related violation.	Consult with Enforcing Attorney
Referrals	• Sites that fail to obtain state industrial or construction permits. • Sites that fail to comply with City enforcement actions. • Sites that discharge waste or hazardous wastes to receiving waters.	NA

IV. Development Planning Enforcement Component

This Section of the ERP describes the City's approaches to investigating, responding to, and enforcing noncompliance with permanent BMP implementation, operation and maintenance obligations associated with New Development and Significant Redevelopment.

A. Overview

The Water Quality Ordinance requires all New Development and Significant Redevelopment to be undertaken in accordance with the DAMP, the LIP, the City's New Development / Significant Redevelopment Program. In conjunction with the New Development / Significant Redevelopment Program, the City has established design standards for new development and

significant redevelopment projects that require installation and implementation of permanent (post-construction) BMPs, including Low Impact Development (LID) techniques, hydromodification controls, source controls and treatment controls, to address the quality and quantity of stormwater runoff. These required BMPs are described in project-specific Water Quality Management Plans (Project WQMPs) and Non-Priority Project Water Quality Checklists (WQCs), which may be recorded, and which describe long-term BMP operation and maintenance requirements and identify the persons or entities responsible for funding and implementing ongoing BMP operation and maintenance. The New Development / Significant Redevelopment Program is more fully described in Section 7 of the LIP.

This Development Planning Enforcement Component describes the enforcement response approaches the City takes to ensure that required permanent BMPs are properly installed and implemented during construction and thereafter appropriately operated and maintained.

B. Investigating and Responding to Noncompliance

The City verifies required permanent BMPs are included in project designs through its development review and plan check process. All permanent structural BMPs must be shown on the grading and/or building plans, and building and/or grading permits will not be issued to allow construction to begin before all plans have been approved. In addition, Project WQMPs and WQCs must be approved by City before grading or building permits will be issued.

During a project's construction phase, City inspectors confirm that required structural BMPs are being constructed per plan during their routine inspections. If structural BMP construction or installation varies from approved plans, the City requires in-field corrections be made, or for the project engineer to confirm that revisions continue to comply with project requirements. Any proposed revisions must be approved by applicable City planning or engineering staff. Prior to grading or building permit close-out and/or the issuance of a certificate of use or a certificate of occupancy, the City will verify that all required permanent structural BMPs have been constructed and installed in conformance with approved plans and specifications and that, if applicable, and Operations and Maintenance (O&M) Plan for all structural BMPs has been prepared and approved by the City.

Once a development project has been completed, ongoing operation and maintenance of post-construction BMPs is verified through inspections or through review of submitted maintenance verification certifications. Where operation or maintenance deficiencies are discovered, they are documented and the responsible party is directed to take necessary corrective actions. Minor deficiencies and corrective actions may warrant resolution through Education Letters or documented Verbal Warnings, and if the responsible party performs all necessary corrective actions promptly, the case is closed and the resolution is documented. Where determined appropriate, the City will issue a Notice of Noncompliance/Notice of Violation or Administrative Compliance Order setting forth required corrective actions as its initial enforcement response. Responsible parties are required to perform corrective actions and demonstrate that all necessary operations and maintenance activities have been completed through re-inspection and/or submittal of appropriate documentation. Where initial

enforcement actions fail to result in corrective action, the City will pursue Escalated Enforcement until compliance is achieved. The City's enforcement response approach for the Development Planning and Enforcement Component is described more fully below.

C. Enforcement Response Approaches

The nature of the City's enforcement response approach to operating and maintenance deficiencies for permanent BMPs is determined on a case-by-case basis and is based on factors such as severity of the violation, site-specific circumstances, and past compliance history. If the situation is determined to pose an immediate risk to public health or the environment, higher level Escalated Enforcement responses may be used initially, and the City will report this information to the Regional Board by phone or e-mail within 24 hours of the discovery followed by a written report within 5 days, as required by the NPDES Permit.

As required by the NPDES Permit, the City seeks to resolve incidents of observed noncompliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where more than 30 days are required to resolve a violation and achieve compliance, the reasons why additional time is needed is documented and kept on file. If Escalated Enforcement is not used when compliance is not achieved within the required compliance period, the rationale for why Escalated Enforcement actions were not used will also be documented.

The following table provides a general overview of the City's enforcement response approach when it discovers that permanent BMPs are not being operated and maintained as required. The enforcement response approaches described in Section III (Illicit Discharge Detection and Elimination Enforcement Component) and Section VI (Existing Development Enforcement Component) of this ERP may also apply. The descriptions in the Table as to when specific enforcement responses are used and appropriate timeframes for compliance are intended to be illustrative in nature and to provide general guidance to City enforcement staff, and are not intended to be exclusive or exhaustive. The City reserves the right to use whatever tools deemed most appropriate for a given situation, as dictated by the specifics of each case, and taking into account the factors described in Section II.A of this ERP.

Development Planning Enforcement Approach

Enforcement Action	Use	Time Schedule to Achieve Compliance
Education Letter	• If suspect noncompliance, but lack sufficient evidence to substantiate it. • May use to advise responsible party of legal obligations where O&M deficiencies are minor and easily correctable and there have been no previous violations. • May be used for first-time administrative violations, such as failure to submit a timely compliance certification.	Goal is to educate responsible party and remedy O&M deficiency. Noncompliance should be corrected within 30 calendar days or before next inspection or predicted rain event, whichever is sooner.
Verbal Warning	• Use to advise responsible party of legal obligations where O&M deficiencies are minor and easily correctable, there is no threat to water quality, there is no history of prior noncompliance, and the responsible party is cooperative and has indicated a willingness to immediately correct the problem.	Noncompliance should be corrected immediately, if possible, but at least within 30 calendar days or before follow-up inspection or next predicted rain event, whichever is sooner.
Notice of Noncompliance/Notice of Violation	• Use where a prior Verbal Warning was given, but the deficiency that was noted in a prior Verbal Warning has not been corrected within the specified timeframe or by the next inspection. • Use for recurring administrative violation. • Use where the severity of the BMP O&M deficiency calls for an enforcement action stronger than a Verbal Warning, but the violation was unknowing and the responsible party is cooperative and has shown a good faith effort to immediately correct the observed O&M deficiency.	Noncompliance should be corrected within 30 calendar days or before follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Administrative Compliance Order	• Use where a prior Verbal Warning and/or Notice of Noncompliance has been insufficient to achieve compliance. • Use for recurring, but not significant, violations involving BMP O&M deficiencies. • Use for BMP O&M deficiencies that are not willful and pose no immediate threat to human health or the environment, but which cannot be remedied within a relatively short period of time. • Use to order implementation of a required BMP. • Use to order repair or replacement of a structural BMP or control device that is defective or has been removed.	Noncompliance should be corrected within 30 calendar days or before follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.
Cease and Desist Order	• Use where BMP O&M deficiencies pose an immediate threat of a significant Illegal Discharge. • Use where lower level enforcement actions have not resulted in compliance and/or available information indicates that further authority of the City may need to be demonstrated before remedial action is forthcoming. • Use for significant recurring violations of BMP O&M requirements.	Immediate compliance should be required where there is an imminent threat of a significant Illegal Discharge. Otherwise, the time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis. Where possible, noncompliance should be corrected within 30 calendar days or before follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.
Nuisance Abatement	• Use where the responsible party has continually failed to comply with a previously issued compliance schedule.	Time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis.

Enforcement Action	Use	Time Schedule to Achieve Compliance
Administrative Citation	• May be used in addition to an Administrative Compliance Order or Cease and Desist Order where monetary sanctions will deter future violations. • May be used in lieu of an Administrative Compliance Order or Cease and Desist Order where a compliance schedule is unnecessary and will help deter future violations. • Use where a prior Verbal Warning, Notice of Noncompliance, and/or Administrative Compliance Order has been insufficient to achieve compliance. • Use for recurring violations.	Time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis. Generally, noncompliance should be corrected within 30 calendar days or before the follow-up inspection or next predicted rain event, whichever is sooner. If more than 30 days is required to achieve compliance, then a written rationale must be documented and kept on file.
Civil Action	• Use when response to administrative enforcement actions is inadequate or the responsible party fails to respond. • Use to obtain a civil injunction requiring restoration or replacement of a required structural BMP that has been improperly removed or is no longer operational.	Time schedule for compliance will vary based on the severity of the violation and will be determined on a case-by-case basis.
Criminal Action	• Use in cases where there is strong evidence of willfulness or intentional disregard for legal requirements, the responsible party has failed to respond to administrative enforcement actions, there is a history of repeated prior violations by the same responsible party, and/or there has been a direct attempt to conceal a violation.	Consult with Enforcing Attorney

Enforcement Action	Use	Time Schedule to Achieve Compliance
Referrals	• Sites that fail to obtain state industrial or construction permits. • Sites that fail to comply with City enforcement actions. • Sites that discharge waste or hazardous wastes to receiving waters.	NA

V. Construction Management Enforcement Component

This Section of the ERP describes the City's approaches to investigating, responding to, and enforcing noncompliance with the City's Ordinances at public and private construction sites within the City.

A. Overview

All construction projects in the City, regardless of size, are required to implement BMPs to prevent Illegal Discharges of Pollutants into the Stormwater Drainage System or watercourses. The City has established a minimum set of BMPs and other measures to be implemented at all construction sites year round. All private and public works construction projects are required, at a minimum, to implement and be protected by an effective combination of erosion and sediment controls and waste and materials management BMPs. In addition, the City requires enhanced or additional BMPs should the project site pose an exceptional threat to water quality. The City's Construction Program and the City departments and staff responsible for overseeing, implementing, and enforcing it, are described in Section 8 of the LIP.

Construction sites that are subject to the Construction General Permit are required to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP). Before issuing a grading or building permit, the City will require proof of Construction General Permit coverage. Private construction projects not covered by the General Permit, but covered under a grading permit, are required to develop Erosion and Sediment Control Plans (ESCPs) that show proposed locations of the erosion and sediment control BMPs that will be implemented during the construction project.

B. Investigating and Responding to Noncompliance

The City performs inspections of construction sites to verify that appropriate BMPs and other requirements for water quality protection are being implemented and maintained, that they appropriately comply with the City's Ordinances and the Construction General Permit, and that they continue to protect water quality. Construction sites are inspected, according to the established priority, until construction activity is complete. Threats to water quality are assessed by the City's Authorized Inspectors for construction site runoff that will not be reasonably

controlled by the BMPs in place or if a failure of BMPs is resulting in the release of sediments or other Pollutants. Violations observed are documented by the inspectors, and appropriate enforcement actions are taken.

If a significant and/or immediate threat to water quality is observed by an Authorized Inspector, action is taken to require the developer/contractor to immediately cease the discharge and appropriate enforcement action is taken. The City's enforcement response approaches to violations at constructions sites are also described further in the following Section.

Although the City does not enforce the Construction General Permit, violations of the City's Ordinances or project permit conditions and plans may also be considered a violation of the General Construction Permit for sites subject to those requirements. When a construction site is subject to the General Construction Permit, City staff may also collaborate with Regional Board staff on enforcement actions.

C. Enforcement Response Approaches

The City's enforcement response approach to construction sites differs based on whether it is a private construction project or a City public works construction project. In either case, however, violations determined to pose an immediate risk to public health or the environment will warrant the use of Escalated Enforcement responses. The following Table outlines the range and progression of enforcement actions that may be taken by the City with respect to both private construction projects and public works construction projects.

Enforcement Actions for Violations at Construction Sites

PRIVATE CONSTRUCTION PROJECTS	← ENFORCEMENT PROGRESSION	PUBLIC WORKS CONSTRUCTION PROJECTS
Verbal Warning		Verbal Warning
Written Warning ▪ Notice of Noncompliance/Notice of Violation ▪ Administrative Compliance Order ▪ Administrative Citations or Fines ▪ Cease and Desist Order		Written Warning ▪ Notice of Noncompliance/Notice of Violation
Stop Work Order		Enforcement of Contract ▪ Stop Work Order ▪ Withholding of Payment ▪ Bond ▪ Fines ▪ Revocation of Contract
Revocation of Permit(s) and/or Denial of Future Permits		
Civil and Criminal Court Actions		Civil and Criminal Court Actions

As required by the NPDES Permit, the City's NPDES Coordinator will notify the Regional Water Board in writing within five (5) calendar days of issuing Escalated Enforcement to a construction site that poses a significant threat to water quality as a result of violations or other noncompliance. Written notification may be provided to the appropriate Regional Water Board staff member by email. The City's NPDES Coordinator will also notify the Regional Board of any persons required to obtain coverage under the Construction General Permit and failing to do so, within five (5) calendar days from the time the City becomes aware of the circumstances. Written notification may be provided electronically by email to RB9_Nonfilers@waterboards.ca.gov.

The City seeks to resolve violations at both private and public works construction sites as quickly as possible, including prior to rain events where feasible. As required by the NPDES Permit, the City seeks to resolve incidents of observed noncompliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where more than 30 days are required to resolve a violation and achieve compliance, the reasons why additional time is needed is documented and kept on file. If Escalated Enforcement is not used when compliance is not achieved within the required compliance period, the rationale for why Escalated Enforcement actions were not used will also be documented.

A general overview of the City's enforcement response approach to violations at private construction sites and public works construction sites is set forth below. For violations at construction sites resulting in actual or threatened Illegal Discharges, refer to the enforcement response approaches described in Section III (Illicit Discharge Detection and Elimination Enforcement Component of this ERP. The overview below is intended to be illustrative in nature and to provide general guidance to City enforcement staff, and is not intended to be exclusive or exhaustive. The City reserves the right to use whatever tools deemed most appropriate for a given situation, as dictated by the specifics of each case, and taking into account the factors described in Section II.A of this ERP.

The nature of the City's enforcement response approach to violations at construction sites is determined on a case-by-case basis and is based on factors such as severity of the violation, site-specific circumstances, and the contractor's past compliance history. If the situation is determined to pose an immediate risk to water quality, higher level Escalated Enforcement responses may be used initially. The following charts depict the range of enforcement options available for violations at private and public works construction sites, respectively, and are intended to provide guidance to Authorized Inspectors in determining what enforcement response is appropriate for a given violation.

Enforcement of Noncompliance for Private Construction Projects

ENFORCEMENT OPTIONS	ACTIONS			CRIMINAL ACTIONS
	NOTICE OF NONCOMPLIANCE/NOTICE OF VIOLATION	ADMINISTRATIVE COMPLIANCE ORDER / ADMINISTRATIVE CITATION	CEASE & DESIST STOP WORK ORDER REVOCATION OF PERMIT(S)	INFRACTIONS AND MISDEMEANORS
COMPLIANCE STRATEGY				
Threat Level	Insignificant	No: Significant	May be Significant	Significant
Environmental Harm	None	No: Immediate	Potential/Immediate	Actual Immediate
Event Duration	Short	Short	Long/Continuous	Long/Continuous
Event Frequency	Isolated	Infrequent	Frequent/Ongoing	Frequent/Ongoing
Cooperation	Readily Complies	Working to Comply	Uncooperative/ Slow to Comply	Non-Responsive
Intent	Unknowingly	No: Willful	Possibly Willful	Willful

Enforcement of Noncompliance for Public Works Construction Projects

ENFORCEMENT OPTIONS	ACTIONS		CRIMINAL ACTIONS
	NOTICE OF NONCOMPLIANCE/NOTICE OF VIOLATION	CONTRACT REMEDIES	INFRACTIONS AND MISDEMEANORS
COMPLIANCE STRATEGY			
Threat Level	Insignificant	No: Significant	May be Significant	Significant
Environmental Harm	None	No: Immediate	Potential/Immediate	Actual Immediate
Event Duration	Short	Short	Long/Continuous	Long/Continuous
Event Frequency	Isolated	Infrequent	Frequent/Ongoing	Frequent/Ongoing
Cooperation	Readily Complies	Working to Comply	Uncooperative/ Slow to Comply	Non-Responsive
Intent	Unknowingly	No: Willful	Possibly Willful	Willful

- Verbal Warnings (both private and public works construction projects)

For insignificant violations that do not pose an immediate threat to water quality, the initial method of requesting corrective action and enforcing compliance will typically be a Verbal Warning from the Authorized Inspector to the contractor. Verbal warnings are often sufficient to achieve correction of the violation, often while the Authorized Inspector is present at the construction site. The Authorized Inspector will notify the developer/contractor's project supervisor of the violation, and document the violation and the notification to the contractor's project supervisor in the inspection file. A specific time frame for correcting the problem and a follow-up inspection date will be documented by the inspector.

- Written Warnings (both private and public works construction projects)

If a deficiency that was noted in a prior Verbal Warning is not corrected by the next inspection, or the severity of the violation is such that a Verbal Warning is not strong enough, a written warning will be issued. A written warning will describe the deficiency that is to be corrected, suggested corrective action(s), and the specific time frame for correction and a date for a follow-up inspection. A copy of the written warning will be provided to the contractor's project supervisor and another copy will be provided to the owner/developer. A copy will be placed in the active inspection file. Once the violation has been corrected to the satisfaction of the inspector, the inspector will document compliance in the inspection file.

For private construction projects, written warnings may range from a Notice of Noncompliance/Notice of Violation, Administrative Compliance Order, Administrative Citation, or Cease and Desist Order – depending on the severity of the of the violation or threat to water quality and the responsiveness and compliance history of the contractor. For public works construction projects, a Notice of Noncompliance/Notice of Violation serves as the only form of written warning given.

- Contract Enforcement Mechanisms (public works construction projects only)

If a contractor is performing construction of a public works project on behalf of the City, then the City will use the provisions within the contract for enforcement of noncompliance where verbal or written warnings prove insufficient. Such contract provisions may allow the City to withhold payment(s), require bonds, apply monetary penalties, order work stopped (without time penalties), or terminate the contract if the contractor performing the work does not comply with all appropriate permits, laws, regulations and ordinances.

- Stop Work Orders (private construction projects only)

If a written warning has not been addressed by the next inspection, or if the developer/contractor has not complied with their permit requirements, or if a significant threat to water quality is observed (such as a failure of BMPs resulting in a significant release of sediment or other pollutants off site), a Stop Work Order will be issued by the inspector or the appropriate official. Stop Work Orders prohibit further construction activity until the problem is resolved and provide a time frame for correcting the problem. The Stop Work Order will describe the infraction and specify what corrective action must be taken. A copy of the Stop

Work Order will be given to the contractor's project supervisor and placed in the active inspection file. For a private construction project, a copy of the Stop Work Order will also be sent to the owner/developer. To restart work once a Stop Work Order has been issued, the contractor's project supervisor must request the inspector to re-inspect the project and verify that the deficiencies have been satisfactorily corrected. If the inspector is satisfied with the corrections, the inspector may sign off on that phase of the project, and work may proceed.

- Revocation of Permit(s) and/or Denial of Future Permits (private construction projects only)

In severe cases of noncompliance or significant discharges at private construction sites, it may be necessary to revoke the grading and/or building permit that a developer/contractor is working under. The developer/contractor would then have to re-apply for permits and meet any requirements that the City may place on the project. Revocation of building or grading permits must be conducted in accordance with the process described in the City's Municipal Code. City Staff should consult with the Enforcing Attorney before proceeding with revocation of permits.

- Civil and Criminal Court Actions

In cases of severe and repeated noncompliance, Civil and/or Criminal court actions may be appropriate. Whether to pursue Civil or Criminal enforcement remedies will be determined in consultation with the Enforcing Attorney.

VI. Existing Development Enforcement Component

This Section of the ERP describes the City's approaches to investigating, responding to, and enforcing noncompliance with the City's Ordinances with respect to existing municipal, commercial and industrial, and residential development.

A. Overview

As required by the NPDES Permit, the City has implemented an Existing Development Management Program pursuant to which it inventories and tracks existing municipal, industrial, commercial, and residential development in the City; requires the implementation, operation, and maintenance of pollution prevention BMPs for activities associated with municipal, industrial, commercial, and residential activities; and periodically inspects inventoried existing development to ensure and enforce proper BMP implementation and compliance with the City's Ordinances. The City's Existing Development Management Program, is divided into separate Municipal, Industrial/Commercial, and Residential Programs. The Existing Development Management Program overlaps with the City's ID/IC and New Development/Significant Redevelopment Programs, and the problematic activities, types of violations, and enforcement response approaches described in Section III (Illicit Discharge Detection and Elimination Enforcement Component) and Section IV (Development Planning Enforcement Component) of this ERP also generally apply to existing development. In addition, summaries of applicable pollution prevention BMPs municipal facilities, industrial

and commercial facilities, residential activities, and homeowners' associations / common interest developments can be found in in Sections 5 and 9 of the LIP.

B. Investigating and Responding to Noncompliance

1. Municipal Facilities and Areas

The City inspects and implements appropriate BMPs for Municipal facilities and areas in accordance with the requirements of the NPDES Permit. During routine municipal facility inspections, City or contract staff will assess facility areas and activities to ensure all are maintained in accordance with City regulations, ordinances and BMP requirements. If BMPs are found to be deficient or otherwise ineffective, the responsible party or department will be provided corrective actions. If the responsible City staff member or department does not perform the necessary corrective actions in response to the direction of their immediate supervisor, escalated enforcement will be taken by involving higher ranking representatives within the responsible department, who may enact internal disciplinary procedures, until the deficiencies are resolved.

If the City determines that specific areas of a leased City facility require additional BMPs, the City often can require the implementation of BMPs in addition to the required minimum BMPs for the specific area/activity. If a leased City facility continues to be out of compliance, the City may choose to discontinue the lease and remove the tenant from the site.

2. Industrial and Commercial Development

a. Fixed Facilities

The City inspects commercial and industrial facilities to determine if they are in compliance with City's Ordinances, to review BMP implementation, to assess BMP effectiveness and to verify inventory information used for facility prioritization. Such inspections include review of: (i) material and waste handling and storage practices; (ii) pollution control BMP implementation and maintenance; and (iii) evidence of past or present unauthorized, non-stormwater discharges. The City will generally conduct on of two types of inspections, compliance inspections and follow-up inspections.

Initial compliance inspections are announced and focus on current facility operations and activities, BMPs currently in use, the effectiveness of those BMPs, and verifying inventory spreadsheet information. All re-occurring compliance inspections cover the same information as an initial compliance inspection, but will typically be unannounced in order to verify compliance and that BMPs are being effectively implemented.

For those facilities deemed to be non-compliant, the City will perform compliance inspections once a month until said facilities are shown to be complaint, and then once every four months for a full calendar year after the facility achieves compliance. Generally, these inspections will focus primarily on areas where a facility was deemed to be non-compliant and may be either announced or unannounced, depending on which course of action the Authorized Inspector deems will be most conducive to continued facility compliance.

Appropriate enforcement actions are taken against industrial and commercial facility owners and operators determined to be out of compliance. The Authorized Inspector will document each observed violation. Depending on the severity of the violation, enforcement actions can range from a verbal warning to civil or criminal court actions with monetary fines. Illegal Discharges and Illicit Connections from industrial and commercial facilities are investigated and responded to as described in Section III of this ERP. If an Authorized Inspector observes a significant and/or immediate threat to water quality, enforcement action will be taken to require the facility owner/operator to immediately cease and correct the discharge or activity and the City will coordinate notification of the appropriate agencies. Conditions that would warrant such action may include observations of runoff from an industrial site that are not reasonably controlled by protective measures or observation of a failure in BMPs resulting in an actual or threatened discharge of Pollutants to the Stormwater Drainage System or a water body. Escalated Enforcement measures will be implemented as needed to achieve compliance. The City may also require industrial/commercial facilities to implement monitoring programs where warranted.

b. Mobile Businesses

Stormwater violations associated with mobile car wash and surface cleaner businesses include Illegal Discharges and failure to properly implement specific activity-based BMPs required of such businesses. The City may become aware of violations associated with mobile cleaning businesses from complaints, field observations, or inspections. Where violations are observed, they are documented and appropriate enforcement actions are taken against mobile business owners and operators. Depending on the severity of the violation, enforcement actions can range from a verbal warning to civil or criminal court actions with monetary fines. If an Authorized Inspector observes a significant and/or immediate threat to water quality, enforcement action will be taken to require the mobile business owner and/or operator to immediately cease the discharge and/or implement the required BMPs. Illegal Discharges associated with mobile businesses are investigated and responded to as described in Section III of this ERP

3. Residential Development

Enforcement actions may be initiated by the City as a response to hotline reports and complaints, or by observations by City representatives. All enforcement actions will be documented

Enforcement of BMPs in common interest developments will be conducted using the following mechanisms: public reporting hotline, analysis of dry weather/illicit discharge monitoring results, and municipal employee observations.

The City may become aware of potential violations associated with activities on residential property through public reporting or complaints or through field observations of City personnel or contractors during residential area inspections, during scheduled dry weather water quality monitoring, and or during routine City activities such as Stormwater Drainage System inspections and maintenance. Additional, focused investigations of areas upstream of outfalls where Pollutants are identified during monitoring activities and complaint response

investigations provide additional information sources. The combination of public reporting, direct observations, targeted investigations, and in-field monitoring provide effective oversight of residential areas and activities.

During investigations of incidents discovered through these mechanisms, the City will continue to use the opportunity to address any other issues of concern and provide education and outreach to residential property owners, occupants, and managers as appropriate to notify and urge them to observe designated BMPs for the high threat activities. When residential BMP deficiencies are observed, follow-up inspections will be performed and violations investigated within a reasonable timeframe.

Illegal Discharges and Illicit Connections from residential properties are investigated and responded to as described in Section III of this ERP. Other violations of the City's Ordinances will also be investigated and documented, and, depending on the nature and severity of the violation, the enforcement may consist of any of the enforcement measures described in this ERP.

C. Enforcement Response Approaches

The nature of the City's enforcement response approach to violations associated with Existing Development is determined on a case-by-case basis and is based the nature of the violation and on factors such as severity of the violation or threat to human health or the environment, site-specific circumstances, and past compliance history. Except as otherwise described in Subsection B, above, the City's enforcement response approaches to violations associated with Existing Development will be the same as the City's enforcement response approaches described Section III (Illicit Discharge Detection and Elimination Enforcement Component) and Section IV (Development Planning Enforcement Component) of this ERP. As described in other components of this ERP, if a particular violation is determined to pose an immediate risk to public health or the environment, higher level Escalated Enforcement responses may be used immediately and, if needed, the City will respond itself to ensure the threat is eliminated in a timely and efficient manner.

As required by the NPDES Permit, the City seeks to resolve incidents of observed noncompliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where more than 30 days are required to resolve a violation and achieve compliance, the reasons why additional time is needed is documented and kept on file. If Escalated Enforcement is not used when compliance is not achieved within the required compliance period, the rationale for why Escalated Enforcement actions were not used will also be documented.

When a site is subject to the Industrial General Permit, the City may collaborate with Regional Board staff on enforcement actions. In addition, as required by the NPDES Permit, the City's NPDES Coordinator will notify the Regional Board of any persons required to obtain coverage under the Industrial General Permit and failing to do so, within five (5) calendar days from the time the City becomes aware of the circumstances. Written notification may be provided electronically by email to RB9_Nonfilers@waterboards.ca.gov.

Exhibit A-4.2

Statement Of legal Authority

CITY of LAGUNA NIGUEL
30111 Crown Valley Parkway / Laguna Niguel, California, 92677
Phone / 949-362-4300 Fax / 949-362-4340

CITY COUNCIL
Mayor John Mark Jennings
Mayor Pro Tem Laurie Davies
Council Member Elaine Gennawey
Council Member Fred Minagar
Council Member Sandy Rains

January 10, 2019

David Gibson, Executive Officer
San Diego Regional Water Quality Control Board
2375 Northside Drive, Suite 100
San Diego, CA 92108-2700

Place ID: 236133:LWALSH

RE: LEGAL AUTHORITY TO IMPLEMENT AND ENFORCE THE REQUIREMENTS OF 40 CFR 122.26(D)(2)(I)(A-F) AND SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD ORDER NO. R9-2013-0001 AS AMENDED BY ORDER NO. R9-2015-0001 AND ORDER NO. R9-2015-0100, NPDES NO. CAS0109266

Dear Mr. Gibson:

The City of Laguna Niguel ("City") submits this statement in its capacity as a co-permittee under San Diego Regional Water Quality Control Board (San Diego Water Board) Order No. R9-2013-0001 as amended by Order No. R9-2015-0001 and Order No. R9-2015-0100 ("Order") in accordance with Directive E.1.b of the Permit Requirements of that Order.

As you are aware, the County of Orange and a number of copermittees, including the City, are currently seeking review of certain portions of the Order, the outcome of which may alter its terms and conditions. Consequently, this statement is not nor should it be construed as a waiver of any rights the City may have to bring or maintain a legal challenge to the Order or to raise any factual or legal issues as part of any such challenge. The City hereby reserves any and all such rights.

The undersigned, as the City Attorney for the City of Laguna Niguel, does hereby certify that the City has taken the necessary steps to obtain and maintain full legal authority within its jurisdiction to implement and enforce each of the requirements contained in the Order. This legal authority authorizes the City to:

(1) Prohibit and eliminate all illicit discharges and illicit connections to its Municipal Separate Storm Sewer System (MS4);

(2) Control the contribution of pollutants in discharges of runoff associated with industrial and construction activity to its MS4 and control the quality of runoff from industrial and construction sites, including industrial and construction sites which have coverage under the statewide General Permit for Discharges of Storm Water Associated with Industrial Activities (Industrial General Permit) or General Permit for Discharges of Storm Water Associated with Construction Activities (Construction General Permit), as well as to those sites which do not;

(3) Control the discharge of spills, dumping, or disposal of materials other than storm water into its MS4;

(4) Control through interagency agreements with the other Copermittees the contribution of pollutants from one portion of the MS4 to another portion of the MS4;

(5) Control, by coordinating and cooperating with other owners of the MS4 such as Caltrans, the U.S. federal government, or sovereign Native American Tribes through interagency agreements, where possible, the contribution of pollutants from their portion of the MS4 to the portion of the MS4 within the City's jurisdiction;

(6) Require compliance with conditions in its statutes, ordinances, permits, contracts, orders, or similar means to hold dischargers to its MS4 accountable for their contributions of pollutants and flows;

(7) Require the use of Best Management Practice (BMPs) to prevent or reduce the discharge of pollutants in storm water from its MS4 to the Maximum Extent Practicable (MEP);

(8) Require documentation on the effectiveness of BMPs implemented to prevent or reduce the discharge of pollutants in storm water from its MS4 to the MEP;

(9) Utilize enforcement mechanisms to require compliance with its statutes, ordinances, permits, contracts, orders, or similar means; and

(10) Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with its statutes, ordinances, permits, contracts, orders, or similar means and with the requirements of this Order, including the prohibition of illicit discharges and connections to its MS4; the Copermittee must also have authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from industrial facilities, including construction sites, discharging into its MS4.

Please do not hesitate to contact the undersigned if you have any questions or need any additional information.

Sincerely,

Terry E. Dixon
City Attorney

cc:
Kristine Ridge, City Manager
Jacki Scott, Public Works Director/City Engineer
Hal Ghafari, Environmental Programs Supervisor

A-5.0 MUNICIPAL ACTIVITIES COMPONENT

A-5.1 INTRODUCTION

Municipal facilities within the city include public parks, administration buildings, fire stations, community facilities, sports fields and a number of other city owned properties. The City also conducts activities and operations to maintain the urban infrastructure such as street and sidewalk repair, storm drain system cleaning, and maintenance and graffiti removal. Stormwater BMPs and programs associated with these facilities and activities are described below. Integrating water quality protection into routine municipal programs will support both the principal requirements of the Fifth term Permit and effectively address 2 of the HPWQCs identified in the WQIP, specifically, unnatural water balance in dry weather and pathogen health risk.

A-5.1.1 Program Overview

The program management model for overseeing, implementing, and enforcing the municipal activities stormwater program element is identified in **Figure A-5.1**.

The below list provides contact information for and describes the role that each of the various city departments that own, operate, or maintain municipal areas and activities. For each Department, the contact information for the employee who has the primary responsibility and oversight for ensuring that the program has been implemented has been included.

Public Works Department

Drainage and Flood Control
Contact Name: Jacki Scott
Title: Public Works Director
Telephone: 949.362.4377
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the operation and maintenance of drainage and flood control facilities throughout the municipality. Activities conducted within the flood control facilities may include the use of pesticides or herbicides, flushing, sediment removal, vegetation and debris removal and a variety of structural repairs.

Park Maintenance
Contact Name: Jerry Sollom
Title: Park Maintenance Superintendent
Telephone: 949.362.4349
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the operation and maintenance of landscaping of public parks, including parking lots, buildings and recreational facilities.

IPM Pesticide and Fertilizer Maintenance
Contact Name: Jerry Sollom
Title: Park Maintenance Superintendent
Telephone: 949.362.4349
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for implementation of the Integrated Pest Management (IPM) Policy.

Solid Waste
Contact Name: Rob Zampino
Title: Building & Facility Superintendent
Telephone: 949.362.5112
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the waste management of facilities.

Street Sweeping
Contact Name: Jeff Metz
Title: Street Maintenance Superintendent
Telephone: 949.362.4348
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for street sweeping on all public streets and parking lots.

Street and Median Maintenance
Contact Name: Jeff Metz
Title: Street Maintenance Superintendent
Telephone: 949.362.4348
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for minor repairs on streets, maintenance of medians and rights-of-way adjacent to streets, signage and catch basin stenciling. Maintenance activities include application of pesticides and herbicides to control vegetation.

General Services Division
Contact Name: Rob Zampino
Title: Building & Facility Superintendent
Telephone: 949.362.5112
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for operation and maintenance of the municipal administrative and operation facilities (i.e. Civic Center, City Operation Center and Yard) and the municipal automotive fleet.

Engineering Division
Contact Name: Jacki Scott
Title: Public Works Director
Telephone: 949.362.4377

Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the administration of public improvement projects.

Parking Lots/Enforcement
Contact Name: Jeff Metz
Title: Street Maintenance Superintendent
Telephone: 949.362.4348
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the operation of public parking lots.

Fleet Management
Contact Name: Edgar Abrenica
Title: Associate Civil Engineer
Telephone: 949.362.4338
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the maintenance, repair and cleaning of all municipal vehicles.

Other Departments:

Parks and Recreation Department
Contact Name: Alison Giglio
Title: Parks and Recreation Director
Telephone: 949. 425.5100
Address: 29751 Crown Valley Parkway, Laguna Niguel, CA 92677

Manages public parks and community facilities such as recreation centers and public pools.

Fire Services (*Orange County Fire Authority)*
Contact Name: Jeff Adams
Title: Fire Chief, Division 5
Telephone: 949.389.0055
Address: 1 Fire Authority Road, Irvine, CA 92602, CA 92856

Operates and maintains fire stations throughout the municipality and conducts training exercises and responds to hazardous material spills.

Police Services (Orange County Sheriff's Department)
Contact Name: Matt McDaniel
Title: Chief of Police Services
Telephone: 949.362.4346
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Operates and maintains police stations and facilities in the municipality.

Outside Agencies:

Wastewater
Contact Name: Moulton Niguel Water District
Title: Water District, Independent from the City
Telephone: 949. 831.2500
Address: 27500 La Paz Rd, Laguna Niguel, CA 92677

Responsible for implementing control measures to minimize infiltration of seepage from sanitary sewers to municipal storm drain systems through the operation and maintenance of all municipal wastewater facilities.

Water
Contact Name: Moulton Niguel Water District
Title: Water District, Independent from the City
Telephone: 949. 831.2500
Address: 27500 La Paz Rd, Laguna Niguel, CA 92677

Responsible for the operation and maintenance of all municipal water facilities.

A-5.1.2 Program Commitments

The major program commitments and the subsections in which they are described in detail include:

- Maintain/update inventories of Municipal Areas and Activities that exist within the jurisdiction (**A-5.2.1**).
- Prioritize fixed facilities, for the purposes of determining the frequency of inspections (high sites inspected annually) (**A-5.2.2**).
- Maintain all Municipal Areas and Activities in accordance with Model Maintenance Procedures and as determined by inspections (**A-5.2.3**).
- Enforce the maintenance requirements through internal procedures and external contract language (**A-5.2.4**).
- Implement an Integrated Pest Management policy (**A-5.3**).
- Educate and train municipal staff (**A-5.4**).

A-5.1.3 Regulatory Requirements

The Model Municipal Activities Program and the Model Integrated Pest Management, Pesticide and Fertilizer Guidelines were developed in order to fulfill the municipal activity commitments and requirements ofSection E.5 of the San Diego Regional Water Quality Control Board Municipal NPDES Stormwater permit, Order No. R9-2013-0001 as amended by Order Nos. R9-2015-0001 and R9-2015-0100.

A-5.2 MODEL MUNICIPAL ACTIVITIES PROGRAM DETAILS

A-5.2.1 Municipal Inventories

An inventory of all Municipal Areas and Activities sites has been compiled and is updated prior to the start of the wet season (October 1). Based on this inventory and inspection records, Laguna Niguel annually evaluates the maintenance frequency for cleaning of MS4 facilities, including catch basins.

The Laguna Niguel's comprehensive municipal program inventories are included in **Exhibit A-5.I** to this LIP.

A-5.2.2 Prioritization

Municipal facilities are prioritized based on the potential for a facility or area to discharge polluted non-stormwater and reflect the priorities set forth in the WQIP.

A-5.2.3 Model Maintenance Procedures

Staff perform operations at municipal areas and perform municipal activities according to the pollution prevention methods in its municipal program. These methods include designation and implementation of minimum BMPs for all municipal areas and activities and are area/activity-specific. For those municipal areas or activities tributary to a Clean Water Act 303(d) impaired water body segment in which the area or activity generates pollutants for which the water body segment is impaired, enhanced measures will be designated. Similarly, additional controls will be designated for municipal areas and activities within or directly adjacent to or discharging directly to coastal lagoons, the ocean, or other receiving waters within environmentally sensitive areas.

The city implements procedures to assess potential water quality impacts to receiving water bodies.

Model maintenance procedures relevant to the Laguna Niguel Municipal Areas and Activities**;** facilities and field programs are included in **Exhibit A-5.III**.

The Laguna Niguel coordinates with the local sewage collection/treatment agency to ensure swift response to and containment of sewage spills. In addition, the Laguna Niguel participates in the Countywide Area Spill Control (CASC) Program.

A-5.2.4 Municipal Inspection and Requirements

Inspections of municipal areas and activities are performed to verify that the maintenance procedures are being implemented, are appropriate for that municipal area and/or activity and are protective of water quality.

Inspections are based upon the priority of the area and/or activity and their threat to water quality as indicated in the site list included in **Exhibit A-5.II**. Inspection frequency also reflects

the priorities set forth in the South Orange County WQIP. Inspection frequency is consistent, whether a facility or program is operated and maintained by municipal staff, contracted staff, or lessors.

A-5.2.4.1 Inspection Frequencies

The frequency of municipal facility and program inspections is shown in **Table A-5.1** below:

Table A-5.1
Inspection Frequencies

Municipal Area/Activity	Inspection Frequency
Roads, Streets, Highways and Parking Facilities	Annually
Flood Management Projects and Flood Control Devices	Annually
Areas/activities tributary to a 303(d) impaired water body segments or where an activity generates pollutants for which the water body segment is impaired	Annually
Areas and activities within or adjacent to or discharging directly to coastal lagoons, the ocean or other receiving waters within environmentally sensitive areas	Annually
Municipal Airfields	Annually
Parks and Recreation Facilities	Annually
Special event venues following special events	Annually
Power washing activities	Annually
Other municipal areas and activities that the City determines may contribute a significant pollutant load to the MS4	Annually
Municipal Facilities	**Inspection Frequency**
Active or closed municipal landfills	Annually
Publicly owned treatment works (including water and wastewater treatment plants) and sanitary sewage collection systems	Annually
Solid waste transfer facilities	Annually
Land application sites	Annually
Corporate yards including maintenance and storage yards for materials, waste, equipment and vehicles	Annually
Household hazardous waste collection facilities	Annually
MS4 and MS4 Facilities	**Inspection Frequency**
MS4 Facilities	Annually Before the Wet Season, with Additional Inspections as Needed During the Wet Season (see specific indications below)

Subsequent to two full years of inspections, any facility determined to require an inspection frequency less than annually will be inspected as needed, at least every other year.

*Other municipal activities will be inspected as needed and in response to water quality data, valid complaints and findings from municipal or contract staff.

A-5.2.4.2 Inspection Documentation Procedures

The inspection forms used during inspection consist of the following:

- General Inspection Forms – This primary form provides for a general characterization of the municipal area/activity being inspected, including the type of area or activity, the reason for inspection, and activities that may take place. A general cover sheet inspection form is required for all inspections.

- Activity Specific Inspection Forms – These secondary forms provide a series of questions about specific activities taking place at a municipal area or for a municipal activity, as well as a list of suggested corrective action plans that can be implemented should a problem be found.

Inspection forms for each municipal area or activity in the Laguna Niguel are included in **Exhibit A-5.IV**.

A-5.2.4.3 Enforcement Procedures

To ensure compliance, the Laguna Niguel will implement enforcement procedures as described in Enforcement Response Plan (**Exhibit A-4.1**).

A-5.2.4.4 Municipal Retrofitting

The Laguna Niguel examines opportunities to retrofit existing MS4 conveyance systems, parks and other recreational areas, where feasible. Countywide analysis of retrofitting opportunities is described in **DAMP Section 5.2.4.4**.

The Laguna Niguel will evaluate existing flood control devices, identify devices causing or contributing to a condition of pollution, identify measures to reduce or eliminate the structure's effect on pollution, and evaluate the feasibility of retrofitting the structural flood control device.

A-5.3 MODEL INTEGRATED PEST MANAGEMENT, PESTICIDES AND FERTILIZER GUIDELINES

The Laguna Niguel has adopted an Integrated Pest Management (IPM) policy consistent with **DAMP Section 5.3.** The Laguna Niguel's IPM policy is included in **Exhibit A-5.V**.

The city will implement BMPs in accordance with the aforementioned IPM policy and that encourage the use of native vegetation, set schedules for irrigation and chemical application and for the collection and proper disposal of unused pesticides, herbicides and fertilizers.

A-5.4 TRAINING AND EDUCATION

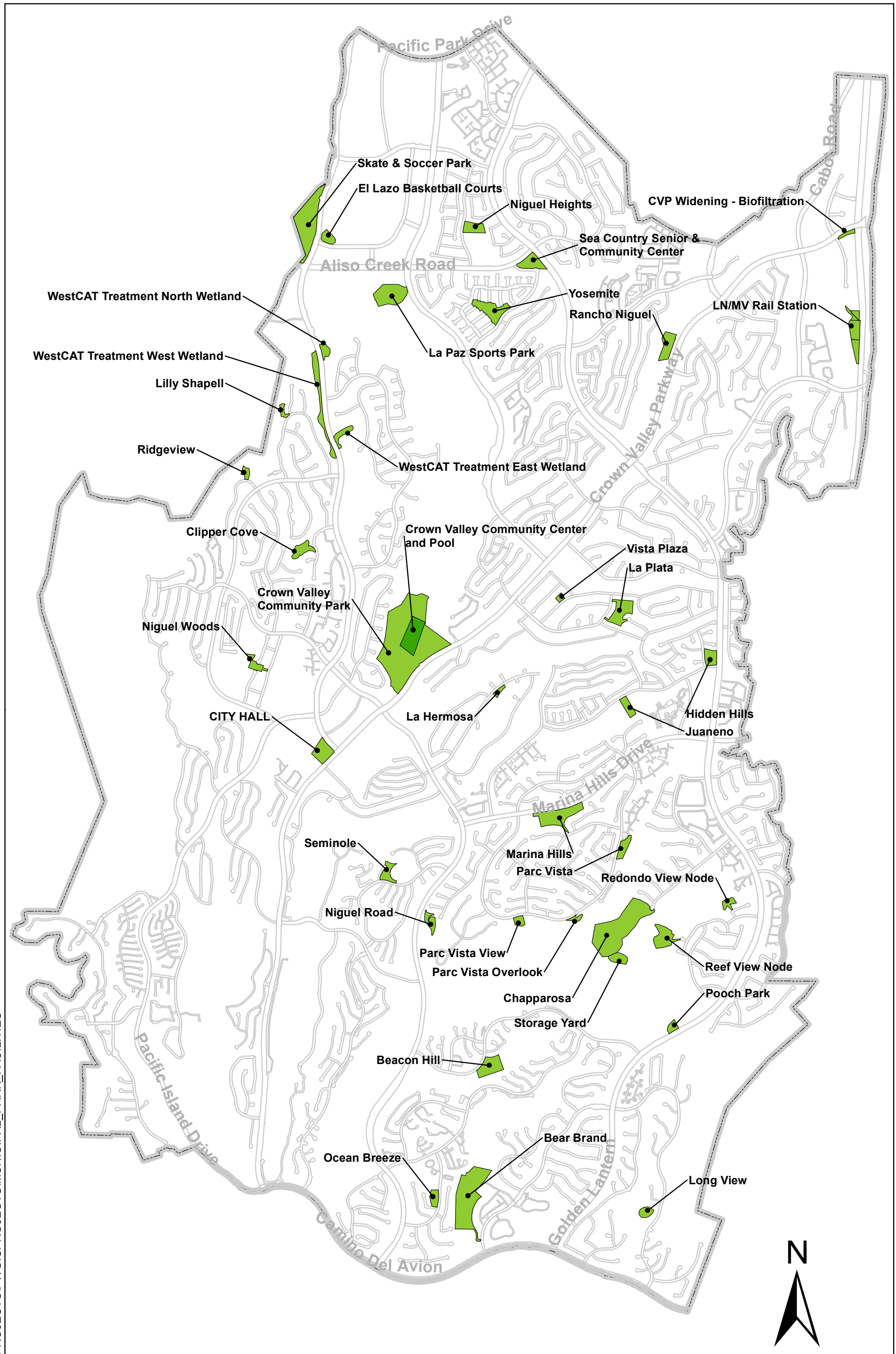
For an effective stormwater program to be efficiently implemented, its staff must have sufficient knowledge, experience, and skills. The Principal Permittee will coordinate, develop and present a number of different training modules in accordance with *The Orange County Stormwater Program Training Program Framework: Core Competencie*s. The City will support this effort by requiring the appropriate employees to attend training sessions, and conduct applicable train-the-trainer sessions, if necessary.

Exhibit A-5.I

Municipal Activities Inventory
(Inventory & Prioritization Spreadsheet/Maps)

Municipal BMPs by Facility

CITY OF LAGUNA NIGUEL	LOCATION INFORMATION								APPLICABLE NON-STRUCTURAL BMPS														
									FF-10	FF-2	FF-9	FP-2	FP-2A	FP-2A	FF-13	DF-1	FF-3	FF-12	FF-11	FF-7	FF-6	FF-8	FP-3
FACILITIES AND PROGRAMS	Street Number	Street Name		acres	sqft	Watershed	Longitude	Latitude	Spill Prevention Control	Building and Maintenance Repair	Parking Lot Maintenance	Landscape Maintenance	Irrigation Runoff Elimination	Irrigation Runoff Elimination	Waste Handling and Disposal	Drainage O&M	Equip Maint	Vehicle Storage	Vehicle Cleaning	Material Storage	Material Loading	Minor Construction	Road Maint
									Sed., Nut., Trash, Metals, Bact., O&G, Org., Pest.	Sed., Trash, Metals, O&G, Org.	Sed., Trash, Metals, Bact., O&G	Sed., Nut., Trash, Bact., Pest.	Sed., Nut., Trash, Bact., Pest.	Sed., Nut., Trash, Bact., Pest.	Trash, Metals, O&G, Org.	Metals, O&G, Org.	Metals, O&G, Org.	Metals, O&G, Org.	Sed., Nut., Trash, Metals, O&G, Org.	Sed., Trash, Metals, O&G, Org., Pest.	Nut., Trash, Metals, O&G, Org., Pest.	Sed., Trash, Metals, O&G, Org.	Sed., O&G, Metals, Trash
MUNICIPAL SITES - PARKS																							
Beacon Hill Park	24472	Beacon Hill	Road	4.75	206,911	K-Salt Creek	-117.70253	33.50307	x			x	x	x	x	x							
Bear Brand Park	32385	Bear Brand Park	Road	16.60	723,055	K-Salt Creek	-117.70369	33.49400	x	x	x	x	x	x	x	x							
Chapparosa Park	25191	Chapparosa Park	Avenue	66.88	2,913,174	K-Salt Creek	-117.69222	33.51233	x	x	x	x	x	x	x	x				x	x	x	x
Clipper Cove Park	29325	Clipper	Way	4.72	205,735	J-Aliso Creek	-117.71775	33.53688	x			x	x	x	x	x							
Crown Valley Community Park	29751	Crown Valley		59.18	2,577,804	J-Aliso Creek	-117.70867	33.53008	x	x	x	x	x	x	x	x	x	x		x	x	x	x
El Lazo Basketball Courts	23804	El Lazo				J-Aliso Creek					x		x			x	x						
Hidden Hills Park	27802	Springwood	Drive	2.43	105,938	J-Aliso Creek	-117.68567	33.53016	x			x	x	x	x	x							
Juañeno Park	25068	Hidden Hills	Road	2.86	124,713	J-Aliso Creek	-117.69211	33.52684	x	x		x	x	x	x	x							
La Hermosa Park	24462	La Hermosa	Drive	0.29	12,632	J-Aliso Creek	-117.70222	33.52775	x			x	x	x	x	x							
La Plata Park	25006	La Plata	Drive	5.11	222,549	J-Aliso Creek	-117.69274	33.53346	x			x	x	x	x	x							
Lilly Shapell Park	NSA	Drakes	Way	0.86	37,244	J-Aliso Creek	-117.71961	33.54604	x			x	x	x	x	x							
Longview Park	NSA	Old Ranch	Road	2.85	124,103	K-Salt Creek	-117.69009	33.49358				x	x	x	x	x							
Marina Hills Park	24802	Marina Hills	Drive	7.54	328,226	K-Salt Creek	-117.69746	33.51952	x	x	x	x	x	x	x	x							
Niguel Heights Park	27804	Niguel Heights	Boulevard	2.80	121,751	K-Salt Creek	-117.70496	33.55827	x			x	x	x	x	x							
Niguel Road Park	30983	Killini		4.80	208,871	J-Aliso Creek	-117.70739	33.51233	x			x	x	x	x	x							
Niguel Woods Park	29883	White Otter	Drive	4.12	179,511	J-Aliso Creek	-117.72159	33.52940	x			x	x	x	x	x							
Ocean Breeze Park	32311 1/2	Charles	Road	1.70	74,227	K-Salt Creek	-117.70679	33.49431	x			x	x	x	x	x							
Parc Vista Park	30618	Parc Vista	Drive	2.53	110,120	K-Salt Creek	-117.69227	33.51760	x			x	x	x	x	x							
Parc Vista Overlook Park	NSA	Parc Vista	Drive	3.24	140,917	K-Salt Creek	-117.69604	33.51293	x			x	x	x	x	x							
Parc Vista View Park	31114	Parc Vista	Drive	1.10	47,916	K-Salt Creek	-117.70040	31.51267	x			x	x	x	x	x							
Pooch Park	NSA	Golden Lantern		3.34	145,447	K-Salt Creek	-117.68820	33.50584	x		x	x	x	x	x	x							
Rancho Niguel Park	28333	Crown Valley		3.81	165,746	J-Aliso Creek	-117.68937	33.55060	x	x		x	x	x	x	x							
Redondo View Node Park	25575 1/2	Redondo		1.63	70,872	K-Salt Creek	-117.68391	33.51398	x			x	x	x	x	x							
Reef View Node Park	25326 1/2	Reef		3.34	145,317	K-Salt Creek	-117.68822	33.51154	x			x	x	x	x	x							
Ridgeview Park	29061	Ridgeview	Drive	0.99	43,299	K-Salt Creek	-117.72243	33.54189	x			x	x	x	x	x							
Seminole Park	30802	Seminole	Drive	2.27	99,012	K-Salt Creek	-117.71074	33.51574	x			x	x	x	x	x							
Yosemite Park	24481	Yosemite	Road	5.44	236,793	J-Aliso Creek	-117.70328	33.55265	x			x	x	x	x	x							
Laguna Niguel Alicia Skate and Soccer Park	27745	Alicia Parkway				J-Aliso Creek	-117.71768	33.55835	x	x	x	x	x	x	x	x							
La Paz Sports Park	NSA	La Paz	Road	6.93	301,741	J-Aliso Creek	-117.71108	33.55381	x	x	x	x	x	x	x	x	x			x	x		
Vista Plaza Park	29541	Vista Plaza	Drive	0.61	26,659	J-Aliso Creek	-117.69755	33.53397	x			x	x	x	x	x							
Oso Creek Trail						L-San Juan Creek																	
MUNICIPAL FACILITY SITES - OTHER																							
Crown Valley Community Center and Pool	29751	Crown Valley		1.02	44,620	J-Aliso Creek	-117.71001	33.53056	x	x	x	x	x		x	x	x					x	
Sea Country Senior and Community Center	24602	Aliso Creek	Road	0.33	14,547	J-Aliso Creek	-117.70018	33.55611	x	x	x	x	x	x	x	x						x	
LN/MV Commuter Rail Station	28200	Forbes	Road	8.65	376,624	L-San Juan Creek	-117.67504	33.55104			x	x	x	x		x		x				x	
Storage Yard for Materials	25191	Chapparosa Park		n/a	n/a	K-Salt Creek	n/a	n/a	x						x	x		x		x	x		
City Hall	30111	Crown Valley				J-Aliso Creek																	
City maintained Streetscape & Slopes (14)	n/a	various		n/a	n/a	J, K, L	n/a	n/a				x	x	x	x	x							
MUNICIPAL OFF-SITE TREATMENT CONTROL BMPS																							
Catch basin debris screens in streets		various				J, K, L									x	x	x						
WetCAT West Alicia Treatment Wetland		Alicia Parkway				J-Aliso Creek	-117.716524	33.546669				x			x	x							
WetCat East Alicia Treatment Wetland		Alicia Parkway				J-Aliso Creek	-117.716444	33.550112				x			x	x							
WetCAT North Alicia Treatment Wetland		Alicia Parkway				J-Aliso Creek	-117.714984	33.544503				x			x	x							
Crown Valley Parkway Widening @I-5						L-San Juan Creek																	
Oso Creek Trail Bioretention facility						L-San Juan Creek																	



Municipal Facility Sites

Q:\GIS\GISPROJECTS\PWGISPROJECTS\MUNICIPAL_PARK_FACILITIES

L E G E N D

- CITY BOUNDARY
- CATCH BASIN
- STORM DRAIN PIPE
- RECEIVING WATERS

Pacific Park Drive
Aliso Creek Road
La Paz Road
Crown Valley Parkway
Cabot Road
Highlands Avenue
Marion Hills Drive
Pacific Island Drive
Niguel Road
Golden Lantern
Camino Del Avion

Q:\GIS\GISPROJECTS\PWGISPROJECTS\CITY_DRAINAGE_SYSTEM

City of Laguna Niguel
Drainage System

Exhibit A-5-II

Municipal Activities Prioritization

			LOCATION INFORMATION							
FACILITIES AND PROGRAMS	**TREATMENT CONTROL BMPS**	**WQMP/PRIORITY/ Const. date**	**Street Number**	**Street Name**		**acres**	**sqft**	**Watershed**	**Longitude**	**Latitude**
MUNICIPAL SITES - PARKS										
El Lazo Basketball Courts	Catch basin debris screen (1)	2001. No WQMP.	23804	El Lazo				J-Aliso Creek		
Laguna Niguel Alicia Skate and Soccer Park		2003 WQMP	27745	Alicia Parkway				J-Aliso Creek	-117.71768	33.55835
	Debris separator unit (1)	High priority						J-Aliso Creek		
La Paz Sports Park		2001. No WQMP.	NSA	La Paz	Road	6.93	301,741	J-Aliso Creek	-117.71108	33.55381
	Drain inlet filter inserts (2)	High priority						J-Aliso Creek		
	Biofiltration basins (3)	High priority						J-Aliso Creek		
Oso Creek Trail	Biofiltration basins (1)	High priority						L-San Juan Creek		
	Pervious Pavement	High priority						L-San Juan Creek		
MUNICIPAL FACILITY SITES - OTHER										
Sea Country Senior and Community Center		2010 WQMP.	24602	Aliso Creek	Road	0.33	14,547	J-Aliso Creek	-117.70018	33.55611
	Catch basin debris screen (1)	High priority						J-Aliso Creek		
	Debris separator unit (1)	High priority						J-Aliso Creek		
City Hall		2010 WQMP.	30111	Crown Valley				J-Aliso Creek		
	Debris separator units (2)	High priority						J-Aliso Creek		
MUNICIPAL OFF-SITE TREATMENT CONTROL BMPS										
Catch basin debris screens in streets	Catch basin debris screen (124)	2001-2011. No WQMP		various				J, K, L		
WetCAT West Alicia Treatment Wetland	Low-flow treatment wetland	2003. No WQMP		Alicia Parkway				J-Aliso Creek	-117.716524	33.546669
	Debris separator unit (1)	High priority						J-Aliso Creek		
WetCat East Alicia Treatment Wetland	Low-flow treatment wetland	2003. No WQMP		Alicia Parkway				J-Aliso Creek	-117.716444	33.550112
	Drain inlet filter inserts (6) at Jaeger and Brant	High priority						J-Aliso Creek		
WetCAT North Alicia Treatment Wetland	Low-flow treatment wetland	2002. No WQMP		Alicia Parkway				J-Aliso Creek	-117.714984	33.544503
Crown Valley Parkway Widening @I-5		2011 WQMP.						L-San Juan Creek		
	Biofiltration planter & swale	Medium priority						L-San Juan Creek		
Oso Creek Trail Bioretention facility	Bioretention planter	High priority						L-San Juan Creek		
	Permeable pavements	2015. No WQMP						L-San Juan Creek		
	Drain inlet screens							L-San Juan Creek		

Exhibit A-5-III

Maintenance Procedures
(Facility/Procedures Summary Spreadsheets)

DF-1
DRAINAGE FACILITY OPERATION AND MAINTENANCE

The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Drainage Facility Maintenance activities. Drainage Facilities are considered High Priority regardless of location. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA	
Inspection and Cleaning:						
___ Annually inspect and clean drainage structures prior to the rainy season, and keep appropriate records. Document which structures are typically clean upon inspection for possible cut-back to inspection every two years.			X	X	X	
___ Conduct supplemental intermittent visual inspections during the wet season and provide additional cleanout as appropriate.			X	X	X	
___ Record quantity of waste collected and provide for proper disposal, including laboratory analysis of representative sample(s) of removed material to ensure it does not meet EPA hazardous waste criteria.			X	X	X	
___ Regularly inspect treatment wetland systems and remove any flow obstacles.			X	X	X	
___ Remove anthropogenic litter from open channels at least once annually before the rainy season.			X	X	X	
Controlling Illicit Connections & Discharges:						
___ Prevent any discharges during the course of MS4 maintenance operations.			X	X	X	
___ Provide energy dissipators below pipe or culvert outfalls.			X	X	X	
___ Repair damaged gutters, v-ditches and pipes as needed.			X	X	X	
Controlling Illegal Dumping						
___ Properly dispose of removed materials at a landfill or recycling facility.			X	X	X	
___ Label all catch basins with "No Dumping – Drains to Ocean."			X	X	X	
POLLUTION PREVENTION METHODS						
___ Require drainage facility maintenance personnel to be trained in relevant BMPs.			X	X	X	
___ Incorporate BMPs into subcontracts.			X	X	X	

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet

and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (numbered with capital letters) and more specific tips and techniques(numbered with lower case letters) that may be considered under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G) Pesticides (PEST)* *Other Toxic Compounds (TOX)* *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General*

1. Inspection and Cleaning of Drainage Facilities

General Guidelines

- ✓ 1A. Annually inspect all drainage structures, and clean as needed.
- ✓ 1B. Maintain appropriate records of inspections, cleaning, quantity of wastes removed and disposal.
- ✓ 1C. Properly dispose of removed materials at a landfill or recycling facility.
- ✓ 1D. Conduct intermittent supplemental visual inspections during the wet season to determine if there are problem inlets where sediment/trash or other pollutants accumulate, and provide for additional cleanouts as appropriate.
- ✓ 1E. Prevent or clean up any discharges that may occur during the course of maintenance and cleaning procedures.
- ✓ 1F. Verify that appropriate employees or subcontractors are trained in proper conductance of maintenance activities, including record keeping and disposal.
- ✓ 1G. Annually inspect and clean v-ditches as needed, prior to the wet season. On shrub-covered slopes, vegetative debris may be placed on the downhill side of the ditch. Trash should be bagged and disposed at a landfill.
- ✓ 1H. Store wastes collected during cleaning activities in appropriate containers.

Tips and Techniques

- ✓ 1h. Remove trash or anthropogenic debris as needed from open channels. (TRASH)
- ✓ 1i Consider retrofitting energy dissipators below culvert outfalls. (SED)
- ✓ 1j. Repair v-ditches that have cracked or displaced. (SED)
- ✓ 1k. Test samples of removed wastes if suspicious conditions exist (TOX)
- ✓ 1l. Consider more-frequent cleaning of selected structures to address specific impairments (ANY)
- ✓ 1m. Consider structural retrofits to the MS4 to help address specific impairments (ANY, HYD)
- ✓ 1n. Consider cleaning out pipes at gradient breaks or

other in-pipe debris accumulation points (ANY)

✓ 1o. Dewater collected wastes if necessary prior to disposal, with outflow water filtered and directed into the sanitary sewer or disposal tank. Do not dewater near a storm drain or stream. (SED, TRASH)

✓ 1p. Provide for lab analysis of random or suspicious samples from the cleaning program to ensure it does not meet the EPA criteria for hazardous waste. If a sample is determined to be hazardous, the sediment must be disposed of as a hazardous waste and the source must be investigated (TOX)

2. Controlling Illicit Connections and Discharges

General Guidelines

✓ 2A. Report prohibited discharges such as dumping, paint spills, abandoned oil containers, etc. observed during the course of normal daily activities so they can be investigated, contained, and cleaned up.

✓ 2B. Where field observations and/or monitoring data indicate significant problems, conduct field investigations to detect and eliminate existing illicit connections and improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s))

✓ 2C. Report all observed illicit connections and discharges to the NPDES Authorized Inspector at 949-362-4345 or to the 24-hour water pollution problem reporting hotline 1-877-89-SPILL (1-877-897-7455).

✓ 2D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.

Storm Drain Stenciling ("No Dumping—Drains to Ocean")

✓ 2E. Implement and maintain a storm drain stenciling program.

- 2a. Consider adding the hotline number to the storm drain stencils (BACT, TOX, TRASH).

3. Controlling Illegal Dumping

Field Investigation

✓ 3A. Report prohibited discharges such as dumpings observed during the course of normal daily activities so they can be investigated, contained and cleaned up.

✓ 3B. Conduct field investigations to detect and eliminate improper disposal of pollutants into the storm drain (i.e. identify problem areas where discharges or illegal connections may occur and follow up stream to determine the source(s)).

✓ 3C. Report all observed illegal dumping to the 24-hour

❑ _____ ❑	water pollution problem reporting hotline (1-877-897-7455).
	✓ 3D. Encourage public reporting of improper waste disposal by distributing public education materials and advertising the 24-hour water pollution problem reporting hotline.
❑ _____ ❑	✓ 3E. If perpetrator can be identified, take appropriate enforcement action.
❑ _____ ❑	• 3a. Consider posting "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs could also indicate fines and penalties for illegal dumping. (ANY)
	Training/Education/Outreach
❑ _____ ❑	✓ 3F. Verify that appropriate employees and subcontractors are trained to recognize and report illegal dumping.
	✓ 3G. Encourage public reporting of illegal dumping by advertising the 24-hour water pollution problem reporting hotline (1-877-897-7455.
❑ _____ ❑	• 3b. Take extra steps to educate the public in neighborhoods where illegal dumping has occurred to inform them why illegal dumping is a problem, and that illegal dumping carries a significant financial penalty. (ANY)
❑ _____ ❑	

FF-2
BUILDING MAINTENANCE AND REPAIR



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Building Maintenance and Repair activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
Building Maintenance:					
___ Prevent cleaning agents and other maintenance materials from entering the MS4.	X	X	X	X	X
___ Prevent repair and construction wastes from entering the MS4.	X	X	X	X	X
___ Clean up spills and leaks promptly.	X	X	X	X	X
Material Storage:					
___ Keep exterior storage areas tidy.	X	X	X	X	X
___ Store trash in covered watertight containers.	X	X	X	X	X
Building Cleaning:					
___ Prevent wash or rinsewaters from entering the storm drain system.	X	X	X	X	X
Graffiti Cleaning:					
___ Prevent cleaning agents, washwaters or wastes from entering the MS4.	X	X	X	X	X
Painting:					
___ Prevent paint or wastes from entering the MS4.	X	X	X	X	X
___ Properly dispose of leftover paint to keep it out of the MS4.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Require building maintenance personnel to be trained in relevant BMPs.	X	X	X	X	X
___ Incorporate relevant BMPs into contractual requirements for any building maintenance subcontracts.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G) Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General*

1. Building Maintenance

General Guidelines

✓ 1A. If when repairing roofs, small particles have accumulated in the gutter, either sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, use the sweep-out method; or place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck and clean the storm drain inlet where you placed the plug if necessary.

✓ 1B. Use sweeping or vacuuming techniques to clean gutters to the extent practical. If water is used for cleaning out gutters, seal storm drain inlets to prevent water from entering. Either direct the water to a landscaped area or dispose discharge to the sanitary sewer.

✓ 1C. When the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques.

✓ 1D. Protect storm drain inlets in the immediate vicinity of the construction activity, and clean them after work is completed if necessary.

• 1a. Consider retrofitting roof downdrains to route storm runoff to landscaped areas, rather than to impermeable surfaces or directly to the storm drain system. Do not route roof storm runoff directly to the base of the building or onto a slope.

Good Housekeeping

✓ 1E. Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.

✓ 1F. Cover materials of particular concern that must be left out, particularly during the rainy season.

✓ 1G. Do not dump waste liquids down the storm drain.

✓ 1H. Properly dispose of wash water, sweepings, and sediments; do not allow these materials to enter the storm drain.

Spill Response

✓ 1I. Clean up spills immediately.

✓ 1J. If a spill occurs on dirt, excavate and remove the contaminated (stained) soil.

2. Material Storage	
☐ ☐	✓ 2A. Properly store and cover materials that are normally used in repair and remodeling such as paints and solvents, to protect them from rain.
☐ ☐	✓ 2B. Properly store and dispose waste generated from the activity.
3. Building Cleaning	
☐ ☐	✓ 3A. When cleaning building exteriors and walls composed of glass, steel, or painted surfaces with no lead or mercury: • Do not allow wash water to enter the storm drain. • When washing without soap, discharges can be directed to landscaped or dirt areas. • When washing with soap, direct discharges to the sanitary sewer if permitted to do so or vacuum/pump water to a tank and dispose of properly
☐ ☐	✓ 3B. When washing building exteriors painted with lead-based or mercury additive paint: • Do not allow discharges to enter storm drain • Vacuum/pump discharges to a tank • Dispose of as a hazardous waste as needed
☐ ☐	✓ 3C. When acid washing mineral deposits: • Do not allow discharges to enter storm drain. • Rinse treated area with alkaline soap and direct washwater to a landscaped or dirt area • Alternatively, washwater may be collected and neutralized to a pH between 6 and 8, and disposed of properly.
☐ ☐	• 3a. When re-painting, consider switching to products without lead or mercury (TOX) • 3D. Also refer to BMP Sheet FP-8 (Power Washing & Surface Cleaning)
4. Graffiti Cleaning	
	Graffiti Removal
☐ ☐	✓ 4A. Avoid graffiti abatement activities during rain events.
☐ ☐	✓ 4B. When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal in the *Roads, Streets*, and *Highway Operation and Maintenance* procedure sheet.
☐ ☐	✓ 4C. Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
☐ ☐	✓ 4D. Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.
☐ ☐	• 4a. Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds). (TOX)

5. Painting

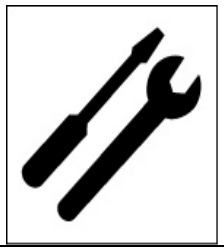
General Guidelines

- ✓ 5A. Develop paint handling procedures for proper use, storage, and disposal of paints.
- ✓ 5B. When practical, painting operations should be properly enclosed or covered to avoid drift.
- ✓ 5C. If transporting paint and materials to and from job sites, use containers with secure lids and tie down to the transport vehicle.
- ✓ 5D. Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- ✓ 5E. Transfer and load paint and hot thermoplastic away from storm drain inlets.
- ✓ 5F. Where there is significant risk of a spill reaching storm drains, protect or plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete.
- ✓ 5G. If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work and collect wash water and dispose of properly.
- ✓ 5H. If painting requires scraping or sand blasting of the existing surface, use a ground cloth to collect the chips. Dispose of the residue properly.
- ✓ 5I. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- ✓ 5J. Brushes and tools covered with non-water-based paints, finishes, or other materials should be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal. Waste solvents or oil based paints must be disposed of as hazardous waste.
- 5a. Consider mixing paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100% effective.
- 5b. Consider replacing paints containing lead or tributyltin with less toxic alternatives.

Paint Disposal

- ✓ 5K. Paints containing lead or tributyl tin are considered a hazardous waste and must be disposed of at an appropriate hazardous waste facility.
- ✓ 5L. Properly store leftover paints if they are to be kept for the next job.

FF-3
EQUIPMENT MAINTENANCE AND REPAIR



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Equipment Maintenance and Repair activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
General Maintenance and Repair:					
___ Clean up spills and leaks promptly upon discovery.	X	X	X	X	X
___ Steam cleaning or degreasing of engines is prohibited at municipal storage areas.	X	X	X	X	X
___ Prevent maintenance materials or repair wastes from entering the MS4.	X	X	X	X	X
___ Maintain equipment so as to prevent oil or gasoline leaks onto pavement or streets.	X	X	X	X	X
___ Place a stockpile of spill cleanup materials where it will be readily accessible.	X	X	X	X	X
Waste Handling/Disposal:					
___ Properly dispose or recycle waste materials.	X	X	X	X	X
POLLUTION PREVENTION MEASURES					
___ Utilize commercial equipment or vehicle maintenance and repair facilities to the extent feasible in lieu of conducting this activity at municipal sites.	X	X	X	X	X
___ Regularly inspect municipal vehicles and equipment for leaks.	X	X	X	X	X
___ Require equipment maintenance personnel to be trained in relevant BMPs.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

1.General Maintenance and Repair

General Guidelines

- ✓ 1A. Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters
- ✓ 1B. Regularly inspect vehicles and equipment for leaks.
- ✓ 1C. Clean yard storm drain inlets regularly.
- • 1a. Move activity indoors or cover repair area with a permanent or temporary roof if practical. (O&G)
- • 1b. Consider retrofitting to minimize contact of stormwater with outside operations through berming and drainage routing. (O&G)
- • 1c. Consider retrofitting to place curbs around the immediate boundaries of the process equipment.

Good Housekeeping

- ✓ 1D. To the extent practical, avoid hosing down work areas. Do not hose into storm drain inlets.
- ✓ 1E. Collect leaking or dripping fluids in drip pans or containers to the extent practical. Fluids are easier to recycle or dispose of properly if kept separate.
- ✓ 1F. Keep a drip pan or absorbent under the vehicle while you unclip hoses, unscrew filters, or remove other parts. Place a drip pan or absorbent material under any vehicle that might leak while you work on it to keep splatters or drips off the shop floor.
- ✓ 1G. Verify that appropriate employees and subcontractors are trained on proper handling and disposal of engine fluids.
- ✓ 1H. Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- ✓ 1I. Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections. Recycle as appropriate, or dispose properly as hazardous waste if necessary.
- • 1d. If work areas are washed and if discharge to the sanitary sewer is allowed, consider retrofitting to treat water with an appropriate treatment device (e.g. clarifier) before discharging. If discharge to the sanitary sewer is not permitted, pump water to a tank and dispose of properly. (O&G)
- • 1e. Consider posting signs regarding dumping restrictions at sinks and stencil outdoor storm drain inlets. (O&G)

2. Vehicle Repair

- ✓ 2A. Regularly inspect vehicles and equipment for leaks, and repair as needed.
- ✓ 2B. Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ 2C. Promptly drain all fluids from wrecked vehicles. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g. larger pans are needed to contain antifreeze, which may gush from some vehicles).
- ✓ 2D. Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.

Vehicle Repair (cont.)

- ✓ 2E. Oil filters disposed of in trashcans or dumpsters can leak oil. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- ✓ 2F. Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.
- ✓ 2a. Perform vehicle fluid removal or changing inside or under cover where feasible to prevent the run-on of stormwater and the runoff of spills. (O&G)

Vehicle Leak and Spill Control

- ✓ 2G. Use absorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- ✓ 2H. Place a stockpile of spill cleanup materials where it will be readily accessible.
- ✓ 2I. Sweep floor using dry absorbent material.

3. Machine Repair

- ✓ 3A. Don't allow excessive build-up of oil or grease on equipment.
- ✓ 3B. Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ 3C. Perform major equipment repairs at an appropriately controlled facility, whenever practical.
- ✓ 3D. Following good housekeeping measures in Vehicle Repair section.

4. Waste Handling/Disposal

Waste Reduction

- ✓ 4A. Try to prevent spills and drips of solvents and cleansers to the shop floor.
- 4a. Do liquid cleaning at a centralized station so the solvents and residues stay in one area. Recycle liquid cleaners when feasible. (TOX)
- 4b. Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse. (O&G)

☐ _____ ☐

☐ _____ ☐

Safer Alternatives

- 4c. If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:
  - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
  - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
  - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
  - Choose cleaning agents that can be recycled.

Recycling

- 4d. Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents. (O&G, TOX)

FF-4
FUELING



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Material Loading and Unloading activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and impact on stormwater surface water quality. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
___ Stockpile fuel spill cleanup materials where they are readily accessible.	X	X	X	X	X
___ Use absorbent materials for cleaning up fuel spills instead of washing down.	X	X	X	X	X
___ Regularly inspect fuel storage and fueling equipment for leaks.	X	X	X	X	X
___ Keep spilled or leaked fuels out of the MS4.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Use commercial fueling services to the extent feasible instead of performing this activity at a municipal site.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) Sediment (SED) Nutrients (NUT) Oil and Grease (O&G) Pesticides (PEST)
Other Toxic Compounds (TOX) Trash (TRASH) Hydrological Impacts (HYD) Any/All or General (ANY)

General Guidelines

- ✓ 1A. If refueling must be done on site, use a location away from storm drains and creeks.
- ✓ 1B. Discourage "topping off" of fuel tanks.
- ✓ 1C. Use dry methods to clean the fueling area whenever possible. If you periodically clean by pressure washing, place a temporary plug in the downstream drain and pump out the accumulated water. Properly dispose of the water.
- ✓ 1D. Verify that appropriate employees and subcontractors are trained on proper fueling and cleanup procedures
- 1a. If re-developing the fueling area, consider retrofitting the area to prevent the run-on of stormwater and the runoff of spills:
  - Pave fueling area with Portland cement concrete (or equivalent smooth impervious surface), with a 2% to 4% slope to prevent ponding. (O&G)
  - Separate the dispensing area from the rest of the site by a grade break that prevents run-on of storm water to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly area may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the "fuel dispensing area" stated above.(O&G)
  - Cover the fuel dispensing area. The cover's minimum dimensions must be equal to or greater than the area within the grade break for the fuel dispensing area. (O&G)
  - Design the cover so that is does not drain onto the fuel dispensing area. (O&G)
- 1b. Consider retrofitting vapor recovery nozzles to help control drips as well as air pollution. (O&G)
- 1c. Consider retrofitting to provide secondary containment such as curbs, berms, etc. at locations designated for transferring fuel from the tank truck to the fuel tank. (O&G)
- 1d. If the facility has large numbers of mobile equipment working throughout the site and they are fueled with a mobile fuel truck, establish a designated area for fueling. With the exception of racked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary "caps" over nearby storm drain inlets so that if a spill occurs it is prevented from entering the storm drain. (O&G)
- 1e. Consider retrofitting if needed to ensure the following safeguards are in place: (O&G)
  - Overflow protection devices on tank systems to warn the operator or automatically shutdown transfer pumps when the tank reaches full capacity
  - Protective guards around tanks and piping to prevent vehicle or forklift damage
  - Clearly tagging or labeling all valves to reduce human error

- Placement of spill kits at fueling areas and/or on vehicles.
- 1f. Stencil storm drain inlets within the facility boundary, by paint/stencil (or equivalent), to indicate whether they flow to an oil/water separator, directly to the sewer, or to a storm drain. Labels are not necessary for plumbing fixtures directly

Spill Response

✓ 1E. Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.

✓ 1F. Place a stockpile of spill cleanup materials where it will be readily accessible. (O&G)

✓ 1G. Aboveground tank leak and spill control (not applicable to propane):

- Check for external corrosion and structural failure
- Check for spills and overfills due to operator error
- Check for failure of piping system
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa
- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.

- 1g. Periodically, integrity testing should be conducted by a qualified professional. (O&G)

FF-6
MATERIAL LOADING AND UNLOADING



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Material Loading and Unloading activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practical. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
___ Stockpile spill cleanup materials where they are readily available.	X	X	X	X	X
___ Regularly inspect loading equipment for leaks.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Require materials handling personnel to be trained in relevant BMPs.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G) Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General(ANY)*

General Guidelines

✓ 1A. Regularly clean work areas to remove materials such as debris, sandblasting material, etc.

✓ 1B. Try to avoid loading and exposing materials during rain events unless the loading dock is covered and protected from rain. A seal or door skirt between the trailer and the building may also prevent exposure to rain.

- 1a. Consider retrofitting the loading/unloading area to prevent stormwater runon that would include grading or berming the area, and positioning roof downspouts so they direct stormwater away from loading/unloading areas. (TRASH, TOX, O&G)
- 1b. Consider retrofitting with overhangs or door skirts that enclose the trailer. (TRASH, TOX, O&G)
- 1c. Consider retrofitting parking areas for tank trucks or delivery vehicles so that spills or leaks can be contained. (TRASH, TOX, O&G)
- 1d. Consider retrofitting so that shipboard cooling and process water discharges are directed away to to minimize contact with areas where spent abrasives, paint, and other debris might accumulate. (TRASH, TOX)

Tank Truck Transfers

✓ 1C. The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.

- 1e. Consider retrofitting the transfer area to prevent runon of stormwater from adjacent areas. Sloping the pad and using a berm around the uphill side of the transfer area should reduce runon. (TRASH, TOX, O&G)
- 1f. Consider retrofitting the transfer area to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump. A positive control valve should be installed on the drain. (TRASH, TOX, O&G)

Spill Control

✓ 1D. Contain leaks during transfer.

✓ 1E. Place spill kits and materials next to or near each loading/unloading area.

- 1g. Use drip pans under hoses.
- 1h. Use drip pans or comparable devices when transferring oils, solvents, and paints.

Inspection

✓ 1F. Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.

✓ 1G. Inspect regularly for leaking valves, pipes, hoses, or soil chutes carrying either water or wastewater.

FF-7
MATERIAL STORAGE, HANDLING, AND DISPOSAL

The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Material, Storage, Handling and Disposal activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
General Materials:					
___ Protect material stores from concentrated surface rain flows.	X	X	X	X	X
___ Keep exterior storage areas tidy.	X	X	X	X	X
Chemical Materials					
___ Exterior storage of chemical materials should be in watertight containers.	X	X	X	X	X
Hazardous Materials					
___ Do not store hazardous materials directly on the ground. Use secondary containment.	X	X	X	X	X
___ Do not store hazardous materials at remote job sites. Keep in a secured storage area.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Require materials-handling personnel to be trained in relevant BMPs.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)* *Other Toxic Compounds (TOX)* *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General*

1. General Material Storage, Handling, and Disposal

☐ _____ ☐ _____

_____

☐ _____ ☐ _____

_____

☐ _____ ☐ _____

✓ Storage

✓ 1A. Keep storage areas clean and dry to the extent practical.

✓ 1B. Encourage vigilance so that leaks and spills are detected as soon as possible.

✓ 1C. Keep outdoor storage areas in good condition (e.g. repair roofs, floors, etc. to limit releases to runoff).

✓ 1D. Wood products treated with chromated copper arsenate,

ammonical copper zinc arsenate, creosote, or pentachlorophenol should be covered with tarps during rain events or stored indoors.

✓ 1E. Parking lots or other surfaces near bulk materials storage areas should be swept periodically to remove debris blown or washed from storage area.

✓ 1F. Verify that appropriate employees and subcontractors are trained in proper storage measures.

- 1a. Store materials indoors if possible. (ANY)

1b. If stored outdoors, cover the storage area with a roof or with temporary cover during rain events. [*Note: the local fire authority/department must be consulted for limitations on clearance of roof covers over containers used to store flammable materials*]. (ANY)

- 1c. Consider retrofitting to minimize stormwater run-on and runoff by covering, enclosing or providing secondary containment for the area. (ANY)
- 1d. Drums stored in an area where unauthorized persons may gain access must be secured to prevent accidental spillage, pilferage, or any unauthorized use. Only personnel with proper training may handle hazardous waste. (TOX, PEST)

Secondary Containment

✓ 1G. Keep liquids in a designated area on a paved impervious surface.

✓ 1H. Review storage areas regularly for leaks or spills.

✓ 1I. Check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.

✓ 1J. Check for leaks or spills during pumping of liquids or gases from trucks to a storage facility or vice versa.

- 1e. Consider retrofitting existing tanks so that they are bermed or surrounded by a secondary containment system such as dikes, liners, vaults, or double walled tanks. (TOX, PEST)
- 1f. Consider retrofitting existing liquids storage areas to create a secondary containment. The area inside the berm should slope to a drain with a dead-end sump that is periodically pumped out. (TOX, PEST, O&G)

2. General Chemical Material Handling and Disposal

☐ _____ ☐

☐ _____ ☐

☐ _____ ☐

☐ _____ ☐

General Guidelines

- ✓ 2A. Try to keep chemicals in their original containers, and keep them well labeled.
- ✓ 2B. Keep secured lids on waste barrels and containers.
- 2a. Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containment. Designate a secure chemical material storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills. (TOX, PEST, O&G)
- 2b. Containers should be placed in a designated area and covered. (TOX, PEST, O&G)
- 2c. Consider retrofitting the existing chemical storage area to reduce exposure to storm water: (TOX, PEST, O&G)
- Store materials inside or under cover on paved surfaces
  - Use secondary containment
  - Use covered dumpsters for waste product containers. Dumpsters shall be kept in good condition without corrosion or leaky seams. Garbage dumpsters should be replaced if they are deteriorating to the point where leakage is occurring.

General Guidelines (cont.)

- 2d. Consider retrofitting so that liquid materials are stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all the containers or 110 percent of the volume of the largest container, whichever is greater. (TOX, PEST, O&G)

Spill Control

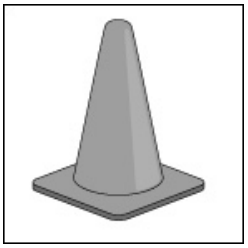
- ✓ 2C. Clean up spills immediately.
- ✓ 2D. Use clear tagging or labeling, and consider restricting access to valves to reduce human error.
- ✓ 2E. Employees or subcontractors trained in emergency spill cleanup procedures should be present when dangerous waste, liquid chemicals, or other wastes are delivered or transferred off-site.
- 2e. Safeguards against accidental releases:
  - Consider retrofitting overflow protection devices to warn operator or automatic shut down transfer pumps (TOX, PEST)
  - Consider retrofitting protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage (TOX, PEST, O&G)
  - Consider purchasing a hazardous materials spill kit.

3. General Hazardous Material Handling

General Guidelines

- ✓ 3A. All hazardous waste must be labeled according to hazardous waste regulations. Consult your Fire Department or your local hazardous waste agency for details.
- ✓ 3B. Store as few hazardous materials on-site as possible. Do not store any hazardous waste directly on the ground. Place these items in secondary containers.
- ✓ 3C. Employees trained in emergency spill cleanup procedures should be present when dangerous waste, liquid chemicals, or other wastes are delivered or transferred off-site.
- 3a. Consider designating a secure hazardous waste storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills. (TOX, PEST, O&G)
- ✓ Batteries
- ✓ 3D. Store new and used batteries securely to avoid breakage and acid spills during earthquakes.

FF-8
MINOR CONSTRUCTION



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Minor Construction activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
General Construction Activities:					
___ Conduct minor construction in dry weather to the extent feasible.	X	X	X	X	X
___ Prevent construction materials and wastes from entering the MS4.	X	X	X	X	X
___ Keep washwater and sediment out of the MS4.	X	X	X	X	X
Interim Material Storage:			X	X	X
___ Protect stored materials from concentrated rain flows.	X	X	X	X	X
___ Store chemical materials in watertight containers.	X	X	X	X	X
Concrete Work:			X	X	X
___ Prevent cement or concrete wastes from entering the MS4.	X	X	X	X	X
___ Prevent concrete truck washdown rinsewater from entering the MS4.	X	X	X	X	X
Building Work:					
___ Prevent repair and construction materials or wastes from entering MS4.	X	X	X	X	X
POLLUTION PREVENTION MEASURES	X	X	X	X	X
___ Require construction project supervisory personnel to be trained in relevant BMPs.	X	X	X	X	X
___ Incorporate relevant BMPs into minor construction subcontracts.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G) Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

1. General Construction Activities	
☐ _____ ☐ ☐ _____ ☐ ☐ _____ ☐ ☐ _____ ☐ _____ _____ _____ _____ _____ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 1A. Prevent debris from entering the storm drain. ✓ 1B. Do not wash materials into a storm drain or bury spilled dry material. ✓ 1C. Do not clean or rinse equipment into a street, gutter, or storm drain. ✓ 1D. Use a storm drain cover or filtering device if dust, grit, wash water, or other pollutants may escape the work area and enter a storm drain inlet. If appropriate, select devices that will not clog flow on rainy days, or remove them temporarily when rain is imminent. The containment device(s) should be in place at the beginning of the workday, and accumulated dirty runoff and solids should be collected and disposed of regularly, before removing the containment device(s) at the end of the work. ✓ 1E. Clean the storm drain inlets in the immediate vicinity of the construction activity after it is completed. ✓ 1F. If a spill occurs on dirt, excavate and remove the contaminated (stained) soil. ✓ 1G. Clean up spills and leaks immediately using dry methods, whenever possible. ✓ 1H. Designate an area for clean up and proper disposal of excess materials. ✓ 1I. Sweep up dry materials and residue from cleaning operations. Avoid using water to clean up. ✓ 1J. Use soil erosion control techniques if bare ground is temporarily exposed. ✓ 1K. Promptly clean up trash, debris, and litter from job sites and dispose properly. ✓ 1L. Inspect vehicles and equipment used at the construction site regularly for leaks. ✓ 1M. Verify that appropriate employees and subcontractors are trained in proper waste management.
2. Interim Material Storage	
☐ _____ ☐ _____ _____ ☐ _____ ☐	✓ 2A. Properly store and cover materials that are normally used during minor construction such as paints, solvents, equipment, fuel, asphalt/concrete materials, sand, etc. ✓ 2B. Properly store and dispose of wastes generated from the activity. ✓ 2C. To the extent practical, store dry and wet materials under cover, protected from rainfall and runoff and away from storm drain inlets. After job is complete, remove temporary stockpiles (asphalt materials, sand, etc.)

☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐	and other materials as soon as possible. ✓ 2D. Apply and store all products in accordance with manufacturer's instructions and proper safety measures. ✓ 2E. Store products in labeled containers and with covers or lids. ✓ 2F. Place stockpiled materials away from storm drain inlets, drainage paths, and natural waterways and provide cover to protect from run-on/run-off if feasible. ✓ 2G. Control stockpiled materials if windy or rainy weather is predicted (e.g. tarps, berming, sandbags, etc.). ✓ 2H. Prevent storm water from eroding stockpiles. ✓ 2I. Inspect stockpiles regularly and after significant rain events.
3. Concrete Work	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐	✓ 3A. Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by dry sweeping up as much waste material as possible. ✓ 3B. When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. Vacuum saw cuttings and water from the pavement or gutter and remove from site. ✓ 3C. To the extent practical, avoid mixing excess amounts of fresh concrete or cement mortar on site. ✓ 3D. To the extent practical, apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. ✓ 3E. To the extent practical, protect applications of fresh concrete from rainfall and runoff until the material has hardened. ✓ 3F. Do not allow excess concrete to be dumped on-site, except in designated areas and promptly remove when concrete has dried. ✓ 3G. Wash concrete trucks and concrete pumper trucks and trailers off site or in designated areas on site, such that there is no discharge of concrete wash water into storm drains, open ditches, streets, catch basins, or other stormwater conveyance structures. ✓ 3H. For on-site washout: • To the extent practical, locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste. • To the extent practical, wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed of properly. • Wherever practical, recycle washout by pumping back into mixers for reuse. • Never dispose of washout into the street, storm drains, drainage

ditches, or creeks.

- ✓ 3I. When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal. Do not allow water to enter storm drain inlets.
- ✓ 3J. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash
- ✓ 3K. To the extent practical, return left-over materials to the transit mixer. Dispose excess concrete, grout, and mortar in the trash.
- 3a. Tarps should be placed under concrete pumper trucks and the rear of trucks while concrete is being delivered or transferred from one area to another, or clean the area immediately after delivery is complete. (TOX))

4. Building Work

General Guidelines

- ✓ 4A. Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- ✓ 4B. Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- ✓ 4C. Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- ✓ 4D. Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- ✓ 4E. If a spill occurs on dirt, excavate and remove the contaminated (stained) soil

Building Demolition

- ✓ 4F. Spray water throughout the site to help control wind blowing of fine materials such as soil, concrete dust, paint chips, and metal chips. The amount of water must be controlled so that runoff from the site does not occur; yet dust control is accomplished.
- ✓ 4G. Oils must never be used for dust control.
- ✓ 4H. Place filter fabric or a similarly effective device at nearby storm drain inlets to prevent particles and solids from entering the storm drainage system. Filters should be placed at the beginning of the workday and the accumulated materials collected and disposed regularly before removing permanently them at the end of the work. Select devices that won't clog storm flow.
- ✓ 4I. Dry sweep surrounding street gutters, sidewalks, driveways, and other paved surfaces at the end of each workday to collect and properly dispose of loose debris and garbage, do not hose down the area to a storm drain.
- ✓ 4J. Use permanent soil erosion control techniques if a building cleared from an area is not to be replaced.

FF-9
PARKING LOT MAINTENANCE

The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Parking Lot Maintenance activities based on priorities determined by site location and operational characteristics. Parking Facilities are considered High Priority regardless of location. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(D)	ESA
Sweeping and Cleaning					
___ Sweep or vacuum parking lots at least monthly.			X	X	N/a
___ Clean out parking lot drain inlets as needed and at least once before the wet season.			X	X	N/A
Surface Repair					
___ Conduct repairs during dry weather.			X	X	N/a
___ Prevent materials or wastes from entering drain inlets.			X	X	N/a
Spill Control					
___ If cleaning oily deposits or other spills, use absorbent materials and prevent any discharge to parking lot drain inlets or the MS4.			X	X	N/a
POLLUTION PREVENTION METHODS					
___ Require maintenance personnel to be trained in relevant BMPs.	X	X	X	X	N/a
___ Incorporate relevant BMPs into maintenance subcontracts.	X	X	X	X	N/a

PROGRAM/FACILITYBEING INSPECTED: _____

Inspector name: _____ Date: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) Sediment (SED) Nutrients (NUT) Oil and Grease (O&G) Pesticides (
Other Toxic Compounds (TOX) Trash (TRASH) Hydrological Impacts (HYD) Any/All or General

SUGGESTED IMPLEMENTATION STRATEGIES:

1. Sweeping and Cleaning

- ✓ 1A. Sweep/vacuum all parking lots at least once before the onset of the wet season.
- ✓ 1B. Clean out parking lot drain inlets as needed at least once before the wet season.
- ✓ 1C. If cleaning with water is necessary, follow the procedures below:
  - Block the storm drain or contain runoff.
  - Wash water should be collected and disposed of properly. If wash water does not contain soap or other cleaning agents the water may be discharged to a pervious surface (dirt or landscaped area).
- ✓ 1D. Dispose of parking lot sweeping debris and dirt at a landfill.
- ✓ 1E. When cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials
  - Do not allow discharges to the storm drain
  - Collect wash water and dispose of properly.
- ✓ 1F. Dispose of spilled materials and absorbents.
- ✓ 1G. If cleaning agents are used, select biodegradable products to the extent practical.
- 1a. Establish more frequent sweeping or drain inlet cleaning schedule based on usage and field observations of waste accumulation. (SED, TRASH, BACT)

Litter Control

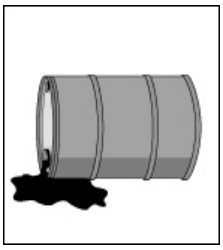
- ✓ 1H. Enforce anti-litter laws.
- ✓ 1I. Provide an adequate number of litter receptacles.
- ✓ 1J. Clean out litter receptacles frequently to prevent spillage.
- ✓ 1K. Sweep/vacuum all parking lots at least once before the onset of the wet season.
- 1b. Post "No Littering" signs. (TRASH)

2. Surface Repair

- ✓ 2A. Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- ✓ 2B. To the extent practical, apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- ✓ 2C. Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered maintenance holes and drains for proper disposal.
- ✓ 2D. Use only as much water as necessary for dust control, to avoid runoff.
- 2a. When repairing parking lots, consider retrofitting to direct stormwater to landscaped areas, and/or installing grate screens or inlet inserts on drain inlets to capture leaf litter, sediment and/or hydrocarbons. (TRASH, SED,

_____	O&G)
3. Control Spills	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 3A. If a spill occurs on dirt, excavate and remove the contaminated (stained) dirt. ✓ 3B. Store spill response materials at a central location and keep maintenance vehicles adequately supplied. ✓ 3C. Appropriately dispose of spilled materials and absorbents.

FF-10
SPILL PREVENTION AND CONTROL



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Spill Prevention and Control activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
Preparation:					
___ Stockpile spill cleanup materials where they are readily accessible.	X	X	X	X	X
Spill Response:					
___ Clean up leaks and spills promptly upon discovery.	X	X	X	X	X
___ Sweep, scoop up or absorb exterior spills instead of washing down.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Train personnel in appropriate spill prevention and cleanup BMPs.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED:: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)* *Other Toxic Compounds (TOX)* *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

SUGGESTED IMPLEMENTATION STRATEGIES

1. Preparation/Prevention	
☐ _____ ☐	✓ 1A. Stockpile appropriate spill cleanup materials where they will be readily accessible.
2. Spill Response	
☐ _____ ☐	✓ 2A. Clean up leaks and spills promptly upon discovery.
☐ _____ ☐	✓ 2B. On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
☐ _____ ☐	✓ 2C. Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
☐ _____ ☐	✓ 2D. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
☐ _____ ☐	✓ 2E. For larger spills, a private spill cleanup company or Hazmat team may be necessary.
☐ _____ ☐	• 2a. If illegal dumping is observed, consider retrofitting "No Dumping" signs with a phone number for reporting dumping and disposal. (ANY)
3. Reporting	
☐ _____ ☐	✓ 3A. Report spills to the MS4 or persistent problems to a city Authorized Inspector
4. Training	
☐ _____ ☐	✓ 4A. Verify that appropriate employees and subcontractors are trained in spill prevention and cleanup.

FF-11
VEHICLE AND EQUIPMENT CLEANING



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Vehicle and Equipment Cleaning activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	**LOW**	**MEDIUM**	**HIGH**	**303(d)**	**ESA**
___ Steam cleaning or degreasing of engines is prohibited at municipal yards.	X	X	X	X	X
___ Prevent wash, rinsewater, or cleaning agents from entering the MS4.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Use commercial car wash or equipment cleaning facilities to the extent feasible.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

☐ _____ ☐ _____

☐ _____ ☐ _____

☐ _____ ☐ _____

☐ _____ ☐ _____

☐ _____ ☐ _____

☐ _____ ☐ _____

✓ 1A. Do not permit steam cleaning or engine degreasing at the wash out area.

- 1a. Use designated, covered, wash areas to prevent contact with stormwater and bermed to contain wash water.
- 1b. Designated wash areas should be well marked with signs indicating where and how washing must be done.
- 1c. Water may be discharged to the sanitary sewer after flowing through a clarifier, upon approval from the sewer agency. If the above conditions are not met, other pre-treatment may be required.
- 1d. Washing operations should be conducted in a designated wash area having the following characteristics:
  - Paved with Portland cement concrete
  - Covered or bermed to prevent contact with storm water

_____ _____ _____ ☐ _____ ☐ ☐ _____ ☐	• Sloped for wash water collection • Connected to the sanitary sewer – upon approval. • Clearly designated • 1e. Consider filtering and recycling wash water. • 1f. Consider retrofitting wash areas with oil/water separators.

FF-12
VEHICLE AND EQUIPMENT STORAGE



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Vehicle and Equipment Storage activities based on priorities determined by site location and operational characteristics. Storage Yards are considered High-Priority areas. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
Storing Vehicles and Equipment:					
___ Maintain vehicles so as to prevent oil or gasoline leaks onto pavement or streets.	X	X	X	X	N/a
Cleaning Vehicle Storage Areas:					
___ Keep vehicle storage areas tidy.	X	X	X	X	N/a
___ Do not hose down to drain inlets or MS4.	X	X	X	X	N/a
POLLUTION PREVENTION METHODS					
___ Require personnel to be trained in relevant BMPs.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

SUGGESTED IMPLEMENTATION STRATEGIES:

1. Storing Vehicles and Equipment

☐ _____ ☐ _____

☐ _____ ☐ _____

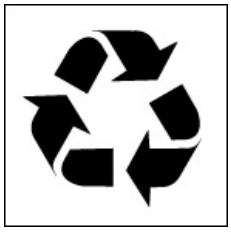
☐ _____ ☐ _____

General Guidelines

- ✓ 1A. Review the storage yard for filling drip pans and other problems (leaking equipment) regularly.
- ✓ 1B. Verify that appropriate employees and subcontractors are trained on procedures.
- 1a. Consider placing drip pans or absorbent materials under

	vehicles and heavy equipment when not in use for significant periods. (O&G) **Batteries** ✓ 1C. Store batteries that have been dropped or are cracked in a secondary container even if it appears that the acid has already drained.
2. Wrecked Vehicle Storage	
	✓ 2A. As the vehicles arrive, place drip pans under them immediately, even if the fluids have leaked out before the car arrives. ✓ 2B. Drain all fluids from wrecked vehicles and "part" cars. Also drain engines, transmission, and other used parts. ✓ 2C. Promptly transfer used fluids to the proper container; do not leave full drip pans or other open containers lying around. • 2a. To the extent practical, do not store vehicles near storm drain inlets. (O&G)
3. Cleaning Vehicle Storage Areas	
	• 3a. Dry sweep parking lots, storage areas, and driveways as needed to collect dirt, waste, and debris. Do not hose down the area to a storm drain. (SED, TRASH) • 3b. Considering using an outside service to clean vehicle storage areas and collect water for off-site disposal. (SED, TRASH)

FF-13
WASTE HAULING AND DISPOSAL



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Waste Hauling and Disposal activities based on priorities determined by site location and operational characteristics. Drainage Facilities are considered High Priority regardless of location. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
Litter Control:					
___ Provide covered litter receptacles in busy pedestrian areas.	X	X	X	X	X
Waste Collection:			X	X	X
___ Store trash in covered watertight containers.	X	X	X	X	X
Spill/Leak Control:			X	X	X
___ Clean out litter receptacles frequently to prevent spillage.	X	X	X	X	X
___ Stockpile spill cleanup materials where they are readily accessible.			X	X	X
___ Prevent any trash container or storage area rinsewater from entering the MS4.	X	X	X	X	X
Run-on/Run-off Prevention:					
___ Keep trash storage areas tidy.	X	X	X	X	X
___ Protect trash storage area from concentrated surface rain flows.	X	X	X	X	X
POLLUTION PREVENTION METHODS					
___ Require waste hauling/disposal personnel to be trained in relevant BMPs.	X	X	X	X	X
___ Incorporate relevant BMPs into contractual requirements for any waste hauling/disposal subcontracts.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G) Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General*

1. Litter Control

General Guidelines

- ✓ 1A. Enforce anti-litter laws.
- ✓ 1B. Provide a sufficient number of litter receptacles at each fixed facility.
- ✓ 1C. Clean out litter receptacles frequently to prevent spillage.
- ✓ 1D. Place trash receptacles at transit stop benches and maintain as necessary.

1a. Consider posting "No Littering" signs. (TRASH)
1b. Provide covered trash receptacles. (TRASH).

2. Waste Collection

General Guidelines

- ✓ 2A. Keep waste collection areas clean.
- ✓ 2B. Regularly inspect solid waste containers for structural damage. Repair or replace damaged containers as necessary.
- ✓ 2C. Do not fill solid waste containers with washout water or any other liquid.
- ✓ 2D. Educate the public and verify that appropriate employees and subcontractors are trained to ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, CRTs, TVs, computers etc. may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- ✓ 2E. Do not mix liquid wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
- 2a. Secure solid waste containers; containers should be closed tightly when not in use. (TRASH)

Good Housekeeping

- ✓ 2F. The waste management area should be kept clean by sweeping and cleaning up spills immediately.
- ✓ 2G. When cleaning around dumpster areas use dry methods when possible (e.g. sweeping, use of absorbents). If water must be used after sweeping/using absorbents, collect water and discharge to landscaped area; or discharge through a grease interceptor, if needed and practical, to the sewer if permitted to do so.
- 2b. Use the entire product before disposing of the container.

	Chemical/Hazardous Waste Management
☐ _____ ☐	✓ 2H. All hazardous waste must be labeled according to hazardous waste regulations. Consult your Fire Department or your local hazardous waste agency for details.
☐ _____ ☐	✓ 2I. Verify that appropriate employees and subcontractors are trained in proper hazardous waste handling management practices.
☐ _____ ☐	✓ 2J. Select designated hazardous waste collection areas on-site and make sure that hazardous waste is collected, removed, and disposed of only at these authorized disposal areas.
☐ _____ ☐	✓ 2K. Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
☐ _____ ☐	• 2c. Consider retrofitting if necessary to place hazardous waste containers in secondary containment. (TOX)
☐ _____ ☐	• 2d. Stencil storm drains on the facility's property. (TOX)
3. Spill/Leak Control	
☐ _____ ☐	✓ 3A. Clean up spills promptly upon discovery.
☐ _____ ☐	✓ 3B. Spill cleanup materials should be placed where they are easily accessible
☐ _____ ☐	✓ 3C. Minimize spillage/leaking from solid waste containers. For larger solid waste containers (especially compactors) that utilize a hydraulic fluid pump system, regularly inspect and replace faulty pumps or hoses to minimize the potential of releases and spills.
☐ _____ ☐	✓ 3D. Check waste management areas for leaking containers or spills.
☐ _____ ☐	✓ 3E. Leaking equipment including valves, lines, seals, or pumps should be repaired promptly.
☐ _____ ☐	✓ 3F. Transfer waste from damaged containers into safe containers.
☐ _____ ☐	✓ 3G. Vehicles transporting waste should have spill prevention equipment that can prevent spills during transport. The spill prevention equipment may include: • Vehicles equipped with baffles for liquid waste • Trucks with sealed gates and spill guards for solid waste
☐ _____ ☐	✓ 3H. Special care should be taken when loading or unloading wastes. *See Loading and Unloading procedure sheet.*
4. Run-on/Run-off Prevention	
☐ _____ ☐	• 4a. Consider retrofitting to prevent stormwater run-on from entering waste management areas by enclosing the area or building a berm around the area. (TOX, PEST, O&G, NUT))
☐ _____ ☐	• 4b. Consider retrofitting to prevent the waste materials from directly contacting rain. (TOX, PEST, O&G, NUT))
☐ _____ ☐	• 4c. Consider retrofitting to cover waste areas with a permanent roof if practical. If not feasible, consider covering waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon. (TOX, PEST, O&G, NUT)
☐ _____ ☐	• 4d. If possible, move the activity indoors; ensuring first that all safety concerns such as fire hazard and ventilation are addressed. (TOX, PEST, O&G, NUT)

Run-on/Run-off Prevention (cont.)

- 4e. Consider replacing dumpsters with covered units to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster. (ANY)
- 4f. Minimize the runoff of stormwater for land application by: (BACT, TOX, PEST)
  - Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, there is a closed drainage system.
  - Avoiding application of waste to the site when it is raining or when the ground is saturated with water.
  - Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site.
  - Maintaining adequate barriers between the land application site and the receiving waters. Planted strips are particularly good.
  - Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins.
  - Performing routine maintenance to ensure the erosion control or site stabilization measures are working.

CITY OF LAGUNA NIGUEL

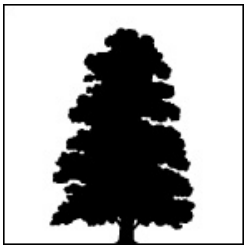
FF-14:
SPECIAL EVENTS

The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Special Events, based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable.

ACTIVITY / ITEM	DESIGNATED MINIMUM BEST MANAGEMENT PRACTICES (BMPs)
Trash/ Litter Management	• Ensure that an adequate number of receptacles are provided for use by vendors and guests. Any overflowing containers observed shall be managed and serviced in a timely manner. • Release of balloons (rubber, latex, mylar or other material) is not allowed. • All waste receptacles shall be leak tight and equipped with lids or covers. Dumpsters shall be closed when not in use. • Pick up litter at least once daily. Litter should not be allowed to be blown away by blowers or wind. • Hazardous and liquid waste shall not be disposed of in dumpsters or trash bins. Hazardous waste shall be disposed of properly at a hazardous waste facility. Liquid waste, such as cooking grease or other food related materials, shall be properly disposed of off-site by generator. Other non-hazardous liquids, such as left over beverages, ice bin residual, etc, should be disposed of in the sanitary sewer system through a sink or toilet, or poured on a pervious area, such as a landscaped or dirt/gravel area, where the liquids can be fully absorbed prior to leaving the site. • If commercial vendors/sales are involved, provide required recycling containers as set forth by City contract waste hauler. • After the event is over and any temporary event facilities are removed, inspect the site for litter or spills, and provide for prompt cleanup and disposal.
Portable Toilets	• Require the vendor to provide a secondary containment pan or storm drain inlet protection, if a spill could reach the storm drain. • Do not place portable toilets near or over a storm drain without secondary containment. • The contact information for the company responsible for the portable facilities must be clearly marked on or near the facilities. • Ensure adequate servicing to prevent overflows or leaks. • It is recommended that vendors be requested to stake down the portable toilets to prevent them from tipping over from wind or vandals, if appropriate.

Car Wash Fundraisers	• The use of an experienced car wash fundraiser vendor, with proper containment equipment such a Prontowash, or dry methods are encouraged. • All car wash water must be contained on site and not allowed to drain to adjacent property or storm drains without treatment BMPs. • If there is adequate on-site area, car wash water may be allowed to absorb into a pervious (i.e. landscaped or gravel/dirt) area. The event water must be fully absorbed prior to leaving site. • If draining to a vegetated area, a filtering device, such as sand or gravel bags shall be used to collect sediment and debris prior to draining to the vegetated area. The collected debris shall be removed and disposed of properly at the end of the event. • A high pressure hose nozzle is encouraged to minimize water use and runoff. An automatic shut off nozzle is required per water district regulations. • A non-toxic, biodegradable soap shall be used.
Pressure Washing / Wet Washing	• All water or wastewater discharges from any washing activities must be prevented from entering streets, storm drains and gutters and collected for proper disposal. • Storm drain inlets (or low points of the site) must be protected with a temporary berm where washwater is contained and then collected for proper disposal. • If contractors (such as powerwashers) are used for wet washing services, they must contain, collect and properly dispose of washwater (most likely offsite). Include this requirement in your contract. • Small amounts of water can be dumped into a sanitary sewer connection, such as a utility sink or toilet, if available, or could be diverted to a pervious (ie. landscaped or gravel/dirt) area, and allowed to soak into the ground. The water must be fully absorbed into the ground prior to leaving site.
Spill Clean Up & Reporting	• Prior to start of event, organizers & staff should assess the event location, and identify the nearby catch basins, that would receive any trash, debris or spills from the event. • Spills of drinks, food, and any other material on a paved area must be cleaned. Liquid spills can be cleaned by using absorbent materials such as paper towels, mops, or an absorbent material. Food or other solid materials may be swept up, and placed in the trash. • Regularly inspect storm drains during the event to assure that pollutants are not entering them. • If pollutants enter a storm drain or if a hazardous material spill occurs, please call Police Dispatch at 949-770-6011 immediately.
Post-Event Clean Up	• All streets, sidewalks, and public areas must be cleaned (sweeping, litter pickup, etc.) and returned to the pre-event condition. • Remove temporary public art (chalk, paint, charcoal, clay, etc). Any wet washing conducted should follow BMPs as noted above. • All storm drain inlet protection devices must be removed.
Contracts & Leases	• Provide adequate language in contracts with vendors to ensure compliance with these rules. • Discuss and distribute information about these water quality requirements during staff (including contractor) training and vendor registration.

FP-2
LANDSCAPE MAINTENANCE



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Landscape Maintenance activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Iimplementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	**MEDIUM**	**HIGH**	**303(d)**	**ESA**
Mowing, Trimming, Weeding, or Planting:					
___ Keep green wastes out of drain inlets.	X	X	X	X	X
___ Immediately clean up and remove grass clippings, trimmings, and weed debris.	X	X		X	X
Irrigation:					
___ Take all feasible measures to eliminate surface irrigation runoff.	X	X	X	X	X
____ Comply with Water District regulations for waste prohibition, water conservation and drought response.	X	X	X	X	X
___ Prevent irrigation overspray onto pavements.	X	X	X	X	X
___ Equip systems with automatic rain sensing shut off.	X	X	X	X	X
Fertilizer and Pesticide Management:					
___ Adhere to all laws and regulations for use, storage and disposal of fertilizers and pesticides.	X	X	X	X	X
___ All pesticide application shall be supervised by a Certified Pest Control Applicator.	X	X	X	X	X
___ Utilize biological controls for pests where feasible.	X	X	X	X	X
___ Do not apply landscape pesticide or herbicide chemicals when rain is imminent.	X	X	X	X	X
___ Do not operate irrigation systems after chemical treatment until all liquid chemical applications have fully dried.	X	X	X	X	X
___ Immediately clean up spilled or excess chemicals or fertilizers.	X	X	X	X	X
___ Use appropriate Integrated Pest Management Techniques.	X	X	X	X	X
___ Reduce fertilizer and pesticide needs by retaining or revegetating with native plants when and where determined appropriate.	X	X	X	X	X
Managing Landscape Waste					
___ Remove pet or wildlife feces by scooping, sweeping or wiping. If needed, direct any hose-down to landscaped areas.	X	X	X	X	X

Erosion Control					
___ Keep soil or soil amendments out of drain inlets**.**	X	X	X	X	

POLLUTION PREVENTION METHODS

___ Require landscape maintenance personnel to be trained in relevant BMPs.
___ Incorporate BMPs into subcontracts when renewed.

PROGRAM/FACILITY BEING INSPECTED: _____
Inspector name: _____ Date: _____
When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

This list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) targeted at specific constituents of concern . The specific target constituents are notated parenthetically as:

Bacteria (BACT) Sediment (SED) Nutrients (NUT) Oil and Grease (O&G) Pesticides (PEST) Other Toxics (TOX) Trash (TRASH) Hydrological Impacts (HYD) Any/All or General (ANY)

1. Mowing, Trimming/Weeding, and Planting

☐ _____ ☐ _____
_____
_____
☐ _____ ☐ _____
_____
_____

☐ _____ ☐ _____
_____
_____
☐ _____ ☐ _____
_____
_____
☐ _____ ☐ _____
_____
_____
☐ _____ ☐ _____
_____
_____
☐ _____ ☐ _____
_____
_____

✓ 1A. Where cost effective and appropriate, use mechanical methods of vegetation removal rather than applying herbicides.

✓ 1B. When conducting mechanical or manual weed control, try to minimize loosening the soil, which could erode into streams or storm drains.

✓ 1C. Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.

✓ 1D. Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).

✓ 1E. Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

✓ 1F. Use baggers on mowing equipment, or use composting mowers.

- 1a. Consider retrofitting with coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides. (PEST, SED)

Planting

- 1b. Where feasible and appropriate, retain and/or plant selected native vegetation whose features are determined to

☐ ☐	be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation. (PEST, NUT, HYD, BACT) • 1c. When planting or replanting consider retrofitting with low water use or inert groundcovers, and/or drought-tolerant, pest-resistant shrubs or trees. (PEST, NUT, HYD, BACT). • 1d. When planting, consider using broadleaf evergreen trees to reduce leaf litter. (BACT)
2. Irrigation	
☐ ☐	✓ 2A. When scheduling irrigation application durations, consider the equipment's precipitation rates and the infiltration rate and slope of the soil to minimize runoff. ✓ 2B. Only irrigate as much as is needed. Adjust irrigation frequencies seasonally and in response to rain. ✓ 2C. Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed. Adjust sprinkler head spray patterns to minimize over spray while achieving necessary coverage. ✓ 2D. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas. ✓ 2E. Verify that appropriate employees and subcontractors are trained in irrigation management techniques for pollution prevention. • 2a. Consider retrofitting popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. (HYD, SED) • 2b. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken. (HYD, SED) • 2c. If recycled water is used for irrigation, ensure that runoff from the landscaped area(s is minimized to the maximum extent practical. (HYD, BACT, NUT) • 2d. Consider retrofitting raised edgings, berms or other measures to reduce runoff. (HYD, BACT, NUT, PEST) • 2e. Consider retrofitting to an evapotranspiration-driven controller. (HYD) • 2f. Consider retrofitting to lower-precipitation-rate sprinkler heads, or to a drip system where appropriate. (HYD)
3. Fertilizer and Pesticide Management	
☐ ☐	✓ 3A. Utilize appropriate integrated pest management techniques.

- ✓ 3B. Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ✓ 3C. Verify that appropriate employees and subcontractors are trained on use of pesticides and in pesticide application techniques to prevent pollution.
- ✓ 3D. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- ✓ 3E. When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.
- ✓ 3F, Do not mix or prepare pesticides or fertilizers for application near storm drains.
- ✓ 3G. Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- ✓ 3H. Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- ✓ 3I. Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- ✓ 3J. Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- ✓ 3K. Inspect pesticide/fertilizer equipment and transportation vehicles for leaks and repair as needed.
- ✓ 3L. Refer to Appendix D for further guidance on Fertilizer and Pesticide management
- 3a. Periodically test soils for determining proper fertilizer use. (NUT)
- 3b. Work fertilizers into the soil rather than dumping or broadcasting them onto the surface. (NUT, BACT)
- 3c. Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species). (PEST)
- 3d. Use slow release fertilizers when/where possible to minimize leaching. (NUT, BACT)

Scheduling

- ✓ 3M. Do not use pesticides if rain is expected within 24 hours.
- ✓ 3N. Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ 3O. Dispose of empty pesticide containers according to the instructions on the container label.
- 3e. Consider purchasing only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product), to reduce the potential for accidental release during storage. (PEST)
- 3f. Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste. (PEST)

4. Managing Landscape Waste	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 4A. Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems. ✓ 4B. Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system. ✓ 4C. Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of. ✓ 4D. Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material. • 4a. Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming. (NUT)
5. Erosion Control	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 5A. Maintain vegetative or other cover on medians and embankments to prevent soil erosion. • 5a. Apply mulch or leave clippings to serve as additional cover for soil stabilization. (SED) • 5b. Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil. (SED) • 5c. Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected. (SED) • 5d. Consider retrofitting structural erosion control measures if needed. •

FP-2A
IRRIGATION RUNOFF ELIMINATION

The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Irrigation Runoff Elimination activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Iimplementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	**MEDIUM**	**HIGH**	**303(d)**	**ESA**
Irrigation:					
___ Implement all feasible measures to eliminate surface irrigation runoff.	X	X	X	X	X
____ Comply with Water District regulations for waste prohibition, water conservation and drought response.	X	X	X	X	X
___ Prevent irrigation overspray onto pavements.	X	X	X	X	X
___ Equip systems with automatic rain sensing shut off.	X	X	X	X	X

POLLUTION PREVENTION METHODS

___ Require landscape maintenance personnel to be trained in relevant BMPs.
___ Incorporate BMPs into subcontracts when renewed.

PROGRAM/FACILITY BEING INSPECTED: _____

Inspector name: _____ Date: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) targeted at specific constituents of concern . The specific target constituents are notated parenthetically as:

Bacteria (BACT) Sediment (SED) Nutrients (NUT) Oil and Grease (O&G) Pesticides (PEST) Other Toxics (TOX) Trash (TRASH) Hydrological Impacts (HYD) Any/All or General (ANY)

1. <u>Implement all feasible measures to eliminate surface runoff of landscape irrigation water.</u>

☐ ☐	✓ 1A. Ensure that persons responsible for landscape maintenance are aware of irrigation management techniques for pollution prevention.
☐ ☐	✓ 1B. Replace irrigation controller batteries routinely, preferably in the spring and fall.
	✓ 1C. Inspect the irrigation system regularly, while it is operating, to identify leaks and to determine if runoff is occurring.
☐ ☐	✓ 1D. Promptly repair any leaks or breaks. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
☐ ☐	✓ 1E. Adjust sprinkler heads and nozzles to avoid over-spray onto pavement and/or other impervious areas.
	✓ 1F. Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded. This can occur in less than 2 minutes depending on landscaping, soil type and topography.
☐ ☐	✓ 1G. Adjust the watering schedule seasonally to reflect reduced winter water demand.
☐ ☐	✓ 1H. Do not water when rain is predicted, or when the ground is already moist from rainfall.
	.

2. <u>Comply with water conservation, drought response and waste prohibition regulations of the water district.</u>

☐ ☐	✓ 2A. When scheduling irrigation application durations, consider the equipment's precipitation rates and the infiltration rate and slope of the soil to minimize runoff.
☐ ☐	✓ 2B. Adhere to the watering schedule restrictions designated by the water district, as appropriate to drought conditions. For more information on water district requirements contact Moulton Niguel Water District at (949) 831-2500 or visit their website at www.mnwd.com.
☐ ☐	✓ 2C. Only irrigate as much as is needed. Adjust irrigation frequencies seasonally and in response to rain.
☐ ☐	✓ 2D. Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
☐ ☐	✓ 2E. Adjust sprinkler head spray patterns to minimize over spray while achieving necessary coverage.
☐ ☐	✓ 2F. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
☐ ☐	

3. Other Tips & Techniques: <u>Consider upgrading irrigation system components to increase irrigation efficiency and reduce the potential for runoff.</u>	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 3a. Consider retrofitting popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. (HYD, SED) ✓ 3b. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken. (HYD, SED) • 3c. If recycled water is used for irrigation, ensure that runoff from the landscaped area(s is minimized to the maximum extent practical. (HYD, BACT, NUT) • 3d. Consider retrofitting raised edgings, berms or other measures to reduce runoff. (HYD, BACT, NUT, PEST) • 3e. Consider retrofitting to an evapotranspiration-driven controller. (HYD) • 3f. Consider retrofitting to lower-precipitation-rate sprinkler heads, or to a drip system where appropriate. (HYD) • 3g. Install sprinkler heads with a low precipitation rate and/or a more adjustable spray pattern or radius as needed. • 3h. Install popup sprinkler heads in areas with a lot of activity and/or where risers may be broken. • 3i. Install water-efficient drip irrigation systems for trees, shrubs and flowers. • 3j. Install a sensor that will reduce flow in case of breakages in the system. • 3k. Install an automatic rain shut-off sensor. • 3l. Install check valves for sprinkler heads at the bottom of slopes to eliminate low-head drainage.

4. Other Tips & Techniques: Consider reducing the need for irrigation.

☐ _____ ☐

☐ _____ ☐

☐ _____ ☐

☐ _____ ☐

☐ _____ ☐

Planting

- 4a. Where feasible and appropriate, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation. (PEST, NUT, HYD, BACT)
- 4b. When planting or replanting consider retrofitting with low water use or inert groundcovers, and/or drought-tolerant, pest-resistant shrubs or trees. (PEST, NUT, HYD, BACT).
- 4c. Add 2-3 inches of mulch around trees and plants to minimize runoff and reduce evaporation
- 4d. Replace turf areas adjacent to pavement and/or other impervious areas with drought tolerant shrubs and groundcover

FP-2B: INTEGRATED PEST MANAGEMENT INCLUDING PESTICIDES, HERBICIDES, & FERTILIZERS

The checklist below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Integrated Pest Management activities, including pesticide, herbicide and fertilizer applications, based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below each list of BMPs is a listing of Other Tips & Techniques that may be utilized where appropriate. Information on the latest IPM information including management of new pests in the landscape is obtained from local UC Cooperative Extension Advisors, UC IPM Regional Advisor, or the Statewide UC IPM Web Site at www.ipm.ucdavis.edu.

I. PREVENTION

A. Landscape Design Procedures - *Minimum Designated BMPs*

☐ Drainage, soil characteristics, water quality and availability are considered during plant selection. Native plants and ecologically adapted species are utilized where compatible with site functional requirements.

☐ Sun exposure, heat, and high temperature conditions are considered during plant selection.

☐ Nursery stock is inspected and rejected if not healthy (injuries, diseased, circling roots/potbound, poor staking and/or pruning).

Other Tips and Techniques

☐ Pest resistant species and cultivars are selected.

☐ Plants with similar growth characteristics and irrigation requirements are grouped together..

☐ Adequate space is allowed for root growth, especially trees.

B. Site Preparation and Planting Procedures - *Minimum Designated BMPs*

☐ Assess soil drainage properties and improve compacted soils prior to planting.

☐ Follow proper planting procedures for particular plant species to avoid planting too deeply or too shallow.

Other Tips and Techniques

☐ Nursery tree stakes are removed at planting and replaced with staking that allows trunk to flex; removing these stakes after 1 to 1.5 years.

☐ Conduct a soil analysis to determine chemical and physical properties of the existing soil and then add appropriate amendments such as organic matter.

C. Water Management – *Minimum Designated BMPs*

☐ Utilize evapotranspiration (ET) data or 'smart' clock technology to schedule irrigation to occur only as needed, and at appropriate times of the day/week.

Other Tips and Techniques

☐ Adjust sprinklers to avoid application of water directly to the trunk of trees (can promote disease) or on to concrete surfaces where it can enter storm drains.

☐ Plants are examined weekly for symptoms of water stress and to assist in determining irrigation scheduling.

☐ Monitor soil moisture with a soil probe or soil moisture sensors to assist in scheduling irrigation.

D. Fertilizing Procedures - *Minimum Designated BMPs*

☐ Fertilizer application occurs in accordance with schedules in the City's Landscape Maintenance Subcontractor Specifications, adjusted as deemed necessary by the Contract Manager.

☐ Fertilizer is not applied within 48 hours of a rain event to avoid losses below the root zone and in surface runoff.

☐ Unused fertilizers are collected in a central location for future use or proper disposal or recycling. Off-target fertilizer applications or spills are cleaned up immediately by sweeping up and applying to landscape or turf or replacing in spreader or bag to ensure material does not enter storm drains.

Other Tips and Techniques

☐ Soil analyses may be conducted in order to determine existing nutrient levels in the soil prior to fertilizing.

☐ Turf grass fertilizer maintenance guidelines are based on UC recommendations found online at UC Guide for Healthy Lawns.

http://www.ipm.ucdavis.edu/TOOLS/TURF/MAINTAIN/fertilize.html

☐ Sports turf grass fertilizer maintenance guidelines are based on UC recommendations found in *Establishing and Maintaining the Natural Turf Athletic Field (UCR ANR Publication Number: 21617).*

☐ Overfertilization, especially of trees and shrubs, is avoided to ensure plant growth is not excessively succulent making it more susceptible to pest infestations.

E. Pruning Procedures – *Minimum Designated BMPs*

☐ Damaged or diseased wood is regularly pruned from landscape plants.

☐ Trees are pruned according to standards set forth by a professional tree care organization such as the International Society of Arboriculture.

☐ Replace plants too large for a space instead of pruning them severely.

☐ Unnecessary pruning is avoided as wounds are entry sites for decay and disease organisms.

☐ Tree height reduction is discouraged. When deemed necessary by a licensed arborist, the crown reduction method approved by a professional tree care organization is utilized. Topping is never done to reduce tree size. NO TOPPING OR 'HAT RACKING' IS PERMITTED.

Other Tips and Techniques

☐ The age and species of the plant is taken into account when determining the time of year to prune. For example, eucalyptus should be pruned in December and January when long-horned beetles are not active.

II. PEST AND SYMPTOM IDENTIFICATION

A. Insects, Mites, and Snails and Slugs – ***Minimum Designated BMPs***

☐ Field personnel are trained to recognize basic pests found in the landscape in the following groups: insects, mites, and mollusks.

☐ Field personnel are trained to utilize disease life cycles to apply treatments when the organism can be controlled most effectively.

☐ Field personnel are trained to distinguish between beneficial insects and actual pests found in the landscape (e.g. parasitizing wasps).

☐ Unknown samples are submitted to the Orange County Agricultural Commissioner for identification by the county entomologist or plant pathologist.

☐ Abiotic or nonliving factors (wind, sunburn, air pollution, etc…) are considered as possible causes of observed symptoms as well as biotic (living) factors.

B. Weeds – *Minimum Designated BMPs*

☐ Field personnel are trained to identify common weeds in the landscape.

☐ Field personnel are trained to utilize weed life cycles to properly control weeds such as controlling crabgrass utilizing a pre-emergent herbicide applied in mid-January.

C. Diseases – *Minimum Designated BMPs*

☐ Field personnel are trained to recognize common diseases or their signs/symptoms in the landscape.

☐ Field personnel are trained to utilize disease life cycles to apply treatments when the organism can be controlled most effectively.

☐ Field personnel are trained to recognize the difference between biotic and abiotic problems.

☐ Field personnel are trained to understand how common diseases are spread throughout the landscape.

☐ Photographs of disease signs and symptoms are taken and compared to reference guides such as UC IPM's *Pests of Landscape Trees and Shrubs*.

Other Tips and Techniques

☐ Disease signs and symptoms are sampled and submitted to the Orange County Agricultural Commissioner for identification by the county plant pathologist.

D. Vertebrates – *Minimum Designated BMPs*

☐ Field personnel are trained to recognize vertebrate pests and the damage they cause in the landscape.

☐ Field personnel are trained to utilize vertebrate behavior to properly control the pest most effectively.

☐ At least one field staff member is trained in vertebrate baiting and trapping.

III. MONITORING FOR PESTS AND PROBLEMS

A. Insect/Mollusk Monitoring Procedures – *Minimum Designated BMPs*

☐ Insects are dislodged from plants by shaking over a collection surface usually consisting of a clipboard with a white sheet of paper.

☐ Soil-dwelling turf insects are brought to the surface for monitoring by flushing a specific area of soil (i.e. 2' x 2' grid) with plain water or a soapy water mixture.

☐ The amount of honeydew (aphids) and frass (caterpillars) present is utilized as an indicator of population levels.

Other Tips and Techniques

☐ Visually inspect plants for insects, mites, snail and slug damage at least monthly; recording results utilizing a method conducive to tracking changes and easy recall of data.

☐ Yellow sticky traps are utilized to assess populations of insects.

☐ If available for a particular insect, phermone-baited traps are utilized.

B. Weed Monitoring Procedures – *Minimum Designated BMPs*

☐ Landscapes are inspected at least 4 times a year (early winter, early spring, summer and early fall) for weeds in order to determine if and when a weed problem exists.

☐ Count and record the number of weeds encountered at periodic intervals (e.g. every 1 to 2 feet) along a straight line transecting a landscapes area or within a selected area, for example 4 sq. ft. samples done in random places in a bed or turf area.

Other Tips and Techniques

☐ Utilize site surveys to record the location, date, and severity of weed problem; recording results utilizing a method conducive to tracking changes and easy recall of data.

C. Disease Monitoring Procedures – *Minimum Designated BMPs*

☐ Landscapes are regularly checked for conditions, such as overwatering and injuries, which promote disease.

☐ Landscapes are checked monthly, at a minimum, for disease symptoms and signs. Disease prone plants are checked more frequently.

Other Tips and Techniques

☐ Records are kept utilizing a method conducive to tracking changes and easy recall of data of each landscape inspection noting, date when disease signs and symptoms were first noticed and the current environmental conditions and soil moisture levels.

D. Vertebrate Monitoring Procedures – *Minimum Designated BMPs*

☐ Landscapes are regularly inspected for vertebrate presence either by damage caused by animal, actual animal sightings, and/or droppings.

☐ Records are kept of the absence or presence of actual vertebrates, the damage caused, the treatment implemented, and/or the presence or absence of droppings.

Other Tips and Techniques

☐ Maps are created and updated at least twice a year, recording area of high vertebrate damage or signs (such as gopher mounds).

IV. ACTION THRESHOLDS AND GUIDELINES

A. Insect/Mollusk Thresholds and Guidelines – *Minimum Designated BMPs*

☐ Insect tolerance levels are established based on the public's acceptance of damage to the landscape or a certain level of nuisance pests (i.e. ants), the actual plant species in the landscape, and long-term monitoring and knowledge of pests causing the damage.

☐ Thresholds are based on levels were reasonable control of the pest can be achieved with minimum impact on the environment.

Other Tips and Techniques

☐ Insect monitoring records are utilized to establish threshold levels for the implementation of control strategies. For example, the threshold for the presence of aphids on a rose garden at City Hall is low, while in a native shrub border it might be considerably higher.

B. Weed Thresholds and Guidelines – ***Minimum Designated BMPs***

☐ Weed tolerance levels are established based on public safety or the public's acceptance and the resources available to manage the landscape at that level.

☐ Public areas are ranked according to high, medium, or low level of weed control and management conducted according to levels set for each rank (see Appendix A)

Other Tips and Techniques

☐ Weed monitoring records are utilized to rank the percentage of the landscape area infested (none, light, moderate, heavy, or very heavy) with weeds.

C. Disease Thresholds and Guidelines – *Minimum Designated BMPs*

☐ Disease tolerance levels are established based on the public's acceptance and the resources available to manage the landscape at the level required.

Other Tips and Techniques

☐ Disease monitoring records are utilized to establish threshold levels for the implementation of control strategies. For example, the threshold for the presence of powdery mildew on roses at City Hall is much lower than the threshold for its presence on Euonymus in a parking lot at a city sports park.

D. Vertebrate Thresholds and Guidelines – *Minimum Designated BMPs*

☐ Vertebrate tolerance levels are established based on public safety, the public's acceptance and the resources available to manage the landscape at the level required.

Other Tips and Techniques

☐ Vertebrate monitoring records are utilized to establish threshold levels for the implementation of control strategies. For example, the threshold for the presence of gopher mounds in a sport field is zero, while in a native shrub border it might be two before a trapping strategy is implemented.

V. SELECTION OF APPROPRIATE MANAGEMENT METHODS

A. Insect/Mollusk Management Methods

Cultural/Mechanical/Physical Control Methods – Minimum Designated BMPs

☐ Plant canopies are thinned to increase light penetration to exposure certain soft-bodied insects (soft-scale) as well as snails and slugs to heat.

☐ Avoid use of plants that snails and slugs use for shelter.

Other Tips and Techniques

☐ Avoid irrigating at sensitive locations between 5pm and 5am when moisture remains on plant material for several hours.

☐ Sticky barriers are applied to trunks of trees and large shrubs to prevent ants and other wingless invertebrates from plant canopies.

☐ Small insect infestations are removed by pruning infested plant parts.

☐ Copper bands are installed around base of trees or planting areas where snail and slug infestations are prevalent.

☐ Strong streams of water are used to dislodge insects such as aphids and whiteflies, from leaves.

Biological Control Methods – Minimum Designated BMPs

☐ Persistent broad-spectrum insecticides are avoided, especially if biological control of an insect has been established by UC researchers. Examples include parasitoid wasps controlling Eugenia Psyllids, Giant Whitefly, and Ash Whitefly.

Other Tips and Techniques

☐ Natural predators (beneficial insects) are augmented with purchases of additional predators from commercially available resources.

Pesticide Control Methods – Minimum Designated BMPs

☐ The most selective, rather than broad-spectrum, pesticide is used

☐ Pesticides are only utilized when the potential for impacts to the environment, especially water quality, are minimized.

☐ Equipment is calibrated prior to the application of the insecticide to avoid excess material being applied to the landscape environment.

☐ Applicators are trained to not apply pesticides to hard surfaces and to not allow any pesticide to enter the storm drain system

☐ Spot treatments are utilized rather than broadcast methods

☐ Insecticide/fertilizer combinations are only used if appropriate timing for BOTH the insecticide application and the fertilizer application.

Other Tips and Techniques

☐ If available for controlling a particular insect, biological and botanical pesticides are selected

☐ Insecticidal soaps are utilized to control infestations of soft-bodied insects such as aphids, thrips, and immature scales.

☐ Horticultural oils (neem oil and narrow-range refined oils) are utilized to control infestations of soft-bodied immature and adult insects such as aphids, scales, and whiteflies.

B. Weed Management Methods

Cultural, Mechanical, and Physical Control Methods – Minimum Designated BMPs

☐ Timers are set to avoid overwatering as weeds establish in areas where soil moisture is excessive.

☐ Drainage is managed to avoid wet areas.

☐ Weeds are removed from a site prior to planting.

☐ Mower height is adjusted to turf species and time of year.

☐ Hand-pulling, mowing, trimmers/brushcutters, flaming, hoeing, and rototilling around landscape plants are the main methods utilized to control annual weeds and young perennial weeds.

☐ Bare soil areas are covered with a thick layer of mulch to suppress weeds and conserve soil moisture.

☐ Soil, mulch, and plant material is weed-free before it is introduced into the landscape.

Other Tips and Techniques

☐ Mower is washed after mowing a weedy site.

☐ Soil solarization is utilized to control some annual and perennial weed species.

Pesticide Control Methods – Minimum Designated BMPs

☐ Spot treatments are utilized rather than broadcast methods.

☐ Herbicide/fertilizer combinations are only used if appropriate timing for BOTH the herbicide application and the fertilizer application.

☐ Herbicides are utilized according to established thresholds (see Appendix A).

☐ Herbicides are applied to the stage of weed growth most susceptible to the chemical.

☐ Equipment is calibrated prior to the application of the herbicide to avoid excess material being applied to the landscape environment.

Other Tips and Techniques

☐ Organically acceptable herbicides (shown to be effective through science-based research) are used where appropriate.

C. Disease Management Methods

Cultural, Mechanical, and Physical Control Methods – Designated Minimum BMPs

☐ Prune out and dispose of localized areas of diseased plants.

☐ Pruning tools are sterilized (e.g. a diluted bleach solution) between plants to prevent the spread of pathogen to other plants.

☐ Proper irrigation and fertilization are maintained to prevent plant stress, water-logging, and subsequent susceptibility to disease.

☐ Mulch is kept at least 6" from base of plants to avoid excessive moisture around crown possibly resulting in crown rots and is no deeper than 4"

☐ Replace disease-prone plants with non-susceptible species.

Other Tips and Techniques

☐ Pathogen-infested plant parts are removed from the soil surface area to reduce certain pathogens (e.g. Camellia Petal Blight).

☐ Soil solarization is utilized to control soil pathogens in annual beds where it is most effective.

Pesticide Control Methods – Minimum Designated BMPs

☐ Preventative fungicides and bactericides are only used where diseases can be predicted from environmental conditions and applied prior to infection or the appearance of symptoms.

☐ Synthetic fungicides are used sparingly in the landscape and only in high visibility areas in order to minimize development of resistance.

☐ Organic fungicides and bactericides are utilized in combination with cultural, mechanical, and physical control methods in order to improve their effectiveness.

Other Tips and Techniques

☐ Copper-based fungicides are only utilized in situations where its entry into surface runoff and storm drains is virtually impossible and after consultation with PCA and IPM coordinator.

☐ Mycopesticides, commercially available beneficial microorganisms, are used where appropriate.

☐ Fungicides classes are rotated to avoid resistance.

D. Vertebrate Management Methods

Cultural and Physical Control Methods – Minimum Designated BMPs

☐ Groundcovers are maintained such that they do not harbor rats.

☐ Sources of drinking water removed (leaky faucets, puddles).

☐ Trash cans have lids and are emptied daily (rats).

☐ Habitat modification, based on pest biology is used to reduce shelter.

☐ Trapping is used for gophers when safe and practical.

☐ Kill traps used for ground squirrels and rabbits, are checked daily, and in places not accessible by children or non-target animals.

☐ Gas cartridges are used for ground squirrels according to UC recommendations.

Other Tips and Techniques

☐ Shrubs pruned at least 1 foot from the ground (rats).

☐ Screens or other barriers installed under structures that have a space between soil and floor (rabbits).

Pesticide Control Methods – Minimum Designated BMPs

☐ Anti-coagulant baits are used and applied according to label and UC recommendations.

☐ Bait is applied in a manner that non-target animals do not access to it.

Other Tips and Techniques

☐ Restricted use rodenticides are used only after applicator has been trained for that product or only by a wildlife management contractor.

VI. GENERAL PESTICIDE MANAGEMENT PRACTICES – *Minimum Designated BMPs*

☐ A licensed Pest Control Adviser is on staff or hired to properly identify pests and the symptoms caused by pests, and to make recommendations for appropriate management, including proper application of mechanical, biological and chemical controls.

☐ Restricted use pesticides are only used when no other alternatives are practical.

☐ If pesticides are necessary, CAUTION-labeled pesticides are considered before more toxic alternatives.

☐ Only small quantities of pesticides or herbicides are purchased, reducing or eliminating the need for stockpiling. Any unused pesticides and herbicides are securely stored under cover for future use, or are collected in a central location for proper disposal as

FP-3
ROADS, STREETS, AND HIGHWAYS OPERATION AND MAINTENANCE



The matrix below identifies activity-specific required Minimum Designated Best Management Practices (BMPs) and required Pollution Prevention Methods (PPMs) for Municipal Roads, Streets, and Highways Operation and Maintenance activities, based on priorities determined by site location and operational characteristics. Roads, streets and highways are always considered High priority. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPs	LOW	MEDIUM	HIGH	303(d)	ESA
Sweeping and Cleaning					
___ Sweep streets at least monthly.			X	X	X
___ Notify citizens of sweeping schedules.			X	X	X
Repair and Maintenance					
___ Keep materials and wastes out of MS4.			X	X	X
___ Conduct repairs in dry weather			X	X	X
___ Prevent washwater and sediment from entering MS4.			X	X	X
Bridge and Structure Maintenance					
___ Conduct maintenance in dry weather.			X	X	X
___ Keep materials and waste out of MS4.			X	X	X
___ Prevent washwater and sediment from entering MS4.			X	X	X
POLLUTION PREVENTION MEASURES					
___ Require maintenance personnel to be trained in relevant BMPs.			X	X	X
___ Incorporate relevant BMPs into contractual requirements for maintenance subcontractors.			X	X	X
___ Regularly inspect municipal vehicles and equipment for leaks.			X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

This list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

SUGGESTED IMPLEMENTATION STRATEGIES

1. Sweeping and Cleaning

Sweeping Frequency and Timing

- ✓ 1A. Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of streets.
- ✓ 1B. Perform street cleaning during dry weather if possible.
- ✓ 1C. Avoid wet cleaning or flushing of streets, and utilize dry methods where possible.
- ✓ 1D. If flushing of a street is absolutely necessary, sweep and remove debris before flushing. Do not let wash water enter storm drain inlets. Collect wash water and direct to a dirt or vegetated area, or pump into a tank and dispose of properly.
- 1a. Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. (TRASH, SED, BACT)
- 1b. Consider retrofitting catch basin grate screens or catch basin inserts in locations where trash/debris problems are especially persistent. (TRASH, SED)

Equipment Operation and Selection

- ✓ 1E. Maintain cleaning equipment in good working condition and purchase replacement equipment as needed.
- ✓ 1F. Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- ✓ 1G. Regularly inspect vehicles and equipment for leaks, and repair promptly.
- 1c. Old sweepers should be replaced as needed with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal. (TRASH, SED, BACT)
- 1d. Clean sweepers at a wash rack that drains to the sanitary sewer. The wash rack area should be covered and bermed and wash water should drain to a clarifier prior to entering the sanitary sewer. (SED, BACT)
- 1e. If possible, use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/ commercial). (SED, TR)

Management of Material Removed by Sweeping

- ✓ 1H. Dispose of street sweeping debris and dirt at a landfill.
- ✓ 1I. Do not store swept material along the side of the street or near a storm drain inlet.
- ✓ 1J. If dewatering of saturated materials is necessary it should be conducted in a designated area away from storm drain inlets and the water contained for proper disposal.
- ✓ 1K. If authorized by the local sanitation agency, water may be discharged to the sanitary sewer only after passing through a clarifier. As an alternative, dewatering can be conducted in a containment area in which saturated materials are placed on a tarp or impervious surface and allowed to dry. Dry debris is then disposed of properly.
- 1f. Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers). (TRASH, SED)

	Maximize Access for Sweepers ✓ 1L. Sweeping should be conducted as close to the curb line as possible. ✓ 1M. Notify residents of street sweeping schedules. (SED, TRASH, BACT) • 1g. Consider instituting a parking policy to restrict parking in problematic areas during periods of street sweeping. (SED, TRASH, BACT) 1h. Consider posting street sweeping signs in problematic areas or the use of temporary signs. (SED, TRASH, BACT)

2. Repair and Maintenance

Pavement Marking

- ✓ 2A. Develop paint handling procedures for proper use, storage, and disposal of paints. Mix indoors if feasible, or within a contained area.
- ✓ 2B. Transfer and load paint and hot thermoplastic away from storm drain inlets.
- ✓ 2C. Sweep up thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- ✓ 2D. Properly store leftover paints if they are to be kept for the next job, or dispose of properly.
- ✓ 2E. See *Spill Control procedure sheet* for guidance on the proper cleanup of paint spills.
- 2a. Where practical, replace paints containing lead and tributyltin with less toxic alternatives. (TOX)
- 2b. Use water based paints where applicable. Clean application equipment in a sink that is connected to the sanitary sewer. (TOX)

Concrete Installation and Repair

- ✓ 2F. Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.
- ✓ 2G. Wash concrete trucks off site or in designated areas on site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other stormwater conveyance structures.
- ✓ 2H. Store concrete materials under cover, away from drainage areas.
- ✓ 2I. Return leftover materials to the transit mixer if practical. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- ✓ 2J. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- ✓ 2K. When washing poured concrete areas to remove fine particles and expose the aggregate, contain the wash water for proper disposal; do not discharge water to the storm drain system.
- ✓ 2L. Do not allow excess concrete to be dumped on-site, except in designated areas.
- ✓ 2M. Apply concrete, asphalt, and seal coat during dry weather to allow the material to adequately dry prior to a rain event.
- ✓ 2N. When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each nearby or appropriate storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small on-site vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.

Concrete Installation and Repair (cont.)

- ✓ 2O. Place sandbags or other protective device around inlets or water courses if needed to protect them during the maintenance operation.

Patching, Resurfacing, and Surface Sealing

- ✓ 2P. Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- ✓ 2Q. Apply concrete, asphalt, and seal coat during dry weather to allow the material to adequately dry prior to a rain event.
- ✓ 2R. Where applicable, cover and seal each nearby or appropriate storm drain inlet (with waterproof material, plastic or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered manholes and storm drain inlets when the job is complete.
- ✓ 2S. Use only as much water as necessary for dust control, to avoid runoff.
- 2c. Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly. (O&G)
- 2d. Prior to a rain event or at the completion of a project, sweep the project area by hand or with a street sweeper. (SED)

Equipment Cleaning, Maintenance, and Storage

- ✓ 2T. Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mudjacking equipment at the end of each day. If equipment can be cleaned and materials reapplied at the job site, do so in compliance with the laws and regulations. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.
- ✓ 2U. If refueling or repairing vehicles and equipment must be done on-site, conduct the activity away from storm drain inlets and watercourses.
- ✓ 2V. Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- 2e. Place drip pans or absorbent materials under heavy equipment when not in use. (O&G)
- 2f. Conduct cleaning at a corporation or maintenance yard if possible. (SED, O&G)
- 2g. When practical perform major equipment repairs at the corporation yard. (O&G)

3. Bridge and Structure Maintenance

Painting and Paint Removal

- ✓ 3A. Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- ✓ 3B. Do not transfer or load paint near storm drain inlets or watercourses.

- ✓ 3C. Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- ✓ 3D. If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- ✓ 3E. Recycle paint when practical (e.g. paint may be used for graffiti removal activities). Dispose of paint at an appropriate household hazardous waste facility.
- ✓ 3F. See *Spill Control procedure sheet* for guidance on the proper cleanup of paint spills.
- 3a. If the bridge crosses a watercourse, perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters. If sanding, use a sander with a vacuum filter bag. (TOX, SED)

Graffiti Removal

- ✓ 3G. Avoid graffiti abatement activities during rain events.
- ✓ 3H. Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- ✓ 3I. Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.
- ✓ 3J. When graffiti is removed by painting over, implement the procedures under *Painting and Paint Removal* above.
- ✓ 3K. Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area.
- ✓ 3L. If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and collect wash water and dispose of properly.
- 3b. Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

Guardrail and Fence Repair

- ✓ 3M. When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in the *Sidewalk, Plaza, and Fountain Maintenance and Cleaning* procedure sheet.
- ✓ 3N. If painting is conducted, follow the *Painting and Paint Removal* procedures above.
- ✓ 3O. If graffiti removal is conducted, follow the *Graffiti Removal* procedures above.
- ✓ 3P. If construction takes place, see the procedure sheet for *Minor Construction*.

Guardrail and Fence Repair (cont.)

- 3c. Consider placing a protective barrier around the work perimeter, or around drain inlets.
- 3d. Recycle materials whenever practical.

FP-4
SIDEWALK, PLAZA, AND PARKING LOT MAINTENANCE, AND CLEANING



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Sidewalk, Plaza, and Parking Lot Maintenance and Cleaning activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
Surface Cleaning:					
___ Prevent rinsewaters from cleaning of pavements from entering the MS4.	X	X	X	X	X
___ Remove pet or other animal feces by scooping, sweeping or wiping.			X	X	X
___ Sweep or vacuum parking areas at least monthly.	X	X	X	X	X
___ Clean out parking lot drain inlets as needed and at least once before the wet season.	X	X	X	X	X
___ If cleaning oily deposits or other spills, use absorbent materials and prevent any dischare to parking lot drain inlets or MS4.	X	X	X	X	X
Graffiti Cleaning:					
___ Prevent cleaning agents or graffiti cleaning wastes from entering the MS4.	X	X	X	X	X
Sidewalk Repair:					
___ Conduct repairs in dry weather.					X
___ Prevent repair materials, construction wastes or sediment from entering the MS4.	X	X	X	X	X
Litter Control:					
___ Provide covered litter receptacles in busy pedestrian areas.	X	X	X	X	X
___ Clean out litter receptacles frequently to prevent overflow.	X	X	X	X	X
Fountain Maintenance:					
___ When draining fountains, discharge to sanitary sewer, or dechlorinate and discharge to landscaped area, if feasible.	X	X	X	X	X
POLLUTION PREVENTION METHODS			X	X	X
___ Train all maintenance personnel in appropriate BMPs.	X	X	X	X	X
___ Incorporate appropriate BMPs into maintenance subcontracts.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G) Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

1. Surface Cleaning

Discharges of wash water to the storm water drainage system from cleaning or hosing of impervious surfaces is prohibited.

Sidewalks and Plazas

- ✓ 1A. Do not discharge wash water from cleaning or hosing of impervious surfaces to the storm water drainage system.
- ✓ 1B. Use dry methods (e.g. sweeping, backpack blowers, vacuuming) whenever practical to clean sidewalks and plazas rather than hosing, pressure washing, or steam cleaning. DO NOT sweep or blow material into curb; use devices that contain the materials.
- ✓ 1C. If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.
- 1a. To remove pet or wildlife feces, scoop, sweep or wipe it up and dispose in trash, sanitary sewer or compost pile. If still needed, direct any hose-down water to landscaped areas. (BACT)
- 1b. Consider retrofitting with more permeable pavement type. (HYD)

Parking Areas, Driveways, Drive-thru

- ✓ 1D. Parking facilities should be swept/vacuumed on a regular basis. Establish frequency of parking lot sweeping based on usage and field observations of waste accumulation.
- ✓ 1E. If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.
- ✓ 1F. Sweep all parking lots at least once before the onset of the wet season.
- ✓ 1G. Use absorbents to pick up oil; then dry sweep.
- ✓ 1H. Appropriately dispose of spilled materials and absorbents.
- 1c. Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. (SED, TRASH, BACT)

Building Surfaces, Decks, etc., without loose paint

- ✓ 1I. If water must be used, block storm drain inlets as needed and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.
- 1d. Consider using high-pressure water, with no soap. (TOX

Unpainted Building Surfaces, Wood Decks, etc.

- ✓ 1J. Water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.
- 1e. Use a biodegradable cleaning agent or acid wash to remove deposits, wood restorer, or other chemicals. Screen wash water using an appropriate filtering device (e.g. filter fabric), if needed, to catch debris. (TOX, SED)
- 1f. Make sure pH is between 6.5 and 8.5 THEN discharge to landscaping (if cold water without a cleaning agent) otherwise dispose of properly.

2. Graffiti Cleaning

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Graffiti Removal** ✓ 2A. Avoid graffiti abatement activities during rain events. ✓ 2B. When graffiti is removed by painting over, implement the procedures under *Painting and Paint Removal* in the *Roads, Streets, and Highway Operation and Maintenance* procedure sheet. ✓ 2C. Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent. ✓ 2D. Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.

☐ _____ ☐ _____	• 2a. Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds). (TOX).
3. Sidewalk Repair	
☐ _____ ☐ ☐ _____ ☐ ☐ _____ ☐	**Surface Removal and Repair** ✓ 3A. Schedule surface removal activities for dry weather if possible. ✓ 3B. Avoid creating excess dust when breaking asphalt or concrete. ✓ 3C. Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up material.
☐ _____ ☐	✓ 3D. Always dry sweep first to clean up tracked dirt. Use a broom, street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so or contain and dispose of properly.
☐ _____ ☐	• 3a. Designate an area for clean up and proper disposal of excess materials. (TOX)
☐ _____ ☐	• 3b. Remove and recycle as much of the broken pavement as practical. (TRASH)
☐ _____ ☐	• 3c. When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains shovel or vacuum the slurry, remove from site and dispose of properly. (TOX)
☐ _____ ☐	• 3d. Consider retrofitting with a more permeable pavement type. (HYD).
	Concrete Installation and Repair ✓ 3E. Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.
☐ _____ ☐	✓ 3F. Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other storm water conveyance structures.
☐ _____ ☐	✓ 3G. Store dry and wet concrete materials under cover, protected from rainfall and runoff and away from drainage areas. After job is complete remove temporary stockpiles (asphalt materials, sand, etc.) and other materials as soon as possible.
☐ _____ ☐	✓ 3H. When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.
☐ _____ ☐	✓ 3I. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.
☐ _____ ☐	• 3e. Return leftover materials to the transit mixer. Dispose of small amounts of excess concrete, grout, and mortar in the trash. (TOX)
	Concrete Installation and Repair (cont.)
☐ _____ ☐	• 3f. Protect applications of fresh concrete from rainfall and runoff until the material has hardened. (TOX)
☐ _____ ☐	• 3g. Consider retrofitting with a more permeable pavement type. (HYD)

4. Litter Control	
☐ _____ ☐ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐	✓ 4A. Enforce anti-litter laws. ✓ 4B. Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events. ✓ 4C. Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow. • 4a. Post "No Littering" signs. (TRASH).
5. Fountain Maintenance	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ _____ _____	✓ 5A. Do not use copper-based algaecides. Control algae with chlorine or other alternatives, such as sodium bromide. ✓ 5B. When draining fountains, never discharge water to a street or storm drain; discharge to the sanitary sewer or to the landscaping. ✓ 5C. If discharging to landscaping, allow chlorine to dissipate for a few days and then recycle/reuse water by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present (concentration must be less than 0.1 ppm).

FP-5
SOLID WASTE HANDLING



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Solid Waste activities based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

DESIGNATED MINIMUM BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
General					
___ Repair or replace damaged solid waste containers.	X	X	X	X	X
___ Prevent any solid waste container rinsewater from entering the MS4.	X	X	X	X	X
Waste Reduction and Recycling:			X	X	X
___ Facilitate opportunities for materials recycling.	X	X	X	X	X
___ Use commercial vehicle maintenance facilities that recycle used motor oil.	X	X	X	X	X
Hazardous Waste Collection:					
___ Facilitate opportunities for collection of household hazardous waste.	X	X	X	X	X
Litter Control:					
___ Provide litter receptacles in busy pedestrian areas, and clean out frequently to prevent overflow.	X	X	X	X	X
POLLUTION PREVENTION MEASURES			X	X	X
___ Train personnel handling solid waste in relevant BMPs.	X	X	X	X	X
___ Incorporate appropriate BMPs into solid waste handling subcontracts.	X	X	X	X	X

PROGRAM/FACILITY BEING INSPECTED: _____

Date: _____ Inspector Name: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES:

The following list of Suggested Implementation Strategies is divided between basic potential strategies suitable for general application (notated with checkmarks and capital letters) and more specific potential strategies (notated with bullet points and lower case letters) that may be applicable under certain circumstances, especially where there are certain Pollutant Constituents of Concern. The specific target constituents are notated parenthetically as:

Bacteria (BACT) *Sediment (SED)* *Nutrients (NUT)* *Oil and Grease (O&G)* *Pesticides (PEST)*
Other Toxic Compounds (TOX) *Trash (TRASH)* *Hydrological Impacts (HYD)* *Any/All or General (ANY)*

1. Preparation/Prevention

☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 1A. Implement procedures, where applicable, to collect, transport, and dispose of solid waste at appropriate disposal facilities in accordance with applicable federal, state, and local laws and regulations. Optional disposal options include the reuse and recycling of appropriate materials. ✓ 1B. Regularly inspect solid waste containers for structural damage. Repair or replace damaged containers as necessary. ✓ 1C. Remove all debris from waste containers prior to cleaning with water. Only clean out containers in a designated area that drains to a landscaped area or a washrack that is connected to a sanitary sewer, or use other methods to capture washwater and dispose properly. ✓ 1D. Minimize spillage/leaking from solid waste containers. For larger solid waste containers (especially compactors) that utilize a hydraulic fluid pump system, regularly inspect and replace faulty pumps or hoses to minimize the potential of releases and spills. ✓ 1E. Educate the public and verify that employees and subcontractors are trained to ensure that only appropriate solid wastes are disposed of. Certain wastes such as hazardous wastes, appliances, fluorescent bulbs, pesticides, etc. may not be disposed of in solid waste containers. • 1a. Consider retrofitting trash storage areas to cover the receptacles and to minimize run-on and run-off.
2. Waste Reduction and Recycling *Although many types of waste can be recycled, recycling options for each waste type may be limited. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of properly.*	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐	✓ 2A. Provide opportunities for the collection and storage of recyclable materials. ✓ 2B. Do not mix liquid wastes, this can cause chemical reactions or make recycling impossible and complicate disposal. ✓ 2C. Recycle used motor oil.
3. Hazardous Waste Collection *Household hazardous wastes (HHW) are defined as waste materials commonly found in homes, institutions or businesses, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.*	
☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	✓ 3A. Follow proper storage and disposal measures for hazardous waste materials as identified on packaging or Material Safety Data Sheets. ✓ 3B. Emergencies related to hazardous waste spills should be reported to 911. • 3a. Identify and promote use of non-hazardous alternatives. • 3b. Promote household hazardous waste (HHW) reuse and recycling.

4. Litter Control	
☐ _____ ☐ ☐ _____ ☐ _____ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ ☐ _____ ☐ _____ _____	✓ 4A. Enforce anti-litter laws. ✓ 4B. Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events. ✓ 4C. Clean out litter receptacles frequently to prevent overflow. ✓ 4D. Increase litter control for events generating substantial quantities of litter. ✓ 4E. Place trash receptacles next to transit stop benches and maintain as necessary. • 4a. Consider retrofitting "No Littering" signs. • 4b. Participate in and/or organize additional clean up programs (e.g. "Coastal Clean Up Day", "Pride Days", "Volunteer Connection Days").

FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE



The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Municipal Water and Sewer Utility Maintenance activities. Water and Sewer Utility Facilities are considered High Priority regardless of location. The City of Laguna Niguel does not provide maintenance of water and sewer utilities but coordinates with the District responsible for these activities. Minimum Designated (required) BMPs are implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the matrix is a listing of Suggested Implementation Strategies for each required BMP.

MINIMUM DESIGNATED BMPS	LOW	MEDIUM	HIGH	303(d)	ESA
When observed or notified of sewage leaks or spills, assist separate Sewering Agency to keep sewage from entering the MS4.			X	X	X
Develop and implement notification procedures for sewage spills to the MS4 from sewer system and private laterals.			X	X	X
POLLUTION PREVENTION METHODS					
Require emergency response personnel to be trained in relevant BMPs.			X	X	X

PROGRAM/FACILITYBEING INSPECTED: _____

Inspector name: _____ Date: _____

When completed, the checklist should be attached to the General Inspection Form Cover Sheet and copies should be provided to the Supervisor of the Facility/Program being inspected.

SUGGESTED IMPLEMENTATION STRATEGIES

1. Water Line Maintenance

☐ _____ ☐
☐ _____ ☐
_____
☐ _____ ☐
☐ _____ ☐
_____
_____
_____
_____
_____
_____
☐ _____ ☐
_____
_____
_____

Planned Discharges

✓ For planned discharges use one of the following options:
- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

✓ General design considerations for inlet protection devices include the following:

- The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
- Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.

✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

✓ Stop the discharge as quickly as possible by turning off water source.

✓ Inspect flow path of the discharged water:

- Control erosion along the flow path.
- Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
- Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions

✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Sewer System Cleaning

✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.

✓ Establish routine maintenance program. Cleaning should

	be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified ✓ Cleaning activities may require removal of tree roots and other identified obstructions.
	Preventative and Corrective Maintenance ✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following: • cracked/deteriorating pipes • leaking joints/seals at manhole • frequent line plugs • line generally flows at or near capacity • suspected infiltration or exfiltration ✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor. ✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed. ✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.
3. Spill/Leak/Overflow Control, Response, and Containment	
	Control ✓ Refer to countywide *Illicit Discharge Detection and Elimination Program*. Components of this program include: • Investigation/inspection and follow-up • Elimination of illicit discharges and connections • Enforcement of ordinances • Respond to sewage spills

Unsatisfactory	OK
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐
☐ _____	☐

Control (cont.)

- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

- ✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- ✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).
- ✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.
- ✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- ✓ Record required information at the spill site.
- ✓ Perform field tests as necessary to determine the source of the spill.
- ✓ Develop additional notification procedures regarding spill reporting as needed.

FP-8: POWER WASHING AND SURFACE CLEANERS



The checklist below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for power washing and surface cleaning activities, based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the Minimum Designated BMPs is a listing of Other Tips & Techniques that may be utilized where appropriate.

A surface cleaning business is considered to be any operation that provides the following services:

- Cleaning (e.g., power sweeping, washing) driveways and parking lots
- Cleaning building exteriors (except sand blasting, window cleaning)
- Driveway cleaning (e.g., power sweeping, washing) services
- Parking lot cleaning (e.g., power sweeping, washing) services
- Power washing building exteriors
- Pressure washing (e.g., buildings, decks, fences)
- Steam cleaning building exteriors

Minimum Designated BMPs: Wastewater or wash water from exterior power washing or other exterior surface cleaning activity shall not be discharged to the street and/or storm drain system.

SUGGESTED IMPLEMENTATION STRATEGIES

The suggested implementation strategies presented below are intended ensure compliance with the Minimum Designated BMP. The following strategies, or equivalently protective techniques, must be observed by all surface cleaners, regardless of the surface to be cleaned or the type of cleaning operation to be performed:

What needs to be done prior to conducting a job?

- Evaluate the chemicals and compounds used for cleaning and reduce or eliminate the use of those that contain solvents, heavy metals, high levels of phosphates, or very high/very low pH.
- Walk through the area where the cleaning will occur prior to the start of the job and identify all area drains, yard drains, and catch basins where wastewater could potentially enter the street or storm drain system.
- Block/seal off identified drains or catch basins using sand bags, plugs, rubber mats, or temporary berms.
- Collect all trash and debris from the area and place in a trash bin for disposal.
- Clean the area of debris prior to cleaning to minimize the amount of suspended solids, soil, and grit in the resulting wastewater.

- Identify where surface washing will occur. Avoid washing whole areas; spot clean where feasible and necessary.
- Identify the wastewater disposal option that will be used. Whether you are discharging to landscaping or sanitary sewer, make sure that the requirements will be met and/or the necessary contacts have been made, as discussed below.
- Inventory spill cleanup equipment to ensure that it is available for immediate use, if needed.
- Conduct surface cleaning in accordance with all operating instructions provided by the equipment supplier. Maintain equipment in good working order and routinely check and test all safety features.

What methods can be used to collect wastewater at a site?

There is no specific containment method that must be used for wastewater collection/diversion. However, the system must be adequately designed so that the wastewater does not flow into an on-site or off-site storm drain inlet or into the street. All surface cleaners should use one of the following methods, regardless of the surface to be cleaned or the type of cleaning operation to be performed:

- Portable containment areas can be made from waterproof tarps, heavy-duty plastic, or rubber matting equipped with berms to prevent wastewater from running into on-site or off-site storm drain inlets or into the street. Materials that have been used for berms include sand bags or water-filled tubing. Whatever containment material is used, it must seal tightly to the ground so that none of the wastewater can pass under or over the berms.
- When power washing smaller pieces of equipment, containment devices to use may include portable vinyl swimming pools, plastic 55-gallon drums on casters, and flat metal or plastic containment pads.
- Depending on the volume of wastewater generated, it may be necessary to use a pump system, which may range in size from a wet-dry vacuum to a sump pump. A basin from which to pump wastewater can also be created by establishing a slightly sloped containment area.
- Stationary or more permanent containment areas can be constructed with cement. Berms and pump systems may be used to contain wastewater and divert it to a holding tank.
- Commercial wastewater collection systems are also available for power washing. These systems can range from portable wash pits to self-contained water recycling systems. A list of companies selling this type of equipment can usually be found in the telephone book under “Pressure Washing Services and Equipment”.
- Storm drain covers can be made of an impermeable barrier such as a heavy-duty vinyl or plastic secured in place with materials such as concrete blocks, gravel bags, or sand bags. Storm drain covers may also be available though commercial vendors.

Note: Blocking storm drain inlets in the public right-of-way is prohibited as a method of containment, unless expressly permitted by the municipality, typically through an encroachment permit process. Wastewater should be contained on-site prior to entering the public right-of-way. Contact the local municipality for more information.

Wastewater Disposal Options

How can wastewater be safely disposed?

Wastewater generated by surface cleaners is not allowed in the storm drain or street. However, the wastewater may be discharged to a landscaped area, the sanitary sewer, or it may be picked up and disposed of by a waste hauler. Please note that laboratory chemical analysis of wastewater may be required

to establish the proper disposal method. A wastewater disposal option should be selected based on the conditions outlined below:

Discharge Wastewater to a Landscaped Area

The wastewater must meet the following requirements if discharging to landscaping:

- The pH must be between 6.5 and 8.5. This can be checked quickly and easily through the use of pH paper test strips.
- The wastewater should not contain large volumes or concentrations of:
    - Toxic materials
    - Degreasers
    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel)
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow
    - Petroleum oil, or other products of mineral oil origin
    - Paint
- Prior to surface washing, you must exercise any reasonable means to eliminate large volumes or concentrations of the above listed pollutants. Common methods to eliminate standing pools of pollutants include the placement of absorbent to adsorb the pollutant, dry-sweeping the absorbent, and disposing of the absorbent properly.
- Wastewater from cleaning food-related vehicles or areas, vehicle exteriors or engines, and buildings with lead- or mercury-based paint should not be discharged to landscaping.
- Filter the wastewater if it contains debris, fibers, or other suspended solids.
- Ensure that the wastewater is fully contained within the landscaped area and will fully infiltrate into the ground prior to leaving the job site.

Sanitary Sewer

If discharging to the sanitary sewer, the following conditions apply:

- The wastewater temperature must be less than 140°F (60°C).
- The pH must be between 6.0 and 12.0. This can be checked quickly and easily through the use of pH paper test strips. Adjust the wastewater to a pH that is between 6.0 and 12.0. Dilution is not an effective or acceptable pretreatment method.
- The wastewater quality must comply with the sanitary sewer facility's local discharge limits and should not contain:
    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel).
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
    - Petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.
    - Oil based paint.
- No wastewater shall be discharged into any publicly owned manholes that directly or indirectly connect to the sanitary sewer system without express authorization from the appropriate agency.

When discharging to the sanitary sewer:

- Filter the wastewater if it contains debris, fibers, or other suspended solids.
- If chemicals (e.g., solvents or acids) are used during the cleaning process, additional precautions may be needed. Contact your local sanitation district to learn if wastewater containing these chemicals

requires pretreatment before discharge to the sanitary sewer or if it needs to be treated as hazardous waste.

- Ensure that the wastewater is released at a flow rate and/or concentration that will not cause problems, pass through, or interference with the sanitary sewer facilities.
- Utilize an approved discharge point such as:
    - Privately owned cleanout (or sink, toilet or floor drain), oil/water separator, or below ground clarifier at the client's property where the wastewater is generated,
    - Privately owned industrial sewer connection at the client's property where the wastewater is generated,
    - Wastehauler station at sanitary sewer facility, and
    - Any other disposal points approved by sanitary sewer facility.
- Maintain a logbook of all discharges.

Waste Hauler

If using a waste hauler, the following types of wastewater may be disposed if it:

- Is corrosive (as indicated by a pH value of less than 5.5) or caustic (as indicated by a pH value of greater than 10.0).
- Contains a pollutant that may create a fire or explosion hazard (e.g., gasoline, diesel).
- Contains solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
- Contains petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.

When using a waste hauler:

- Ensure that the waste hauler is certified by appropriate sanitary sewer and local health care agencies, is Hazardous Waste DOT certified, and complies with applicable discharge regulations, which may include obtaining necessary permits and conducting water quality monitoring requirements.
- Identify the wastes involved and determine if a hazardous waste has been generated. Examples of situations that may potentially generate hazardous wastes include:
    - Power washing old paint off a building. Old paint stripped off commercial buildings may contain metals (e.g., lead, chromium, cadmium, and mercury), causing it to be a regulated hazardous waste. Paint chips cannot be left on the ground at the job site. Paint chips need to be collected, evaluated, and disposed of properly.
    - The use of certain solvents as degreasing agents, which may cause the wastewater to be classified as a listed or characteristic hazardous waste.
- Maintain a logbook of all discharges and hazardous waste manifests, if applicable.

WASTE WATER DISCHARGE/BEST MANAGEMENT PRACTICE (BMP)

Prepared By: *Property Management*

PURPOSE

This procedure describes the Best Management Practices (BMPs) for water pollution control. The goal of the procedure is to comply with federal, state, and local regulations and to minimize the discharge of pollutants into receiving waters or storm water drainage systems caused by wastewater run off from emergency and non-emergency activities.

BACKGROUND

This procedure describes the Best Management Practices (BMPs) for water pollution control. The goal of the procedure is to comply with federal, state, and local regulations and to minimize the discharge of pollutants into receiving waters or storm water drainage systems caused by wastewater run off from emergency and non-emergency activities.

DEFINITIONS

Routine Activities: Daily actions and procedures in the normal course of the operations and maintenance of OCFA facilities and equipment.

Emergency Activities: Those activities directly associated with the OCFA emergency service response

PROCEDURE

Emergency Activities

Water runoff created as a result of an emergency is exempt from regulatory requirements. However, when and where possible and practicable, reasonable care shall be taken to minimize the impact upon the environment. The emergency exception to normal BMPs shall exist only as long as necessary as determined by the incident commander.

Discharges Associated with Fire Fighting

- If possible, avoid directing water flows directly onto surfaces that erode and where runoff may enter waterways or storm drains.

WASTE WATER DISCHARGE/BEST MANAGEMENT PRACTICE (BMP)

Prepared By: *Property Management*

- If possible, apply water flows in such a manner that runoff will flow over vegetated areas prior to entering waterways or storm drains.

- When practical, block the storm drains that will prevent debris from entering the storm drain system.

Discharges Associated with Trauma Scenes

Trauma scene wastes (i.e. blood, body parts, and human tissue) may be generated at various types of crime or accident scenes. These types of wastes can pose a serious human health risk to those who are responsible for overseeing and conducting the cleanup. It is important that the procedures described below be employed when feasible to protect personnel and prevent unnecessary discharge of material into the storm drain. The types of blood borne pathogens that may be encountered at a trauma scene include, but are not limited to, HIV, Hepatitis B, and Hepatitis C. See Attachment for specific clean-up procedures.

Non-Emergency Activities

Non-emergency activities must be conducted in a manner that prevents discharge of pollutants into the storm drain system and restricts to the maximum extent possible, runoff of water from OCFA facilities.

Training Activities

- Where possible, direct water flows to landscaped, green belt areas or biological swales.

- When flowing water cannot be contained in the landscaped areas, survey the area prior to the training exercise to ensure that debris and pollutants will not enter the storm water system as a result of the flows generated during the drill.

- Where possible, use fog streams for short durations, and/or low gpm nozzle settings.

- Foam should not be used for training except as specifically allowed within the RFOTC.

Regional Fire Operations Training Center and Fire Station Activities

Vehicle and Equipment Washing

- All washing of apparatus and other OCFA vehicles on OCFA facilities shall be confined to vehicle wash down locations connected to water interceptor/clarifier systems.

WASTE WATER DISCHARGE/BEST MANAGEMENT PRACTICE (BMP)

Prepared By: *Property Management*

- Vehicle and equipment washing at fire stations that are not equipped with interceptor/clarifier systems shall be accomplished only where clean water can be contained on site or directed into the storm drain system.
- Runoff water shall be prevented from leaving the site to the maximum extent possible.
- Washing of vehicles is prohibited on front driveway aprons (see exception below).
- The primary method of washing apparatus is bucket washing and wiping.
- The next preferred apparatus washing method is use of low volume, high pressure systems which allow evaporation on site, and prevent site runoff.
- When other methods of cleaning the unit are insufficient and thorough washing of equipment is necessary, the following procedures shall be followed:
    - Minimize use of water and utilize a shut off device at the hose end.
    - When possible, use only water and the minimum quantity of cleaning agents.
    - Steam cleaning of engines, greasy equipment, etc., shall be conducted at RFOTC Fleet Services only.
    - Only OCFA apparatus and vehicle may be washed on OCFA facilities.

Stations with Approved Wash Areas

Stations with vehicle wash areas are connected to water clarification systems that are designed and engineered to clean water runoff prior to entering the sanitary sewer system. For stations so equipped, all vehicle and equipment washing shall be confined to the wash down area.

Stations without Designed Wash Areas

Stations without a designed wash area shall select and identify a vehicle washing area at the rear of the fire station that includes the following:

- Areas that are relatively level and that allow for evaporation rather than draining to a storm drain

WASTE WATER DISCHARGE/BEST MANAGEMENT PRACTICE (BMP)

Prepared By: *Property Management*

- Areas that are free of petroleum, oils and distillates and that are swept clean of debris and potential pollutants that could be carried into the storm drain system

- Areas that allow for prevention of runoff into storm drains by flowing onto landscaped or green areas but that do not cause damage or erosion

Battalion Chiefs shall approve a station vehicle wash area for all stations without a wash area connected to the sanitary sewer. Each station shall prepare and post a site plan that clearly identifies the approved wash area.

Those fire stations that do not have a rear area to wash fire equipment are allowed to utilize the front driveway apron but shall make every effort possible to adhere to the other identified Best Management Practices.

Vehicle Fueling

- Automatic fueling shut off devices should not be defeated by "topping off" the fuel tank.

- Any fuel spills resulting from refueling shall be immediately cleaned.

- Maintain a spill control kit consisting of which contains at least absorbent cloth for minor wipe-up/clean-up, petroleum absorbent containment materials, granulated petroleum absorbent materials, shovel, and broom. A metal can, with a tight fitting lid, should be used to contain any absorbent used to collect spilled fuel.

- Washing down the fueling area is prohibited.

Washing Hose, Salvage Covers, and Hall Runners

- Sweep the area to be used before starting.

- Direct water flows to landscaped/green areas that will not cause erosion or damage.

- Where practical, allow water to evaporate rather than run off.

- Prevent any contaminates, such as cleaning agents, from entering the storm drain system.

- Use methods that employ minimal water.

WASTE WATER DISCHARGE/BEST MANAGEMENT PRACTICE (BMP)

Prepared By: *Property Management*

Facility Maintenance

- Monitor and maintain irrigation systems to minimize volume, runoff and erosion.
- Maintain landscaped areas to prevent introduction of leaves and other landscape waste into the storm water system.
- Hydraulic/hose washing of hardscape is prohibited. Hardscape areas shall be swept and collected debris placed into a proper receptacle.
- Vehicle parking areas should be periodically inspected and significant accumulations of materials and substances (oil, fuel, grease, leaves, etc.) removed and disposed of. When oil and grease accumulations cannot be cleaned with absorbents, towels, etc., Property Management may be contacted for assistance.

General Equipment Clean Up and Decontamination at the Fire Station Following a Trauma Incident

Decontaminate all equipment that has been contaminated with bodily fluids by using one of the following methods:

- Wash with soap and hot water in an approved area connected to the sanitary sewer.
- Soak in germicidal solution for a period of time recommended in the manufacturer's instructions and rinse well in an approved area that is connected to a sanitary sewer.
- Spray with germicide and wipe, re-spray, and wipe clean. All decontamination wipes that are saturated with liquid blood must be placed in a red biohazard bag and disposed of in an approved medical waste container at the hospital.

RELATED REFERENCES

SOP HR.02.02 Communicable Disease Exposure

SOP HR.02.03 Communicable Disease Exposure Prevention

WASTE WATER DISCHARGE/BEST MANAGEMENT PRACTICE (BMP)

Prepared By: *Property Management*

LEGAL CITES/REFERENCES

None

ATTACHMENTS

- Trauma Scene Clean-Up

Trauma Scene Clean-Up

General Trauma Scene Cleanup Guidelines

- Trauma scene cleanup operations must be performed in accordance with the Medical Waste Management Act, *California Health and Safety Code, Sections 117600 – 118360.* Fire Departments on emergency calls who clean up a scene themselves are not required to have a Biowaste Hauling Permit to remove liquid or solid trauma scene waste from the scene for temporary storage or disposal. The County of Orange Medical Waste Section Emergency Response through Control 1 after hours (714) 628-7008 is available for consultation/assistance with trauma scene management.

- A Registered Trauma Scene Management Practitioner (RTSMP) is necessary when a scene requires decontamination and cleanup beyond the capability of Public Agency personnel on scene. RTSMP's are registered with the Department of Health Services pursuant to Section 118321 of the Medical Waste Management Act. A list of RTSMP's can be obtained from the California Department of Health Services. Additional information may be obtained by calling the Department of Health Services at (916) 327-6904.

- Additional information and guidance to be implemented may be obtained 24 hours a day by contacting the County of Orange Public Facilities and Resources Department for Waste Water Run Off BMP at (714) 567-6363 or Orange County Environmental Health for Trauma Scene Clean-up (BMP) at (714) 667-3784. Orange County Communication (Control 1) has 24-hour contacts with both agencies.

Trauma Scene Clean-up Public Property (BMP)

Non-Fatality Trauma Scene Requiring Minor Trauma Scene Cleanup.
Determine if on-scene personnel can handle the trauma scene cleanup without the services of a RTSMP. If the IC/Company Officer determines the trauma scene clean-up can be performed by on scene personnel, then proceed using the following procedures:

- Assure SOP HR.02.02 *Communicable Disease Exposure* and SOP HR.02.03 *Communicable Disease Exposure Prevention* are followed

- Stabilize scene to prevent blood, body tissue, or body parts from entering the storm drain, follow same procedures used to prevent hazardous materials from entering storm drain

- Place any body tissue or body parts in appropriate red biohazard bags; these bags are to be taken to appropriate hospital for disposal

- All blood on ground must be cleaned up by spraying 10% bleach to water solution on the blood and letting stand for 10 minutes. After the bleach/water solution has been on the blood for 10 minutes, it can then be washed down the gutter to the storm drain inlet. All debris is to be removed from the gutter leading to the storm drain prior to washing down.
  - The 10% bleach/water solution must be mixed daily or mixed when needed. The bleach/water solution is not to be carried on units pre-mixed for more than 24 hours at a time.

Trauma Scene Clean-Up

Non-Fatality Trauma Scene Requiring the Use of an RTSMP

In the event the IC/Company Officer determine that the trauma scene clean-up exceeds the capabilities of the emergency personnel on scene, (i.e. exceeds the amount of trauma scene cleanup supplies carried on the unit such as red biohazard bags, bleach solution, etc.), then follow these procedures:

- Request through ECC a representative from the jurisdiction where the trauma scene has occurred to respond to the scene
  1. Contract City - Request Public Works official
  2. Unincorporated Areas – Request Orange County Environmental Health official
  3. Freeways – Orange County Environmental Health, California Highway Patrol should standby until they arrive.

- Standby until the appropriate official arrives on scene. If law enforcement has a need to remain on scene for investigation, etc., the IC/Company Officer may coordinate with them as to who will remain waiting for the appropriate official. Once the appropriate official arrives, they will make contact with an approved RTSMP to arrange for cleanup and make arrangements for payment.

Fatality Trauma Scene Cleanup

When a fatality occurs, requiring blood, body tissue, or body parts clean up, the then follow these procedures:

- Stabilize scene to prevent blood, body tissue, or body parts from entering the storm drain. Follow the same procedures to prevent hazardous materials from entering storm drain. IC/Company Officer must coordinate closely with law enforcement officials to assure that any stabilization efforts do not interfere with their investigation and possible destruction of evidence.

- Law enforcement personnel should standby while waiting the arrival of the Coroner.

- The Coroner will be responsible for the trauma scene cleanup.

Trauma Scene Cleanup Private Property (BMP)

Non-Fatality Trauma Scene Cleanup

When an incident occurs on private property and has the potential for allowing blood, body tissue, or body parts to enter the storm drain system, the same procedures are to be followed as on public property.

Fatality Trauma Scene Cleanup

When a fatality on private property occurs requiring trauma scene cleanup, the procedures will be the same as for a fatality on public property.

Exhibit A-5-IV

Municipal Inspection & Enforcement

MUNICIPAL PROCEDURES GENERAL INSPECTION FORM
COVER SHEET

(Required for all inspections)

Inspection Performed by: _____ **Time of Inspection:** _____
Date: _____ **Weather at Time of Inspection:** _____

***Program or Facility Information*:**
Name of Facility/Program: **Staff Contact Name:**
Staff Title: **Phone Number**
Is this a: ☐ leased facility or ☐ subcontracted program? **Is this a:** ☐ lessor **or** ☐ subcontractor self-inspection?

***Lessor/Subcontractor Information*:**
Company Name: _____ **Contact Name:** _____
Address: _____ **Contact Title:** _____
City/State/Zip: _____ **Phone Number:** _____

***Type of Facility*:**
☐ Public Building ☐ Roads, Streets and Highways ☐ Landfill/Waste Disposal Site ☐ Airport/Airfield
☐ Parks/Cemetery ☐ Storage/Maintenance/Corporate Yard ☐ Public Parking Facility ☐ Sports Facility
☐ Drainage System ☐ Publicly Owned Treatment Works ☐ Stable/Animal Shelter ☐ Other: _____

***Type of Activities/BMP Procedures Checklist*:**

☐ DF-1 Drainage System O&M
☐ FF-1 Bay/Harbor Activities
☐ FF-2 Building Maintenance and Repair
☐ FF-3 Equipment Maintenance and Repair
☐ FF-4 Fueling
☐ FF-6 Material Loading and Unloading
☐ FF-7 Material Handling, Storage, Disposal
☐ FF-8 Minor Construction
☐ FF-9 Parking Lot Maintenance
☐ FF-10 Spill Prevention and Control
☐ FF-11Vehicle and Equipment Cleaning
☐ FF-12 Vehicle and Equipment Storage
☐ FF-13 Waste Handling, Storage, Disposal
☐ FF-14 Special Events
☐ FP-1 Lake Management
☐ FP-2 Landscape Maintenance
☐ FP-2A Irrigation Runoff
☐ FP-2B Integrated Pest Management
☐ FP-3 Road, Streets and Highways O&M
☐ FP-4 Sidewalk, Plaza and Fountain Maintenance
☐ FP-5 Solid Waste Handling
☐ FP-6 Water/Sewer Utility O&M
☐ FP-7 Fire Department Activities
☐ FP-8 Power Washing/Surface Cleaning

***Reason for Inspection*:**
☐ Routine Inspection ☐ Follow-up Inspection
☐ First Inspection ☐ Complaint Inspection
☐ Other: _____

***Outcome of Inspection*:**

	BMP's Checklists	Unsatisfactory BMP's	Comments	Detail Att'd.
☐ No Corrective Action Necessary				
☐ Verbal Warning	_____	_____	_____	☐
☐ Written Warning	_____	_____	_____	☐
☐ NOV - Notice of Violation	_____	_____	_____	☐
☐ Other: _____	_____	_____	_____	☐

Additional Comments: _____

Next Inspection Date: _____

Exhibit A-5-V

Integrated Pest Management, Pesticides and Fertilizer Guidelines

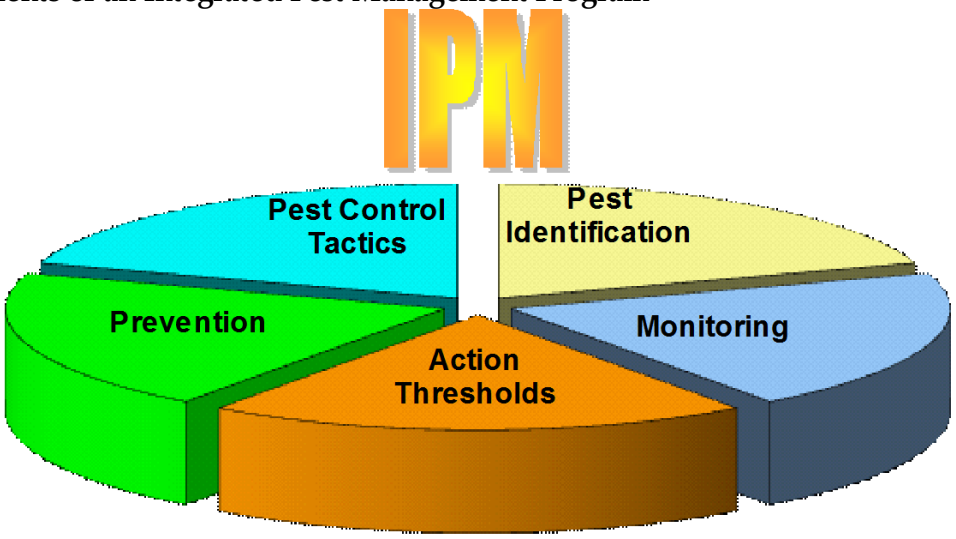
City of Laguna Niguel Integrated Pest Management Policy*

Background on Pesticide Use and Integrated Pest Management

For most of the last 55 years, the trend in pest management has been toward a greater reliance on chemical pesticides. The result has been not only a tremendous increase in the use of many dangerous chemicals, but also an increase in the number of pests that are resistant to the pesticides or new organisms becoming pests. Additionally, some pesticides used for terrestrial pest management have been found in waterways causing additional problems in the environment.

Pest control managers are now moving away from their reliance on pesticides alone toward an integrated approach that combines limited pesticide use with more environmentally friendly pest control techniques. This system is know as integrated pest management (IPM), a strategy that focuses on the long-term prevention of pests or their damage through a combination of techniques, including preventative, cultural, mechanical, environmental, biological, and chemical control tactics (**Figure 1**). The techniques are utilized simultaneously to control pest populations in the most effective manner possible.

Figure 1
Components of an Integrated Pest Management Program



Developing a comprehensive Integrated Pest Management (IPM) Program and approach allows the primary efforts to focus on pollution prevention by monitoring and preventing pests as well as minimizing heavy pest infestations which reduces the need for chemicals and/or multiple applications.

IPM programs utilize monitoring techniques and economic thresholds to determine when to implement control strategies which are then used according to established guidelines only after monitoring indicates that such treatment is appropriate. Pest

control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms and the environment.

The use of pesticides is often a last resort measure. Because of this, the management guidelines for pesticide use are presented in a separate section immediately following the IPM guidelines.

Scope of IPM Guidelines

IPM practices are encouraged over the sole use of pesticides as the primary means of pest management (**Table 1**). As a part of the Municipal Activities Program Manual, the public agencies and their contractors should evaluate the non-chemical components of IPM before intensive use of pesticides.

The goal of IPM is not to eliminate all pests, but to keep their populations at tolerable levels. Pesticides may be part of an IPM program, but they should only be used after the pests exceed established thresholds and only applied in the affected area. In general, pest control strategies should be those that are least disruptive to biological control organisms (natural enemies), least hazardous to humans and the environment (including non-target organisms), and have the best likelihood of long-term effectiveness.
Pesticides should not be applied until pests are approaching damaging levels. Because this requires early detection of the pests, monitoring on a regular basis is extremely important and should be used to determine if natural enemies are present and adequately controlling the pest. If possible, a person should be trained and designated to scout the sites on a regular basis.

Components of an IPM Program

An IPM program is a long-term, multi-faceted system to manage pests (**Figure 1**). Use of pesticides is a short-term solution to pest problems and should be used only when the other components fail to maintain the pests or their damage below an acceptable level. Successful IPM practitioners are knowledgeable about the biology of the plants and pests and successful IPM programs primarily use combinations of cultural practices as well as a combination of physical, mechanical and biological controls.

Pest Identification

It is important to learn to identify all stages of common pests at each site. For example, if you can identify weed seedlings, you can control them before they become larger and more difficult to control and before they flower, disseminating seeds throughout the site. It is also important to be sure that a pest is actually causing the problem. Often damage such as wilting is attributed to root disease but may actually be caused by under watering or wind damage.

Table 1
Advantages and Disadvantages of a Pesticide-Based Program Versus. an IPM-Based Pest Control Program.

Pesticide Based Pest Control		**IPM Based Pest Control**	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Quick suppression of pests.	Loss of natural controls.	Long-term control.	Training is required to identify pests and natural enemies.
Labor is only for spraying.	Not long-term	Safer to the environment.	Must have knowledge of pesticides and their effects on other organisms.
Not much preparation or follow-up needed.	More pesticides in environment.	Pesticides can be used (only used as last resort).	Must maintain a record-keeping system.
	Contamination of water bodies from runoff.	Reduces disruption of natural enemies.	Must scout regularly.
	Pesticide safety for applicators, public, animals.	Reduces contamination from runoff.	Labor is required for monitoring.
	Often get outbreaks of other pests.	Less exposure to pesticides	
		Can be proactive in pest control actions.	

Prevention

Good pest prevention practices are critical to any IPM program, and can be very effective in reducing pest incidence. Numerous practices can be used to prevent pest incidence and reduce pest population buildup such as the use of resistant varieties, good sanitary practices and proper plant culture. Examples of prevention include choosing an appropriate location for planting, making sure the root system is able to grow adequately and selecting plants that are compatible with the site's environment.

Monitoring

The basis of IPM is the development and use of a regular monitoring or scouting program. Monitoring involves examining plants and surrounding areas for pests, examining tools such as sticky traps for insect pests and quantitatively or qualitatively measuring the pest population size or injury. This information can be used to determine if pest populations are increasing, decreasing, or staying the same and to determine when to use a control tactic.

It is important to use a systematic approach. For example you should examine the same section of a plant each time you check for pests, rather than looking at the lower leaves

on some plants and the upper ones on others. Otherwise, randomly looking at a plant or a section of a growing area does not allow you to track changes in pest population or damage over time. **Figure 2** illustrates an example of a form used to record monitoring or scouting information collected in the field.

It is important to establish and maintain a record-keeping system to evaluate and improve your IPM program. Records should include information such as date of examination, pests found, size and extent of the infestation, location of the infestation, control options utilized, effectiveness of the control options, labor and material costs.

Figure 2
Example of a Scouting Form for Monitoring Pests and Control Activities.

City:

Reported by: _____ Date: _____

Location: _____

_____ Initial report _____ Follow-up Report _____ 2nd Follow-up Report

Date reported to IPM Coordinator or Supervisor: _____

Arthropods

Pest name	Growth stages	Host	Count or estimate	Damage	Recommended action

Weeds

Pest name	Growth stages		Count or estimate	Damage	Recommended action

Diseases

Pest name	Growth stages	Host	Count or estimate	Damage	Recommended action

Comments (include labor and materials cost or used):

Injury Levels and Action Thresholds

In order to have a way to determine when a control measure should be taken, injury levels and action thresholds must be set for each pest. An injury level is the pest population size where unacceptable damage occurs. Action thresholds are the set of conditions required to trigger a control action.

Pest Control Tactics

Integrated pest management programs use a variety of pest control tactics in a compatible manner that minimizes adverse effects to the environment. A combination of several control tactics is usually more effective in minimizing pest damage than any single control method. The type of control that an agency selects will likely vary on a case-by-case basis due to the varying site conditions.

The primary pest control tactics to choose from include:

- Cultural
- Mechanical
- Environmental/Physical
- Biological
- Pesticide

Cultural Controls

Cultural controls are modifications of normal plant care activities that reduce or prevent pests. In addition to those methods used in the pest preventions, other cultural control methods include adjusting the frequency and amount of irrigation, fertilization, and mowing height. For example, spider mite infestations are worse on water-stressed plants, over-fertilization may cause succulent growth which then encourages aphids, too low of a mowing height may thin turf and allow weeds to become established.

Mechanical Controls

Mechanical control tactics involve the use of manual labor and machinery to reduce or eliminate pest problems using methods such as handpicking, physical barriers, or machinery to reduce pest abundance indirectly. Examples include hand-pulling or hoeing and applying mulch to control weeds, using trap boards for snails and slugs, and use of traps for gophers.

Environmental/Physical Controls

The use of environmental manipulations that indirectly control or prevent pests by altering temperature, light, and humidity can be effective in controlling pests. Although in outdoor situations these tactics are difficult to use for most pests, they can be effective in controlling birds and mammals if their habitat can be modified such that they do not choose to live or roost in the area. Examples include removing garbage in a timely manner and using netting or wire to prevent bird from roosting.

Biological Controls

Biological control practices use living organisms to reduce pest populations. These organisms are often also referred to as beneficials, natural enemies or biocontrols. They act to keep pest populations low enough to prevent significant economic damage. Biocontrols include pathogens, parasites, predators, competitive species, and antagonistic organisms. Beneficial organisms can occur naturally or can be purchased and released.

The most common organisms used for biological control in landscapes are predators, parasites, pathogens and herbivores.

- Predators are organisms that eat their prey (e.g. Ladybugs).

- Parasites spend part or all of their life cycle associated with their host. Common parasites lay their eggs in or on their host and then the eggs hatch, the larvae feed on the host, killing it (e.g. Tiny stingless wasps for aphids and whiteflies).

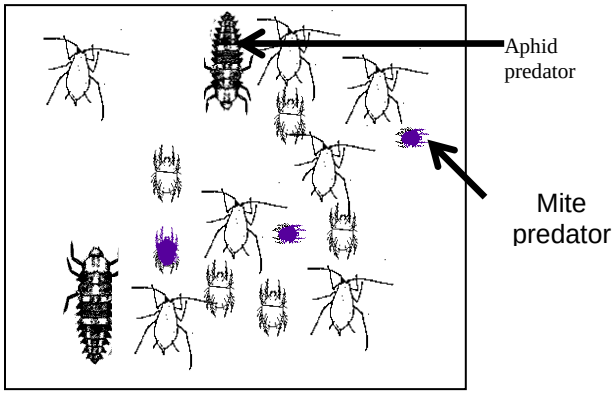
- Pathogens are microscopic organisms, such as bacteria, viruses, and fungi that cause diseases in pest insects, mites, nematodes, or weeds (e.g. *Bacillus thuringiensis* or BT).

- Herbivores are insects or animals that feed on plants. These are effective for weed control. Biocontrols for weeds eat seeds, leaves, or tunnel into plant stems (e.g. goats and some seed and stem borers).

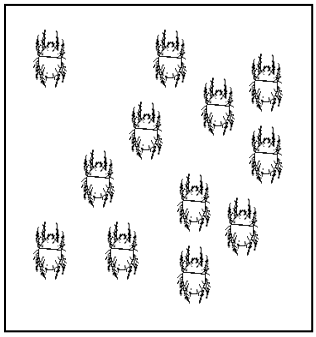
In order to conserve naturally occurring beneficials, broad-spectrum pesticides should not be used since the use of these types of pesticides may result in secondary pest outbreak due to the mortality of natural enemies that may be keeping other pests under control (**Figure 3**).

Figure 3
Example of Secondary Pest Outbreak
Caused By Use of a Broad Spectrum Insecticide

A. Aphids and mites controlled by predators



B. After a broad spectrum spray for aphids, predators for mites and aphids are also killed, resulting in an outbreak of mites



Pesticide Controls

Any substance used for defoliating plants, regulating plant growth or preventing, destroying, repelling or mitigating any pest, is a pesticide. Insecticides, herbicides, fungicides are all pesticides.

Pesticides should only be used when other methods fail to provide adequate control of pests and just before pest populations cause unacceptable damage since the overuse of pesticides can cause beneficial organisms to be killed and pest resistance to develop. When pesticides must be used, considerations should be made for how to use them most successfully. Avoid pesticides that are broad-spectrum and relatively persistent since these are the ones that can cause the most environmental damage and increase the likelihood of pesticide resistance. Always choose the least toxic effective method.

In addition, considerations should be given to the proximity to water bodies, irrigation schedules, weather (rain or wind) the loss of use of an area (application in a park may result in the area being sectioned off) etc. that are all secondary factors that may result in the pesticide being moved off-site into the environment.

FP-2B: INTEGRATED PEST MANAGEMENT INCLUDING PESTICIDES, HERBICIDES, & FERTILIZERS

The checklist below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Integrated Pest Management activities, including pesticide, herbicide and fertilizer applications, based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below each list of BMPs is a listing of Other Tips & Techniques that may be utilized where appropriate. Information on the latest IPM information including management of new pests in the landscape is obtained from local UC Cooperative Extension Advisors, UC IPM Regional Advisor, or the Statewide UC IPM Web Site at www.ipm.ucdavis.edu.

I. PREVENTION

A. Landscape Design Procedures - *Minimum Designated BMPs*

☐ Drainage, soil characteristics, water quality and availability are considered during plant selection. Native plants and ecologically adapted species are utilized where compatible with site functional requirements.

☐ Sun exposure, heat, and high temperature conditions are considered during plant selection.

☐ Nursery stock is inspected and rejected if not healthy (injuries, diseased, circling roots/potbound, poor staking and/or pruning).

Other Tips and Techniques

☐ Pest resistant species and cultivars are selected.

☐ Plants with similar growth characteristics and irrigation requirements are grouped together..

☐ Adequate space is allowed for root growth, especially trees.

B. Site Preparation and Planting Procedures - *Minimum Designated BMPs*

☐ Assess soil drainage properties and improve compacted soils prior to planting.

☐ Follow proper planting procedures for particular plant species to avoid planting too deeply or too shallow.

Other Tips and Techniques

☐ Nursery tree stakes are removed at planting and replaced with staking that allows trunk to flex; removing these stakes after 1 to 1.5 years.

☐ Conduct a soil analysis to determine chemical and physical properties of the existing soil and then add appropriate amendments such as organic matter.

C. Water Management – *Minimum Designated BMPs*

☐ Utilize evapotranspiration (ET) data or 'smart' clock technology to schedule irrigation to occur only as needed, and at appropriate times of the day/week.

Other Tips and Techniques

☐ Adjust sprinklers to avoid application of water directly to the trunk of trees (can promote disease) or on to concrete surfaces where it can enter storm drains.

☐ Plants are examined weekly for symptoms of water stress and to assist in determining irrigation scheduling.

☐ Monitor soil moisture with a soil probe or soil moisture sensors to assist in scheduling irrigation.

D. Fertilizing Procedures - *Minimum Designated BMPs*

☐ Fertilizer application occurs in accordance with schedules in the City's Landscape Maintenance Subcontractor Specifications, adjusted as deemed necessary by the Contract Manager.

☐ Fertilizer is not applied within 48 hours of a rain event to avoid losses below the root zone and in surface runoff.

☐ Unused fertilizers are collected in a central location for future use or proper disposal or recycling. Off-target fertilizer applications or spills are cleaned up immediately by sweeping up and applying to landscape or turf or replacing in spreader or bag to ensure material does not enter storm drains.

Other Tips and Techniques

☐ Soil analyses may be conducted in order to determine existing nutrient levels in the soil prior to fertilizing.

☐ Turf grass fertilizer maintenance guidelines are based on UC recommendations found online at UC Guide for Healthy Lawns.

http://www.ipm.ucdavis.edu/TOOLS/TURF/MAINTAIN/fertilize.html

☐ Sports turf grass fertilizer maintenance guidelines are based on UC recommendations found in *Establishing and Maintaining the Natural Turf Athletic Field (UCR ANR Publication Number: 21617).*

☐ Overfertilization, especially of trees and shrubs, is avoided to ensure plant growth is not excessively succulent making it more susceptible to pest infestations.

E. Pruning Procedures – *Minimum Designated BMPs*

☐ Damaged or diseased wood is regularly pruned from landscape plants.

☐ Trees are pruned according to standards set forth by a professional tree care organization such as the International Society of Arboriculture.

☐ Replace plants too large for a space instead of pruning them severely.

☐ Unnecessary pruning is avoided as wounds are entry sites for decay and disease organisms.

☐ Tree height reduction is discouraged. When deemed necessary by a licensed arborist, the crown reduction method approved by a professional tree care organization is utilized. Topping is never done to reduce tree size. NO TOPPING OR 'HAT RACKING' IS PERMITTED.

Other Tips and Techniques

☐ The age and species of the plant is taken into account when determining the time of year to prune. For example, eucalyptus should be pruned in December and January when long-horned beetles are not active.

II. PEST AND SYMPTOM IDENTIFICATION

A. Insects, Mites, and Snails and Slugs – ***Minimum Designated BMPs***

☐ Field personnel are trained to recognize basic pests found in the landscape in the following groups: insects, mites, and mollusks.

☐ Field personnel are trained to utilize disease life cycles to apply treatments when the organism can be controlled most effectively.

☐ Field personnel are trained to distinguish between beneficial insects and actual pests found in the landscape (e.g. parasitizing wasps).

☐ Unknown samples are submitted to the Orange County Agricultural Commissioner for identification by the county entomologist or plant pathologist.

☐ Abiotic or nonliving factors (wind, sunburn, air pollution, etc…) are considered as possible causes of observed symptoms as well as biotic (living) factors.

B. Weeds – *Minimum Designated BMPs*

☐ Field personnel are trained to identify common weeds in the landscape.

☐ Field personnel are trained to utilize weed life cycles to properly control weeds such as controlling crabgrass utilizing a pre-emergent herbicide applied in mid-January.

C. Diseases – *Minimum Designated BMPs*

☐ Field personnel are trained to recognize common diseases or their signs/symptoms in the landscape.

☐ Field personnel are trained to utilize disease life cycles to apply treatments when the organism can be controlled most effectively.

☐ Field personnel are trained to recognize the difference between biotic and abiotic problems.

☐ Field personnel are trained to understand how common diseases are spread throughout the landscape.

☐ Photographs of disease signs and symptoms are taken and compared to reference guides such as UC IPM's *Pests of Landscape Trees and Shrubs*.

Other Tips and Techniques

☐ Disease signs and symptoms are sampled and submitted to the Orange County Agricultural Commissioner for identification by the county plant pathologist.

D. Vertebrates – *Minimum Designated BMPs*

☐ Field personnel are trained to recognize vertebrate pests and the damage they cause in the landscape.

☐ Field personnel are trained to utilize vertebrate behavior to properly control the pest most effectively.

☐ At least one field staff member is trained in vertebrate baiting and trapping.

III. MONITORING FOR PESTS AND PROBLEMS

A. Insect/Mollusk Monitoring Procedures – *Minimum Designated BMPs*

☐ Insects are dislodged from plants by shaking over a collection surface usually consisting of a clipboard with a white sheet of paper.

☐ Soil-dwelling turf insects are brought to the surface for monitoring by flushing a specific area of soil (i.e. 2' x 2' grid) with plain water or a soapy water mixture.

☐ The amount of honeydew (aphids) and frass (caterpillars) present is utilized as an indicator of population levels.

Other Tips and Techniques

☐ Visually inspect plants for insects, mites, snail and slug damage at least monthly; recording results utilizing a method conducive to tracking changes and easy recall of data.

☐ Yellow sticky traps are utilized to assess populations of insects.

☐ If available for a particular insect, phermone-baited traps are utilized.

B. Weed Monitoring Procedures – *Minimum Designated BMPs*

☐ Landscapes are inspected at least 4 times a year (early winter, early spring, summer and early fall) for weeds in order to determine if and when a weed problem exists.

☐ Count and record the number of weeds encountered at periodic intervals (e.g. every 1 to 2 feet) along a straight line transecting a landscapes area or within a selected area, for example 4 sq. ft. samples done in random places in a bed or turf area.

Other Tips and Techniques

☐ Utilize site surveys to record the location, date, and severity of weed problem; recording results utilizing a method conducive to tracking changes and easy recall of data.

C. Disease Monitoring Procedures – *Minimum Designated BMPs*

☐ Landscapes are regularly checked for conditions, such as overwatering and injuries, which promote disease.

☐ Landscapes are checked monthly, at a minimum, for disease symptoms and signs. Disease prone plants are checked more frequently.

Other Tips and Techniques

☐ Records are kept utilizing a method conducive to tracking changes and easy recall of data of each landscape inspection noting, date when disease signs and symptoms were first noticed and the current environmental conditions and soil moisture levels.

D. Vertebrate Monitoring Procedures – *Minimum Designated BMPs*

☐ Landscapes are regularly inspected for vertebrate presence either by damage caused by animal, actual animal sightings, and/or droppings.

☐ Records are kept of the absence or presence of actual vertebrates, the damage caused, the treatment implemented, and/or the presence or absence of droppings.

Other Tips and Techniques

☐ Maps are created and updated at least twice a year, recording area of high vertebrate damage or signs (such as gopher mounds).

IV. ACTION THRESHOLDS AND GUIDELINES

A. Insect/Mollusk Thresholds and Guidelines – *Minimum Designated BMPs*

☐ Insect tolerance levels are established based on the public's acceptance of damage to the landscape or a certain level of nuisance pests (i.e. ants), the actual plant species in the landscape, and long-term monitoring and knowledge of pests causing the damage.

☐ Thresholds are based on levels were reasonable control of the pest can be achieved with minimum impact on the environment.

Other Tips and Techniques

☐ Insect monitoring records are utilized to establish threshold levels for the implementation of control strategies. For example, the threshold for the presence of aphids on a rose garden at City Hall is low, while in a native shrub border it might be considerably higher.

B. Weed Thresholds and Guidelines – ***Minimum Designated BMPs***

☐ Weed tolerance levels are established based on public safety or the public's acceptance and the resources available to manage the landscape at that level.

☐ Public areas are ranked according to high, medium, or low level of weed control and management conducted according to levels set for each rank (see Appendix A)

Other Tips and Techniques

☐ Weed monitoring records are utilized to rank the percentage of the landscape area infested (none, light, moderate, heavy, or very heavy) with weeds.

C. Disease Thresholds and Guidelines – *Minimum Designated BMPs*

☐ Disease tolerance levels are established based on the public's acceptance and the resources available to manage the landscape at the level required.

Other Tips and Techniques

☐ Disease monitoring records are utilized to establish threshold levels for the implementation of control strategies. For example, the threshold for the presence of powdery mildew on roses at City Hall is much lower than the threshold for its presence on Euonymus in a parking lot at a city sports park.

D. Vertebrate Thresholds and Guidelines – *Minimum Designated BMPs*

☐ Vertebrate tolerance levels are established based on public safety, the public's acceptance and the resources available to manage the landscape at the level required.

Other Tips and Techniques

☐ Vertebrate monitoring records are utilized to establish threshold levels for the implementation of control strategies. For example, the threshold for the presence of gopher mounds in a sport field is zero, while in a native shrub border it might be two before a trapping strategy is implemented.

V. SELECTION OF APPROPRIATE MANAGEMENT METHODS

A. Insect/Mollusk Management Methods

Cultural/Mechanical/Physical Control Methods – Minimum Designated BMPs

☐ Plant canopies are thinned to increase light penetration to exposure certain soft-bodied insects (soft-scale) as well as snails and slugs to heat.

☐ Avoid use of plants that snails and slugs use for shelter.

Other Tips and Techniques

☐ Avoid irrigating at sensitive locations between 5pm and 5am when moisture remains on plant material for several hours.

☐ Sticky barriers are applied to trunks of trees and large shrubs to prevent ants and other wingless invertebrates from plant canopies.

☐ Small insect infestations are removed by pruning infested plant parts.

☐ Copper bands are installed around base of trees or planting areas where snail and slug infestations are prevalent.

☐ Strong streams of water are used to dislodge insects such as aphids and whiteflies, from leaves.

Biological Control Methods – Minimum Designated BMPs

☐ Persistent broad-spectrum insecticides are avoided, especially if biological control of an insect has been established by UC researchers. Examples include parasitoid wasps controlling Eugenia Psyllids, Giant Whitefly, and Ash Whitefly.

Other Tips and Techniques

☐ Natural predators (beneficial insects) are augmented with purchases of additional predators from commercially available resources.

Pesticide Control Methods – Minimum Designated BMPs

☐ The most selective, rather than broad-spectrum, pesticide is used

☐ Pesticides are only utilized when the potential for impacts to the environment, especially water quality, are minimized.

☐ Equipment is calibrated prior to the application of the insecticide to avoid excess material being applied to the landscape environment.

☐ Applicators are trained to not apply pesticides to hard surfaces and to not allow any pesticide to enter the storm drain system

☐ Spot treatments are utilized rather than broadcast methods

☐ Insecticide/fertilizer combinations are only used if appropriate timing for BOTH the insecticide application and the fertilizer application.

Other Tips and Techniques

☐ If available for controlling a particular insect, biological and botanical pesticides are selected

☐ Insecticidal soaps are utilized to control infestations of soft-bodied insects such as aphids, thrips, and immature scales.

☐ Horticultural oils (neem oil and narrow-range refined oils) are utilized to control infestations of soft-bodied immature and adult insects such as aphids, scales, and whiteflies.

B. Weed Management Methods

Cultural, Mechanical, and Physical Control Methods – Minimum Designated BMPs

☐ Timers are set to avoid overwatering as weeds establish in areas where soil moisture is excessive.

☐ Drainage is managed to avoid wet areas.

☐ Weeds are removed from a site prior to planting.

☐ Mower height is adjusted to turf species and time of year.

☐ Hand-pulling, mowing, trimmers/brushcutters, flaming, hoeing, and rototilling around landscape plants are the main methods utilized to control annual weeds and young perennial weeds.

☐ Bare soil areas are covered with a thick layer of mulch to suppress weeds and conserve soil moisture.

☐ Soil, mulch, and plant material is weed-free before it is introduced into the landscape.

Other Tips and Techniques

☐ Mower is washed after mowing a weedy site.

☐ Soil solarization is utilized to control some annual and perennial weed species.

Pesticide Control Methods – Minimum Designated BMPs

☐ Spot treatments are utilized rather than broadcast methods.

☐ Herbicide/fertilizer combinations are only used if appropriate timing for BOTH the herbicide application and the fertilizer application.

☐ Herbicides are utilized according to established thresholds (see Appendix A).

☐ Herbicides are applied to the stage of weed growth most susceptible to the chemical.

☐ Equipment is calibrated prior to the application of the herbicide to avoid excess material being applied to the landscape environment.

Other Tips and Techniques

☐ Organically acceptable herbicides (shown to be effective through science-based research) are used where appropriate.

C. Disease Management Methods

Cultural, Mechanical, and Physical Control Methods – Designated Minimum BMPs

☐ Prune out and dispose of localized areas of diseased plants.

☐ Pruning tools are sterilized (e.g. a diluted bleach solution) between plants to prevent the spread of pathogen to other plants.

☐ Proper irrigation and fertilization are maintained to prevent plant stress, water-logging, and subsequent susceptibility to disease.

☐ Mulch is kept at least 6" from base of plants to avoid excessive moisture around crown possibly resulting in crown rots and is no deeper than 4"

☐ Replace disease-prone plants with non-susceptible species.

Other Tips and Techniques

☐ Pathogen-infested plant parts are removed from the soil surface area to reduce certain pathogens (e.g. Camellia Petal Blight).

☐ Soil solarization is utilized to control soil pathogens in annual beds where it is most effective.

Pesticide Control Methods – Minimum Designated BMPs

☐ Preventative fungicides and bactericides are only used where diseases can be predicted from environmental conditions and applied prior to infection or the appearance of symptoms.

☐ Synthetic fungicides are used sparingly in the landscape and only in high visibility areas in order to minimize development of resistance.

☐ Organic fungicides and bactericides are utilized in combination with cultural, mechanical, and physical control methods in order to improve their effectiveness.

Other Tips and Techniques

☐ Copper-based fungicides are only utilized in situations where its entry into surface runoff and storm drains is virtually impossible and after consultation with PCA and IPM coordinator.

☐ Mycopesticides, commercially available beneficial microorganisms, are used where appropriate.

☐ Fungicides classes are rotated to avoid resistance.

D. Vertebrate Management Methods

Cultural and Physical Control Methods – Minimum Designated BMPs

☐ Groundcovers are maintained such that they do not harbor rats.

☐ Sources of drinking water removed (leaky faucets, puddles).

☐ Trash cans have lids and are emptied daily (rats).

☐ Habitat modification, based on pest biology is used to reduce shelter.

☐ Trapping is used for gophers when safe and practical.

☐ Kill traps used for ground squirrels and rabbits, are checked daily, and in places not accessible by children or non-target animals.

☐ Gas cartridges are used for ground squirrels according to UC recommendations.

Other Tips and Techniques

☐ Shrubs pruned at least 1 foot from the ground (rats).

☐ Screens or other barriers installed under structures that have a space between soil and floor (rabbits).

Pesticide Control Methods – Minimum Designated BMPs

☐ Anti-coagulant baits are used and applied according to label and UC recommendations.

☐ Bait is applied in a manner that non-target animals do not access to it.

Other Tips and Techniques

☐ Restricted use rodenticides are used only after applicator has been trained for that product or only by a wildlife management contractor.

VI. GENERAL PESTICIDE MANAGEMENT PRACTICES – *Minimum Designated BMPs*

☐ A licensed Pest Control Adviser is on staff or hired to properly identify pests and the symptoms caused by pests, and to make recommendations for appropriate management, including proper application of mechanical, biological and chemical controls.

☐ Restricted use pesticides are only used when no other alternatives are practical.

☐ If pesticides are necessary, CAUTION-labeled pesticides are considered before more toxic alternatives.

☐ Only small quantities of pesticides or herbicides are purchased, reducing or eliminating the need for stockpiling. Any unused pesticides and herbicides are securely stored under cover for future use, or are collected in a central location for proper disposal as

hazardous waste, or are transferred to the County's hazardous material recycling center, as appropriate.

☐ MSDSs are regularly updated to reflect new pesticides or label changes to pesticides in storage.

Appendix A

Ranking public areas for weeds (or other pest) management:

Areas ranked as **HIGH** may include areas that the public sees and expects to be well-maintained. Examples are entrances to public buildings such as city hall and libraries.

Areas ranked as **MEDIUM** may include areas the public sees but does not expect a high level of maintenance. Examples are landscaped areas away from the entrance, recreational and picnic areas. These areas can tolerate a higher lever of weeds.

Areas ranked as **LOW** may include areas the public rarely sees or does not expect a high level of maintenance. Examples are medians, landscaped areas in parking lots, wildlands. These areas can tolerate a higher lever of weeds.

A-6.0 PUBLIC EDUCATION

A-6.1 INTRODUCTION

Water quality protection themed education and outreach can contribute to the protection of creeks streams and coastal waters. By encouraging and fostering the adoption of behaviors protective of water quality by the general public and by regulated businesses and commerce, the City may reduce the sources and pathways of pollution arising from common daily activities.

The City of Laguna Niguel supports and participates in the countywide public education program – *H_2OC* which is also the principal means of ensuring compliance with the public education and outreach elements of the Fifth Term Permit. In addition to this effort, the City conducts local programs to additionally increase awareness and foster environmental protective behaviors. The below list provides contact information for the primary and secondary city representatives responsible for outreaching to the public concerning stormwater pollution prevention.

Public Works Department
Contact Name: Hal Ghafari
Title: Environmental Programs Supervisor
Telephone: (949) 362-4384
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

A-6.2 REGULATORY REQUIREMENTS

The federal regulations require a description of educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials (Federal Register/Vol. 55, No. 222, p. 48071). In addition, the regulations also specify education programs for construction site operators and a program to facilitate public reporting of illicit discharges.

The Public Education Program was developed as a model for fulfilling the public education requirements of SectionE.7 of the of the San Diego Regional Water Quality Control Board Municipal NPDES Stormwater permit, Order No. R9-2013-0001, (As amended by Order Nos. R9-2015-0001 and R9-2015-0100), Fifth term Permit.

A-6.3 MODEL PUBLIC EDUCATION PROGRAM

The City of Laguna Niguel supports *H_2OC*, the dynamic Countywide outreach campaign. This campaign is built upon a foundation of cooperative Permittee development of programs and materials, implementation at Countywide and city levels, and the validation of its success through the use of opinion surveys and other direct measures of public behavior.

Education efforts of *H_2OC* follow a two-pronged approach comprising large-scale broad residential and business outreach as part of a foundational campaign and small-scale behavior-

based action campaigns to build a base of residents from which the Education Program can document adoption of specific BMPs.

The NPDES Public Education Sub-Committee (Committee) comprised of Co-Permittee representatives meets monthly to collaboratively direct *H_2OC*. The City of Laguna Niguel participates in the Committee to ensure program strategies and materials developed are appropriate to residents and businesses within the city.

The objectives of the Model Public Education Program are to provide the following:

- Increase urban runoff pollution awareness
- Increase awareness for specific segments of the community of the importance of participation in controlling non-point source pollution;
- Provide information on alternative behaviors and practices that can contribute to controlling non-point source pollution;
- Provide the public with opportunities to participate in the development, implementation, and refinement of the Water Quality Improvement Plan (WQIP); and
- Track public awareness in the educational programs and changes in behavior toward activities more protective of water quality.

A-6.3.1 Foundational Campaign Elements

The foundational campaign forms the underpinning of *H_2OC* based on maintaining a consistent water quality message and includes overall program branding, school and business outreach, pollutant-specific and residential program outreach and annual development and implementation of a media plan. The primary goal of the foundational campaign is to achieve permit compliance by increasing knowledge of residents and businesses and changing behavior over time. The success of these efforts is measured through the achievement of impressions and building engagement in *H_2OC*.

A-6.3.1.1 School Outreach

H_2OC uses agreements and relationships with organizations that outreach to school-aged children to deliver messaging on pollution prevention. These organizations, such as the Orange County Department of Education (OCDE), Discovery Science Center (DSC), the Pacific Marine Mammal Center, and the Ocean Institute, provide an avenue for disseminating materials and messaging in a format conducive to student learning. Materials developed to inform children of stormwater pollution prevention behaviors are designed to encourage adoption of BMPs at school and in the home, as well as meet California Content Standards.

A-6.3.1.2 Business Outreach

The City will continue to distribute materials developed specifically for food service establishments (FSEs), mobile businesses, automotive service centers and detailing establishments, pet care businesses, pest control operators, landscape service companies, gasoline service stations and the land development and construction industry.

Previously developed outreach to the construction industry will be supplemented by materials promoting residential and commercial implementation of LID techniques, retrofitting of existing development and encouragement of infiltration.

A-6.3.1.3 Pollutant-specific Outreach

Outreach materials are developed for residents and businesses in Orange County regarding specific pollutants of concern and reviewed annually and updated by *H_2OC* as needed. City-specific materials supplement these efforts ensuring that pollution issues specific to the city are adequately addressed. Pollutant-specific outreach include proper use and disposal of pesticides and fertilizers, proper disposal of pet waste, residential automobile washing and proper disposal of household hazardous waste. Pollutant-specific outreach to businesses will focus on water conservation, reduction of metals in runoff and proper use and disposal of chemicals and other hazardous wastes.

A-6.3.1.4 Residential Program

The Residential Program includes recommendations (*"Tips"*) for pollution-prevention methods for residential areas. Specific pollution prevention practices identified for each residential activity that poses a threat to water quality are provided in the activity fact sheets presented in **Exhibit A-9.II**. The City of Laguna Niguel uses the implementation strategies discussed in **Section A-9.5.4** to encourage pollution prevention in residential areas.

In addition, the City will facilitate proper management and disposal of used oil, toxic materials and other household hazardous wastes (HHWs) by providing educational materials describing the operation of the County's principal Household Hazardous Waste Collection Centers.

A-6.3.1.5 Speakers Bureau

A speakers' bureau was developed for *H_2OC* to supplement the previous outreach efforts through local Chambers of Commerce. On behalf of the Permittees the County as Principal Permittee distributes requests for presentations to local groups such as Chambers of Commerce, Rotary Clubs, Kiwanis Clubs, Key Clubs, National Honor Society groups and environmental groups (e.g. Sierra Club).

A-6.3.1.6 Common Interest Areas/Homeowner Association Activities Program

The Common Interest Area (CIA) / Homeowner Association Area (HOA) Activities Program includes specifications for pollution-prevention methods for CIA/HOA areas and is described in DAMP Section 9.6 and Section A-9.6. The City of Laguna Niguel 's CIA/HOA Program uses the implementation strategies discussed in Section A-9.3.4 to encourage pollution prevention as part of the jurisdictional CIA/HOA Program.
The City is a founding member and an active participant of the H2O for HOAs events. The events are H2O for HOAs events are half-day water-focused seminars and exhibit targeting Homeowner Associations (HOA) board members and manager, and their landscape maintenance contractors, with over 50 percent of the contents related to over-irrigation and stormwater quality protection. Majority of the City jurisdiction is managed by over 120 HOAs,

and we believe these events are having tremendous positive effects on how the HOAs manage water on their landscapes.

A-6.3.2 Action Campaigns

To document sustainable behavior change, *H₂OC* pairs general pollution prevention outreach (via the Foundational Campaign) with localized action campaigns that focus on changing specific behaviors in small, community-based target groups. The action campaigns utilize Community-Based Social Marketing (CBSM)[1] techniques to document behavior change on a more frequent scale.

Community-Based Social Marketing involves four basic steps:

1. Identifying barriers and motivators to an activity;
2. Developing a strategy that utilizes tools to leverage those barriers and motivators in order to affect behavior change;
3. Pilot the strategy; and
4. Evaluate the strategy and refine it for future implementation.

By simplifying campaign messaging and requesting adoption of specific BMPs, *H₂OC* seeks to remove the uncertainty caused by offering a large number of stormwater pollution-preventing behaviors in favor of one single high-impact action.

H₂OC Overwatering is Out

The ultimate goal of the *H₂OC Overwatering is Out* action campaign is to improve water quality through eliminating residential irrigation runoff. This is accomplished by encouraging residents to sign up for program messaging (i.e. tips to reduce overwatering) and to commit to making changes to their irrigation habits or landscape to reduce runoff. Built into the program is also the ability to quantify behavior changes that are the direct result of the action campaign.

The City of Laguna Niguel supports the *H₂OC Overwatering is Out* action campaign by promoting the program at city events, including a link to h2oc.org/resources/take-action/overwatering-is-out/ on the city website and social media, collecting opt-ins, and etc. The City's Environmental Programs Supervisor acts as the representative of the south County Cities on the tiger team that guided development and continuous update of the *H₂OC*.org website and review an update of the regional public education material.

A-6.4 CITY EDUCATION PROGRAM

The City of Laguna Niguel implements a city-specific public education campaign to complement *H₂OC* to address local issues and target constituencies that are best reached through a local rather than a countywide effort.

[1] McKenzie-Mohr, Doug & Smith, William (1999). *Fostering sustainable behavior: An introduction to community-based social marketing.* Gabriola Island, B.C.: New Society (www.CBSM.com)

A-6.4.1 Public Education Material Distribution

The City makes educational materials available to its residents at the City Hall on the Public Works Department Counter and the Community Development Department Counter, as well as on the *H_2OC* website (https://h2oc.org/resources/view-order-brochures/).

A-6.4.2 Employee Training and Outreach

In addition to the overall comprehensive training effort, the City conducts broad educational outreach on water quality issues to all its employees.

The following approaches have been identified:

- Conducting meetings with new employees to inform them of water quality issues and the City's responsibilities;
- Including informational inserts with employees' paychecks;
- Placing information on the City's internal website and/or in the City's employee newsletter;
- Routing relevant newspaper and magazine articles to specific departments or personnel; and
- Hold meetings with departments to help fine-tune public outreach based on their experiences and observations. For example, a certain department representative might say that the residents or businesses it works with have a good understanding of one concept, but need more information about another. Based on this information, the City can produce or obtain educational materials that address these issues.

A-6.4.3 Outreach Events

The City of Laguna Niguel participates in at least one community, regional or countywide event per year. Materials developed by *H_2OC* encourage the public to report illegal discharges/dumping and include the hotline reporting number. Brochures and other materials also reference the countywide website H2OC.org ; contained therein are brochures, factsheets and other outreach materials covering a wide range of topics from household use of fertilizers and pesticides to pet care to automotive maintenance activities.

A-6.4.4 Industrial/Commercial and Construction Outreach

Outreach to Industrial Site Owners and Operators

The City distributes educational materials during inspections to educate industrial facility owners and operators about BMPs. These efforts target employees, property management and focus on specific industrial activities. The Industrial/Commercial Program is further described in **DAMP Section 9.2** and **Section A-9.2**.

The following approaches have been identified:

- Mailing or delivering brochures with information about regulations, requirements and industry-specific BMPs to industrial site owners/operators;
- Distributing BMP information and educating owners and operators during inspections or other interactions with City staff (**DAMP Section 9.2.3** and **Section A-9.2.3** of this LIP);
- Providing information when industrial companies apply for and/or renew business licenses or permits; and
- Conducting seminars or workshops for targeted industries that have a high potential for pollution. The workshops would cover BMPs for pollution prevention and how their actions can help protect water quality. The City may partner with neighboring cities in a common watershed to maximize attendance and understanding of industries' responsibilities in the watershed.

Outreach to Commercial Site Owners and Operators

During commercial facility inspections, target audiences for BMP materials include employees, property management, franchise chain owners and merchant associations. The Industrial/Commercial Program is further described in **DAMP Section 9.2** and **Section A-9.2** of this LIP.

The following approaches have been identified:

- Providing information about BMPs and regulations when commercial owners apply for or renew business licenses or permits;
- Mailing or delivering brochures on regulations, requirements and business-specific BMPs;
- Distributing BMP information and educating owners and operators during inspections or other interactions with City staff (**DAMP Section 9.2.3** and **Section A-9.2.3** of this LIP); and
- Conducting seminars or workshops for targeted commercial sites that have a high potential for pollution. The workshops would cover BMPs for pollution prevention and how their actions can help protect water quality. The City may partner with neighboring cities in a common watershed to maximize attendance and understanding of businesses' responsibilities in the watershed.

Outreach to Construction Site Contractors/Developers

The City of Laguna Niguel distributes BMP and pollution prevention information, including erosion and sediment control, low impact development (LID) techniques, runoff control and pollutants of concern during construction site inspections. The Construction Program is further described in **DAMP Section 8.2** and **Section A-8.2** of this LIP.

The following approaches have been identified:

- Distributing BMP materials to developers, contractors, residential owners and construction companies when City permits are issued;
- Distributing BMP materials at construction sites within the City;

- Sending a letter to construction sites prior to each rainy season re-emphasizing how runoff is created and reminding the operators to update their BMPs;
- Maintaining a supply of information materials at City offices and facilities for interested parties to obtain during business hours throughout the year.; and
- Requiring that companies submitting construction bids for City Requests for Proposals (RFPs) include language agreeing to follow BMPs.

6.4.5 Outreach to Quasi-Governmental Agencies/Districts

The City works to reach agencies such as water districts, school districts, transportation agencies, utility districts, fire and police departments and service providers (i.e. waste haulers).

The following approaches have been identified:

- Providing regulatory and BMP information based on the industry (i.e., information about oil spills and cleanup methods for transportation agencies);
- Forming partnerships with agencies to help distribute information through means such as billing inserts;
- Educating personnel during inspections or other interaction with municipal personnel; and
- Assisting school districts with education programs that meet the Phase I public education requirements.

6.4.6 Residential, General Public and School Outreach

Outreach to Residential Community and General Public

Educating the residential community and general public within the City of Laguna Niguel is key to a successful outreach plan. The City has opportunities to supplement the Countywide Program through its daily interactions with its citizenry and in accordance with the Residential Program described above in **Section A-6.2.7**, in **DAMP Section 9.5 and Section A-9.5** of this LIP.

The following approaches have been identified:

- Publishing information about urban runoff and stormwater pollution issues on the City's website and providing links to other related websites such as H2OC.org;
- Maintaining a supply of brochures and promotional materials at public buildings including City Hall, libraries and community centers;
- Running information on the City's community access channel;
- Participating in community events by hosting a booth with information and promotional materials;
- Participating in and promoting clean-up events such as the annual Cleanup Day;
- Presenting information to community or social groups, as requested;
- Writing and distributing news releases with seasonal tips or notices of events;
- Adding stormwater logo and website information to appropriate City vehicles;

- Storm drain stenciling reminding residents that materials entering the storm drain goes to the ocean;
- Working with other jurisdictions, including the Principal Permittee and other Permittees, on joint outreach programs;
- Publicizing the countywide 24-hour water pollution reporting hotline number 1-877-89SPILL or www.myoceservices.ocgov.com, which handles water pollution complaints. All inquiries about stormwater and public education materials can be made via H2OC.org; and
- Providing the public with opportunities to participate in the development, implementation, and refinement of the WQIP, and publishing details of these opportunities on the City's website.

Outreach to School Children

Education activities targeting school children informs the next generation of adults at an early age and can be a conduit for providing information to parents. The following approaches have been identified for school children:

- Offering child-friendly brochures, coloring books or promotional materials to schools and school districts within the City;
- Sending information to schools regarding activities like creek clean-up events;
- Offering to provide speakers or educational materials such as video clips for assemblies;
- Sponsoring assemblies directly relating to urban runoff and stormwater pollution; and
- Participating in the Countywide Program to develop a comprehensive school program in conjunction with the Principal Permittee and other Permittees, water agencies and school districts.

6.4.7 Jurisdictional Program Effectiveness Assessment

The City of Laguna Niguel reports results of its public education and outreach efforts on an annual basis in its Program Effectiveness Assessment (PEA). Evaluation of the Model Public Education Program will be conducted annually in the WQIP Annual Report.

A-7.0 NEW DEVELOPMENT/SIGNIFICANT REDEVELOPMENT COMPONENT

A-7.1 Introduction

Watershed urbanization can adversely impact waterways and coastal waters and give rise to the symptoms of Urban Stream Syndrome (See **Section A-1.1**). To reduce these impacts, the city has established design standards for new development and significant redevelopment projects that require implementation of BMPs including Low Impact Development (LID) techniques, hydromodification controls, source controls and treatment controls. Implementation of these design standards ensures that the hydrologic impacts that can arise from watershed imperviousness are mitigated and consequently this key element of the Program addresses all of the HPWQCs identified in the WQIP.

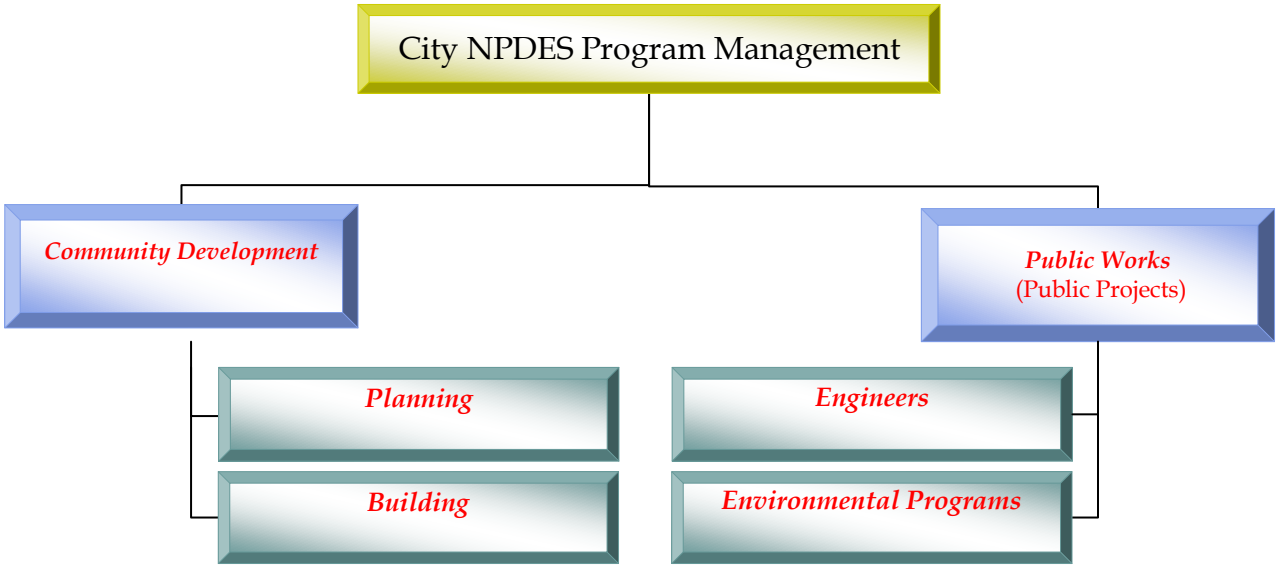
A-7.1.1 Program Overview

The New Development and Significant Redevelopment Program links new development BMP design, construction and operation to the earlier phases of new development project planning encompassed by the Laguna Niguel General Plan, environmental review process and discretionary development planning and review and approval processes. The General Plan specifies policies that guide new development. The environmental review process examines impacts from proposed new development with respect to the General Plan policies and many environmental issues, including water quality, and includes consideration of mitigation measures to reduce any identified significant impacts.

The development planning and permit approval processes carry forward requirements in the form of CEQA commitments and mitigation measures, conditions of approval, design specifications, tracking, and inspection and enforcement actions. These three "front-end" planning processes must be coordinated and linked to the later phases of BMP design, construction and operation for new development/significant redevelopment to help ensure stormwater quality protection features are planned, evaluated and selected, and designed in accordance with goals for the protection of water quality and other environmental resources.

The key staff that is responsible for overseeing, implementing, and enforcing the new development/redevelopment program is identified in **Figure A-7-1**.

Figure A-7.1 New Development/Redevelopment Program Management Organization Chart



Community Development Department

30111 Crown Valley Pkwy
Laguna Niguel, CA 92677

The Community Development Department is responsible for:

- Implementing the policies and objectives of the City set forth in the General Plan and Zoning Ordinance
- Reviewing proposed developments for consistency with standards and policies relating to land use, and preservation of the environment
- Preparing for and supporting discretionary review and approval actions taken by the Planning Commission and City Council related to new development and significant redevelopment projects
- Overseeing that all building construction complies with adopted codes, and that permitting and licensing systems are efficient and serve the needs of the public, as well as the City.

Public Works Department
30111 Crown Valley Pkwy
Laguna Niguel, CA 92677

The ***Public Works Department*** is responsible for:

- Administration of public improvement projects and ensuring construction in the public right-of-way complies with adopted codes and engineering standards.
- Administration of building improvement projects and ensuring construction complies with adopted codes and engineering standards.

A-7.2 General Plan Assessment

During the period of the Fifth Term Permit, the city reviewed and revised as necessary its General Plan or equivalent plan, (e.g., Comprehensive, Master, or Community Plan) for the purpose of providing effective water quality and watershed protection principles and policies that direct land-use decisions and require implementation of consistent water quality protection measures for all development and redevelopment projects.

A-7.3 CEQA Environmental Review Process

During the period of the Fifth Term Permit Term, the city reviewed and revised as necessary its environmental review process to include requirements for evaluation of water quality effects and identification of appropriate mitigation measures.

A-7.4 Development Project Review, Approval and Permitting

A-7.4.1 Project Review, Approval, and Permitting Process Overview

During project review, approval, and permitting, the City shall require new development and significant redevelopment projects to address the quality and quantity of stormwater runoff through the incorporation of permanent (post-construction) BMPs in project design. The City shall require project-specific Water Quality Management Plans (Project WQMPs) for all private and public projects that:

- Qualify as one of the Priority Project Categories listed in **Table A-7.1**.

The City shall require completion of a project-specific Non-Priority Project Water Quality Checklist for all public and Private Projects that:

- Do not qualify as one of the Priority Project Categories but meet one of the following criteria:
  - Fall under the planning and building authority of the city
  - Do not meet any of the Priority Development Project categories, and
  - Have a significant nexus to water quality.

Table A-7.1. Priority Project Categories

Priority Project Categories
New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.
New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).
New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets (RGOs). This category includes RGOs that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.
New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction

The Model WQMP and TGD contain all the information specified for the BMP Design Manual and should for purposes of compliance be considered to be a BMP Design Manual[1] .

The primary difference between a Priority Project and a Non-Priority Project is that Priority Projects are required to fully evaluate and incorporate LID BMPs to meet the quantitative requirements of the Permit and/or demonstrate infeasibility and participate in alternative compliance options. Non-Priority Projects must incorporate all applicable source control BMPs, and incorporate to the extent possible site design BMPs. LID BMPs and implement LID BMPs where applicable and feasible.

A-7.4.2 Public Agency Projects

The City has incorporated the requirement for a Project WQMP into the process of planning, design, approval, and construction oversight of its public agency projects that qualify as Priority Projects based on similar characteristics as one of the categories listed in **Table A-7.1** Depending upon the type of public agency project being planned or designed, the City's or the design architect/engineering contractor will prepare the Project WQMP for a public facility project.

The City may develop a separate "Master Project WQMP" for all anticipated future projects with similar characteristics based upon the requirements outlined in this document. A Master Project WQMP would list all of the qualifying streets, roads, and highways projects anticipated to occur within the City's jurisdiction over a given time period and the proposed methods of compliance with this Model WQMP.

Non-Priority Project Water Quality Checklist is required to be completed for private new development and significant redevelopment projects, and equivalent public agency capital projects that qualify as Non-Priority Projects. Additional information regarding Non-Priority Projects can be found in the Model WQMP Section 1.3.2.

A-7.4.4 Review and Approval of Project WQMPs

Project WQMPs are required to be submitted as conceptual or preliminary during the discretionary or land use entitlement phase, with the level of detail to ensure the project design meets the LID permit requirements. The level of detail in a Conceptual/Preliminary Project WQMP can vary somewhat depending upon the level of detail known at the time discretionary project approval is sought, but the minimum requirements listed in the Model WQMP and TGD must be satisfied. The city may request additional information and submittal before approving a Conceptual/Preliminary Project WQMP.

The review and approval of a Project WQMP is one of the last critical points at which the city can impose conditions or standards that will minimize the impacts of urban runoff and stormwater pollution on local water resources. The city may request additional information and submittal before approving a Project WQMP. Prior to issuance of grading or building permits, the project applicant must update the Conceptual/Preliminary Project WQMP and submit the completed

[1] The BMP Design Manual was previously referred to as the Standard Storm Water Mitigation Plan under Order No. R8-2009-0002.

Project WQMP for review and approval. The Model WQMP and TGD will be used as a guide for preparation of a Conceptual/Preliminary WQMP and/or a Project WQMP. The WQMP Template can be used by a project proponent to complete a Preliminary/Conceptual and/or Final WQMP for a specific project.

When reviewing Conceptual/Preliminary WQMPs and Project WQMPs submitted for approval, Permittees will assess the potential project impacts on receiving waters and ensure that the Project WQMP adequately identifies such impacts, including all pollutants and conditions of concern. The city will examine all identified BMPs, as a whole, to ensure that they address the pollutants and conditions of concern identified within the Project WQMP. LID and hydromodification control BMPs should be considered and incorporated at the earliest conceptual planning stages of a project for early review, to potentially avoid necessary project changes and delays during the review and approval process. For all projects requiring discretionary or land use entitlement actions, a Conceptual or Preliminary WQMP should be submitted as part of the application for project approval during the environmental review phase (CEQA) and must be submitted prior to approval of entitlements and Planning Commission approval of a project or other public hearing.

The City will determine when a Conceptual or Preliminary WQMP must be submitted during the planning process for different planning actions which may vary depending upon the phase of planning for the Project. However, it is strongly recommended that the Conceptual or Preliminary WQMP be prepared and submitted during the preparation of environmental documentation for compliance with CEQA. The local jurisdiction will assure that a final Project WQMP is submitted for review and approval prior to issuance of grading or building permits.

A Conceptual or Preliminary WQMP supports the CEQA process and provides documentation to support a checklist for an initial Study and Negative Declaration or Mitigated Negative Declaration, or serves as the basis for the water quality section of an EIR. It should also serve as the basis for the Lead Agency and Responsible Agency to conclude that the MEP standard is being met by serving as the basis that selected BMPs will not have the potential to cause significant effects and/or that the effects have been mitigated, and "are not significant with mitigation". The Conceptual or Preliminary WQMP should be circulated with the CEQA document or summarized within the circulated CEQA document.

The Final Project WQMP must be consistent with the Conceptual or Preliminary WQMP. If there are any substantial differences, the City must make a determination that the differences do not diminish the effectiveness of the BMPs to mitigate or address the project's potential impacts to water quality. Furthermore, any changes must not result in any new environmental impacts not previously disclosed in the local jurisdiction's circulated environmental document(s). If the changes diminish the project's ability to mitigate or address its water quality impacts, or result in previously undisclosed environmental impacts, the City should require that the project be subject to further environmental review.

The Permittees recognize the importance of understanding the physical, chemical and biological conditions of the receiving waters at a watershed scale and the impact of incremental projects on these conditions and will continue to enlarge their understanding of receiving waters on a watershed scale through implementation of the watershed chapters of the DAMP. This information will assist in providing a strong linkage between the planning process and the development review and permitting process as required by the Permits. The Project WQMP is a

project planning level document and as such is not expected to contain final BMP design drawings and details (these will be in the construction plans). However, the Project WQMP must identify and locate selected BMPs, provide design parameters including hydraulic sizing of treatment BMPs and contain sufficient BMP detail to ensure the BMPs are adequately sized. BMP fact sheets can be used in conjunction with project-specific design parameters and sizing to convey design intent. The TGD contains a number of BMP fact sheets that can be used for most LID BMPs. There are a number of resources listed in the Model WQMP for Site Design, Source Control, and Treatment Control BMPs that should be considered to guide the design and implementation of the BMPs.

A-7.4.5 Review and Approval of Non-Priority Project Water Quality Plans

The review and approval of a Non-Priority Project Water Quality Checklist follows similar considerations as review of Project WQMPs. The Non-Priority Project Water Quality Checklist is provided in the Model WQMP Section 1.3.2.

A-7.4.6 Plan Check: Issuance of Grading or Building Permits

The construction plans submitted by the applicant for plan check must incorporate all of the structural BMPs identified in an approved Project WQMP. Therefore, the City will require applicants to obtain approval of the final Project WQMP prior to issuing a building or grading permit.

The final Project WQMP must include calculations to support the structural integrity of the selected LID or treatment control BMP as appropriate and be prepared by or under the direction of a California Registered Civil Engineer and affixed with their stamp.

Plan Check for Private Projects with Land Use Permits

For projects with land use permits, the City shall review the environmental (CEQA) documentation (including the Mitigation Monitoring and Reporting Program), the conditions of approval and the approved Project WQMP for an understanding of the water quality issues and structural BMPs required. The City shall review construction plans for conformity with the approved Project WQMP. If the selected BMPs were approved in concept during the land use entitlement process, the City shall require the applicant to submit detailed construction plans showing locations and design details of all BMPs that are in substantial conformance with the preliminary approvals. The City shall review a project's construction plans to assure that the plans are consistent with the BMP design criteria and guidance provided in **DAMP Section 7, Exhibit 7.III.**

Plan Check for Projects with By-Right Zoning (Ministerial Projects)

For qualifying projects with by-right zoning or projects that do not involve discretionary authority and review, applicants will typically submit a grading or building permit application consisting of a proposed Project WQMP or Non-Priority Project Water Quality Checklist as applicable and construction plans that incorporate the BMPs included in the proposed Project WQMP or Non-Priority Project Water Quality Plan. The Permittee shall first review the proposed Project WQMP or Non-Priority Project Water Quality Checklist for conformity with the

requirements described in Model WQMP and TGD. The approved Project WQMP or Non-Priority Project Water Quality Checklist shall then be used in reviewing the construction plans for consistency with the BMP design criteria.

Plan Check for Public Agency Projects

Prior to initiating grading or construction activities, the City shall ensure that the construction plans for its public works projects reflect the structural BMPs described in the approved Project WQMP. In conducting the design review process for its public agency projects, the City shall review the construction plans and specifications for conformity with the approved Project WQMP and for consistency with the BMP design criteria and guidance provided in **Model WQMP and TGD**.

A-7.4.7 Permit Closeout, Certificates of Use, and Certificates of Occupancy

The Project WQMP continues with the property after the completion of the construction phase the City may require that the terms, conditions and requirements be recorded with the County Recorder's office by the property owner or any successive owner as authorized by the Water Quality Ordinance.
The end of the construction phase therefore represents a transition from the New Development/Significant Redevelopment Program to the Existing Development Program (**Section A-9)**. Accompanying this is a close out of permits and issuance of certificates of use and occupancy. The City will use this juncture to assure satisfactory completion of all requirements in the Project WQMP by requiring the applicant to:

- Demonstrate that all structural BMPs described in the Project WQMP have been constructed and installed in conformance with approved plans and specifications,
- Demonstrate that an O&M Plan has been approved for all structural BMPs within the Project WQMP,
- Demonstrate that a mechanism or agreement acceptable to the City has been executed for the long-term funding and performance of BMP operation, maintenance, repair, and/or replacement.
- Demonstrate that the applicant is prepared to implement all non-structural BMPs described in the Project WQMP,
- Demonstrate that an adequate number of copies of the Project WQMP are available onsite, and
- For industrial facilities subject to California's General Permit for Stormwater Discharges Associated with Industrial Activity as defined by Standard Industrial Classification (SIC) code, demonstrate that coverage has been obtained by providing a copy of the Notice of Intent (NOI) submitted to the State Water Resources Control Board and a copy of the notification of the issuance of a WDID Number.

The O&M Plan for structural BMPs that is prepared by the applicant for private sector projects shall describe and/or include:

- Structural BMPs
- Employee responsibilities and training for BMP operation and maintenance
- Operating schedule
- Maintenance frequency and schedule
- Specific maintenance activities
- Required permits from resource agencies, if any
- Forms to be used in documenting maintenance activities
- Recordkeeping requirements (at least 5 years)

At a minimum, the City shall require the annual inspection and maintenance of all structural BMPs.

Following satisfactory inspection, those structural BMPs agreed during the planning process to be within City right-of-ways, or on land to be dedicated to City ownership will be accepted. Upon acceptance, responsibility for operation and maintenance will transfer from the developer or contractor to the appropriate City department, including the funding mechanism identified in the approved final Project WQMP.

If a property owner or a private entity, such as a homeowners association (HOA), retains or assumes responsibility for operation and maintenance of structural BMPs, the Permittee shall require access for inspection through an agreement or other means. The HOA shall be required to maintain the BMPs in operating condition.

If the Permittee will be responsible for operating and maintaining structural BMPs on private property, an easement will be established to allow for entry and proper management of the BMPs. Such access easements shall be binding throughout the life of the project, or until the BMPs requiring access are acceptably replaced with a BMP not requiring access. Funding for the long-term operation and maintenance of structural BMPs will be front-funded or otherwise guaranteed via mechanisms such as approved assessment districts, or other funding mechanisms.

Public Agency Projects

For public agency projects, upon completion of construction when contract close-out occurs, the responsibility for operation and maintenance of the structural BMPs will transfer from the contractor to the appropriate Permittee department and become part of the Municipal Activities Program (Section A-5). The Permittee has the authority to approve the transfer of structural BMPs to any other public entity within its jurisdiction and shall negotiate satisfactory operation and maintenance standards with the public agencies accepting the operation and maintenance responsibilities. Alternatively, the responsibility for the operation and maintenance of structural BMPs may be transferred to a private entity through contracts or lease agreements. In any such transfer agreement, the Permittee shall be identified as a beneficiary empowered to enforce maintenance agreements.

A-7.5 Project Water Quality Management Plan (WQMP) Preparation

In accordance with the requirements in the Development Project Review, Approval and Permitting process stated previously, the City will require Conceptual or Preliminary WQMPs and final Project WQMPs for certain new development and significant redevelopment projects called "Priority Development Projects." A Non-Priority Project Water Quality Checklist is required to be completed for private new development and significant redevelopment projects, and equivalent public agency capital projects that qualify as Non-Priority Projects. Additional information regarding Non-Priority Projects can be found in the Model WQMP Section 1.3.2.

Conceptual or Preliminary WQMPs and final Project WQMPs are to be prepared using the guidelines set forth in Model WQMP Section 4.3

A-7.5.1 Project WQMP Requirements

The purpose of the Project WQMP is to define project features and BMPs that will mitigate the project's impact on water quality and the environment. In order to complete a Project WQMP, the following steps will need to be performed:

1. Determine discretionary permits and WQ conditions that may apply **– Model WQMP Section 2.1**
2. Describe the project **– Model WQMP Section 2.2**
3. Assess the site **– Model WQMP Section 2.3**
4. Develop and select BMPs, including LID BMPs, site design BMPs, hydromodification control BMPs, and source control BMPs **– Model WQMP Section 2.4, 2.5 and 2.6.**
5. Determine any applicable alternative compliance approaches **– Model WQMP Section 3.0**
6. Identify parties responsible for BMP maintenance and funding sources **– Model WQMP Section 2.8**

The steps are discussed in further detail in the Model WQMP.

A-7.6 Education and Training

To assist responsible municipal staff and contract staff in understanding the 2017 Model WQMP and TGD, training sessions will be conducted at least annually and/or on-line training will be available. In addition to Permittee sponsored training, staff may also attend training seminars or workshops related to general water quality and stormwater management during construction, conducted by other organizations.

A-8.0 CONSTRUCTION COMPONENT

A-8.1 INTRODUCTION

Construction and grading activities are a potential source of pollutants in all phases of execution. Consequently, effective management of construction projects occurs throughout the City by implementing ordinances, performing inspections, requiring BMPs and undertaking enforcement actions. Local regulatory oversight of construction therefore directly supports both the principal requirements of the Fifth Term Permit and effectively addresses two of the HPWQCs identified in the WQIP, specifically, unnatural water balance in dry weather and pathogen health risk.

A-8.1.1 Program Overview

The following sections present a detailed set of guidelines to prevent or minimize the impacts of urban runoff generated by construction activities within the City on receiving water bodies.

The following section outlines and describes the City departments that are involved in issuing building and/or grading permits for private development projects and are responsible for inspecting these projects during construction, or that manage public works construction projects that have a potential to impact water quality.

Public Works Department

The Public Works Department develops, builds and maintains the City's infrastructure, including streetscapes, open space, parks, athletic fields, bike trails, roadways, traffic signals and many miles of interconnected drainage system. They are also responsible for the administration of public improvement projects (typically result in construction activity). The Engineering Division ensures all construction in the public right-of-way complies with adopted codes and engineering standards.

Planning Department

The Planning Department is responsible for implementing the policies and objectives of the community as set forth in the municipality’s General Plan and Zoning Ordinance. This Department also reviews proposed developments for consistency with the City's standards and policies relating to land use, and preservation of the environment, to ensure that the quality of life will be maintained or enhanced for future generations.

The Building Department ensures that all building construction in the City complies with adopted codes, and that permitting and licensing systems are efficient and serve the needs of the public, as well as the City.

A-8.1.2 Program Commitments

The major program commitments and the subsections in which they are described in detail include:

- Maintain/update inventories of construction sites (**A-8.2.2**);
- Prioritize fixed facilities, construction sites (**A-8.2.3**);
- BMPs for construction sites (**A-8.2.4**);
- Documentation requirements (**A-8.2.5**);
- Inspection and enforcement (**A-8.2.6**); and
- Education and training (**A-8.3**).

A-8.1.3 Regulatory Requirements

The Model Construction Program was developed to fulfill the municipal activity commitments and requirements of:

- Section E.4 of the San Diego Regional Water Quality Control Board Municipal NPDES Stormwater permit, Order No. R9-2013-0001 as amended by Order Nos. R9-2015-0001 and R9-2015-0100.

A-8.2 MODEL CONSTRUCTION PROGRAM

A.8.2.1 Model Program Overview

The City has incorporated the model construction program described in **DAMP Section 8.2** as the basis for this section of its LIP/ JRMP. This construction program presents requirements and guidelines for pollution prevention methods that must be used by construction site owners, developers, contractors, and other responsible parties, in order to prevent illicit discharges into the MS4, implement and maintain structural and non-structural BMPs to reduce pollutants in stormwater runoff from construction sites to the MS4, reduce construction site discharges of stormwater pollutants from the MS4 to the maximum extent practicable (MEP), and prevent construction site discharges from the MS4 from causing or contributing to a violation of water quality standards.

A-8.2.2 Inventory of Construction Sites

A watershed-based inventory of all construction sites has been developed including sites covered by the State's Construction General Permit[1], a local grading permit or a local building permit, and public works construction projects.

The City's comprehensive watershed-based construction site inventory is are maintained in compliance with Provision E.4.. The inventory will at a minimum be updated prior to the start of each wet season (October 1). During the update process, projects for which building or

[1] State Water Resources Control Board (SWRCB) Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity

grading permit(s) have expired or have been closed, and projects that have been completed, will be removed from the inventory. New projects will also be added to the inventory as they are initiated.

A-8.2.3 Prioritization of Construction Sites

After the inventory is compiled, construction projects are prioritized based on the nature and size of the construction activity, topography, and the characteristics of soils and receiving water quality. Priorities will at a minimum be updated annually in conjunction with the annual update of the inventory.

A-8.2.4 BMPs for Construction Projects

All construction projects, regardless of size, are required to implement BMPs to prevent discharges into the storm drain system or watercourses. The City has established a minimum set of BMPs and other measures to be implemented at all construction sites year round. BMP implementation requirements may vary seasonally (wet and dry seasons); however, dry season BMP implementation must plan for and address unseasonal rain events that may occur during the dry season.

All private and public works projects are required, at a minimum, to implement and be protected by an effective combination of erosion and sediment controls and waste and materials management BMPs. The minimum requirements are summarized in **Table A-8.1**. These minimum requirements are conveyed to construction contractors as part of the permit conditions and plan notes. In addition, they are reviewed as a part of the pre-construction meeting for projects that require a meeting with the inspector and/or project manager prior to beginning work.

Table A-8.1
Minimum Requirements for All Construction Sites

CATEGORY	MINIMUM REQUIREMENTS
Management Measures	i. Pollution prevention where appropriate; ii. Development and implementation of a site specific run-off management plan; iii. Minimization of areas that are cleared and graded to only the portion of the site that is necessary for construction; iv. Minimization of exposure time of disturbed soil areas; v. Minimization of grading during the wet season and correlation of grading with seasonal dry weather periods to the extent feasible; vi. Limitation of grading to a maximum disturbed area as determined by the City before either temporary or permanent erosion controls are implemented to prevent stormwater pollution. The City has the option of temporarily increasing the size of disturbed soil areas by a set amount beyond the maximum, if the individual site is in compliance with applicable stormwater regulations and the site has adequate control practices implemented to prevent stormwater pollution; vii. Temporary stabilization and reseeding of disturbed soil areas as rapidly as feasible; viii. Wind erosion controls; ix. Tracking controls; x. Non-stormwater management measures to prevent illicit discharges and control stormwater pollution sources; xi. Waste management measures; xii. Preservation of natural hydrologic features where feasible; xiii. Preservation of riparian buffers and corridors where feasible; xiv. Evaluation and maintenance of all BMPs, until removed; and xv. Retention, reduction, and proper management of all stormwater pollutant discharges on site to the MEP standard.
Erosion and Sediment Controls	i. Erosion prevention is to be used as the most important measure for keeping sediment on site during construction; ii. Sediment controls are to be used as a supplement to erosion prevention for keeping sediment on-site during construction; i. Slope stabilization must be used on all active slopes during rain events regardless of the season and on all inactive slopes during the rainy season and during rain events in the dry season; and ii. Permanent revegetation or landscaping as early as feasible.

Enhanced BMPs

The City requires enhanced or additional BMPs should the project site pose an exceptional threat to water quality. In determining the potential threat, the City considers the following factors:

a) Soil erosion potential or soil type;
b) Site slopes;
c) Project size and type;
d) Sensitivity and proximity to receiving water bodies;
e) Non-stormwater discharges;
f) Ineffectiveness of other BMPs;
g) Proximity and sensitivity of aquatic threatened and endangered species of concern;
h) Known effects of Advanced Sediment Treatment (AST) chemicals; and
i) Any other relevant factors

If an exceptional threat to water quality is determined based on the above factors, the City will require implementation of advanced treatment for sediment at construction sites (or portions thereof).

Construction BMPs

The City has designated construction-specific BMPs as set forth in **DAMP Section 8.2.4.3**. **Table A-8.2**, below describes the BMPs designated for use with this LIP/JRMP. Copies of the corresponding BMP fact sheets are included as **Exhibit A-8.I**.

Table A-8.2
Designated Construction BMPs

CATEGORY	BMP #	BMP NAME
Erosion Control BMPs	EC-1	Scheduling
	EC-2	Preservation of Existing Vegetation
	EC-3	Hydraulic Mulch
	EC-4	Hydroseeding
	EC-5	Soil Binders
	EC-6	Straw Mulch
	EC-7	Geotextiles and Mats
	EC-8	Wood Mulching
	EC-9	Earth Dikes and Drainage Swales
	EC-10	Velocity Dissipation Devices
	EC-11	Slope Drains
	EC-12	Streambank Stabilization
	EC-13	*Reserved*
	EC-14	Compost Blanket
	EC-15	Soil Preparation/Roughening
	EC-16	Non-Vegetative Stabilization
Sediment	SE-1	Silt Fence

Table A-8.2
Designated Construction BMPs

CATEGORY	BMP #	BMP NAME
Control BMPs	SE-2	Sediment Basin
	SE-3	Sediment Trap
	SE-4	Check Dam
	SE-5	Fiber Rolls
	SE-6	Gravel Bag Berm
	SE-7	Street Sweeping and Vacuuming
	SE-8	Sandbag Barrier
	SE-9	Straw Bale Barrier
	SE-10	Storm Drain Inlet Protection
	SE-11	Active Treatment Systems
	SE-12	Temporary Silt Dike
	SE-13	Compost Socks and Berms
	SE-14	Biofilter Bags
Wind Erosion Control BMPs	WE-1	Wind Erosion Control
Tracking Control BMPs	TC-1	Stabilized Construction Entrance/ Exit
	TC-2	Stabilized Construction Roadway
	TC-3	Entrance/Outlet Tire Wash
Non-Stormwater Control BMPs	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	Concrete Finishing
	NS-14	Material and Equipment Use Over Water
	NS-15	Structure Demolition/Removal Over or Adjacent to Water
	NS-16	Temporary Batch Plants
Waste Management & Materials Pollution Control BMPs	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

Table A-8.2
Designated Construction BMPs

CATEGORY	BMP #	BMP NAME
	WM-8	Concrete Waste Management
	WM-9	Sanitary/ Septic Waste Management
	WM-10	Liquid Waste Management

A-8.2.5 Documentation Requirements

Requirements for Construction General Permit Sites

Construction sites that are subject to the Construction General Permit are required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) meeting the requirements of the Construction General Permit.

Private Construction Projects Covered by the Construction General Permit

The following bullets describe the process that is followed by a private construction project:

- The project owner, developer or contractor is responsible for preparing the Notice of Intent (NOI), which must be signed by the owner or person delegated authority and submitted to the State Water Resources Control Board (SWRCB) via the Stormwater Multi-Application, Reporting, and Tracking System (SMARTS). Before issuing a grading or building permit, the City will require proof of Construction General Permit coverage (See conditions of approval **Section A-7.4.3**).
- Once the project owner, developer or contractor receives a grading or building permit (if applicable), the SWPPP must be prepared by Qualified SWPPP Developer (QSD), and signed by the responsible party and must be implemented year-round throughout the duration of the project's construction. City staff are not responsible for reviewing, approving or enforcing the SWPPP; these are responsibilities of the Regional Board. Inspector(s) may choose to use the SWPPP as a tool for on-site inspections.
- The City will inspect and enforce local permit(s) and ordinances, and will notify the Regional Board of non-compliance when the non-compliance meets the criteria of posing a threat to human or environmental health as discussed in **DAMP Section 8.4.6**.
- Within 90 days of when construction is complete or ownership has been transferred, the discharger shall electronically file a Notice of Termination (NOT), a final site map, and photos through the SWRCB SMARTS system. Filing a NOT certifies that all Construction General Permit requirements have been met.

Public Agency Construction Projects Covered by the General Permit

The following bullets describe the process that is followed by a public works construction project:

- The City will prepare all Permit Registration Documents (PRDs) and submit it to the SWRCB through the SMARTS system.
- The SWPPP will be prepared by a QSD, before the contractor is allowed to start construction activities. It is important to note that city staff is not responsible for enforcing the SWPPP, these are responsibilities of the Regional Water Quality Control Board; but inspectors are required to become familiar with the SWPPP as it is part of the contract documents.
- During construction, the City will inspect and enforce the contract documents and will notify the appropriate Regional Board when non-compliance meets the criteria of posing a threat to human or environmental health as discussed in Section 8.2.6.7 of the DAMP.
- Once the project is completed, the City will submit an NOT to the SWRCB.

Requirements for Other Sites

Private Construction Projects Not Covered by the Construction General Permit

Private construction projects not covered by the Construction General Permit, but covered under a grading permit, are required to develop Erosion and Sediment Control Plans (ESCPs). These ESCPs must show proposed locations of the erosion and sediment control BMPs that will be implemented during the construction project to comply with the minimum requirements listed in **Table A-8.1**.

Public Works Construction Projects Not Covered by the Construction General Permit

Public agency construction projects not covered by the Construction General Permit comply with appropriate pollution prevention control practices in accordance with the current edition of the "Green Book" Standard Specifications for Public Works Construction and the provisions of **Section A-8**, and shall develop and implement ESCPs.

A-8.2.6 Municipal Inspections and Enforcement

Inspection Responsibilities

The City performs inspections of construction sites to verify that the requirements for water quality protection are being implemented and maintained, that they appropriately comply with local permits and ordinances and the Construction General Permit, and that they continue to protect water quality. Construction sites are inspected, according to the established priority, until construction activity is complete.

Inspection Frequencies

The City will inspect construction sites based upon the priority of the project. The frequency of construction site inspections is shown in **Table A-8.3**.

Table A-8.3

Inspection Frequency of Construction Projects Based on Construction Site Priority

Inspection Criteria Priorities for inspecting sites must consider the nature and size of the construction activity, topography, and the characteristics of soils and receiving water quality.	**Rainy Season Inspection Frequency (Oct 1 - April 30)**	**Dry Season Inspection Frequency (May 1 - Sept 30)**
Construction sites within the City's jurisdiction meeting any of the following criteria: • Any site 30 acres or larger • Any site 1 acre or larger and tributary to a CWA section 303(d) water body segment impaired for sediment or within or directly adjacent to, or discharging directly to, the ocean or a receiving water within an ESA • Other sites determined by the Copermittees or the Regional Board as a significant threat to water quality.	Biweekly	Annually in August or September
Construction sites with one acre or more of soil disturbance not meeting the criteria specified for 'high' priority sites	Monthly	As Needed
Construction sites that are less than one acre in size	As Needed	As Needed
** Reinspection frequencies is determined based upon the severity of deficiencies, the nature of the construction activity, and the characteristics of soils and receiving water quality. **		

Inspection Documentation Procedures

The City's construction site inspection checklist is included in **Exhibit A-8.V**. Records of all inspections and non-compliance reporting will be retained for a period of at least five years.

Enforcement Actions

Enforcement of construction projects will be undertaken by the City's inspectors and/or other staff who possess internal enforcement authority through established policies and procedures. Threat to water quality will be assessed by inspectors for construction site runoff that will not be reasonably controlled by the BMPs in place or if a failure of BMPs is resulting in the release of sediments or other pollutants. Violations observed will be documented by the inspectors.

If a significant and/or immediate threat to water quality is observed by an inspector, action will be taken to require the developer/contractor to immediately cease the discharge. Consistent with Enforcement Response Plan (see **Exhibit A-4.1**) **Table A-8.4** outlines the City's enforcement steps that will be taken by inspectors for private construction projects and for public works construction projects. Depending on the violation, the inspector may choose to utilize contract language, a local permit, the grading ordinance or the water quality ordinance as the basis for enforcement.

Table A-8.4
Enforcement Actions for Construction Problems

PRIVATE CONSTRUCTION PROJECTS		**PUBLIC WORKS CONSTRUCTION PROJECTS**
Verbal Warning		Verbal Warning
Written Warning ▪ Correction Notice ▪ Notice of Violation ▪ Administrative Citations or Fines	← WARNING PROGRESSION	Written Warning ▪ Correction Notice ▪ Notice of Violation ▪ Administrative Citations or Fines ▪
Stop Work Order		Enforcement of Contract ▪ Stop Work Order ▪ Withholding of Payment ▪ Bond ▪ Fines ▪ Revocation of Contract
Revocation of Permit(s) and/or Denial of Future Permits		
Civil and Criminal Court Actions		Civil and Criminal Court Actions

City approved enforcement forms used by inspection staff are provided in **Exhibit A-8.VI**.

Non-Compliance Reporting

The City will consider a site non-compliant when one or more violations of local ordinances, permits, or plans exist on the site. For the purpose of this document, such a violation shall also be considered a violation of the Construction General Permit for sites subject to those requirements. If a non-compliant private construction project meets the criteria of posing a threat to human or environmental health as discussed in of the **DAMP Section 8.2.6.7**, then the Regional Board will be notified as required.

Oral notification to the Regional Board of non-compliant private construction sites that are determined to pose a threat to human or environmental health will be provided within 24-hours of the discovery of non-compliance. Such oral notification shall be followed up by a written report and submitted to the Regional Board within 5 days of the incidence of non-compliance. Written notification(s) will identify the type(s) of non-compliance, describe the actions necessary to achieve compliance, and include a time schedule, subject to the modifications by the Regional Boardindicating when compliance will be achieved.

The City will notify the Regional Board prior to the wet season, or shall include with their annual LIP update, a summary of all construction sites with alleged violations. Information provided shall include, but not be limited to, the following:

1. WDID number if enrolled under the Construction General Permit
2. Site Location, including address
3. Current violations or suspected violations

A form for evaluating the potential impacts to human or environmental health is provided in **Exhibit A-8.VII**

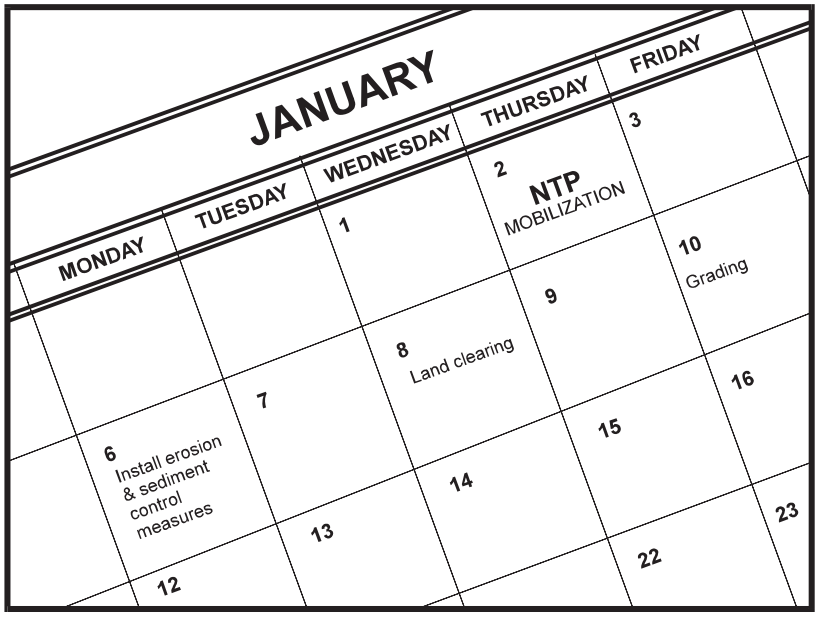
A-8.3 EDUCATION AND TRAINING

For an effective stormwater program to be efficiently implemented, its staff must have sufficient knowledge, experience, and skills. he Principal Permittee will coordinate, develop and present a number of different training modules in accordance with *The Orange County Stormwater Program Training Program Framework: Core C*

Exhibit A-8.I

Construction BMPs Fact Sheets

Scheduling EC-1



Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. 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.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - 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.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

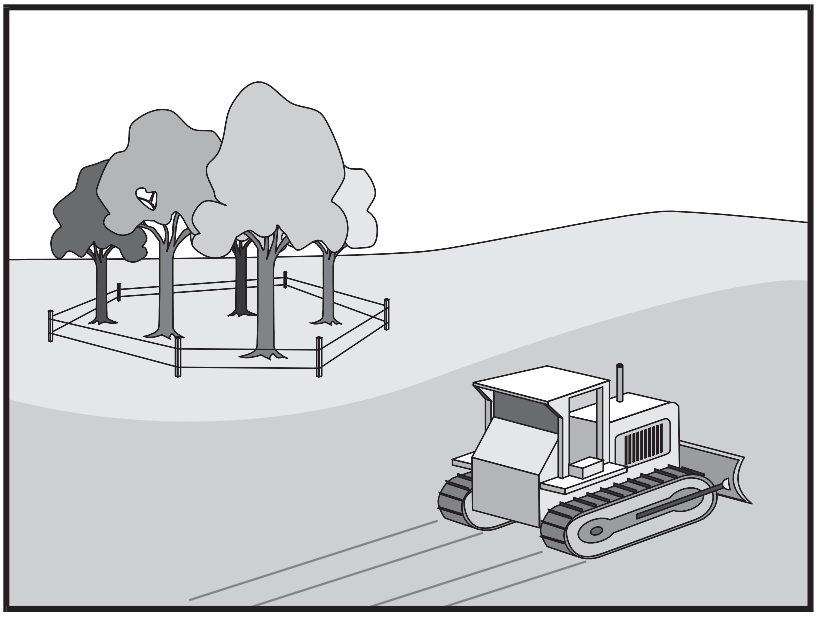
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

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

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far 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 or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

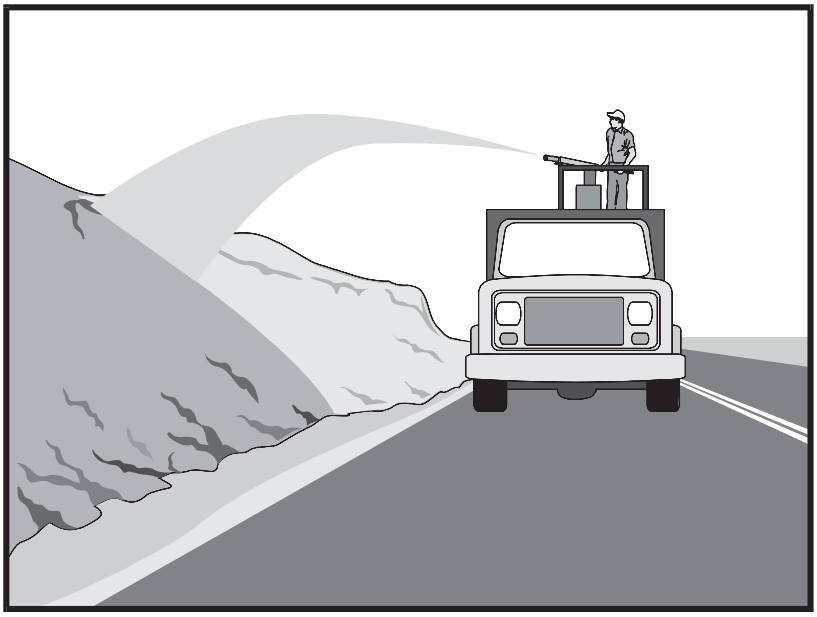
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch EC-3



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Hydraulic Mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

Suitable Applications

Hydraulic mulch as a temporary, stand alone, erosion control BMP is suitable for disturbed areas that require temporary protection from wind and water erosion until permanent soil stabilization activities commence. Examples include:

- Rough-graded areas that will remain inactive for longer than permit-required thresholds (e.g., 14 days) or otherwise require stabilization to minimize erosion or prevent sediment discharges.
- Soil stockpiles.
- Slopes with exposed soil between existing vegetation such as trees or shrubs.
- Slopes planted with live, container-grown vegetation or plugs.
- Slopes burned by wildfire.

Hydraulic mulch can also be applied to augment other erosion control BMPs such as:

- In conjunction with straw mulch (see EC-6 Straw Mulch) where the rate of hydraulic mulch is reduced to 100-500 lbs per acre and the slurry is applied over the straw as a tackifying agent to hold the straw in place.
- Supplemental application of soil amendments, such as fertilizer, lime, gypsum, soil bio-stimulants or compost.

Limitations

In general, hydraulic mulch is not limited by slope length, gradient or soil type. However, the following limitations typically apply:

- Most hydraulic mulch applications, particularly bonded fiber matrices (BFMs), require at least 24 hours to dry before rainfall occurs.
- Temporary applications (i.e., without a vegetative component) may require a second application in order to remain effective for an entire rainy season.
- Treatment areas must be accessible to hydraulic mulching equipment.
- Availability of water sources in remote areas for mixing and application.
- As a stand-alone temporary BMP, hydraulic mulches may need to be re-applied to maintain their erosion control effectiveness, typically after 6-12 months depending on the type of mulch used.
- Availability of hydraulic mulching equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Cellulose fiber mulches alone may not perform well on steep slopes or in course soils.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown and some may have water quality impacts due to their chemical makeup. Refer to specific chemical properties identified in the product Material Safety Data Sheet; products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.

Implementation

- Where feasible, it is preferable to prepare soil surfaces prior to application by roughening embankments and fill areas with a crimping or punching type roller or by track walking.
- The majority of hydraulic mulch applications do not necessarily require surface/soil preparation (See EC-15 Soil Preparation) although in almost every case where re-vegetation is included as part of the practice, soil preparation can be beneficial. One of the advantages of hydraulic mulch over other erosion control methods is that it can be applied in areas where soil preparation is precluded by site conditions, such as steep slopes, rocky soils, or inaccessibility.

- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Hydraulic mulching is generally performed utilizing specialized machines that have a large water-holding/mixing tank and some form of mechanical agitation or other recirculation method to keep water, mulch and soil amendments in suspension. The mixed hydraulic slurry can be applied from a tower sprayer on top of the machine or by extending a hose to areas remote from the machine.
- Where possible apply hydraulic mulch from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage and failure of the BMP.
- Hydraulic mulch can also include a vegetative component, such as seed, rhizomes, or stolons (see EC-4 Hydraulic Seed).
- Typical hydraulic mulch application rates range from 2,000 pounds per acre for standard mulches (SMs) to 3,500 pounds per acre for BFMs. However, the required amount of hydraulic mulch to provide adequate coverage of exposed topsoil may appear to exceed the standard rates when the roughness of the soil surface is changed due to soil preparation methods (see EC-15 Soil Preparation) or by slope gradient.
- Other factors such as existing soil moisture and soil texture can have a profound effect on the amount of hydraulic mulch required (i.e. application rate) applied to achieve an erosion-resistant covering.
- Avoid use of mulch without a tackifier component, especially on slopes.
- Mulches used in the hydraulic mulch slurry can include:
  - Cellulose fiber
  - Thermally-processed wood fibers
  - Cotton
  - Synthetics
  - Compost (see EC-14, Compost Blanket)
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Categories of Hydraulic Mulches

Standard Hydraulic Mulch (SM)

Standard hydraulic mulches are generally applied at a rate of 2,000 pounds per acre and are manufactured containing around 5% tackifier (i.e. soil binder), usually a plant-derived guar or psyllium type. Most standard mulches are green in color derived from food-color based dyes.

Hydraulic Matrices (HM) and Stabilized Fiber Matrices (SFM)

Hydraulic matrices and stabilized fiber matrices are slurries which contain increased levels of tackifiers/soil binders; usually 10% or more by weight. HMs and SFMs have improved performance compared to a standard hydraulic mulch (SM) because of the additional percentage of tackifier and because of their higher application rates, typically 2,500 – 4,000 pounds per acre. Hydraulic matrices can include a mixture of fibers, for example, a 50/50 blend of paper and wood fiber. In the case of an SFM, the tackifier/soil binder is specified as a polyacrylamide (PAM).

Bonded Fiber Matrix (BFM)

Bonded fiber matrices (BFMs) are hydraulically-applied systems of fibers, adhesives (typically guar based) and chemical cross-links. Upon drying, the slurry forms an erosion-resistant blanket that prevents soil erosion and promotes vegetation establishment. The cross-linked adhesive in the BFM should be biodegradable and should not dissolve or disperse upon re-wetting. BFMs are typically applied at rates from 3,000 to 4,000 lbs/acre based on the manufacturer's recommendation. BFMs should not be applied immediately before, during or immediately after rainfall or if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Mechanically-Bonded Fiber Matrices (MBFM)

Mechanically-bonded fiber matrices (MBFMs) are hydraulically applied systems similar to BFM that use crimped synthetic fibers and PAM and are typically applied to a slope at a higher application rate than a standard BFM.

Hydraulic Compost Matrix (HCM)

Hydraulic compost matrix (HCM) is a field-derived practice whereby finely graded or sifted compost is introduced into the hydraulic mulch slurry. A guar-type tackifier can be added for steeper slope applications as well as any specified seed mixtures. A HCM can help to accelerate seed germination and growth. HCMs are particularly useful as an in-fill for three-dimensional re-vegetation geocomposites, such as turf reinforcement mats (TRM) (see EC-7 Geotextiles and Mats).

Costs

Average installed costs for hydraulic mulch categories are is provided in Table 1, below.

Table 1
HYDRAULIC MULCH BMPs
INSTALLED COSTS

BMP	Installed Cost/Acre
Standard Hydraulic Mulching (SM)	$1,700 - $3,600 per acre
Hydraulic Matrices (HM) and Stabilized Fiber Matrices	
Guar-based	$2,000 - $4,000 per acre
PAM-based	$2,500 - $5,610 per acre
Bonded Fiber Matrix (BFM)	$3,900 - $6,900 per acre
Mechanically Bonded Fiber Matrix (MBFM)	$4,500 - $6,000 per acre
Hydraulic Compost Matrix (HCM)	$3,000 - $3,500 per acre

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004)

Inspection and Maintenance

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Compare the number of bags or weight of applied mulch to the area treated to determine actual application rates and compliance with specifications.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Controlling Erosion of Construction Sites, Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

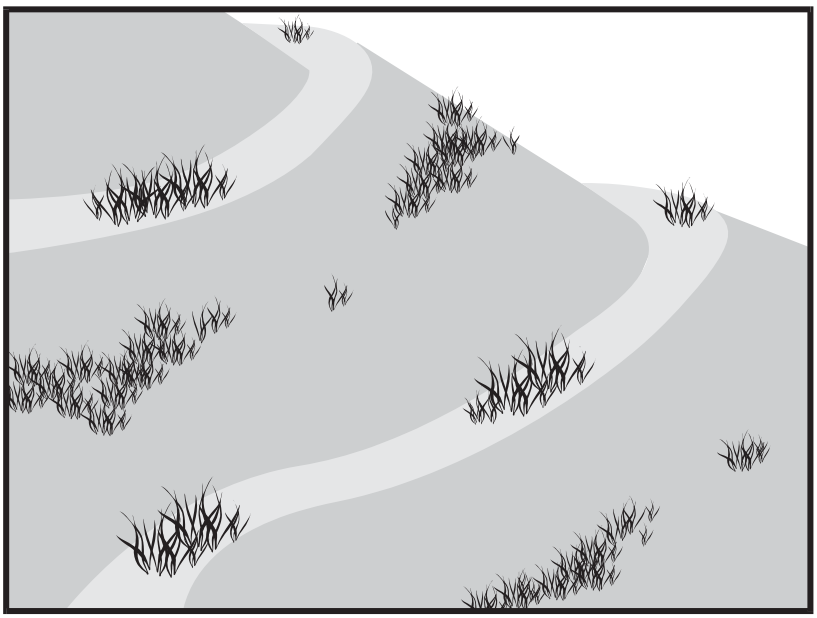
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding EC-4



Description and Purpose

Hydroseeding typically consists of applying a mixture of a hydraulic mulch, seed, fertilizer, and stabilizing emulsion with a hydraulic mulcher, to temporarily protect exposed soils from erosion by water and wind. Hydraulic seeding, or hydroseeding, is simply the method by which temporary or permanent seed is applied to the soil surface.

Suitable Applications

Hydroseeding is suitable for disturbed areas requiring temporary protection until permanent stabilization is established, for disturbed areas that will be re-disturbed following an extended period of inactivity, or to apply permanent stabilization measures. Hydroseeding without mulch or other cover (e.g. EC-7, Erosion Control Blanket) is not a stand-alone erosion control BMP and should be combined with additional measures until vegetation establishment.

Typical applications for hydroseeding include:

- Disturbed soil/graded areas where permanent stabilization or continued earthwork is not anticipated prior to seed germination.
- Cleared and graded areas exposed to seasonal rains or temporary irrigation.
- Areas not subject to heavy wear by construction equipment or high traffic.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Availability of hydroseeding equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Hydraulic seed should be applied with hydraulic mulch or a stand-alone hydroseed application should be followed by one of the following:
    - Straw mulch (see Straw Mulch EC-6)
    - Rolled erosion control products (see Geotextiles and Mats EC-7)
    - Application of Compost Blanket (see Compost Blanket EC-14)

  Hydraulic seed may be used alone only on small flat surfaces when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control.
- Hydraulic seed without mulch does not provide immediate erosion control.
- Temporary seeding may not be appropriate for steep slopes (i.e., slopes readily prone to rill erosion or without sufficient topsoil).
- 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 may not be appropriate for short term inactivity (i.e. less than 3-6 months).
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown and some may have water quality impacts due to their chemical makeup. Additionally these constituents may require non-visible pollutant monitoring. Refer to specific chemical properties identified in the product Material Safety Data Sheet; products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.

Implementation

In order to select appropriate hydraulic seed mixtures, an evaluation of site conditions should be performed with respect to:

- Soil conditions
- Site topography and exposure (sun/wind)
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS), Resource Conservation Districts and Agricultural Extension Service can provide information on appropriate seed mixes.

The following steps should be followed for implementation:

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying (See EC-15, Soil Preparation) the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.
- Avoid use of hydraulic seed in areas where the BMP would be incompatible with future earthwork activities.
- Hydraulic seed can be applied using a multiple step or one step process.
  - In a multiple step process, hydraulic seed is applied first, followed by mulch or a Rolled Erosion Control Product (RECP).
  - In the one step process, hydraulic seed is applied with hydraulic mulch in a hydraulic matrix. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.
- All hydraulically seeded areas should have mulch, or alternate erosion control cover to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds should be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag should be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container should be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed should be pellet inoculated. Inoculant sources should be species specific and should be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer should conform to the requirements of the California Food and Agricultural Code, which can be found at http://www.leginfo.ca.gov/.html/fac_table_of_contents.html. Fertilizer should be pelleted or granular form.
- Follow up applications should be made as needed to cover areas of poor coverage or germination/vegetation establishment and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Costs

Average cost for installation and maintenance may vary from as low as $1,900 per acre for flat slopes and stable soils, to $4,000 per acre for moderate to steep slopes and/or erosive soils. Cost of seed mixtures vary based on types of required vegetation.

BMP	Installed Cost per Acre
Hydraulic Seed	$1,900-$4,000

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems should be inspected for complete coverage and adjusted as needed to maintain complete coverage.

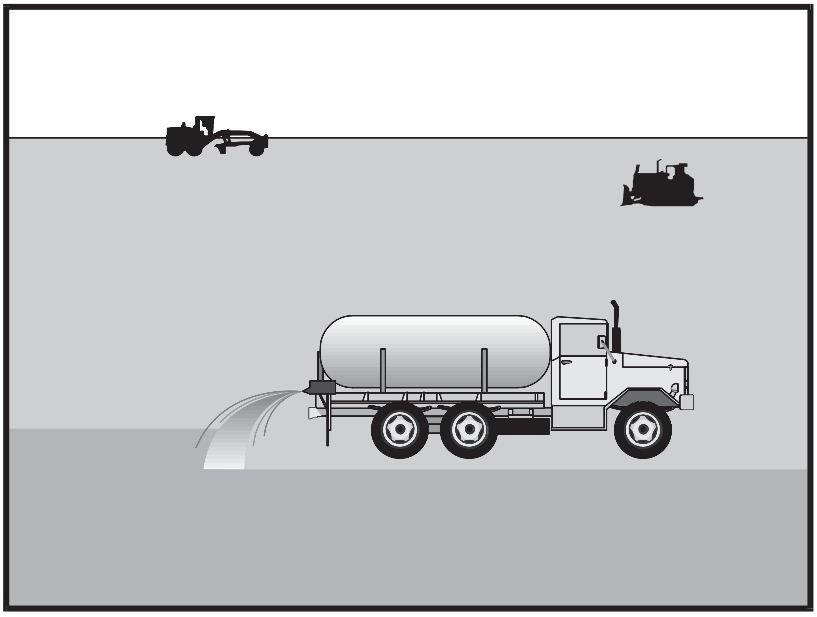
References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders EC-5



Categories		
EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Soil binding consists of application and maintenance of a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring temporary protection. Because soil binders, when used as a stand-alone practice, can often be incorporated into the soil, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are commonly used in the following areas:

- Rough graded soils that will be inactive for a short period of time
- Soil stockpiles
- Temporary haul roads prior to placement of crushed rock
- Compacted soil road base
- Construction staging, materials storage, and layout areas

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. Curing time

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.
- Plant-material-based soil binders do not generally hold up to pedestrian or vehicular traffic across treated areas as well as polymeric emulsion blends or cementitious-based binders.
- Soil binders may not sufficiently penetrate compacted soils.
- Some soil binders are soil texture specific in terms of their effectiveness. For example, polyacrylamides (PAMs) work very well on silt and clayey soils but their performance decreases dramatically in sandy soils.
- 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.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of some chemical soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup. Additionally, these chemical may require non-visible pollutant monitoring. Products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to the product Material Safety Data Sheet for chemical properties.

Implementation

General Considerations

- Soil binders should conform to local municipality specifications and requirements.
- Site 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 should not stain paved or painted surfaces. Soil binders should not pollute stormwater when cured. Obtain a Material Safety Data Sheet (MSDS) from the manufacturer to ensure non-toxicity.
- Stormwater runoff from PAM treated soils should pass through one of the following sediment control BMP prior to discharging to surface waters.
    - When the total drainage area is greater than or equal to 5 acres, PAM treated areas should drain to a sediment basin.
    - Areas less than 5 acres should drain to sediment control BMPs, such as a sediment trap, or a series of check dams. The total number of check dams used should be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam should be spaced evenly in the drainage channel through which stormwater flows are discharged off site.

- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this Fact Sheet. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

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

- Suitability to situation - Consider where the soil binder will be applied, 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 is related to the functional longevity of the binder, which 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.

Plant-Material-Based (Short Lived, <6 months) Binders

Guar: Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	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. Application rates should be from 80 to 200 lb/acre, 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 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material-Based (Long Lived, 6-12 months) Binders

Pitch and Rosin Emulsion: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should 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 should 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 and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

Acrylic Copolymers and Polymers: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound typically requires 12 to 24 hours drying time. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

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 the manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. 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 (H:V)	lb/acre
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:1 to 1:1	10.0 – 20.0

Poly-Acrylamide (PAM) and Copolymer of Acrylamide**:** Linear copolymer polyacrylamide for use as a soil binder is packaged as a dry flowable solid, as a liquid. Refer to the manufacturer's recommendation for dilution and application rates as they vary based on liquid or dry form, site conditions and climate.

- Limitations specific to PAM are as follows:
  - Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
  - The specific PAM copolymer formulation must be anionic. Cationic PAM should not be used in any application because of known aquatic toxicity problems. Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, should be used for soil applications.
  - PAM designated for erosion and sediment control should be "water soluble" or "linear" or "non-cross linked".
  - PAM should not be used as a stand-alone BMP to protect against water-based erosion. When combined with mulch, its effectiveness increases dramatically.

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 55 to 60 lb/acre. 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 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Applying Soil Binders

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 should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F 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 time.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd^2 or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd^2.

Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate installed costs:

Soil Binder	Cost per Acre (2004)[1]	Estimated Cost per Acre (2009)[2]
Plant-Material-Based (Short Lived) Binders	$700-$900	$770-$990
Plant-Material-Based (Long Lived) Binders	$1,200-$1,500	$1,320-$1,650
Polymeric Emulsion Blend Binders	$700 -$1,500	$770-$1,650
Cementitious-Based Binders	$800-$1,200	$880-$1,350

1. Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

2. 2009 costs reflect a 10% escalation over year 2004 costs. Escalation based on informal survey of industry trends. Note: Expected cost increase is offset by competitive economic conditions.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Reapply the selected soil binder as needed to maintain effectiveness.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Binders
Relative Cost	Low	Moderate to High	Low to High	Low to Moderate
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 (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

References

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

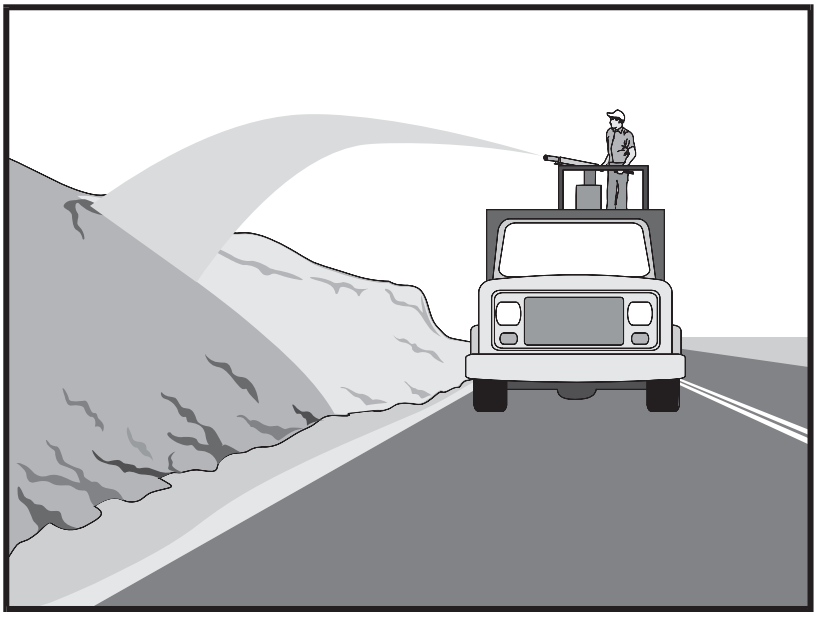
Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Straw Mulch EC-6



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-7 Geotextiles and Mats
EC-8 Wood Mulching
EC-14 Compost Blanket

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper, or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch can be specified for the following applications:

- As a stand-alone BMP on disturbed areas until soils can be prepared for permanent vegetation. The longevity of straw mulch is typically less than six months.
- Applied in combination with temporary seeding strategies
- Applied in combination with permanent seeding strategies to enhance plant establishment and final soil stabilization
- Applied around containerized plantings to control erosion until the plants become established to provide permanent stabilization

Limitations

Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.

- There is a potential for introduction of weed seed and unwanted plant material if weed-free agricultural straw is not specified.
- Straw mulch applied by hand is more time intensive and potentially costly.
- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.
- Potential fugitive dust control issues associated with straw applications can occur. Application of a stabilizing emulsion or a water stream at the same time straw is being blown can reduce this problem.
- Use of plastic netting should be avoided in areas where wildlife may be entrapped and may be prohibited for projects in certain areas with sensitive wildlife species, especially reptiles and amphibians.

Implementation

- Straw should be derived from weed-free wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw should be used.
- Use tackifier to anchor 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 can be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier should not be applied during or immediately before rainfall.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Application Procedures

- When using a tackifier to anchor the straw mulch, 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.
- Apply straw at a rate of between 3,000 and 4,000 lb/acre, either by machine or by hand distribution and provide 100% ground cover. A lighter application is used for flat surfaces and a heavier application is used for slopes.
- Evenly distribute straw mulch on the soil surface.
- Anchoring straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating) can be used in lieu of a tackifier.

- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.

  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier should be selected based on longevity and ability to hold the fibers in place. A tackifier is typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.

  - On very small areas, a spade or shovel can be used to punch in straw mulch.

  - On slopes with soils that 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 coulter, known commercially as a "crimper."

Costs

Average annual cost for installation and maintenance is included in the table below. Application by hand is more time intensive and potentially more costly.

BMP	Unit Cost per Acre
Straw mulch, crimped or punched	$2,458-$5,375
Straw mulch with tackifier	$1,823-$4,802

Source: Cost information received from individual product suppliers solicited by Geosyntec Consultants (2004).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.

- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives. Straw mulch as a stand-alone BMP is temporary and is not suited for long-term erosion control.

- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.

- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

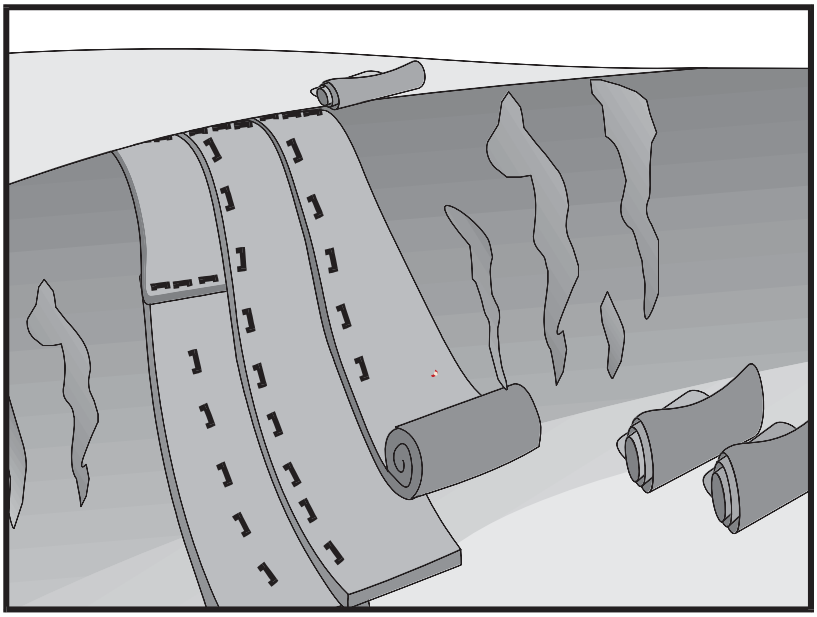
Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Geotextiles and Mats EC-7



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Mattings, or Rolled Erosion Control Products (RECPs), can be made of natural or synthetic materials or a combination of the two. RECPs are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, RECPs may be used to stabilize soils until vegetation is established or to reinforce non-woody surface vegetation.

Suitable Applications

RECPs are typically applied on slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks, swales and other drainage channels where moving water at velocities between 3 ft/s and 6 ft/s are likely to cause scour and wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. RECPs may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). RECPs should be considered when the soils are fine grained and potentially erosive. RECPs should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- 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 3.3 ft/s
- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies

Limitations

- RECP installed costs are generally higher than other erosion control BMPs, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes).
- RECPs may delay seed germination, due to reduction in soil temperature.
- RECPs 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). If a staple or pin cannot be driven into the soil because the underlying soil is too hard or rocky, then an alternative BMP should be selected.
- If used for temporary erosion control, RECPs should be removed and disposed of prior to application of permanent soil stabilization measures.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until more environmentally friendly measures, such as seeding and mulching, may be installed.
    - Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
    - Plastic sheeting results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- RECPs may have limitations based on soil type, slope gradient, or channel flow rate; consult the manufacturer for proper selection.
- Not suitable for areas that have foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.
- RECPs that incorporate a plastic netting (e.g. straw blanket typically uses a plastic netting to hold the straw in place) may not be suitable near known wildlife habitat. Wildlife can become trapped in the plastic netting.
- RECPs may have limitations in extremely windy climates. However, when RECPs are properly trenched at the top and bottom and stapled in accordance with the manufacturer's recommendations, problems with wind can be minimized.

Implementation

Material Selection

- Natural RECPs have been found to be effective where re-vegetation will be provided by re-seeding. The choice of material should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

- The following natural and synthetic RECPs are commonly used:

Geotextiles

- Material can be a woven or a non-woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Generally plastic sheeting should only be used as stockpile covering or for very small graded areas for short periods of time (such as through one imminent storm event). If plastic sheeting must be used, choose a plastic that will withstand photo degradation.

- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope (when used as a temporary slope protection) and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil (when used as a temporary slope protection).

- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable RECPs are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order 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. See typical installation details at the end of this fact sheet.

- **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. The performance of jute as a stand-alone RECP is low. Most other RECPs outperform jute as a temporary erosion control product and therefore jute is not commonly used. It is designed to be used in conjunction with vegetation. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd^2, $\pm$10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5 lb/yd^2. Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. 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 must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- 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 or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must 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 ¼ in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must 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 re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must 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 percent open area, which facilitates root growth. It's 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 must 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 re-vegetation. The material is furnished in rolled strips,

which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper soil preparation is essential to ensure complete contact of the RECP with the soil. Soil Roughening is not recommended in areas where RECPs will be installed.
- 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 2 to 3 in. of topsoil.

Seeding/Planting

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

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots shall be installed as required by the manufacturer.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the seedbed should be friable, made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

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.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should 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 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft (or greater, per manufacturer's specifications).
- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 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 should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2. Check manufacturer's specifications to determine if a higher density staple pattern is required.

Installation in Channels

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

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channels.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 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 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 3 in.
- Secure these initial ends of mats with anchors at 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 3 in. overlap.

- 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 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 6 in. centers at 25 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 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 12 in. by 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 mat (TRM))

Installation should be in accordance with the manufacturer's recommendations. Typical installation guidelines are as follows:

- After seeding, spread and lightly rake ½-3/4 inches of fine topsoil into the TRM apertures to completely fill TRM thickness. Use backside of rake or other flat implement.
- Alternatively, if allowed by product specifications, spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment.
- 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

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Installed costs can be relatively high compared to other BMPs. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre (2004)[1]	Estimated Cost per Acre (2009)[2]
Biodegradable	Jute Mesh	$6,000-$7,000	$6,600-$7,700
	Curled Wood Fiber	$8,000-$10,500	$8,800-$11,050
	Straw	$8,000-$10,500	$8,800-$11,050
	Wood Fiber	$8,000-$10,500	$8,800-$11,050
	Coconut Fiber	$13,000-$14,000	$14,300-$15,400
	Coconut Fiber Mesh	$30,000-$33,000	$33,000-$36,300
	Straw Coconut Fiber	$10,000-$12,000	$11,000-$13,200
Non-Biodegradable	Plastic Netting	$2,000-$2,200	$2,200-$2,220
	Plastic Mesh	$3,000-$3,500	$3,300-$3,850
	Synthetic Fiber with Netting	$34,000-$40,000	$37,400-$44,000
	Bonded Synthetic Fibers	$45,000-$55,000	$49,500-$60,500
	Combination with Biodegradable	$30,000-$36,000	$33,000-$39,600

1. Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

2. 2009 costs reflect a 10% escalation over year 2004 costs. Escalation based on informal survey of industry trends. Note: Expected cost increase is offset by competitive economic conditions.

Inspection and Maintenance

- RECPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.

References

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

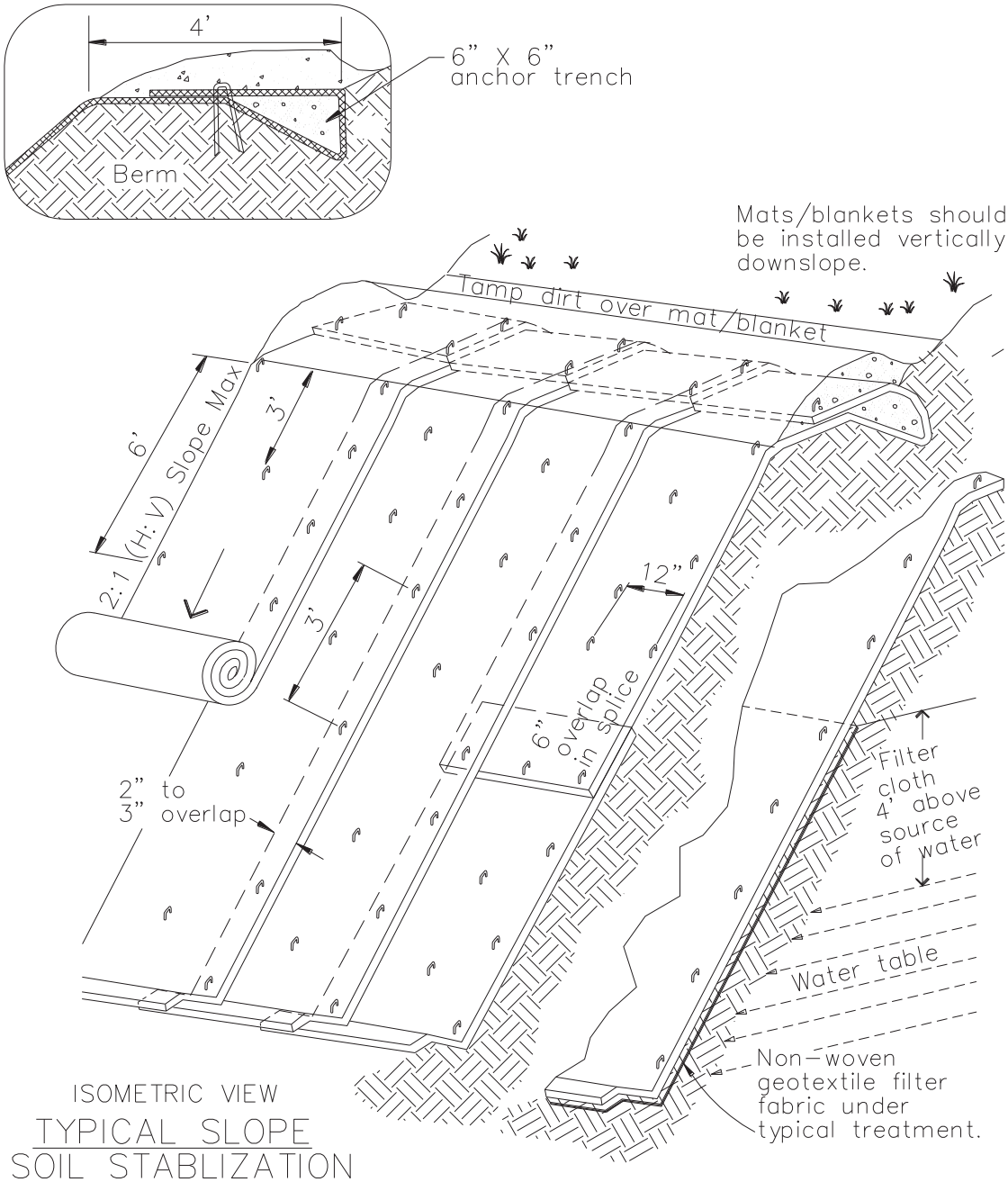
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



ISOMETRIC VIEW

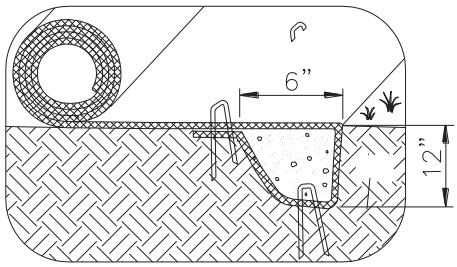
TYPICAL SLOPE
SOIL STABLIZATION
NTS

WET SLOPE LINING
NTS

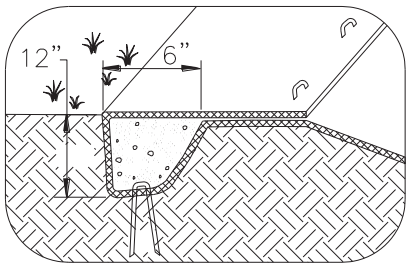
NOTES:

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

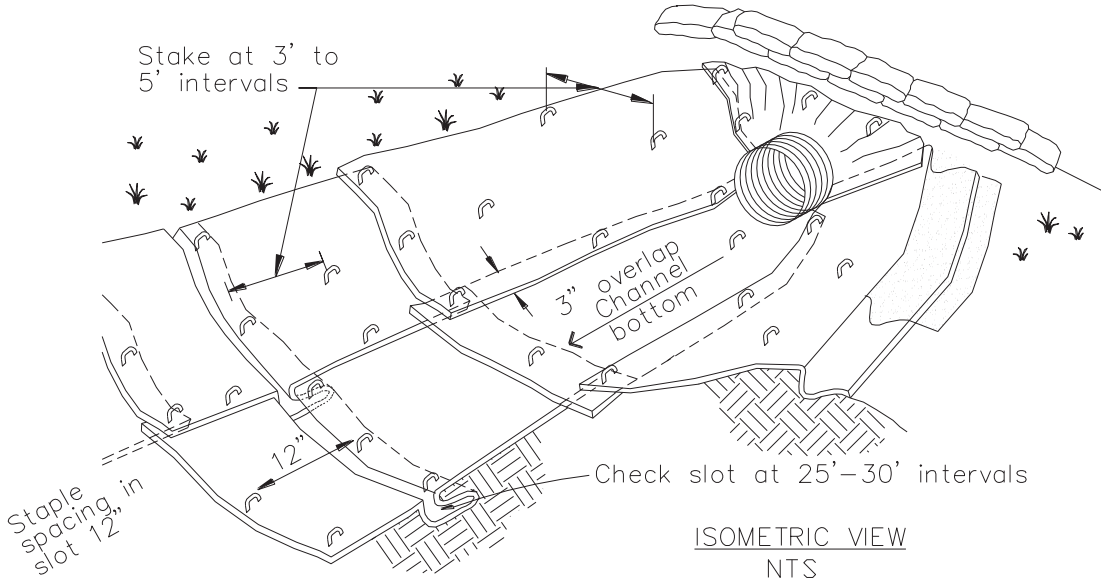
TYPICAL INSTALLATION DETAIL



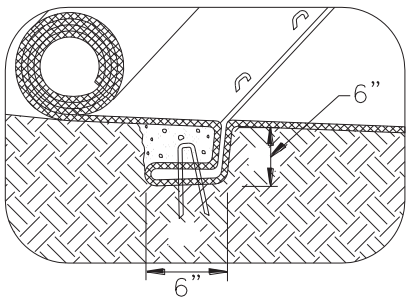
INITIAL CHANNEL ANCHOR TRENCH
NTS



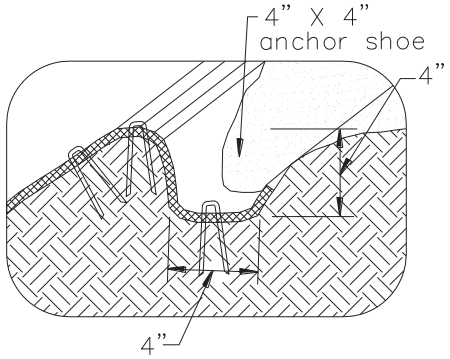
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
NTS



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

TYPICAL INSTALLATION DETAIL

Wood Mulching EC-8



Description and Purpose

Wood mulching consists of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Suitable Applications

Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established.

Limitations

- Not suitable for use on slopes steeper than 3:1 (H:V). Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter.
- Wood mulch and compost may introduce unwanted species.
- Not suitable for areas exposed to concentrated flows.
- May need to be removed prior to further earthwork.

Implementation

Mulch Selection

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such as 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 methods are highlighted here:

- Green Material: This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Methods of application are generally by hand although pneumatic methods are available.
  - Green material can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 2 in.
- Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable. See note under limitations.
  - Distribute by hand or use pneumatic methods.
  - Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.
- Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is around $4,000 per acre, but cost can increase if the source is not close to the project site.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Regardless of the mulching technique selected, the key consideration in inspection and maintenance 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 should 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 should focus on longevity and integrity of the mulch.
- Reapply mulch when bare earth becomes visible.

References

Controlling Erosion of Construction Sites Agriculture Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

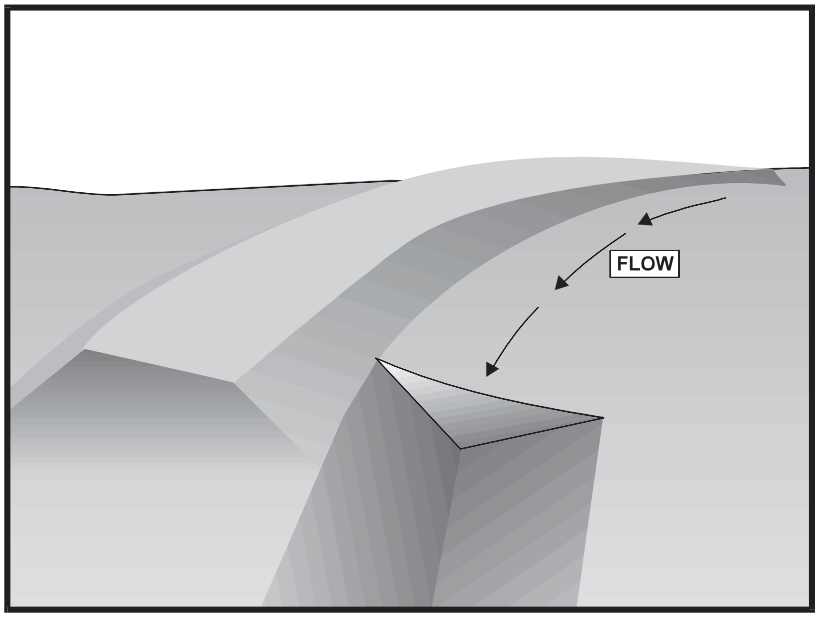
Sedimentation and Erosion Control, An Inventory of Current Practices Draft, U.S. EPA, April 1990.

Soil Erosion by Water Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Earth Dikes and Drainage Swales EC-9



Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It 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.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in drainage swales.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert

runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should 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, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin

(SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.

- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/$yd^3$.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- 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.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

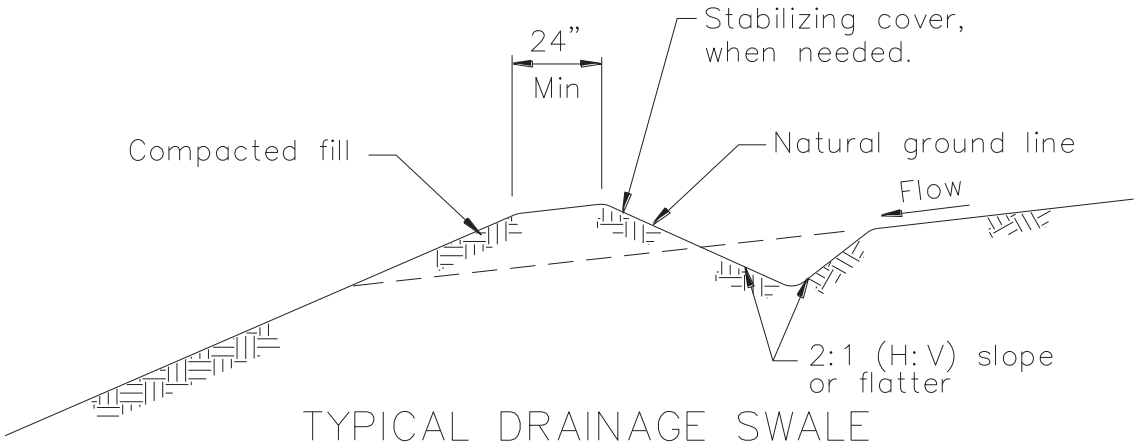
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

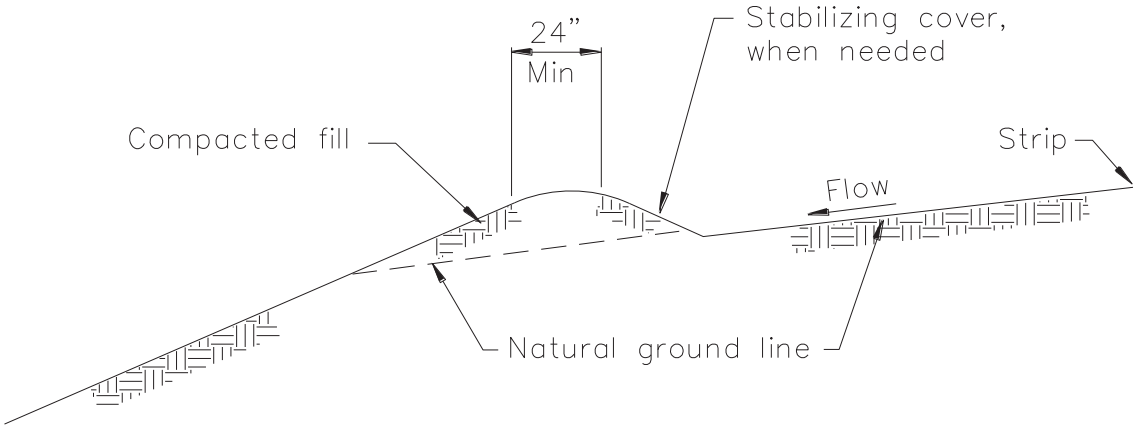
Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL DRAINAGE SWALE
NOT TO SCALE

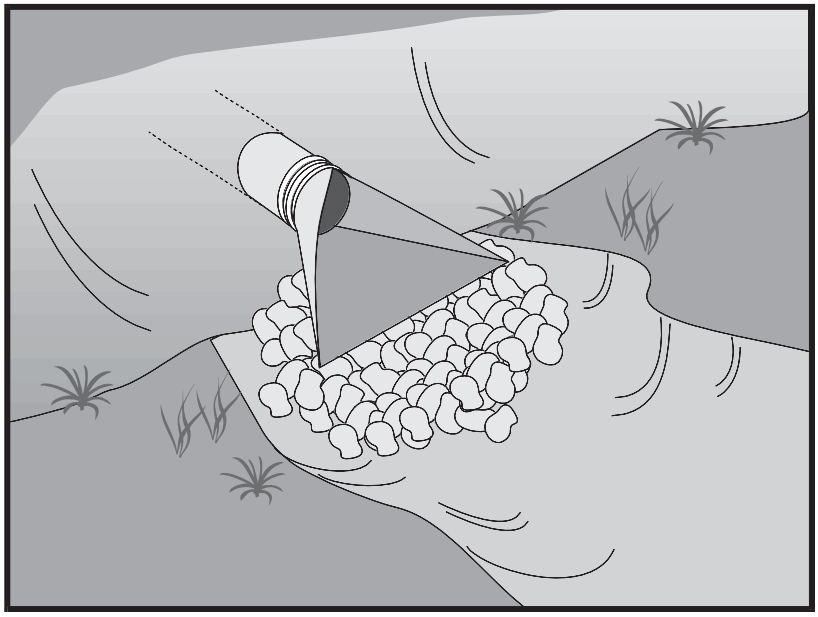
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

Velocity Dissipation Devices EC-10



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runon during construction.

- 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

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- 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.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in velocity dissipation devices.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.

- Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.

- Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.

- Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- 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.

- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.

- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.

- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

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

References

County of Sacramento Improvement Standards, Sacramento County, May 1989.

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

Handbook of Steel Drainage & Highway Construction, American Iron and Steel Institute, 1983.

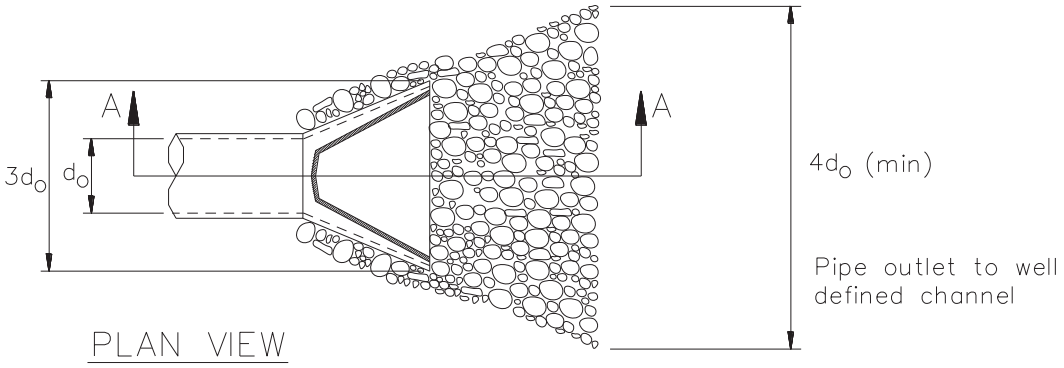
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

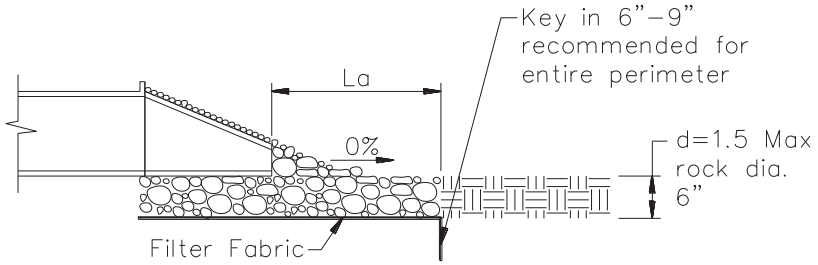
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, state of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



PLAN VIEW

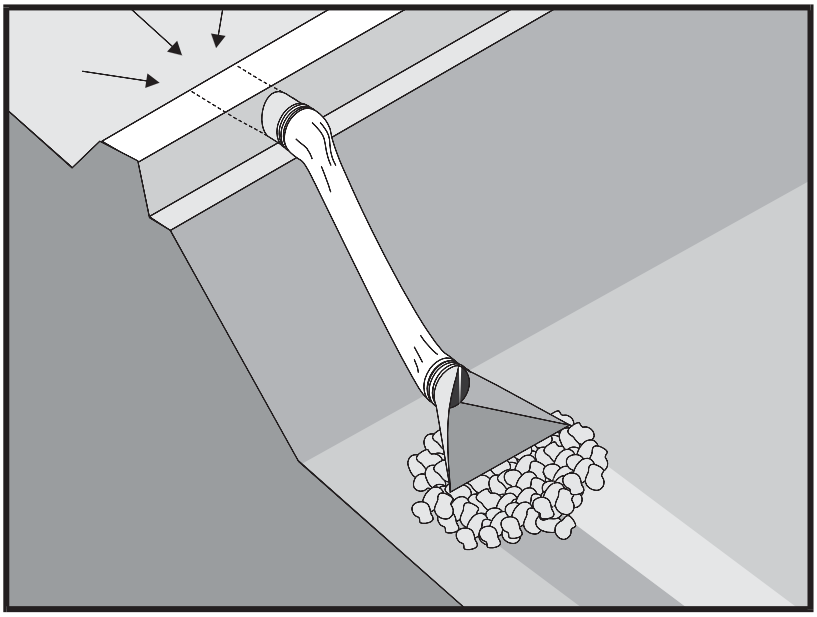


SECTION A–A

Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS

Slope Drains EC-11



Description 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 earth dikes and drainage ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.
- If the sectional downdrain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.

- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in energy dissipaters associated with slope drain outlets.

Implementation

General

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

Installation

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.
- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.
- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.
- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.
- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.
- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.
- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.

- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.
- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.
- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.
- 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 watertight.
  - 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 outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.
  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

Design and Layout

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

Materials:

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.

- **Flexible Pipe**: The flexible pipe slope drain consists of a flexible tube of heavy duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.

- **Section Downdrains**: The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.

- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

Costs

- Cost varies based on pipe selection and selected outlet protection.

Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12”	$19.60 per LF
15”	$22.00
18”	$26.00
24”	$32.00
30”	$50.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12”	$24.50
14”	$49.00
16”	$51.00
18”	$54.00
20”	$66.00
24”	$93.00
30”	$130.00

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.
- 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.
- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.
- Inspect pipes for leakage. Repair leaks and restore damaged slopes.
- Inspect slope drainage for accumulations of debris and sediment.

- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.
- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

References

Draft – Sedimentation and Erosion Control, An Inventory of Current Practices, U.S.E.P.A., April 1990.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

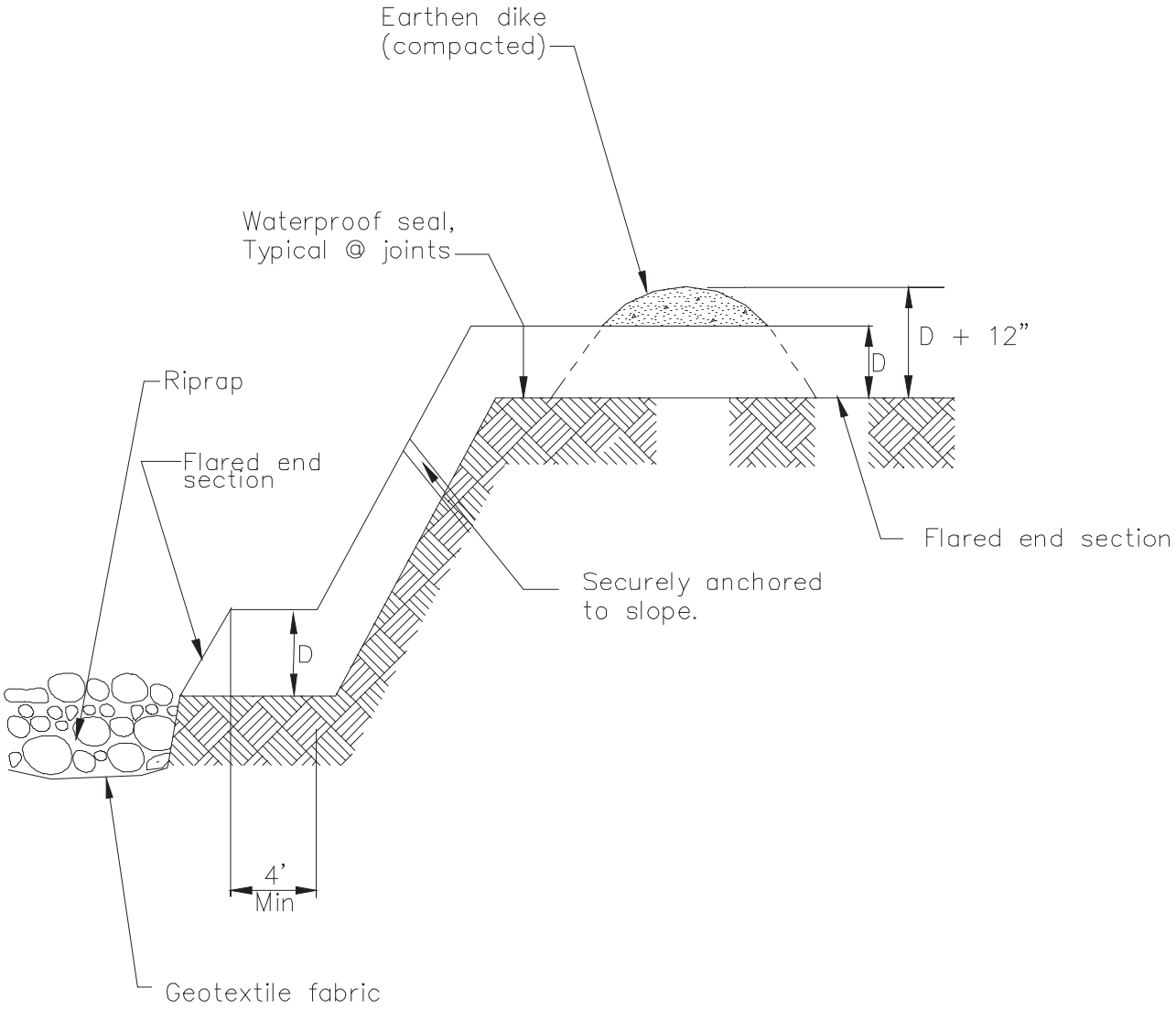
National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL SLOPE DRAIN
NOT TO SCALE

Streambank Stabilization EC-12



Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

Combination of erosion and sediment controls.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Stream channels, streambanks, 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. BMPs can reduce the discharge of sediment and other pollutants to minimize the impact of construction activities on watercourses. Streams on the 303(d) list and listed for sediment may require numerous measures to prevent any increases in sediment load to the stream.

Suitable 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 supercede the guidance in this BMP.

- If numerical based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. Streams listed as 303(d) impaired for sediment, silt, or turbidity, are required to

conduct sampling to verify that there is no net increase in sediment load due to construction activities.

Implementation

Planning

- Proper planning, design, and construction techniques can minimize impacts normally associated with in stream construction activities. Poor planning can adversely affect soil, fish, 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

- Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with EC-1, Scheduling. Scheduling considerations will be different when working near perennial streams vs. ephemeral streams and are as follows.

- When in-stream construction is conducted in a perennial stream, work 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, 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 tying up 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 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 50 ft from stream channel. 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 areas disturbed by prior construction or other activity 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 lb/in^2, where possible. Low ground pressure equipment includes: wide or high flotation tires (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

- Preserve existing vegetation in accordance with EC-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 15 to 100 ft. On gradual slopes, most of the filtering occurs within the first 30 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, evapo transpiration, 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 (100 to 1500 ft).
- When working near watercourses, it is important to understand the work site's placement in the watershed. Riparian vegetation in 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 50 ft plus four times the percent slope of the land, measured between the road and the top of stream bank.

Hydraulic Mulch

- Apply hydraulic mulch on disturbed streambanks above mean high water level in accordance with EC-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 (eutrophication is an algal bloom caused by excessively high nutrient levels in the water).

Hydroseeding

- Hydroseed disturbed streambanks in accordance with EC-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

- Apply soil binders to disturbed streambanks in accordance with EC-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

- Apply straw mulch to disturbed streambanks in accordance with EC-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 and Mats

- Install geotextiles and mats as described in EC-7, Geotextiles and 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

- Convey, intercept, or divert runoff from disturbed streambanks using EC-9, Earth Dikes and Drainage Swales.

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.
- Appropriately sized velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Velocity Dissipation Devices

- Place velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with EC-10, Velocity Dissipation Devices.

Slope Drains

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

Limitations

- Appropriately sized outlet protection and velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Streambank Sediment Control

Silt Fences

- Install silt fences in accordance with SE-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

- Install fiber rolls in accordance with SE-5, Fiber Rolls, along contour of slopes 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 SE-1, Silt Fence or SE-9 Straw Bale Barrier. Install silt fence, straw bale barrier, or other erosion control method along toe of slope above the high water level.

Gravel Bag Berm

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment laden sheet flow runoff in accordance with SE-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 live stream.

Limitations

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

Straw Bale Barrier

- Install straw bale barriers in accordance with SE-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 SE-1, Silt Fence,

on down slope side of 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 BMP.

Applications

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

Limitations

- Inappropriate for contributing drainage areas greater than 5 acres.
- 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 aesthetics is a concern.

Specifications

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

Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Reshape berms as needed and replace lost or dislodged rock, and filter fabric.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

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 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, cuts or fills slopes.

Limitations

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

Implementation

- Refer to NS-5, Clear Water Diversion, for implementation requirements.

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 "pull" 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 re-vegetation.

- **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 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 flow. 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.

Implementation

- 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).

Inspection and Maintenance

- None necessary

Costs

Cost may vary according to the combination of practices implemented.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events until final stabilization is achieved.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

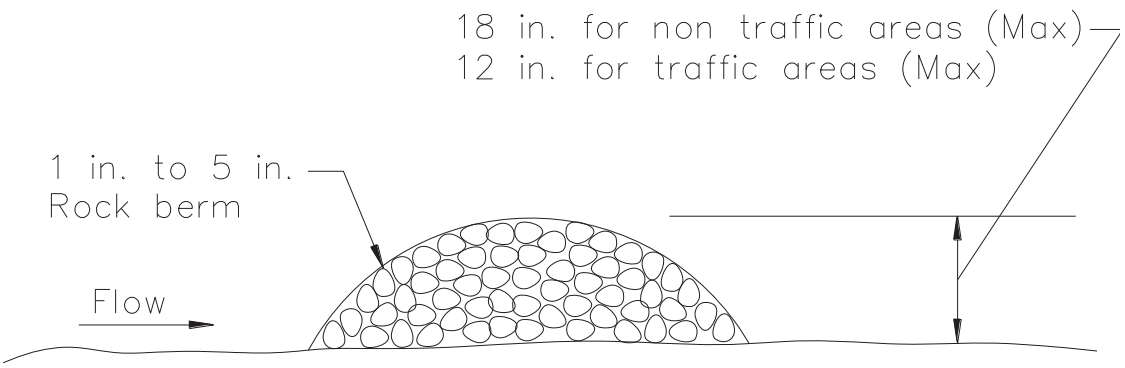
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, An Inventory of Current Practices (Draft), UESPA, 1990.

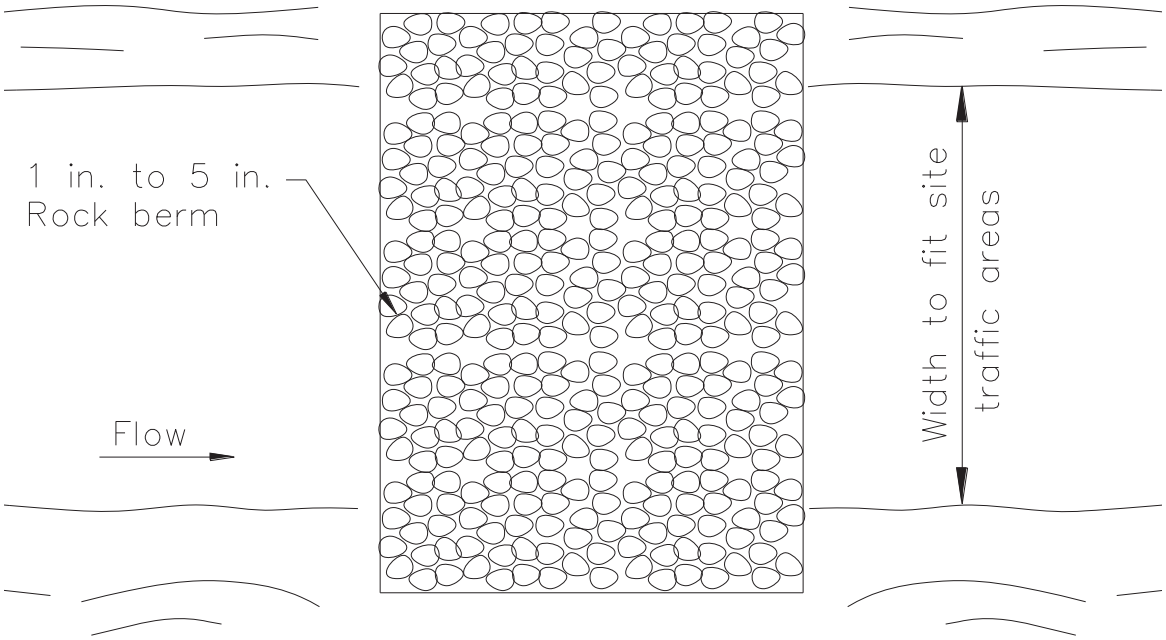
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



SECTION



PLAN

TYPICAL ROCK FILTER
NOT TO SCALE

Reserved

EC-13

BMP Factsheet removed in 2009.
Formerly PAM. See SE-11, Active Treatment Systems.

Categories

EC	Erosion Control
SE	Sediment Control
TC	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment
Nutrients
Trash
Metals
Bacteria
Oil and Grease
Organics

Potential Alternatives

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Compost Blanket EC-14



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

A compost blanket is applied to slopes and earth disturbed areas to prevent erosion, and in some cases, increase infiltration and/or establish vegetation. The compost blanket can be applied by hand, conveyor system, compost spreader, or pneumatic delivery (blower) system. The blanket thickness is determined from the slope steepness and anticipated precipitation. A compost blanket protects the soil surface from raindrop erosion, particularly rills and gullies that may form under other methods of erosion control.

A compost blanket, if properly installed, can be very successful at vegetation establishment, weed suppression and erosion control. The compost blanket comes into direct contact with the underlying soil, reducing rill formation. Furthermore, compost provides organic matter and nutrients important for vegetation growth. The compost blanket provides soil structure that allows water to infiltrate the soil surface and retain moisture, which also promotes seed germination and vegetation growth, in addition to reducing runoff.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Greenwaste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly, compost selection is an important design consideration in the application of this type of erosion control.

Suitable Applications

A compost blanket is appropriate for slopes and earth disturbed areas requiring protection until permanent stabilization is established. A compost blanket can also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment. Examples include:

- Rough-graded areas that will remain inactive for longer than 14 days
- Soil stockpiles
- Slopes with exposed soil between existing vegetation such as trees or shrubs
- Slopes planted with live, container-grown vegetation
- Disturbed areas where plants are slow to develop

A compost blanket is typically used on slopes of 2:1 (H:V) or gentler. However, a compost blanket can be effective when applied to slopes as steep as 1:1 (H:V) with appropriate design considerations including slope length, blanket thickness, adding components such as a tackifier, or using compost blankets in conjunction with other techniques, such as compost socks and berms or fiber rolls.

Compost can be pre-seeded prior to application to the soil (recommended by the EPA for construction site stormwater runoff control) or seeded after the blanket has been installed. The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons (USEPA, 1998).

Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Carefully consider the qualifications and experience of any compost producer/supplier.
- A compost blanket applied by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost effective method of application.
- When blowers are used, the treatment areas should be within 300 ft of a road or surface capable of supporting trucks.
- Wind may limit application of compost and result in application to undesired locations.
- Compost blankets should not be applied in areas of concentrated flows.
- Steeper slopes may require additional blanket thickness and other stability measures such as using tackifiers or slope interruption devices (compost socks and berms, or fiber rolls). The same applies for sites with high precipitation totals or during the rainy season.

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in Table 1 below, taken from Caltrans Standard Special Provision 10-1 (SSP 10-1), Erosion Control (Compost Blanket).

- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.

- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.

- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.

- Compost should be high-quality mature compost. Immature compost can potentially leach nutrients.

- Compost should not be derived from mixed municipal solid waste and should be free of visible contaminants.

- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

- Compost should not possess objectionable odors.

- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	*TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30-60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inch 90-100% Passing, 1 inch 65-100% Passing, 3/4 inch 0 - 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Installation

- Prior to compost application, prepare the slope by removing loose rocks, roots, stumps, and other debris greater than 2" in diameter. Prepare the slope area surface by scarifying or track walking/roughening if necessary.
- Select method to apply the compost blanket. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.
- A compost blanket thickness of 1" to 4" should be applied to slopes of 2:1 (H:V) or gentler, based on site-specific conditions. Increase blanket thickness with increased slope steepness and/or during installation during the rainy season (for example, 2" to 3" should be used for a

3:1 slope, while 1" to 2" can be used for a 4:1 slope). Erosion control using a compost blanket is not recommended for slopes greater than 1:1 (H:V).

- For steeper slopes, tackifiers should be utilized and/or other stabilization techniques employed. For example, compost socks or berms can be installed at intervals over the compost blanket (in a similar manner as Fiber Rolls, SE-5).
- Compost socks or berms (or equivalent linear sediment control BMP) should be placed at the top and/or bottom of the slope for additional erosion control performance.
- For optimum vegetation establishment, a blanket thickness of 1" to 2" is recommended. If vegetation establishment is not the primary function of the compost blanket, a thicker blanket may be recommended based on slope or rainfall conditions.
- Evenly distribute compost on the soil surface to the desired blanket thickness (1/2" to 4" as calculated prior based on site conditions and objectives). Even distribution is an important factor in preventing future rill and gully erosion.
- The compost blanket should extend 3 to 6 feet over the top of the shoulder of the slope. A compost sock or compost berm can be used at the top of the slope as an auxiliary technique to prevent runoff from flowing underneath the compost blanket.
- Use additional anchoring and erosion control BMPs in conjunction of the compost blanket as needed.

Costs

The cost associated with a compost blanket is similar to that of a straw mat and generally less expensive than a geotextile blanket (USEPA, 2009). Caltrans has provided a recent estimate for $5,000 to $8,000 per acre for application of an unseeded 1 inch compost blanket (Caltrans Compost Specifications, 2009). Recently obtained vendor costs indicate that proprietary blends of compost that are seeded and contain a nutrient rich "tackifier" can cost approximately $0.35 per square foot, or approximately $15,000 per acre for a 2 inch blanket. Application by hand is more time intensive and likely more costly.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident, another layer of compost should be reapplied as soon as possible. It may be necessary to install an additional type of stormwater BMP at the top of slope or as a slope interrupter to control flow, such as a fiber roll (SE-5) or compost sock (SE-11).
- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Limit or prohibit foot traffic to minimize damage to BMP or impede vegetation establishment.

References

An Analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, pubs.caes.uga.edu/caespubs/pubcd/B1200.htm, Faucette, B. and Risse, M., 2009.

Demonstration Project Using Yard Debris Compost for Erosion Control, Final Report, presented to Metropolitan Service District, W&H Pacific, 1993.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, 2005.

Standard Special Provision 10-1, Erosion Control (Compost Blanket), California Department of Transportation (Caltrans). 2007 Update.

Evaluation of Environmental Benefits and Impacts of Compost and Industry Standard Erosion and Sediment Controls Measures Used in Construction Activities, Dissertation, Institute of Ecology, University of Georgia, Faucette, B., 2004.

Filter Sock Presentation provided at Erosion, Sediment Control and Stormwater Management with Compost BMPs Workshop, U.S. Composting Council 13th Annual Conference and Trade Show, McCoy, S., 2005.

National Pollutant Discharge Elimination System (NPDES), Compost Blankets, U.S. Environmental Protection Agency (USEPA). http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118, 2009.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing Designation M10-03, Compost for Erosion/Sediment Control (Compost Blankets), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

Stormwater Best Management Practices (BMPs) Field Trials of Erosion Control Compost in Reclamation of Rock Quarry Operations, Nonpoint Source Protection Program CWA §319(h), Texas Commission on Environmental Quality, Adams, T., McFarland, A., Hauck, L., Barrett, M., and Eck, B., 2008.

Soil Preparation/Roughening EC-15



Description and Purpose

Soil Preparation/Roughening involves assessment and preparation of surface soils for BMP installation. This can include soil testing (for seed base, soil characteristics, or nutrients), as well as roughening surface soils by mechanical methods (including sheepsfoot rolling, track walking, scarifying, stair stepping, and imprinting) to prepare soil for additional BMPs, or to break up sheet flow. Soil Preparation can also involve tilling topsoil to prepare a seed bed and/or incorporation of soil amendments, to enhance vegetative establishment.

Suitable Applications

Soil preparation: Soil preparation is essential to proper vegetative establishment. In particular, soil preparation (i.e. tilling, raking, and amendment) is suitable for use in combination with any soil stabilization method, including RECPs or sod. Soil preparation should not be confused with roughening.

Roughening: Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces. Soil preparation is most effective when used in combination with erosion controls. Soil Roughening is suitable for use as a complementary process for controlling erosion on a site. Roughening is not intended to be used as a stand-alone BMP, and should be used with perimeter controls, additional erosion control measures, grade breaks, and vegetative establishment for maximum effectiveness. Roughening is intended to only affect surface soils and should not compromise slope stability or overall compaction. Suitable applications for soil roughening include:

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-7 Geotextiles and Mats

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Along any disturbed slopes, including temporary stockpiles, sediment basins, or compacted soil diversion berms and swales.

- Roughening should be used in combination with hydraulically applied stabilization methods, compost blanket, or straw mulch; but should not be used in combination with RECPs or sod because roughening is intended to leave terraces on the slope.

Limitations

- Preparation and roughening must take place prior to installing other erosion controls (such as hydraulically applied stabilizers) or sediment controls (such as fiber rolls) on the faces of slopes.

- In such cases where slope preparation is minimal, erosion control/revegetation BMPs that do not require extensive soil preparation - such as hydraulic mulching and seeding applications - should be employed.

- Consideration should be given to the type of erosion control BMP that follows surface preparation, as some BMPs are not designed to be installed over various types of tillage/roughening, i.e., RECPs (erosion control blankets) should not be used with soil roughening due to a "bridging" effect, which suspends the blanket above the seed bed.

- Surface roughness has an effect on the amount of mulch material that needs to be applied, which shows up as a general increase in mulch material due to an increase in surface area (Topographic Index -see EC-3 Hydraulic Mulching).

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

General

A roughened surface can significantly reduce erosion. Based on tests done at the San Diego State Erosion Research Laboratory, various roughening techniques on slopes can result in a 12 - 76% reduction in the erosion rate versus smooth slopes.

Materials

Minimal materials are required unless amendments and/or seed are added to the soil. The majority of soil roughening/preparation can be done with equipment that is on hand at a normal construction site, such as bull dozers and compaction equipment.

Installation Guidelines

Soil Preparation

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.

- Based upon soil testing conducted, apply additional soil amendments (e.g. fertilizers, additional seed) to the soil to help with germination. Follow EC-4, Hydroseeding, when selecting and applying seed and fertilizers.

Cut Slope Roughening:

- Stair-step grade or groove the cut slopes that are steeper than 3:1.
- Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
- Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.
- Do not make individual vertical cuts more than 2 feet (0.6 m) high in soft materials or more than 3 feet (0.9 m) high in rocky materials.
- Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

Fill Slope Roughening:

- Place on fill slopes with a gradient steeper than 3:1 in lifts not to exceed 8 inches (0.2 m), and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4-6 inches (0.1-0.2 m) deep.
- Use grooving or tracking to roughen the face of the slopes, if necessary.
- Do not blade or scrape the final slope face.

Roughening for Slopes to be Mowed:

- Slopes which require mowing activities should not be steeper than 3:1.
- Roughen these areas to shallow grooves by track walking, scarifying, sheepsfoot rolling, or imprinting.
- Make grooves close together (less than 10 inches), and not less than 1 inch deep, and perpendicular to the direction of runoff (i.e., parallel to the slope contours).
- Excessive roughness is undesirable where mowing is planned.

Roughening With Tracked Machinery:

- Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface.
- Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
- Seed and mulch roughened areas as soon as possible to obtain optimum seed germination and growth.

Costs

Costs are based on the additional labor of tracking or preparation of the slope plus the cost of any required soil amendment materials.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check the seeded slopes for signs of erosion such as rills and gullies. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
- Inspect BMPs weekly during normal operations, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Non-Vegetative Stabilization EC-16



Description and Purpose

Non-vegetative stabilization methods are used for temporary or permanent stabilization of areas prone to erosion and should be used only where vegetative options are not feasible; examples include:

- Areas of vehicular or pedestrian traffic such as roads or paths;
- Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
- Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
- Areas where vegetation will not grow adequately within the construction time frame.

There are several non-vegetative stabilization methods and selection should be based on site-specific conditions.

Decomposed Granite (DG) is a permanent erosion protection method that consists of a layer of stabilized decomposed granite placed over an erodible surface.

Degradable Mulches of various types (see EC-3, EC-6, EC-8) can be used for temporary non-vegetative stabilization; examples include straw mulch, compost, wood chips or hydraulic mulch.

Geotextiles and Mats can be used for temporary non-vegetative stabilization (see EC-7). These BMPs are typically manufactured from degradable or synthetic materials and are

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

designed and specified based on their functional longevity, i.e., how long they will persist and provide erosion protection. All geotextiles and mats should be replaced when they exceed their functional longevity or when permanent stabilization methods are instituted.

Gravel Mulch is a non-degradable erosion control product that is composed of washed and screened coarse to very coarse gravel, 16 mm to 64 mm (0.6" - 2.5"), similar to an AASHTO No. 3 coarse aggregate.

Rock Slope Protection consists of utilizing large rock or rip-rap (4"- 24") to stabilize slopes with a high erosion potential and those subject to scour along waterways.

Soil Binders can be used for temporary non-vegetative stabilization (see EC-5). The key to their use is functional longevity. In most cases, the soil binder will need to be routinely monitored and re-applied to maintain an erosion-resistant coverage.

Suitable Applications

Non-vegetated stabilization methods are suitable for use on disturbed soil areas and on material stockpiles that need to be temporarily or permanently protected from erosion by water and wind. Non-vegetated stabilization should only be utilized when vegetation cannot be established in the required timeframe, due to soil or climactic conditions, or where vegetation may be a potential fire hazard.

Decomposed Granite (DG) and Gravel Mulch are suitable for use in areas where vegetation establishment is difficult, on flat surfaces, trails and pathways, and when used in conjunction with a stabilizer or tackifier, on shallow slopes (i.e., 10:1 [H:V]). DG and gravel can also be used on shallow rocky slopes where vegetation cannot be established for permanent erosion control.

Degradable Mulches can be used to cover and protect soil surfaces from erosion both in temporary and permanent applications. In many cases, the use of mulches by themselves requires routine inspection and re-application. See EC-3 Hydraulic Mulch, EC-6 Straw Mulch, EC-8 Wood Mulch, or EC-14 Compost Blankets for more information.

Geotextiles and Mats can be used as a temporary stand-alone soil stabilization method. Depending on material selection, geotextiles and mats can be a short-term (3 mos – 1 year) or long-term (1-2 years) temporary stabilization method. For more information on geotextiles and mats see EC-7 Geotextiles and Mats.

Rock Slope Protection can be used when the slopes are subject to scour or have a high erosion potential, such as slopes adjacent to flowing waterways or slopes subject to overflow from detention facilities (spillways).

Soil Binders can be used for temporary stabilization of stockpiles and disturbed areas not subject to heavy traffic. See EC-5 Soil Binders for more information.

Limitations

General

- Refer to EC-3, EC-6, EC-8, and EC-14 for limitations on use of mulches. Refer to EC-7 for limitations on use of geotextiles and mats. Refer to EC-5 for limitations on use of Soil Binders.

Decomposed Granite

- Not available in some geographic regions.
- If not tackified, material may be susceptible to erosion even on slight slopes (e.g., 30:1 [H:V]).
- Installed costs may be more expensive than vegetative stabilization methods.

Gravel Mulch

- Availability is limited in some geographic regions.
- If not properly screened and washed, can contain fine material that can erode and/or create dust problems.
- If inadequately sized, material may be susceptible to erosion on sloped areas.
- Pore spaces fill with dirt and debris over time; may provide a growing medium for weeds.

Rock Slope Protection

- Installation is labor intensive.
- Installed costs can be significantly higher than vegetative stabilization methods.
- Rounded stones may not be used on slopes greater than 2:1 [H:V].

Implementation

General

Non-vegetated stabilization should be used in accordance with the following general guidance:

- Should be used in conjunction with other BMPs, including drainage, erosion controls and sediment controls.
- Refer to EC-3, EC-6, EC-8, and EC-14 for implementation details for mulches. Refer to EC-7 for implementation details for geotextiles and mats. Refer to EC-5 for implementation details for soil binders.
- Non-vegetated stabilization measures should be implemented as soon as the disturbance in the areas they are intended to protect has ceased.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Decomposed Granite Stabilization

- If used for a road or path should be installed on a prepared base.
- Should be mixed with a stabilizer if used for roads or pathways, or on slope applications.
- Though porous it is recommended to prevent standing water on or next to a decomposed granite road or pathway.

Gravel Mulch

- Should be sized based on slope, rainfall, and upgradient run-on conditions. Stone size should be increased as potential for erosion increases (steeper slopes, high intensity rainfall).
- If permanent, a weed control fabric should be placed prior to installation.
- Should be installed at a minimum 2" depth.
- Should completely cover all exposed surfaces.

Rock Slope Protection

- Rock slope protection installation should follow Caltrans Standard Specification 72-2: Rock Slope Protection. Refer to the specification for rock conformity requirements and installation methods.
- When using rock slope protection, rock size and installation method should be specified by an Engineer.
- A geotextile fabric should be placed prior to installation.

Costs

- Costs are highly variable depending not only on technique chosen, but also on materials chosen within specific techniques. In addition, availability of certain materials will vary by region/location, which will also affect the cost. Costs of mulches, geotextiles and mats, and soil binders are presented in their respective fact sheets. Costs for decomposed granite, gravel mulch stabilization and rock slope protection may be higher depending on location and availability of materials. Caltrans has provided an estimate for gravel mulch of \$10 - \$15/yd^2 in flat areas and \$11 - \$23/yd^2 on side slopes.

Inspection and Maintenance

General

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- For permanent installation, require inspection periodically and after major storm events to look for signs of erosion or damage to the stabilization.
- All damage should be repaired immediately.
- Refer to EC-3, EC-6, EC-8, and EC-14 for inspection and maintenance requirements for mulches. Refer to EC-7 for inspection and maintenance requirements for geotextiles and mats. Refer to EC-5 for inspection and maintenance requirements for soil binders.

Decomposed Granite and Gravel Mulch Stabilization

- Rake out and add decomposed granite or gravel as needed to areas subject to rill erosion. Inspect upgradient drainage controls and repair/modify as necessary.

- Should remain stable under loose surface material. Any significant problem areas should be repaired to restore uniformity to the installation.

References

Arid Zone Forestry: A Guide for Field Technicians. Food and Agriculture Organization of the United Nations, 1989.

Design of Roadside Channels with Flexible Linings, Hydraulic Engineering Circular Number 15, Third Edition, Federal Highway Administration, 2007.

Design Standards for Urban Infrastructure - Soft Landscape Design, Department of Territory and Municipal Services - Australian Capital Territory http://www.tams.act.gov.au/work/standards_and_procedures/design_standards_for_urban_infrastructure

Erosion and Sediment Control Handbook: A Guide for Protection of State Waters through the use of Best Management Practices during Land Disturbing Activities, Tennessee Department of Environment and Conservation, 2002.

Gravel Mulch, Landscape Architecture Non-Standard Specification 10-2, California Department of Transportation (Caltrans), http://www.dot.ca.gov/hq/LandArch/roadside/detail-gm.htm

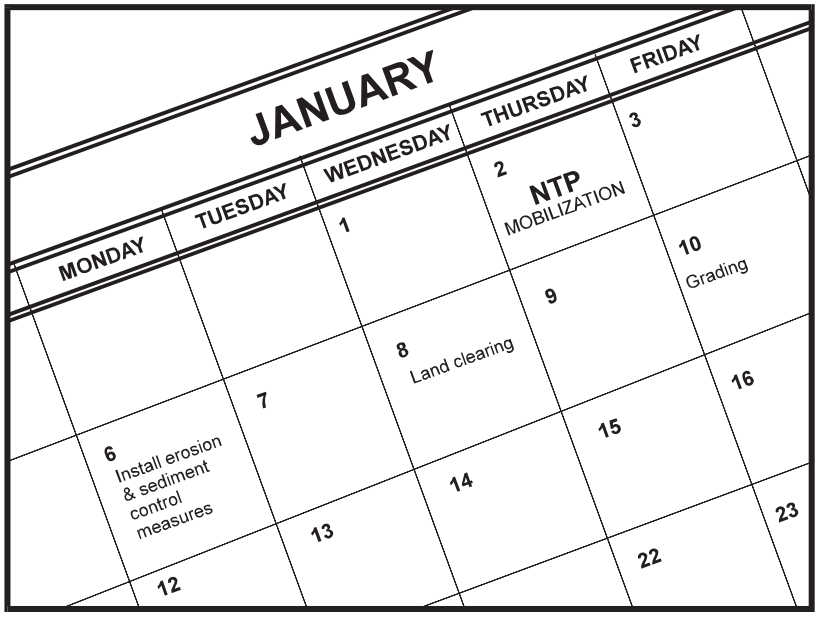
Maine Erosion and Sediment Control BMPs, DEPLW0588, Maine Department of Environmental Protection: Bureau of Land and Water Quality, 2003.

National Menu of Best Management Practices, US Environmental Protection Agency, 2006.

Standard Specification 72-2: Rock Slope Protection. California Department of Transportation, 2006.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Scheduling EC-1



Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. 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.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - 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.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

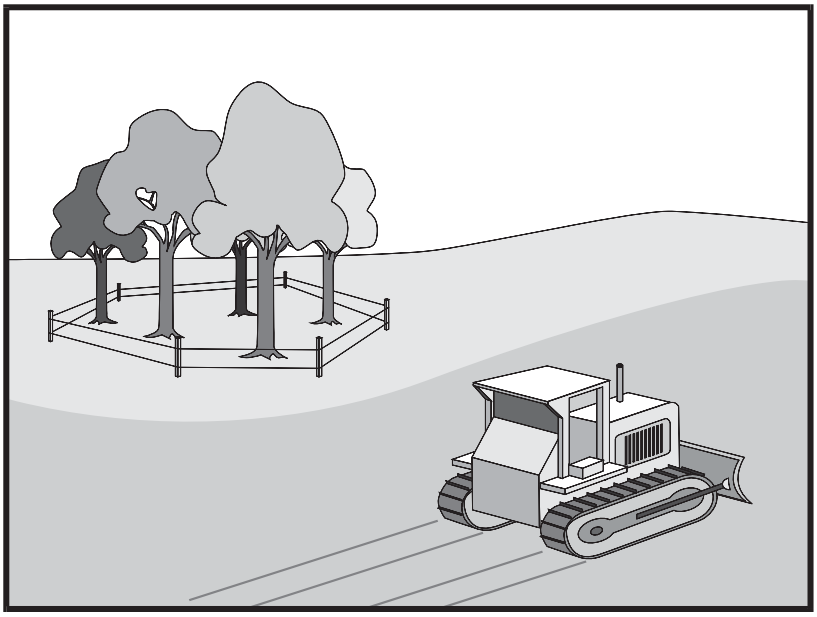
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

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

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far 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 or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

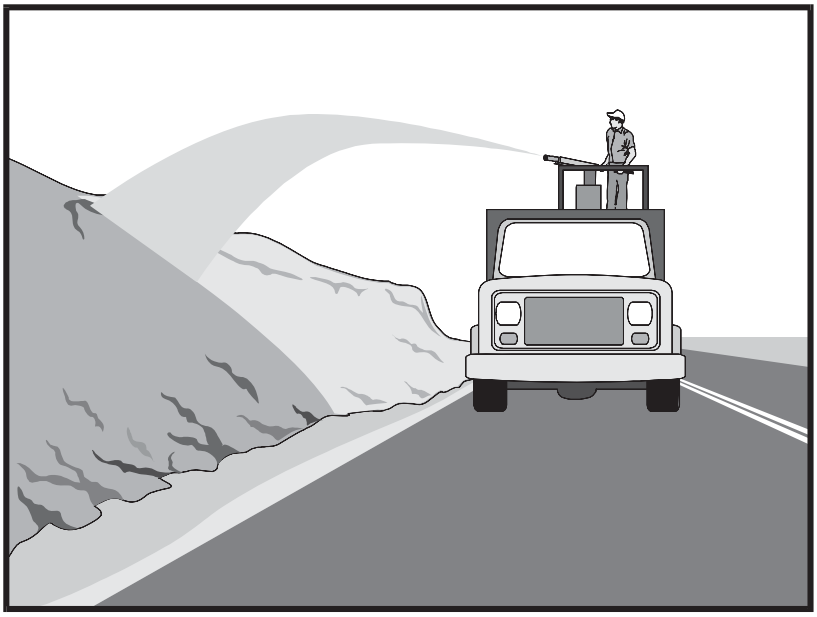
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch EC-3



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Hydraulic Mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

Suitable Applications

Hydraulic mulch as a temporary, stand alone, erosion control BMP is suitable for disturbed areas that require temporary protection from wind and water erosion until permanent soil stabilization activities commence. Examples include:

- Rough-graded areas that will remain inactive for longer than permit-required thresholds (e.g., 14 days) or otherwise require stabilization to minimize erosion or prevent sediment discharges.
- Soil stockpiles.
- Slopes with exposed soil between existing vegetation such as trees or shrubs.
- Slopes planted with live, container-grown vegetation or plugs.
- Slopes burned by wildfire.

Hydraulic mulch can also be applied to augment other erosion control BMPs such as:

- In conjunction with straw mulch (see EC-6 Straw Mulch) where the rate of hydraulic mulch is reduced to 100-500 lbs per acre and the slurry is applied over the straw as a tackifying agent to hold the straw in place.
- Supplemental application of soil amendments, such as fertilizer, lime, gypsum, soil bio-stimulants or compost.

Limitations

In general, hydraulic mulch is not limited by slope length, gradient or soil type. However, the following limitations typically apply:

- Most hydraulic mulch applications, particularly bonded fiber matrices (BFMs), require at least 24 hours to dry before rainfall occurs.
- Temporary applications (i.e., without a vegetative component) may require a second application in order to remain effective for an entire rainy season.
- Treatment areas must be accessible to hydraulic mulching equipment.
- Availability of water sources in remote areas for mixing and application.
- As a stand-alone temporary BMP, hydraulic mulches may need to be re-applied to maintain their erosion control effectiveness, typically after 6-12 months depending on the type of mulch used.
- Availability of hydraulic mulching equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Cellulose fiber mulches alone may not perform well on steep slopes or in course soils.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown and some may have water quality impacts due to their chemical makeup. Refer to specific chemical properties identified in the product Material Safety Data Sheet; products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.

Implementation

- Where feasible, it is preferable to prepare soil surfaces prior to application by roughening embankments and fill areas with a crimping or punching type roller or by track walking.
- The majority of hydraulic mulch applications do not necessarily require surface/soil preparation (See EC-15 Soil Preparation) although in almost every case where re-vegetation is included as part of the practice, soil preparation can be beneficial. One of the advantages of hydraulic mulch over other erosion control methods is that it can be applied in areas where soil preparation is precluded by site conditions, such as steep slopes, rocky soils, or inaccessibility.

- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Hydraulic mulching is generally performed utilizing specialized machines that have a large water-holding/mixing tank and some form of mechanical agitation or other recirculation method to keep water, mulch and soil amendments in suspension. The mixed hydraulic slurry can be applied from a tower sprayer on top of the machine or by extending a hose to areas remote from the machine.
- Where possible apply hydraulic mulch from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage and failure of the BMP.
- Hydraulic mulch can also include a vegetative component, such as seed, rhizomes, or stolons (see EC-4 Hydraulic Seed).
- Typical hydraulic mulch application rates range from 2,000 pounds per acre for standard mulches (SMs) to 3,500 pounds per acre for BFMs. However, the required amount of hydraulic mulch to provide adequate coverage of exposed topsoil may appear to exceed the standard rates when the roughness of the soil surface is changed due to soil preparation methods (see EC-15 Soil Preparation) or by slope gradient.
- Other factors such as existing soil moisture and soil texture can have a profound effect on the amount of hydraulic mulch required (i.e. application rate) applied to achieve an erosion-resistant covering.
- Avoid use of mulch without a tackifier component, especially on slopes.
- Mulches used in the hydraulic mulch slurry can include:
  - Cellulose fiber
  - Thermally-processed wood fibers
  - Cotton
  - Synthetics
  - Compost (see EC-14, Compost Blanket)
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Categories of Hydraulic Mulches

Standard Hydraulic Mulch (SM)

Standard hydraulic mulches are generally applied at a rate of 2,000 pounds per acre and are manufactured containing around 5% tackifier (i.e. soil binder), usually a plant-derived guar or psyllium type. Most standard mulches are green in color derived from food-color based dyes.

Hydraulic Matrices (HM) and Stabilized Fiber Matrices (SFM)

Hydraulic matrices and stabilized fiber matrices are slurries which contain increased levels of tackifiers/soil binders; usually 10% or more by weight. HMs and SFMs have improved performance compared to a standard hydraulic mulch (SM) because of the additional percentage of tackifier and because of their higher application rates, typically 2,500 – 4,000 pounds per acre. Hydraulic matrices can include a mixture of fibers, for example, a 50/50 blend of paper and wood fiber. In the case of an SFM, the tackifier/soil binder is specified as a polyacrylamide (PAM).

Bonded Fiber Matrix (BFM)

Bonded fiber matrices (BFMs) are hydraulically-applied systems of fibers, adhesives (typically guar based) and chemical cross-links. Upon drying, the slurry forms an erosion-resistant blanket that prevents soil erosion and promotes vegetation establishment. The cross-linked adhesive in the BFM should be biodegradable and should not dissolve or disperse upon re-wetting. BFMs are typically applied at rates from 3,000 to 4,000 lbs/acre based on the manufacturer's recommendation. BFMs should not be applied immediately before, during or immediately after rainfall or if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Mechanically-Bonded Fiber Matrices (MBFM)

Mechanically-bonded fiber matrices (MBFMs) are hydraulically applied systems similar to BFM that use crimped synthetic fibers and PAM and are typically applied to a slope at a higher application rate than a standard BFM.

Hydraulic Compost Matrix (HCM)

Hydraulic compost matrix (HCM) is a field-derived practice whereby finely graded or sifted compost is introduced into the hydraulic mulch slurry. A guar-type tackifier can be added for steeper slope applications as well as any specified seed mixtures. A HCM can help to accelerate seed germination and growth. HCMs are particularly useful as an in-fill for three-dimensional re-vegetation geocomposites, such as turf reinforcement mats (TRM) (see EC-7 Geotextiles and Mats).

Costs

Average installed costs for hydraulic mulch categories are is provided in Table 1, below.

Table 1
HYDRAULIC MULCH BMPs
INSTALLED COSTS

BMP	Installed Cost/Acre
Standard Hydraulic Mulching (SM)	$1,700 - $3,600 per acre
Hydraulic Matrices (HM) and Stabilized Fiber Matrices	
Guar-based	$2,000 - $4,000 per acre
PAM-based	$2,500 - $5,610 per acre
Bonded Fiber Matrix (BFM)	$3,900 - $6,900 per acre
Mechanically Bonded Fiber Matrix (MBFM)	$4,500 - $6,000 per acre
Hydraulic Compost Matrix (HCM)	$3,000 - $3,500 per acre

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004)

Inspection and Maintenance

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Compare the number of bags or weight of applied mulch to the area treated to determine actual application rates and compliance with specifications.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Controlling Erosion of Construction Sites, Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

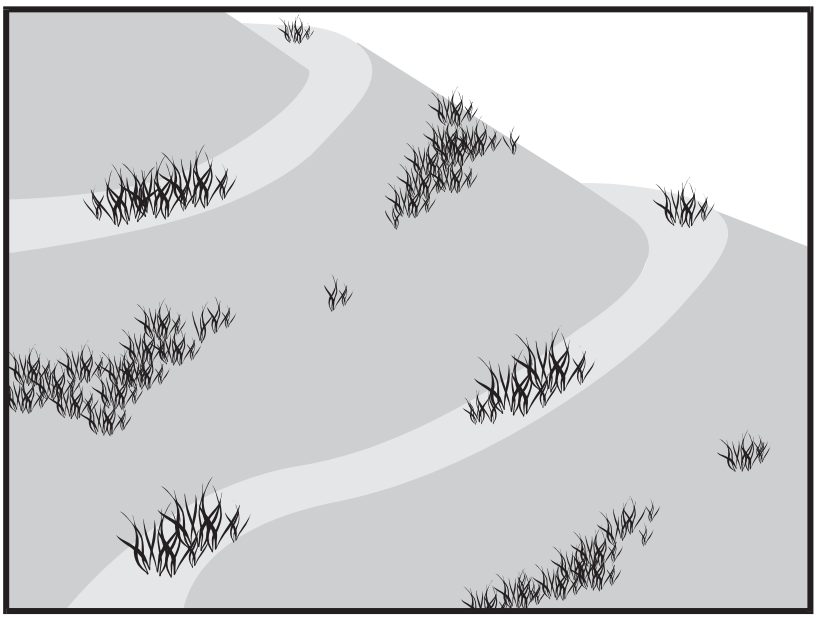
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding EC-4



Description and Purpose

Hydroseeding typically consists of applying a mixture of a hydraulic mulch, seed, fertilizer, and stabilizing emulsion with a hydraulic mulcher, to temporarily protect exposed soils from erosion by water and wind. Hydraulic seeding, or hydroseeding, is simply the method by which temporary or permanent seed is applied to the soil surface.

Suitable Applications

Hydroseeding is suitable for disturbed areas requiring temporary protection until permanent stabilization is established, for disturbed areas that will be re-disturbed following an extended period of inactivity, or to apply permanent stabilization measures. Hydroseeding without mulch or other cover (e.g. EC-7, Erosion Control Blanket) is not a stand-alone erosion control BMP and should be combined with additional measures until vegetation establishment.

Typical applications for hydroseeding include:

- Disturbed soil/graded areas where permanent stabilization or continued earthwork is not anticipated prior to seed germination.
- Cleared and graded areas exposed to seasonal rains or temporary irrigation.
- Areas not subject to heavy wear by construction equipment or high traffic.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Availability of hydroseeding equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Hydraulic seed should be applied with hydraulic mulch or a stand-alone hydroseed application should be followed by one of the following:
    - Straw mulch (see Straw Mulch EC-6)
    - Rolled erosion control products (see Geotextiles and Mats EC-7)
    - Application of Compost Blanket (see Compost Blanket EC-14)

  Hydraulic seed may be used alone only on small flat surfaces when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control.
- Hydraulic seed without mulch does not provide immediate erosion control.
- Temporary seeding may not be appropriate for steep slopes (i.e., slopes readily prone to rill erosion or without sufficient topsoil).
- 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 may not be appropriate for short term inactivity (i.e. less than 3-6 months).
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown and some may have water quality impacts due to their chemical makeup. Additionally these constituents may require non-visible pollutant monitoring. Refer to specific chemical properties identified in the product Material Safety Data Sheet; products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.

Implementation

In order to select appropriate hydraulic seed mixtures, an evaluation of site conditions should be performed with respect to:

- Soil conditions
- Site topography and exposure (sun/wind)
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS), Resource Conservation Districts and Agricultural Extension Service can provide information on appropriate seed mixes.

The following steps should be followed for implementation:

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying (See EC-15, Soil Preparation) the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.
- Avoid use of hydraulic seed in areas where the BMP would be incompatible with future earthwork activities.
- Hydraulic seed can be applied using a multiple step or one step process.
  - In a multiple step process, hydraulic seed is applied first, followed by mulch or a Rolled Erosion Control Product (RECP).
  - In the one step process, hydraulic seed is applied with hydraulic mulch in a hydraulic matrix. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.
- All hydraulically seeded areas should have mulch, or alternate erosion control cover to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds should be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag should be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container should be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed should be pellet inoculated. Inoculant sources should be species specific and should be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer should conform to the requirements of the California Food and Agricultural Code, which can be found at http://www.leginfo.ca.gov/.html/fac_table_of_contents.html. Fertilizer should be pelleted or granular form.
- Follow up applications should be made as needed to cover areas of poor coverage or germination/vegetation establishment and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Costs

Average cost for installation and maintenance may vary from as low as $1,900 per acre for flat slopes and stable soils, to $4,000 per acre for moderate to steep slopes and/or erosive soils. Cost of seed mixtures vary based on types of required vegetation.

BMP	Installed Cost per Acre
Hydraulic Seed	$1,900-$4,000

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems should be inspected for complete coverage and adjusted as needed to maintain complete coverage.

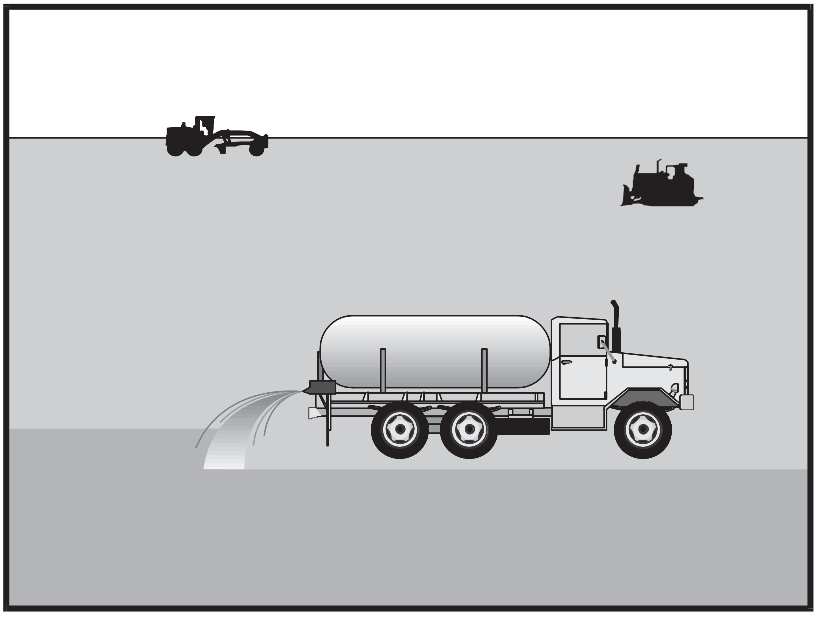
References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders EC-5



Categories		
EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Soil binding consists of application and maintenance of a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring temporary protection. Because soil binders, when used as a stand-alone practice, can often be incorporated into the soil, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are commonly used in the following areas:

- Rough graded soils that will be inactive for a short period of time
- Soil stockpiles
- Temporary haul roads prior to placement of crushed rock
- Compacted soil road base
- Construction staging, materials storage, and layout areas

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. Curing time

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.
- Plant-material-based soil binders do not generally hold up to pedestrian or vehicular traffic across treated areas as well as polymeric emulsion blends or cementitious-based binders.
- Soil binders may not sufficiently penetrate compacted soils.
- Some soil binders are soil texture specific in terms of their effectiveness. For example, polyacrylamides (PAMs) work very well on silt and clayey soils but their performance decreases dramatically in sandy soils.
- 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.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of some chemical soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup. Additionally, these chemical may require non-visible pollutant monitoring. Products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to the product Material Safety Data Sheet for chemical properties.

Implementation

General Considerations

- Soil binders should conform to local municipality specifications and requirements.
- Site 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 should not stain paved or painted surfaces. Soil binders should not pollute stormwater when cured. Obtain a Material Safety Data Sheet (MSDS) from the manufacturer to ensure non-toxicity.
- Stormwater runoff from PAM treated soils should pass through one of the following sediment control BMP prior to discharging to surface waters.
    - When the total drainage area is greater than or equal to 5 acres, PAM treated areas should drain to a sediment basin.
    - Areas less than 5 acres should drain to sediment control BMPs, such as a sediment trap, or a series of check dams. The total number of check dams used should be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam should be spaced evenly in the drainage channel through which stormwater flows are discharged off site.

- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this Fact Sheet. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

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

- Suitability to situation - Consider where the soil binder will be applied, 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 is related to the functional longevity of the binder, which 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.

Plant-Material-Based (Short Lived, <6 months) Binders

Guar: Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	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. Application rates should be from 80 to 200 lb/acre, 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 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material-Based (Long Lived, 6-12 months) Binders

Pitch and Rosin Emulsion: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should 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 should 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 and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

Acrylic Copolymers and Polymers: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound typically requires 12 to 24 hours drying time. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

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 the manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. 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 (H:V)	lb/acre
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:1 to 1:1	10.0 – 20.0

Poly-Acrylamide (PAM) and Copolymer of Acrylamide**:** Linear copolymer polyacrylamide for use as a soil binder is packaged as a dry flowable solid, as a liquid. Refer to the manufacturer's recommendation for dilution and application rates as they vary based on liquid or dry form, site conditions and climate.

- Limitations specific to PAM are as follows:
  - Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
  - The specific PAM copolymer formulation must be anionic. Cationic PAM should not be used in any application because of known aquatic toxicity problems. Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, should be used for soil applications.
  - PAM designated for erosion and sediment control should be "water soluble" or "linear" or "non-cross linked".
  - PAM should not be used as a stand-alone BMP to protect against water-based erosion. When combined with mulch, its effectiveness increases dramatically.

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 55 to 60 lb/acre. 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 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Applying Soil Binders

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 should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F 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 time.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd^2 or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd^2.

Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate installed costs:

Soil Binder	Cost per Acre (2004)[1]	Estimated Cost per Acre (2009)[2]
Plant-Material-Based (Short Lived) Binders	$700-$900	$770-$990
Plant-Material-Based (Long Lived) Binders	$1,200-$1,500	$1,320-$1,650
Polymeric Emulsion Blend Binders	$700 -$1,500	$770-$1,650
Cementitious-Based Binders	$800-$1,200	$880-$1,350

1. Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

2. 2009 costs reflect a 10% escalation over year 2004 costs. Escalation based on informal survey of industry trends. Note: Expected cost increase is offset by competitive economic conditions.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Reapply the selected soil binder as needed to maintain effectiveness.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Binders
Relative Cost	Low	Moderate to High	Low to High	Low to Moderate
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 (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

References

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

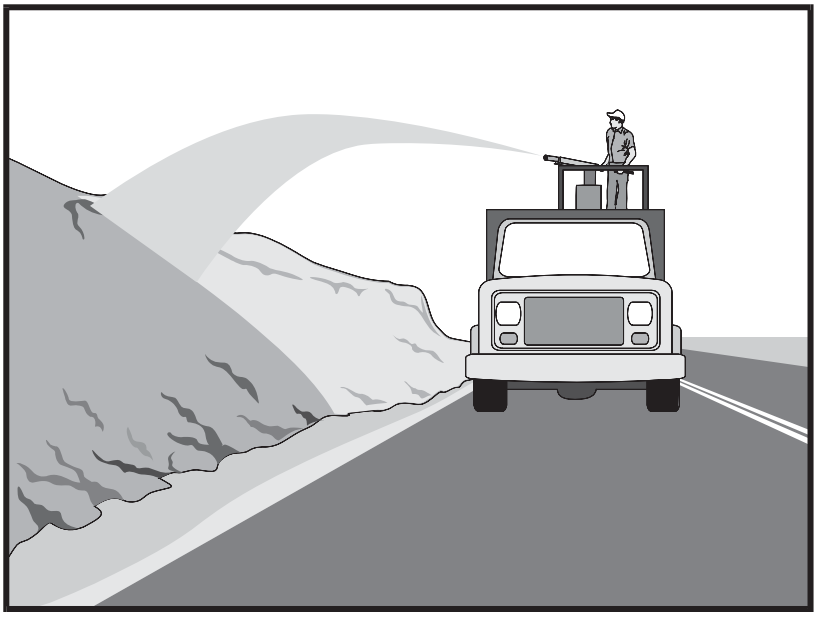
Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Straw Mulch EC-6



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-7 Geotextiles and Mats
EC-8 Wood Mulching
EC-14 Compost Blanket

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper, or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch can be specified for the following applications:

- As a stand-alone BMP on disturbed areas until soils can be prepared for permanent vegetation. The longevity of straw mulch is typically less than six months.
- Applied in combination with temporary seeding strategies
- Applied in combination with permanent seeding strategies to enhance plant establishment and final soil stabilization
- Applied around containerized plantings to control erosion until the plants become established to provide permanent stabilization

Limitations

Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.

- There is a potential for introduction of weed seed and unwanted plant material if weed-free agricultural straw is not specified.
- Straw mulch applied by hand is more time intensive and potentially costly.
- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.
- Potential fugitive dust control issues associated with straw applications can occur. Application of a stabilizing emulsion or a water stream at the same time straw is being blown can reduce this problem.
- Use of plastic netting should be avoided in areas where wildlife may be entrapped and may be prohibited for projects in certain areas with sensitive wildlife species, especially reptiles and amphibians.

Implementation

- Straw should be derived from weed-free wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw should be used.
- Use tackifier to anchor 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 can be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier should not be applied during or immediately before rainfall.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Application Procedures

- When using a tackifier to anchor the straw mulch, 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.
- Apply straw at a rate of between 3,000 and 4,000 lb/acre, either by machine or by hand distribution and provide 100% ground cover. A lighter application is used for flat surfaces and a heavier application is used for slopes.
- Evenly distribute straw mulch on the soil surface.
- Anchoring straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating) can be used in lieu of a tackifier.

- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.

  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier should be selected based on longevity and ability to hold the fibers in place. A tackifier is typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.

  - On very small areas, a spade or shovel can be used to punch in straw mulch.

  - On slopes with soils that 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 coulter, known commercially as a "crimper."

Costs

Average annual cost for installation and maintenance is included in the table below. Application by hand is more time intensive and potentially more costly.

BMP	Unit Cost per Acre
Straw mulch, crimped or punched	$2,458-$5,375
Straw mulch with tackifier	$1,823-$4,802

Source: Cost information received from individual product suppliers solicited by Geosyntec Consultants (2004).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.

- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives. Straw mulch as a stand-alone BMP is temporary and is not suited for long-term erosion control.

- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.

- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

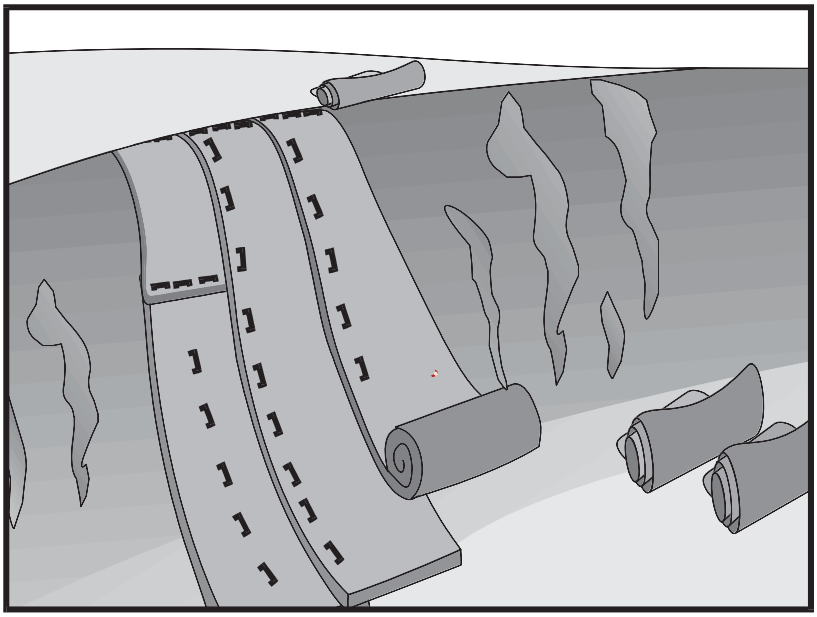
Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Geotextiles and Mats EC-7



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Mattings, or Rolled Erosion Control Products (RECPs), can be made of natural or synthetic materials or a combination of the two. RECPs are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, RECPs may be used to stabilize soils until vegetation is established or to reinforce non-woody surface vegetation.

Suitable Applications

RECPs are typically applied on slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks, swales and other drainage channels where moving water at velocities between 3 ft/s and 6 ft/s are likely to cause scour and wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. RECPs may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). RECPs should be considered when the soils are fine grained and potentially erosive. RECPs should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- 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 3.3 ft/s
- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies

Limitations

- RECP installed costs are generally higher than other erosion control BMPs, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes).
- RECPs may delay seed germination, due to reduction in soil temperature.
- RECPs 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). If a staple or pin cannot be driven into the soil because the underlying soil is too hard or rocky, then an alternative BMP should be selected.
- If used for temporary erosion control, RECPs should be removed and disposed of prior to application of permanent soil stabilization measures.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until more environmentally friendly measures, such as seeding and mulching, may be installed.
    - Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
    - Plastic sheeting results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- RECPs may have limitations based on soil type, slope gradient, or channel flow rate; consult the manufacturer for proper selection.
- Not suitable for areas that have foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.
- RECPs that incorporate a plastic netting (e.g. straw blanket typically uses a plastic netting to hold the straw in place) may not be suitable near known wildlife habitat. Wildlife can become trapped in the plastic netting.
- RECPs may have limitations in extremely windy climates. However, when RECPs are properly trenched at the top and bottom and stapled in accordance with the manufacturer's recommendations, problems with wind can be minimized.

Implementation

Material Selection

- Natural RECPs have been found to be effective where re-vegetation will be provided by re-seeding. The choice of material should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

- The following natural and synthetic RECPs are commonly used:

Geotextiles

- Material can be a woven or a non-woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Generally plastic sheeting should only be used as stockpile covering or for very small graded areas for short periods of time (such as through one imminent storm event). If plastic sheeting must be used, choose a plastic that will withstand photo degradation.

- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope (when used as a temporary slope protection) and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil (when used as a temporary slope protection).

- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable RECPs are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order 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. See typical installation details at the end of this fact sheet.

- **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. The performance of jute as a stand-alone RECP is low. Most other RECPs outperform jute as a temporary erosion control product and therefore jute is not commonly used. It is designed to be used in conjunction with vegetation. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd^2, $\pm$10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5 lb/yd^2. Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. 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 must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- 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 or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must 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 ¼ in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must 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 re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must 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 percent open area, which facilitates root growth. It's 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 must 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 re-vegetation. The material is furnished in rolled strips,

which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper soil preparation is essential to ensure complete contact of the RECP with the soil. Soil Roughening is not recommended in areas where RECPs will be installed.
- 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 2 to 3 in. of topsoil.

Seeding/Planting

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

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots shall be installed as required by the manufacturer.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the seedbed should be friable, made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

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.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should 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 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft (or greater, per manufacturer's specifications).
- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 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 should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2. Check manufacturer's specifications to determine if a higher density staple pattern is required.

Installation in Channels

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

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channels.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 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 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 3 in.
- Secure these initial ends of mats with anchors at 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 3 in. overlap.

- 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 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 6 in. centers at 25 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 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 12 in. by 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 mat (TRM))

Installation should be in accordance with the manufacturer's recommendations. Typical installation guidelines are as follows:

- After seeding, spread and lightly rake ½-3/4 inches of fine topsoil into the TRM apertures to completely fill TRM thickness. Use backside of rake or other flat implement.
- Alternatively, if allowed by product specifications, spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment.
- 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

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Installed costs can be relatively high compared to other BMPs. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre (2004)[1]	Estimated Cost per Acre (2009)[2]
Biodegradable	Jute Mesh	$6,000-$7,000	$6,600-$7,700
	Curled Wood Fiber	$8,000-$10,500	$8,800-$11,050
	Straw	$8,000-$10,500	$8,800-$11,050
	Wood Fiber	$8,000-$10,500	$8,800-$11,050
	Coconut Fiber	$13,000-$14,000	$14,300-$15,400
	Coconut Fiber Mesh	$30,000-$33,000	$33,000-$36,300
	Straw Coconut Fiber	$10,000-$12,000	$11,000-$13,200
Non-Biodegradable	Plastic Netting	$2,000-$2,200	$2,200-$2,220
	Plastic Mesh	$3,000-$3,500	$3,300-$3,850
	Synthetic Fiber with Netting	$34,000-$40,000	$37,400-$44,000
	Bonded Synthetic Fibers	$45,000-$55,000	$49,500-$60,500
	Combination with Biodegradable	$30,000-$36,000	$33,000-$39,600

1. Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

2. 2009 costs reflect a 10% escalation over year 2004 costs. Escalation based on informal survey of industry trends. Note: Expected cost increase is offset by competitive economic conditions.

Inspection and Maintenance

- RECPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.

References

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

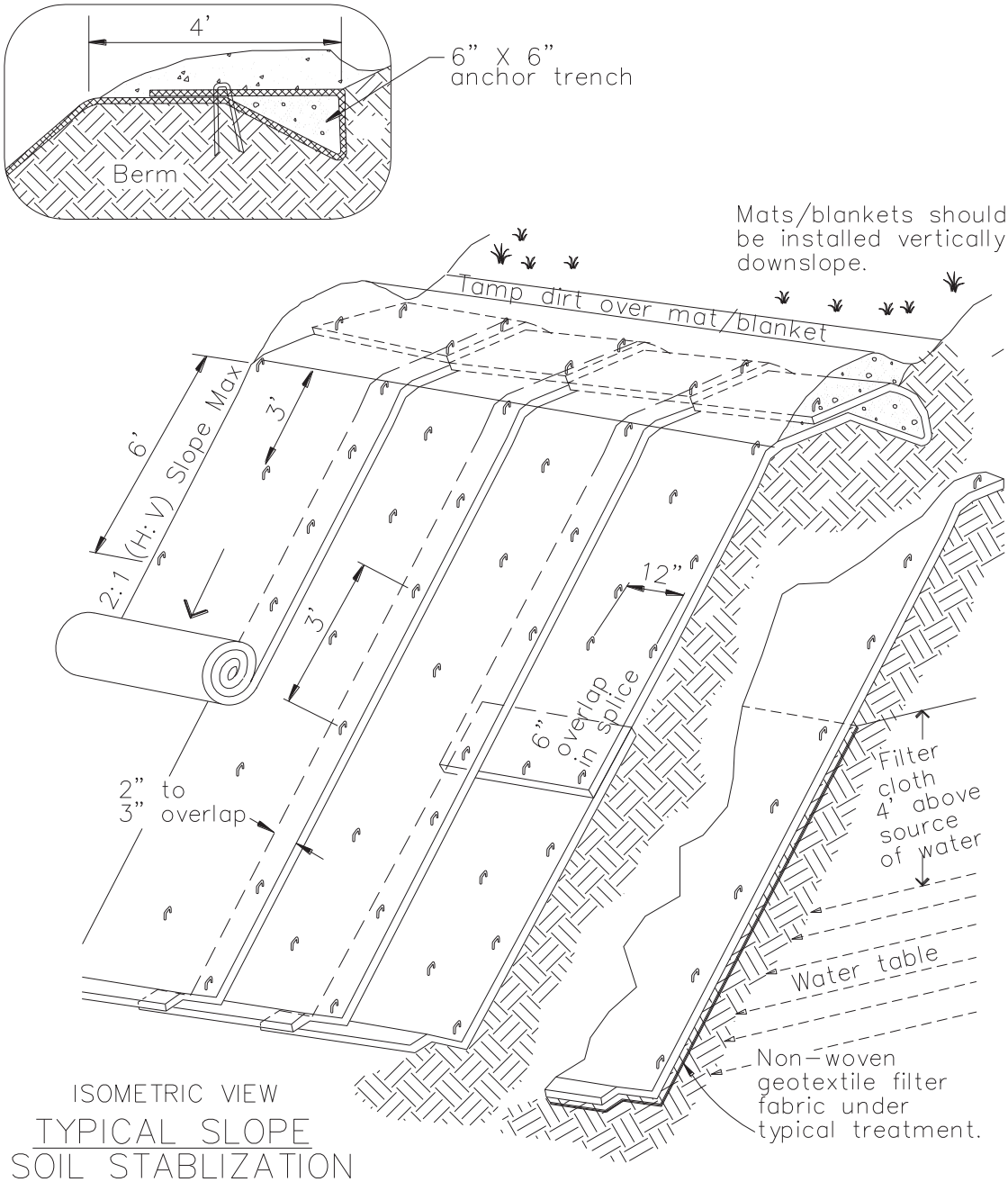
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



ISOMETRIC VIEW

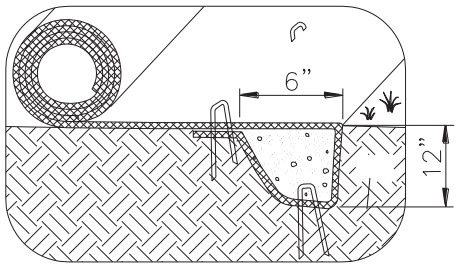
TYPICAL SLOPE
SOIL STABLIZATION
NTS

WET SLOPE LINING
NTS

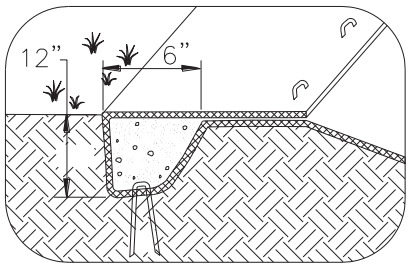
NOTES:

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

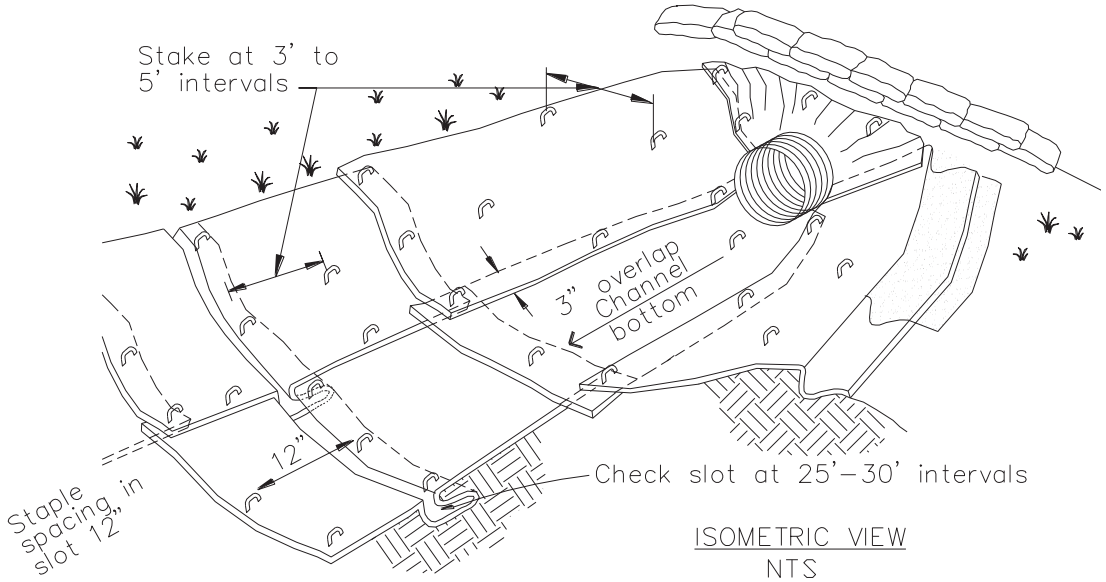
TYPICAL INSTALLATION DETAIL



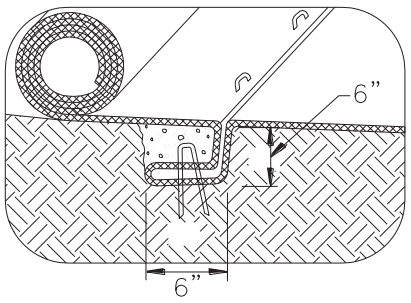
INITIAL CHANNEL ANCHOR TRENCH
NTS



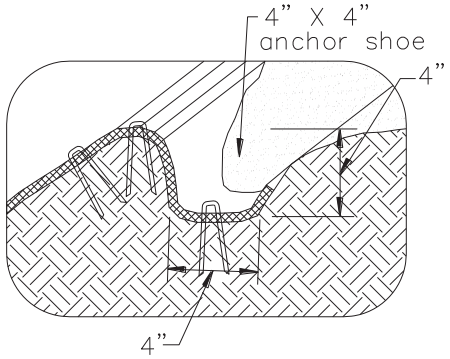
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
NTS



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

TYPICAL INSTALLATION DETAIL

Wood Mulching EC-8



Description and Purpose

Wood mulching consists of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Suitable Applications

Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established.

Limitations

- Not suitable for use on slopes steeper than 3:1 (H:V). Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter.
- Wood mulch and compost may introduce unwanted species.
- Not suitable for areas exposed to concentrated flows.
- May need to be removed prior to further earthwork.

Implementation

Mulch Selection

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-6 Straw Mulch

EC-7 Geotextiles and Mats

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such as 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 methods are highlighted here:

- Green Material: This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Methods of application are generally by hand although pneumatic methods are available.
  - Green material can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 2 in.
- Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable. See note under limitations.
  - Distribute by hand or use pneumatic methods.
  - Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.
- Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is around $4,000 per acre, but cost can increase if the source is not close to the project site.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Regardless of the mulching technique selected, the key consideration in inspection and maintenance 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 should 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 should focus on longevity and integrity of the mulch.
- Reapply mulch when bare earth becomes visible.

References

Controlling Erosion of Construction Sites Agriculture Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

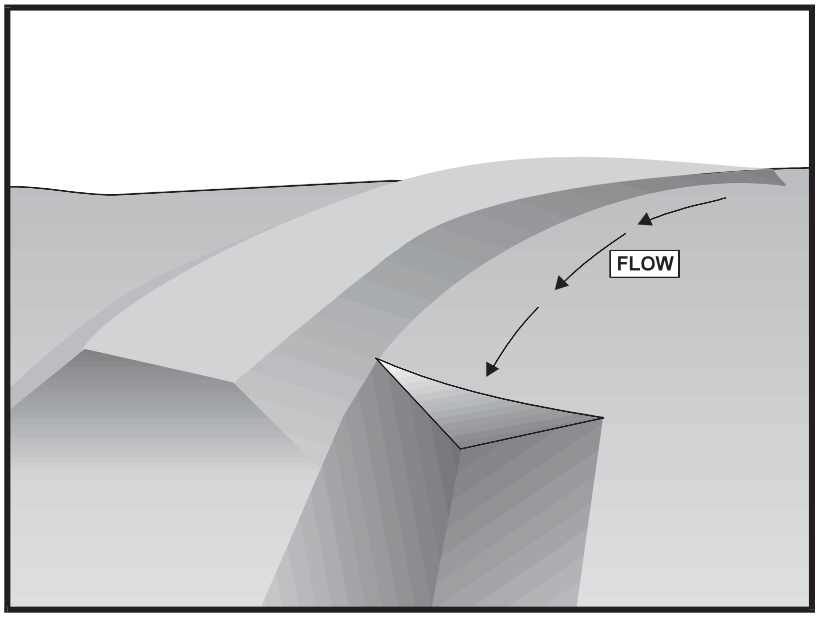
Sedimentation and Erosion Control, An Inventory of Current Practices Draft, U.S. EPA, April 1990.

Soil Erosion by Water Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Earth Dikes and Drainage Swales EC-9



Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It 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.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in drainage swales.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert

runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should 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, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin

(SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.

- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/$yd^3$.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- 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.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

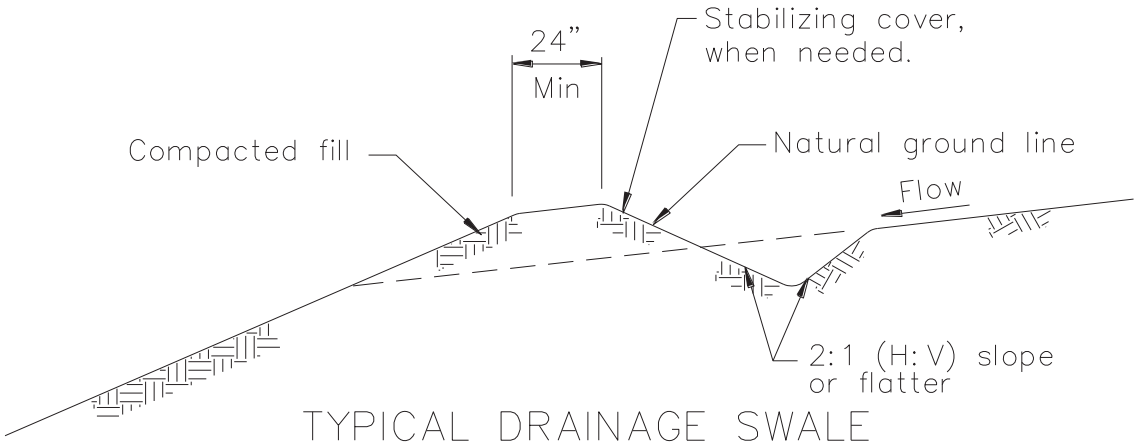
National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

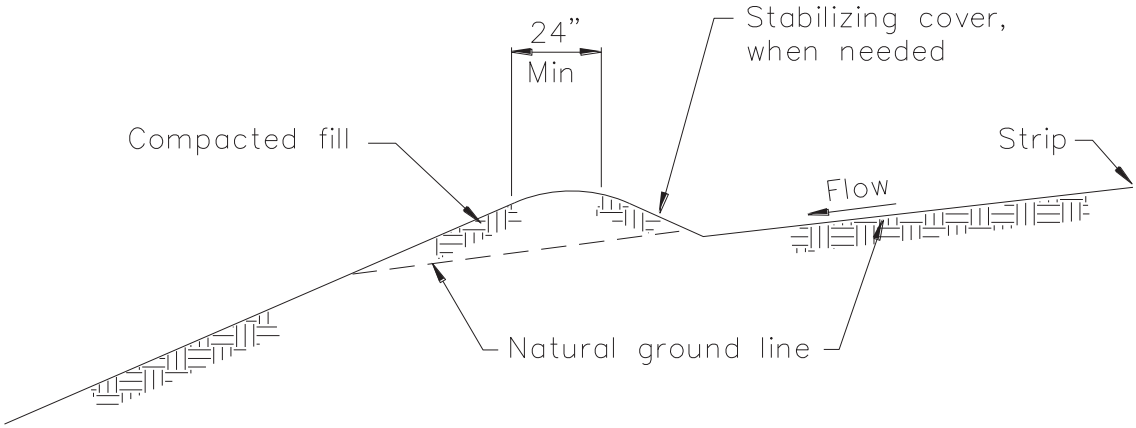
Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL DRAINAGE SWALE
NOT TO SCALE

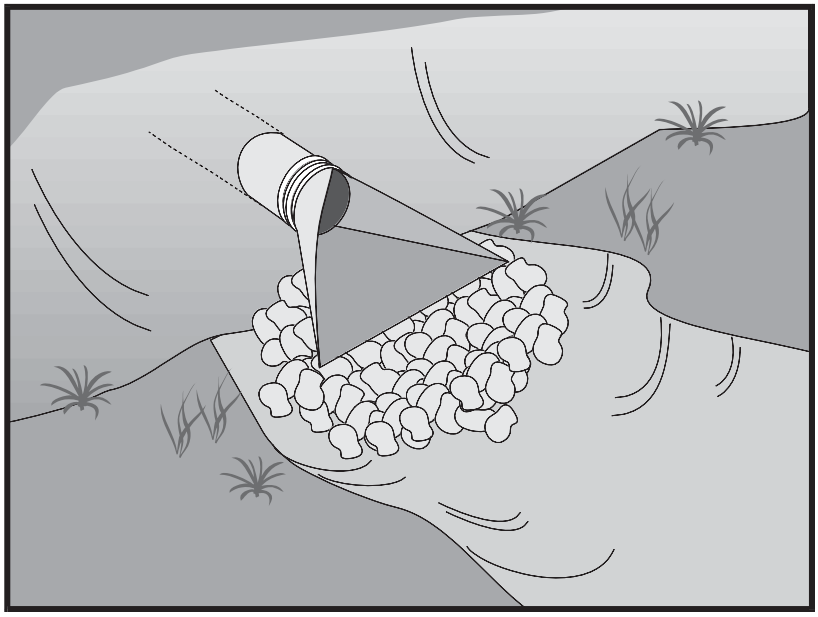
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

Velocity Dissipation Devices EC-10



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runon during construction.

- 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

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- 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.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in velocity dissipation devices.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.

- Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.

- Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.

- Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- 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.

- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.

- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.

- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

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

References

County of Sacramento Improvement Standards, Sacramento County, May 1989.

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

Handbook of Steel Drainage & Highway Construction, American Iron and Steel Institute, 1983.

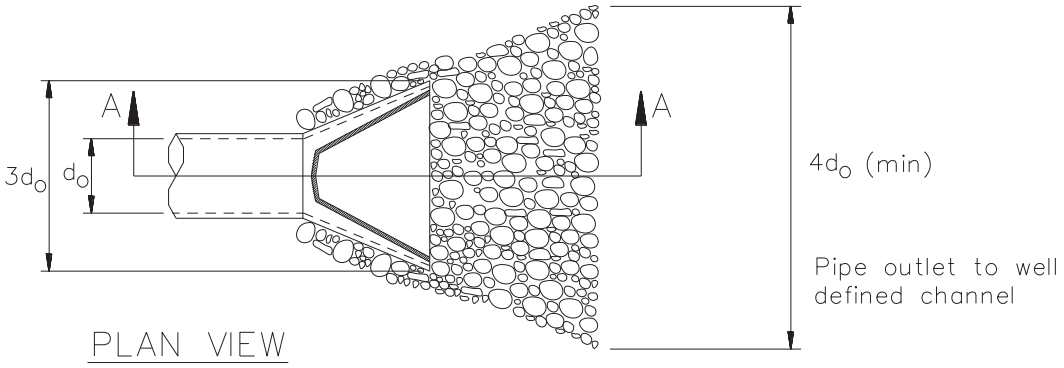
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

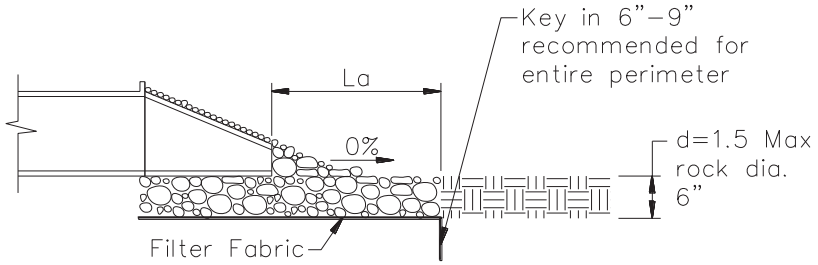
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, state of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



PLAN VIEW

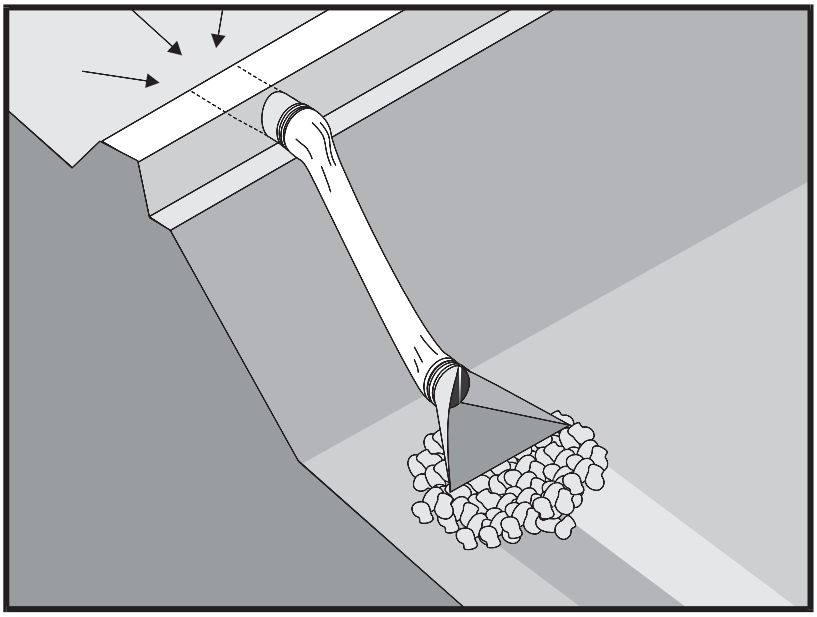


SECTION A–A

Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS

Slope Drains EC-11



Description 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 earth dikes and drainage ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.
- If the sectional downdrain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.

- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in energy dissipaters associated with slope drain outlets.

Implementation

General

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

Installation

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.
- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.
- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.
- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.
- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.
- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.
- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.

- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.
- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.
- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.
- 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 watertight.
  - 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 outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.
  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

Design and Layout

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

Materials:

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.

- **Flexible Pipe**: The flexible pipe slope drain consists of a flexible tube of heavy duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.

- **Section Downdrains**: The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.

- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

Costs

- Cost varies based on pipe selection and selected outlet protection.

Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12”	$19.60 per LF
15”	$22.00
18”	$26.00
24”	$32.00
30”	$50.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12”	$24.50
14”	$49.00
16”	$51.00
18”	$54.00
20”	$66.00
24”	$93.00
30”	$130.00

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.
- 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.
- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.
- Inspect pipes for leakage. Repair leaks and restore damaged slopes.
- Inspect slope drainage for accumulations of debris and sediment.

- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.
- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

References

Draft – Sedimentation and Erosion Control, An Inventory of Current Practices, U.S.E.P.A., April 1990.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

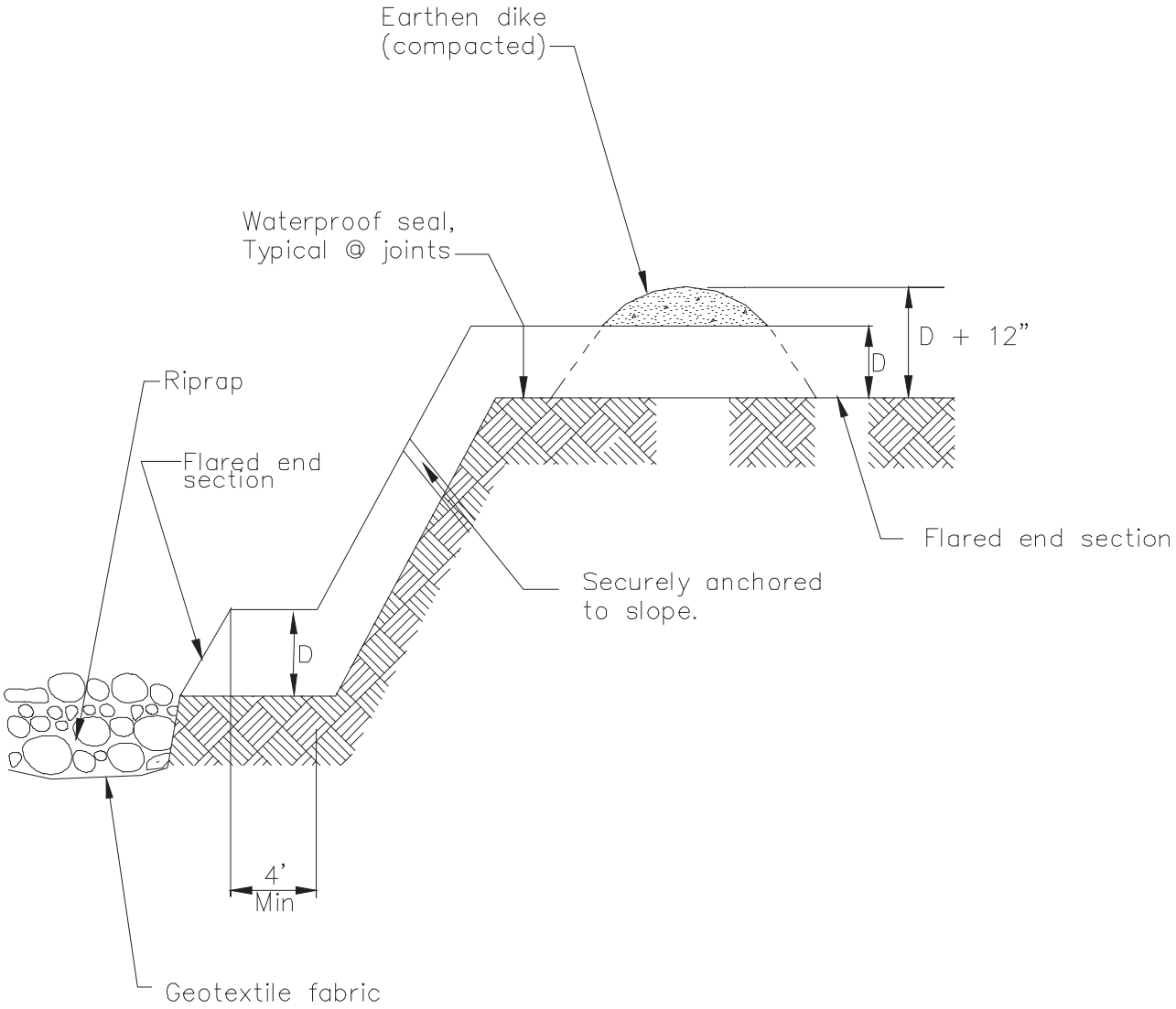
National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL SLOPE DRAIN
NOT TO SCALE

Streambank Stabilization EC-12



Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

Combination of erosion and sediment controls.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Stream channels, streambanks, 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. BMPs can reduce the discharge of sediment and other pollutants to minimize the impact of construction activities on watercourses. Streams on the 303(d) list and listed for sediment may require numerous measures to prevent any increases in sediment load to the stream.

Suitable 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 supercede the guidance in this BMP.

- If numerical based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. Streams listed as 303(d) impaired for sediment, silt, or turbidity, are required to

conduct sampling to verify that there is no net increase in sediment load due to construction activities.

Implementation

Planning

- Proper planning, design, and construction techniques can minimize impacts normally associated with in stream construction activities. Poor planning can adversely affect soil, fish, 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

- Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with EC-1, Scheduling. Scheduling considerations will be different when working near perennial streams vs. ephemeral streams and are as follows.

- When in-stream construction is conducted in a perennial stream, work 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, 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 tying up 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 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 50 ft from stream channel. 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 areas disturbed by prior construction or other activity 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 lb/in^2, where possible. Low ground pressure equipment includes: wide or high flotation tires (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

- Preserve existing vegetation in accordance with EC-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 15 to 100 ft. On gradual slopes, most of the filtering occurs within the first 30 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, evapo transpiration, 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 (100 to 1500 ft).
- When working near watercourses, it is important to understand the work site's placement in the watershed. Riparian vegetation in 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 50 ft plus four times the percent slope of the land, measured between the road and the top of stream bank.

Hydraulic Mulch

- Apply hydraulic mulch on disturbed streambanks above mean high water level in accordance with EC-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 (eutrophication is an algal bloom caused by excessively high nutrient levels in the water).

Hydroseeding

- Hydroseed disturbed streambanks in accordance with EC-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

- Apply soil binders to disturbed streambanks in accordance with EC-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

- Apply straw mulch to disturbed streambanks in accordance with EC-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 and Mats

- Install geotextiles and mats as described in EC-7, Geotextiles and 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

- Convey, intercept, or divert runoff from disturbed streambanks using EC-9, Earth Dikes and Drainage Swales.

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.
- Appropriately sized velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Velocity Dissipation Devices

- Place velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with EC-10, Velocity Dissipation Devices.

Slope Drains

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

Limitations

- Appropriately sized outlet protection and velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Streambank Sediment Control

Silt Fences

- Install silt fences in accordance with SE-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

- Install fiber rolls in accordance with SE-5, Fiber Rolls, along contour of slopes 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 SE-1, Silt Fence or SE-9 Straw Bale Barrier. Install silt fence, straw bale barrier, or other erosion control method along toe of slope above the high water level.

Gravel Bag Berm

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment laden sheet flow runoff in accordance with SE-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 live stream.

Limitations

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

Straw Bale Barrier

- Install straw bale barriers in accordance with SE-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 SE-1, Silt Fence,

on down slope side of 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 BMP.

Applications

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

Limitations

- Inappropriate for contributing drainage areas greater than 5 acres.
- 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 aesthetics is a concern.

Specifications

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

Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Reshape berms as needed and replace lost or dislodged rock, and filter fabric.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

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 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, cuts or fills slopes.

Limitations

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

Implementation

- Refer to NS-5, Clear Water Diversion, for implementation requirements.

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 "pull" 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 re-vegetation.

- **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 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 flow. 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.

Implementation

- 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).

Inspection and Maintenance

- None necessary

Costs

Cost may vary according to the combination of practices implemented.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events until final stabilization is achieved.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

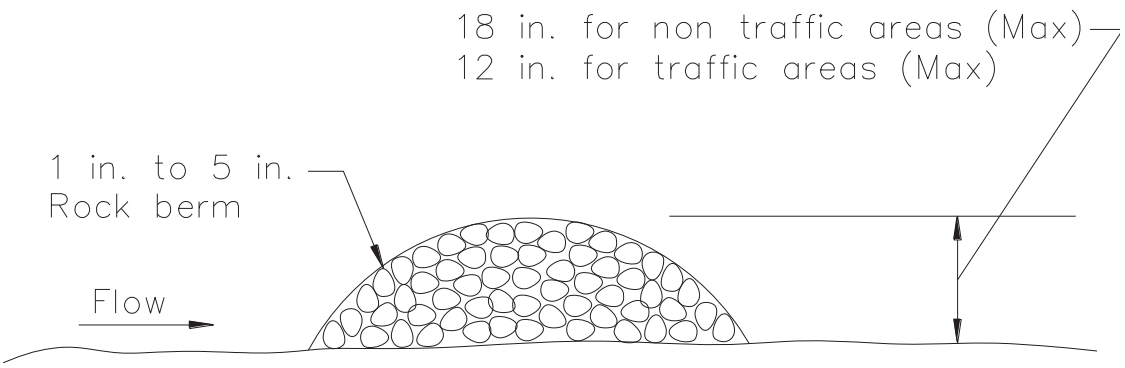
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, An Inventory of Current Practices (Draft), UESPA, 1990.

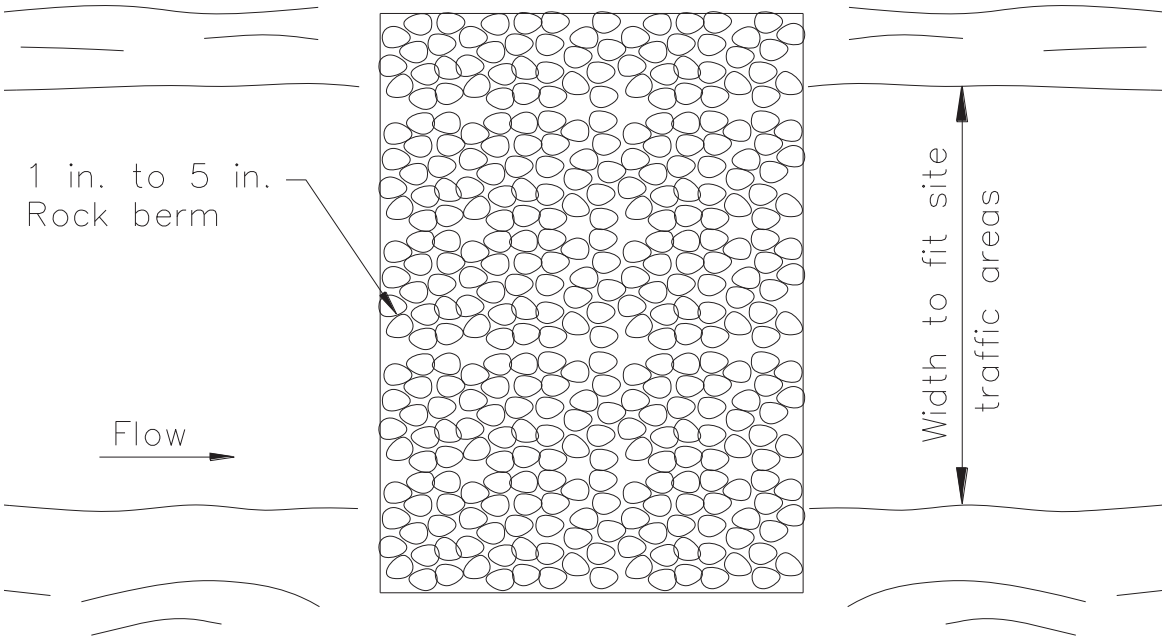
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



SECTION



PLAN

TYPICAL ROCK FILTER
NOT TO SCALE

Reserved

EC-13

BMP Factsheet removed in 2009.
Formerly PAM. See SE-11, Active Treatment Systems.

Categories

EC	Erosion Control
SE	Sediment Control
TC	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment
Nutrients
Trash
Metals
Bacteria
Oil and Grease
Organics

Potential Alternatives

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Compost Blanket EC-14



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

EC-5 Soil Binders

EC-7 Geotextiles and Mats

EC-8 Wood Mulching

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

A compost blanket is applied to slopes and earth disturbed areas to prevent erosion, and in some cases, increase infiltration and/or establish vegetation. The compost blanket can be applied by hand, conveyor system, compost spreader, or pneumatic delivery (blower) system. The blanket thickness is determined from the slope steepness and anticipated precipitation. A compost blanket protects the soil surface from raindrop erosion, particularly rills and gullies that may form under other methods of erosion control.

A compost blanket, if properly installed, can be very successful at vegetation establishment, weed suppression and erosion control. The compost blanket comes into direct contact with the underlying soil, reducing rill formation. Furthermore, compost provides organic matter and nutrients important for vegetation growth. The compost blanket provides soil structure that allows water to infiltrate the soil surface and retain moisture, which also promotes seed germination and vegetation growth, in addition to reducing runoff.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Greenwaste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly, compost selection is an important design consideration in the application of this type of erosion control.

Suitable Applications

A compost blanket is appropriate for slopes and earth disturbed areas requiring protection until permanent stabilization is established. A compost blanket can also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment. Examples include:

- Rough-graded areas that will remain inactive for longer than 14 days
- Soil stockpiles
- Slopes with exposed soil between existing vegetation such as trees or shrubs
- Slopes planted with live, container-grown vegetation
- Disturbed areas where plants are slow to develop

A compost blanket is typically used on slopes of 2:1 (H:V) or gentler. However, a compost blanket can be effective when applied to slopes as steep as 1:1 (H:V) with appropriate design considerations including slope length, blanket thickness, adding components such as a tackifier, or using compost blankets in conjunction with other techniques, such as compost socks and berms or fiber rolls.

Compost can be pre-seeded prior to application to the soil (recommended by the EPA for construction site stormwater runoff control) or seeded after the blanket has been installed. The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons (USEPA, 1998).

Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Carefully consider the qualifications and experience of any compost producer/supplier.
- A compost blanket applied by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost effective method of application.
- When blowers are used, the treatment areas should be within 300 ft of a road or surface capable of supporting trucks.
- Wind may limit application of compost and result in application to undesired locations.
- Compost blankets should not be applied in areas of concentrated flows.
- Steeper slopes may require additional blanket thickness and other stability measures such as using tackifiers or slope interruption devices (compost socks and berms, or fiber rolls). The same applies for sites with high precipitation totals or during the rainy season.

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in Table 1 below, taken from Caltrans Standard Special Provision 10-1 (SSP 10-1), Erosion Control (Compost Blanket).

- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.

- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.

- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.

- Compost should be high-quality mature compost. Immature compost can potentially leach nutrients.

- Compost should not be derived from mixed municipal solid waste and should be free of visible contaminants.

- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

- Compost should not possess objectionable odors.

- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	*TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30-60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inch 90-100% Passing, 1 inch 65-100% Passing, 3/4 inch 0 - 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Installation

- Prior to compost application, prepare the slope by removing loose rocks, roots, stumps, and other debris greater than 2" in diameter. Prepare the slope area surface by scarifying or track walking/roughening if necessary.
- Select method to apply the compost blanket. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.
- A compost blanket thickness of 1" to 4" should be applied to slopes of 2:1 (H:V) or gentler, based on site-specific conditions. Increase blanket thickness with increased slope steepness and/or during installation during the rainy season (for example, 2" to 3" should be used for a

3:1 slope, while 1" to 2" can be used for a 4:1 slope). Erosion control using a compost blanket is not recommended for slopes greater than 1:1 (H:V).

- For steeper slopes, tackifiers should be utilized and/or other stabilization techniques employed. For example, compost socks or berms can be installed at intervals over the compost blanket (in a similar manner as Fiber Rolls, SE-5).
- Compost socks or berms (or equivalent linear sediment control BMP) should be placed at the top and/or bottom of the slope for additional erosion control performance.
- For optimum vegetation establishment, a blanket thickness of 1" to 2" is recommended. If vegetation establishment is not the primary function of the compost blanket, a thicker blanket may be recommended based on slope or rainfall conditions.
- Evenly distribute compost on the soil surface to the desired blanket thickness (1/2" to 4" as calculated prior based on site conditions and objectives). Even distribution is an important factor in preventing future rill and gully erosion.
- The compost blanket should extend 3 to 6 feet over the top of the shoulder of the slope. A compost sock or compost berm can be used at the top of the slope as an auxiliary technique to prevent runoff from flowing underneath the compost blanket.
- Use additional anchoring and erosion control BMPs in conjunction of the compost blanket as needed.

Costs

The cost associated with a compost blanket is similar to that of a straw mat and generally less expensive than a geotextile blanket (USEPA, 2009). Caltrans has provided a recent estimate for $5,000 to $8,000 per acre for application of an unseeded 1 inch compost blanket (Caltrans Compost Specifications, 2009). Recently obtained vendor costs indicate that proprietary blends of compost that are seeded and contain a nutrient rich "tackifier" can cost approximately $0.35 per square foot, or approximately $15,000 per acre for a 2 inch blanket. Application by hand is more time intensive and likely more costly.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident, another layer of compost should be reapplied as soon as possible. It may be necessary to install an additional type of stormwater BMP at the top of slope or as a slope interrupter to control flow, such as a fiber roll (SE-5) or compost sock (SE-11).
- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Limit or prohibit foot traffic to minimize damage to BMP or impede vegetation establishment.

References

An Analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, pubs.caes.uga.edu/caespubs/pubcd/B1200.htm, Faucette, B. and Risse, M., 2009.

Demonstration Project Using Yard Debris Compost for Erosion Control, Final Report, presented to Metropolitan Service District, W&H Pacific, 1993.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, 2005.

Standard Special Provision 10-1, Erosion Control (Compost Blanket), California Department of Transportation (Caltrans). 2007 Update.

Evaluation of Environmental Benefits and Impacts of Compost and Industry Standard Erosion and Sediment Controls Measures Used in Construction Activities, Dissertation, Institute of Ecology, University of Georgia, Faucette, B., 2004.

Filter Sock Presentation provided at Erosion, Sediment Control and Stormwater Management with Compost BMPs Workshop, U.S. Composting Council 13th Annual Conference and Trade Show, McCoy, S., 2005.

National Pollutant Discharge Elimination System (NPDES), Compost Blankets, U.S. Environmental Protection Agency (USEPA). http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118, 2009.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing Designation M10-03, Compost for Erosion/Sediment Control (Compost Blankets), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

Stormwater Best Management Practices (BMPs) Field Trials of Erosion Control Compost in Reclamation of Rock Quarry Operations, Nonpoint Source Protection Program CWA §319(h), Texas Commission on Environmental Quality, Adams, T., McFarland, A., Hauck, L., Barrett, M., and Eck, B., 2008.

Soil Preparation/Roughening EC-15



Description and Purpose

Soil Preparation/Roughening involves assessment and preparation of surface soils for BMP installation. This can include soil testing (for seed base, soil characteristics, or nutrients), as well as roughening surface soils by mechanical methods (including sheepsfoot rolling, track walking, scarifying, stair stepping, and imprinting) to prepare soil for additional BMPs, or to break up sheet flow. Soil Preparation can also involve tilling topsoil to prepare a seed bed and/or incorporation of soil amendments, to enhance vegetative establishment.

Suitable Applications

Soil preparation: Soil preparation is essential to proper vegetative establishment. In particular, soil preparation (i.e. tilling, raking, and amendment) is suitable for use in combination with any soil stabilization method, including RECPs or sod. Soil preparation should not be confused with roughening.

Roughening: Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces. Soil preparation is most effective when used in combination with erosion controls. Soil Roughening is suitable for use as a complementary process for controlling erosion on a site. Roughening is not intended to be used as a stand-alone BMP, and should be used with perimeter controls, additional erosion control measures, grade breaks, and vegetative establishment for maximum effectiveness. Roughening is intended to only affect surface soils and should not compromise slope stability or overall compaction. Suitable applications for soil roughening include:

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-7 Geotextiles and Mats

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Along any disturbed slopes, including temporary stockpiles, sediment basins, or compacted soil diversion berms and swales.

- Roughening should be used in combination with hydraulically applied stabilization methods, compost blanket, or straw mulch; but should not be used in combination with RECPs or sod because roughening is intended to leave terraces on the slope.

Limitations

- Preparation and roughening must take place prior to installing other erosion controls (such as hydraulically applied stabilizers) or sediment controls (such as fiber rolls) on the faces of slopes.

- In such cases where slope preparation is minimal, erosion control/revegetation BMPs that do not require extensive soil preparation - such as hydraulic mulching and seeding applications - should be employed.

- Consideration should be given to the type of erosion control BMP that follows surface preparation, as some BMPs are not designed to be installed over various types of tillage/roughening, i.e., RECPs (erosion control blankets) should not be used with soil roughening due to a "bridging" effect, which suspends the blanket above the seed bed.

- Surface roughness has an effect on the amount of mulch material that needs to be applied, which shows up as a general increase in mulch material due to an increase in surface area (Topographic Index -see EC-3 Hydraulic Mulching).

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

General

A roughened surface can significantly reduce erosion. Based on tests done at the San Diego State Erosion Research Laboratory, various roughening techniques on slopes can result in a 12 - 76% reduction in the erosion rate versus smooth slopes.

Materials

Minimal materials are required unless amendments and/or seed are added to the soil. The majority of soil roughening/preparation can be done with equipment that is on hand at a normal construction site, such as bull dozers and compaction equipment.

Installation Guidelines

Soil Preparation

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.

- Based upon soil testing conducted, apply additional soil amendments (e.g. fertilizers, additional seed) to the soil to help with germination. Follow EC-4, Hydroseeding, when selecting and applying seed and fertilizers.

Cut Slope Roughening:

- Stair-step grade or groove the cut slopes that are steeper than 3:1.
- Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
- Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.
- Do not make individual vertical cuts more than 2 feet (0.6 m) high in soft materials or more than 3 feet (0.9 m) high in rocky materials.
- Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

Fill Slope Roughening:

- Place on fill slopes with a gradient steeper than 3:1 in lifts not to exceed 8 inches (0.2 m), and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4-6 inches (0.1-0.2 m) deep.
- Use grooving or tracking to roughen the face of the slopes, if necessary.
- Do not blade or scrape the final slope face.

Roughening for Slopes to be Mowed:

- Slopes which require mowing activities should not be steeper than 3:1.
- Roughen these areas to shallow grooves by track walking, scarifying, sheepsfoot rolling, or imprinting.
- Make grooves close together (less than 10 inches), and not less than 1 inch deep, and perpendicular to the direction of runoff (i.e., parallel to the slope contours).
- Excessive roughness is undesirable where mowing is planned.

Roughening With Tracked Machinery:

- Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface.
- Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
- Seed and mulch roughened areas as soon as possible to obtain optimum seed germination and growth.

Costs

Costs are based on the additional labor of tracking or preparation of the slope plus the cost of any required soil amendment materials.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check the seeded slopes for signs of erosion such as rills and gullies. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
- Inspect BMPs weekly during normal operations, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Non-Vegetative Stabilization EC-16



Description and Purpose

Non-vegetative stabilization methods are used for temporary or permanent stabilization of areas prone to erosion and should be used only where vegetative options are not feasible; examples include:

- Areas of vehicular or pedestrian traffic such as roads or paths;
- Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
- Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
- Areas where vegetation will not grow adequately within the construction time frame.

There are several non-vegetative stabilization methods and selection should be based on site-specific conditions.

Decomposed Granite (DG) is a permanent erosion protection method that consists of a layer of stabilized decomposed granite placed over an erodible surface.

Degradable Mulches of various types (see EC-3, EC-6, EC-8) can be used for temporary non-vegetative stabilization; examples include straw mulch, compost, wood chips or hydraulic mulch.

Geotextiles and Mats can be used for temporary non-vegetative stabilization (see EC-7). These BMPs are typically manufactured from degradable or synthetic materials and are

Categories

EC	Erosion Control	☑
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

designed and specified based on their functional longevity, i.e., how long they will persist and provide erosion protection. All geotextiles and mats should be replaced when they exceed their functional longevity or when permanent stabilization methods are instituted.

Gravel Mulch is a non-degradable erosion control product that is composed of washed and screened coarse to very coarse gravel, 16 mm to 64 mm (0.6" - 2.5"), similar to an AASHTO No. 3 coarse aggregate.

Rock Slope Protection consists of utilizing large rock or rip-rap (4"- 24") to stabilize slopes with a high erosion potential and those subject to scour along waterways.

Soil Binders can be used for temporary non-vegetative stabilization (see EC-5). The key to their use is functional longevity. In most cases, the soil binder will need to be routinely monitored and re-applied to maintain an erosion-resistant coverage.

Suitable Applications

Non-vegetated stabilization methods are suitable for use on disturbed soil areas and on material stockpiles that need to be temporarily or permanently protected from erosion by water and wind. Non-vegetated stabilization should only be utilized when vegetation cannot be established in the required timeframe, due to soil or climactic conditions, or where vegetation may be a potential fire hazard.

Decomposed Granite (DG) and Gravel Mulch are suitable for use in areas where vegetation establishment is difficult, on flat surfaces, trails and pathways, and when used in conjunction with a stabilizer or tackifier, on shallow slopes (i.e., 10:1 [H:V]). DG and gravel can also be used on shallow rocky slopes where vegetation cannot be established for permanent erosion control.

Degradable Mulches can be used to cover and protect soil surfaces from erosion both in temporary and permanent applications. In many cases, the use of mulches by themselves requires routine inspection and re-application. See EC-3 Hydraulic Mulch, EC-6 Straw Mulch, EC-8 Wood Mulch, or EC-14 Compost Blankets for more information.

Geotextiles and Mats can be used as a temporary stand-alone soil stabilization method. Depending on material selection, geotextiles and mats can be a short-term (3 mos – 1 year) or long-term (1-2 years) temporary stabilization method. For more information on geotextiles and mats see EC-7 Geotextiles and Mats.

Rock Slope Protection can be used when the slopes are subject to scour or have a high erosion potential, such as slopes adjacent to flowing waterways or slopes subject to overflow from detention facilities (spillways).

Soil Binders can be used for temporary stabilization of stockpiles and disturbed areas not subject to heavy traffic. See EC-5 Soil Binders for more information.

Limitations

General

- Refer to EC-3, EC-6, EC-8, and EC-14 for limitations on use of mulches. Refer to EC-7 for limitations on use of geotextiles and mats. Refer to EC-5 for limitations on use of Soil Binders.

Decomposed Granite

- Not available in some geographic regions.
- If not tackified, material may be susceptible to erosion even on slight slopes (e.g., 30:1 [H:V]).
- Installed costs may be more expensive than vegetative stabilization methods.

Gravel Mulch

- Availability is limited in some geographic regions.
- If not properly screened and washed, can contain fine material that can erode and/or create dust problems.
- If inadequately sized, material may be susceptible to erosion on sloped areas.
- Pore spaces fill with dirt and debris over time; may provide a growing medium for weeds.

Rock Slope Protection

- Installation is labor intensive.
- Installed costs can be significantly higher than vegetative stabilization methods.
- Rounded stones may not be used on slopes greater than 2:1 [H:V].

Implementation

General

Non-vegetated stabilization should be used in accordance with the following general guidance:

- Should be used in conjunction with other BMPs, including drainage, erosion controls and sediment controls.
- Refer to EC-3, EC-6, EC-8, and EC-14 for implementation details for mulches. Refer to EC-7 for implementation details for geotextiles and mats. Refer to EC-5 for implementation details for soil binders.
- Non-vegetated stabilization measures should be implemented as soon as the disturbance in the areas they are intended to protect has ceased.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Decomposed Granite Stabilization

- If used for a road or path should be installed on a prepared base.
- Should be mixed with a stabilizer if used for roads or pathways, or on slope applications.
- Though porous it is recommended to prevent standing water on or next to a decomposed granite road or pathway.

Gravel Mulch

- Should be sized based on slope, rainfall, and upgradient run-on conditions. Stone size should be increased as potential for erosion increases (steeper slopes, high intensity rainfall).
- If permanent, a weed control fabric should be placed prior to installation.
- Should be installed at a minimum 2" depth.
- Should completely cover all exposed surfaces.

Rock Slope Protection

- Rock slope protection installation should follow Caltrans Standard Specification 72-2: Rock Slope Protection. Refer to the specification for rock conformity requirements and installation methods.
- When using rock slope protection, rock size and installation method should be specified by an Engineer.
- A geotextile fabric should be placed prior to installation.

Costs

- Costs are highly variable depending not only on technique chosen, but also on materials chosen within specific techniques. In addition, availability of certain materials will vary by region/location, which will also affect the cost. Costs of mulches, geotextiles and mats, and soil binders are presented in their respective fact sheets. Costs for decomposed granite, gravel mulch stabilization and rock slope protection may be higher depending on location and availability of materials. Caltrans has provided an estimate for gravel mulch of \$10 - \$15/yd^2 in flat areas and \$11 - \$23/yd^2 on side slopes.

Inspection and Maintenance

General

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- For permanent installation, require inspection periodically and after major storm events to look for signs of erosion or damage to the stabilization.
- All damage should be repaired immediately.
- Refer to EC-3, EC-6, EC-8, and EC-14 for inspection and maintenance requirements for mulches. Refer to EC-7 for inspection and maintenance requirements for geotextiles and mats. Refer to EC-5 for inspection and maintenance requirements for soil binders.

Decomposed Granite and Gravel Mulch Stabilization

- Rake out and add decomposed granite or gravel as needed to areas subject to rill erosion. Inspect upgradient drainage controls and repair/modify as necessary.

- Should remain stable under loose surface material. Any significant problem areas should be repaired to restore uniformity to the installation.

References

Arid Zone Forestry: A Guide for Field Technicians. Food and Agriculture Organization of the United Nations, 1989.

Design of Roadside Channels with Flexible Linings, Hydraulic Engineering Circular Number 15, Third Edition, Federal Highway Administration, 2007.

Design Standards for Urban Infrastructure - Soft Landscape Design, Department of Territory and Municipal Services - Australian Capital Territory http://www.tams.act.gov.au/work/standards_and_procedures/design_standards_for_urban_infrastructure

Erosion and Sediment Control Handbook: A Guide for Protection of State Waters through the use of Best Management Practices during Land Disturbing Activities, Tennessee Department of Environment and Conservation, 2002.

Gravel Mulch, Landscape Architecture Non-Standard Specification 10-2, California Department of Transportation (Caltrans), http://www.dot.ca.gov/hq/LandArch/roadside/detail-gm.htm

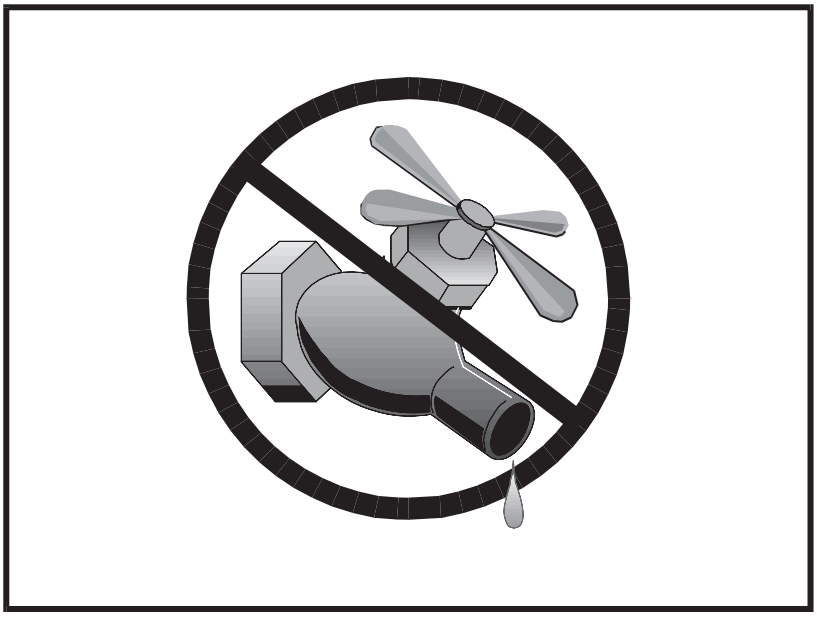
Maine Erosion and Sediment Control BMPs, DEPLW0588, Maine Department of Environmental Protection: Bureau of Land and Water Quality, 2003.

National Menu of Best Management Practices, US Environmental Protection Agency, 2006.

Standard Specification 72-2: Rock Slope Protection. California Department of Transportation, 2006.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Water Conservation Practices NS-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Direct construction water runoff to areas where it can soak into the ground or be collected and reused.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

Costs

The cost is small to none compared to the benefits of conserving water.

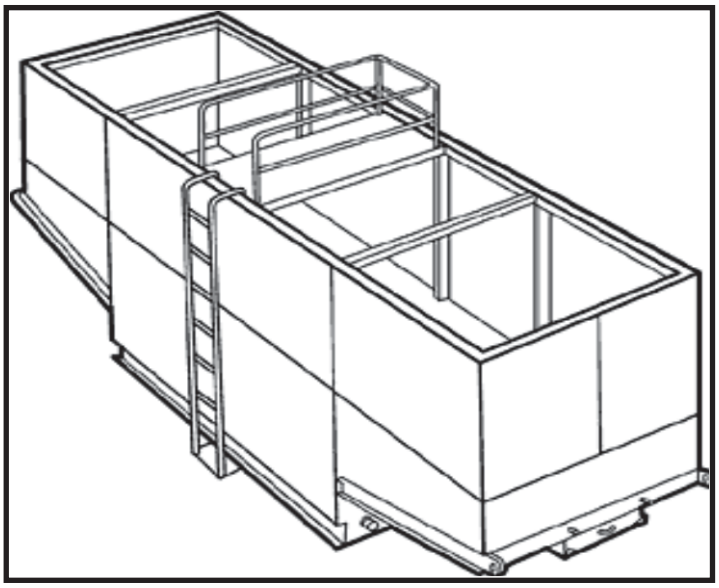
Inspection and Maintenance

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Dewatering Operations NS-2



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.

The General Permit incorporates Numeric Action Levels (NAL) for turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Discharges from dewatering operations can contain high levels of fine sediment that, if not properly treated, could lead to exceedances of the General Permit requirements or Basin Plan standards.

The dewatering operations described in this fact sheet are not Active Treatment Systems (ATS) and do not include the use of chemical coagulations, chemical flocculation or electrocoagulation.

Suitable Applications

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

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated

precipitation (stormwater) from depressed areas at a construction site.

Stormwater mixed with non-stormwater should be managed as non-stormwater.

Limitations

- Dewatering operations will require, and should comply with applicable local and project-specific permits and regulations. In some areas, all dewatering activities, regardless of the discharge volume, require a dewatering permit.
- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this fact sheet primarily address sediment. Other secondary pollutant removal benefits are discussed where applicable.
- The controls detailed in this fact sheet only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Avoid dewatering discharges where possible by using the water for dust control.

Implementation

- A Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP).
- Regional Water Quality Control Board (RWQCB) Regions may require notification and approval prior to any discharge of water from construction sites.
- The destination of discharge from dewatering activities will typically determine the type of permit required for the discharge. For example, when discharging to a water of the U.S., a dewatering permit may be required through the site's governing RWQCB. When discharging to a sanitary sewer or Municipal Separate Storm Sewer System (MS4), a permit may need to be obtained from the owner of the sanitary sewer or MS4 in addition to obtaining an RWQCB dewatering permit. Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges should not cause erosion at the discharge point. Appropriate BMPs should be implemented to maintain compliance with all applicable permits.
- Maintain dewatering records in accordance with all local and project-specific permits and regulations.

Sediment Treatment

A variety of methods can be used to treat water during dewatering operations. Several devices are presented below and provide options to achieve sediment removal. The sediment particle size and permit or receiving water limitations on sediment or turbidity are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate. Use of other enhanced treatment methods (i.e., introduction of chemicals or electric current to enhance flocculation and removal of sediment) must comply with: 1) for storm drain or surface water discharges, the requirements for Active Treatment Systems (see SE-11); or 2) for sanitary sewer discharges, the requirements of applicable sanitary sewer discharge permits.

Sediment Basin (see also SE-2)

Description:

- A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment basins are generally larger than Sediment Traps (SE-3) and have a designed outlet structure.

Appropriate Applications:

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

Implementation:

- Excavation and construction of related facilities is required.
- Temporary sediment basins should 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 outlet, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Sediment Trap (See also SE-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. Sediment traps are generally smaller than Sediment Basins (SE-2) and do not have a designed outlet (but do have a spillway or overflow).

Appropriate Applications:

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

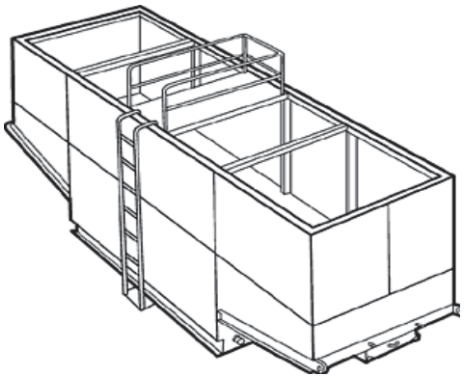
Implementation:

- Excavation and construction of related facilities is required.
- Trap inlets should 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.

Weir Tanks



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 should be consulted to appropriately size tank.
- Treatment capacity (i.e., volume and number of tanks) should provide at a minimum the required volume for discrete particle settling for treatment design flows.

Maintenance:

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

Dewatering Tanks



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:

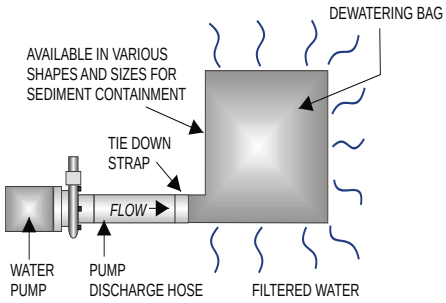
- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

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

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 gravel, sand, silt, and fines.

Appropriate Applications:

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

Implementation:

- Water is pumped into one side of the bag and seeps through the top, bottom, and sides of the bag.
- Place filter bag on pavement or a gravel bed or paved surface. Avoid placing a dewatering bag on unprotected bare soil. If placing the bag on bare soil is unavoidable, a secondary barrier should be used, such as a rock filter bed placed beneath and beyond the edges of the bag to, prevent erosion and capture sediments that escape the bag.
- Perimeter control around the downstream end of the bag should be implemented. Secondary sediment controls are important especially in the initial stages of discharge, which tend to allow fines to pass through the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier (as applicable) is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- Caution should be taken when removing and disposing of the bag, to prevent the release of captured sediment
- Properly dispose of the bag offsite. If sediment is removed from the bag prior to disposal (bags can potentially be reused depending upon their condition), dispose of sediment in accordance with the general maintenance procedures described at the end of this BMP Fact Sheet.

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 using other methods.

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 stand-alone 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 regular service to monitor and maintain the level of the sand media. If subjected to high loading rates, filters can plug quickly.
- Venders generally provide data on maximum head loss through the filter. The filter should be monitored daily while in use, and cleaned when head loss reaches target levels.
- If cleaned by backwashing, the backwash water may need to be hauled away for disposal, or returned to the upper end of the treatment train for another pass through the series of dewatering BMPs.

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. Vendors provide 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 equals or exceeds the manufacturer's recommendation.

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 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 equals or exceeds the manufacturer's recommendation.

Costs

- Sediment control costs vary considerably depending on the dewatering and sediment treatment system that is selected. Pressurized filters tend to be more expensive than gravity settling, but are often more effective. Simple tanks are generally rented on a long-term basis (one or more months) and can range from $360 per month for a 1,000 gallon tank to $2,660 per month for a 10,000 gallon tank. Mobilization and demobilization costs vary considerably.

Inspection and Maintenance

- Inspect and verify that dewatering BMPs are in place and functioning prior to the commencement of activities requiring dewatering.

- Inspect dewatering BMPs daily while dewatering activities are being conducted.

- Inspect all equipment before use. Monitor dewatering operations to ensure they do not cause offsite discharge or erosion.
- Sample dewatering discharges as required by the General Permit.
- Unit-specific maintenance requirements are included with the description of each unit.
- Sediment removed during the maintenance of a dewatering device may be either spread onsite and stabilized, or disposed of at a disposal site as approved by the owner.
- Sediment that is commingled with other pollutants should be disposed of in accordance with all applicable laws and regulations and as approved by the owner.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

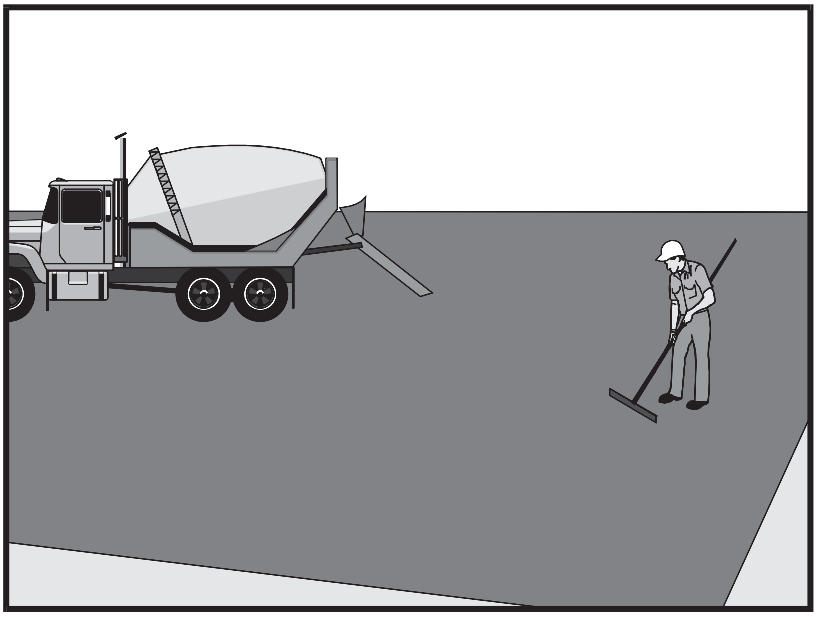
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003; Updated March 2004.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Labor Surcharge & Equipment Rental Rates, April 1, 2002 through March 31, 2003, California Department of Transportation (Caltrans).

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Paving and Grinding Operations NS-3



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☒

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

The General Permit incorporates Numeric Action Levels (NAL) for pH and turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials associated with paving and grinding operations, including mortar, concrete, and cement and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Paving opportunities may be limited during wet weather.

  Discharges of freshly paved surfaces may raise pH to environmentally harmful levels and trigger permit violations.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is forecasted.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).
- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC (Portland cement concrete) and AC (asphalt concrete) waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing should not be allowed to enter any storm drains or watercourses. Install inlet protection and perimeter controls until area is stabilized (i.e. cutting, grinding or other removal activities are complete and loose material has been properly removed and disposed of)or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; SE-5, Fiber Rolls, or SE-13 Compost Socks and Berms
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt should be recycled or disposed of properly.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by a vacuum attachment to the grinding machine, or by sweeping, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Pavement removal activities should not be conducted in the rain.
- Collect removed pavement material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.

- If removed pavement material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

  - Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.

  - Old asphalt should be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect waste materials by dry methods, such as sweeping or shoveling, 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 WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if authorized by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate should not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized (i.e. all sealing operations are complete and cured and loose materials have been properly removed and disposed).

- Inlet protection (SE-10, Storm Drain Inlet Protection) should be used during application of seal coat, tack coat, slurry seal, and fog seal.

- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials and dispose of in accordance with the applicable regulations. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.

- Substances used to coat asphalt transport trucks and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

Thermoplastic Striping

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should 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.
- Do 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.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing.
- 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.

Costs

- All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of paving and grinding operations.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sample stormwater runoff required by the General Permit.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

References

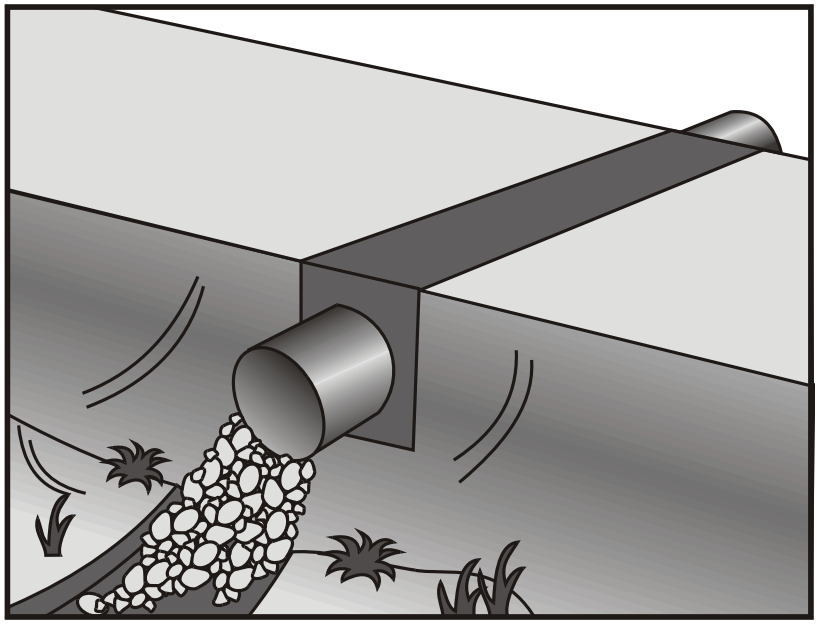
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Hot Mix Asphalt-Paving Handbook AC 150/5370-14, Appendix I, U.S. Army Corps of Engineers, July 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Temporary Stream Crossing NS-4



Description and Purpose

A temporary stream crossing is a temporary culvert, ford or bridge placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not intended to maintain traffic for the public. The temporary access will eliminate erosion and downstream sedimentation caused by vehicles.

Suitable Applications

Temporary stream crossings should be installed at all designated crossings of perennial and intermittent streams on the construction site, as well as for dry channels that may be significantly eroded by construction traffic.

Temporary streams crossings are installed at sites:

- Where appropriate permits have been secured (404 Permits, and 401 Certifications)
- 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

Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Where appropriate permits have been obtained for the stream crossing

Limitations

The following limitations may apply:

- Installation and removal will usually disturb the waterway.
- Installation 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.
- Installation may require dewatering or temporary diversion of the stream. See NS-2, Dewatering Operations and NS-5, Clear Water Diversion.
- Installation may cause 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) ford crossing will be contingent upon approval by fisheries agencies.
- Ford crossings may degrade water quality due to contact with vehicles and equipment.
- May be expensive for a temporary improvement.
- Requires other BMPs to minimize soil disturbance during installation and removal.
- Fords should only be used in dry weather.

Implementation

General

The purpose of this BMP is to provide a safe, erosion-free access across a stream for construction equipment. Minimum standards and specifications for the design, construction, maintenance, and removal of the structure should be established by an engineer registered in California. Temporary stream crossings may be necessary to prevent construction equipment from causing erosion of the stream and tracking sediment and other pollutants into the stream.

Temporary stream crossings are used as access points to construction sites when other detour routes may be too long or burdensome for the construction equipment. Often heavy construction equipment must cross streams or creeks, and detour routes may impose too many constraints such as being too narrow or poor soil strength for the equipment loadings. Additionally, the contractor may find a temporary stream crossing more economical for light–duty vehicles to use for frequent crossings, and may have less environmental impact than construction of a temporary access road.

Location of the temporary stream crossing should address:

- Site selection where erosion potential is low.

- Areas where the side slopes from site runoff will not spill into the side slopes of the crossing.

The following types of temporary stream crossings should be considered:

- **Culverts** – A temporary culvert is effective in controlling erosion but will cause erosion during installation and removal. A temporary culvert can be easily constructed and allows for heavy equipment loads.
- **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 that would benefit from an influx of gravels. A temporary ford provides little sediment and erosion control and is ineffective in controlling erosion in the stream channel. A temporary ford is the least expensive stream crossing and allows for maximum load limits. It also offers very low maintenance. Fords are more appropriate during the dry ice season and in arid areas of California.
- **Bridges** - Appropriate for streams with high flow velocities, steep gradients and where temporary restrictions in the channel are not allowed.

Design

During the long summer construction season in much of California, rainfall is infrequent and many streams are dry. Under these conditions, a temporary ford may be sufficient. A ford is not appropriate if construction will continue through the winter rainy season, if summer thunderstorms are likely, or if the stream flows during most of the year. Temporary culverts and bridges should then be considered and, if used, should be sized to pass a significant design storm (i.e., at least a 10-year storm). The temporary stream crossing should be protected against erosion, both to prevent excessive sedimentation in the stream and to prevent washout of the crossing.

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

- Comply with any special requirements for culvert and bridge crossings, 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 should be selected based on careful evaluation of the risks due to over topping, flow backups, or washout.
- Install sediment traps immediately downstream of crossings to capture sediments. See SE-3, Sediment Trap.
- Avoid oil or other potentially hazardous materials for surface treatment.
- 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.

- 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 6 to 12 in. 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 provide the least disturbance of the streambed and constriction of the waterway flows.

Construction and Use

- 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 streambed to prevent potential flooding upstream of the crossing.
- Install temporary erosion control BMPs in accordance with erosion control BMP fact sheets to minimize erosion of embankment into flow lines.
- Any temporary artificial obstruction placed within flowing water should only be built from material, such as clean gravel or sandbags, that will not introduce sediment or silt into the watercourse.
- Temporary water body crossings and encroachments should be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments should be clean, rounded river cobble.
- Vehicles and equipment should 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.
- The exterior of vehicles and equipment that will encroach on the water body within the project should be maintained free of grease, oil, fuel, and residues.
- Drip pans should 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.

- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate soil stabilization measures.

- Riparian vegetation, when removed pursuant to the provisions of the work, should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble must be removed upon completion of project activities.

- Conceptual temporary stream crossings are shown in the attached figures.

Costs

Caltrans Construction Cost index for temporary bridge crossings is $45-$95/ft^2.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Check for blockage in the channel, sediment buildup or trapped debris in culverts, blockage behind fords or under bridges.

- Check for erosion of abutments, channel scour, riprap displacement, or piping in the soil.

- Check for structural weakening of the temporary crossings, such as cracks, and undermining of foundations and abutments.

- Remove sediment that collects behind fords, in culverts, and under bridges periodically.

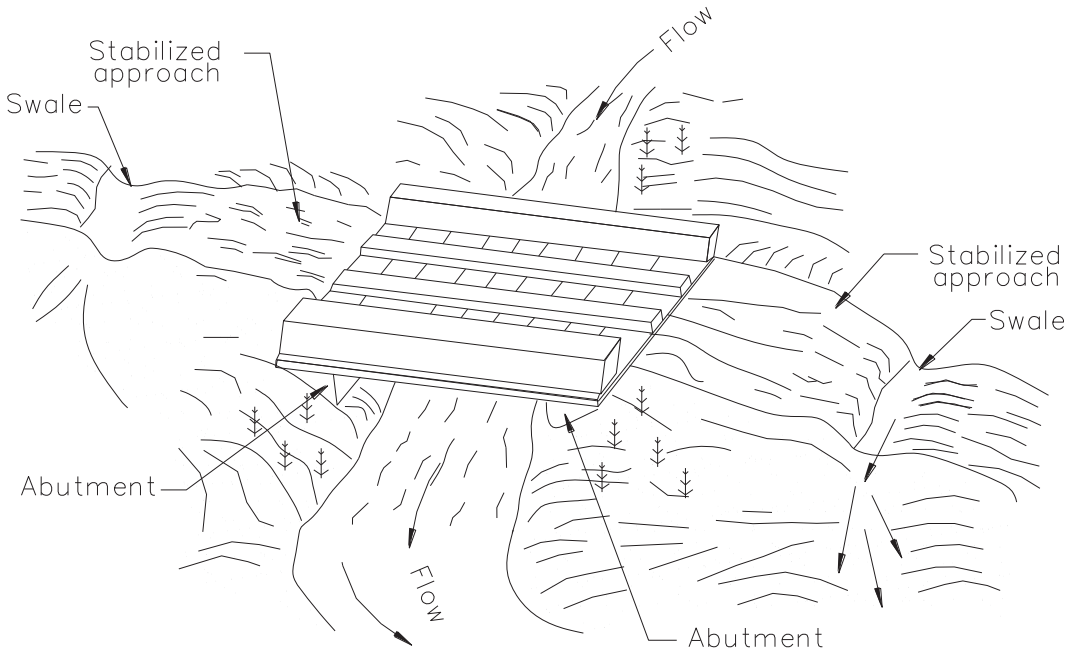
- Replace lost or displaced aggregate from inlets and outlets of culverts and cellular confinement systems.

- Remove temporary crossing promptly when it is no longer needed.

References

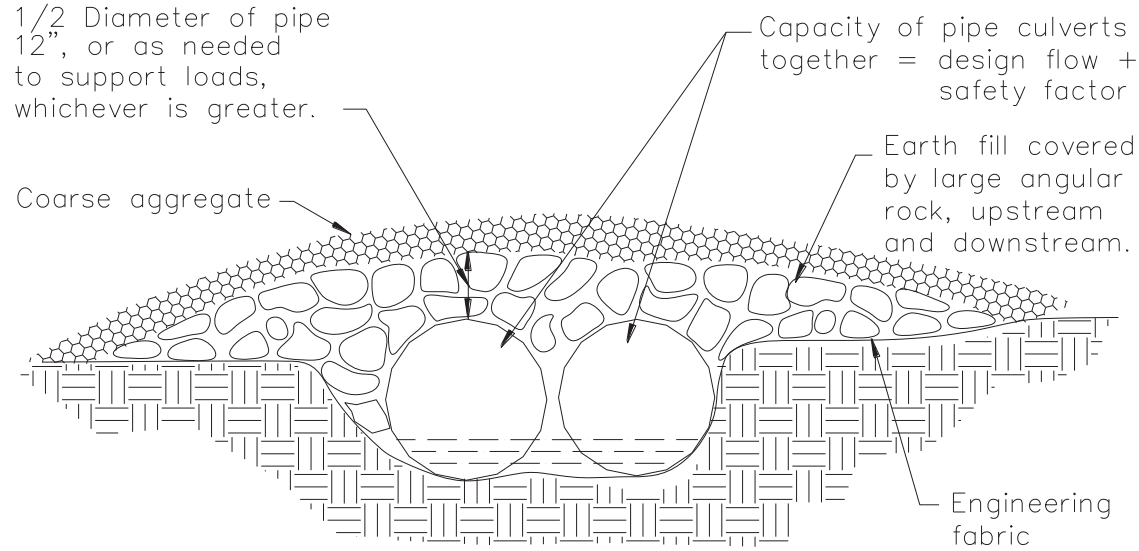
California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

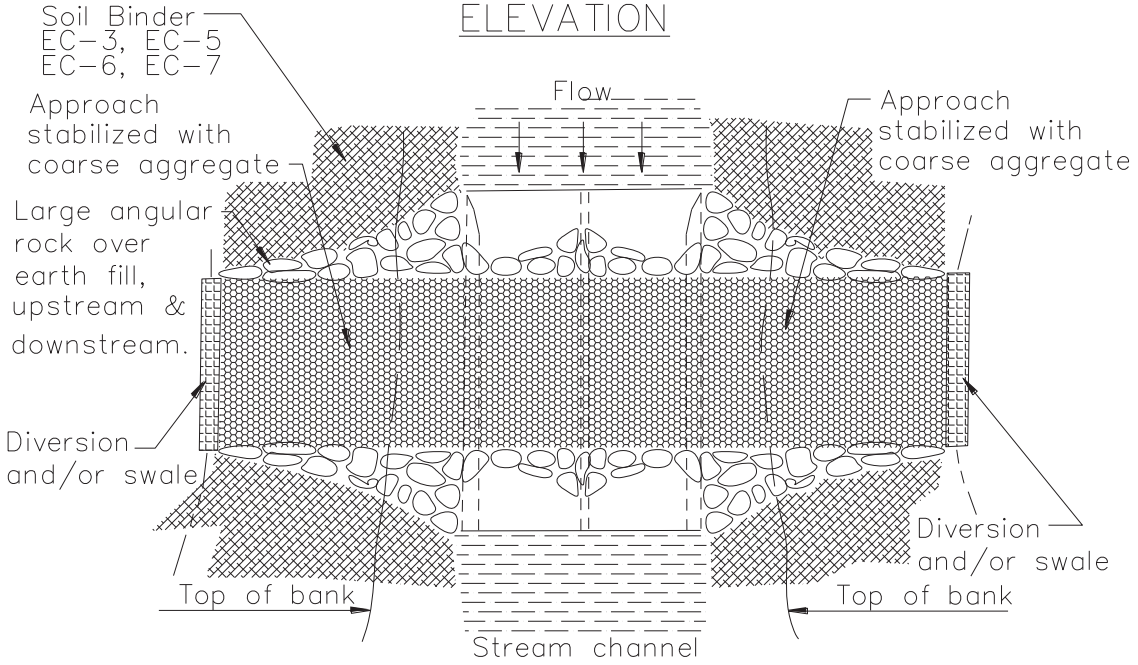


NOTE:
Surface flow of road diverted by swale and/or dike.

TYPICAL BRIDGE CROSSING
NOT TO SCALE

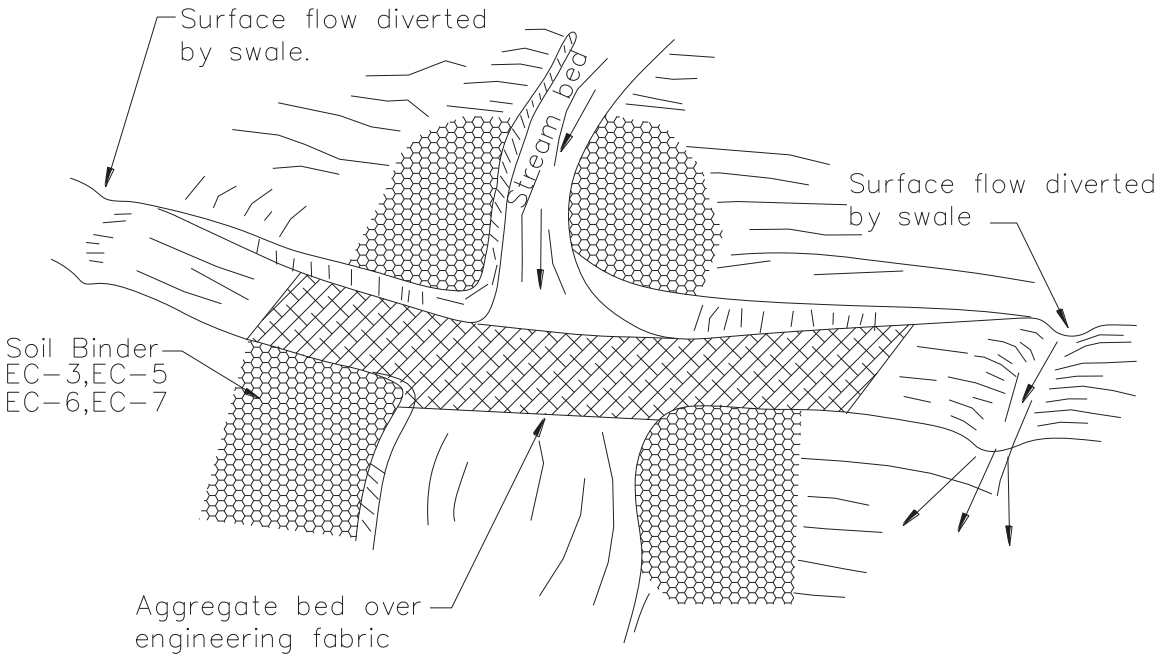


ELEVATION

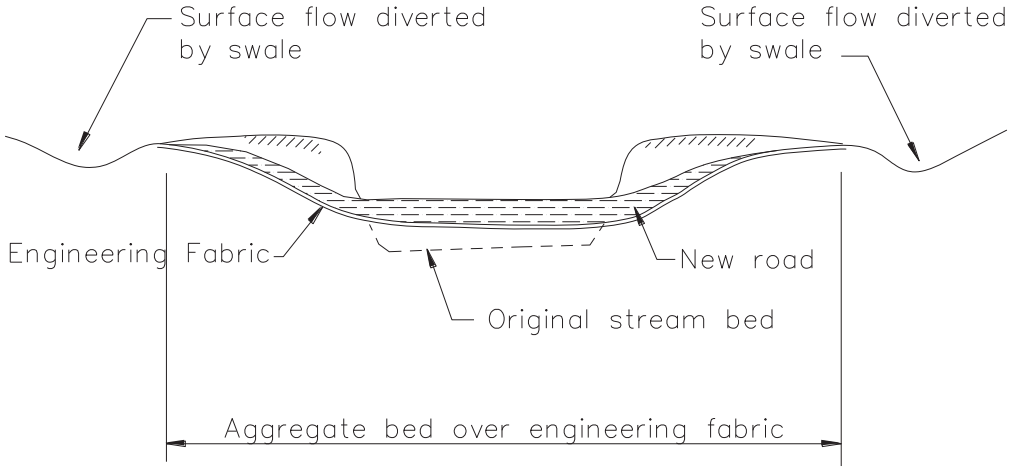


PLAN VIEW

TYPICAL CULVERT CROSSING
NOT TO SCALE

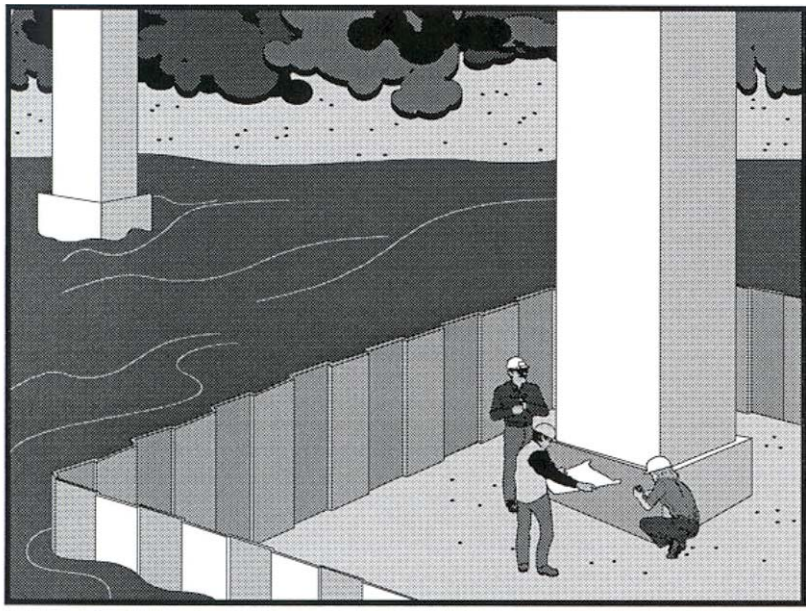


Aggregate approch
1:5 (V:H) Maximum slope on road



TYPICAL FORD CROSSING
NOT TO SCALE

Clear Water Diversion NS-5



Description and Purpose

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a project, transport it around the work area, and discharge it downstream with minimal water quality degradation from 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. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, rock, gravel bags, wood, aqua barriers, cofferdams, filter fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes.

Suitable Applications

A clear water diversion is typically implemented where appropriate permits (1601 Agreement) have been secured and work must be performed in a flowing 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 heavy pipe (called a "flume") with a trench

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

excavated under it, is appropriate for the diversion of streams less than 20 ft wide, with flow rates less than 100 cfs.

- Clear water diversions incorporating clean washed gravel may be appropriate for use in salmonid spawning streams.

Limitations

- Diversion and encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
- Installation 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.
- Diversion and 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 are not appropriate in channels where there is insufficient stream flow to support aquatic species in the area dewatered as a result of the diversion.
- Diversion or isolation activities are inappropriate in deep water unless designed or reviewed by an engineer registered in California.
- 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.
- Not appropriate if installation, maintenance, and removal of the structures will disturb sensitive aquatic species of concern.

Implementation

General

- Implement guidelines presented in EC-12, Streambank Stabilization to minimize impacts to streambanks.
- Where working areas encroach on flowing streams, barriers adequate to prevent the flow of muddy water into streams should be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams should 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 should be completely clean of petroleum residue, and water levels should be below the fuel tanks, gearboxes, and axles of the equipment unless lubricants and fuels are sealed such that inundation by water will not result in discharges of fuels, oils, greases, or hydraulic fluids.

- 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 should not enter the water body except as necessary to cross the stream to access the work site.
- Stationary equipment such as motors and pumps located within or adjacent to a water body, should be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water should, at all times, be allowed to pass downstream to maintain aquatic life.
- Equipment should not be parked below the high water mark unless allowed by a permit.
- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate erosion control measures.
- Riparian vegetation approved for trimming as part of the project should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble should be removed upon completion of project activities.
- Drip pans should 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 1 hour.
- Where possible, avoid or minimize diversion and encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. Scheduling should 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 and Encroachments

- Construct diversion channels in accordance with EC-9, Earth Dikes and Drainage Swales.
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, in accordance with EC-7, Geotextiles and Mats, or use rock slope protection.
- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment and 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 EC-10, Velocity Dissipation Devices.

Temporary Dry Construction Areas

- When dewatering behind temporary structures to create a temporary dry construction area, such as cofferdams, 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 NS-2, Dewatering Operations.

- Any substance used to assemble or maintain diversion structures, such as form oil, should be non-toxic and non-hazardous.

- Any material used to minimize seepage underneath diversion structures, such as grout, should be non-toxic, non-hazardous, and as close to a neutral pH as possible.

Comparison of Diversion and Isolation Techniques:

- Gravel bags are relatively inexpensive, but installation and removal can be labor intensive. It is also difficult to dewater the isolated area. Sandbags should not be used for this technique in rivers or streams, as sand should never be put into or adjacent to a stream, even if encapsulated in geotextile.

- Gravel Bag Berms (SE-6) used in conjunction with an impermeable membrane are cost effective, and can be dewatered relatively easily. If spawning gravel is used, the impermeable membrane can be removed from the stream, and the gravel can be spread out and left as salmonid spawning habitat if approved in the permit. Only clean, washed gravel should be used for both the gravel bag and gravel berm techniques.

- Cofferdams are relatively expensive, but frequently allow full dewatering. Also, many options now available are relatively easy to install.

- Sheet pile enclosures are a much more expensive solution, but do allow full dewatering. This technique is not well suited to small streams, but can be effective on large rivers or lakes, and where staging and heavy equipment access areas are available.

- K-rails are an isolation method that does not allow full dewatering, but can be used in small to large watercourses, and in fast-water situations.

- A relatively inexpensive isolation method is filter fabric isolation. This method involves placement of gravel bags or continuous berms to 'key-in' the fabric, and subsequently staking the fabric in place. This method should be used in relatively calm water, and can be used in smaller streams. Note that this is not a dewatering method, but rather a sediment isolation method.

- Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They can also be used for in-stream construction, when dewatering an area is not required.

- When used in watercourses or streams, cofferdams must be used in accordance with permit requirements.

- Manufactured diversion structures should be installed following manufacturer's specifications.

- Filter fabric and turbidity curtain isolation installation methods can be found in the specific technique descriptions that follow.

Filter Fabric Isolation Technique

Definition and Purpose

A filter fabric isolation structure 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.
- Filter fabric isolation is relatively inexpensive. 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 is used, all other components of the isolation can be removed from the stream, and the gravel may be spread out and left as salmonid spawning habitat if approved in the permit. 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 method should be used in relatively calm water, and can be used in smaller streams. This is not a dewatering method, but rather a sediment isolation method.
- Water levels inside and outside the fabric curtain must be about the same, as differential heads will cause the curtain to collapse.

Limitations

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

Design and Installation

- For the filter fabric isolation method, a non-woven or heavy-duty fabric 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. If a sandbag splits open in a watercourse, the sand could cause a decrease in water quality, and could bury sensitive aquatic habitat.
- 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 18 ft for ease of handling (otherwise, it gets too heavy to move).

- 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 silt fence 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 silt fence 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 6 ft.

Inspection and Maintenance

- Immediately repair any gaps, holes or scour.
- Remove and properly dispose of sediment buildup.
- Remove BMP upon completion of construction activity. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

Turbidity Curtain Isolation Technique

Definition and Purpose

A turbidity curtain 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, 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 sediment 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, 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 resuspension of particles and by accidental dumping by the removal equipment.

Design and Installation

- 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 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 1 ft.

- The top of the curtain should consist of flexible flotation buoys, and the bottom should be held down by a load line incorporated into the curtain fabric. The fabric should be a brightly colored impervious mesh.
- The curtain should be held in place by anchors placed at least every 100 ft.
- First, place the anchors, then tow the fabric out in a furled 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.
- Consideration must be given to the probable outcome of the removal procedure. It must be determined 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 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 temporary sediment control or stream isolation method uses K-rails 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 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.

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

Limitations

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

Design and Installation

- 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-rails to sit. Washed gravel should always be used.
- 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 rail 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.

Inspection and Maintenance:

- The barrier should be inspected and any leaks, holes, 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

The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Advantages of a Pumped Diversion

- Downstream sediment transport can be nearly eliminated.
- Dewatering of the work area is possible.
- Pipes can be moved around to allow construction operations.
- The dams can serve as temporary access to the site.
- Increased flows can be managed by adding more pumping capacity.

Disadvantages of a Pumped Diversion

- Flow volume is limited by pump capacity.
- A pumped diversion requires 24 hour monitoring of pumps.
- Sudden rain could overtop dams.
- Erosion at the outlet.

- Minor in-stream disturbance is required to install and remove dams.

Advantages of Excavated Channels and Flumes

- Excavated channels isolate work from water flow and allow dewatering.
- Excavated channels can handle larger flows than pumps.

Disadvantages of Excavated Channels and Flumes

- Bypass channel or flume must be sized to handle flows, including possible floods.
- Channels must be protected from erosion.
- Flow diversion and re-direction with small dams involves in-stream disturbance and mobilization of sediment.

Design and Installation

- Installation guidelines will vary based on existing site conditions and type of diversion used.
- Pump capacity must be sufficient for design flow.
- A standby pump is required in case a primary pump fails.
- Dam materials used to create dams upstream and downstream of diversion should be erosion resistant; materials such as steel plate, sheet pile, 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.

Inspection and Maintenance

- Pumped diversions require 24 hour monitoring of pumps.
- Inspect embankments and diversion channels 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. Remove holes, gaps, or scour.
- Upon completion of work, the diversion or isolation structure should be removed and flow should be redirected through the new culvert or back into the original stream channel. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

Costs

Costs of clear water diversion vary considerably and can be very high.

Inspection and Maintenance

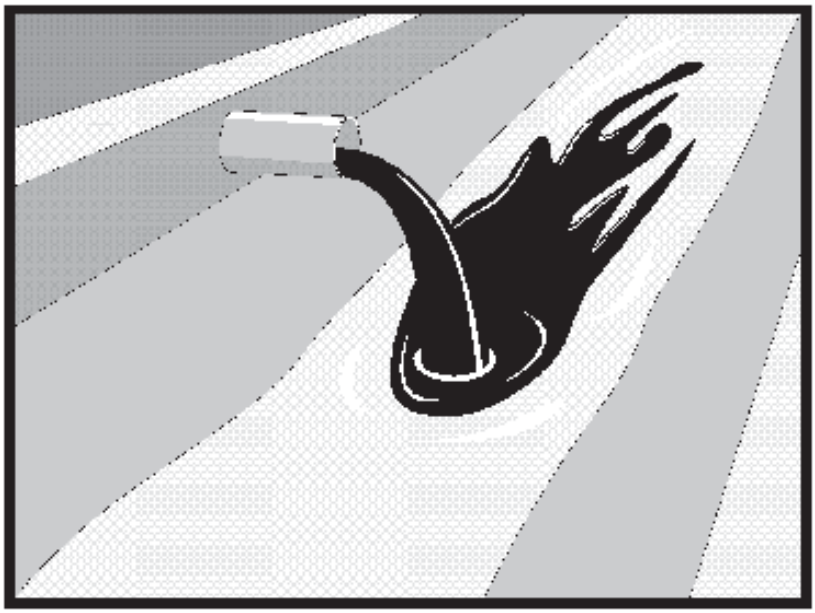
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Refer to BMP-specific inspection and maintenance requirements.

References

California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October, 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Illicit Connection / Discharge NS-6



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description 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.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered or illegally dumped material is found on the construction site.

Limitations

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. If pre-existing hazardous materials or wastes are known to exist onsite, they should be identified in the SWPPP and handled as set forth in the SWPPP.

Implementation

Planning

- Review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- Inspect site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions and notify the owner.

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

Identification of Illicit Connections and Illegal Dumping or Discharges

- **General –** unlabeled and unidentifiable material should be treated as hazardous.
- **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 sub drain 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 offsite construction projects
- **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 non-irrigation season
  - Non-standard junction structures
  - Broken concrete or other disturbances at or near junction structures

Reporting

Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery. For illicit connections or discharges to the storm drain system, notify the local stormwater management agency. For illegal dumping, notify the local law enforcement agency.

Cleanup and Removal

The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the local stormwater management agency for further information.

Costs

Costs to look for and report illicit connections and illegal discharges and dumping are low. The best way to avoid costs associated with illicit connections and illegal discharges and dumping is to keep the project perimeters secure to prevent access to the site, to observe the site for vehicles that should not be there, and to document any waste or hazardous materials that exist onsite before taking possession of the site.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect the site regularly to check for any illegal dumping or discharge.
- Prohibit employees and subcontractors from disposing of non-job related debris or materials at the construction site.
- Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery.

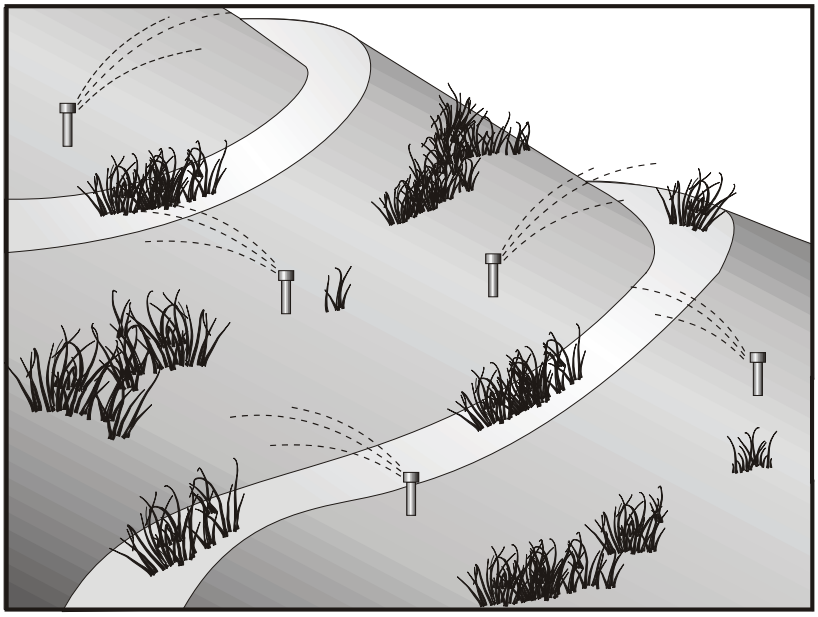
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Potable Water/Irrigation NS-7



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Potable Water/Irrigation 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.

Suitable Applications

Implement this BMP whenever potable water or irrigation water discharges occur at or enter a construction site.

Limitations

None identified.

Implementation

- Direct water from offsite sources around or through a construction site, where feasible, in a way that minimizes contact with the construction site.
- Discharges from water line flushing should be reused for landscaping purposes where feasible.
- Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow.
- Protect downstream stormwater drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- 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.

Costs

Cost to manage potable water and irrigation are low and generally considered to be a normal part of related activities.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Repair broken water lines as soon as possible.
- Inspect irrigated areas regularly for signs of erosion and/or discharge.

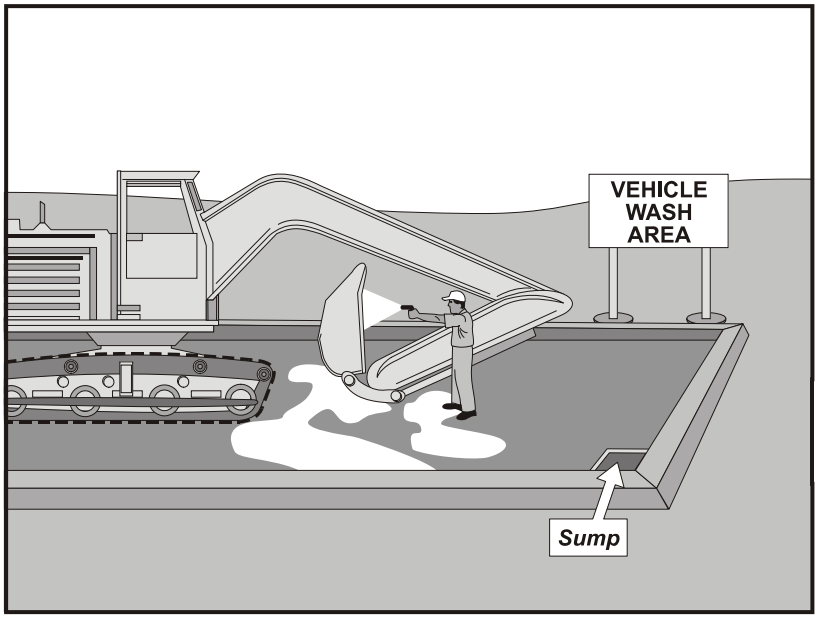
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle and Equipment Cleaning NS-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, 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. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

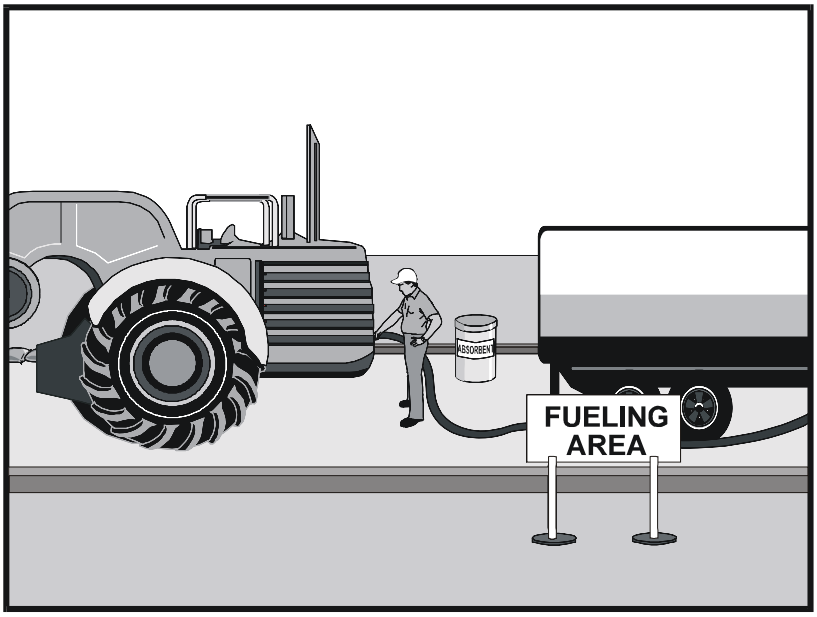
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- 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.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.

- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.

- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

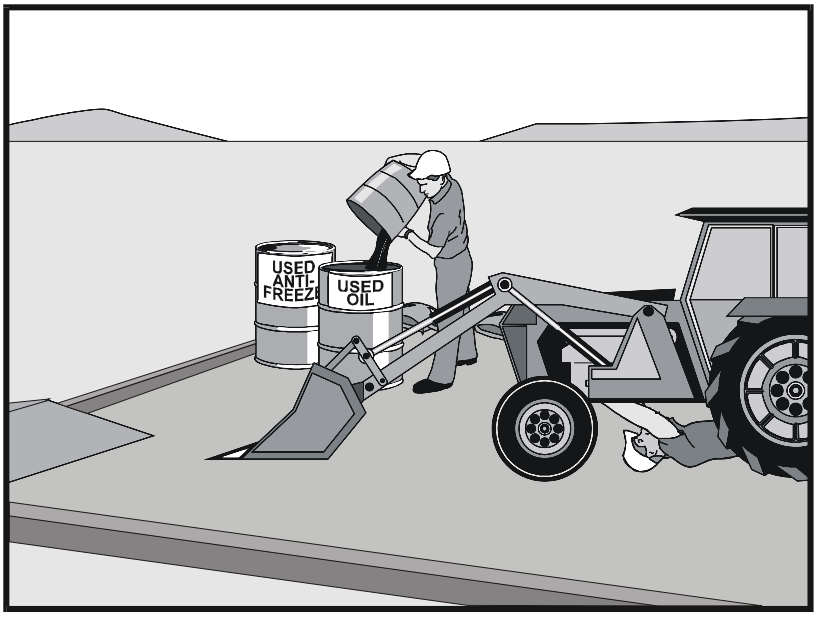
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

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

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8,

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should 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.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should 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 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.

- Repair leaks of fluids and oil immediately.

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

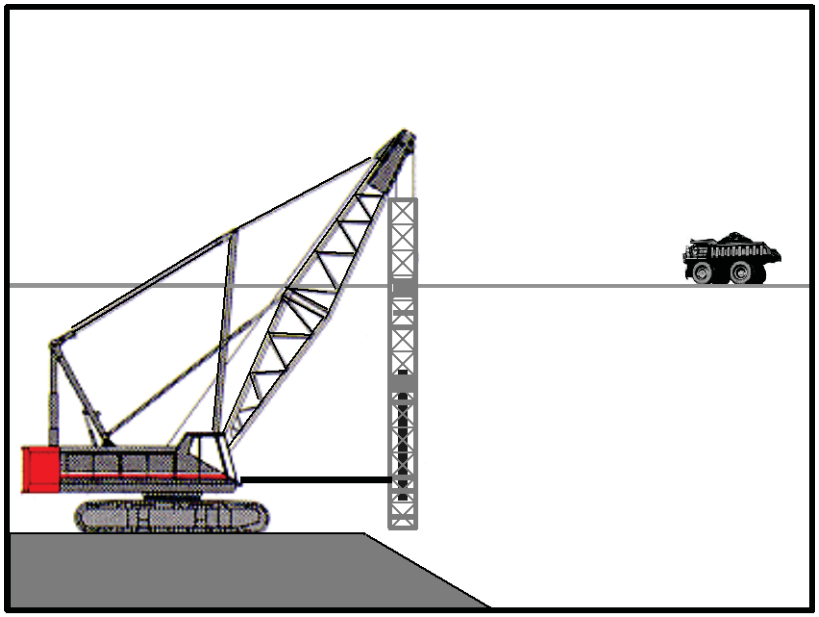
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Pile Driving Operations NS-11



Description 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 precast concrete, steel, or timber. Driven sheet piles are also used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce or eliminate the discharge of potential pollutants to the storm drain system, watercourses, and waters of the United States.

Suitable Applications

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

Limitations

None identified.

Implementation

- Use drip pans or absorbent pads during vehicle and equipment operation, maintenance, cleaning, fueling, and storage. Refer to NS-8, Vehicle and Equipment Cleaning, NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Have spill kits and cleanup materials available at all locations of pile driving. Refer to WM-4, Spill Prevention and Control.
- Equipment that is stored or in use in streambeds, or on docks, barges, or other structures over water bodies should be kept leak free.
- Park equipment over plastic sheeting or equivalent where possible. Plastic is not a substitute for drip pans or absorbent pads. The storage or use of equipment in streambeds or other bodies of water must 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 stormwater, drainage courses, and inlets. Protect hammers and other hydraulic attachments from runon and runoff 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, when practicable.

Costs

All of the above measures can be low cost.

Inspection and Maintenance

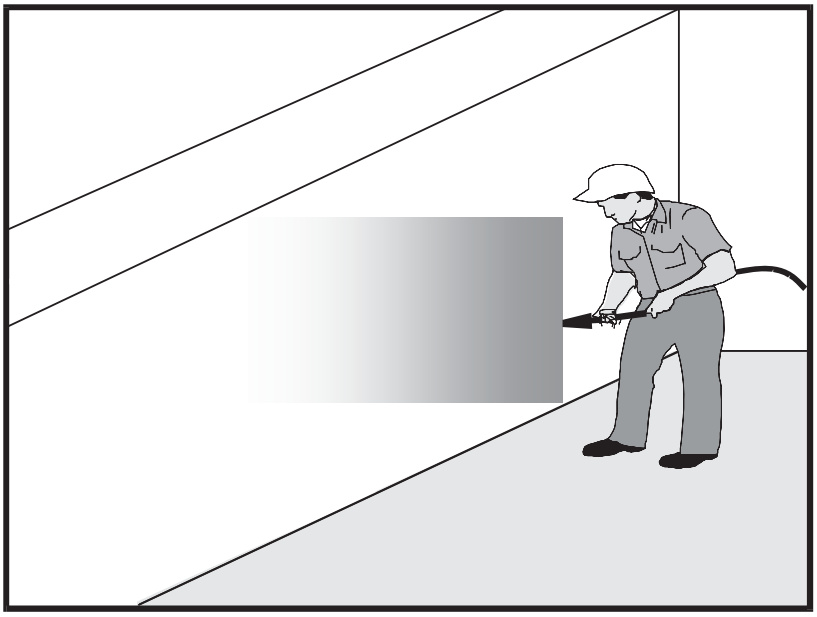
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect equipment every day at startup and repair equipment as needed (i.e., worn or damaged hoses, fittings, and gaskets). Recheck equipment at shift changes or at the end of the day and scheduled repairs as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Concrete Curing NS-12



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

Suitable Applications

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.
- Minimize the drift 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 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 evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.
- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

Education

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

Costs

All of the above measures are generally low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.
- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect cure containers and spraying equipment for leaks.

References

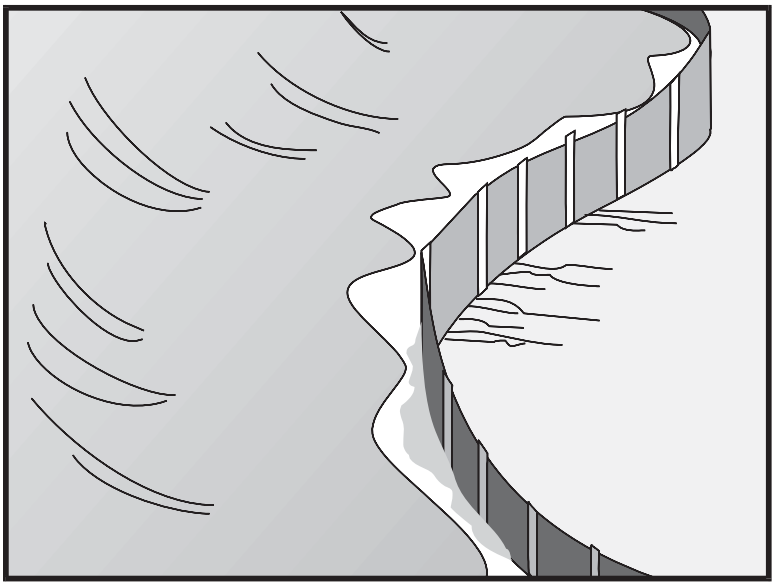
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Silt Fence SE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains water, promoting sedimentation of coarse sediment behind the fence. Silt fence does not retain soil fine particles like clays or silts.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (SE-10). Silt fences should not be used in locations where the flow is concentrated. Silt fences should always be used in combination with erosion controls. Suitable applications include:

- At perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- Below other small cleared areas.

Targeted Constituents

Sediment (coarse sediment)	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm SE-12 Manufactured Linear Sediment Controls

SE-13 Compost Socks and Berms

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Do not use in locations where ponded water may cause a flooding hazard.
- Do not use silt fence to divert water flows or place across any contour line.
- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.
- Must be trenched and keyed in.
- Not intended for use as a substitute for Fiber Rolls (SE-5), when fiber rolls are being used as a slope interruption device.
- Do not use on slopes subject to creeping, slumping, or landslides.

Implementation

General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap coarse sediment by intercepting and detaining sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Silt fence should be used in combination with erosion controls up-slope in order to provide the most effective sediment control.
- Silt fence alone is not effective at reducing turbidity. (Barrett and Malina, 2004)
- Designers should consider diverting sediment laden water to a temporary sediment basin or trap. (EPA, 2012)
- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft^2 of ponding area should be provided for every acre draining to the fence.
- Efficiency of silt fences is primarily dependent on the detention time of the runoff behind the control. (Barrett and Malina, 2004)
- The drainage area above any fence should not exceed a quarter of an acre. (Rule of Thumb-100-feet of silt fence per 10,000 square feet of disturbed area.) (EPA 2012)

- The maximum length of slope draining to any point along the silt fence should be 100 ft per foot of silt fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area draining to the silt fence is permanently stabilized, after which, the silt fence fabric and posts should be removed and properly disposed.
- J-Hooks, which have ends turning up the slope to break up long runs of fence and provide multiple storage areas that work like mini-retention areas, may be used to increase the effectiveness of silt fence.
- Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

Design and Layout

In areas where high winds are anticipated the fence should be supported by a plastic or wire mesh. The geotextile fabric of the silt fence should contain ultraviolet inhibitors and stabilizers to provide longevity equivalent to the project life or replacement schedule.

- Layout in accordance with the attached figures.
- For slopes that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to protect silt fence from rocks (e.g., rockfall netting) ensure the integrity of the silt fence installation.

Standard vs. Heavy Duty Silt Fence

Standard Silt Fence

- Generally applicable in cases where the area draining to fence produces moderate sediment loads.

Heavy Duty Silt Fence

- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
- Use is generally limited to areas affected by high winds.
- Area draining to fence produces moderate sediment loads.

Materials

Standard Silt Fence

- Silt fence material should be woven geotextile with a minimum width of 36 in. The fabric should conform to the requirements in ASTM designation D6461.
- Wooden stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should 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.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

Heavy-Duty Silt Fence

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts instead of wood stakes.

Installation Guidelines – Traditional Method

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).
- Bottom of the silt fence should be keyed-in a minimum of 12 in.
- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.
- When standard strength geotextile is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy–duty wire staples at least 1 in. long. The mesh should extend into the trench.
- When extra-strength geotextile and closer post spacing are used, the mesh support fence may be eliminated.
- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.
- The trench should be backfilled with native material and compacted.
- 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 should the reach exceed 500 ft.
- Cross barriers should be a minimum of 1/3 and a maximum of ½ the height of the linear barrier.
- See typical installation details at the end of this fact sheet.

Installation Guidelines - Static Slicing Method

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 inches into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the geotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
    - Ease of installation (most often done with a 2 person crew).
    - Minimal soil disturbance.
    - Better level of compaction along fence, less susceptible to undercutting
    - Uniform installation.
- Limitations:
    - Does not work in shallow or rocky soils.
    - Complete removal of geotextile material after use is difficult.
    - Be cautious when digging near potential underground utilities.

Costs

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is $7 per linear foot based on vendor research. Range of cost is $3.50 - $9.10 per linear foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches 1/3 of the barrier height.
- Silt fences should be left in place until the upgradient area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.

- Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Monitoring Data on Effectiveness of Sediment Control Techniques, Proceedings of World Water and Environmental Resources Congress, Barrett M. and Malina J. 2004.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, and Inventory of Current Practices (Draft), USEPA, 1990.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

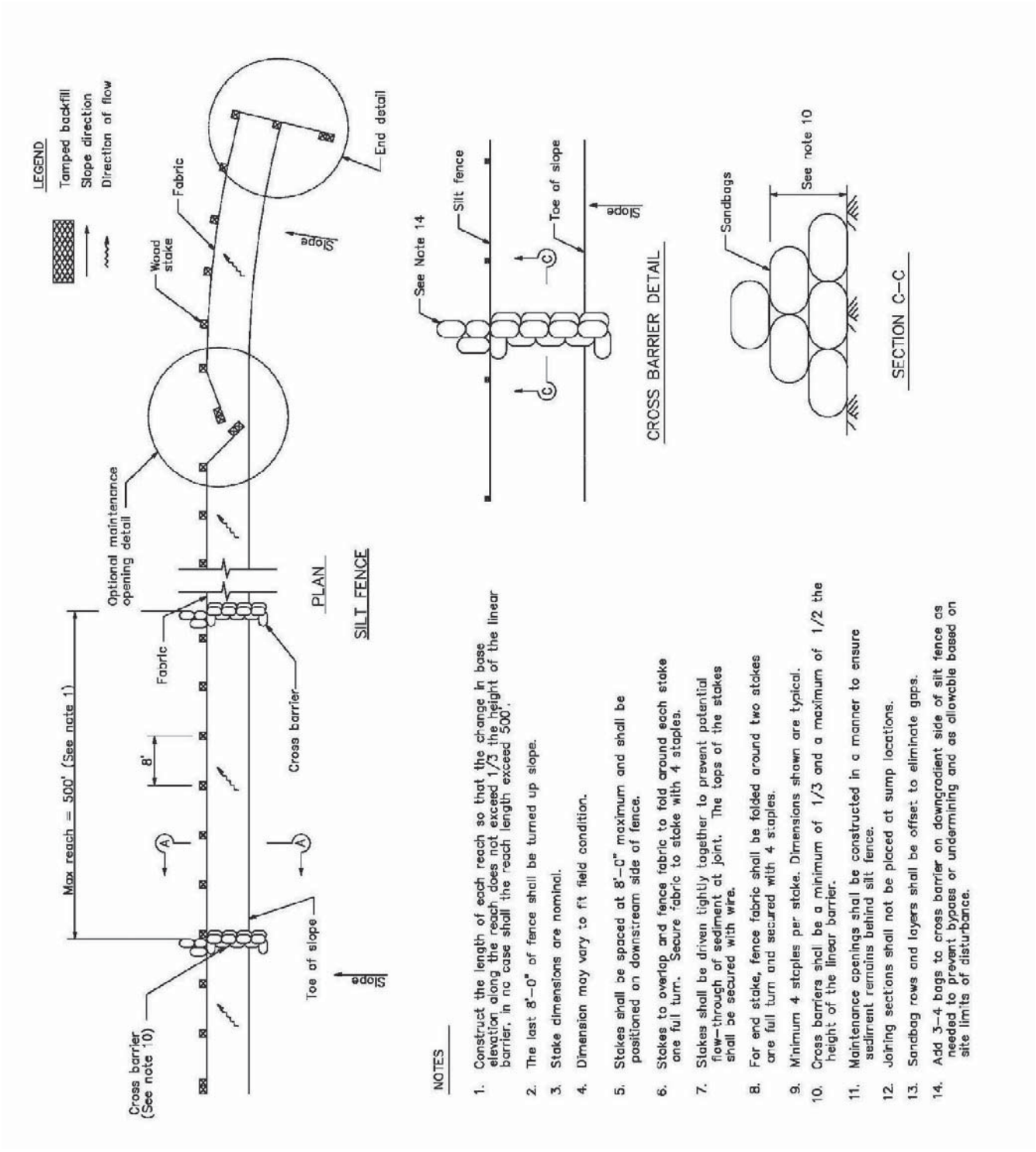
U.S. Environmental Protection Agency (USEPA). Stormwater Best Management Practices: Silt Fences. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 2012.

U.S. Environmental Protection Agency (USEPA). Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

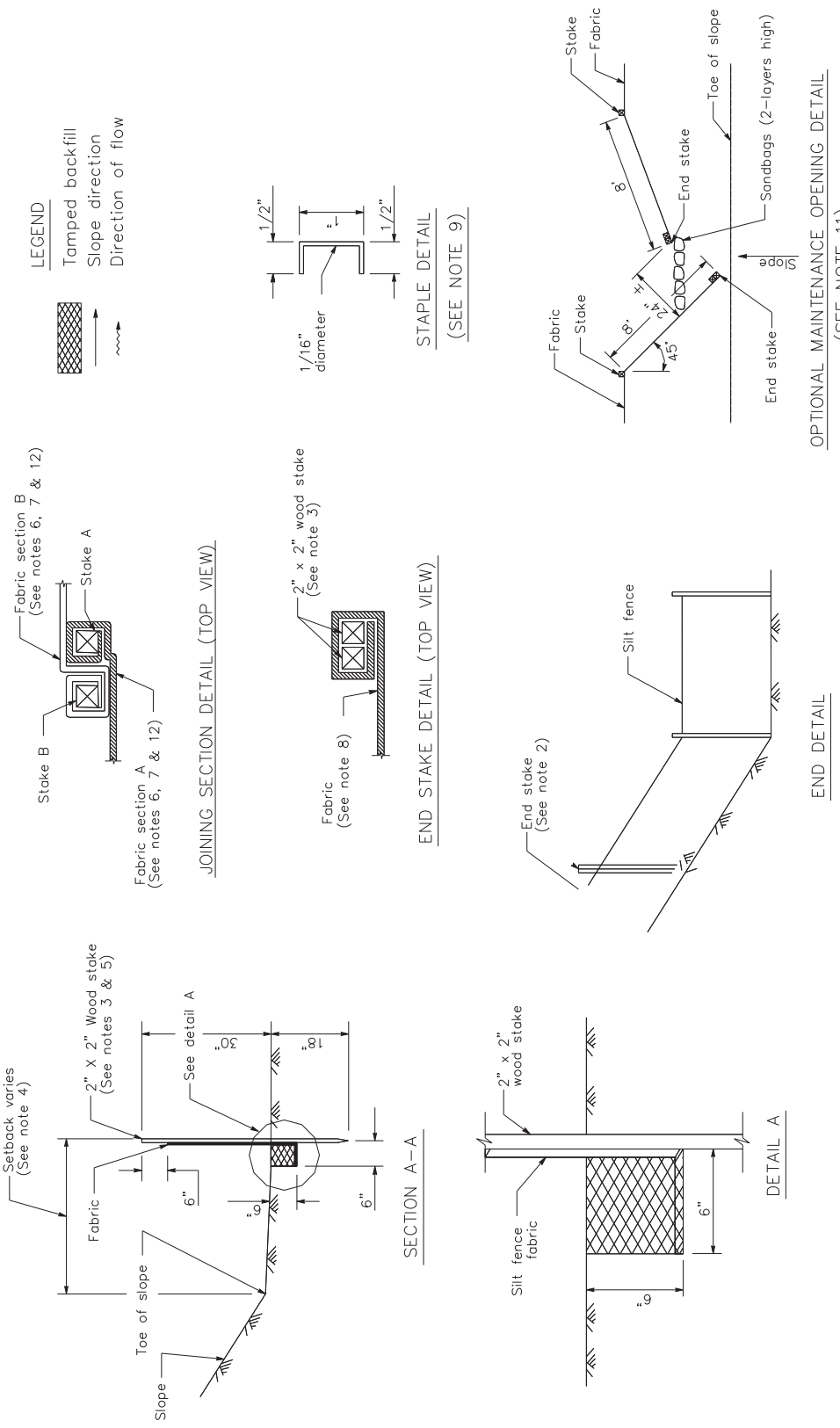
Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

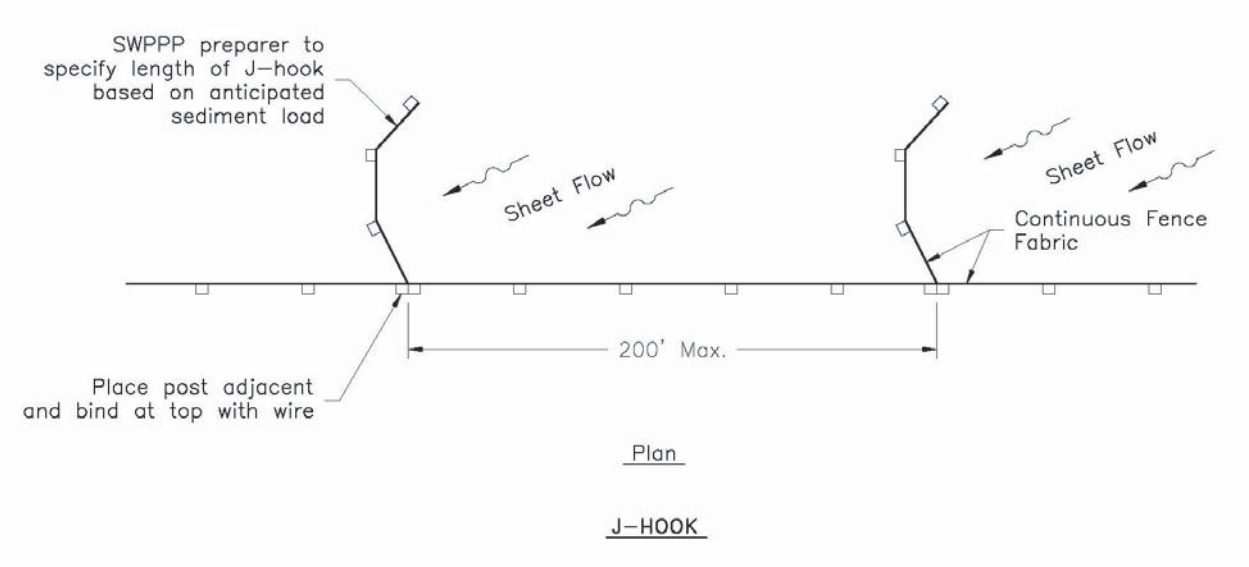
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



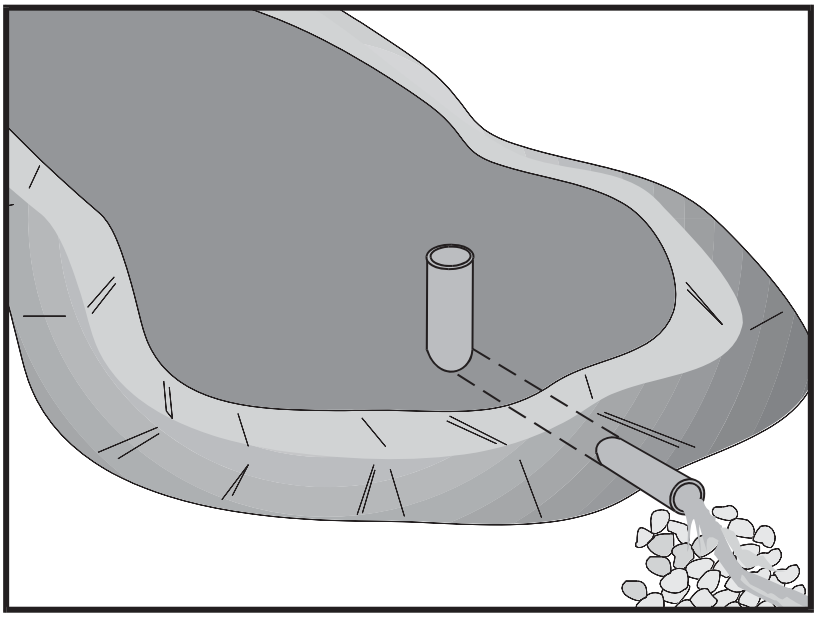
NOTES

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 500'.
2. The last 8'-0" 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 8'-0" 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.
14. Add 3-4 bags to cross barrier on downgradient side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbance.


LEGEND
Tamped backfill
Slope direction
Direction of flow
1/2"
1"
1/2"
1/16" diameter
STAPLE DETAIL
(SEE NOTE 9)
Stake
Fabric
Toe of slope
8'
End stake
Sandbags (2-layers high)
Slope
4'
2'
8'
45°
Fabric
Stake
End stake
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)
Fabric section B
(See notes 6, 7 & 12)
Stake A
Stake B
Fabric section A
(See notes 6, 7 & 12)
JOINING SECTION DETAIL (TOP VIEW)
2" x 2" wood stake
(See note 3)
Fabric
(See note 8)
END STAKE DETAIL (TOP VIEW)
Silt fence
End stake
(See note 2)
END DETAIL
Setback varies
(See note 4)
2" X 2" Wood stake
(See notes 3 & 5)
See detail A
30"
18"
Fabric
6"
6"
6"
Toe of slope
Slope
SECTION A-A
2" x 2"
wood stake
Silt fence
fabric
6"
6"
DETAIL A


SWPPP preparer to specify length of J–hook based on anticipated sediment load
Sheet Flow
Sheet Flow
Continuous Fence Fabric
200' Max.
Place post adjacent and bind at top with wire
Plan
J–HOOK

Sediment Basin SE-2



Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is released.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin
- Erosion control practices to minimize disturbed areas on-site and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional

Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

(a.k.a. "physical") enhancements such as alternative outlet configurations or flow deflection baffles increase detention time and other techniques such as outlet skimmers preferentially drain flows with lower sediment concentrations. These "physical" enhancement techniques are described in this fact sheet. To further enhance sediment removal particularly at sites with fine soils or turbidity sensitive receiving waters, some projects may need to consider implementing Active Treatment Systems (ATS) whereby coagulants and flocculants are used to enhance settling and removal of suspended sediments. Guidance on implementing ATS is provided in SE-11.

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres and evaluated on a site by site basis
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- As a general guideline, sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. However, the tributary area should be evaluated on a site by site basis.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this fact sheet are only effective in removing sediment down to about the silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical (or other appropriate method) treatment is used in addition to the sediment basin.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from California Department of Water Resources Division of Safety of Dams (http://www.water.ca.gov/damsafety/).

- Water that stands in sediment basins longer than 96 hours may become a source of mosquitoes (and midges), particularly along perimeter edges, in shallow zones, in scour or below-grade pools, around inlet pipes, along low-flow channels, and among protected habitats created by emergent or floating vegetation (e.g. cattails, water hyacinth), algal mats, riprap, etc.

- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure expected to be used during active construction in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to convey runoff to the basin inlet.

Many development projects in California are required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins if properly designed and maintained can trap a significant amount of the sediment that flows into them. However, traditional basins do not remove all inflowing sediment. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. Locations best suited for a sediment basin are generally in lower elevation areas of the site (or basin tributary area) where site drainage would not require significant diversion or other means to direct water to the basin but outside jurisdictional waterways. However, as necessary, drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). . The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Construct before clearing and grading work begins when feasible.

- Do not locate the basin in a jurisdictional stream.

- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft must obtain approval from the Division of Dam Safety. Local dam safety requirements may be more stringent.
- Limit the contributing area to the sediment 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 basin.
- The basin should 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, and (3) where the basins can be maintained on a year-round basis 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.

Design

When designing a sediment basin, designers should evaluate the site constraints that could affect the efficiency of the BMP. Some of these constraints include: the relationship between basin capacity, anticipated sediment load, and freeboard, available footprint for the basin, maintenance frequency and access, and hydraulic capacity and efficiency of the temporary outlet infrastructure. Sediment basins should be designed to maximize sediment removal and to consider sediment load retained by the basin as it affects basin performance.

Three Basin Design Options (Part A) are presented below along with a Typical Sediment/Detention Basin Design Methodology (Part B). Regardless of the design option that is selected, designers also need to evaluate the sediment basin capacity with respect to sediment accumulation (See "*Step 3. Evaluate the Capacity of the Sediment Basin"),* and should incorporate approaches identified in "*Step 4. Other Design Considerations*" to enhance basin performance.

A) Basin Design Options:

Option 1:

Design sediment basin(s) using the standard equation:

$$A_s = \frac{1.2Q}{V_s} \qquad \text{(Eq. 1)}$$

Where:

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

V_s = Settling velocity of the design particle size chosen (V_s = 0.00028 ft/s for a design particle size of 0.01 mm at 68°F)

1.2 = Factor of safety recommended by USEPA to account for the reduction in basin efficiency caused due to turbulence and other non ideal conditions.

$Q = CIA$ (Eq.2)

Where

Q = Peak basin influent flow rate measured in cubic feet per second (ft^3/s)

C = Runoff coefficient (unitless)

I = Peak rainfall intensity for the 10-year, 6-hour rain event (in/hr)

A = Area draining into the sediment basin in acres

The design particle size should be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the Vs used should be 100 percent of the calculated settling velocity.

This sizing basin method is dependent on the outlet structure design or the total basin length with an appropriate outlet. If the designer chooses to utilize the outlet structure to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a minimum of twice the basin width; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). If the designer chooses to utilize the basin length (with appropriate basin outlet) to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a specifically designed to capture 100% of the design particle size; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity).

Basin design guidance provided herein assumes standard water properties (e.g., estimated average water temperature, kinematic viscosity, etc.) as a basis of the design. Designers can use an alternative design (Option 3) with site specific water properties as long as the design is as protective as Option 1.

The design guidance uses the peak influent flow rate to size sediment basins. Designers can use an alternative design (Option 3) with site specific average flow rates as long as the design is as protective as Option 1.

The basin should be located on the site where it can be maintained on a year-round basis and should be maintained on a schedule to retain the 2 ft of capacity.

Option 2:

Design 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 1.

Option 3:

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 1.

B) Typical Sediment/Detention Basin Design Methodology:

Design of a sediment basin requires the designer to have an understanding of the site constraints, knowledge of the local soil (e.g., particle size distribution of potentially contributing soils), drainage area of the basin, and local hydrology. Designers should not assume that a sediment basin for location A is applicable to location B. Therefore, designers can use this factsheet as guidance but will need to apply professional judgment and knowledge of the site to design an effective and efficient sediment basin. The following provides a general overview of typical design methodologies:

Step 1. Hydrologic Design

- Evaluate the site constraints and assess the drainage area for the sediment basin. Designers should consider on- and off-site flows as well as changes in the drainage area associated with site construction/disturbance. To minimize additional construction during the course of the project, the designer should consider identifying the maximum drainage area when calculating the basin dimensions.

- If a local hydrology manual is not available it is recommended to follow standard rational method procedures to estimate the flow rate. The references section of this factsheet provides a reference to standard hydrology textbooks that can provide standard methodologies. If local rainfall depths are not available, values can be obtained from standard precipitation frequency maps from NOAA (downloaded from http://www.wrcc.dri.edu/pcpnfreq.html).

Step 2. Hydraulic Design

- Calculate the surface area required for the sediment basin using Equation 1. In which the flow rate is estimated for a 10-yr 6-hr event using rational method procedure listed in local hydrology manual and Vs is estimated using Stokes Law presented in Equation 3.

$$V_s = 2.81d^2 \qquad \text{(Eq.3)}$$

Where

V_s = Settling velocity in feet per second at 68˚F

d = diameter of sediment particle in millimeters (smallest soil grain size determined by wet sieve analysis or fine silt (0.01 mm [or 0.0004 in.])

- In general the basin outlet design requires an iterative trial and error approach that considered the maximum water surface elevation, the elevation versus volume (stage-storage) relationship, the elevation verses basin outflow (a.k.a.-discharge) relationship, and the estimated inflow hydrograph. To adequately design the basins to settle sediment, the outlet configuration and associated outflow rates can be estimated by numerous methodologies. The following provides some guidance for design the basin outlet:

  - An outlet should have more than one orifice.

  - An outlet design typically utilizes multiple horizontal rows of orifices (approximately 3 or more) with at least 2 orifices per row (see Figures 1 and 2 at the end of this fact sheet).

- Orifices can vary in shape.
- Select the appropriate orifice diameter and number of perforations per row with the objective of minimizing the number of rows while maximizing the detention time.
- The diameter of each orifice is typically a maximum of 3-4 inches and a minimum of 0.25-0.5 inches.
- If a rectangular orifice is used, it is recommended to have minimum height of 0.5 inches and a maximum height of 6 inches.
- Rows are typically spaced at three times the diameter center to center vertically with a minimum distance of approximately 4 inches on center and a maximum distance of 1 foot on center.
- To estimate the outflow rate, each row is calculated separately based on the flow through a single orifice then multiplied by the number of orifices in the row. This step is repeated for each of the rows. Once all of the orifices are estimated, the total outflow rate versus elevation (stage-discharge curve) is developed to evaluate the detention time within the basin.
- Flow through a single orifice can be estimated using an Equation 4:

$$Q = BC'A(2gH)^{0.5} \qquad \text{(Eq.4)}$$

Where
Q = Outflow rate in ft^3/s
C′ = Orifice coefficient (unitless)
A = Area of the orifice (ft^2)
g = acceleration due to gravity (ft^3/s)
H = Head above the orifice (ft)
B = Anticipated Blockage or clogging factor (unitless), It is dependent on anticipated sediment and debris load, trash rack configuration etc, so the value is dependent on design engineers professional judgment and/or local requirements (B is never greater than 1 and a value of 0.5 is generally used)

  - Care must be taken in the selection of orifice coefficient ("C′"); 0.60 is most often recommended and used. However, based on actual tests, Young and Graziano (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
- If different sizes of orifices are used along the riser then they have to be sized such that not more than 50 percent of the design storm event drains in one-third of the drawdown time (to provide adequate settling time for events smaller than the design storm event)

and the entire volume drains within 96 hours or as regulated by the local vector control agency. If a basin fails to drain within 96 hours, the basin must be pumped dry.

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

- Floating Outlet Skimmer: The floating skimmer (see Figure 3 at the end of this fact sheet is an alternative outlet configuration (patented) that drains water from upper portion of the water column. This configuration has been used for temporary and permanent basins and can improve basin performance by eliminating bottom orifices which have the potential of discharging solids. Some design considerations for this alternative outlet device includes the addition of a sand filter or perforated under drain at the low point in the basin and near the floating skimmer. These secondary drains allow the basin to fully drain. More detailed guidelines for sizing the skimmer can be downloaded from http://www.fairclothskimmer.com/.

- Hold and Release Valve: An ideal sediment/detention basin would hold all flows to the design storm level for sufficient time to settle solids, and then slowly release the storm water. Implementing a reliable valve system for releasing detention basins is critical to eliminate the potential for flooding in such a system. Some variations of hold and release valves include manual valves, bladder devices or electrically operated valves. When a precipitation event is forecast, the valve would be close for the duration of the storm and appropriate settling time. When the settling duration is met (approximately 24 or 48 hours), the valve would be opened and allow the stormwater to be released at a rate that does not resuspend settled solids and in a non-erosive manner. If this type of system is used the valve should be designed to empty the entire basin within 96 hours or as stipulated by local vector control regulations.

Step 3. Evaluate the Capacity of the Sediment Basin

- Typically, sediment basins do not perform as designed when they are not properly maintained or the sediment yield to the basin is larger than expected. As part of a good sediment basin design, designers should consider maintenance cycles, estimated soil loss and/or sediment yield, and basin sediment storage volume. The two equations below can be used to quantify the amount of soil entering the basin.

- The Revised Universal Soil Loss Equation (RUSLE, Eq.5) can be used to estimate annual soil loss and the Modified Universal Soil Equation (MUSLE, Eq.6) can be used to estimate sediment yield from a single storm event.

$$A = R \times K \times LS \times C \times P \qquad \text{(Eq.5)}$$

$$Y = 95(Q \times q_p)^{0.56} \times K \times LS \times C \times P \qquad \text{(Eq.6)}$$

Where:

A = annual soil loss, tons/acre-year

R = rainfall erosion index, in 100 ft.tons/acre.in/hr

K = soil erodibility factor, tons/acre per unit of R

LS = slope length and steepness factor (unitless)

C = vegetative cover factor (unitless)

P = erosion control practice factor (unitless)

Y = single storm sediment yield in tons

Q = runoff volume in acre-feet

q_p = peak flow in cfs

- Detailed descriptions and methodologies for estimating the soil loss can be obtained from standard hydrology text books (See References section).
- Determination of the appropriate equation should consider construction duration and local environmental factors (soils, hydrology, etc.). For example, if a basin is planned for a project duration of 1 year and the designer specifies one maintenance cycle, RUSLE could be used to estimate the soil loss and thereby the designer could indicate that the sediment storage volume would be half of the soil loss value estimated. As an example for use of MUSLE, a project may have a short construction duration thereby requiring fewer maintenance cycles and a reduced sediment storage volume. MUSLE would be used to estimate the anticipated soil loss based on a specific storm event to evaluate the sediment storage volume and appropriate maintenance frequency.
- The soil loss estimates are an essential step in the design and it is essential that the designer provide construction contractors with enough information to understand maintenance frequency and/or depths within the basin that would trigger maintenance. Providing maintenance methods, frequency and specification should be included in design bid documents such as the SWPPP Site Map.
- Once the designer has quantified the amount of soil entering the basin, the depth required for sediment storage can be determined by dividing the estimated sediment loss by the surface area of the basin.

Step 4. Other Design Considerations

- Consider designing the volume of the settling zone for the total storm volume associated with the 2-year event or other appropriate design storms specified by the local agency. This volume can be used as a guide for sizing the basin without iterative routing calculations. The depth of the settling zone can be estimated by dividing the estimated 2-yr storm volume by the surface area of the basin.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.

- The basin depth must be no less than 3 ft (not including freeboard).

- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 96 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 96-hour limit is specified to mitigate vector control concerns.

- Confirmation of the basin performance can be evaluated by routing the design storm (10-yr 6-hr, or as directed by local regulations) through the basin based on the basin volume (stage-storage curve) and the outlet design (stage-discharge curve based on the orifice configuration or equivalent outlet design).

- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.

  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap (or equivalent protection) on fill slopes.

  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.

- Rock, vegetation or appropriate erosion control should be used to protect the basin inlet, outlet, and slopes against erosion.

- The total depth of the sediment basin should include the depth required for sediment storage, depth required for settling zone and freeboard of at least 1 foot or as regulated by local flood control agency for a flood event specified by the local agency.

- The basin alignment should be designed such that the length of the basin is more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet. If the site topography does not allow for this configuration baffles should be installed so that the ratio is satisfied. If a basin has more than one inflow point, any inflow point that conveys more than 30 percent of the total peak inflow rate has to meet the required length to width ratio.

- An alternative basin sizing method proposed by Fifield (2004) can be consulted to estimate an alternative length to width ratio and basin configuration. These methods can be considered as part of Option 3 which allows for alternative designs that are protective or more protective of water quality.

- Baffles (see Figure 4 at the end of this fact sheet) can be considered at project sites where the existing topography or site constraints limit the length to width ratio. Baffles should be constructed of earthen berms or other structural material within the basin to divert flow in the basin, thus increasing the effective flow length from the basin inlet to the outlet riser. Baffles also reduce the change of short circuiting and allows for settling throughout the basin.

- Baffles are typically constructed from the invert of the basin to the crest of the emergency spillway (i.e., design event flows are meant to flow around the baffles and flows greater than the design event would flow over the baffles to the emergency spillway).
- Use of other materials for construction of basin baffles (such as silt fence) may not be appropriate based on the material specifications and will require frequent maintenance (maintain after every storm event). Maintenance may not be feasible when required due to flooded conditions resulting from frequent (i.e., back to back) storm events. Use of alternative baffle materials should not deviate from the intended purpose of the material, as described by the manufacturer.
- Sediment basins are best used in conjunction with erosion controls.
- Basins with an impounding levee greater than 4.5 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 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- A forebay, constructed upstream of the basin, may be provided to remove debris and larger particles.
- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- The principal outlet should 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 should 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.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.

- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

The cost of a sediment basin is highly variable and is dependent of the site configuration. To decrease basin construction costs, designers should consider using existing site features such as berms or depressed area to site the sediment basin. Designers should also consider potential savings associated with designing the basin to minimize the number of maintenance cycles and siting the basin in a location where a permanent BMP (e.g., extended detention basin) is required for the project site.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level and as required by local requirements. It is recommended that at a minimum, basins be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the basin must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance should be managed properly. The sediment should be appropriately evaluated and used or disposed of accordingly. Options include: incorporating sediment into earthwork on the site (only if there is no risk that sediment is contaminated); or off-site export/disposal at an appropriate location (e.g., sediment characterization and disposal to an appropriate landfill).
- Remove standing water from basin within 96 hours after accumulation.
- If the basin does not drain adequately (e.g., due to storms that are more frequent or larger than the design storm or other unforeseen site conditions), dewatering should be conducted in accordance with appropriate dewatering BMPs (see NS-2) and in accordance with local permits as applicable.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

References

A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zones, Metropolitan Washington Council of Governments, March 1992.

Draft-Sedimentation and Erosion Control, an Inventory of Current Practices, USEPA. April 1990.

U.S. Environmental Protection Agency (USEPA). Erosion and Sediment Control, Surface Mining in the Eastern U.S., U.S. Environmental Protection Agency, Office of Water, Washington, DC,Washington, D.C., 1976.

Fifield, J.S. Designing for Effective Sediment and Erosion Control on Construction Sites. Forester Press, Santa Barbara, CA. 2004.

Goldman S.J., Jackson K. and Bursztynsky T.A. Erosion and Sediment Control Handbook. McGraw-Hill Book Company, 1986.

U.S. Environmental Protection Agency (USEPA). Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters. EPA 840-B-9-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1993.

Guidelines for the Design and Construction of Small Embankment Dams, Division of Safety of Dams, California Department of Water Resources, March 1986.

Haan C.T., Barfield B.J. and Hayes J.C. Design Hydrology and Sedimentology for Small Catchments. Academic Press. 1994.

Inlet/Outlet Alternatives for Extended Detention Basins. State of California Department of Transportation (Caltrans), 2001.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

McLean, J., 2000. Mosquitoes in Constructed Wetlands: A Management Bugaboo? In T.R. Schueler and H.K. Holland [eds.], The Practice of Watershed Protection. pp. 29-33. Center for Watershed Protection, Ellicott City, MD, 2000.

Metzger, M.E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. The Dark Side of Stormwater Runoff Management: Disease Vectors Associated with Structural BMPs, 2002.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Water, Work Group-Working Paper, USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Quality Management Plan for the Lake Tahoe Region, Volume II Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Young, G.K. and Graziano, F., Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission, 1989.

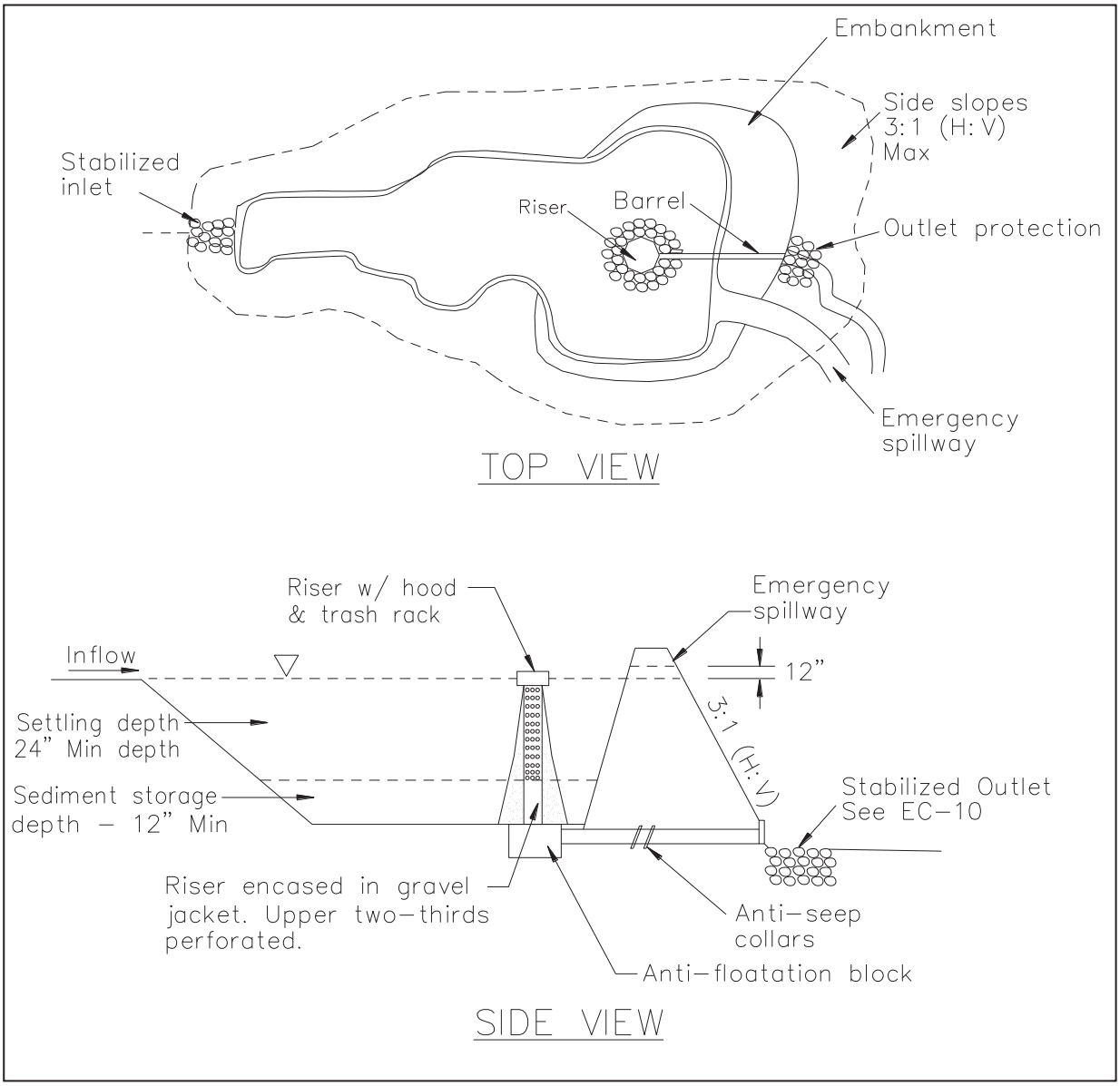


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
MULTIPLE ORIFICE DESIGN
NOT TO SCALE

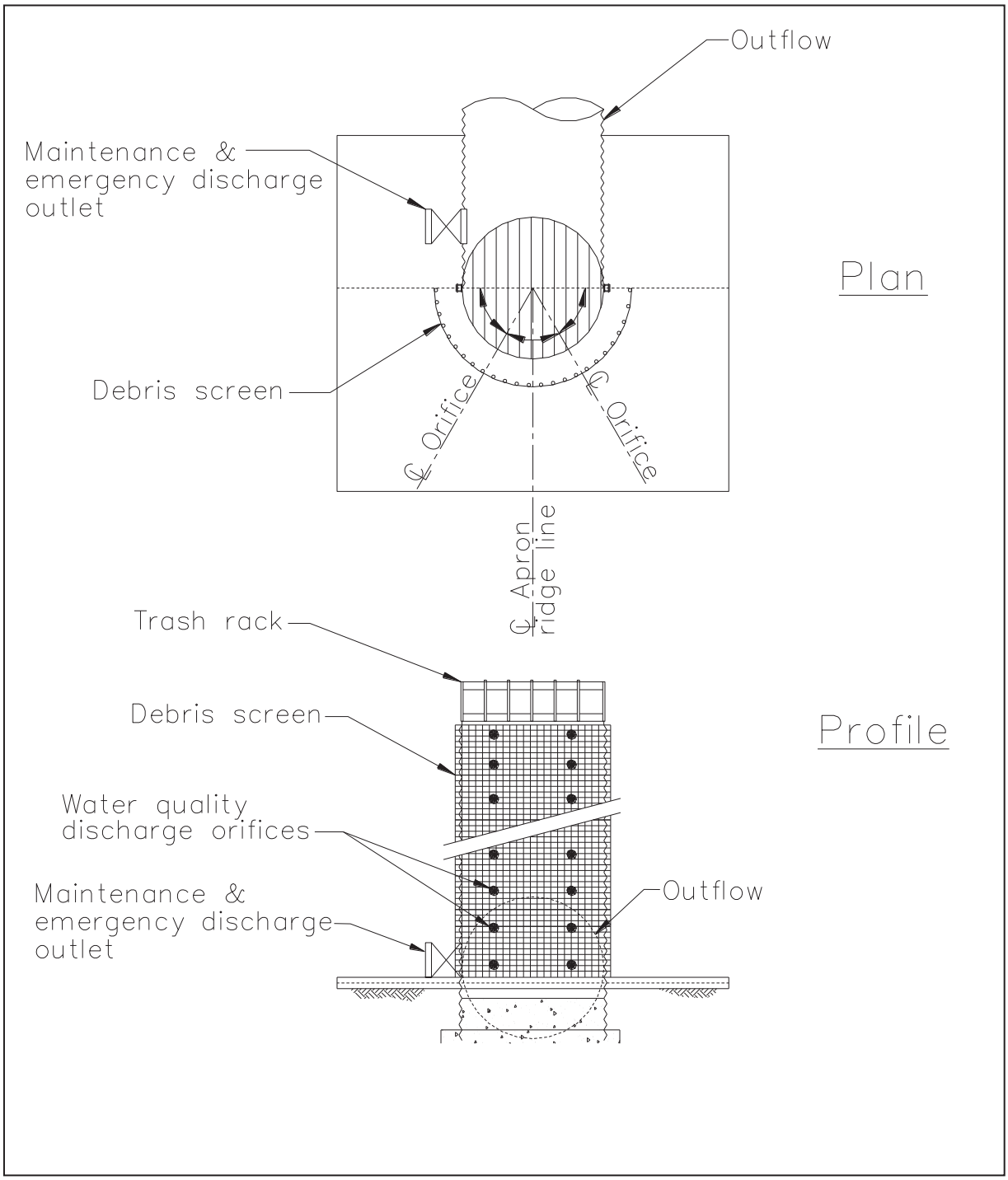


FIGURE 2: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

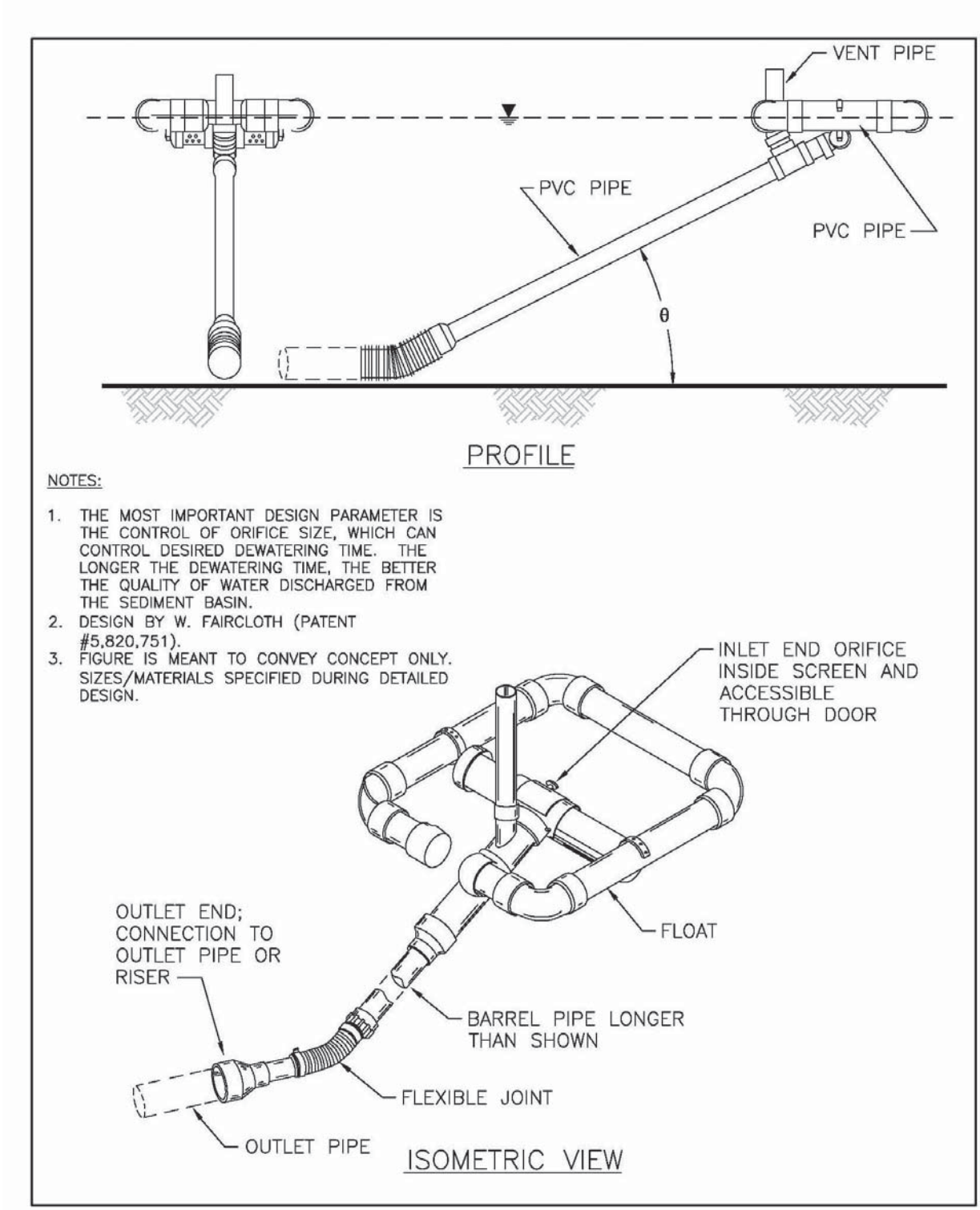


FIGURE 3: TYPICAL SKIMMER
NOT TO SCALE

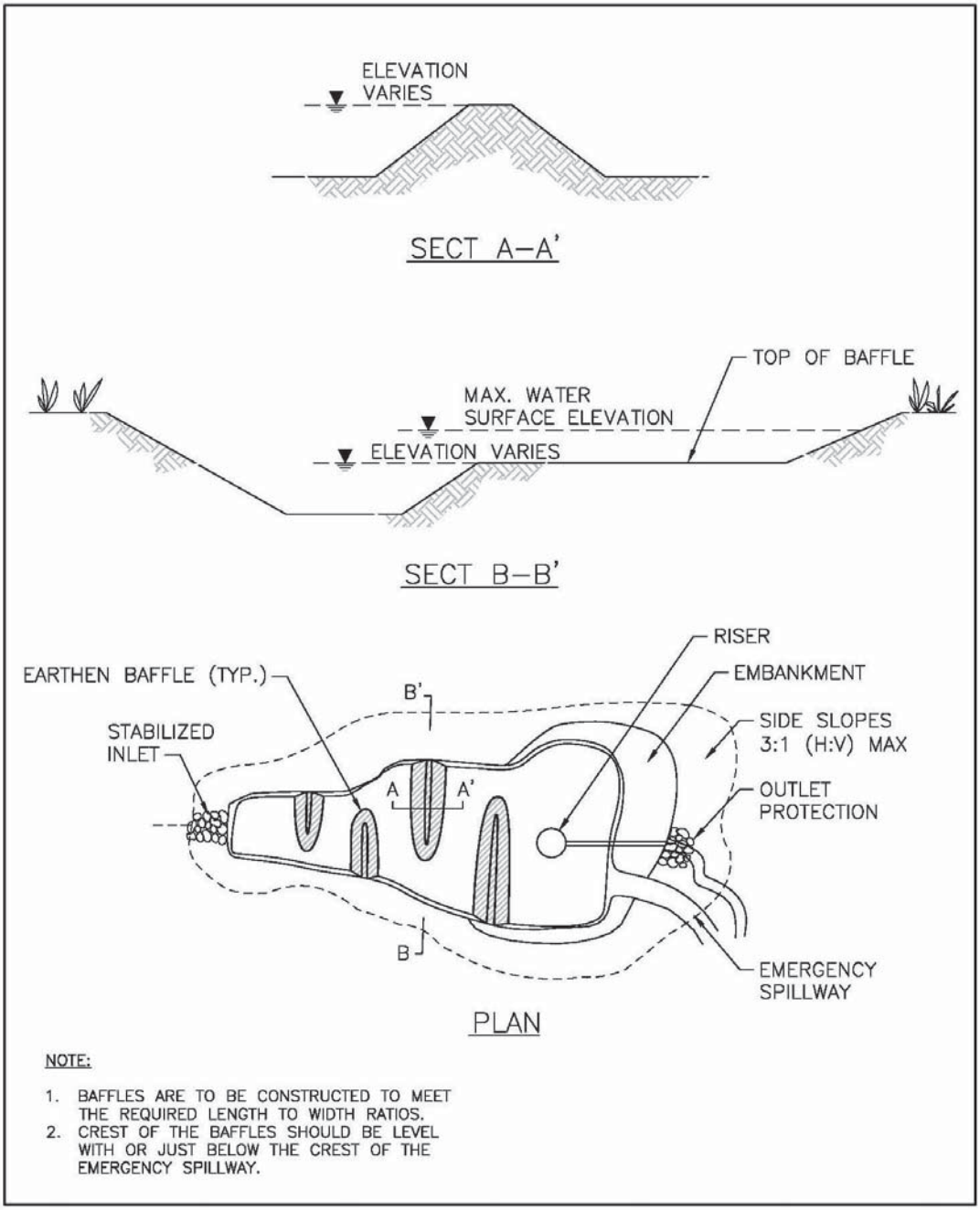
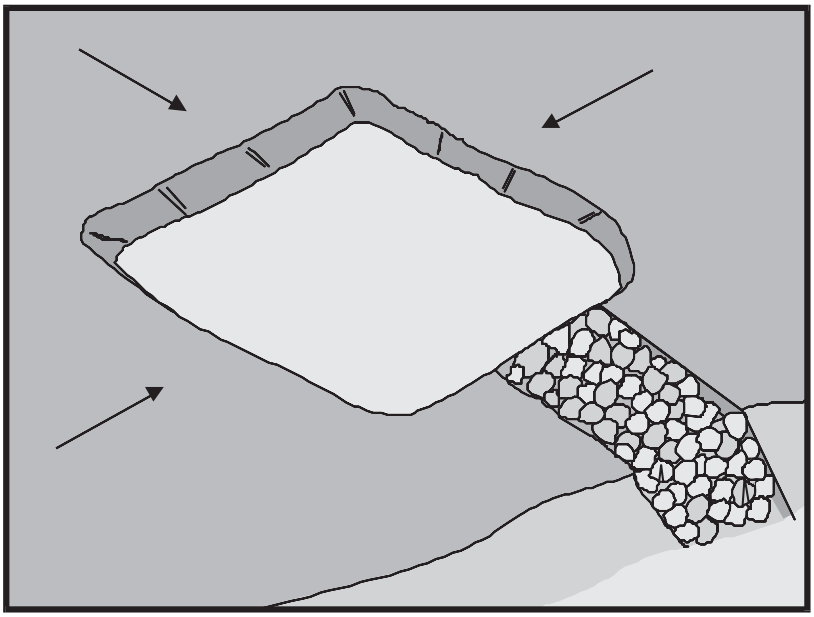


FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN WITH BAFFLES

NOT TO SCALE

Sediment Trap SE-3



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged by gravity flow. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Trap design guidance provided in this fact sheet is not intended to guarantee compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment traps should be used in conjunction with a comprehensive system of BMPs.

Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.

- 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 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

Implementation

Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume

the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criteria for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should 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 should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd^3/acre and 33 yd^3/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 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 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

Installation

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.

- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.
- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.
- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

Costs

Average annual cost per installation and maintenance (18 month useful life) is $0.73 per ft^3 ($1,300 per drainage acre). Maintenance costs are approximately 20% of installation costs.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect outlet area for erosion and stabilize if required.
- Inspect trap banks for seepage and structural soundness, repair as needed.
- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Inspect fencing for damage and repair as needed.
- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 96 hours or less to prevent vector production.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.
- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs per NS-2 shall be implemented at all times during dewatering activities.

References

Brown, W., and T. Schueler. The Economics of Stormwater BMPs in the Mid-Atlantic Region. Prepared for Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD, 1997.

Draft – Sedimentation and Erosion Control, an Inventory of Current Practices, USEPA, April 1990.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E., D.F. Messer, C.L. Beitia, C.M. Myers, and V.L. Kramer, The Dark Side of Stormwater Runoff Management: Disease Vectors Associated with Structural BMPs, 2002.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

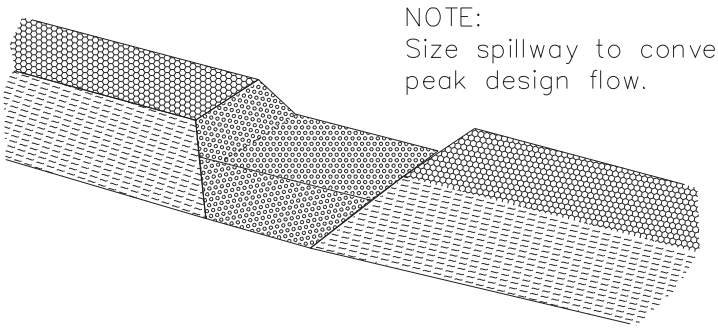
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

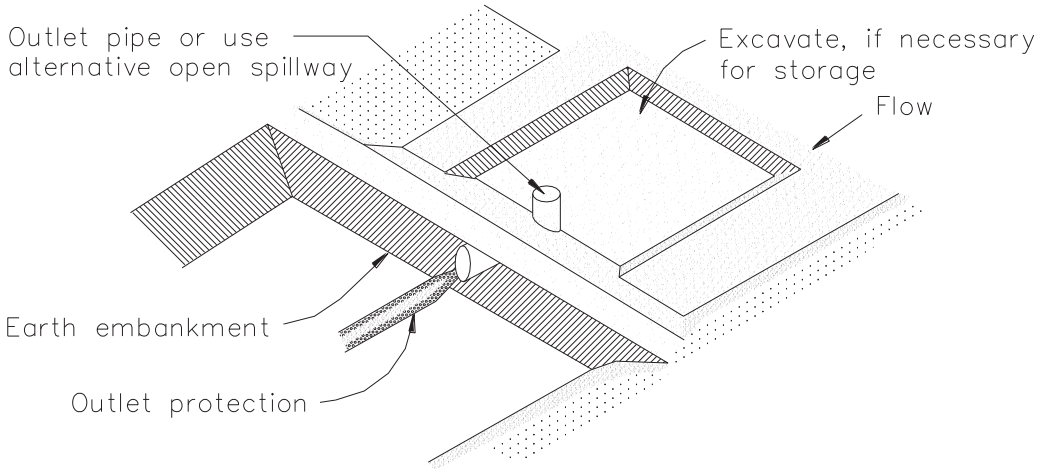
Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

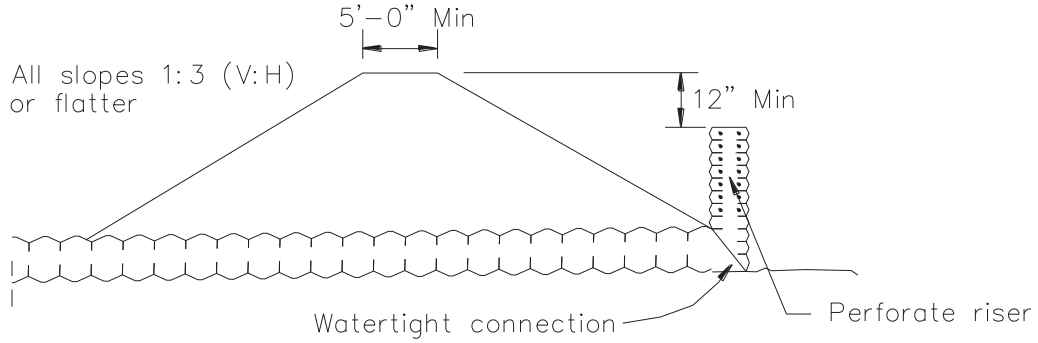
U.S. Environmental Protection Agency (USEPA). Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters. EPA 840-B-9-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL OPEN SPILLWAY

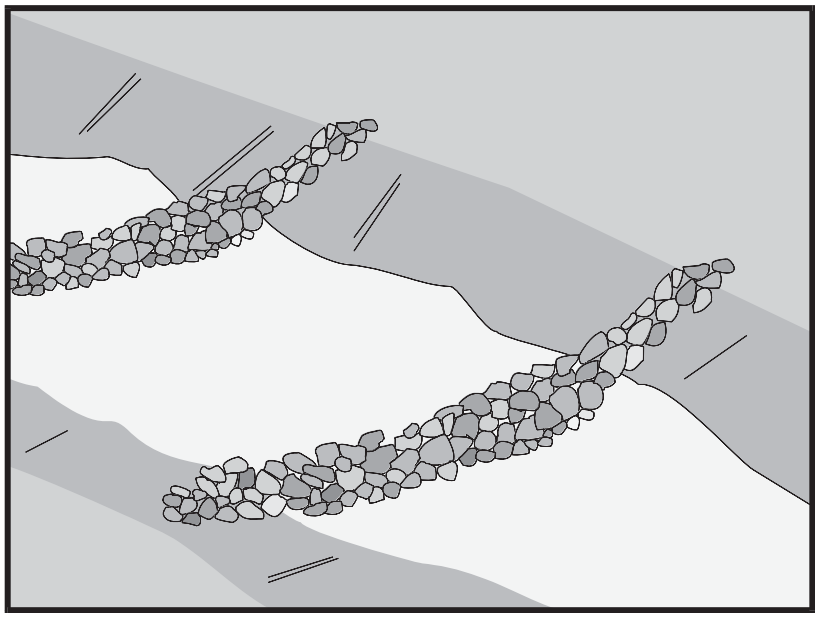




EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE

Check Dams SE-4



Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- 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.
- To act as a grade control structure.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Not to be used in live streams or in channels with extended base flows.
- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion potential or sediment-laden flow 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.
- Do not construct check dams with straw bales or silt fence.
- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as as sediment controls. Note that use of 1-2 isolated check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity should be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, either:

- Don't use check dams. Consider alternative BMPs, or.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam (see "Spacing Between Check Dams" detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of

the ditch or swale (see "Typical Rock Check Dam" detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet (see "Gravel Bag Check Dam" detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer's instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- For multiple check dam installation, backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap should be cleaned following each storm event.

- High flows (typically a 2-year storm or larger) should 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 should be removed when grass has matured sufficiently to protect the ditch or swale.

Materials

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.
- Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms.
- Sandbags used for check dams should conform to SE-8, Sandbag Barrier.
- Fiber rolls used for check dams should conform to SE-5, Fiber Rolls.
- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Upper rows or gravel and sand bags shall overlap joints in lower rows.
- Fiber rolls should be trenched in, backfilled, and firmly staked in place.
- Install along a level contour.
- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

Costs

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

References

Draft – Sedimentation and Erosion Control, and Inventory of Current Practices, USEPA, April 1990.

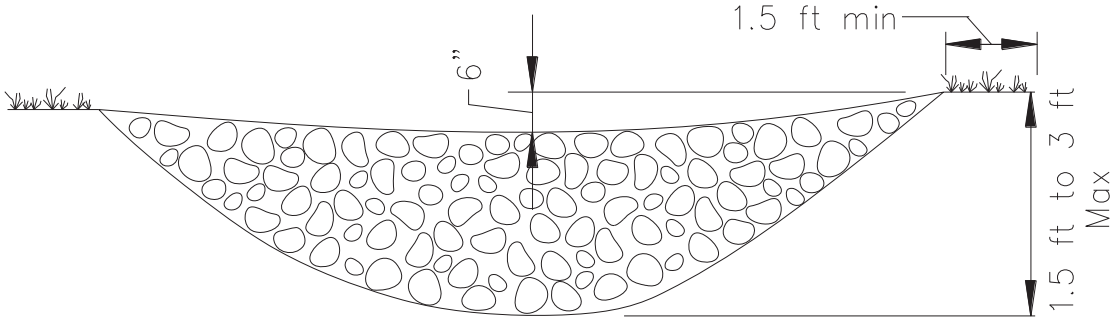
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

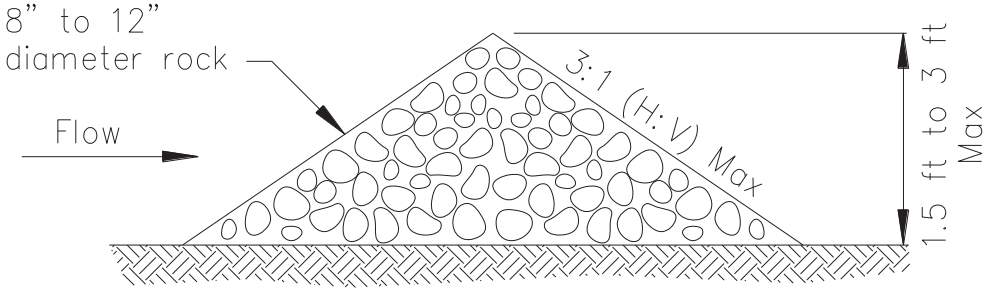
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

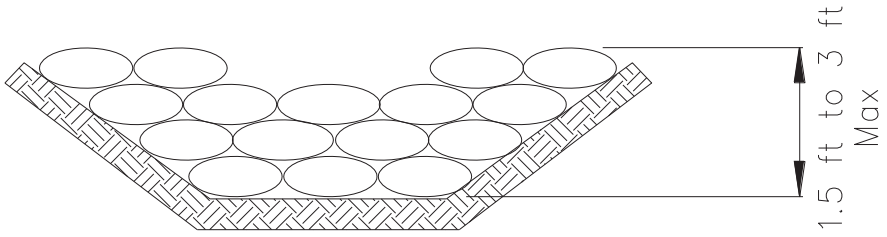


ELEVATION

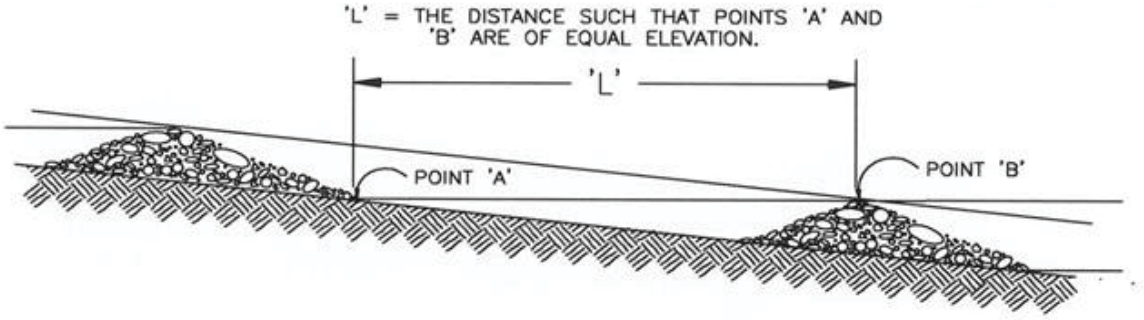


TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE

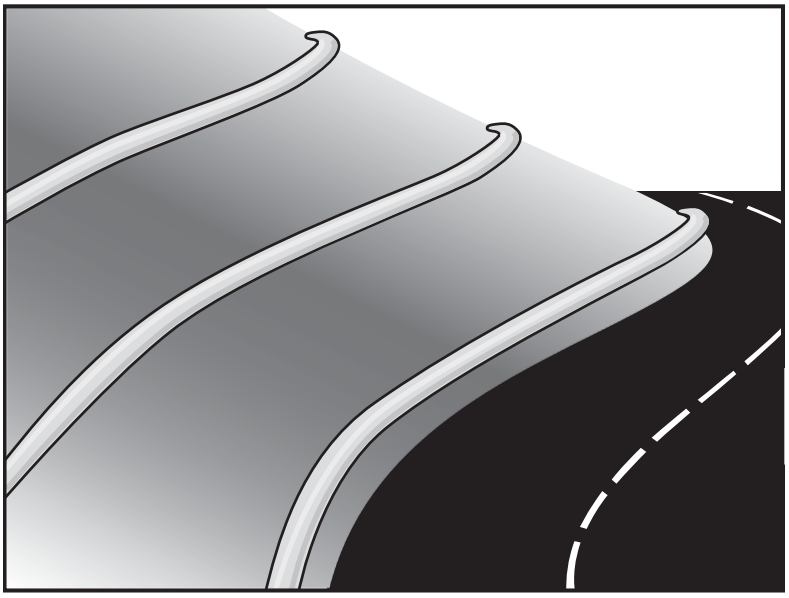


GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE



SPACING BETWEEN CHECK DAMS

Fiber Rolls SE-5



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.
- At operational storm drains as a form of inlet protection.

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Around temporary stockpiles.

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed

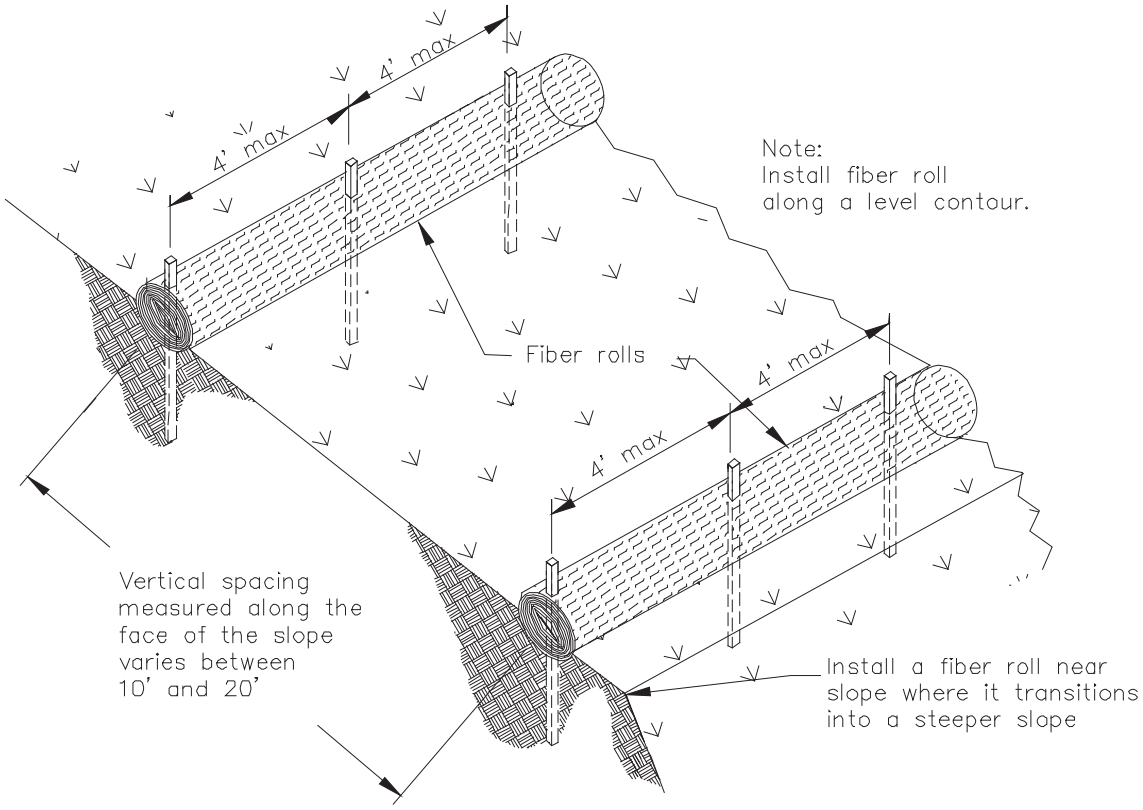
in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.
- Repair any rills or gullies promptly.

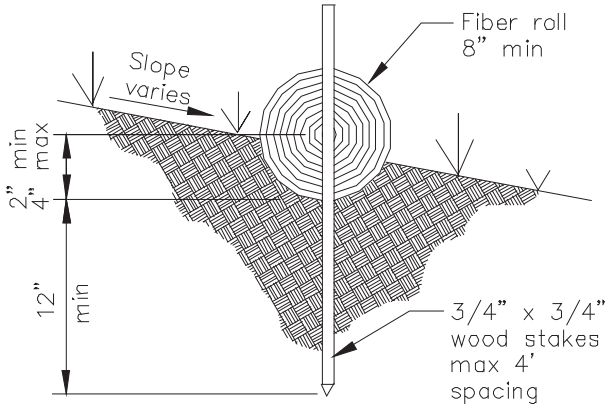
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

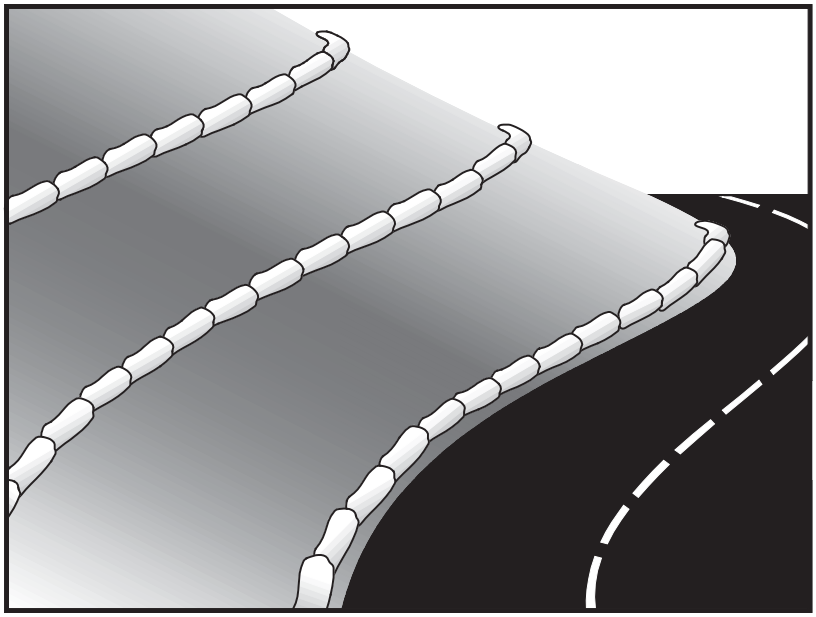


TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Gravel Bag Berm SE-6



Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As a linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-8 Sandbag Barrier

SE-12 Temporary Silt Dike

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- At the top of slopes to divert runoff away from disturbed slopes.
- As chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the berm, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Durability of gravel bags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months.
- Easily damaged by construction equipment.
- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel-filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate gravel bag berms on level contours.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 (H:V) or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 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 should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** Fill material should be 0.5 to 1 in. crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Material costs for gravel bags are average and are dependent upon material availability. $2.50-3.00 per filled gravel bag is standard based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.

- Reshape or replace gravel bags as needed.

- Repair washouts or other damage as needed.

- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

References

Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Street Sweeping and Vacuuming SE-7



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

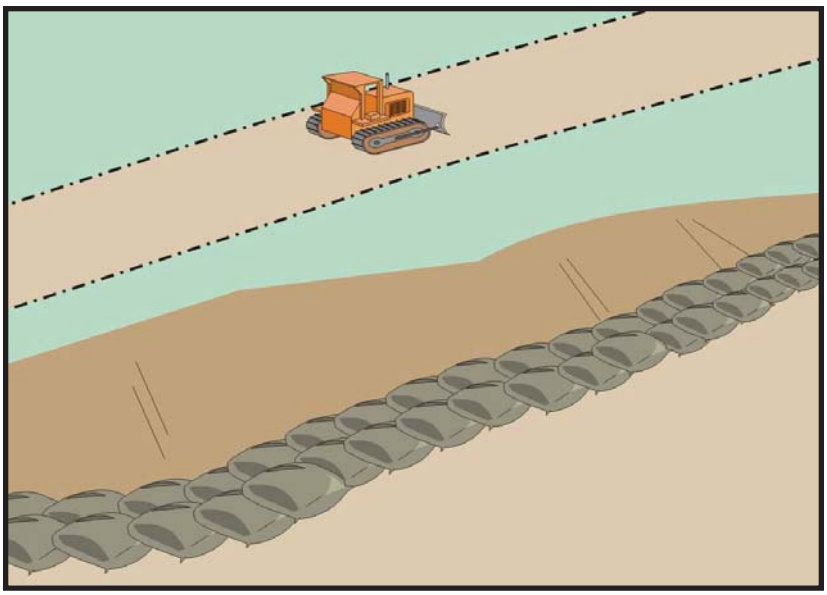
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- 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.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Sandbag Barrier SE-8



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be a suitable control measure for the applications described below. It is important to consider that sand bags are less porous than gravel bags and ponding or flooding can occur behind the barrier. Also, sand is easily transported by runoff if bags are damaged or ruptured. The SWPPP Preparer should select the location of a sandbag barrier with respect to the potential for flooding, damage, and the ability to maintain the BMP.

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes.
  - As sediment traps at culvert/pipe outlets.
  - Below other small cleared areas.
  - Along the perimeter of a site.
  - Down slope of exposed soil areas.
  - Around temporary stockpiles and spoil areas.
  - Parallel to a roadway to keep sediment off paved areas.
  - Along streams and channels.

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
  - At the top of slopes to divert runoff away from disturbed slopes.
  - As check dams across mildly sloped construction roads.

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Sandbags are not intended to be used as filtration devices.
- Easily damaged by construction equipment.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Durability of sandbags is somewhat limited and bags will need to be replaced when there are signs of damage or wear.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. Sand-filled bags have limited porosity, which is further limited as the fine sand tends to quickly plug with sediment, limiting or completely blocking the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms or SE-14, Biofilter Bags. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to gravel bag berms, but less porous. Generally, sandbag barriers should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate sandbag barriers on a level contour.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Sandbags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

  - Slope inclination 2:1 (H:V) or greater: Sandbags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- Butt ends of bags tightly.
- Overlap butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 (H:V) or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- See typical sandbag barrier installation details at the end of this fact sheet.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 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 an acceptable substitute, as sand can more easily mobilize out of burlap.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 3 (Caltrans Standard Specification, Section 25) or similar permeable material free from clay and deleterious material, such as recycled concrete or asphalt.

Costs

Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Additional labor is required to fill the bags. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag. These costs are based upon vendor research.

Inspection and Maintenance

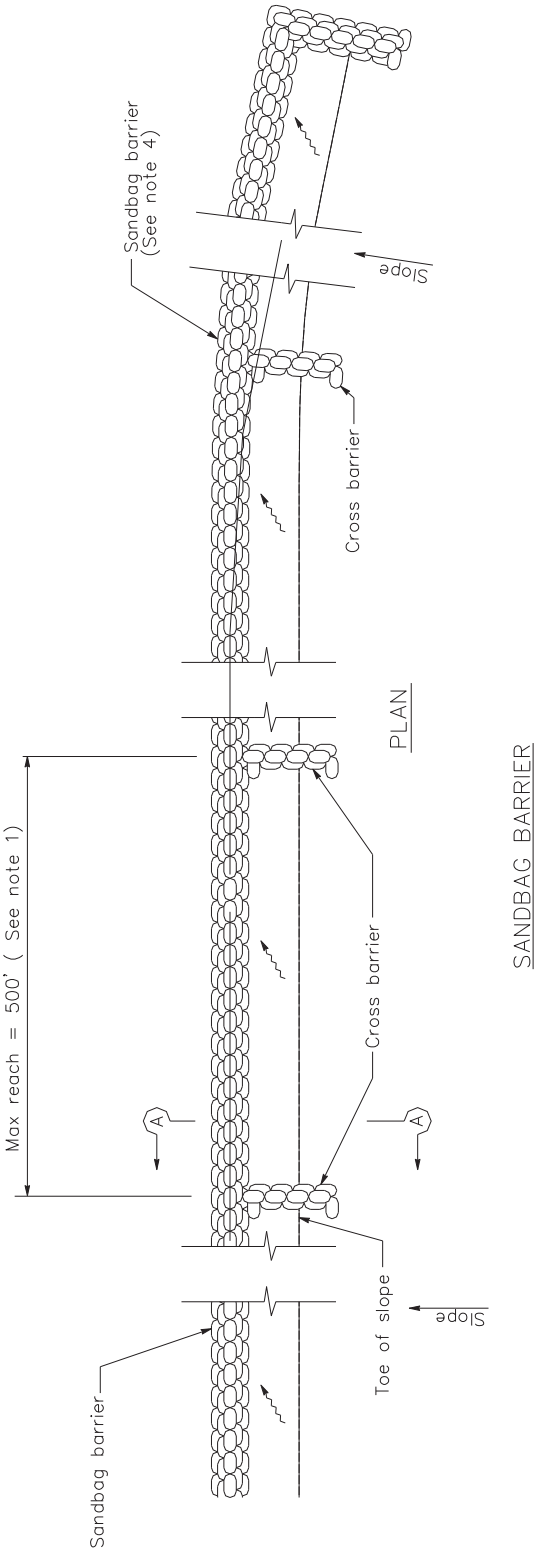
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

Standard Specifications for Construction of Local Streets and Roads, California Department of Transportation (Caltrans), July 2002.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

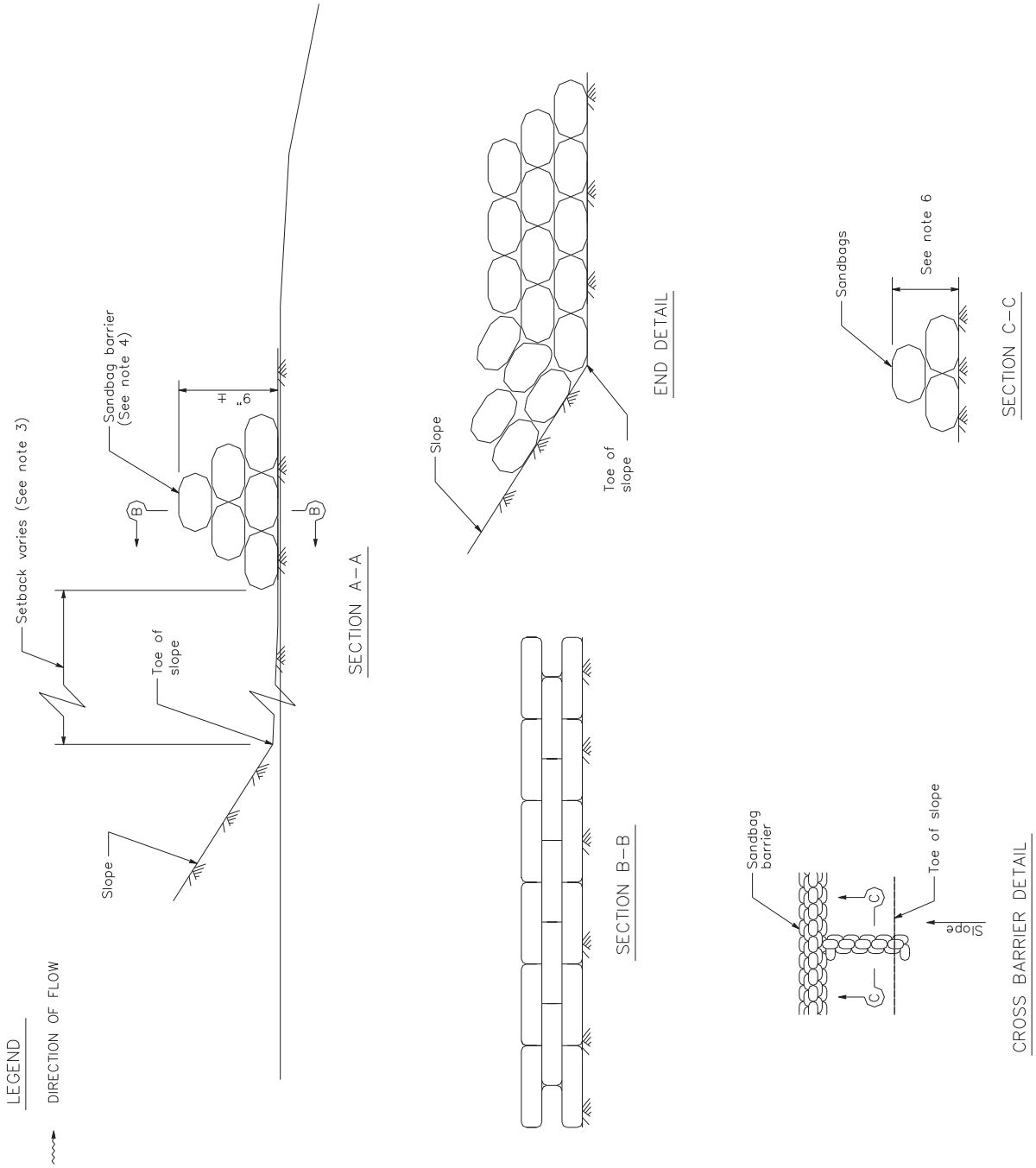
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



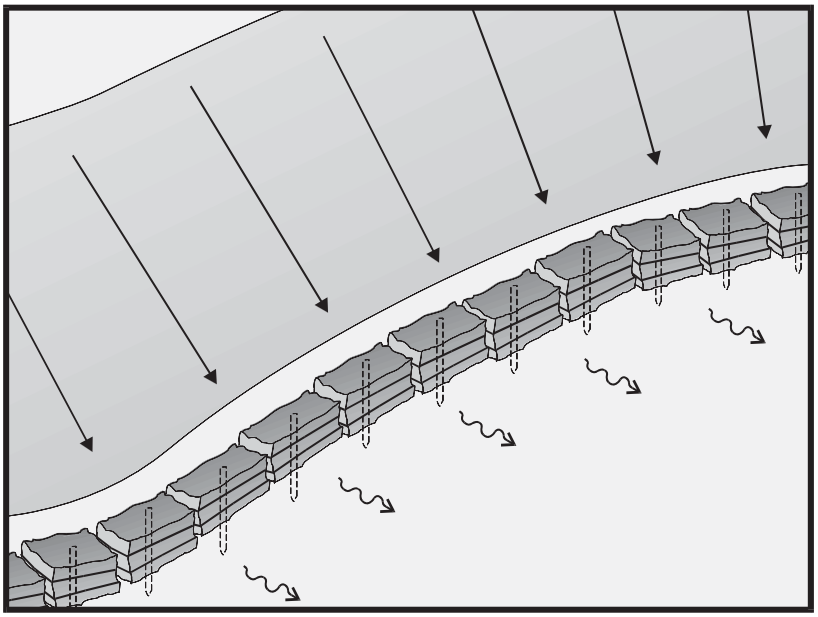
SANDBAG BARRIER

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 500'.
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.


LEGEND
DIRECTION OF FLOW
Setback varies (See note 3)
Sandbag barrier (See note 4)
H
B
B
Toe of slope
Slope
SECTION A–A
Slope
Toe of slope
END DETAIL
SECTION B–B
Sandbags
See note 6
SECTION C–C
Sandbag barrier
C
C
Toe of slope
Slope
CROSS BARRIER DETAIL

Straw Bale Barrier SE-9



Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet-flow runoff, allowing sediment to settle out.

Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Temporary Silt Dike

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.

- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.
- Maximum flow path to the barrier should be limited to 100 ft.
- Straw bale barriers should consist of two parallel rows.
  - Butt ends of bales tightly
  - Stagger butt joints between front and back row
  - Each row of bales must be trenched in and firmly staked
- Straw bale barriers are limited in height to one bale laid on its side.
- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.
- See attached figure for installation details.

Materials

- ***Straw Bale Size:*** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.
- ***Bale Bindings:*** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.
- ***Stakes:*** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should 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 should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Costs

Straw bales cost $5 - $7 each. Adequate labor should be budgeted for installation and maintenance.

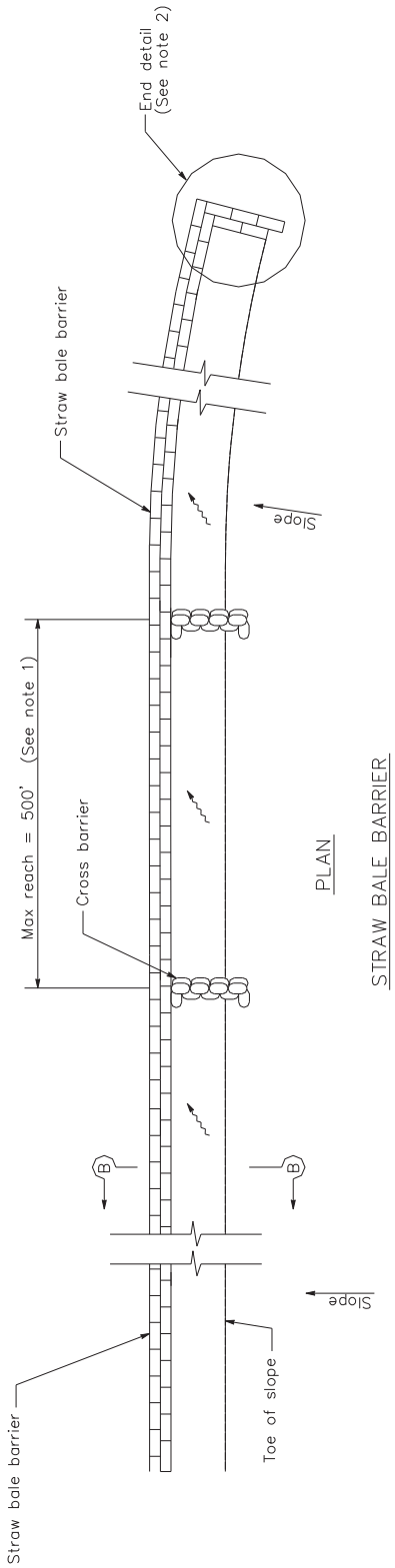
Inspection and Maintenance

Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.
- Replace or repair damaged bales as needed.
- Repair washouts or other damages as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



PLAN

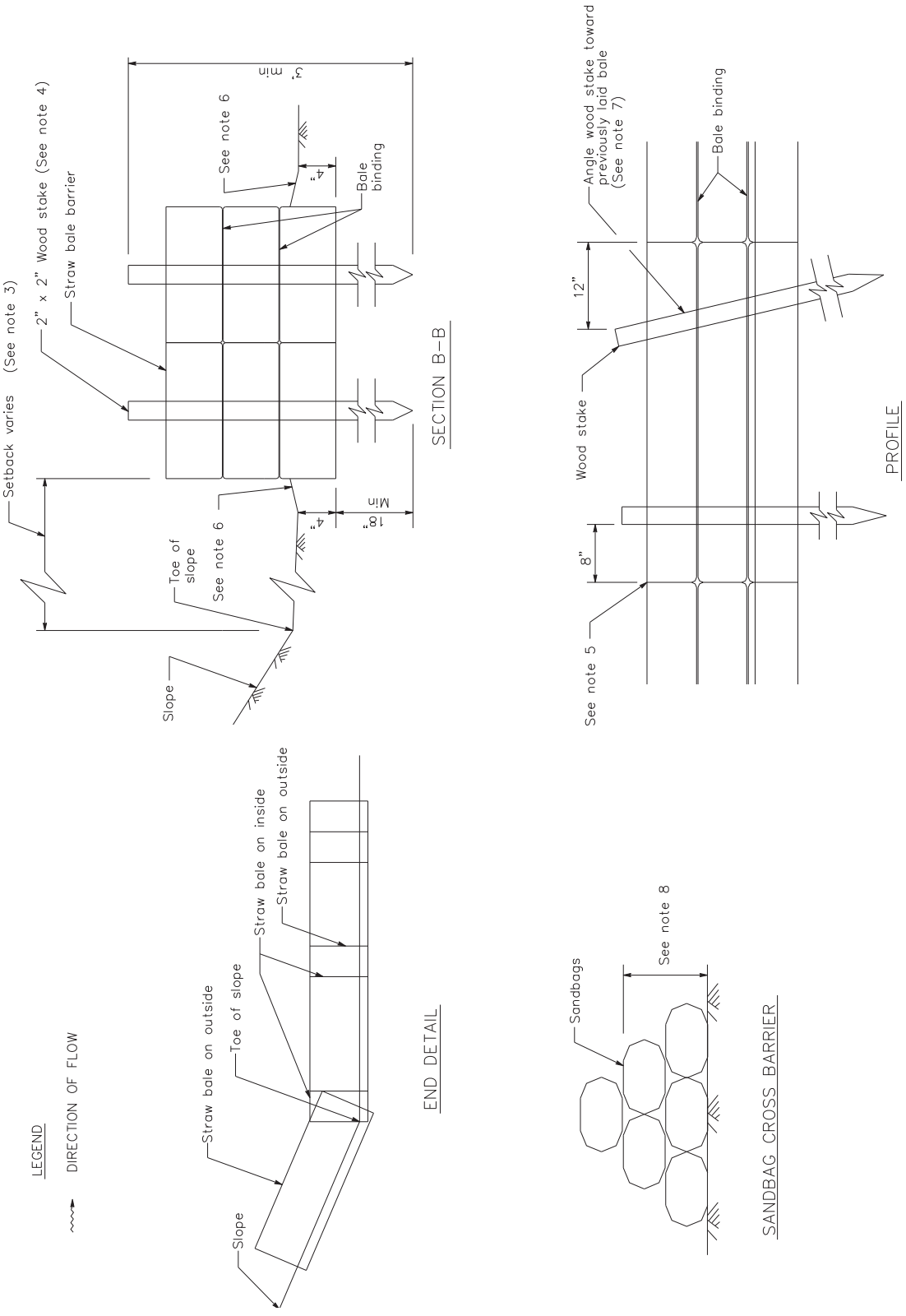
STRAW BALE BARRIER

LEGEND

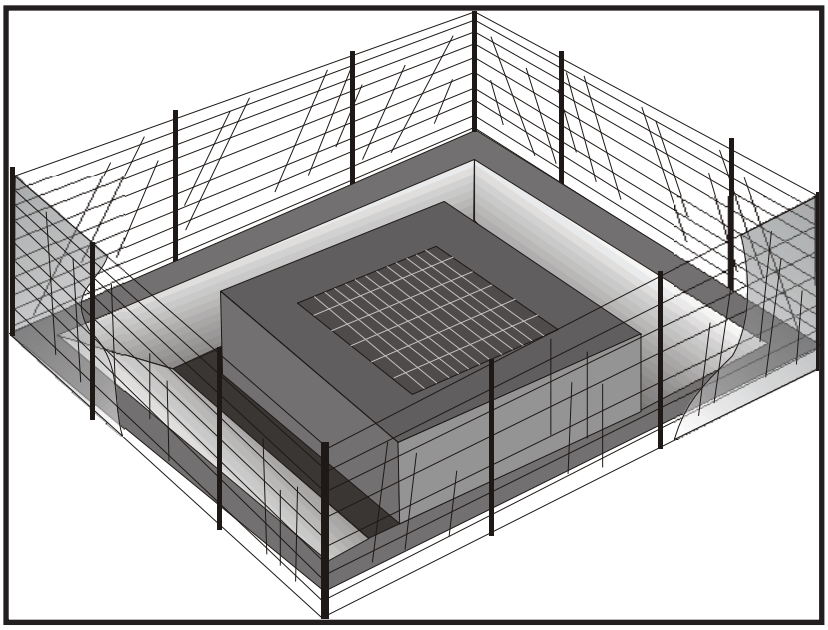
DIRECTION OF FLOW

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 500'.
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. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.


Setback varies (See note 3)
2" x 2" Wood stake (See note 4)
Straw bale barrier
See note 6
Bale binding
Min 3"
4"
Min 18"
Toe of slope
See note 6
Slope
SECTION B-B
Angle wood stake toward previously laid bale (See note 7)
Bale binding
12"
Wood stake
8"
See note 5
PROFILE
Straw bale on inside
Straw bale on outside
Straw bale on outside
Toe of slope
Slope
END DETAIL
Sandbags
See note 8
SANDBAG CROSS BARRIER
LEGEND
DIRECTION OF FLOW

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

SE-13 Compost Socks and Berms

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

- Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use

other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and 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.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.
- Seven types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.

- Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
- Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
- Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
- Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
- Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
- Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
- Compost Socks: Allow filtered run-off to pass through the compost while retaining sediment and potentially other pollutants (SE-13). Appropriate for flows under 1.0 cfs.

- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence*** **-** Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.

  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap -*** Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag -*** Flow from a severe storm should 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 SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.

  2. Leave room upstream of barrier for water to pond and sediment to settle.

  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.

  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter -*** Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.

  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.

  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.

  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.
    2. Biofilter bags should be placed around inlets to intercept runoff flows.
    3. All bag joints should overlap by 6 in.
    4. Leave room upstream for water to pond and for sediment to settle out.
    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

- ***DI Protection Type 7 – Compost Socks*** – A compost sock can be assembled on site by filling a mesh sock (e.g., with a pneumatic blower). Compost socks do not require special trenching compared to other sediment control methods (e.g., silt fence). Compost socks should conform to specification detailed in SE-13, Compost Socks and Berms.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.
- See SE-13 for Compost Sock cost information.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

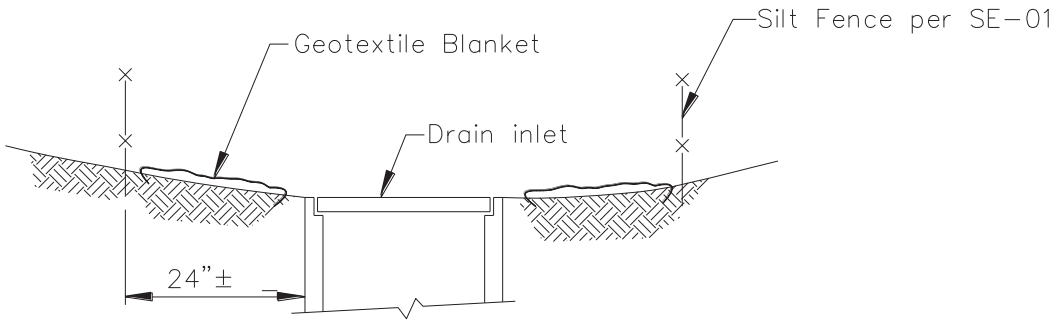
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.
    - Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

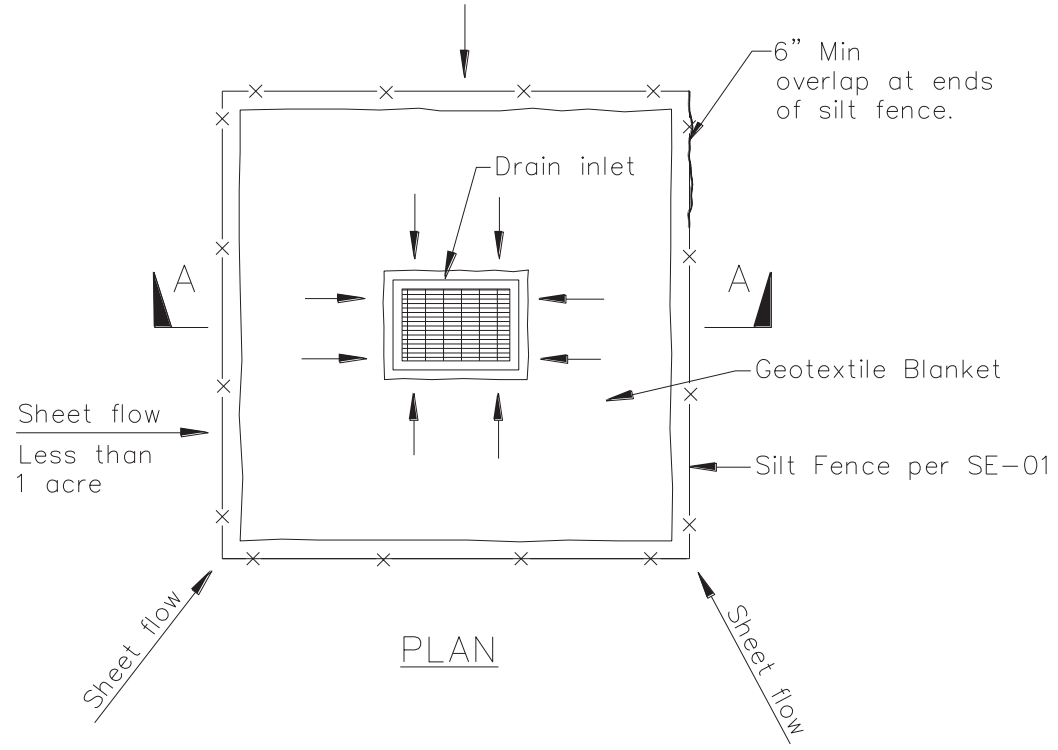
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A–A

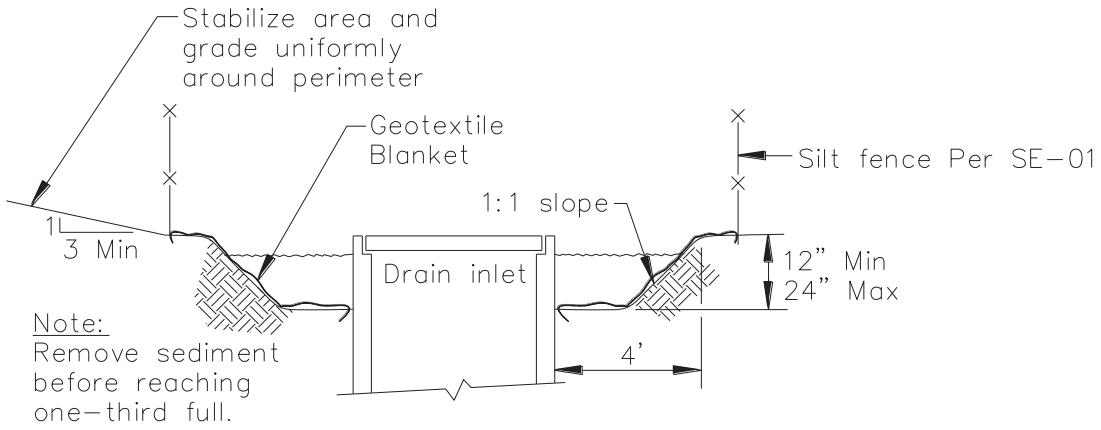


PLAN

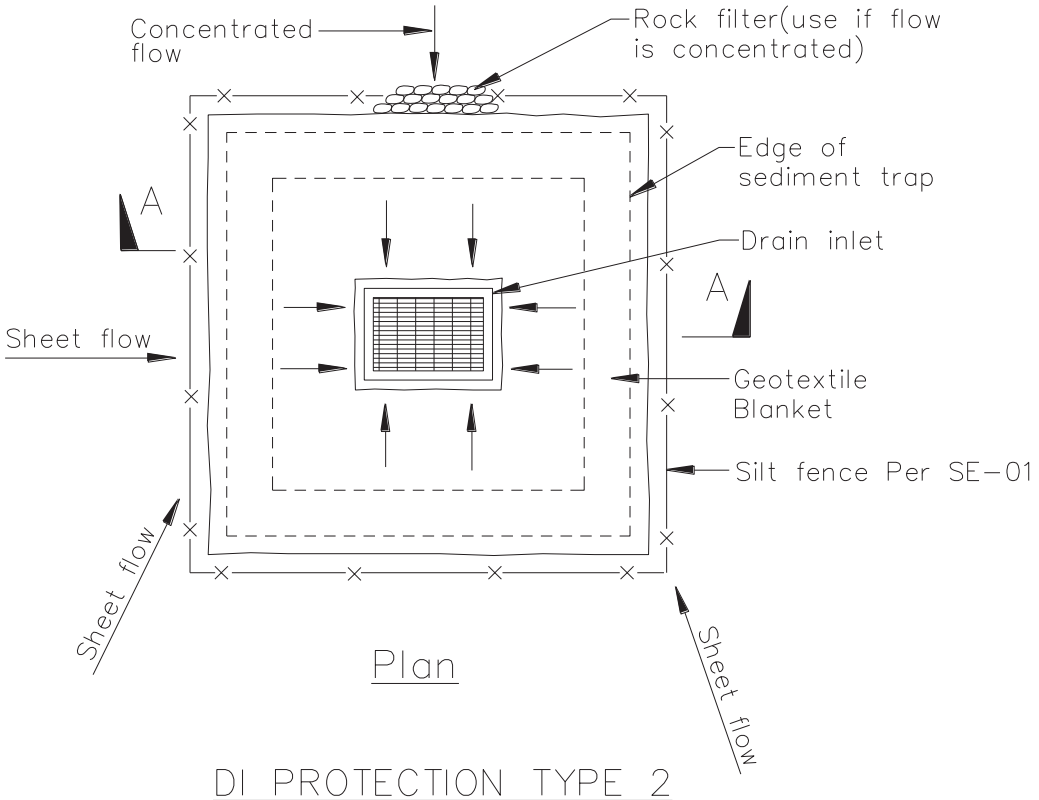
DI PROTECTION TYPE 1
NOT TO SCALE

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.



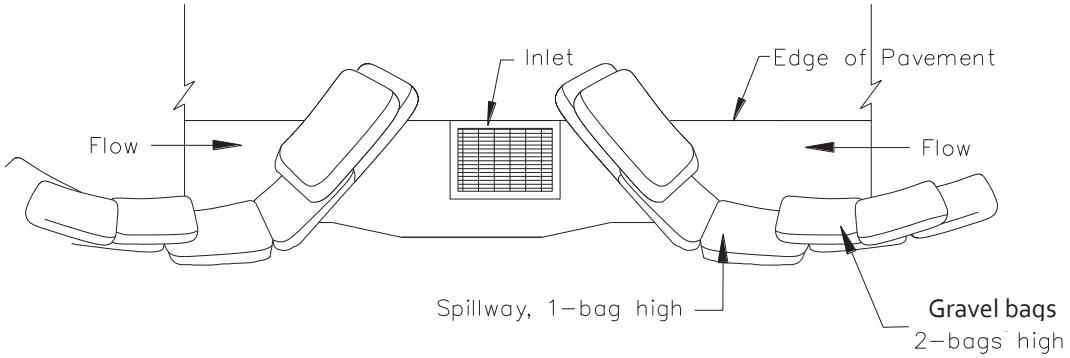
Section A–A



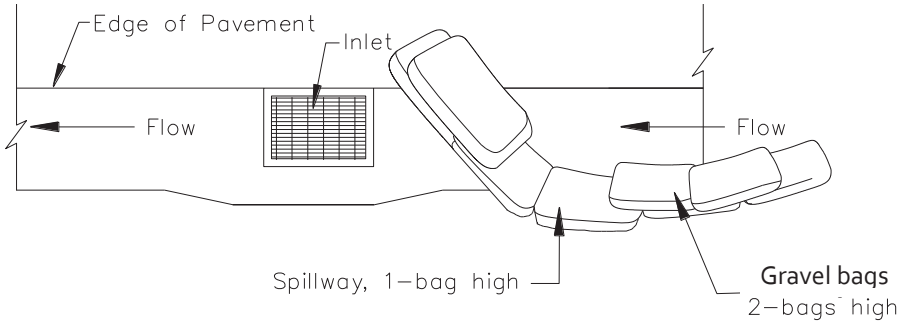
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

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 ON SUMP

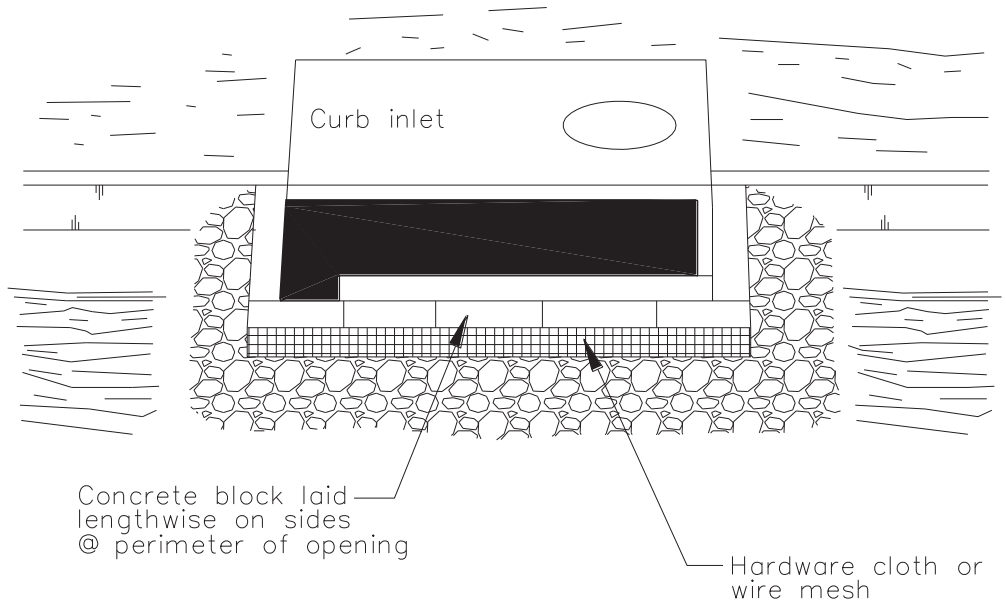


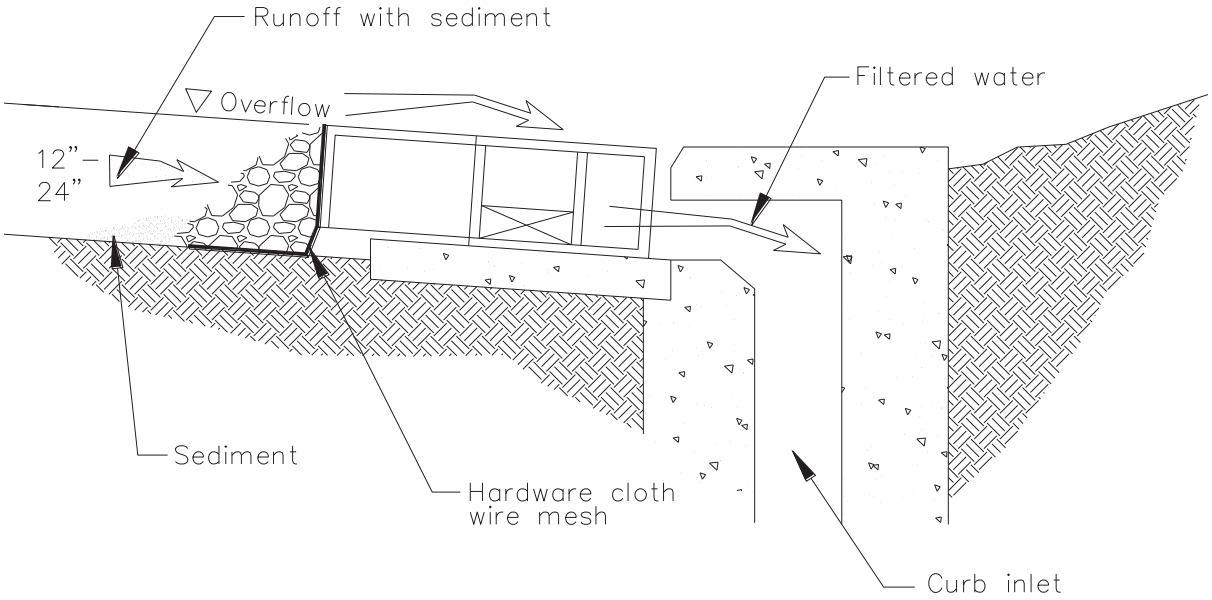
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.
6. Protection can be effective even if it is not immediately adjacent to the inlet provided that the inlet is protected from potential sources of pollution.

DI PROTECTION TYPE 3
NOT TO SCALE

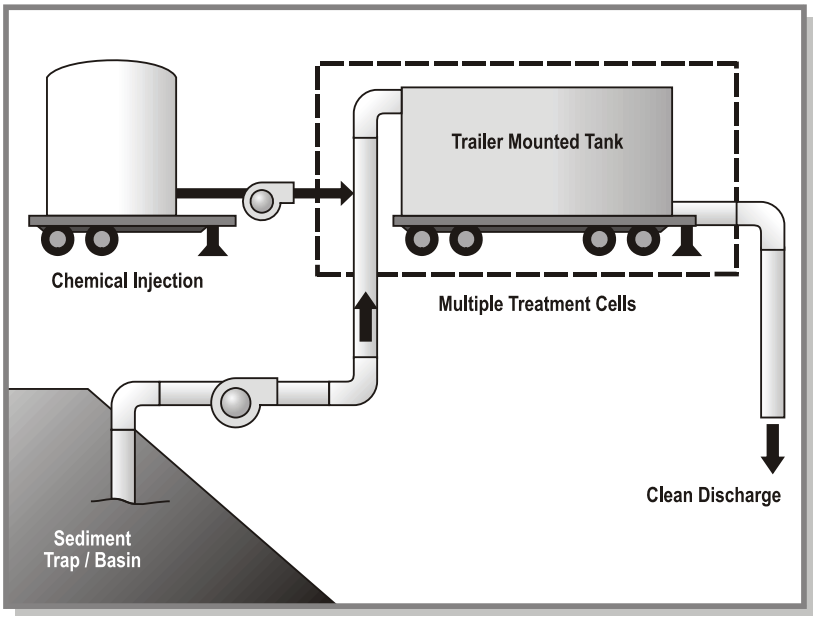




DI PROTECTION – TYPE 4

NOT TO SCALE

Active Treatment Systems SE-11



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Active Treatment Systems (ATS) reduce turbidity of construction site runoff by introducing chemicals to stormwater through direct dosing or an electrical current to enhance flocculation, coagulation, and settling of the suspended sediment. Coagulants and flocculants are used to enhance settling and removal of suspended sediments and generally include inorganic salts and polymers (USACE, 2001). The increased flocculation aids in sedimentation and ability to remove fine suspended sediments, thus reducing stormwater runoff turbidity and improving water quality.

Suitable Applications

ATS can reliably provide exceptional reductions of turbidity and associated pollutants and should be considered where turbid discharges to sediment and turbidity sensitive waters cannot be avoided using traditional BMPs. Additionally, it may be appropriate to use an ATS when site constraints inhibit the ability to construct a correctly sized sediment basin, when clay and/or highly erosive soils are present, or when the site has very steep or long slope lengths.

Limitations

Dischargers choosing to utilize chemical treatment in an ATS must follow all guidelines of the Construction General Permit Attachment F – Active Treatment System Requirements. General limitations are as follows:

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Numeric Effluent Limit (NEL) for all discharges (10 NTU daily flow-weighted average)
- Limited availability of chemical residual testing procedures that meet permit requirements for flow-through treatment
- Specific field and classroom ATS training required to operate equipment
- Batch treatment requires extensive toxicity testing of effluent
- Batch treatment requires large footprint to accommodate treatment cells
- Requires additional filtration to remove residual floc and treatment chemicals prior to discharge
- Petroleum based polymers should not be used
- Requires site-specific design and equipment
- Limited discharge rates depending on receiving water body
- Labor intensive operation and maintenance
- ATS costs are higher on a unit basis for smaller sites that would be expected to have a lower volume of treated runoff
- ATS costs are seasonably variable due to increases or decreases in rainfall volumes

Implementation

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling, but are ineffective at removing smaller particulates such as clay and fine silt. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). ATS may be used to reduce the turbidity of stormwater runoff. With an ATS, very high turbidities can be reduced to levels comparable to what is found in streams during dry weather.

Criteria for ATS Product Use

Chemically treated stormwater discharged from construction sites must be non-toxic to aquatic organisms. The following protocol should be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- An ATS Plan, which includes an Operation and Maintenance component, a Monitoring, Sampling and Reporting component, a Health and Safety component, and a Spill Prevention component must be prepared and submitted to the Regional Water Quality Control Board (RWQCB).

- Treatment chemicals should be approved by EPA for potable water use or otherwise be demonstrated to be protective of human health and the environment. Chemical residual or whole effluent toxicity testing is required.

- Prior to field use of chemical treatment, jar tests are to be conducted to demonstrate that turbidity reduction necessary to meet the NELs and receiving water criteria can be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions. Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability. A minimum of six site-specific jar tests must be conducted per chemical.

- The proposed maximum dosage should be at least a factor of five lower than the no observed effects concentration (NOEC).

- Effluent discharge from an ATS to a receiving water is conditional upon the favorable results of full-scale whole effluent bioassay/toxicity testing for batch treatment systems and upon chemical residuals testing for flow-through systems.

- Contact the RWQCB for a list of treatment chemicals that may be pre-approved for use.

Active Treatment System Design Considerations

The design and operation of an ATS should take into consideration the factors that determine optimum, cost-effective performance. While site characteristics will influence system design, it is important to recognize the following overriding considerations:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is an optimum dosage rate. This is a situation where the adage “adding more is always better” is not the case.

- The coagulant must be mixed rapidly into the water to insure proper dispersion.

- The mixing system for batch treatment must be sized to provide adequate mixing for the design storage volume. Lack of adequate mixing during the flocculation phase results in flocs that are too small and/or insufficiently dense. Too much mixing can rapidly destroy floc as it is formed.

- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a filtration system such as sand, bag, or cartridge filter that would catch any unintended floc discharge.

- ATS is also regulated for pH of the discharge. A pH-adjusting chemical should be added into the treated water to control pH if the selected coagulant requires alteration of the pH of the discharge outside of the acceptable range.

Active Treatment System Design

ATS can be designed as batch treatment systems using either ponds or portable trailer-mounted tanks, or as flow-through systems using any number of proprietary designed systems.

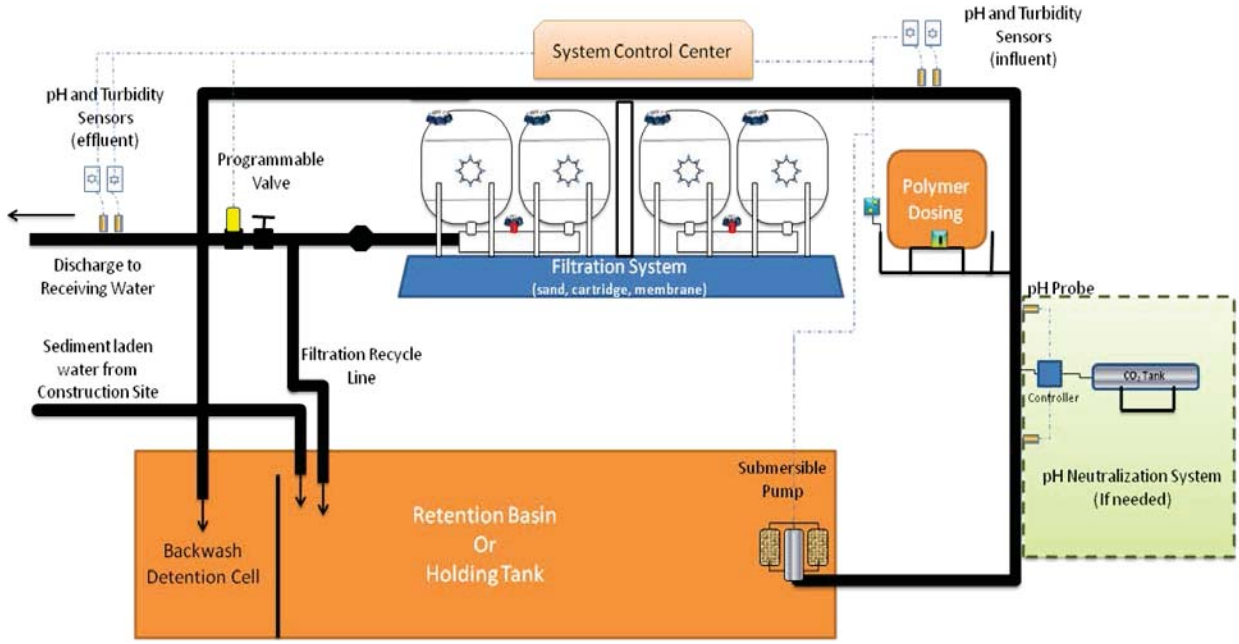


Figure has been adapted from Port of Seattle response to Washington Dept. of Ecology Action Order 2948

Batch Treatment

Batch Treatment systems consist of the stormwater collection system (either temporary diversion or the permanent site drainage system); a sediment basin, trap or holding tanks; pumps; a chemical feed system; treatment cells; and, interconnecting piping.

Batch treatment systems should use a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be basins, traps, or tanks. Portable tanks may also be suitable for some sites.

The following equipment should be located in a secured, covered location:

- The chemical injector
- Secondary contaminant for acid, caustic, buffering compound, and treatment chemical
- Emergency shower and eyewash
- Monitoring equipment which consists of a pH meter and a turbidimeter (if not already within the instrumentation panel of the chemical injector)

Flow-through Treatment

At a minimum, a flow-through ATS system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), an untreated stormwater storage pond or holding tank, and a chemically enhanced filtration system.

Stormwater is collected at interception point(s) on the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area.

The stormwater is stored until treatment occurs. It is important that the holding pond be large enough to provide adequate storage.

Stormwater is then pumped from the untreated stormwater storage pond to the chemically enhanced filtration system where polymer is added. Adjustments to pH may be necessary before chemical addition. The filtration system continually monitors the stormwater for turbidity and pH. If the discharge water is out of the acceptable turbidity or pH range, the water is recycled to the untreated stormwater pond (or holding tank) where it can be retreated. Flow through systems must ensure that:

- Cumulative flow volume shall be recorded daily. The data recording system shall have the capacity to record a minimum of seven days of continuous data.
- Instrumentation systems are interfaced with system control to provide auto shutoff or recirculation in the event that effluent measurements exceed turbidity or pH.
- Upon system upset, power failure, or other catastrophic event, the ATS will default to a recirculation mode or safe shut down.
- The instrumentation system provides a method for controlling coagulant dose, to prevent potential overdosing.

Sizing Criteria

An ATS shall be designed and approved by a Certified Professional in Erosion and Sediment Control (CPESC), a Certified Professional in Storm Water Quality (CPSWQ); a California registered civil engineer; or any other California registered engineer.

ATS must be designed to capture and treat (within 72 hours) runoff from the 10-year 24-hour storm event. The runoff volume of the watershed area to be treated from this size storm event is required to be calculated using the Rational Method with a runoff coefficient of 1.

If sediment basins are used to capture flow-through or batch treatment, see SE-2, Sediment Basin, for design criteria. Bypass should be provided around the ATS to accommodate extreme storm events. Primary settling should be encouraged in the sediment basin/storage pond. A forebay with access for maintenance may be beneficial.

The permissible discharge rate governed by potential downstream effect should be used to calculate the recommended size of the treatment cells. Local requirements related to Phase I or Phase II NPDES permit thresholds should be considered in developing maximum discharge rates the ATS Plan.

Costs

Costs for ATS may be significant due to equipment rental requirements and cost of chemicals. ATS cost is lower on a treated unit-basis for large construction sites with large volumes of runoff.

Inspection and Maintenance

ATS must be operated and maintained by individuals with experience in their use and trained in accordance with training requirements below. ATS should be monitored continuously while in

use. A designated responsible person shall be on site daily at all times during treatment operations. Daily on-site visual monitoring of the system for proper performance shall be conducted and recorded in the project data log. The name, phone number, and training documentation of the person responsible for system operation and monitoring shall be included in the project data log.

The following monitoring requirements and results should be recorded in the data log:

Operational and Compliance Monitoring

- Effluent flow rate and volume shall be continuously monitored and recorded at 15- minute or less intervals.
- Influent and effluent pH must be continuously monitored and recorded at 15-minute or less intervals.
- Influent and effluent turbidity (expressed in NTU) must be continuously monitored and recorded at 15-minute or less intervals.
- The type and amount of chemical used for pH adjustment, if any, shall be monitored and recorded.
- Dose rate of chemical used in the ATS system (expressed in mg/L) shall be monitored and reported 15-minutes after startup and every 8 hours of operation.
- Laboratory duplicates – monthly laboratory duplicates for residual coagulant analysis must be performed and records shall be maintained onsite.
- Effluent shall be monitored and recorded for residual chemical/additive levels.
- If a residual chemical/additive test does not exist and the ATS is operating in a batch treatment mode of operation refer to the toxicity monitoring requirements below.

Toxicity Monitoring

Batch Treatment

Toxicity testing for systems operated in batch treatment mode should be made in accordance with the following:

- Acute toxicity testing on effluent samples representing effluent from each batch prior to discharge shall be undertaken. All bioassays shall be sent to a laboratory certified by the Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP). The required field of testing number for Whole Effluent Toxicity (WET) testing is E113.
- Acute toxicity tests shall be conducted with the following species and protocols. The methods to be used in the acute toxicity testing shall be those outlined for a 96-hour acute test in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, USEPA-841-R-02-012" for Fathead minnow, *Pimephales promelas*. Rainbow trout, *Oncorhynchus mykiss*, may be used as a substitute for fathead minnow.

All toxicity tests shall meet quality assurance criteria and test acceptability criteria in the most recent versions of the EPA test method for WET testing.

Flow-through Treatment

Toxicity testing for systems operated in flow-through treatment mode should be made in accordance with the following:

- A residual chemical test method shall be used that has a method detection limit (MDL) of 10% or less than the maximum allowable threshold concentration (MATC) for the specific coagulant in use and for the most sensitive species of the chemical used. The MATC is equal to the geometric mean of the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) Acute and Chronic toxicity results for most sensitive species determined for the specific coagulant.
- The residual chemical test method shall produce a result within one hour of sampling.
- A California State certified laboratory shall validate the selected residual chemical test. Specifically the lab will review the test protocol, test parameters, and the detection limit of the coagulant. The discharger shall electronically submit this documentation as part of the ATS Plan.

Numeric Effluent Limit (NEL) Compliance:

All chemically treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits have been established by the Construction General Permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity limits have been set as 10 NTU as a daily flow-weighted average or 20 NTU from a single sample. pH must be within the range of 6.0 to 9.0 standard units. It is often possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements should be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water should not be taken from the treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training:

Operators shall have training specific to using an ATS and liquid coagulants for stormwater discharges in California. The training shall be in the form of a formal class with a certificate and requirements for testing and certificate renewal. Training shall include a minimum of eight hours classroom and 32 hours field training.

Standard BMPs:

Erosion and sediment control BMPs should be implemented throughout the site to prevent erosion and discharge of sediment to the ATS. Some types of chemical coagulation and flocculation are only achievable in water below a certain turbidity; therefore minimizing the amount of sediment reaching the system will increase the likelihood of meeting effluent limits and will potentially lower costs of chemical dosing.

Sediment Removal and Disposal

- Sediment shall be removed from the storage or treatment cells as necessary to ensure that the cells maintain their required water storage (i.e., volume) capability.
- Handling and disposal of all solids generated during ATS operations shall be done in accordance with all local, state, and federal laws and regulations.
- If sediment is determined to be non-toxic, it may be incorporated into the site away from drainages.

References

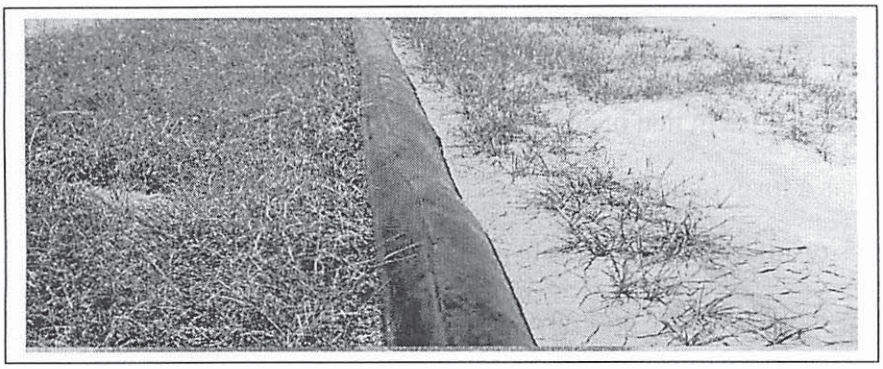
Engineering and Design – Precipitation/Coagulation/Flocculation. United States Army Corps of Engineers, EM 1110-1-4012, 2001.

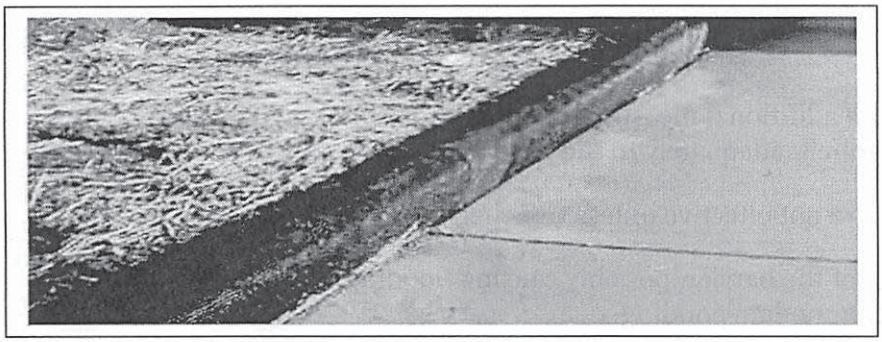
Evaluation of Active Treatment Systems (ATS) for Construction Site Runoff. California Building and Industry Association (prepared by Geosyntec Consultants), 2008.

Stormwater Management Manual for Western Washington, Volume II – Construction Stormwater Pollution Prevention, Washington State Department of Ecology, August 2001.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Temporary Silt Dike SE-12





Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

Description and Purpose

Temporary silt dikes are pre-manufactured devices that are typically specified and installed for drainage and sediment control on the perimeter of disturbed sites or stockpiles and as check dams within channels. Manufactured products include flexible and rigid silt dikes. Both types of temporary silt dikes can be reused. Flexible temporary silt dikes typically consist of a triangular foam or recycled rubber core covered in geotextile fabric. Rigid temporary silt dikes typically consist of an outer jacket made of a rigid High Density Polyethylene (HDPE) matrix and contain an integrated HDPE or polypropylene geotextile filter or a tubular assembly of overlapping layers of porous synthetic materials (frequently called synthetic sediment control rolls). Temporary silt dikes come in a variety of profiles including triangular, round, rectangular, L-shaped, I-shaped, and T-shaped.

Suitable Applications

Temporary silt dikes are generally used in areas as a substitute for fiber rolls and silt fences in sediment control applications to slow down runoff water, divert drainage or contain fines and sediment. Temporary silt dikes are a linear control and application suitability varies based on the specific product type. They may be suitable for:

- On paved surfaces for perimeter protection.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- As check structures in channels.
- Along the perimeter of disturbed sites in lieu of silt fence.
- At operational storm drains as a form of inlet protection.
- Around temporary stockpiles or material/equipment storage areas.
- At the interface between graveled driveways and pavement.
- Along the toe of exposed and erodible slopes.

Limitations

- Temporary silt dikes require additional measures to adhere to asphalt in cold and windy climates, as glue may not adhere adequately to the pavement.
- Rigid temporary silt dikes are not effective unless trenched-in and staked.
- Runoff will pond upstream of the barrier, possibly causing flooding or bypass if sufficient space does not exist to accommodate ponding.
- Temporary silt dikes may require frequent maintenance especially when used near vehicle traffic or to detain concentrated flows (e.g. check dams or inlet protection).
- When used to detain concentrated flows, maintenance requirements increase.
- Temporary silt dikes are not biodegradable and should be removed after construction activities are complete and disturbed soil areas have been stabilized.
- Temporary silt dikes may not be suitable for application as linear slope controls (slope interruptions).
- Temporary silt dikes should not be used on slopes subject to creep, slumping, or landslide.

Implementation

General

When appropriately placed, temporary silt dikes intercept and slow sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The device is porous, which allows the ponded runoff to flow slowly through the silt dike, releasing the runoff as sheet flows. Generally, temporary silt dikes should be used in conjunction with temporary soil stabilization controls up-slope to provide an effective combination of erosion and sediment control.

Design and Layout

- Temporary silt dikes used on soil should be trenched or attached to the ground per manufacturer specifications in a manner that precludes runoff or ponded water from flowing around or under the silt dike.
- Temporary silt dikes used on asphalt or concrete may be attached using a variety of methods, including nailing the dikes to the pavement, or using a high strength adhesive.

- Follow manufacturer specifications when installing temporary silt dikes.
- Allow sufficient space up slope from the silt dike to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, temporary silt dike should be set back three feet from the slope toe to facilitate cleaning. Where site conditions do not allow set back, the silt dike may be constructed on the toe of the slope. To prevent flows behind the barrier, sand or gravel bags can be placed perpendicular and between the silt dike and slope to serve as a barrier to parallel flow.
- Drainage area should not exceed 5 acres.
- Butt ends of temporary silt dike tightly. Overlaps should be sealed in accordance with the manufacturer's detail.
- Ends of runs should be sloped uphill to prevent concentrated end-around flows.
- For installations as check dams, see SE-4.

Materials

- Several manufactured products are available.

Costs

- Flexible silt dike averages $35-45 per 7 ft. section.
- Rigid silt dike averages $1.80-$7.00 per foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Temporary silt dike exposed to sunlight will need to be replaced more frequently due to photo-degradation.
- Reshape or replace sections of damaged temporary silt dike as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove temporary silt dikes when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of properly.

References

City of Elko Construction Site Best Management Practices Handbook, December 2005

Construction Site Best Management Practices Handbook, June 2008 Update, Truckee Meadows Regional Stormwater Quality Management Program, June 2008

Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices, Texas Commission on Environmental Quality, Revised July 2005, Addendum Sheet, January26, 2011

Stormwater Management Manual for Western Washington Volume II, Construction Stormwater Pollution Prevention, Washington State Department of Ecology, February 2005

Compost Socks and Berms SE-13



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☒
Bacteria	☒
Oil and Grease	☒
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Compost socks and berms act as three-dimensional biodegradable filtering structures to intercept runoff where sheet flow occurs and are generally placed at the site perimeter or at intervals on sloped areas. Compost socks are generally a mesh sock containing compost and a compost berm is a dike of compost, trapezoidal in cross section. When employed to intercept sheet flow, both BMPs are placed perpendicular to the flow of runoff, allowing filtered runoff to pass through the compost and retaining sediment (and potentially other pollutants). A compost sock can be assembled on site by filling a mesh sock (e.g. with a pneumatic blower). The compost berm should be constructed using a backhoe or equivalent and/or a pneumatic delivery (blower) system and should be properly compacted. Compost socks and berms act as filters, reduce runoff velocities, and in some cases, aid in establishing vegetation.

Compost is organic, biodegradable, and renewable. Compost provides soil structure that allows water to infiltrate the compost medium which helps prevent rill erosion and the retained moisture promotes seed germination and vegetation growth, in addition to providing organic matter and nutrients important for fostering vegetation. Compost improves soil quality and productivity, as well as erosion and sediment control.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

The compost of the compost sock or berm can be selected that targets site specific objectives in capturing sediment and other pollutants, supporting vegetation, or additional erosion control.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Greenwaste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly compost selection is an important design consideration in the application of this type of erosion and sediment control.

Suitable Applications

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow (compost berms should only be used at the top of slopes or on slopes 4:1 (H:V) or flatter, all other slope applications should use compost socks)
- Along the perimeter of a project
- As check dams in unlined ditches (compost socks only)
- Down-slope of exposed soil areas
- At operational storm drains as a form of inlet protection (compost socks only)
- Around temporary stockpiles

Compost socks and berms do not require special trenching or BMP removal compared to other sediment control methods (e.g. silt fence or fiber rolls). Compost socks and berms can remain in place after earth disturbing activities are completed or the compost components can be spread over the site providing nutrients for plant growth and augmenting soil structure. BMPs that remain in place are particularly advantageous below embankments, especially adjacent streams, by limiting re-entry and the disturbance to sensitive areas.

Compost can be pre-seeded prior to application (recommended by the EPA for construction site stormwater runoff control and required for compost socks) or seeded after installation (for compost berms only). The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons.

Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Compost should be obtained from a supplier certified by the California Integrated Waste Management Board or compost should otherwise meet the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7. Carefully consider the qualifications and experience of any compost producer/supplier.

- Application by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost effective method of assembly.
- Compost socks and berms should not be employed at the base of slopes greater than 2:1 (H:V). They can be employed with other erosion control methods for steeper slopes.
- Difficult to move once saturated.
- Compost berms should not be applied in areas of concentrated flows.
- Compost socks and berms are easy to fix; however, they are susceptible to damage by frequent traffic. Compost socks can be used around heavy machinery, but regular disturbance decreases sock performance.

Implementation

Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in **Table 1**, taken from Caltrans Standard Special Provision 10-1 (SSP 10-1), Erosion Control (Compost Blanket).
- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.
- Compost medium parameter specifications for compost socks and berms have been developed to assist in compost selection, such as those provided by the American Association of State Highway Transportation Officials (AASHTO).
- Particle size is important parameter for selecting compost. Well consolidated coarser grades of compost (e.g. small and large pieces) perform better for filtration objectives, while finer grades better support vegetation. Particle size of the compost should be selected based on site conditions, such as expected precipitation, and filtration goals and / or long term plant nutrients.
- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.

- If vegetation establishment is a desired function of the compost, a compost sample should be inspected by a qualified individual. Vegetation has different nutrient and moisture needs.
- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.
- Compost should not be derived from mixed municipal solid waste and should be reasonably free of visible contaminates.
- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.
- Compost should not possess objectionable odors.
- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	*TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30-60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inch 90-100% Passing, 1 inch 65-100% Passing, 3/4 inch 0 - 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Installation

- Prior to application, prepare locations for socks and berms by removing brush and thick vegetation. The compost of the sock and/or berm should be allowed to come in full contact with the ground surface.

- Select method to apply the compost sock or berm. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.

- The compost of the berm should be distributed evenly to the surface, compacted, and shaped trapezoidal in cross section. Berm design is generally consists of a base two times the height. AASHTO specification MP 9-03 provides compost berm dimensions based on anticipated

site precipitation (AASHTO, 2003 and USEPA, 2009). State agencies, such as Oregon Department of Environmental Quality (ODEQ) have developed berm dimension based on slope steepness and length (ODEQ, 2004).

- Compost socks can be assembled on site by filling mesh socks with the selected compost. Mesh socks can be tied at one end, filled, and then tied at the other end. The ends of socks can be interlocked until the desired length is achieved. The sock diameter is a function of slope steepness and length. Again, ASSHTO provides specifications for various parameters. Compost socks range from 8" to 18", but are typically 12" to 18" in diameter.

- Compost socks are typically placed in contours perpendicular to sheet flow. They can also be placed in V formation on a slope. Compost socks need to be anchored, typically stakes, through the center of the sock. To prevent water flowing around them, the ends of compost socks should be placed upslope.

- Locate compost socks and berms on level contours spaced as follows:

  - Slope inclination of 4:1 (H:V) or flatter: Socks and/or berms should be placed at a maximum interval of 20 ft.

  - Slope inclination between 4:1 and 2:1 (H:V): Socks should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).

  - Slope inclination 2:1 (H:V) or greater: Socks should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).

- Place perimeter socks and berms using a j-hook installation. Use of vegetation will also provide additional anchoring.

- Compost socks and berms can be placed around the perimeter of an affected area, like a silt fence, if the area is flat or on a contour. Do not place these socks and berms where ponded water could become an issue.

- If used at the toe of slopes, the compost sock or berm should at a minimum of 5 to 10 feet away.

- Use additional anchoring and erosion control BMPs in conjunction of the compost socks and berms as needed.

- Consider using compost berms or socks as necessary at the top and/or bottom of the slope for additional erosion control performance.

- Compost socks and berms can also be effective over rocky and frozen ground if installed properly.

- It is recommended that the drainage areas of these compost BMPs do not exceed 0.25 acre per 100 feet placement interval and runoff does not exceed 1 cubic foot per second.

Costs

Recently obtained vendor costs indicated $3.50 per linear foot for compost berm application and $2.00 per linear foot for 8" socks and $2.50 per linear foot for 12"socks. Costs do not include final compost sock or berm functions at the end of construction activities, including spreading or removal, if required. ODEQ estimates that compost berms cost 30 percent less than silt fences to install.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Once damage is identified, mend or reapply the sock or berm as needed. Washed out areas should be replaced. If the sock or berm height is breached during a storm, an additional sock can be stacked to increase the sock height and similarly the berm dimensions can be increased, as applicable. An additional sock or berm may be installed upslope, as needed. It may be necessary to apply an additional type of stormwater BMP, such as a compost blanket.

- Sediment contained by the sock or berm should be removed prior reaching 1/3 of the exposed height of the BMP. The sediment can be stabilized with the compost sock or berm with vegetation at the end of construction activities.

- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

- Limit traffic to minimize damage to BMPs or impede vegetation establishment.

References

An analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, pubs.caes.uga.edu/caespubs/pubcd/B1200.htm, Faucette, B. and Risse, M., 2001.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Standard Special Provision 10-1, Erosion Control (Compost Blanket), State of California Department of Transportation (Caltrans). 2007 Update.

Evaluation of Environmental Benefits and Impacts of Compost and Industry Standard Erosion and Sediment Controls Measures Used in Construction Activities, Dissertation, Institute of Ecology, University of Georgia, Faucette, B., 2004.

National Pollutant Discharge Elimination System (NPDES), Compost Blankets, U.S. Environmental Protection Agency (USEPA). http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118, 2009.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Designation MP-9, Compost for Erosion/Sediment Control (Filter Berms), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

Stormwater Best Management Practices (BMPs) Field Trials of Erosion Control Compost in Reclamation of Rock Quarry Operations, Nonpoint Source Protection Program CWA §319(h), Texas Commission on Environmental Quality, Adams, T., McFarland, A., Hauck, L., Barrett, M., and Eck, B., 2008.

Biofilter Bags SE-14



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

- SE-1 Silt Fence
- SE-4 Check Dams
- SE-5 Fiber Roll
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-10 Storm Drain Inlet Protection

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Biofilter bags, or bio-bags, are a multi-purpose sediment control BMP consisting of a plastic mesh bag filled with 100% recycled wood product waste. Biofilter bags come in a variety of sizes (30" x 18" and 30" x 9" being common) and generally have between 1-2 cubic yards of recycled wood waste (or wood chips). Biofilter bags work by detaining flow and allowing a slow rate of discharge through the wood media. This action removes suspended sediment through gravity settling of the detained water and filtration within the bag.

Suitable Applications

Biofilter bags are a short-term BMP that can be rapidly deployed, maintained, and replaced. Biofilter bags can be an effective short-term solution to place in developed rills to prevent further erosion until permanent measures can be established. Suitable short-term applications include:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - Below other small cleared areas
  - Along the perimeter of a site (with low-expected flow)
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas

- Along streams and channels

- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
  - At the top of slopes to divert runoff away from disturbed slopes
  - As check dams across mildly sloped construction roads
- Inlet Protection (See SE-10)
- Supplement to silt fences or other sediment control devices

Limitations

- Short life-span (maximum usefulness of 2-3 months and should be replaced more frequently if needed); regular maintenance and replacement required to ensure effectiveness. Bags will rapidly fill with sediment and reduce permeability.
- Easily damaged by construction vehicles.
- If not properly staked, will fail on slope applications.
- If improperly installed can allow undercutting or side-cutting flow.
- Not effective where water velocities or volumes are high.
- Potentially buoyant and easily displaced if not properly installed.

Implementation

General

Biofilter bags are a relatively low cost temporary BMP that are easily deployed and have a simple installation that can be performed by hand. Without proper installation, however, biofilter bags can fail due to their light weight, potential displacement, and multiple joint locations. One of the benefits of utilizing biofilter bags is that the media (wood-product) can be recycled or used onsite when no longer needed (where acceptable).

Design and Layout – Linear control

- Locate biofilter bags on level contours.
  - Slopes between 20:1 and 4:1 (H:V): Biofilter bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slopes between 4:1 and 2:1 (H:V): Biofilter bags should be placed at a maximum interval of 15 ft, with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Biofilter bags should be placed at a maximum interval of 10 ft., with the first row placed the slope toe.

- Turn the ends of the biofilter bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the biofilter bag berm to allow ponding, and to provide room for sediment storage.
- Stake biofilter bags into a 1 to 2 in. deep trench with a width equal to the bag.
  - Drive one stake at each end of the bag.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- Biofilter bags should be overlapped (6 in.), not abutted.

Costs

Pre-filled biofilter bags cost approximately $2.50-$3.50 per bag, dependent upon size.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Biofilter bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace biofilter bags as needed.
- Repair washouts or other damage as needed.
- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove biofilter bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Biofilter media may be used on-site, if allowed.

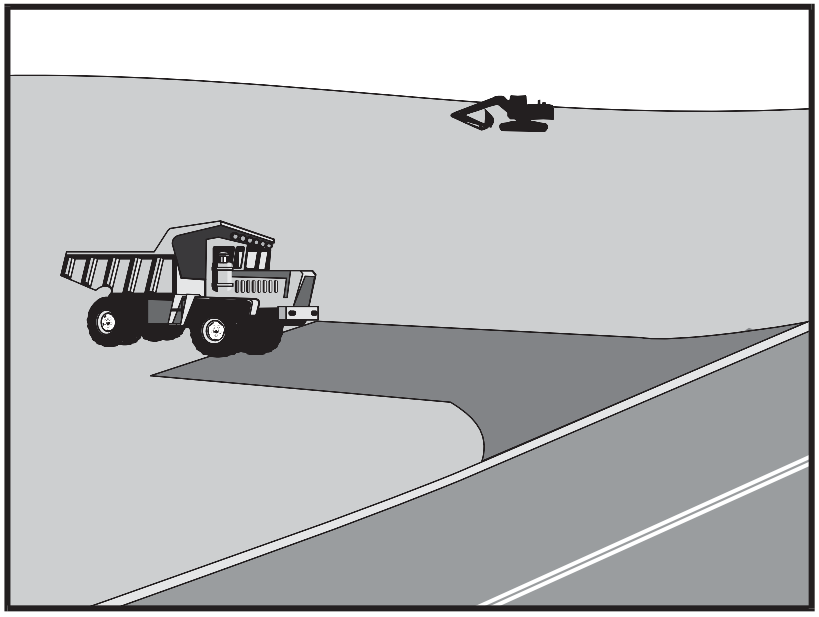
References

Catalog of Stormwater Best Management Practices for Idaho Cities and Counties. Volume 2, Section 7, BMP 34 – Biofilter Bags, Idaho Department of Environmental Quality, 2005.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stabilized Construction Entrance / Exit TC-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description 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.

Suitable 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.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft or maximum site will allow, and 10 ft minimum width or to accommodate traffic.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- 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 heaviest vehicles and equipment that will use it.

- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

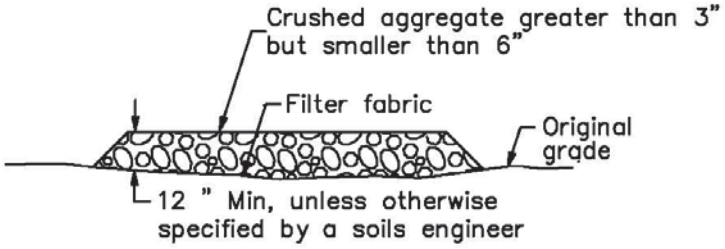
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

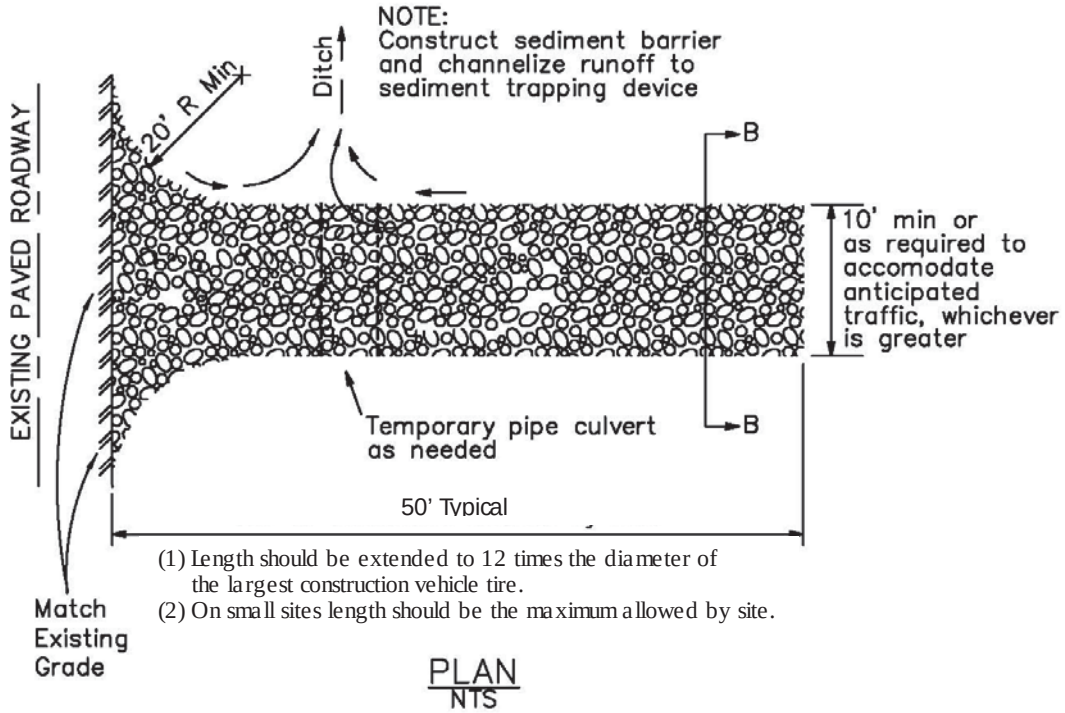
Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



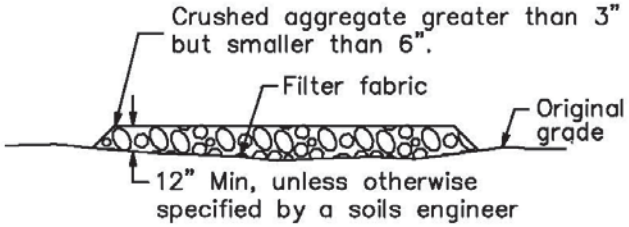
SECTION B–B
NTS



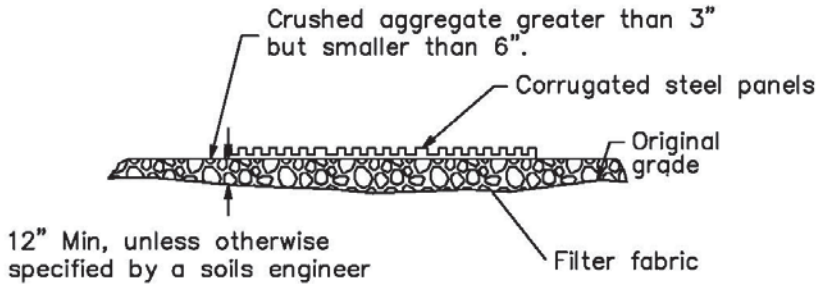
(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS

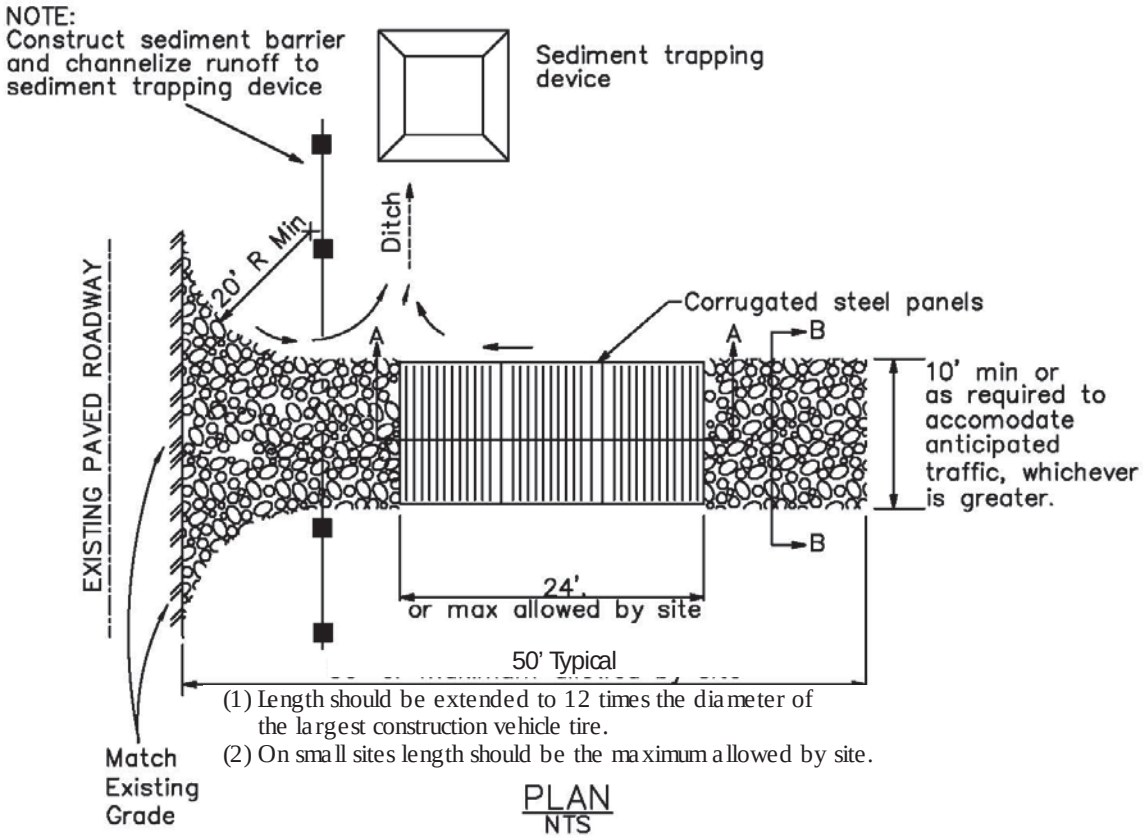
Stabilized Construction Entrance / Exit TC-1



SECTION B–B
NTS



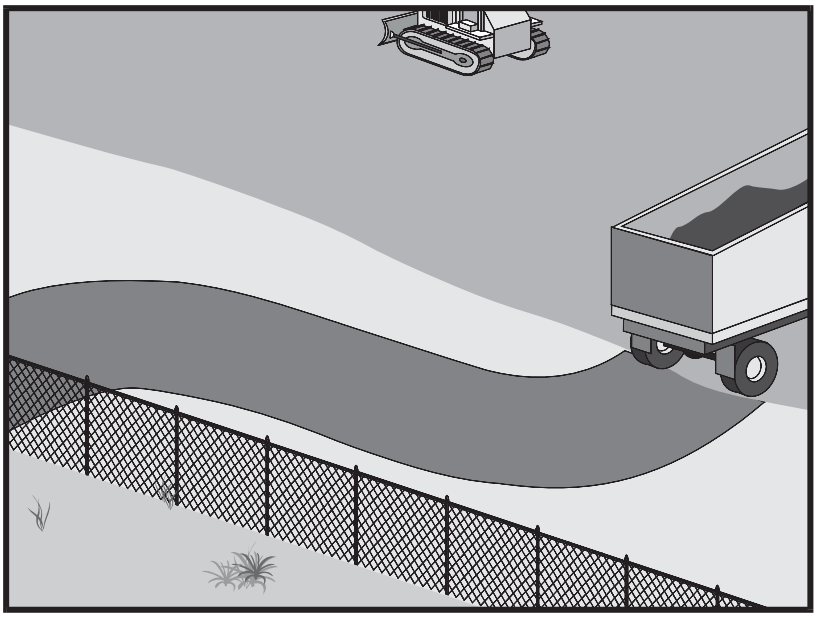
SECTION A–A
NOT TO SCALE



(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS

Stabilized Construction Roadway TC-2



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and 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

Limitations

- The roadway must be removed or paved when construction is complete.

- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support 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 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.
- Periodically apply additional aggregate on gravel roads.
- Active dirt construction roads are commonly watered three or more times per day during the dry season.

Costs

Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay. No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

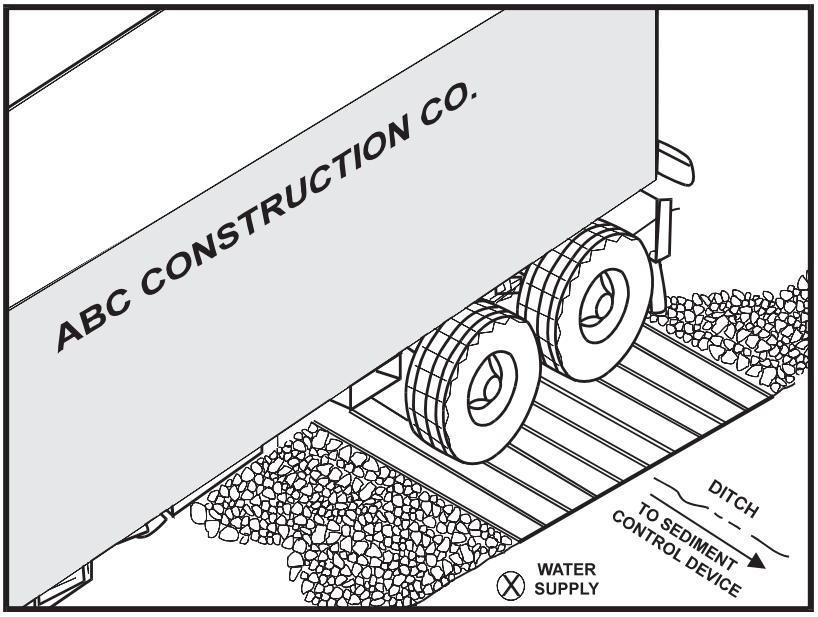
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Entrance/Outlet Tire Wash TC-3



Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Suitable Applications

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

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

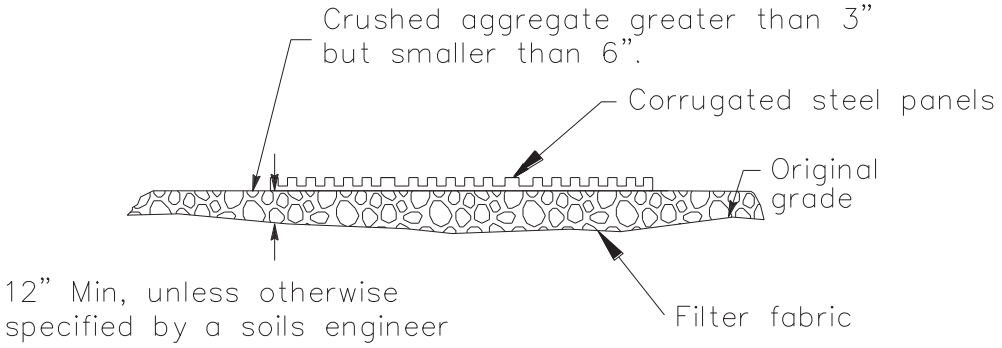
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

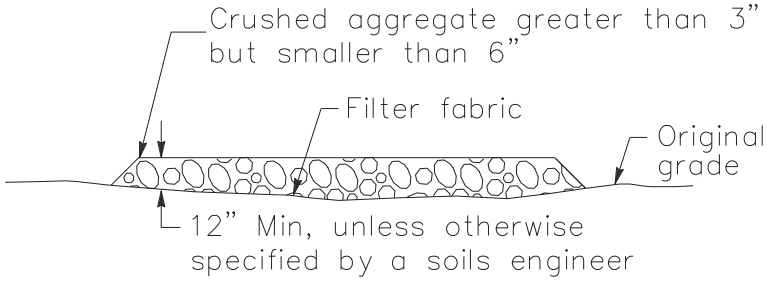
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

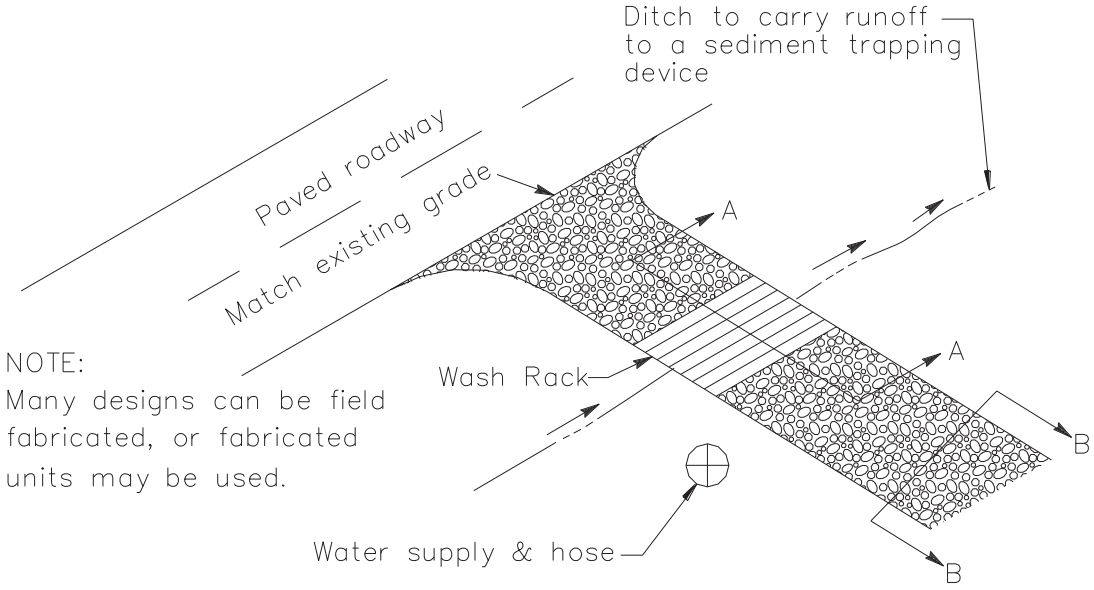
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A–A
NOT TO SCALE

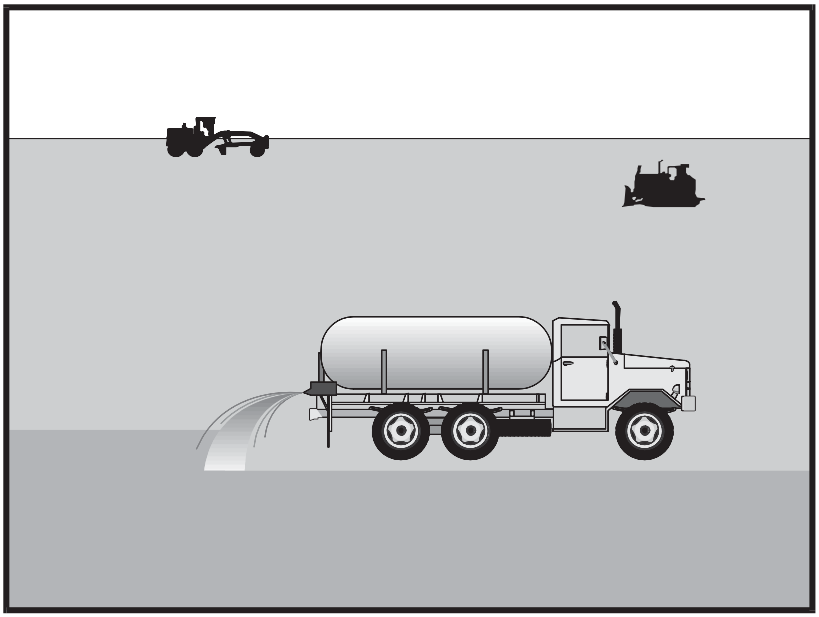


SECTION B–B
NTS



TYPICAL TIRE WASH
NOT TO SCALE

Wind Erosion Control WE-1



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

Implementation

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyls, acrylic), clay additives (e.g. bentonite, montimorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	x	x	x	x	x			x
Disturbed Areas Subject to Traffic			x	x	x	x		x
Material Stockpiles		x	x	x			x	x
Demolition			x			x	x	
Clearing/ Excavation			x	x				x
Truck Traffic on Unpaved Roads			x	x	x	x	x	
Tracking					x	x		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- Water should 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 should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality

Control Board (RWQCB) requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."

- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater and should meet all applicable regulatory requirements.

Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

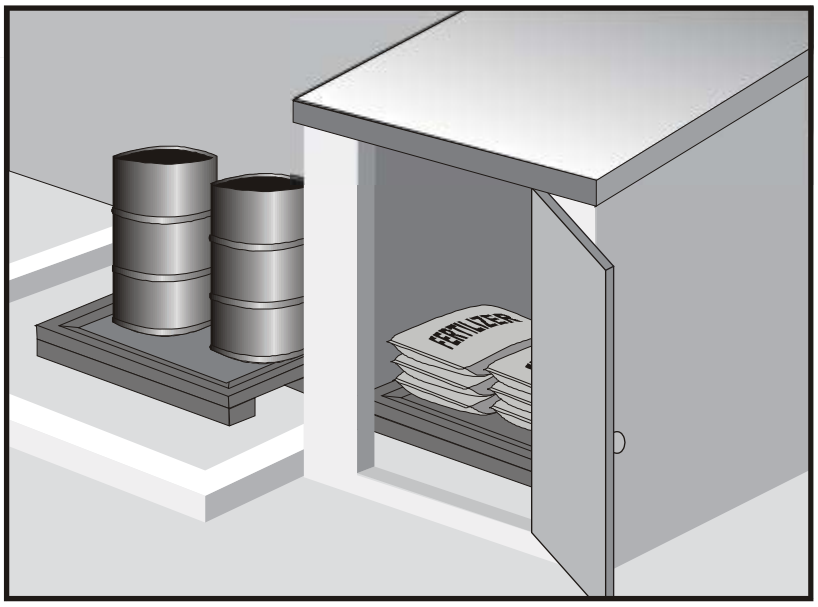
California Air Pollution Control Laws, California Air Resources Board, updated annually.

Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Material Delivery and Storage WM-1



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
    - Avoid transport near drainage paths or waterways.
    - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
    - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 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 should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

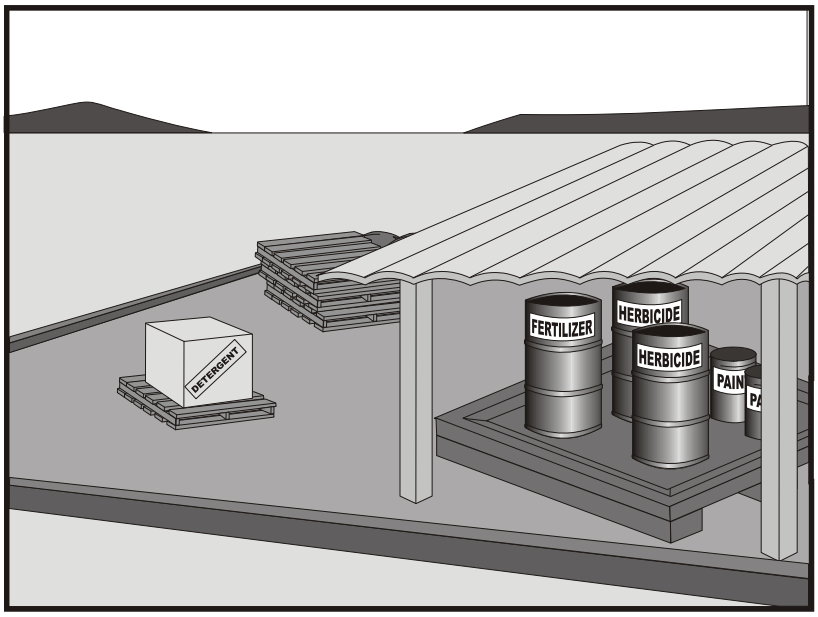
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use WM-2



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, 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 practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, 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 onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- 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.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

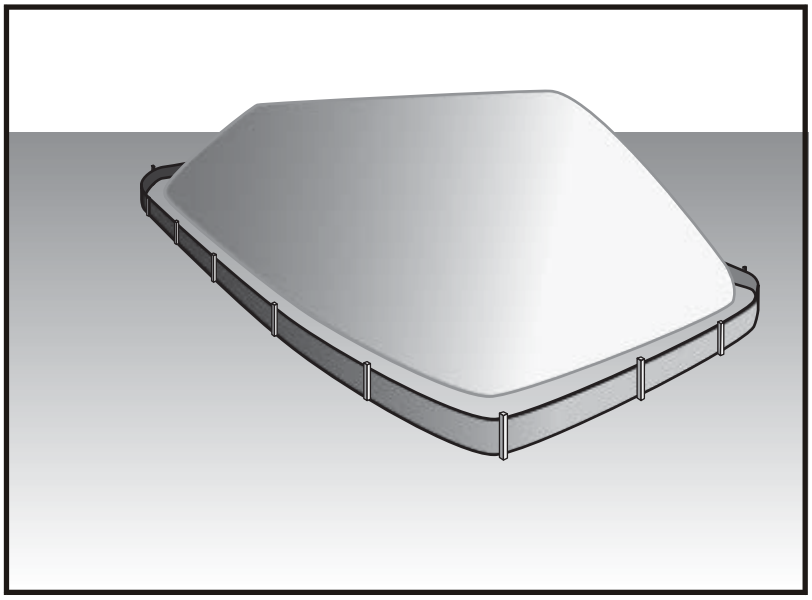
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management WM-3



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- After 14 days of inactivity, a stockpile is non-active and requires further protection described below. All stockpiles are required to be protected as non-active stockpiles immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater runon using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

A stockpile is considered non-active if it either is not used for 14 days or if it is scheduled not to be used for 14 days or more. Stockpiles need to be protected immediately if they are not scheduled to be used within 14 days. Non-active stockpiles of the identified materials should be protected as follows:

Soil stockpiles

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Stockpiles of fly ash, stucco, hydrated lime

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

Stockpiles/Storage of wood (Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

A stockpile is active when it is being used or is scheduled to be used within 14 days of the previous use. Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

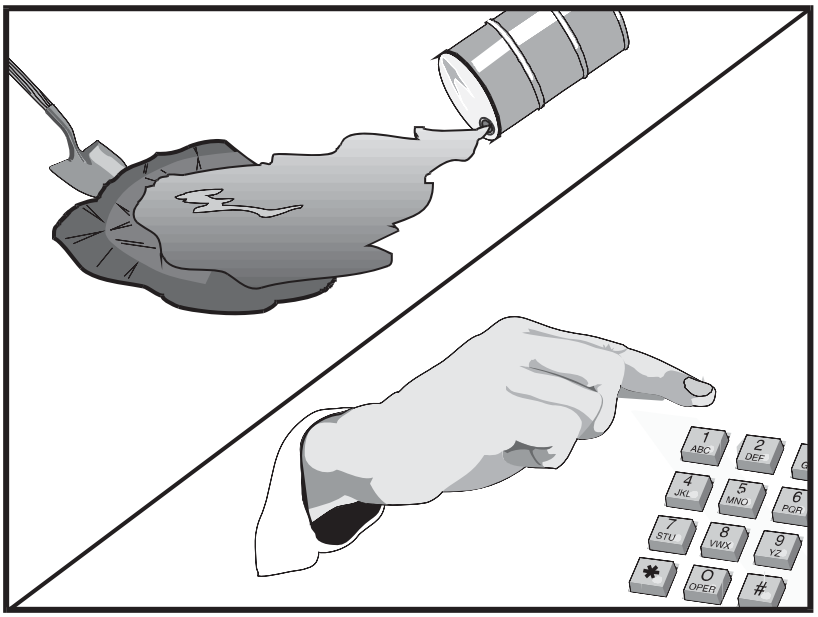
Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.
- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Spill Prevention and Control WM-4



Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows 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.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- 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 should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

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.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and 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.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - 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 should be taken:
  - 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, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs 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, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

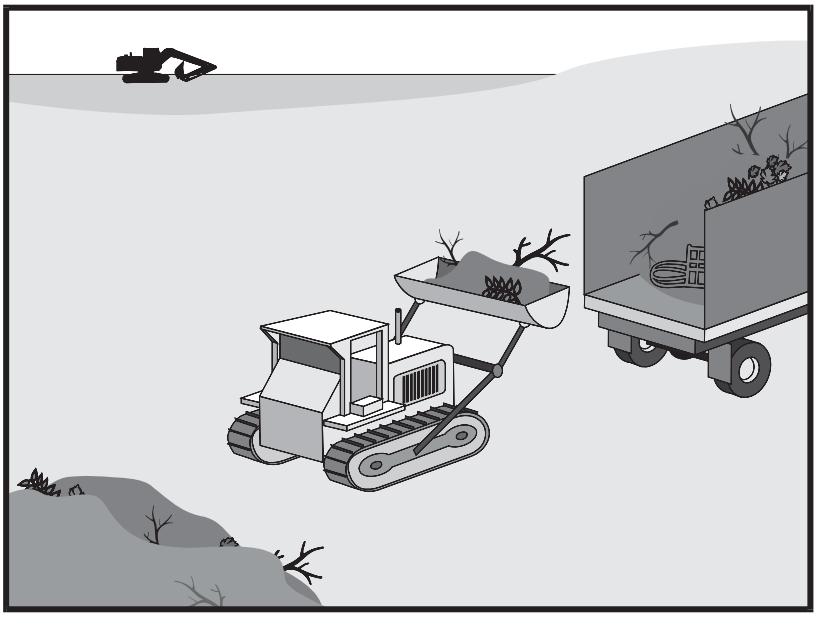
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, 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

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.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Cover waste containers at the end of each work day and when it is raining.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management 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.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should 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 should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should 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 should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see 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 surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

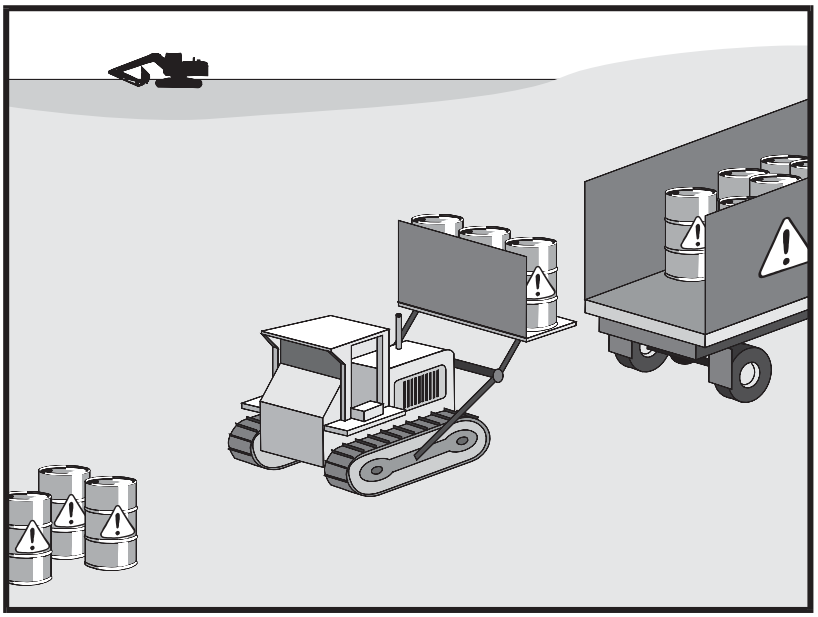
References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable 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
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- 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 WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 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 should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

- Throughout the rainy season, temporary containment facilities should 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.

- Drums should not be overfilled and wastes should not be mixed.

- Unless watertight, containers of dry waste should be stored on pallets.

- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.

- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

- The following actions should be taken with respect to temporary contaminant:

  - Ensure that adequate hazardous waste storage volume is available.

  - Ensure that hazardous waste collection containers are conveniently located.

  - Designate hazardous waste storage areas onsite 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.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should 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 certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

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 superintendent or representative should 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.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

- Hazardous spills should 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, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

References

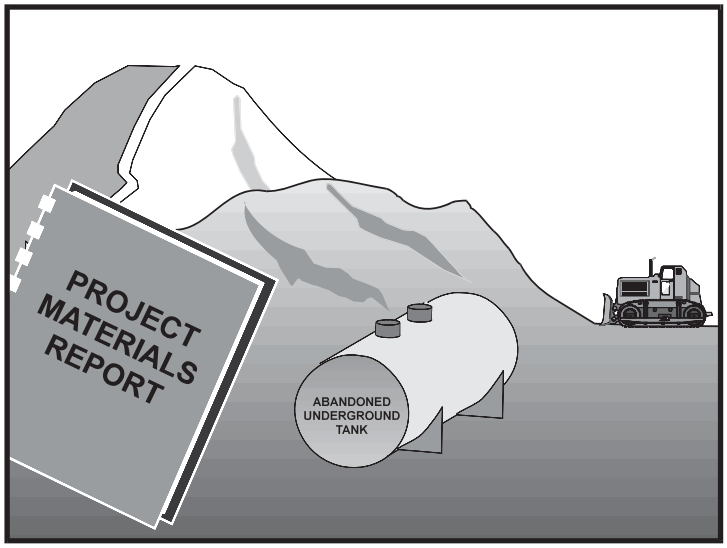
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Contaminated Soil Management WM-7



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

Suitable 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, aerial deposition, past use and leaks from underground storage tanks.

Limitations

Contaminated soils that cannot be treated onsite must be disposed of offsite by a licensed hazardous waste hauler. The presence of contaminated soil may indicate contaminated water as well. See NS-2, Dewatering Operations, for more information.

The procedures and practices presented in this BMP are general. The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered onsite.

Implementation

Most owners and developers conduct pre-construction environmental assessments as a matter of routine. Contaminated soils are often identified during project planning and development with known locations identified in the plans, specifications and in the SWPPP. The contractor should review applicable reports and investigate appropriate call-outs in the

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

plans, specifications, and SWPPP. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil highlight the need for contractors to confirm a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough, pre-construction inspections of the site and review documents related to the site. If inspection or reviews indicated presence of contaminated soils, develop a plan before starting work.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills. Contaminated soil can be expensive to treat and dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- 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
  - Contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
  - Suspected soils should be tested at a certified laboratory.

Education

- Have employees and subcontractors complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified, prior to performing any excavation work at the locations containing material classified as hazardous.
- 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 should result in no visible dust.
- Caution should be exercised to prevent spillage of lead containing material during transport.

- Quality should be monitored during excavation of soils contaminated with lead.

Handling Procedures for Contaminated Soils

- Minimize onsite storage. Contaminated soil should be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 66265.250 to 66265.260.
- Test suspected soils at an approved certified laboratory.
- Work with the local regulatory agencies to develop options for treatment or disposal if the soil is contaminated.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- Take the following precautions if temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.
- Remove contaminated material and hazardous material on exteriors of transport vehicles and place either into the current transport vehicle or into 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 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.
- Excavate, transport, and dispose of contaminated material and hazardous material 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 that have jurisdiction over such work.
- To determine if it contains hazardous substances, arrange to have tested, any liquid or sludge found in the underground tank prior to its removal.
- 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 or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal and transported to disposal facilities permitted to accept such waste.

Water Control

- All necessary precautions and preventive measures should be taken 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, should be discharged to clean, closed top, watertight transportable holding tanks, treated, and disposed of in accordance with federal, state, and local laws.

Costs

Prevention of leaks and spills is inexpensive. Treatment or disposal of contaminated soil can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for contractor's Water Pollution Control Manager, foreman, and/or construction supervisor to monitor onsite 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.

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

References

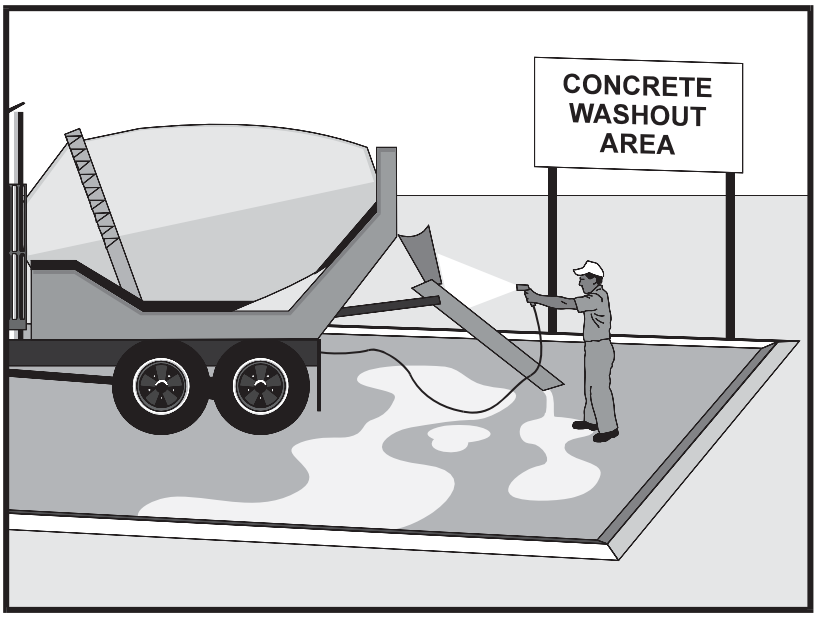
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Prevent the discharge of pollutants to stormwater from concrete waste by conducting washout onsite or offsite in a designated area, and by employee and subcontractor training.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

Suitable 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.
- Slurries containing portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.
- Concrete trucks and other concrete-coated equipment are washed onsite.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Mortar-mixing stations exist.
- Stucco mixing and spraying.
- See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washouts shall be implemented in a manner that prevents leaching to underlying soils. Washout containers must be water tight and washouts on or in the ground must be lined with a suitable impervious liner, typically a plastic type material.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.
- See typical concrete washout installation details at the end of this fact sheet.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.

- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.

- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.

Concrete Demolition Wastes

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.

- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

Concrete Slurry Wastes

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

- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).

- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.

- Saw-cut concrete slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine or by sweeping. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.

- Concrete slurry residue should be disposed in a temporary washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.

- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.

- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of or recycled offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of or recycle hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
  - Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag Barrier).
  - Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
  - Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a “roll-off”; this concrete washout facility should be properly sealed to prevent leakage, and should be removed from the site and replaced when the container reaches 75% capacity.
- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations..

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures. Roll-0ff concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and properly disposed or recycled in accordance with federal, state or local regulations.

- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

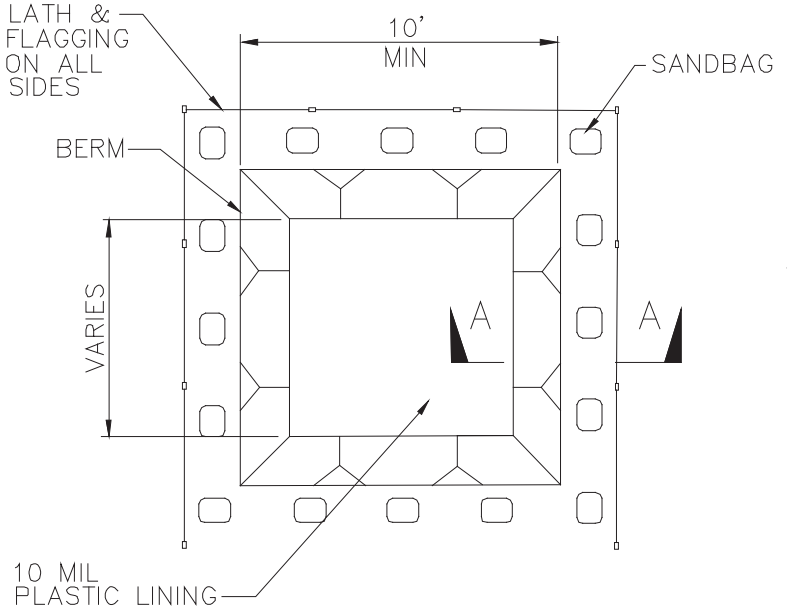
- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

References

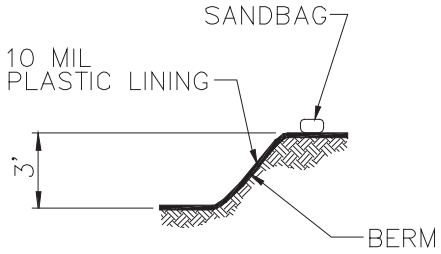
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000, Updated March 2003.

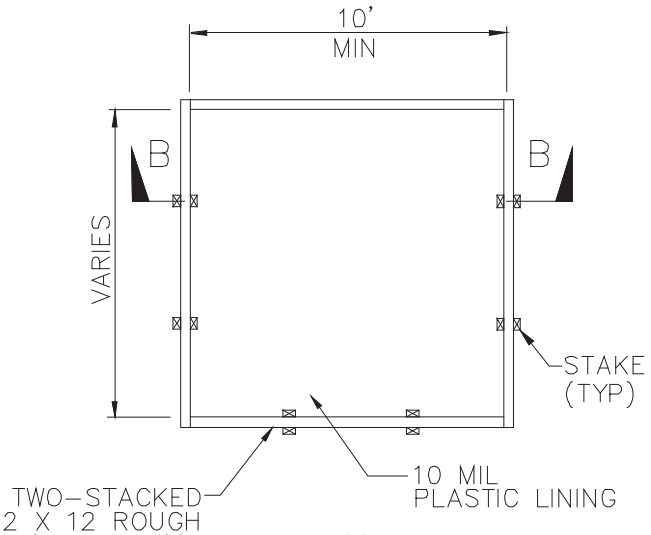
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



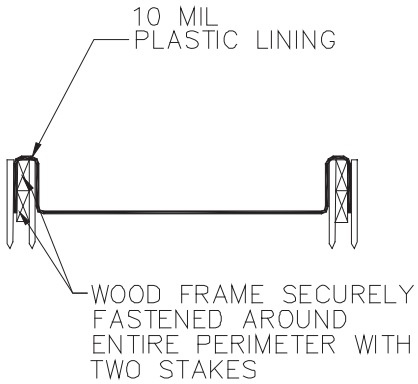
PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



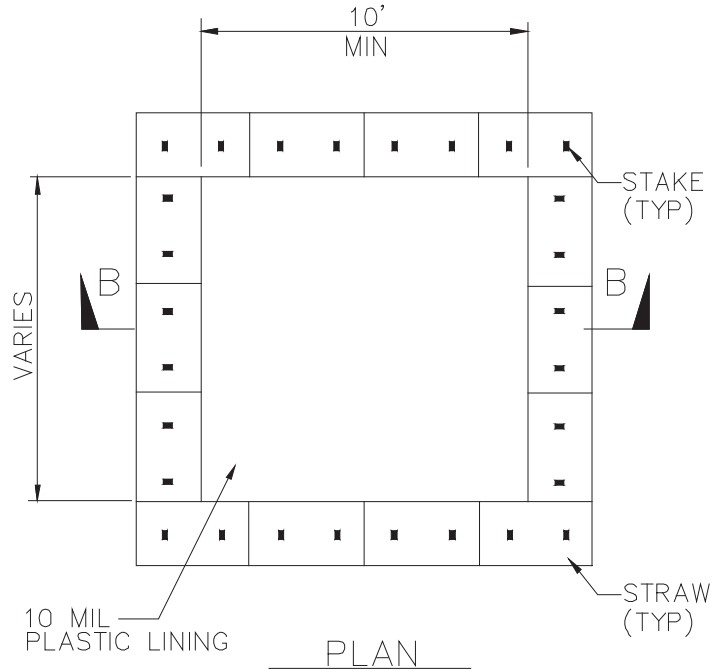
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"



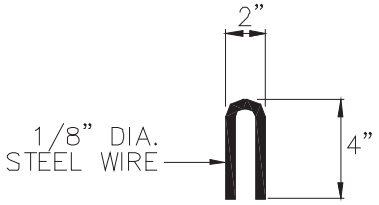
SECTION B–B
NOT TO SCALE

NOTES

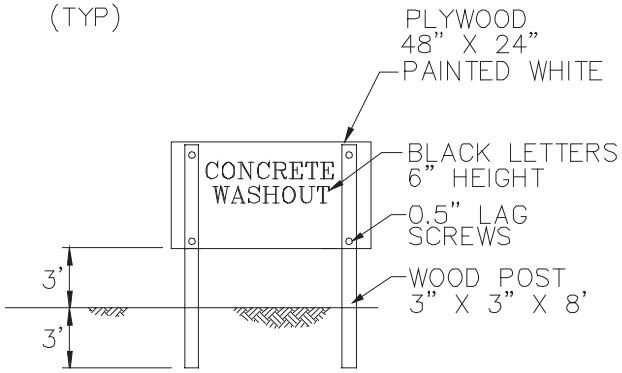
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



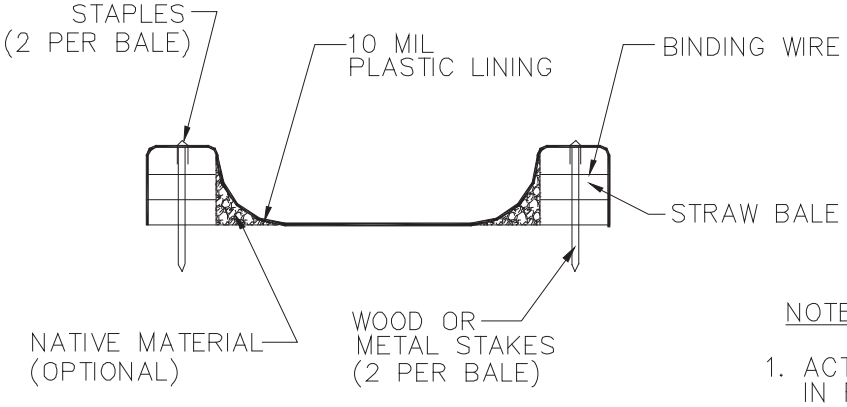
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

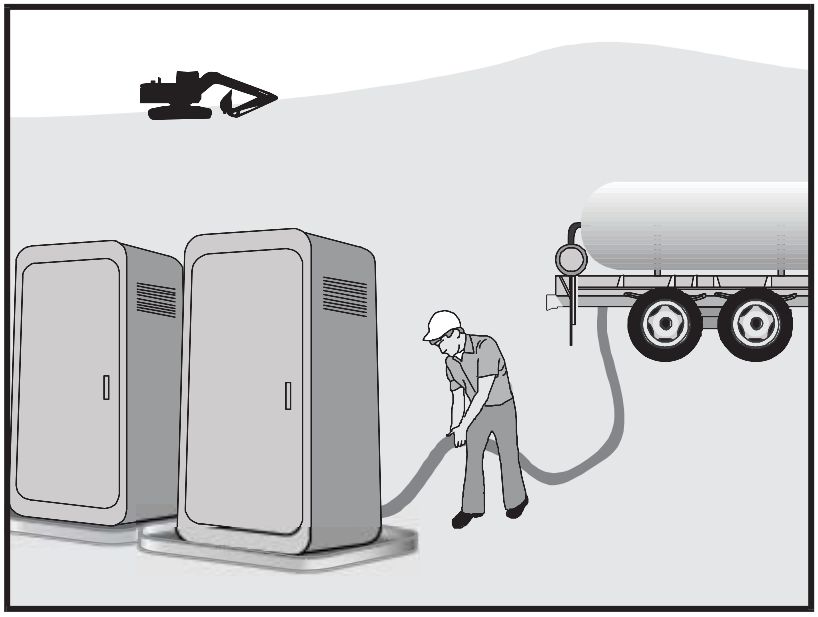


SECTION B–B
NOT TO SCALE

NOTES

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

Sanitary/Septic Waste Management WM-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

Education

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

Costs

All of the above are low cost measures.

Inspection and Maintenance

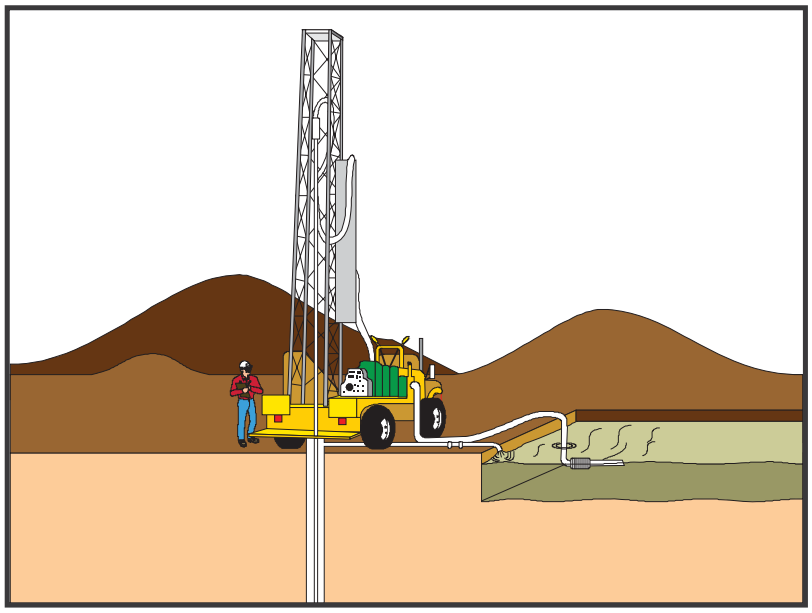
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Liquid Waste Management WM-10



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Liquid waste management includes 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.

Suitable Applications

Liquid waste management is applicable to construction projects that generate any of the following non-hazardous by-products, residuals, or wastes:

- Drilling slurries and drilling fluids
- Grease-free and oil-free wastewater and rinse water
- Dredgings
- Other non-stormwater 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., NPDES permits, Army Corps permits, Coastal Commission permits, etc.).
- Liquid waste management does not apply to dewatering operations (NS-2 Dewatering Operations), solid waste management (WM-5, Solid Waste Management), hazardous wastes (WM-6, Hazardous Waste Management), or

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

concrete slurry residue (WM-8, Concrete Waste Management).

- 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.

Implementation

General 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 device, 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 statewide NPDES permit; different regions might have different requirements not outlined in this permit.
- Apply NS-8, Vehicle and Equipment Cleaning for managing wash water and rinse water from vehicle and equipment cleaning operations.

Containing Liquid Wastes

- Drilling residue and drilling fluids should not be allowed to enter storm drains and watercourses and should be disposed of.
- If an appropriate location is available, drilling residue and drilling fluids that are exempt under Title 23, CCR § 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 WM-8, Concrete Waste Management.
- Liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.
- Liquid wastes should be contained 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.

- Precautions should be taken to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in WM-4, Spill Prevention and Control.

- Containment areas or devices should not be located 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 that have the potential to affect the storm drainage system (such as wash water and rinse water from cleaning walls or pavement), before they run off a surface.

- 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.

- Use a sediment trap (SE-3, Sediment Trap) for capturing and treating sediment laden liquid waste or capture in a containment device and allow sediment to settle.

Disposing of Liquid Wastes

- A typical method to handle liquid waste is to dewater the contained liquid waste, using procedures such as described in NS-2, Dewatering Operations, and SE-2, Sediment Basin, and dispose of resulting solids per WM-5, Solid Waste Management.

- Methods of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 or 404 permits, and local agency discharge permits, etc. Review the SWPPP to see if disposal methods are identified.

- 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 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.

Costs

Prevention costs for liquid waste management are minimal. Costs increase if cleanup or fines are involved.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

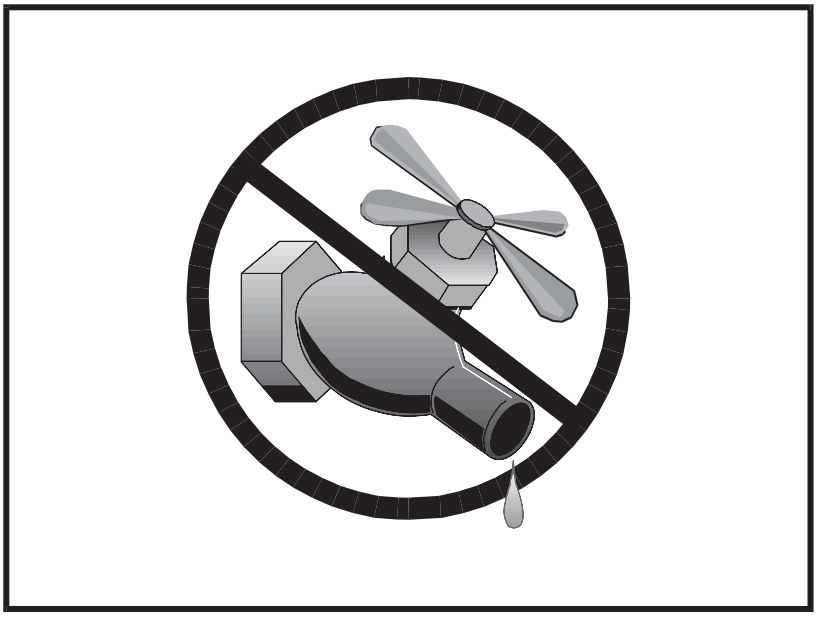
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- 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 WM-5, Solid Waste Management.
- Inspect containment areas and capturing devices and repair as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Conservation Practices NS-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Direct construction water runoff to areas where it can soak into the ground or be collected and reused.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

Costs

The cost is small to none compared to the benefits of conserving water.

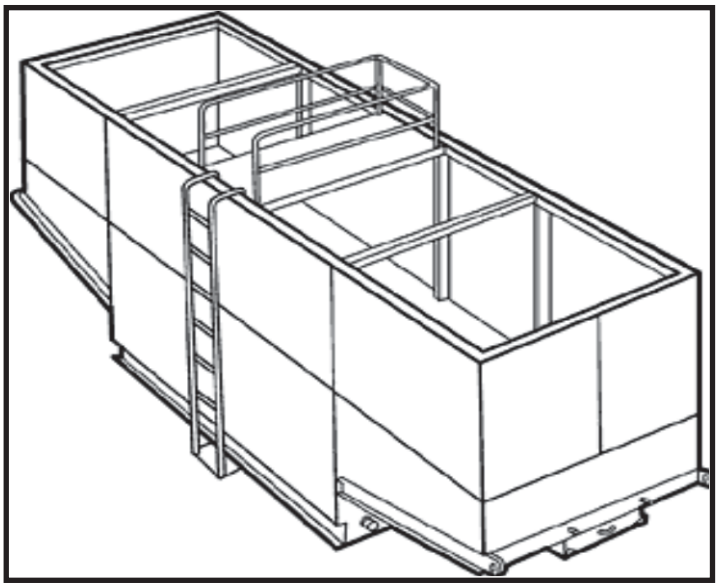
Inspection and Maintenance

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Dewatering Operations NS-2



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.

The General Permit incorporates Numeric Action Levels (NAL) for turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Discharges from dewatering operations can contain high levels of fine sediment that, if not properly treated, could lead to exceedances of the General Permit requirements or Basin Plan standards.

The dewatering operations described in this fact sheet are not Active Treatment Systems (ATS) and do not include the use of chemical coagulations, chemical flocculation or electrocoagulation.

Suitable Applications

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

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated

precipitation (stormwater) from depressed areas at a construction site.

Stormwater mixed with non-stormwater should be managed as non-stormwater.

Limitations

- Dewatering operations will require, and should comply with applicable local and project-specific permits and regulations. In some areas, all dewatering activities, regardless of the discharge volume, require a dewatering permit.
- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this fact sheet primarily address sediment. Other secondary pollutant removal benefits are discussed where applicable.
- The controls detailed in this fact sheet only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Avoid dewatering discharges where possible by using the water for dust control.

Implementation

- A Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP).
- Regional Water Quality Control Board (RWQCB) Regions may require notification and approval prior to any discharge of water from construction sites.
- The destination of discharge from dewatering activities will typically determine the type of permit required for the discharge. For example, when discharging to a water of the U.S., a dewatering permit may be required through the site's governing RWQCB. When discharging to a sanitary sewer or Municipal Separate Storm Sewer System (MS4), a permit may need to be obtained from the owner of the sanitary sewer or MS4 in addition to obtaining an RWQCB dewatering permit. Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges should not cause erosion at the discharge point. Appropriate BMPs should be implemented to maintain compliance with all applicable permits.
- Maintain dewatering records in accordance with all local and project-specific permits and regulations.

Sediment Treatment

A variety of methods can be used to treat water during dewatering operations. Several devices are presented below and provide options to achieve sediment removal. The sediment particle size and permit or receiving water limitations on sediment or turbidity are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate. Use of other enhanced treatment methods (i.e., introduction of chemicals or electric current to enhance flocculation and removal of sediment) must comply with: 1) for storm drain or surface water discharges, the requirements for Active Treatment Systems (see SE-11); or 2) for sanitary sewer discharges, the requirements of applicable sanitary sewer discharge permits.

Sediment Basin (see also SE-2)

Description:

- A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment basins are generally larger than Sediment Traps (SE-3) and have a designed outlet structure.

Appropriate Applications:

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

Implementation:

- Excavation and construction of related facilities is required.
- Temporary sediment basins should 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 outlet, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Sediment Trap (See also SE-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. Sediment traps are generally smaller than Sediment Basins (SE-2) and do not have a designed outlet (but do have a spillway or overflow).

Appropriate Applications:

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

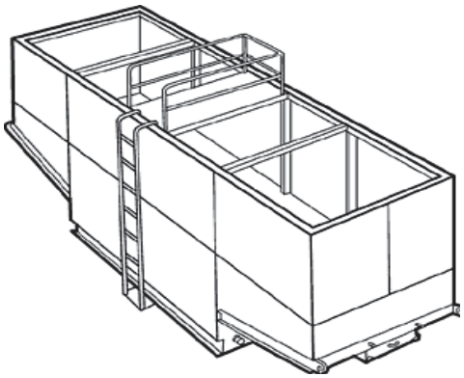
Implementation:

- Excavation and construction of related facilities is required.
- Trap inlets should 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.

Weir Tanks



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 should be consulted to appropriately size tank.
- Treatment capacity (i.e., volume and number of tanks) should provide at a minimum the required volume for discrete particle settling for treatment design flows.

Maintenance:

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

Dewatering Tanks



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:

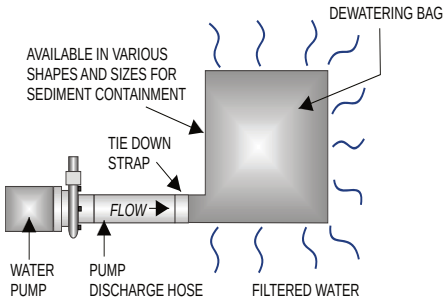
- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

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

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 gravel, sand, silt, and fines.

Appropriate Applications:

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

Implementation:

- Water is pumped into one side of the bag and seeps through the top, bottom, and sides of the bag.
- Place filter bag on pavement or a gravel bed or paved surface. Avoid placing a dewatering bag on unprotected bare soil. If placing the bag on bare soil is unavoidable, a secondary barrier should be used, such as a rock filter bed placed beneath and beyond the edges of the bag to, prevent erosion and capture sediments that escape the bag.
- Perimeter control around the downstream end of the bag should be implemented. Secondary sediment controls are important especially in the initial stages of discharge, which tend to allow fines to pass through the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier (as applicable) is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- Caution should be taken when removing and disposing of the bag, to prevent the release of captured sediment
- Properly dispose of the bag offsite. If sediment is removed from the bag prior to disposal (bags can potentially be reused depending upon their condition), dispose of sediment in accordance with the general maintenance procedures described at the end of this BMP Fact Sheet.

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 using other methods.

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 stand-alone 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 regular service to monitor and maintain the level of the sand media. If subjected to high loading rates, filters can plug quickly.
- Venders generally provide data on maximum head loss through the filter. The filter should be monitored daily while in use, and cleaned when head loss reaches target levels.
- If cleaned by backwashing, the backwash water may need to be hauled away for disposal, or returned to the upper end of the treatment train for another pass through the series of dewatering BMPs.

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. Vendors provide 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 equals or exceeds the manufacturer's recommendation.

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 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 equals or exceeds the manufacturer's recommendation.

Costs

- Sediment control costs vary considerably depending on the dewatering and sediment treatment system that is selected. Pressurized filters tend to be more expensive than gravity settling, but are often more effective. Simple tanks are generally rented on a long-term basis (one or more months) and can range from $360 per month for a 1,000 gallon tank to $2,660 per month for a 10,000 gallon tank. Mobilization and demobilization costs vary considerably.

Inspection and Maintenance

- Inspect and verify that dewatering BMPs are in place and functioning prior to the commencement of activities requiring dewatering.

- Inspect dewatering BMPs daily while dewatering activities are being conducted.

- Inspect all equipment before use. Monitor dewatering operations to ensure they do not cause offsite discharge or erosion.
- Sample dewatering discharges as required by the General Permit.
- Unit-specific maintenance requirements are included with the description of each unit.
- Sediment removed during the maintenance of a dewatering device may be either spread onsite and stabilized, or disposed of at a disposal site as approved by the owner.
- Sediment that is commingled with other pollutants should be disposed of in accordance with all applicable laws and regulations and as approved by the owner.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

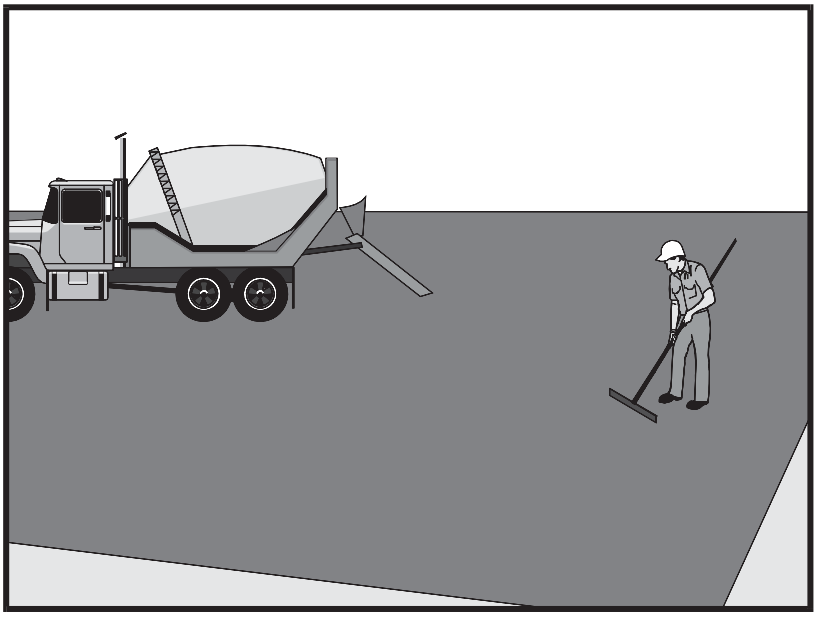
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003; Updated March 2004.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Labor Surcharge & Equipment Rental Rates, April 1, 2002 through March 31, 2003, California Department of Transportation (Caltrans).

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Paving and Grinding Operations NS-3



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☒

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

The General Permit incorporates Numeric Action Levels (NAL) for pH and turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials associated with paving and grinding operations, including mortar, concrete, and cement and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Paving opportunities may be limited during wet weather.

  Discharges of freshly paved surfaces may raise pH to environmentally harmful levels and trigger permit violations.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is forecasted.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).
- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC (Portland cement concrete) and AC (asphalt concrete) waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing should not be allowed to enter any storm drains or watercourses. Install inlet protection and perimeter controls until area is stabilized (i.e. cutting, grinding or other removal activities are complete and loose material has been properly removed and disposed of)or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; SE-5, Fiber Rolls, or SE-13 Compost Socks and Berms
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt should be recycled or disposed of properly.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by a vacuum attachment to the grinding machine, or by sweeping, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Pavement removal activities should not be conducted in the rain.
- Collect removed pavement material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.

- If removed pavement material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

  - Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.

  - Old asphalt should be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect waste materials by dry methods, such as sweeping or shoveling, 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 WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if authorized by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate should not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized (i.e. all sealing operations are complete and cured and loose materials have been properly removed and disposed).

- Inlet protection (SE-10, Storm Drain Inlet Protection) should be used during application of seal coat, tack coat, slurry seal, and fog seal.

- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials and dispose of in accordance with the applicable regulations. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.

- Substances used to coat asphalt transport trucks and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

Thermoplastic Striping

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should 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.
- Do 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.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing.
- 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.

Costs

- All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of paving and grinding operations.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sample stormwater runoff required by the General Permit.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

References

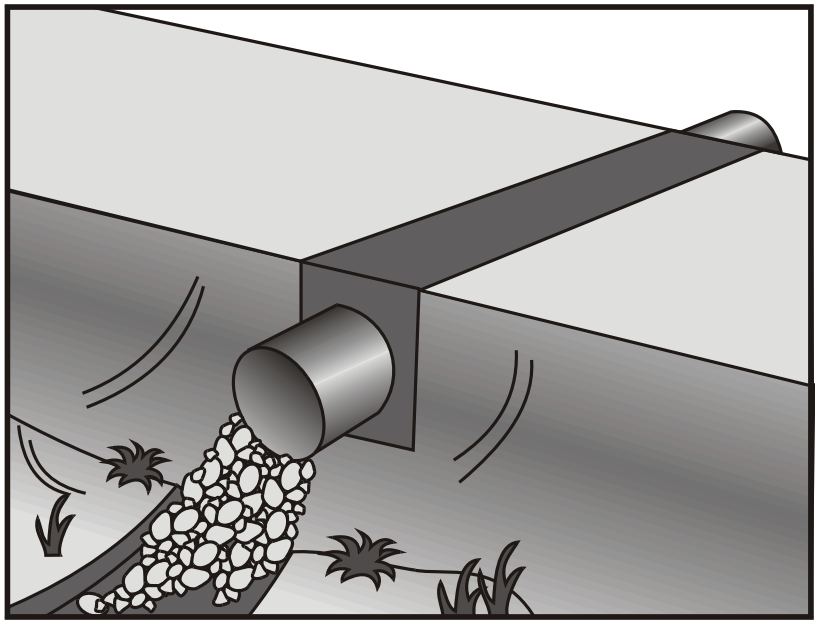
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Hot Mix Asphalt-Paving Handbook AC 150/5370-14, Appendix I, U.S. Army Corps of Engineers, July 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Temporary Stream Crossing NS-4



Description and Purpose

A temporary stream crossing is a temporary culvert, ford or bridge placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not intended to maintain traffic for the public. The temporary access will eliminate erosion and downstream sedimentation caused by vehicles.

Suitable Applications

Temporary stream crossings should be installed at all designated crossings of perennial and intermittent streams on the construction site, as well as for dry channels that may be significantly eroded by construction traffic.

Temporary streams crossings are installed at sites:

- Where appropriate permits have been secured (404 Permits, and 401 Certifications)
- 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

Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☒
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Where appropriate permits have been obtained for the stream crossing

Limitations

The following limitations may apply:

- Installation and removal will usually disturb the waterway.
- Installation 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.
- Installation may require dewatering or temporary diversion of the stream. See NS-2, Dewatering Operations and NS-5, Clear Water Diversion.
- Installation may cause 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) ford crossing will be contingent upon approval by fisheries agencies.
- Ford crossings may degrade water quality due to contact with vehicles and equipment.
- May be expensive for a temporary improvement.
- Requires other BMPs to minimize soil disturbance during installation and removal.
- Fords should only be used in dry weather.

Implementation

General

The purpose of this BMP is to provide a safe, erosion-free access across a stream for construction equipment. Minimum standards and specifications for the design, construction, maintenance, and removal of the structure should be established by an engineer registered in California. Temporary stream crossings may be necessary to prevent construction equipment from causing erosion of the stream and tracking sediment and other pollutants into the stream.

Temporary stream crossings are used as access points to construction sites when other detour routes may be too long or burdensome for the construction equipment. Often heavy construction equipment must cross streams or creeks, and detour routes may impose too many constraints such as being too narrow or poor soil strength for the equipment loadings. Additionally, the contractor may find a temporary stream crossing more economical for light–duty vehicles to use for frequent crossings, and may have less environmental impact than construction of a temporary access road.

Location of the temporary stream crossing should address:

- Site selection where erosion potential is low.

- Areas where the side slopes from site runoff will not spill into the side slopes of the crossing.

The following types of temporary stream crossings should be considered:

- **Culverts** – A temporary culvert is effective in controlling erosion but will cause erosion during installation and removal. A temporary culvert can be easily constructed and allows for heavy equipment loads.
- **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 that would benefit from an influx of gravels. A temporary ford provides little sediment and erosion control and is ineffective in controlling erosion in the stream channel. A temporary ford is the least expensive stream crossing and allows for maximum load limits. It also offers very low maintenance. Fords are more appropriate during the dry ice season and in arid areas of California.
- **Bridges** - Appropriate for streams with high flow velocities, steep gradients and where temporary restrictions in the channel are not allowed.

Design

During the long summer construction season in much of California, rainfall is infrequent and many streams are dry. Under these conditions, a temporary ford may be sufficient. A ford is not appropriate if construction will continue through the winter rainy season, if summer thunderstorms are likely, or if the stream flows during most of the year. Temporary culverts and bridges should then be considered and, if used, should be sized to pass a significant design storm (i.e., at least a 10-year storm). The temporary stream crossing should be protected against erosion, both to prevent excessive sedimentation in the stream and to prevent washout of the crossing.

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

- Comply with any special requirements for culvert and bridge crossings, 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 should be selected based on careful evaluation of the risks due to over topping, flow backups, or washout.
- Install sediment traps immediately downstream of crossings to capture sediments. See SE-3, Sediment Trap.
- Avoid oil or other potentially hazardous materials for surface treatment.
- 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.

- 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 6 to 12 in. 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 provide the least disturbance of the streambed and constriction of the waterway flows.

Construction and Use

- 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 streambed to prevent potential flooding upstream of the crossing.
- Install temporary erosion control BMPs in accordance with erosion control BMP fact sheets to minimize erosion of embankment into flow lines.
- Any temporary artificial obstruction placed within flowing water should only be built from material, such as clean gravel or sandbags, that will not introduce sediment or silt into the watercourse.
- Temporary water body crossings and encroachments should be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments should be clean, rounded river cobble.
- Vehicles and equipment should 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.
- The exterior of vehicles and equipment that will encroach on the water body within the project should be maintained free of grease, oil, fuel, and residues.
- Drip pans should 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.

- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate soil stabilization measures.

- Riparian vegetation, when removed pursuant to the provisions of the work, should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble must be removed upon completion of project activities.

- Conceptual temporary stream crossings are shown in the attached figures.

Costs

Caltrans Construction Cost index for temporary bridge crossings is $45-$95/ft^2.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Check for blockage in the channel, sediment buildup or trapped debris in culverts, blockage behind fords or under bridges.

- Check for erosion of abutments, channel scour, riprap displacement, or piping in the soil.

- Check for structural weakening of the temporary crossings, such as cracks, and undermining of foundations and abutments.

- Remove sediment that collects behind fords, in culverts, and under bridges periodically.

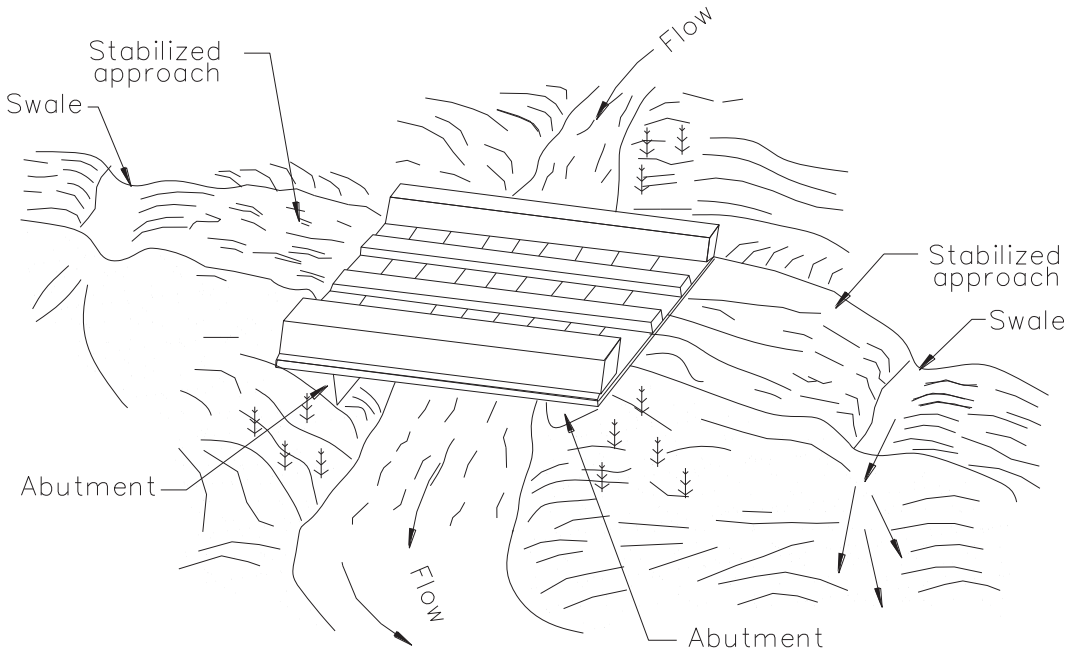
- Replace lost or displaced aggregate from inlets and outlets of culverts and cellular confinement systems.

- Remove temporary crossing promptly when it is no longer needed.

References

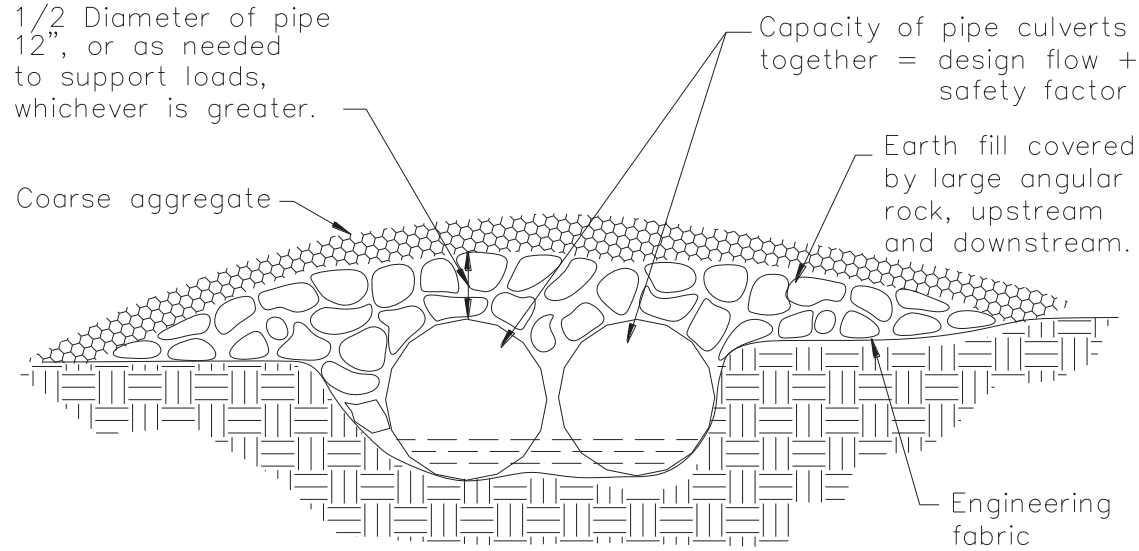
California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

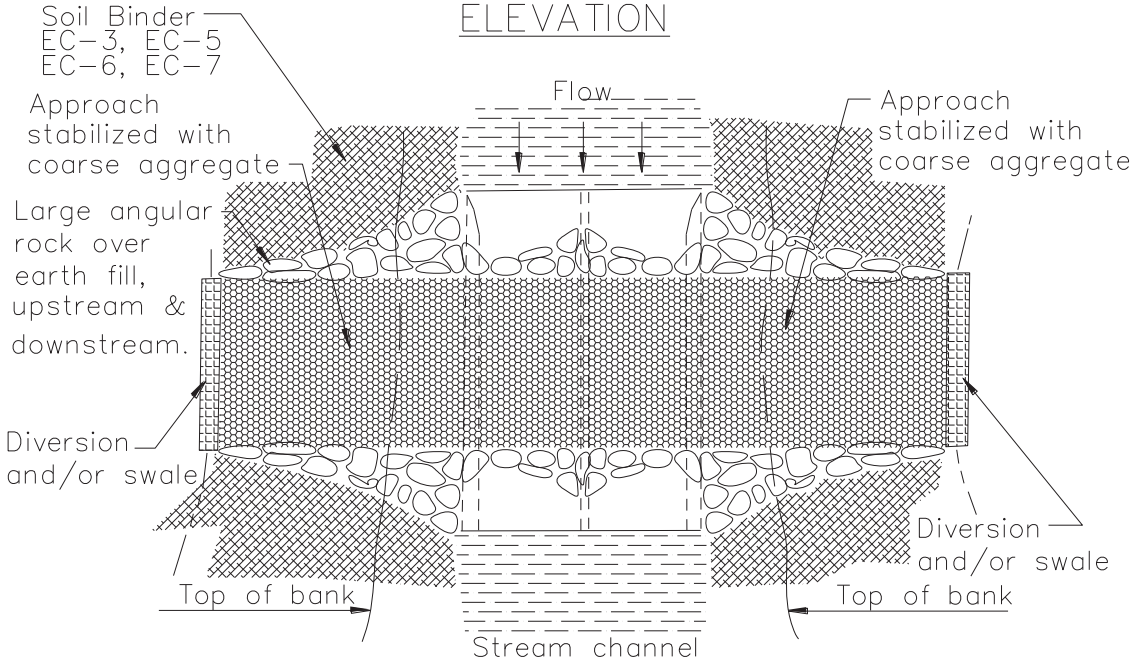


NOTE:
Surface flow of road diverted by swale and/or dike.

TYPICAL BRIDGE CROSSING
NOT TO SCALE

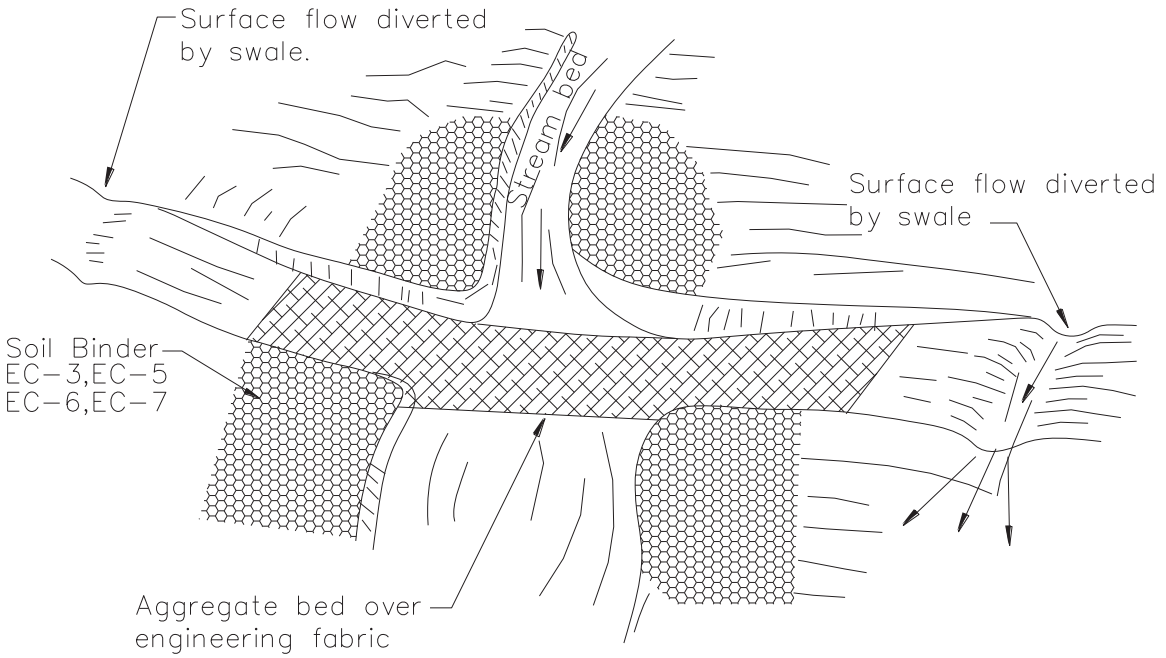


ELEVATION

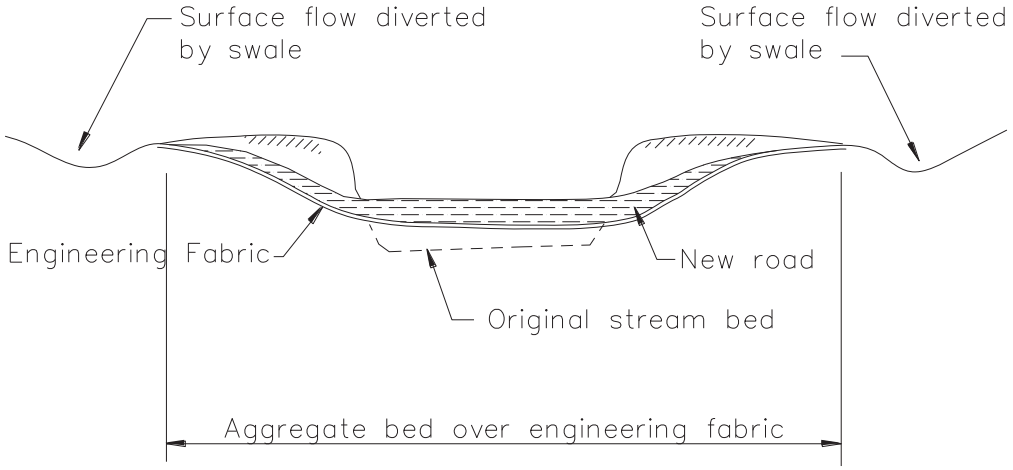


PLAN VIEW

TYPICAL CULVERT CROSSING
NOT TO SCALE

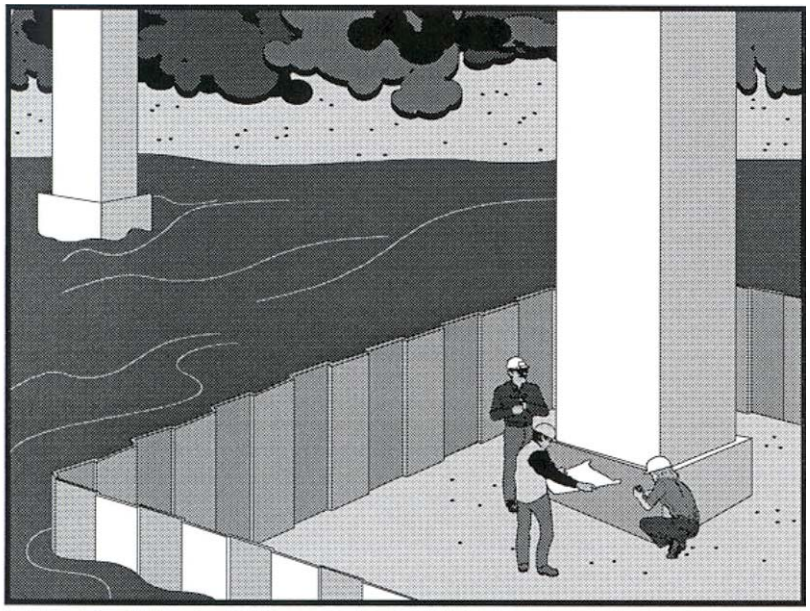


Aggregate approch
1:5 (V:H) Maximum slope on road



TYPICAL FORD CROSSING
NOT TO SCALE

Clear Water Diversion NS-5



Description and Purpose

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a project, transport it around the work area, and discharge it downstream with minimal water quality degradation from 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. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, rock, gravel bags, wood, aqua barriers, cofferdams, filter fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes.

Suitable Applications

A clear water diversion is typically implemented where appropriate permits (1601 Agreement) have been secured and work must be performed in a flowing 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 heavy pipe (called a "flume") with a trench

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

excavated under it, is appropriate for the diversion of streams less than 20 ft wide, with flow rates less than 100 cfs.

- Clear water diversions incorporating clean washed gravel may be appropriate for use in salmonid spawning streams.

Limitations

- Diversion and encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
- Installation 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.
- Diversion and 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 are not appropriate in channels where there is insufficient stream flow to support aquatic species in the area dewatered as a result of the diversion.
- Diversion or isolation activities are inappropriate in deep water unless designed or reviewed by an engineer registered in California.
- 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.
- Not appropriate if installation, maintenance, and removal of the structures will disturb sensitive aquatic species of concern.

Implementation

General

- Implement guidelines presented in EC-12, Streambank Stabilization to minimize impacts to streambanks.
- Where working areas encroach on flowing streams, barriers adequate to prevent the flow of muddy water into streams should be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams should 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 should be completely clean of petroleum residue, and water levels should be below the fuel tanks, gearboxes, and axles of the equipment unless lubricants and fuels are sealed such that inundation by water will not result in discharges of fuels, oils, greases, or hydraulic fluids.

- 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 should not enter the water body except as necessary to cross the stream to access the work site.
- Stationary equipment such as motors and pumps located within or adjacent to a water body, should be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water should, at all times, be allowed to pass downstream to maintain aquatic life.
- Equipment should not be parked below the high water mark unless allowed by a permit.
- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate erosion control measures.
- Riparian vegetation approved for trimming as part of the project should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble should be removed upon completion of project activities.
- Drip pans should 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 1 hour.
- Where possible, avoid or minimize diversion and encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. Scheduling should 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 and Encroachments

- Construct diversion channels in accordance with EC-9, Earth Dikes and Drainage Swales.
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, in accordance with EC-7, Geotextiles and Mats, or use rock slope protection.
- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment and 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 EC-10, Velocity Dissipation Devices.

Temporary Dry Construction Areas

- When dewatering behind temporary structures to create a temporary dry construction area, such as cofferdams, 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 NS-2, Dewatering Operations.

- Any substance used to assemble or maintain diversion structures, such as form oil, should be non-toxic and non-hazardous.

- Any material used to minimize seepage underneath diversion structures, such as grout, should be non-toxic, non-hazardous, and as close to a neutral pH as possible.

Comparison of Diversion and Isolation Techniques:

- Gravel bags are relatively inexpensive, but installation and removal can be labor intensive. It is also difficult to dewater the isolated area. Sandbags should not be used for this technique in rivers or streams, as sand should never be put into or adjacent to a stream, even if encapsulated in geotextile.

- Gravel Bag Berms (SE-6) used in conjunction with an impermeable membrane are cost effective, and can be dewatered relatively easily. If spawning gravel is used, the impermeable membrane can be removed from the stream, and the gravel can be spread out and left as salmonid spawning habitat if approved in the permit. Only clean, washed gravel should be used for both the gravel bag and gravel berm techniques.

- Cofferdams are relatively expensive, but frequently allow full dewatering. Also, many options now available are relatively easy to install.

- Sheet pile enclosures are a much more expensive solution, but do allow full dewatering. This technique is not well suited to small streams, but can be effective on large rivers or lakes, and where staging and heavy equipment access areas are available.

- K-rails are an isolation method that does not allow full dewatering, but can be used in small to large watercourses, and in fast-water situations.

- A relatively inexpensive isolation method is filter fabric isolation. This method involves placement of gravel bags or continuous berms to 'key-in' the fabric, and subsequently staking the fabric in place. This method should be used in relatively calm water, and can be used in smaller streams. Note that this is not a dewatering method, but rather a sediment isolation method.

- Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They can also be used for in-stream construction, when dewatering an area is not required.

- When used in watercourses or streams, cofferdams must be used in accordance with permit requirements.

- Manufactured diversion structures should be installed following manufacturer's specifications.

- Filter fabric and turbidity curtain isolation installation methods can be found in the specific technique descriptions that follow.

Filter Fabric Isolation Technique

Definition and Purpose

A filter fabric isolation structure 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.
- Filter fabric isolation is relatively inexpensive. 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 is used, all other components of the isolation can be removed from the stream, and the gravel may be spread out and left as salmonid spawning habitat if approved in the permit. 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 method should be used in relatively calm water, and can be used in smaller streams. This is not a dewatering method, but rather a sediment isolation method.
- Water levels inside and outside the fabric curtain must be about the same, as differential heads will cause the curtain to collapse.

Limitations

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

Design and Installation

- For the filter fabric isolation method, a non-woven or heavy-duty fabric 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. If a sandbag splits open in a watercourse, the sand could cause a decrease in water quality, and could bury sensitive aquatic habitat.
- 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 18 ft for ease of handling (otherwise, it gets too heavy to move).

- 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 silt fence 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 silt fence 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 6 ft.

Inspection and Maintenance

- Immediately repair any gaps, holes or scour.
- Remove and properly dispose of sediment buildup.
- Remove BMP upon completion of construction activity. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

Turbidity Curtain Isolation Technique

Definition and Purpose

A turbidity curtain 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, 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 sediment 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, 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 resuspension of particles and by accidental dumping by the removal equipment.

Design and Installation

- 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 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 1 ft.

- The top of the curtain should consist of flexible flotation buoys, and the bottom should be held down by a load line incorporated into the curtain fabric. The fabric should be a brightly colored impervious mesh.
- The curtain should be held in place by anchors placed at least every 100 ft.
- First, place the anchors, then tow the fabric out in a furled 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.
- Consideration must be given to the probable outcome of the removal procedure. It must be determined 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 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 temporary sediment control or stream isolation method uses K-rails 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 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.

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

Limitations

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

Design and Installation

- 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-rails to sit. Washed gravel should always be used.
- 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 rail 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.

Inspection and Maintenance:

- The barrier should be inspected and any leaks, holes, 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

The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Advantages of a Pumped Diversion

- Downstream sediment transport can be nearly eliminated.
- Dewatering of the work area is possible.
- Pipes can be moved around to allow construction operations.
- The dams can serve as temporary access to the site.
- Increased flows can be managed by adding more pumping capacity.

Disadvantages of a Pumped Diversion

- Flow volume is limited by pump capacity.
- A pumped diversion requires 24 hour monitoring of pumps.
- Sudden rain could overtop dams.
- Erosion at the outlet.

- Minor in-stream disturbance is required to install and remove dams.

Advantages of Excavated Channels and Flumes

- Excavated channels isolate work from water flow and allow dewatering.
- Excavated channels can handle larger flows than pumps.

Disadvantages of Excavated Channels and Flumes

- Bypass channel or flume must be sized to handle flows, including possible floods.
- Channels must be protected from erosion.
- Flow diversion and re-direction with small dams involves in-stream disturbance and mobilization of sediment.

Design and Installation

- Installation guidelines will vary based on existing site conditions and type of diversion used.
- Pump capacity must be sufficient for design flow.
- A standby pump is required in case a primary pump fails.
- Dam materials used to create dams upstream and downstream of diversion should be erosion resistant; materials such as steel plate, sheet pile, 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.

Inspection and Maintenance

- Pumped diversions require 24 hour monitoring of pumps.
- Inspect embankments and diversion channels 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. Remove holes, gaps, or scour.
- Upon completion of work, the diversion or isolation structure should be removed and flow should be redirected through the new culvert or back into the original stream channel. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

Costs

Costs of clear water diversion vary considerably and can be very high.

Inspection and Maintenance

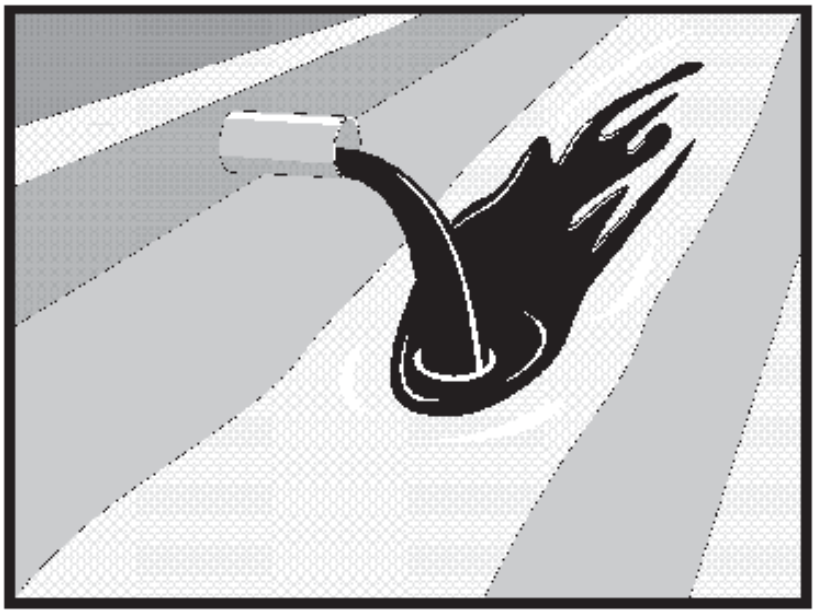
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Refer to BMP-specific inspection and maintenance requirements.

References

California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October, 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Illicit Connection / Discharge NS-6



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description 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.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered or illegally dumped material is found on the construction site.

Limitations

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. If pre-existing hazardous materials or wastes are known to exist onsite, they should be identified in the SWPPP and handled as set forth in the SWPPP.

Implementation

Planning

- Review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- Inspect site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions and notify the owner.

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

Identification of Illicit Connections and Illegal Dumping or Discharges

- **General –** unlabeled and unidentifiable material should be treated as hazardous.
- **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 sub drain 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 offsite construction projects
- **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 non-irrigation season
  - Non-standard junction structures
  - Broken concrete or other disturbances at or near junction structures

Reporting

Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery. For illicit connections or discharges to the storm drain system, notify the local stormwater management agency. For illegal dumping, notify the local law enforcement agency.

Cleanup and Removal

The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the local stormwater management agency for further information.

Costs

Costs to look for and report illicit connections and illegal discharges and dumping are low. The best way to avoid costs associated with illicit connections and illegal discharges and dumping is to keep the project perimeters secure to prevent access to the site, to observe the site for vehicles that should not be there, and to document any waste or hazardous materials that exist onsite before taking possession of the site.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect the site regularly to check for any illegal dumping or discharge.
- Prohibit employees and subcontractors from disposing of non-job related debris or materials at the construction site.
- Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery.

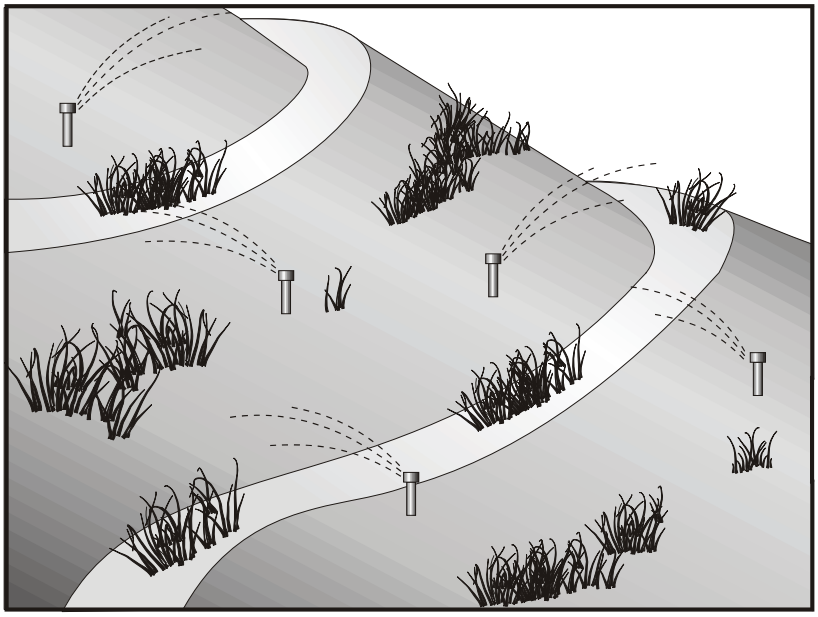
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Potable Water/Irrigation NS-7



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Potable Water/Irrigation 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.

Suitable Applications

Implement this BMP whenever potable water or irrigation water discharges occur at or enter a construction site.

Limitations

None identified.

Implementation

- Direct water from offsite sources around or through a construction site, where feasible, in a way that minimizes contact with the construction site.
- Discharges from water line flushing should be reused for landscaping purposes where feasible.
- Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow.
- Protect downstream stormwater drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- 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.

Costs

Cost to manage potable water and irrigation are low and generally considered to be a normal part of related activities.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Repair broken water lines as soon as possible.
- Inspect irrigated areas regularly for signs of erosion and/or discharge.

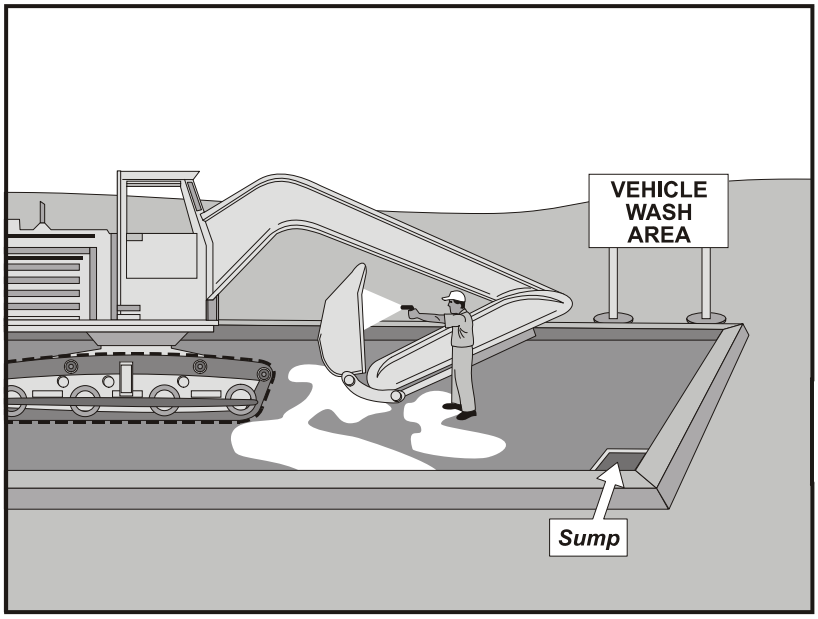
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle and Equipment Cleaning NS-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, 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. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

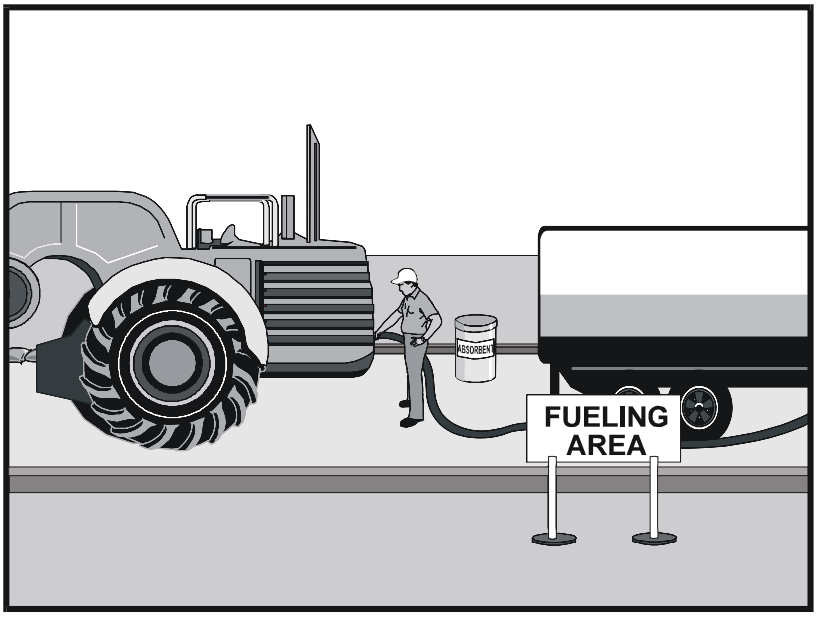
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- 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.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.

- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.

- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

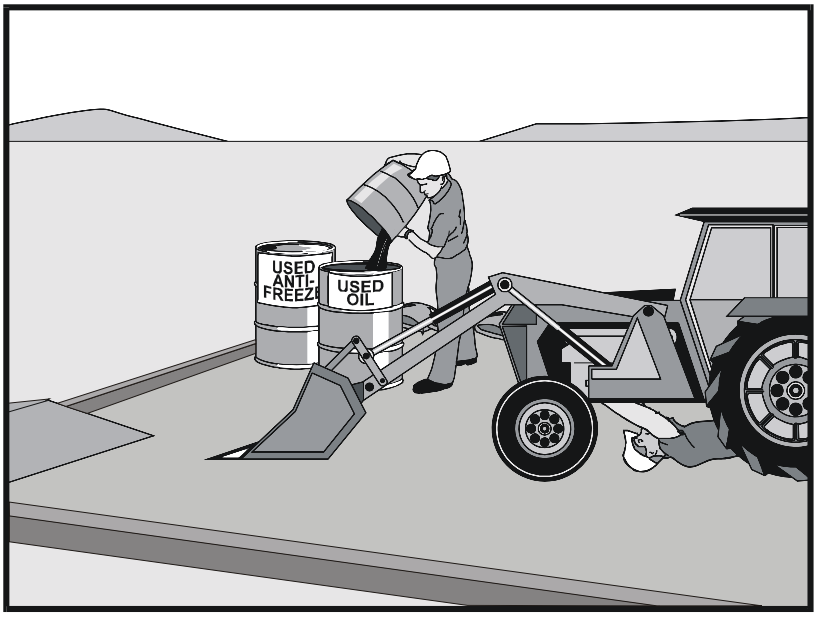
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

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

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8,

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should 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.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should 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 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.

- Repair leaks of fluids and oil immediately.

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

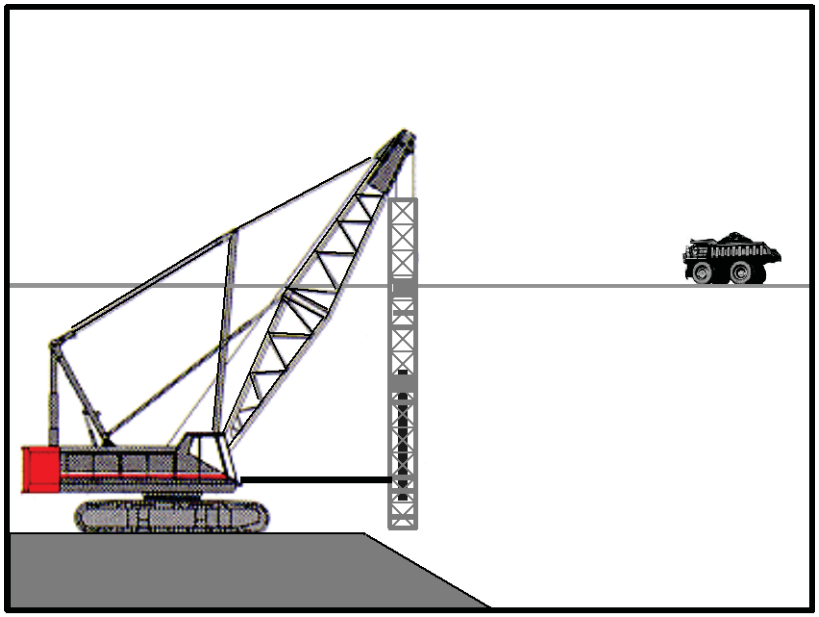
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Pile Driving Operations NS-11



Description 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 precast concrete, steel, or timber. Driven sheet piles are also used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce or eliminate the discharge of potential pollutants to the storm drain system, watercourses, and waters of the United States.

Suitable Applications

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

Limitations

None identified.

Implementation

- Use drip pans or absorbent pads during vehicle and equipment operation, maintenance, cleaning, fueling, and storage. Refer to NS-8, Vehicle and Equipment Cleaning, NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Have spill kits and cleanup materials available at all locations of pile driving. Refer to WM-4, Spill Prevention and Control.
- Equipment that is stored or in use in streambeds, or on docks, barges, or other structures over water bodies should be kept leak free.
- Park equipment over plastic sheeting or equivalent where possible. Plastic is not a substitute for drip pans or absorbent pads. The storage or use of equipment in streambeds or other bodies of water must 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 stormwater, drainage courses, and inlets. Protect hammers and other hydraulic attachments from runon and runoff 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, when practicable.

Costs

All of the above measures can be low cost.

Inspection and Maintenance

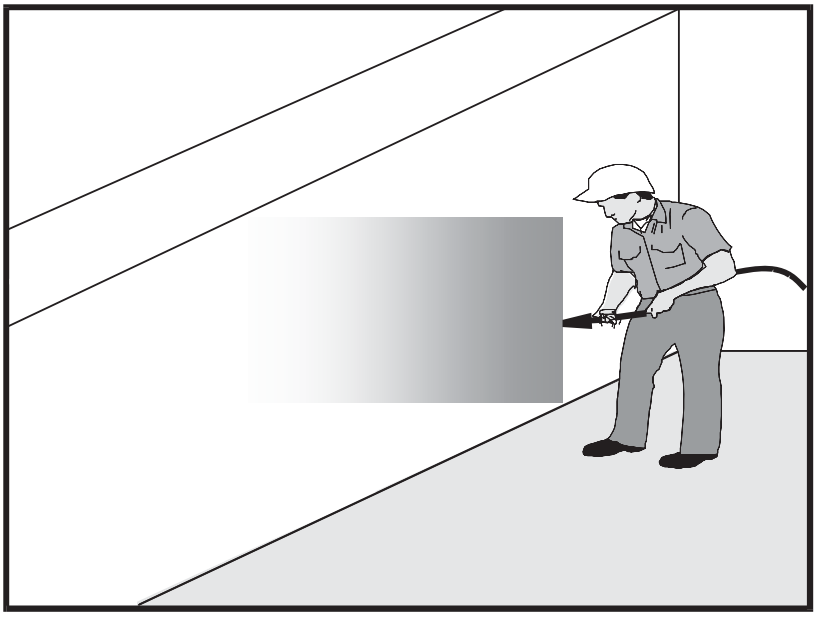
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect equipment every day at startup and repair equipment as needed (i.e., worn or damaged hoses, fittings, and gaskets). Recheck equipment at shift changes or at the end of the day and scheduled repairs as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Concrete Curing NS-12



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

Suitable Applications

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.
- Minimize the drift 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 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 evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.
- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

Education

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

Costs

All of the above measures are generally low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.
- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect cure containers and spraying equipment for leaks.

References

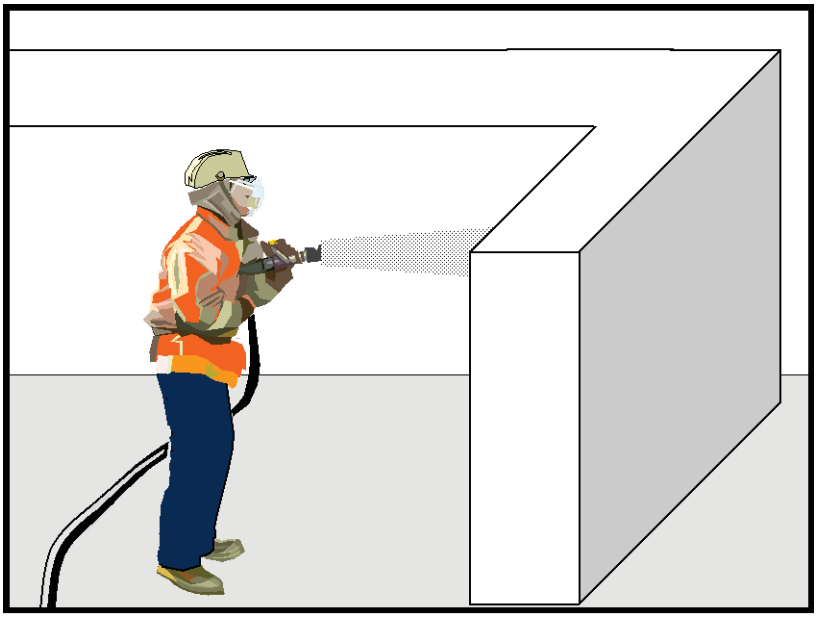
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Concrete Finishing NS-13



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

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. Stormwater and non-stormwater exposed to concrete finishing by-products may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate BMPs can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Concrete and its associated curing materials have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

Suitable Applications

These procedures apply to all construction locations where concrete finishing operations are performed.

Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

- Collect and properly dispose of water from high-pressure water blasting operations.
- Collect contaminated water from blasting operations at the top of slopes. Transport or dispose of contaminated water while using BMPs such as those for erosion control. Refer to EC-9, Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering). Refer to NS-2 Dewatering Operations.
- Protect inlets during sandblasting operations. Refer to SE-10, Storm Drain Inlet Protection.
- Refer to WM-8, Concrete Waste Management for disposal of concrete debris.
- 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 WM-6, Hazardous Waste Management.

Education

- Educate employees, subcontractors, and suppliers on proper concrete finishing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete finishing procedures.

Costs

These measures are generally of low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts concrete dust and debris as required by the General Permit.

- Sweep or vacuum up debris from sandblasting at the end of each shift.
- At the end of each work shift, remove and contain liquid and solid waste from containment structures, if any, and from the general work area.
- Inspect containment structures for damage prior to use and prior to onset of forecasted rain.

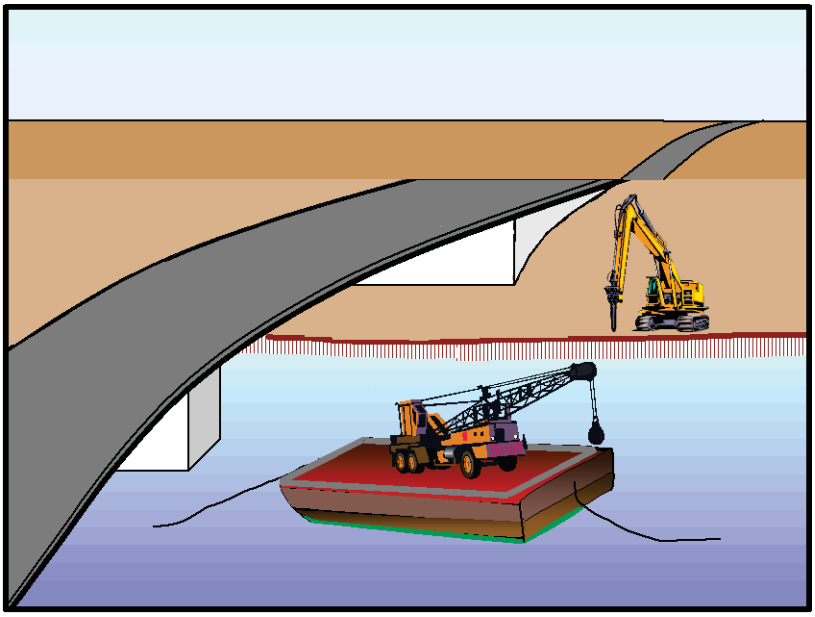
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Material Over Water NS-14



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

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.

Suitable Applications

Applies where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse including waters of the United States. These procedures should be implemented for construction materials and wastes (solid and liquid), soil or dredging materials, or any other materials that may cause or contribute to exceedances of water quality standards.

Limitations

Dredge and fill activities are regulated by the US Army Corps of Engineers and Regional Boards under Section 404/401 of the Clean Water Act.

Implementation

- Refer to WM-1, Material Delivery and Storage and WM-4, Spill Prevention and Control.
- Use drip pans and absorbent materials for equipment and vehicles and ensure that an adequate supply of spill clean up materials is available.
- Drip pans should be placed under all vehicles and equipment placed on docks, barges, or other structures over

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

water bodies when the vehicle or equipment is expected to be idle for more than 1 hour.

- Maintain equipment in accordance with NS-10, Vehicle and Equipment Maintenance. If a leaking line cannot be repaired, remove equipment from over the water.
- Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc.
- Secure all materials to prevent discharges to receiving waters via wind.
- Identify types of spill control measures to be employed, including the storage of such materials and equipment. Ensure that staff is trained regarding the use of the materials, deployment and access of control measures, and reporting measures.
- In case of spills, contact the local Regional Board as soon as possible but within 48 hours.
- Refer to WM-5, Solid Waste Management (non-hazardous) and WM-6, Hazardous Waste Management. Ensure the timely and proper removal of accumulated wastes
- Comply with all necessary permits required for construction within or near the watercourse, such as Regional Water Quality Control Board, U.S. Army Corps of Engineers, Department of Fish and Game or and other local permitting.
- Discharges to waterways should be reported to the Regional Water Quality Control Board immediately upon discovery. A written discharge notification must follow within 7 days. Follow the spill reporting procedures contained in SWPPP.

Costs

These measures are generally of low to moderate cost. Exceptions are areas for temporary storage of materials, engine fluids, or wastewater pump out.

Inspection and Maintenance

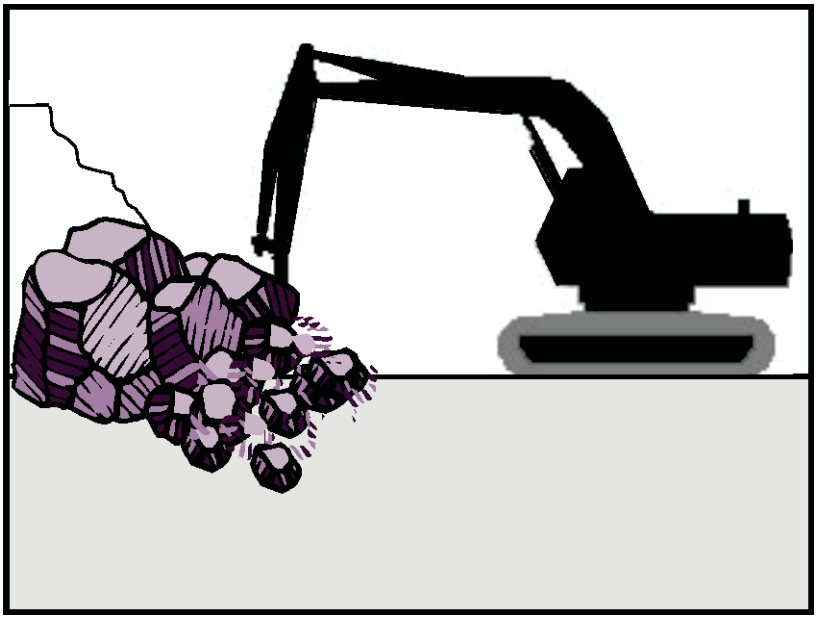
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Ensure that employees and subcontractors implement the 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 water courses, including waters of the United States.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Demolition Adjacent to Water NS-15



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

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

Suitable Applications

Full bridge demolition and removal, partial bridge removal (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

None identified.

Implementation

- Refer to 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 owner.
- Stockpile accumulated debris and waste generated during demolition away from watercourses and in accordance with WM-3, Stockpile Management.
- Ensure safe passage of wildlife, as necessary.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Discharges to waterways shall be reported to the Regional Water Quality Control Board immediately upon discovery. A written discharge notification must follow within 7 days. Follow the spill reporting procedures in the SWPPP.

- For structures containing hazardous materials, i.e., lead paint or asbestos, refer to BMP WM-6, Hazardous Waste Management. For demolition work involving soil excavation around lead-painted structures, refer to WM-7, Contaminated Soil Management.

Costs

Cost may vary according to the combination of practices implemented.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Any debris-catching devices shall be emptied regularly. Collected debris shall be removed and stored away from the watercourse and protected from runon and runoff.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Temporary Batch Plants NS-16



Description and Purpose

The construction of roads, bridges, retaining walls, and other large structures in remote areas, often requires temporary batch plant facilities to manufacture Portland Cement Concrete (PCC) or asphalt cement (AC). Temporary batch plant facilities typically consist of silos containing fly ash, lime, and cement; heated tanks of liquid asphalt; sand and gravel material storage areas; mixing equipment; above ground storage tanks containing concrete additives and water; and designated areas for sand and gravel truck unloading, concrete truck loading, and concrete truck washout. Proper control and use of equipment, materials, and waste products from temporary batch plant facilities will reduce the discharge of potential pollutants to the storm drain system or watercourses, reduce air emissions, and mitigate noise impacts.

Suitable Applications

These procedures typically apply to construction sites where temporary batch plant facilities are used.

Limitations

The General Permit for discharges of stormwater associated with industrial activities may be applicable to temporary batch plants.

Specific permit requirements or mitigation measures such as Air Resources Board (ARB), Air Quality Management District (AQMD), Air Pollution Control District (APCD), Regional Water Quality Control Board (RWQCB), county ordinances and city

Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

ordinances may require alternative mitigation measures for temporary batch plants.

Implementation

Planning

Implementation steps are as follows:

- Temporary batch plants may be subject to the General Industrial NPDES permit. To comply with the permit, a Notice of Intent (NOI) must be submitted to the State Water Resource Control Board.
- Proper planning, design, and construction of temporary batch plants should be implemented to minimize potential water quality, air pollution, and noise impacts associated with temporary batch plants.
- BMPs and a Sampling and Analysis Plan (SAP) must be included in the project Stormwater Pollution Prevention Plan (SWPPP). BMPs must be implemented, inspected, and maintained.
- Temporary batch plants should be managed to comply with AQMD Statewide Registration Program and/or local AQMD Portable Equipment Registration requirements.
- Construct temporary batch plants down-wind of existing developments whenever possible.
- Placement of access roads should be planned to mitigate water and air quality impacts.

Layout and Design

- Temporary batch plants should be properly located and designed to mitigate water quality impacts to receiving water bodies. Batch plants should be located away from watercourses, drainage courses, and drain inlets. Batch plants should be located to minimize the potential for stormwater runon onto the site.
- Temporary batch plant facilities (including associated stationary equipment and stockpiles) should be located at least 300 ft from any recreational area, school, residence, or other structure not associated with the construction project.
- Construct continuous interior AC or PCC berms around batch plant equipment (mixing equipment, silos, concrete drop points, conveyor belts, admixture tanks, etc.) to facilitate proper containment and cleanup of releases. Rollover or flip top curb or dikes should be placed at ingress and egress points.
- Direct runoff from the paved or unpaved portion of the batch plant into a sump and pipe to a lined washout area or dewatering tank.
- Direct stormwater and non-stormwater runoff from unpaved portions of batch plant facility to catchment ponds or tanks.
- Construct and remove concrete washout facilities in accordance with WM-8, Concrete Waste Management.

- Layout of a typical batch plant and associated BMP is located at the end of this BMP fact sheet.

Operational Procedures

- Washout of concrete trucks should be conducted in a designated area in accordance with WM-8, Concrete Waste Management.
- Do not dispose of concrete into drain inlets, the stormwater drainage system, or watercourses.
- Equipment washing should occur in a designated area in accordance with WM-8, Concrete Waste Management. Washing equipment, tools, or vehicles to remove PCC shall be conducted in accordance with NS-7, Potable Water/Irrigation, and NS-8, Vehicle and Equipment Cleaning.
- All dry material transfer points should be ducted through a fabric or cartridge type filter unless there are no visible emissions from the transfer point.
- Equip all bulk storage silos, including auxiliary bulk storage trailers, with fabric or cartridge type filter(s).
- Maintain silo vent filters in proper operating condition.
- Equip silos and auxiliary bulk storage trailers with dust-tight service hatches.
- Fabric dust collection system should be capable of controlling 99 percent of the particulate matter.
- Fabric dust collectors (except for vent filters) should be equipped with an operational pressure differential gauge to measure the pressure drop across the filters.
- All transfer points should be equipped with a wet suppression system to control fugitive particulate emissions unless there are no visible emissions.
- All conveyors should be covered, unless the material being transferred results in no visible emissions.
- There should be no visible emissions beyond the property line, while the equipment is being operated.
- Collect dust emissions from the loading of open-bodied trucks at the drip point of dry batch plants, or dust emissions from the drum feed for central mix plants.
- Equip silos and auxiliary bulk storage trailers with a visible and/or audible warning mechanism to warn operators that the silo or trailer is full.
- All open-bodied vehicles transporting material should be loaded with a final layer of wet sand and the truck shall be covered with a tarp to reduce emissions.

NS-16 Temporary Batch Plants

Tracking Control

- Plant roads (batch truck and material delivery truck roads) and areas between stockpiles and conveyor hoppers should be stabilized (TR-2, Stabilized Construction Roadway), watered (WE-1, Wind Erosion Control), treated with dust-suppressant chemicals, or paved with a cohesive hard surface that can be repeatedly swept, maintained intact, and cleaned as necessary to control dust emissions.

- Trucks should not track PCC from plants onto public roads. Use appropriate practices from TR-1, Stabilized Construction Entrance/Exit to prevent tracking.

Materials Storage

- WM-1, Material Delivery and Storage, should be implemented at all batch plants using concrete components or compounds. An effective strategy is to cover and contain materials.

- WM-2, Material Use should be conducted in a way to minimize or eliminate the discharge of materials to storm drain system or watercourse.

- Ensure that finer materials are not dispersed into the air during operations, such as unloading of cement delivery trucks.

- Stockpiles should be covered and enclosed with perimeter sediment barriers per WM-3, Stockpile Management. Uncovered stockpiles should be sprinkled with water and/or dust-suppressant chemicals as necessary to control dust emissions, unless the stockpiled material results in no visible emissions. An operable stockpile watering system should be onsite at all times.

- Store bagged and boxed materials on pallets and cover on non-working days prior to rain.

- Minimize stockpiles of demolished PCC by recycling them in a timely manner.

- Provide secondary containment for liquid materials (WM-1). Containment should provide sufficient volume to contain precipitation from a 25-year storm plus 10% of the aggregate volume of all containers or plus 100% of the largest container, whichever is greater.

- Handle solid and liquid waste in accordance with WM-5, Solid Waste Management, WM-10, Liquid Waste Management, and WM-8, Concrete Waste Management.

- Maintain adequate supplies of spill cleanup materials and train staff to respond to spills per WM-4, Spill Prevention and Control.

- Immediately clean up spilled cement and fly ash and contain or dampen so that dust or emissions from wind erosion or vehicle traffic are minimized.

Equipment Maintenance

- Equipment should be maintained to prevent fluid leaks and spills per NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.

- Maintain adequate supplies of spill cleanup materials and train staff to respond to spills per WM-4, Spill Prevention and Control.

- Incorporate other BMPs such as WM-5, Solid Waste Management, WM-6, Hazardous Waste Management, and WM-10, Liquid Waste Management.

Costs

Costs will vary depending on the size of the facility and combination of BMPs implemented.

Inspection and Maintenance

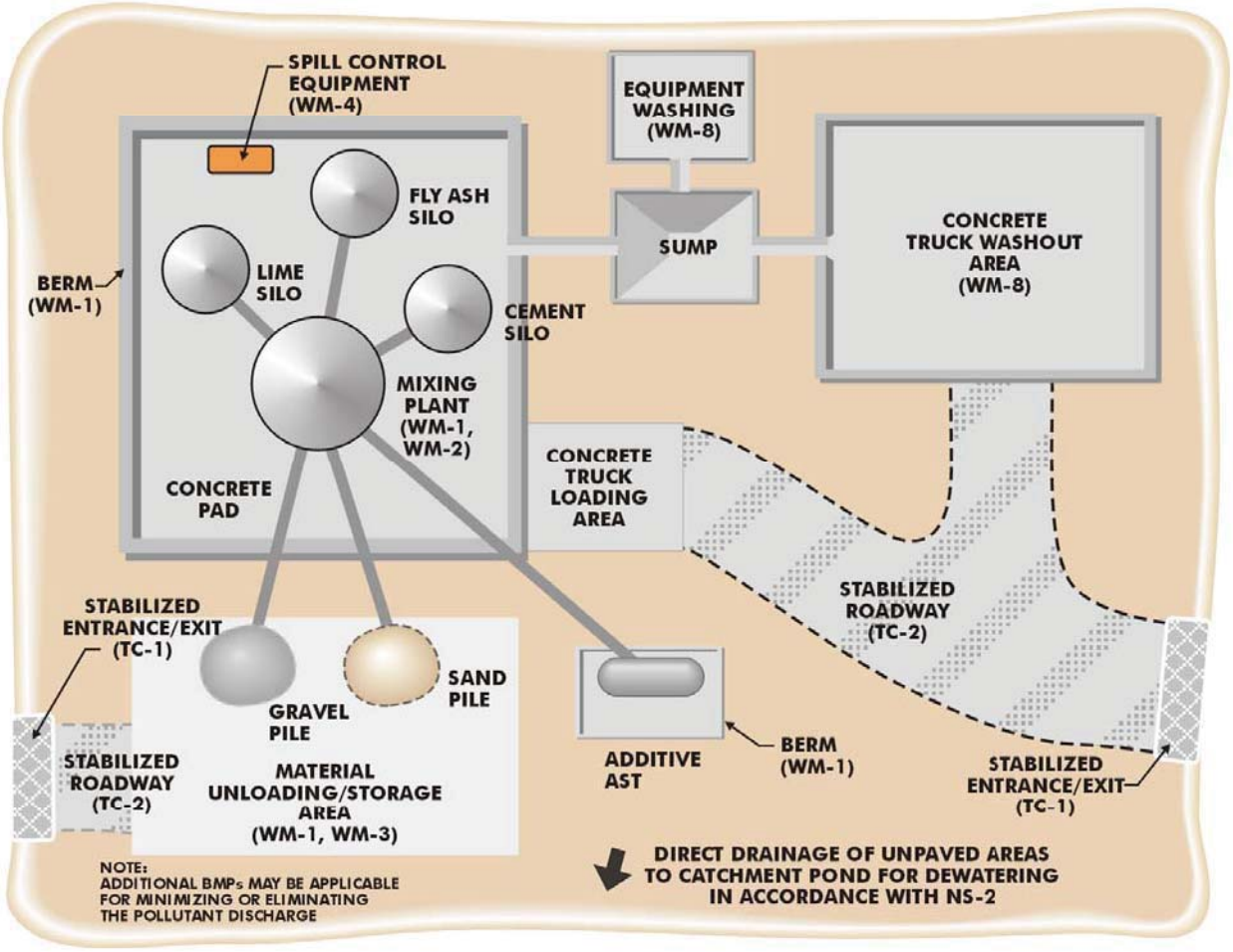
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).
- Inspect and maintain Stabilized Construction Entrance/Exit (TR-1) as needed.
- Inspect and maintain stabilized haul roads as needed.
- Inspect and maintain materials and waste storage areas as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

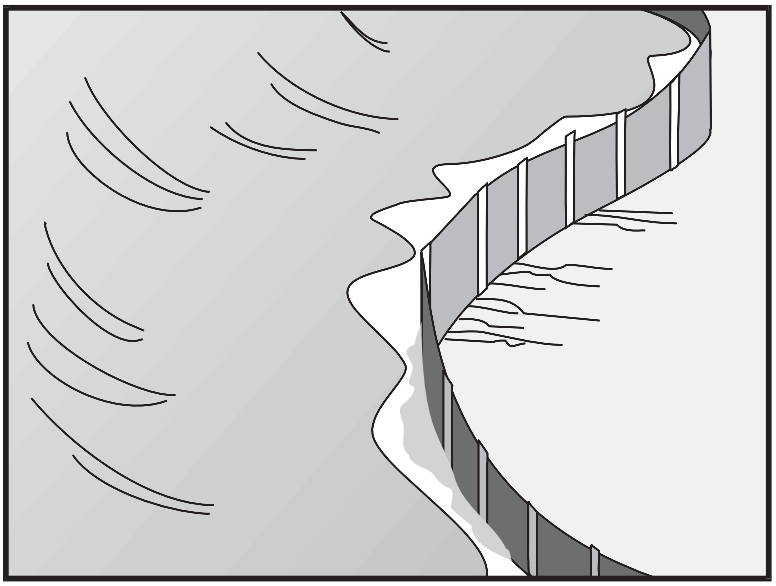
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

NS-16 Temporary Batch Plants



Typical Temporary Batch

Silt Fence SE-1



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains water, promoting sedimentation of coarse sediment behind the fence. Silt fence does not retain soil fine particles like clays or silts.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (SE-10). Silt fences should not be used in locations where the flow is concentrated. Silt fences should always be used in combination with erosion controls. Suitable applications include:

- At perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- Below other small cleared areas.

Targeted Constituents

Sediment (coarse sediment)	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm SE-12 Manufactured Linear Sediment Controls

SE-13 Compost Socks and Berms

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Do not use in locations where ponded water may cause a flooding hazard.
- Do not use silt fence to divert water flows or place across any contour line.
- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.
- Must be trenched and keyed in.
- Not intended for use as a substitute for Fiber Rolls (SE-5), when fiber rolls are being used as a slope interruption device.
- Do not use on slopes subject to creeping, slumping, or landslides.

Implementation

General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap coarse sediment by intercepting and detaining sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Silt fence should be used in combination with erosion controls up-slope in order to provide the most effective sediment control.
- Silt fence alone is not effective at reducing turbidity. (Barrett and Malina, 2004)
- Designers should consider diverting sediment laden water to a temporary sediment basin or trap. (EPA, 2012)
- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft^2 of ponding area should be provided for every acre draining to the fence.
- Efficiency of silt fences is primarily dependent on the detention time of the runoff behind the control. (Barrett and Malina, 2004)
- The drainage area above any fence should not exceed a quarter of an acre. (Rule of Thumb-100-feet of silt fence per 10,000 square feet of disturbed area.) (EPA 2012)

- The maximum length of slope draining to any point along the silt fence should be 100 ft per foot of silt fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area draining to the silt fence is permanently stabilized, after which, the silt fence fabric and posts should be removed and properly disposed.
- J-Hooks, which have ends turning up the slope to break up long runs of fence and provide multiple storage areas that work like mini-retention areas, may be used to increase the effectiveness of silt fence.
- Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

Design and Layout

In areas where high winds are anticipated the fence should be supported by a plastic or wire mesh. The geotextile fabric of the silt fence should contain ultraviolet inhibitors and stabilizers to provide longevity equivalent to the project life or replacement schedule.

- Layout in accordance with the attached figures.
- For slopes that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to protect silt fence from rocks (e.g., rockfall netting) ensure the integrity of the silt fence installation.

Standard vs. Heavy Duty Silt Fence

Standard Silt Fence

- Generally applicable in cases where the area draining to fence produces moderate sediment loads.

Heavy Duty Silt Fence

- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
- Use is generally limited to areas affected by high winds.
- Area draining to fence produces moderate sediment loads.

Materials

Standard Silt Fence

- Silt fence material should be woven geotextile with a minimum width of 36 in. The fabric should conform to the requirements in ASTM designation D6461.
- Wooden stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should 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.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

Heavy-Duty Silt Fence

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts instead of wood stakes.

Installation Guidelines – Traditional Method

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).
- Bottom of the silt fence should be keyed-in a minimum of 12 in.
- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.
- When standard strength geotextile is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy–duty wire staples at least 1 in. long. The mesh should extend into the trench.
- When extra-strength geotextile and closer post spacing are used, the mesh support fence may be eliminated.
- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.
- The trench should be backfilled with native material and compacted.
- 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 should the reach exceed 500 ft.
- Cross barriers should be a minimum of 1/3 and a maximum of ½ the height of the linear barrier.
- See typical installation details at the end of this fact sheet.

Installation Guidelines - Static Slicing Method

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 inches into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the geotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
    - Ease of installation (most often done with a 2 person crew).
    - Minimal soil disturbance.
    - Better level of compaction along fence, less susceptible to undercutting
    - Uniform installation.
- Limitations:
    - Does not work in shallow or rocky soils.
    - Complete removal of geotextile material after use is difficult.
    - Be cautious when digging near potential underground utilities.

Costs

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is $7 per linear foot based on vendor research. Range of cost is $3.50 - $9.10 per linear foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches 1/3 of the barrier height.
- Silt fences should be left in place until the upgradient area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.

- Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Monitoring Data on Effectiveness of Sediment Control Techniques, Proceedings of World Water and Environmental Resources Congress, Barrett M. and Malina J. 2004.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, and Inventory of Current Practices (Draft), USEPA, 1990.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

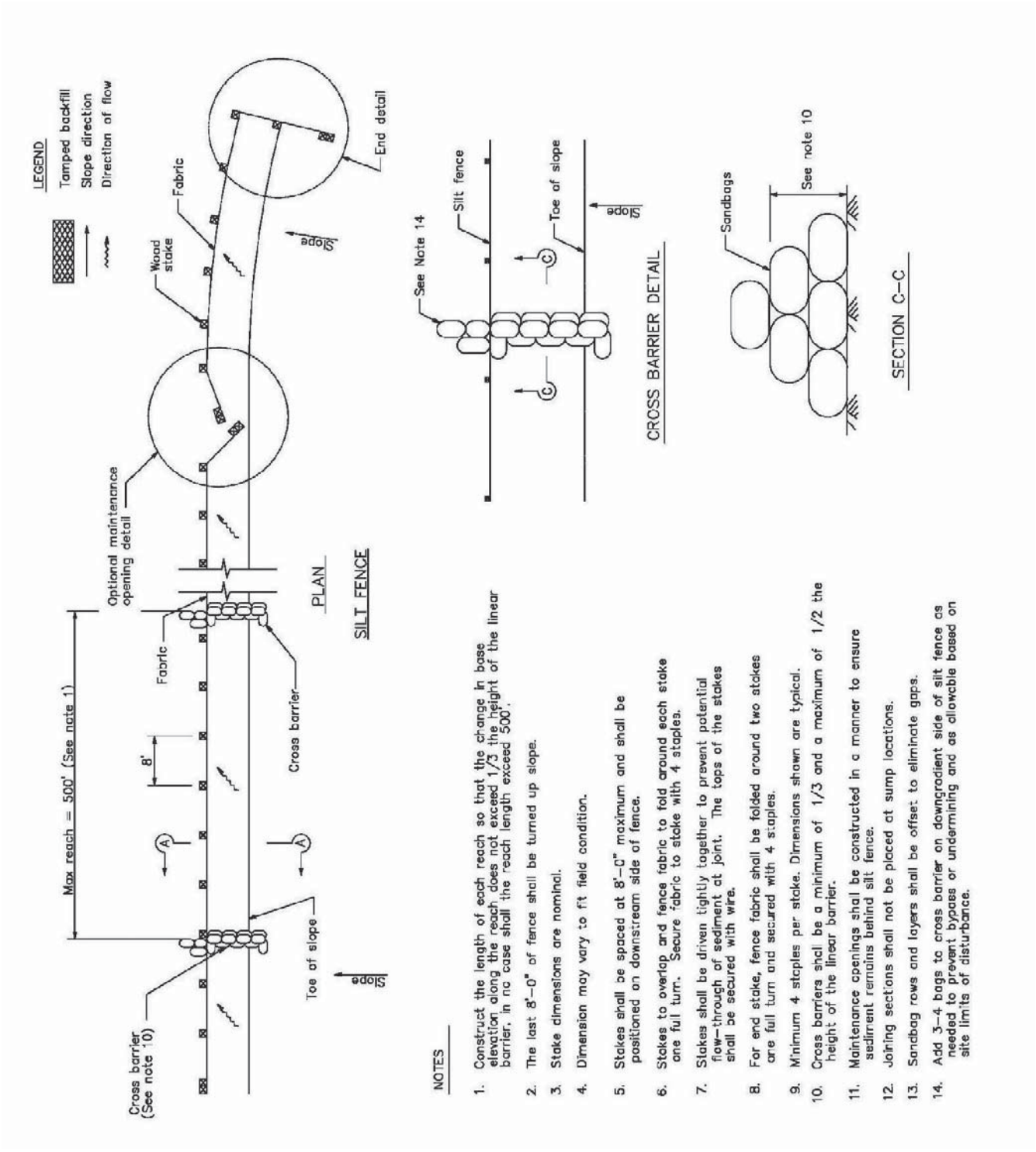
U.S. Environmental Protection Agency (USEPA). Stormwater Best Management Practices: Silt Fences. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 2012.

U.S. Environmental Protection Agency (USEPA). Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

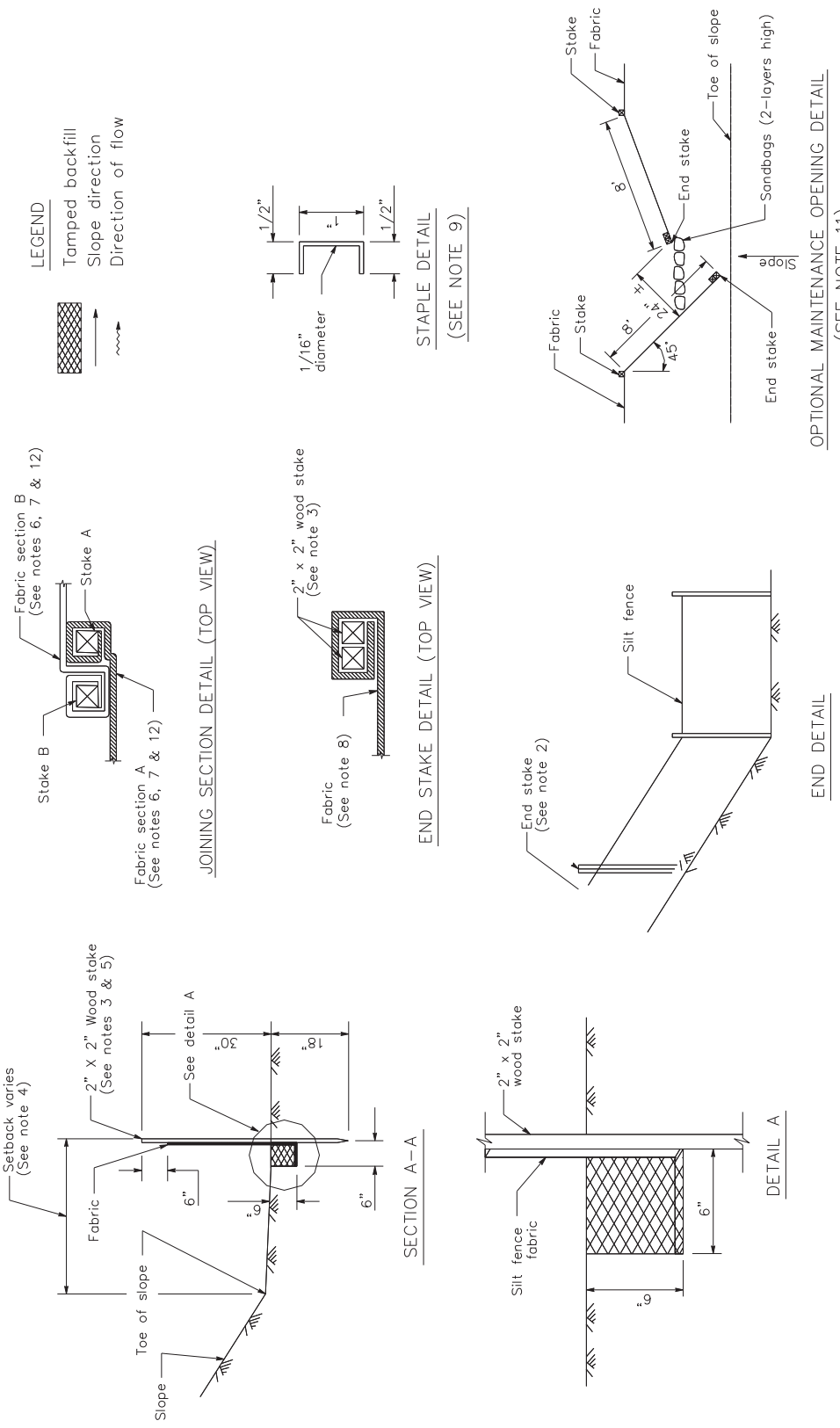
Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

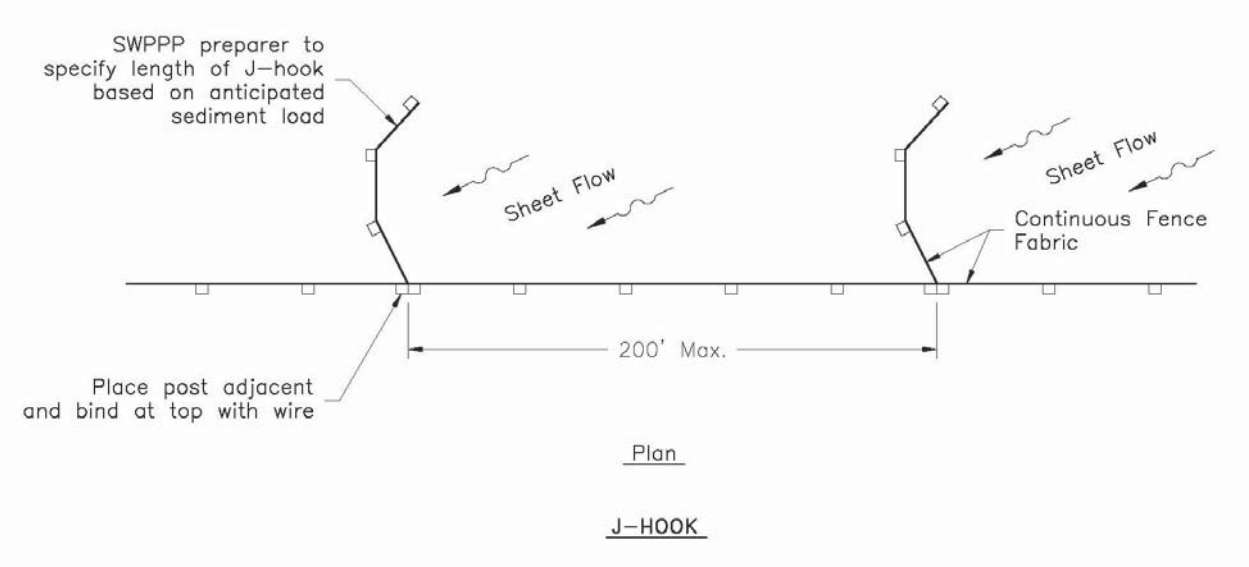
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



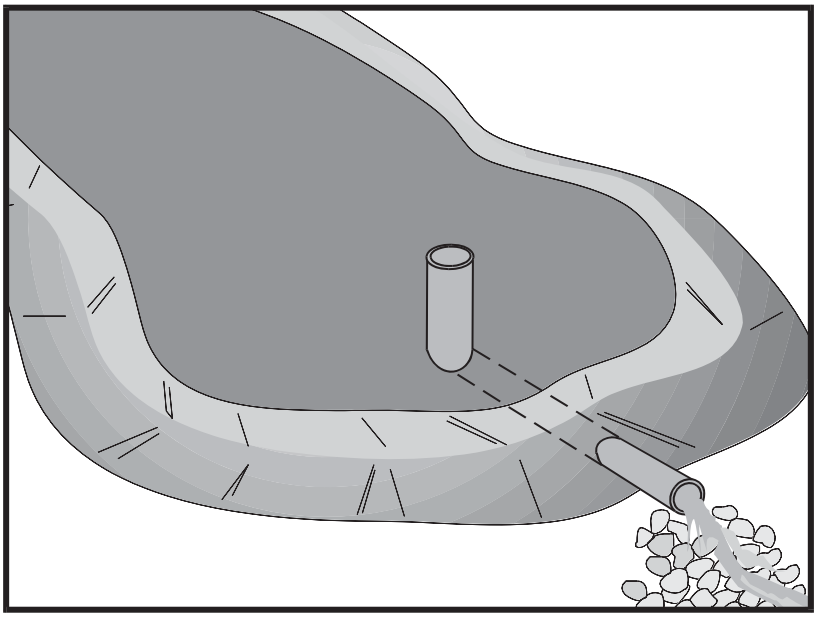
NOTES

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 500'.
2. The last 8'-0" 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 8'-0" 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.
14. Add 3-4 bags to cross barrier on downgradient side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbance.


LEGEND
Tamped backfill
Slope direction
Direction of flow
1/2"
1"
1/2"
1/16" diameter
STAPLE DETAIL
(SEE NOTE 9)
Stake
Fabric
Toe of slope
8'
End stake
Sandbags (2-layers high)
Slope
4'
2'
8'
45°
Fabric
Stake
End stake
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)
Fabric section B
(See notes 6, 7 & 12)
Stake A
Stake B
Fabric section A
(See notes 6, 7 & 12)
JOINING SECTION DETAIL (TOP VIEW)
2" x 2" wood stake
(See note 3)
Fabric
(See note 8)
END STAKE DETAIL (TOP VIEW)
Silt fence
End stake
(See note 2)
END DETAIL
Setback varies
(See note 4)
2" X 2" Wood stake
(See notes 3 & 5)
See detail A
30"
18"
Fabric
6"
6"
6"
Toe of slope
Slope
SECTION A-A
2" x 2"
wood stake
Silt fence
fabric
6"
6"
DETAIL A


SWPPP preparer to specify length of J–hook based on anticipated sediment load
Sheet Flow
Sheet Flow
Continuous Fence Fabric
200' Max.
Place post adjacent and bind at top with wire
Plan
J–HOOK

Sediment Basin SE-2



Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is released.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin
- Erosion control practices to minimize disturbed areas on-site and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional

Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

(a.k.a. "physical") enhancements such as alternative outlet configurations or flow deflection baffles increase detention time and other techniques such as outlet skimmers preferentially drain flows with lower sediment concentrations. These "physical" enhancement techniques are described in this fact sheet. To further enhance sediment removal particularly at sites with fine soils or turbidity sensitive receiving waters, some projects may need to consider implementing Active Treatment Systems (ATS) whereby coagulants and flocculants are used to enhance settling and removal of suspended sediments. Guidance on implementing ATS is provided in SE-11.

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres and evaluated on a site by site basis
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- As a general guideline, sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. However, the tributary area should be evaluated on a site by site basis.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this fact sheet are only effective in removing sediment down to about the silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical (or other appropriate method) treatment is used in addition to the sediment basin.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from California Department of Water Resources Division of Safety of Dams (http://www.water.ca.gov/damsafety/).

- Water that stands in sediment basins longer than 96 hours may become a source of mosquitoes (and midges), particularly along perimeter edges, in shallow zones, in scour or below-grade pools, around inlet pipes, along low-flow channels, and among protected habitats created by emergent or floating vegetation (e.g. cattails, water hyacinth), algal mats, riprap, etc.

- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure expected to be used during active construction in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to convey runoff to the basin inlet.

Many development projects in California are required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins if properly designed and maintained can trap a significant amount of the sediment that flows into them. However, traditional basins do not remove all inflowing sediment. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. Locations best suited for a sediment basin are generally in lower elevation areas of the site (or basin tributary area) where site drainage would not require significant diversion or other means to direct water to the basin but outside jurisdictional waterways. However, as necessary, drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). . The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Construct before clearing and grading work begins when feasible.

- Do not locate the basin in a jurisdictional stream.

- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft must obtain approval from the Division of Dam Safety. Local dam safety requirements may be more stringent.
- Limit the contributing area to the sediment 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 basin.
- The basin should 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, and (3) where the basins can be maintained on a year-round basis 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.

Design

When designing a sediment basin, designers should evaluate the site constraints that could affect the efficiency of the BMP. Some of these constraints include: the relationship between basin capacity, anticipated sediment load, and freeboard, available footprint for the basin, maintenance frequency and access, and hydraulic capacity and efficiency of the temporary outlet infrastructure. Sediment basins should be designed to maximize sediment removal and to consider sediment load retained by the basin as it affects basin performance.

Three Basin Design Options (Part A) are presented below along with a Typical Sediment/Detention Basin Design Methodology (Part B). Regardless of the design option that is selected, designers also need to evaluate the sediment basin capacity with respect to sediment accumulation (See "*Step 3. Evaluate the Capacity of the Sediment Basin"),* and should incorporate approaches identified in "*Step 4. Other Design Considerations*" to enhance basin performance.

A) Basin Design Options:

Option 1:

Design sediment basin(s) using the standard equation:

$$A_s = \frac{1.2Q}{V_s} \qquad \text{(Eq. 1)}$$

Where:

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

V_s = Settling velocity of the design particle size chosen (V_s = 0.00028 ft/s for a design particle size of 0.01 mm at 68°F)

1.2 = Factor of safety recommended by USEPA to account for the reduction in basin efficiency caused due to turbulence and other non ideal conditions.

$Q = CIA$ (Eq.2)

Where

Q = Peak basin influent flow rate measured in cubic feet per second (ft^3/s)

C = Runoff coefficient (unitless)

I = Peak rainfall intensity for the 10-year, 6-hour rain event (in/hr)

A = Area draining into the sediment basin in acres

The design particle size should be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the Vs used should be 100 percent of the calculated settling velocity.

This sizing basin method is dependent on the outlet structure design or the total basin length with an appropriate outlet. If the designer chooses to utilize the outlet structure to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a minimum of twice the basin width; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). If the designer chooses to utilize the basin length (with appropriate basin outlet) to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a specifically designed to capture 100% of the design particle size; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity).

Basin design guidance provided herein assumes standard water properties (e.g., estimated average water temperature, kinematic viscosity, etc.) as a basis of the design. Designers can use an alternative design (Option 3) with site specific water properties as long as the design is as protective as Option 1.

The design guidance uses the peak influent flow rate to size sediment basins. Designers can use an alternative design (Option 3) with site specific average flow rates as long as the design is as protective as Option 1.

The basin should be located on the site where it can be maintained on a year-round basis and should be maintained on a schedule to retain the 2 ft of capacity.

Option 2:

Design 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 1.

Option 3:

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 1.

B) Typical Sediment/Detention Basin Design Methodology:

Design of a sediment basin requires the designer to have an understanding of the site constraints, knowledge of the local soil (e.g., particle size distribution of potentially contributing soils), drainage area of the basin, and local hydrology. Designers should not assume that a sediment basin for location A is applicable to location B. Therefore, designers can use this factsheet as guidance but will need to apply professional judgment and knowledge of the site to design an effective and efficient sediment basin. The following provides a general overview of typical design methodologies:

Step 1. Hydrologic Design

- Evaluate the site constraints and assess the drainage area for the sediment basin. Designers should consider on- and off-site flows as well as changes in the drainage area associated with site construction/disturbance. To minimize additional construction during the course of the project, the designer should consider identifying the maximum drainage area when calculating the basin dimensions.

- If a local hydrology manual is not available it is recommended to follow standard rational method procedures to estimate the flow rate. The references section of this factsheet provides a reference to standard hydrology textbooks that can provide standard methodologies. If local rainfall depths are not available, values can be obtained from standard precipitation frequency maps from NOAA (downloaded from http://www.wrcc.dri.edu/pcpnfreq.html).

Step 2. Hydraulic Design

- Calculate the surface area required for the sediment basin using Equation 1. In which the flow rate is estimated for a 10-yr 6-hr event using rational method procedure listed in local hydrology manual and Vs is estimated using Stokes Law presented in Equation 3.

$$V_s = 2.81d^2 \qquad \text{(Eq.3)}$$

Where

V_s = Settling velocity in feet per second at 68˚F

d = diameter of sediment particle in millimeters (smallest soil grain size determined by wet sieve analysis or fine silt (0.01 mm [or 0.0004 in.])

- In general the basin outlet design requires an iterative trial and error approach that considered the maximum water surface elevation, the elevation versus volume (stage-storage) relationship, the elevation verses basin outflow (a.k.a.-discharge) relationship, and the estimated inflow hydrograph. To adequately design the basins to settle sediment, the outlet configuration and associated outflow rates can be estimated by numerous methodologies. The following provides some guidance for design the basin outlet:

  - An outlet should have more than one orifice.

  - An outlet design typically utilizes multiple horizontal rows of orifices (approximately 3 or more) with at least 2 orifices per row (see Figures 1 and 2 at the end of this fact sheet).

- Orifices can vary in shape.
- Select the appropriate orifice diameter and number of perforations per row with the objective of minimizing the number of rows while maximizing the detention time.
- The diameter of each orifice is typically a maximum of 3-4 inches and a minimum of 0.25-0.5 inches.
- If a rectangular orifice is used, it is recommended to have minimum height of 0.5 inches and a maximum height of 6 inches.
- Rows are typically spaced at three times the diameter center to center vertically with a minimum distance of approximately 4 inches on center and a maximum distance of 1 foot on center.
- To estimate the outflow rate, each row is calculated separately based on the flow through a single orifice then multiplied by the number of orifices in the row. This step is repeated for each of the rows. Once all of the orifices are estimated, the total outflow rate versus elevation (stage-discharge curve) is developed to evaluate the detention time within the basin.
- Flow through a single orifice can be estimated using an Equation 4:

$$Q = BC'A(2gH)^{0.5} \qquad \text{(Eq.4)}$$

Where
Q = Outflow rate in ft^3/s
C′ = Orifice coefficient (unitless)
A = Area of the orifice (ft^2)
g = acceleration due to gravity (ft^3/s)
H = Head above the orifice (ft)
B = Anticipated Blockage or clogging factor (unitless), It is dependent on anticipated sediment and debris load, trash rack configuration etc, so the value is dependent on design engineers professional judgment and/or local requirements (B is never greater than 1 and a value of 0.5 is generally used)

  - Care must be taken in the selection of orifice coefficient ("C′"); 0.60 is most often recommended and used. However, based on actual tests, Young and Graziano (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
- If different sizes of orifices are used along the riser then they have to be sized such that not more than 50 percent of the design storm event drains in one-third of the drawdown time (to provide adequate settling time for events smaller than the design storm event)

and the entire volume drains within 96 hours or as regulated by the local vector control agency. If a basin fails to drain within 96 hours, the basin must be pumped dry.

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

- Floating Outlet Skimmer: The floating skimmer (see Figure 3 at the end of this fact sheet is an alternative outlet configuration (patented) that drains water from upper portion of the water column. This configuration has been used for temporary and permanent basins and can improve basin performance by eliminating bottom orifices which have the potential of discharging solids. Some design considerations for this alternative outlet device includes the addition of a sand filter or perforated under drain at the low point in the basin and near the floating skimmer. These secondary drains allow the basin to fully drain. More detailed guidelines for sizing the skimmer can be downloaded from http://www.fairclothskimmer.com/.

- Hold and Release Valve: An ideal sediment/detention basin would hold all flows to the design storm level for sufficient time to settle solids, and then slowly release the storm water. Implementing a reliable valve system for releasing detention basins is critical to eliminate the potential for flooding in such a system. Some variations of hold and release valves include manual valves, bladder devices or electrically operated valves. When a precipitation event is forecast, the valve would be close for the duration of the storm and appropriate settling time. When the settling duration is met (approximately 24 or 48 hours), the valve would be opened and allow the stormwater to be released at a rate that does not resuspend settled solids and in a non-erosive manner. If this type of system is used the valve should be designed to empty the entire basin within 96 hours or as stipulated by local vector control regulations.

Step 3. Evaluate the Capacity of the Sediment Basin

- Typically, sediment basins do not perform as designed when they are not properly maintained or the sediment yield to the basin is larger than expected. As part of a good sediment basin design, designers should consider maintenance cycles, estimated soil loss and/or sediment yield, and basin sediment storage volume. The two equations below can be used to quantify the amount of soil entering the basin.

- The Revised Universal Soil Loss Equation (RUSLE, Eq.5) can be used to estimate annual soil loss and the Modified Universal Soil Equation (MUSLE, Eq.6) can be used to estimate sediment yield from a single storm event.

$$A = R \times K \times LS \times C \times P \qquad \text{(Eq.5)}$$

$$Y = 95(Q \times q_p)^{0.56} \times K \times LS \times C \times P \qquad \text{(Eq.6)}$$

Where:

A = annual soil loss, tons/acre-year

R = rainfall erosion index, in 100 ft.tons/acre.in/hr

K = soil erodibility factor, tons/acre per unit of R

LS = slope length and steepness factor (unitless)

C = vegetative cover factor (unitless)

P = erosion control practice factor (unitless)

Y = single storm sediment yield in tons

Q = runoff volume in acre-feet

q_p = peak flow in cfs

- Detailed descriptions and methodologies for estimating the soil loss can be obtained from standard hydrology text books (See References section).
- Determination of the appropriate equation should consider construction duration and local environmental factors (soils, hydrology, etc.). For example, if a basin is planned for a project duration of 1 year and the designer specifies one maintenance cycle, RUSLE could be used to estimate the soil loss and thereby the designer could indicate that the sediment storage volume would be half of the soil loss value estimated. As an example for use of MUSLE, a project may have a short construction duration thereby requiring fewer maintenance cycles and a reduced sediment storage volume. MUSLE would be used to estimate the anticipated soil loss based on a specific storm event to evaluate the sediment storage volume and appropriate maintenance frequency.
- The soil loss estimates are an essential step in the design and it is essential that the designer provide construction contractors with enough information to understand maintenance frequency and/or depths within the basin that would trigger maintenance. Providing maintenance methods, frequency and specification should be included in design bid documents such as the SWPPP Site Map.
- Once the designer has quantified the amount of soil entering the basin, the depth required for sediment storage can be determined by dividing the estimated sediment loss by the surface area of the basin.

Step 4. Other Design Considerations

- Consider designing the volume of the settling zone for the total storm volume associated with the 2-year event or other appropriate design storms specified by the local agency. This volume can be used as a guide for sizing the basin without iterative routing calculations. The depth of the settling zone can be estimated by dividing the estimated 2-yr storm volume by the surface area of the basin.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.

- The basin depth must be no less than 3 ft (not including freeboard).

- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 96 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 96-hour limit is specified to mitigate vector control concerns.

- Confirmation of the basin performance can be evaluated by routing the design storm (10-yr 6-hr, or as directed by local regulations) through the basin based on the basin volume (stage-storage curve) and the outlet design (stage-discharge curve based on the orifice configuration or equivalent outlet design).

- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.

  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap (or equivalent protection) on fill slopes.

  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.

- Rock, vegetation or appropriate erosion control should be used to protect the basin inlet, outlet, and slopes against erosion.

- The total depth of the sediment basin should include the depth required for sediment storage, depth required for settling zone and freeboard of at least 1 foot or as regulated by local flood control agency for a flood event specified by the local agency.

- The basin alignment should be designed such that the length of the basin is more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet. If the site topography does not allow for this configuration baffles should be installed so that the ratio is satisfied. If a basin has more than one inflow point, any inflow point that conveys more than 30 percent of the total peak inflow rate has to meet the required length to width ratio.

- An alternative basin sizing method proposed by Fifield (2004) can be consulted to estimate an alternative length to width ratio and basin configuration. These methods can be considered as part of Option 3 which allows for alternative designs that are protective or more protective of water quality.

- Baffles (see Figure 4 at the end of this fact sheet) can be considered at project sites where the existing topography or site constraints limit the length to width ratio. Baffles should be constructed of earthen berms or other structural material within the basin to divert flow in the basin, thus increasing the effective flow length from the basin inlet to the outlet riser. Baffles also reduce the change of short circuiting and allows for settling throughout the basin.

- Baffles are typically constructed from the invert of the basin to the crest of the emergency spillway (i.e., design event flows are meant to flow around the baffles and flows greater than the design event would flow over the baffles to the emergency spillway).
- Use of other materials for construction of basin baffles (such as silt fence) may not be appropriate based on the material specifications and will require frequent maintenance (maintain after every storm event). Maintenance may not be feasible when required due to flooded conditions resulting from frequent (i.e., back to back) storm events. Use of alternative baffle materials should not deviate from the intended purpose of the material, as described by the manufacturer.
- Sediment basins are best used in conjunction with erosion controls.
- Basins with an impounding levee greater than 4.5 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 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- A forebay, constructed upstream of the basin, may be provided to remove debris and larger particles.
- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- The principal outlet should 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 should 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.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.

- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

The cost of a sediment basin is highly variable and is dependent of the site configuration. To decrease basin construction costs, designers should consider using existing site features such as berms or depressed area to site the sediment basin. Designers should also consider potential savings associated with designing the basin to minimize the number of maintenance cycles and siting the basin in a location where a permanent BMP (e.g., extended detention basin) is required for the project site.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level and as required by local requirements. It is recommended that at a minimum, basins be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the basin must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance should be managed properly. The sediment should be appropriately evaluated and used or disposed of accordingly. Options include: incorporating sediment into earthwork on the site (only if there is no risk that sediment is contaminated); or off-site export/disposal at an appropriate location (e.g., sediment characterization and disposal to an appropriate landfill).
- Remove standing water from basin within 96 hours after accumulation.
- If the basin does not drain adequately (e.g., due to storms that are more frequent or larger than the design storm or other unforeseen site conditions), dewatering should be conducted in accordance with appropriate dewatering BMPs (see NS-2) and in accordance with local permits as applicable.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

References

A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zones, Metropolitan Washington Council of Governments, March 1992.

Draft-Sedimentation and Erosion Control, an Inventory of Current Practices, USEPA. April 1990.

U.S. Environmental Protection Agency (USEPA). Erosion and Sediment Control, Surface Mining in the Eastern U.S., U.S. Environmental Protection Agency, Office of Water, Washington, DC,Washington, D.C., 1976.

Fifield, J.S. Designing for Effective Sediment and Erosion Control on Construction Sites. Forester Press, Santa Barbara, CA. 2004.

Goldman S.J., Jackson K. and Bursztynsky T.A. Erosion and Sediment Control Handbook. McGraw-Hill Book Company, 1986.

U.S. Environmental Protection Agency (USEPA). Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters. EPA 840-B-9-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1993.

Guidelines for the Design and Construction of Small Embankment Dams, Division of Safety of Dams, California Department of Water Resources, March 1986.

Haan C.T., Barfield B.J. and Hayes J.C. Design Hydrology and Sedimentology for Small Catchments. Academic Press. 1994.

Inlet/Outlet Alternatives for Extended Detention Basins. State of California Department of Transportation (Caltrans), 2001.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

McLean, J., 2000. Mosquitoes in Constructed Wetlands: A Management Bugaboo? In T.R. Schueler and H.K. Holland [eds.], The Practice of Watershed Protection. pp. 29-33. Center for Watershed Protection, Ellicott City, MD, 2000.

Metzger, M.E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. The Dark Side of Stormwater Runoff Management: Disease Vectors Associated with Structural BMPs, 2002.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Water, Work Group-Working Paper, USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Quality Management Plan for the Lake Tahoe Region, Volume II Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Young, G.K. and Graziano, F., Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission, 1989.

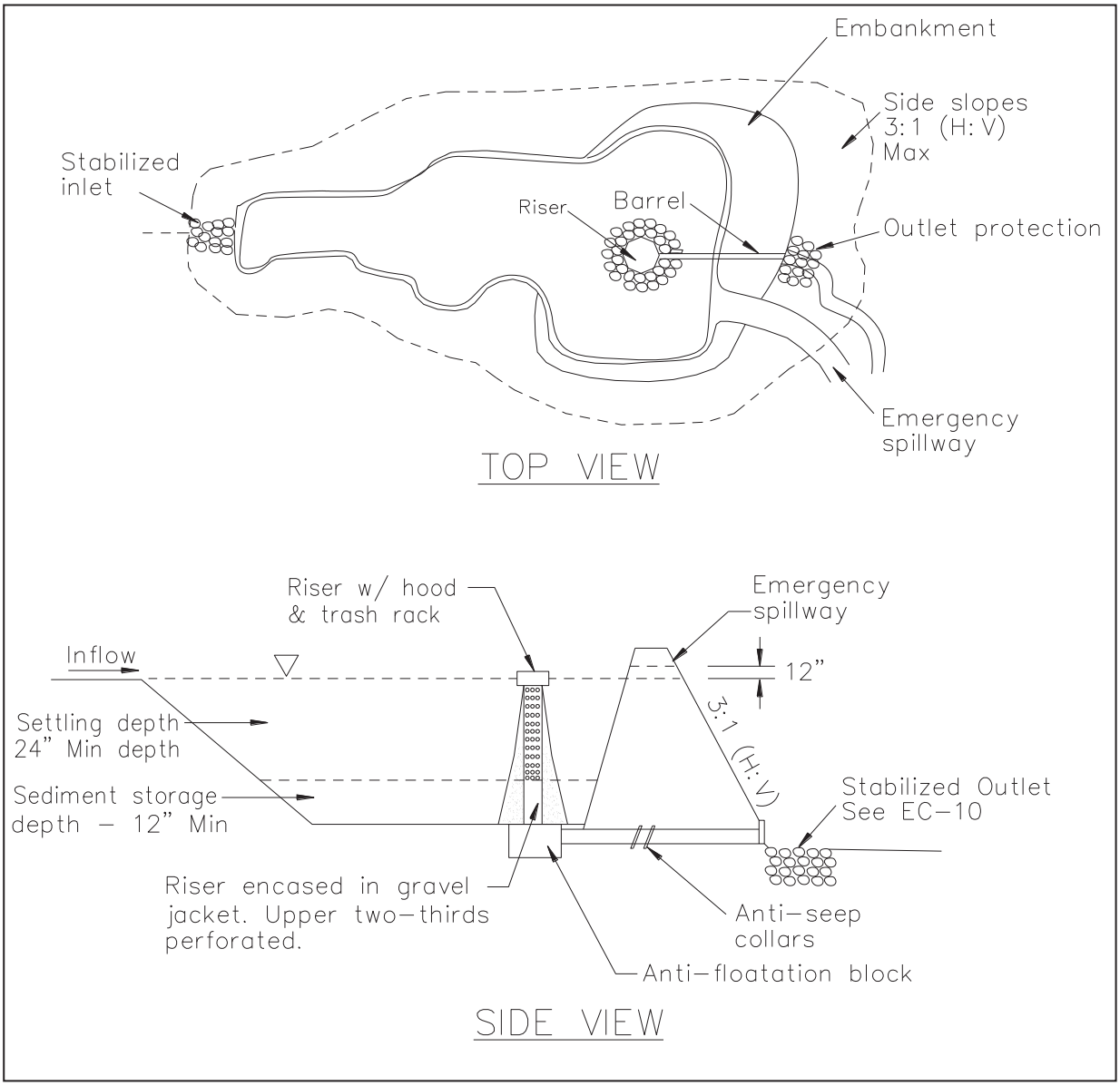


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
MULTIPLE ORIFICE DESIGN
NOT TO SCALE

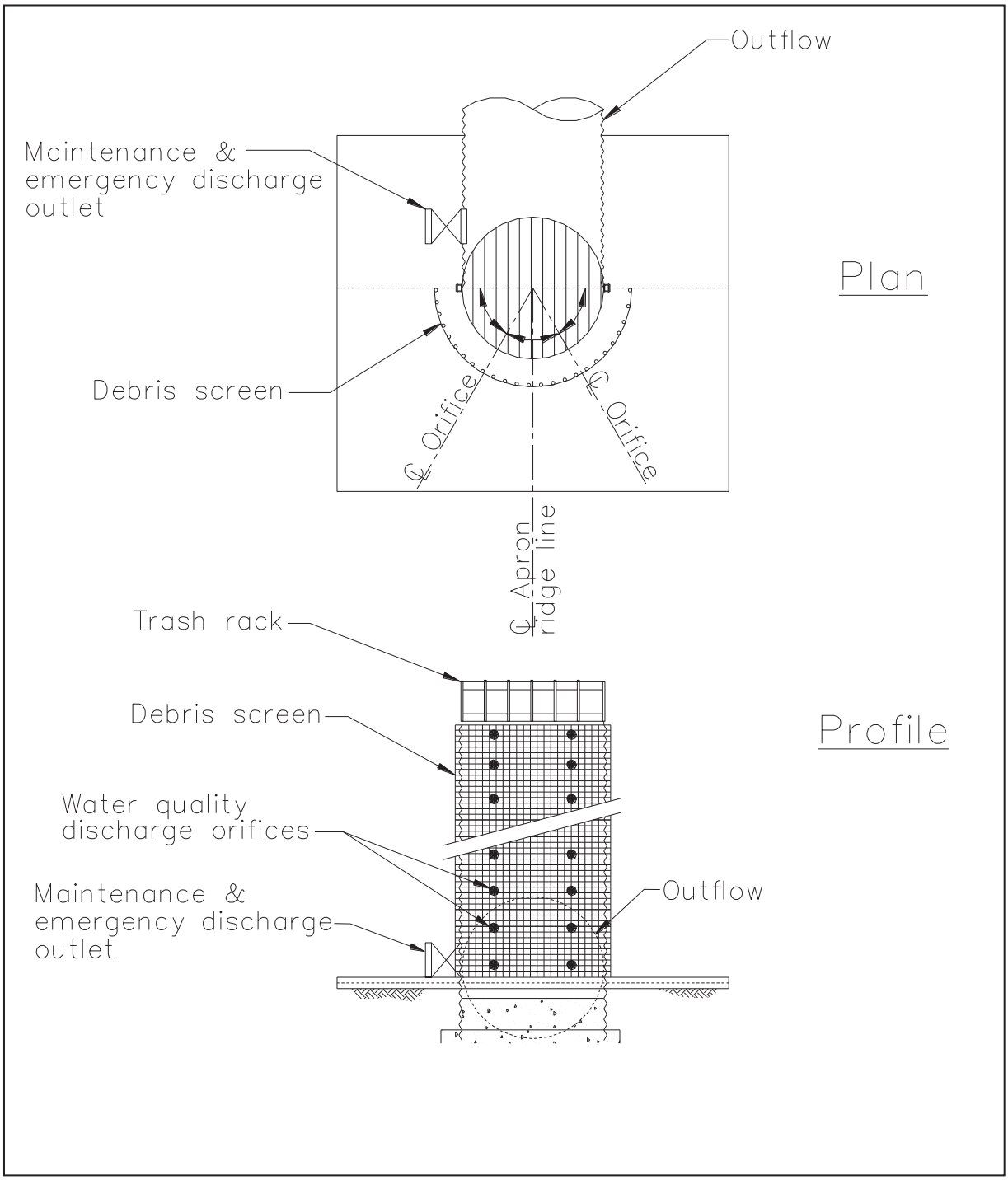


FIGURE 2: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

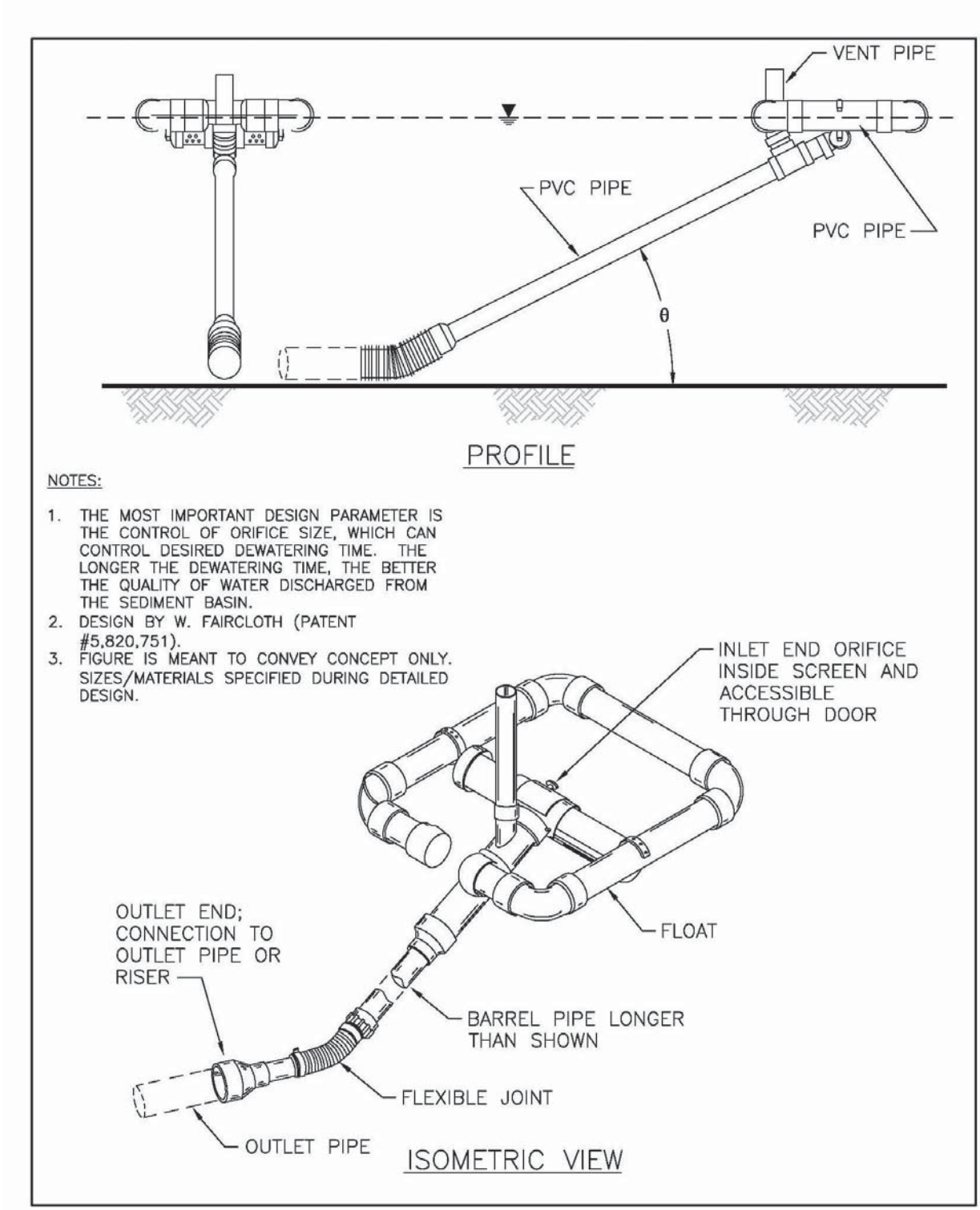


FIGURE 3: TYPICAL SKIMMER
NOT TO SCALE

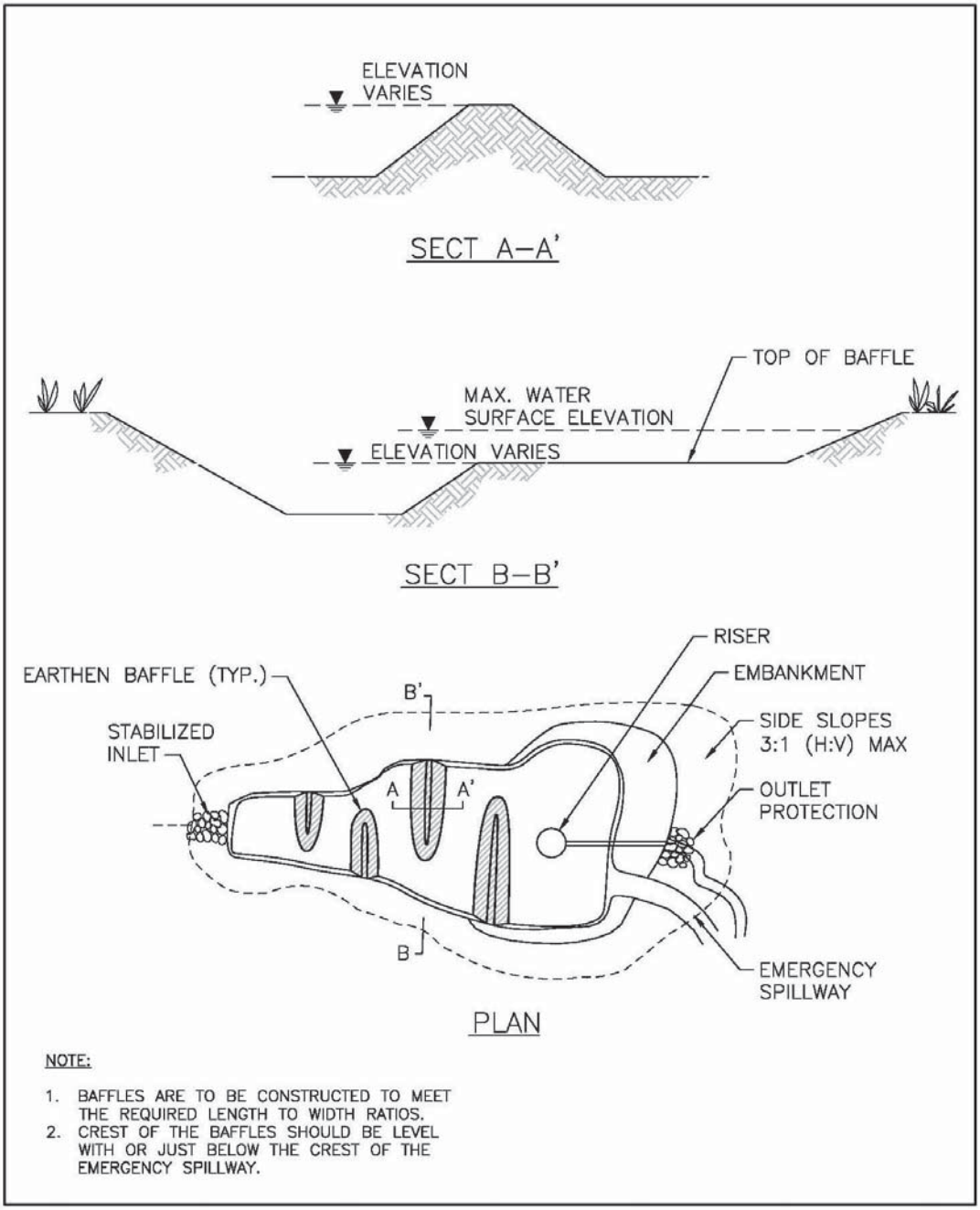
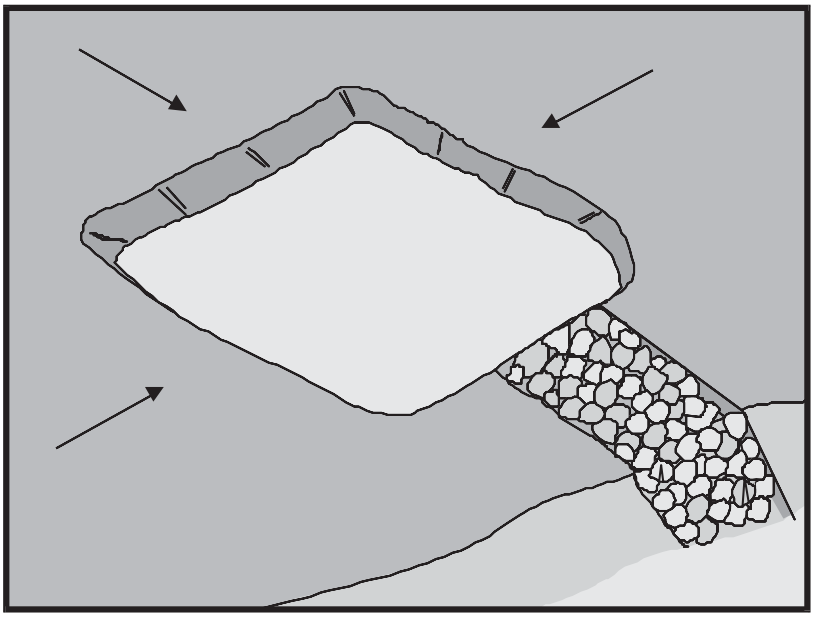


FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN WITH BAFFLES

NOT TO SCALE

Sediment Trap SE-3



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged by gravity flow. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Trap design guidance provided in this fact sheet is not intended to guarantee compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment traps should be used in conjunction with a comprehensive system of BMPs.

Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.

- 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 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

Implementation

Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume

the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criteria for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should 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 should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd^3/acre and 33 yd^3/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 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 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

Installation

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.

- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.
- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.
- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

Costs

Average annual cost per installation and maintenance (18 month useful life) is $0.73 per ft^3 ($1,300 per drainage acre). Maintenance costs are approximately 20% of installation costs.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect outlet area for erosion and stabilize if required.
- Inspect trap banks for seepage and structural soundness, repair as needed.
- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Inspect fencing for damage and repair as needed.
- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 96 hours or less to prevent vector production.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.
- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs per NS-2 shall be implemented at all times during dewatering activities.

References

Brown, W., and T. Schueler. The Economics of Stormwater BMPs in the Mid-Atlantic Region. Prepared for Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD, 1997.

Draft – Sedimentation and Erosion Control, an Inventory of Current Practices, USEPA, April 1990.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Metzger, M.E., D.F. Messer, C.L. Beitia, C.M. Myers, and V.L. Kramer, The Dark Side of Stormwater Runoff Management: Disease Vectors Associated with Structural BMPs, 2002.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

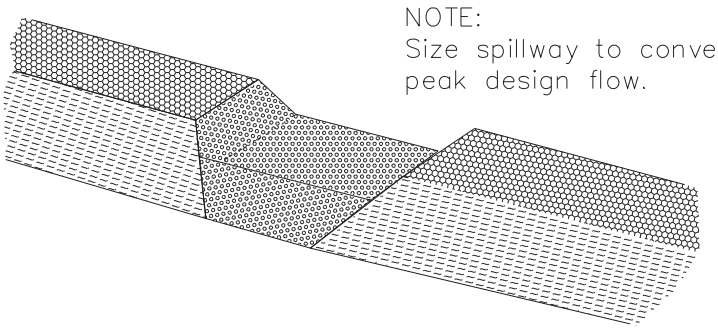
Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

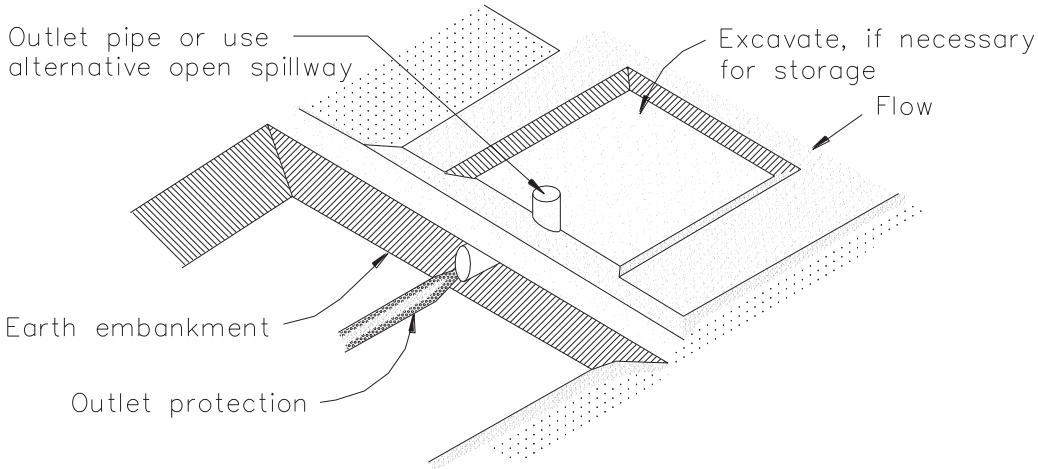
Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

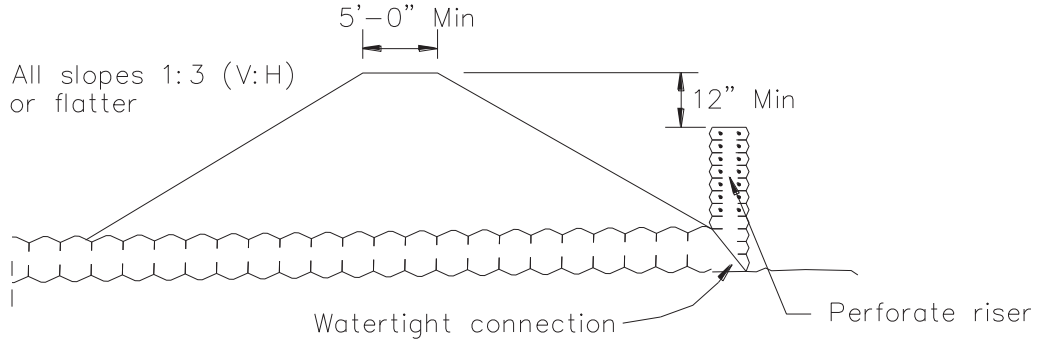
U.S. Environmental Protection Agency (USEPA). Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters. EPA 840-B-9-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL OPEN SPILLWAY

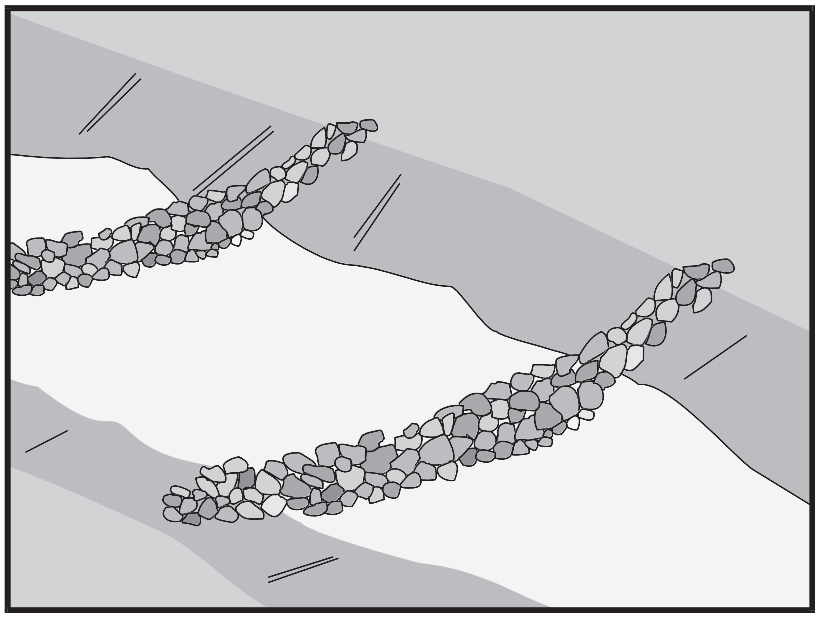




EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE

Check Dams SE-4



Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- 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.
- To act as a grade control structure.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

- Not to be used in live streams or in channels with extended base flows.
- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion potential or sediment-laden flow 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.
- Do not construct check dams with straw bales or silt fence.
- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as as sediment controls. Note that use of 1-2 isolated check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity should be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, either:

- Don't use check dams. Consider alternative BMPs, or.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam (see "Spacing Between Check Dams" detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of

the ditch or swale (see "Typical Rock Check Dam" detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet (see "Gravel Bag Check Dam" detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer's instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- For multiple check dam installation, backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap should be cleaned following each storm event.

- High flows (typically a 2-year storm or larger) should 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 should be removed when grass has matured sufficiently to protect the ditch or swale.

Materials

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.
- Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms.
- Sandbags used for check dams should conform to SE-8, Sandbag Barrier.
- Fiber rolls used for check dams should conform to SE-5, Fiber Rolls.
- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Upper rows or gravel and sand bags shall overlap joints in lower rows.
- Fiber rolls should be trenched in, backfilled, and firmly staked in place.
- Install along a level contour.
- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

Costs

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

References

Draft – Sedimentation and Erosion Control, and Inventory of Current Practices, USEPA, April 1990.

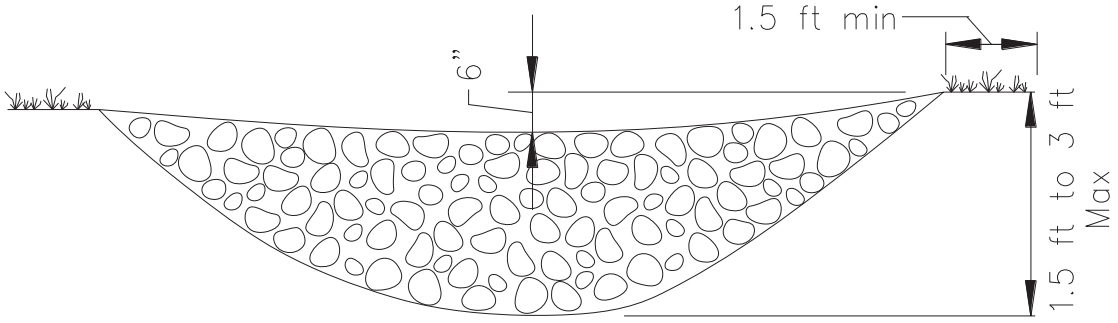
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

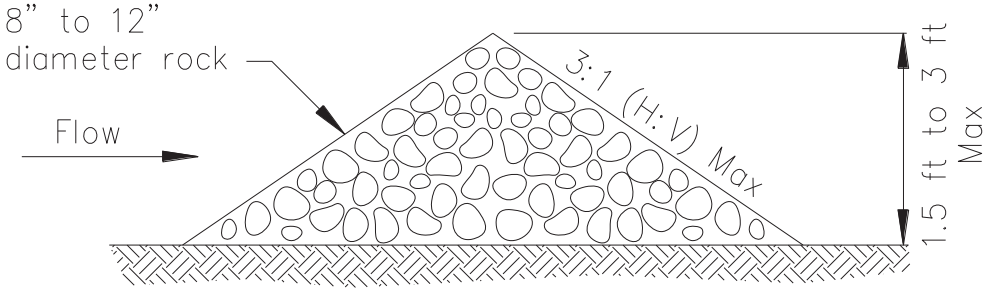
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

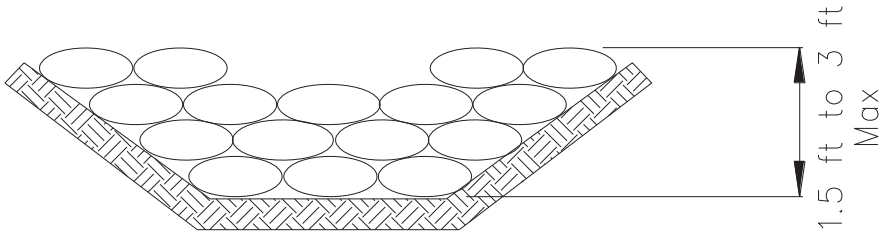


ELEVATION

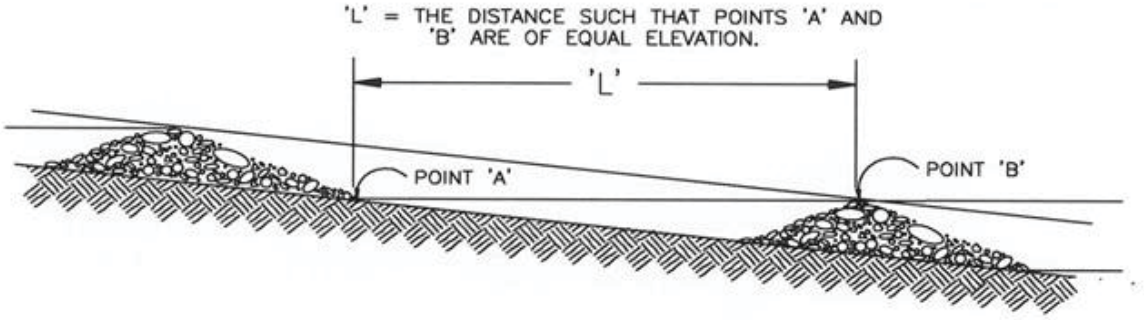


TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE

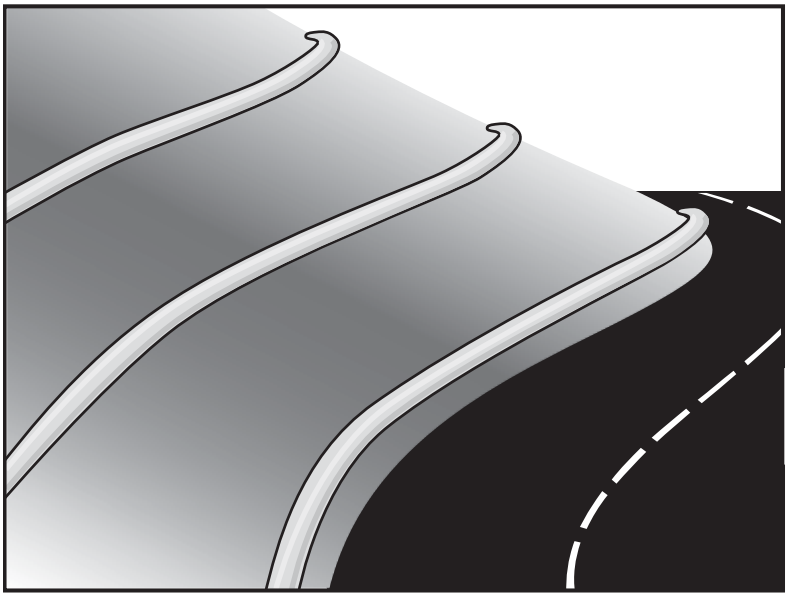


GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE



SPACING BETWEEN CHECK DAMS

Fiber Rolls SE-5



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.
- At operational storm drains as a form of inlet protection.

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Around temporary stockpiles.

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed

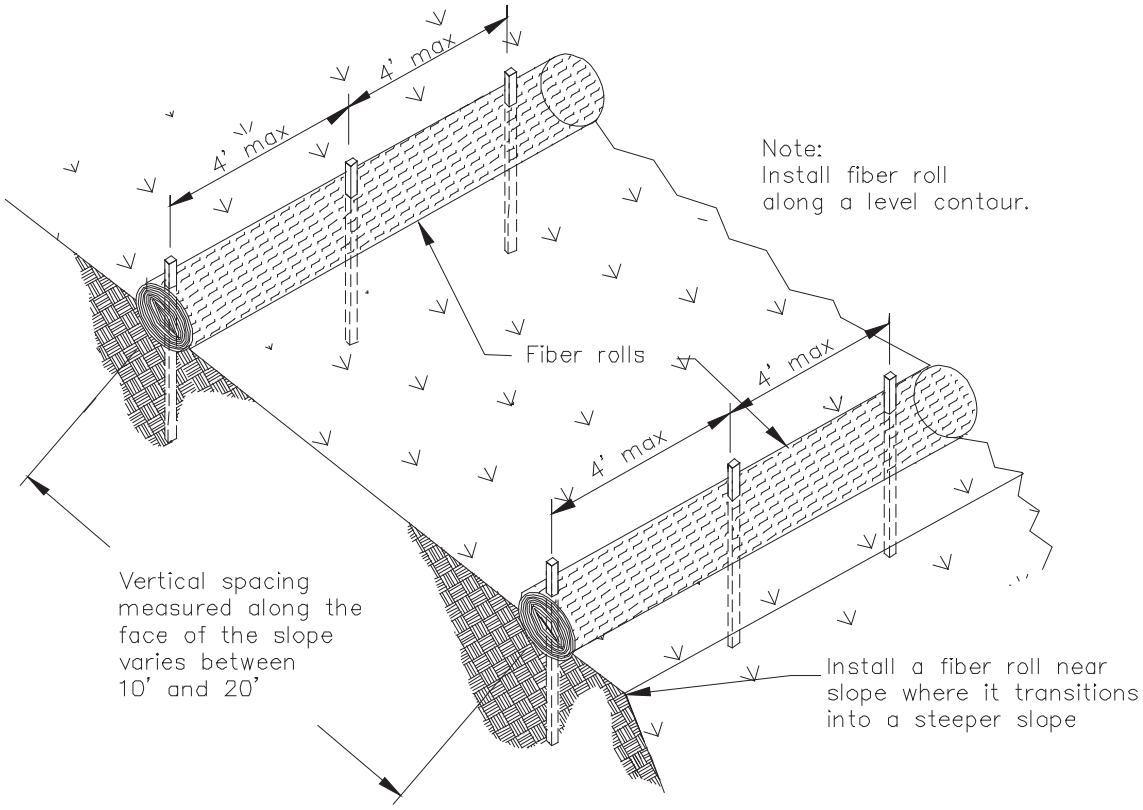
in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.
- Repair any rills or gullies promptly.

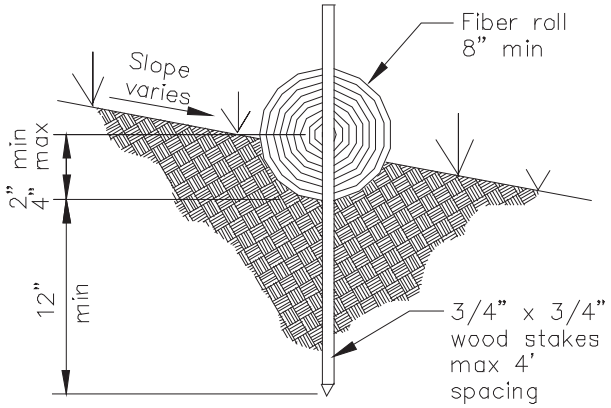
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

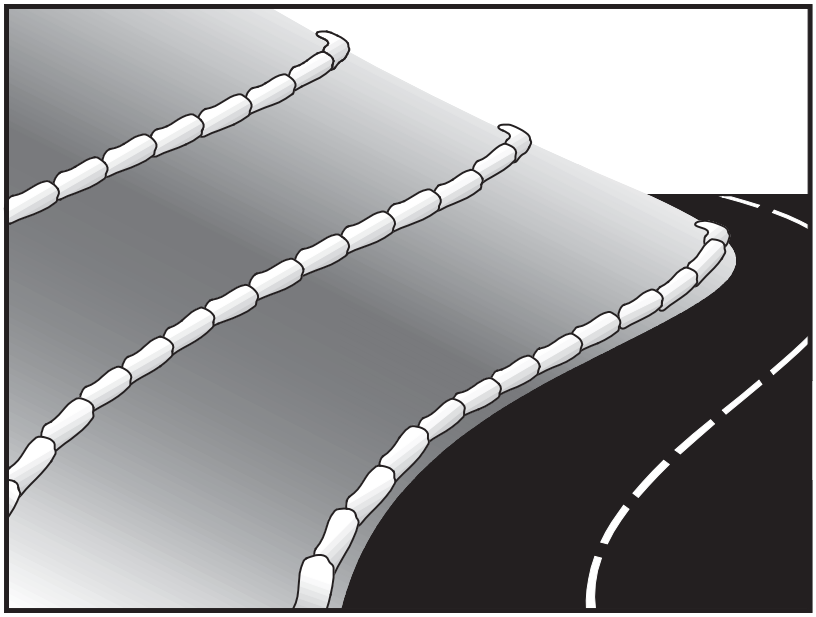


TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Gravel Bag Berm SE-6



Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As a linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-8 Sandbag Barrier

SE-12 Temporary Silt Dike

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- At the top of slopes to divert runoff away from disturbed slopes.
- As chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the berm, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Durability of gravel bags is somewhat limited and bags may need to be replaced when installation is required for longer than 6 months.
- Easily damaged by construction equipment.
- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel-filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate gravel bag berms on level contours.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 (H:V) or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 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 should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** Fill material should be 0.5 to 1 in. crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Material costs for gravel bags are average and are dependent upon material availability. $2.50-3.00 per filled gravel bag is standard based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.

- Reshape or replace gravel bags as needed.

- Repair washouts or other damage as needed.

- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

References

Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Street Sweeping and Vacuuming SE-7



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

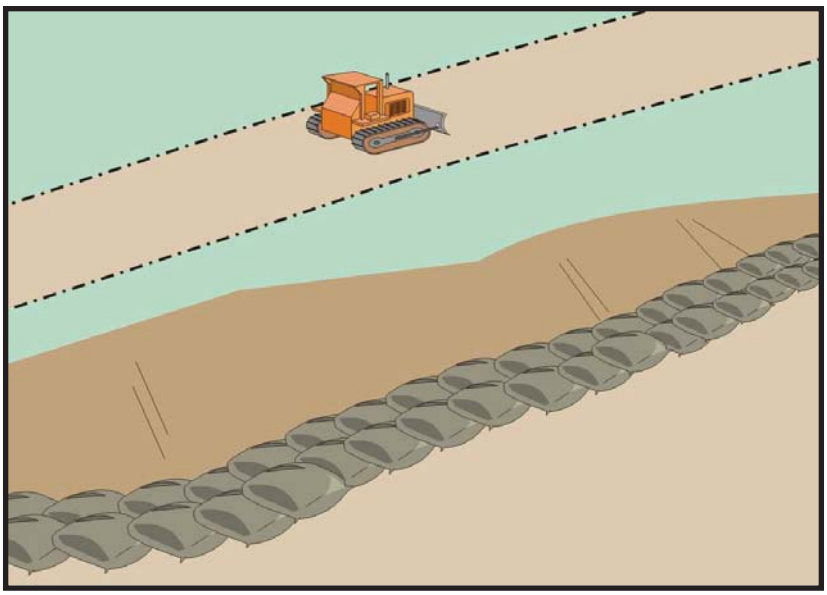
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- 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.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Sandbag Barrier SE-8



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be a suitable control measure for the applications described below. It is important to consider that sand bags are less porous than gravel bags and ponding or flooding can occur behind the barrier. Also, sand is easily transported by runoff if bags are damaged or ruptured. The SWPPP Preparer should select the location of a sandbag barrier with respect to the potential for flooding, damage, and the ability to maintain the BMP.

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes.
  - As sediment traps at culvert/pipe outlets.
  - Below other small cleared areas.
  - Along the perimeter of a site.
  - Down slope of exposed soil areas.
  - Around temporary stockpiles and spoil areas.
  - Parallel to a roadway to keep sediment off paved areas.
  - Along streams and channels.

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
  - At the top of slopes to divert runoff away from disturbed slopes.
  - As check dams across mildly sloped construction roads.

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Sandbags are not intended to be used as filtration devices.
- Easily damaged by construction equipment.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Durability of sandbags is somewhat limited and bags will need to be replaced when there are signs of damage or wear.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. Sand-filled bags have limited porosity, which is further limited as the fine sand tends to quickly plug with sediment, limiting or completely blocking the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms or SE-14, Biofilter Bags. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to gravel bag berms, but less porous. Generally, sandbag barriers should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate sandbag barriers on a level contour.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Sandbags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

  - Slope inclination 2:1 (H:V) or greater: Sandbags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- Butt ends of bags tightly.
- Overlap butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 (H:V) or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- See typical sandbag barrier installation details at the end of this fact sheet.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 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 an acceptable substitute, as sand can more easily mobilize out of burlap.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 3 (Caltrans Standard Specification, Section 25) or similar permeable material free from clay and deleterious material, such as recycled concrete or asphalt.

Costs

Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Additional labor is required to fill the bags. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag. These costs are based upon vendor research.

Inspection and Maintenance

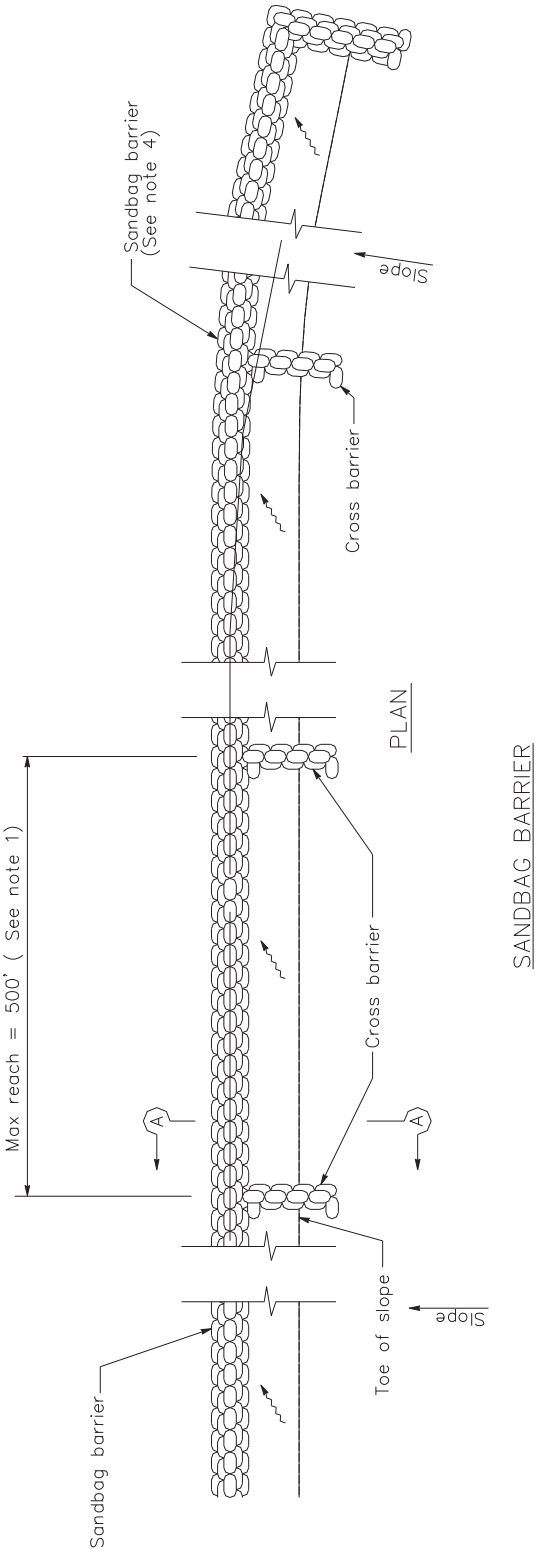
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

Standard Specifications for Construction of Local Streets and Roads, California Department of Transportation (Caltrans), July 2002.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

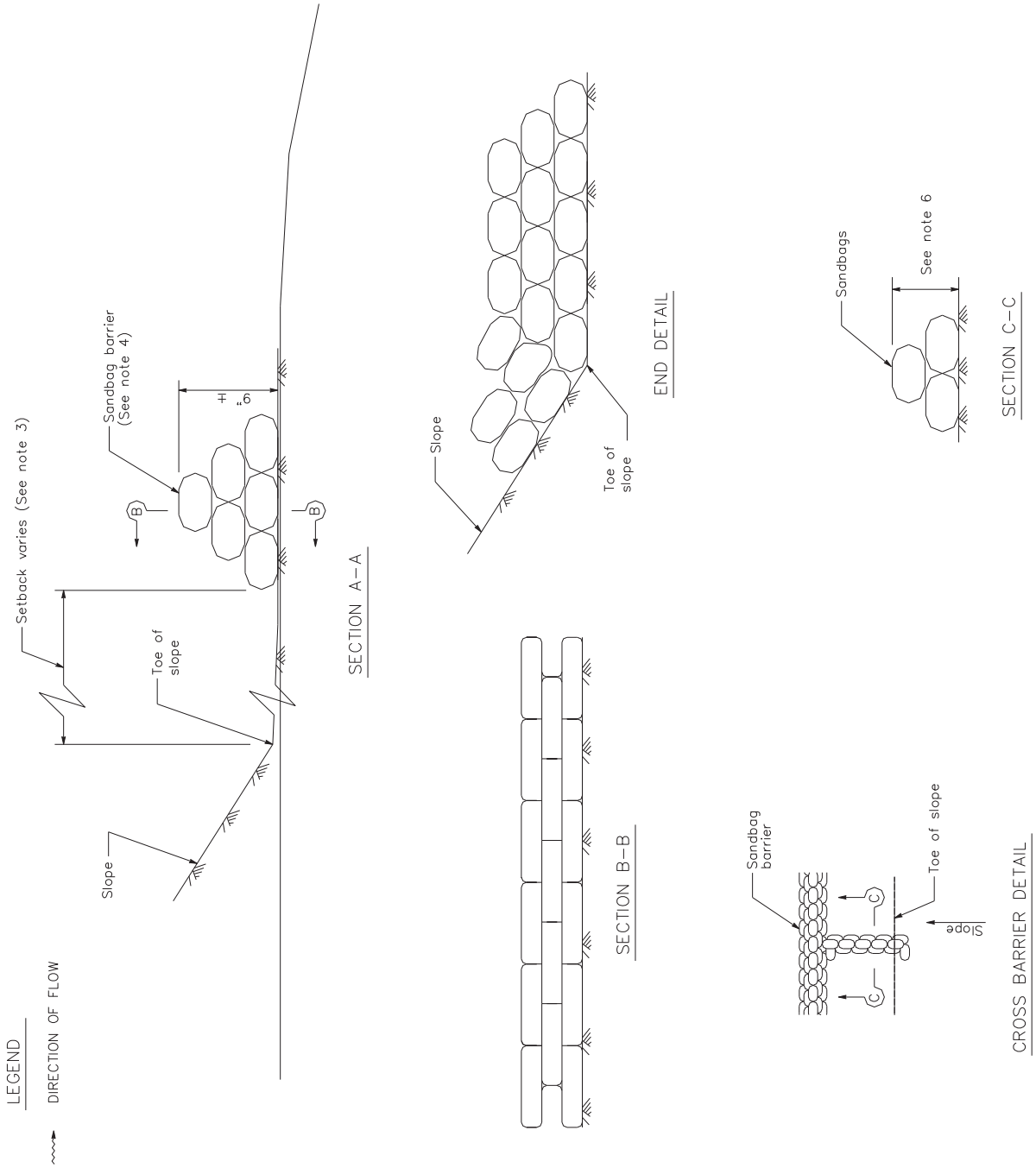
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



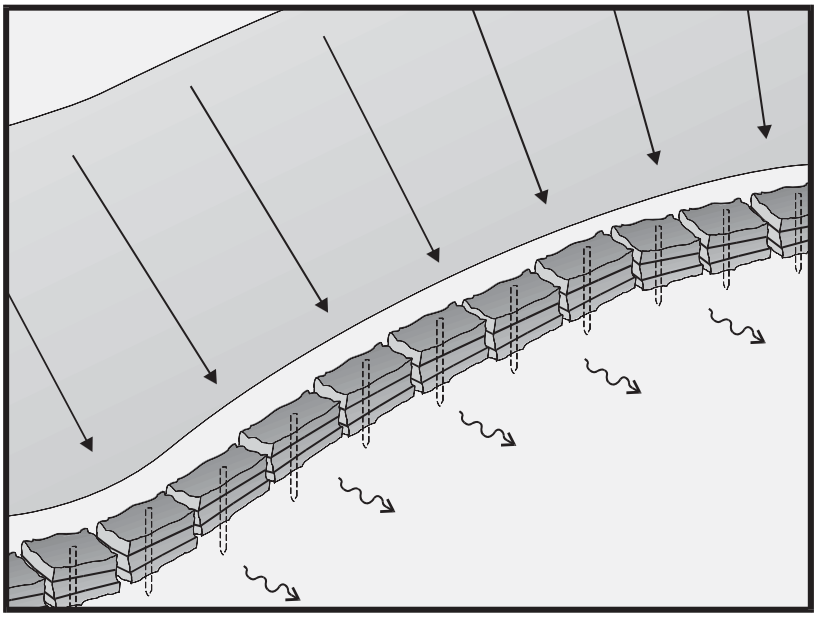
SANDBAG BARRIER

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 500'.
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.


LEGEND
DIRECTION OF FLOW
Setback varies (See note 3)
Sandbag barrier (See note 4)
H
B
B
Toe of slope
Slope
SECTION A–A
Slope
Toe of slope
END DETAIL
SECTION B–B
Sandbags
See note 6
SECTION C–C
Sandbag barrier
C
C
Toe of slope
Slope
CROSS BARRIER DETAIL

Straw Bale Barrier SE-9



Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet-flow runoff, allowing sediment to settle out.

Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Temporary Silt Dike

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.

- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.
- Maximum flow path to the barrier should be limited to 100 ft.
- Straw bale barriers should consist of two parallel rows.
  - Butt ends of bales tightly
  - Stagger butt joints between front and back row
  - Each row of bales must be trenched in and firmly staked
- Straw bale barriers are limited in height to one bale laid on its side.
- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.
- See attached figure for installation details.

Materials

- ***Straw Bale Size:*** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.
- ***Bale Bindings:*** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.
- ***Stakes:*** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should 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 should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Costs

Straw bales cost $5 - $7 each. Adequate labor should be budgeted for installation and maintenance.

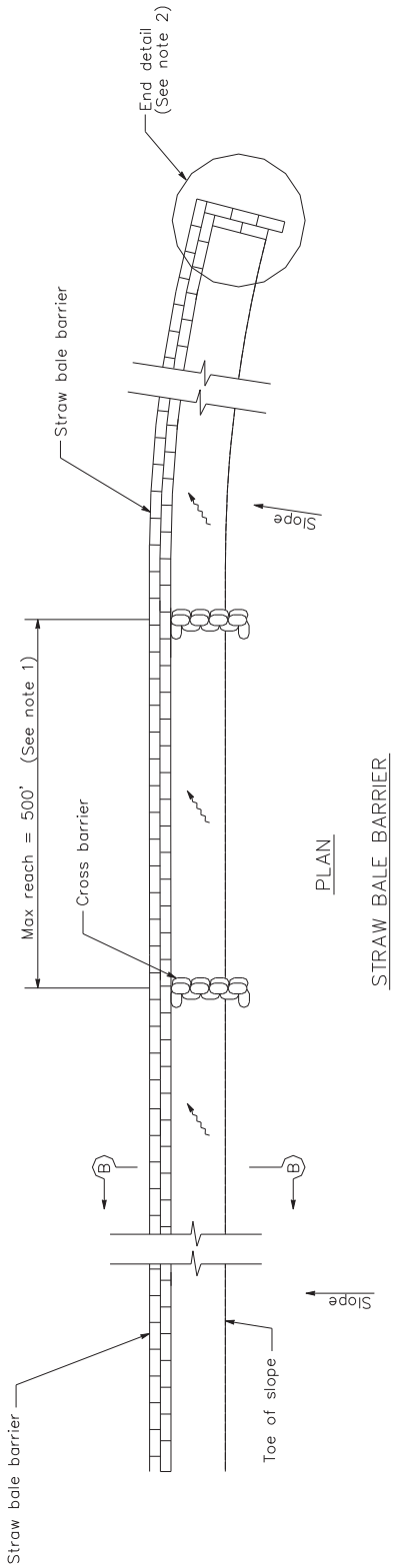
Inspection and Maintenance

Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.
- Replace or repair damaged bales as needed.
- Repair washouts or other damages as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



PLAN

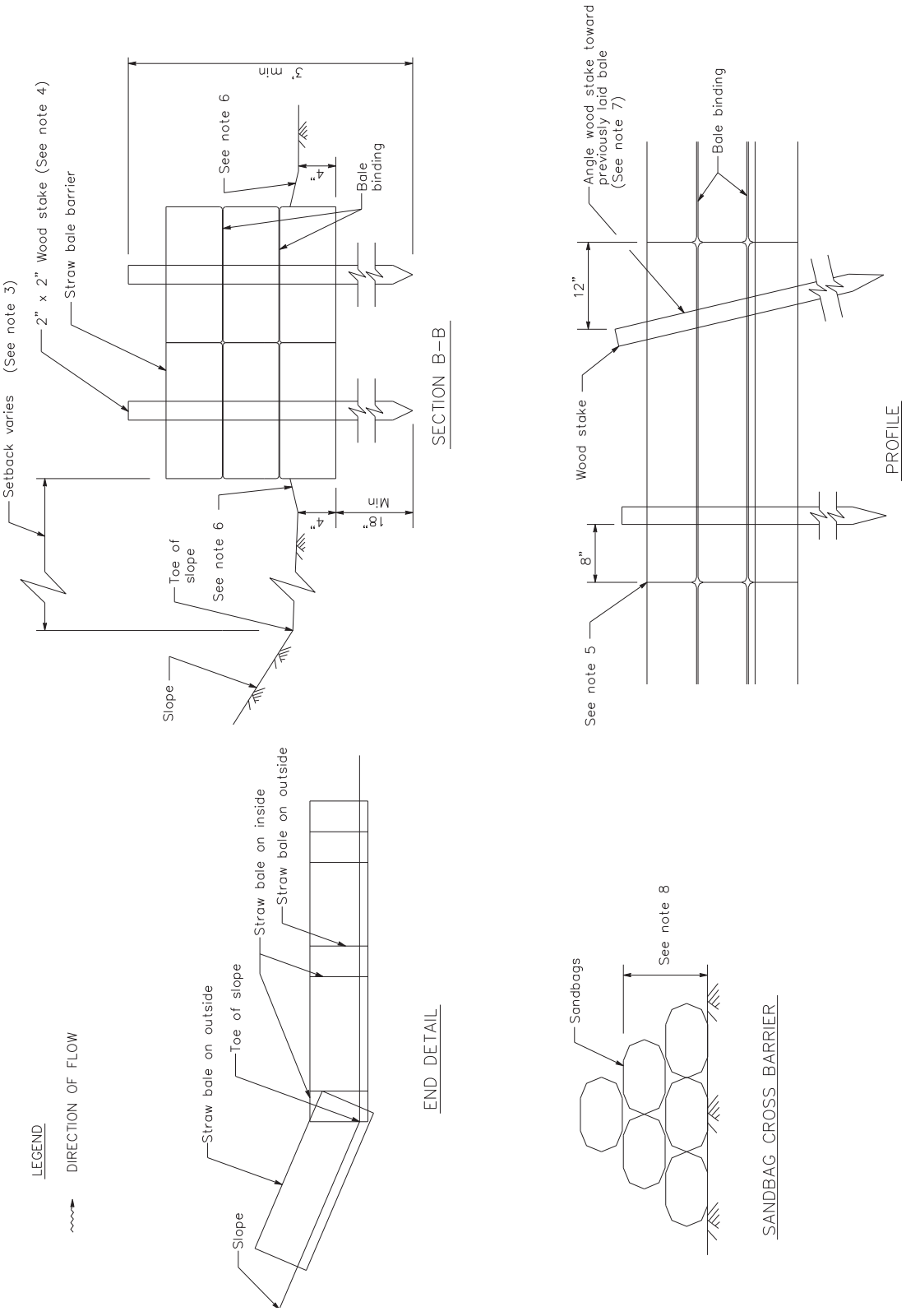
STRAW BALE BARRIER

LEGEND

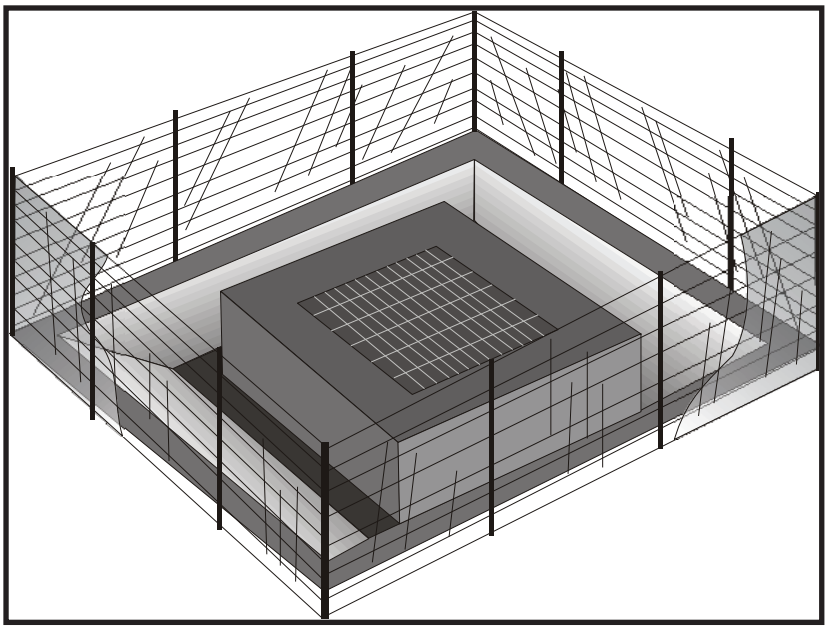
DIRECTION OF FLOW

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 500'.
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. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.


Setback varies (See note 3)
2" x 2" Wood stake (See note 4)
Straw bale barrier
See note 6
Bale binding
Min 3"
4"
Min 18"
Toe of slope
See note 6
Slope
SECTION B-B
Angle wood stake toward previously laid bale (See note 7)
Bale binding
12"
Wood stake
8"
See note 5
PROFILE
Straw bale on inside
Straw bale on outside
Straw bale on outside
Toe of slope
Slope
END DETAIL
Sandbags
See note 8
SANDBAG CROSS BARRIER
LEGEND
DIRECTION OF FLOW

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

SE-13 Compost Socks and Berms

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

- Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use

other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and 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.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.
- Seven types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.

- Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
- Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
- Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
- Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
- Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
- Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
- Compost Socks: Allow filtered run-off to pass through the compost while retaining sediment and potentially other pollutants (SE-13). Appropriate for flows under 1.0 cfs.

- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence*** **-** Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.

  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap -*** Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag -*** Flow from a severe storm should 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 SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.

  2. Leave room upstream of barrier for water to pond and sediment to settle.

  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.

  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter -*** Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.

  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.

  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.

  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.
    2. Biofilter bags should be placed around inlets to intercept runoff flows.
    3. All bag joints should overlap by 6 in.
    4. Leave room upstream for water to pond and for sediment to settle out.
    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

- ***DI Protection Type 7 – Compost Socks*** – A compost sock can be assembled on site by filling a mesh sock (e.g., with a pneumatic blower). Compost socks do not require special trenching compared to other sediment control methods (e.g., silt fence). Compost socks should conform to specification detailed in SE-13, Compost Socks and Berms.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.
- See SE-13 for Compost Sock cost information.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

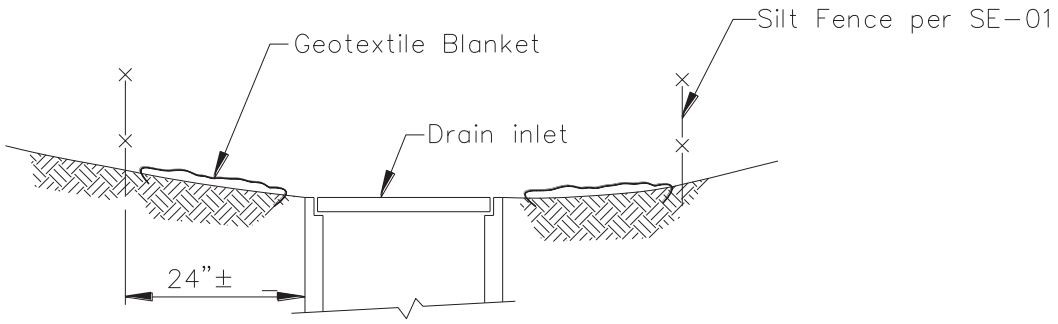
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.
    - Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

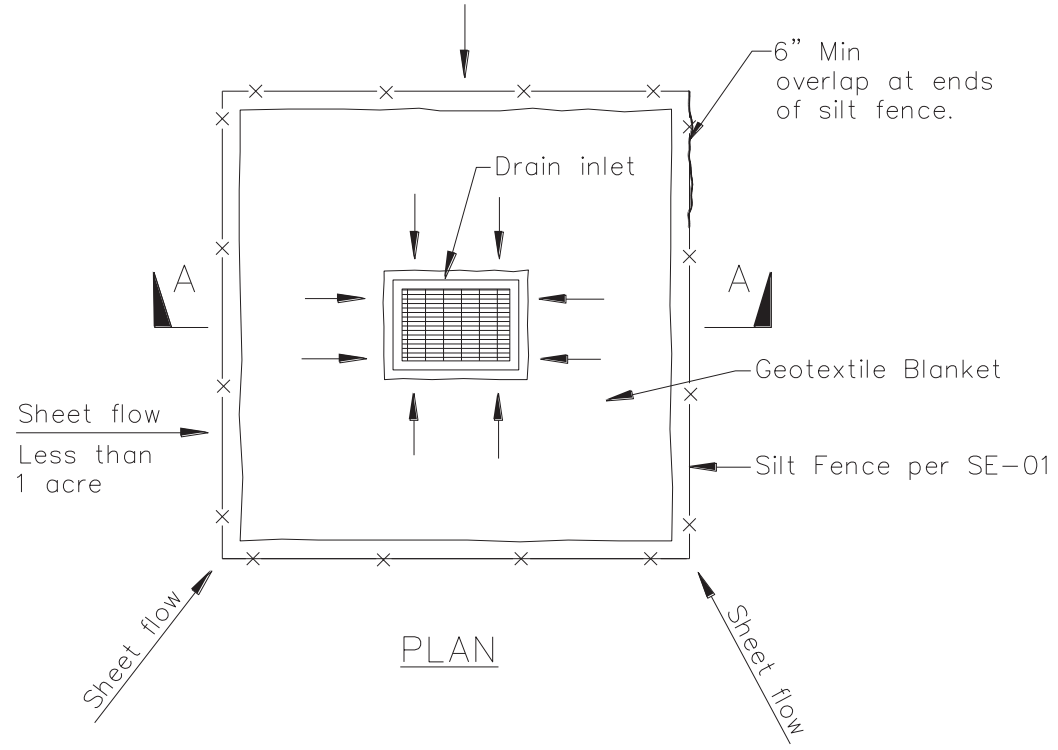
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A–A

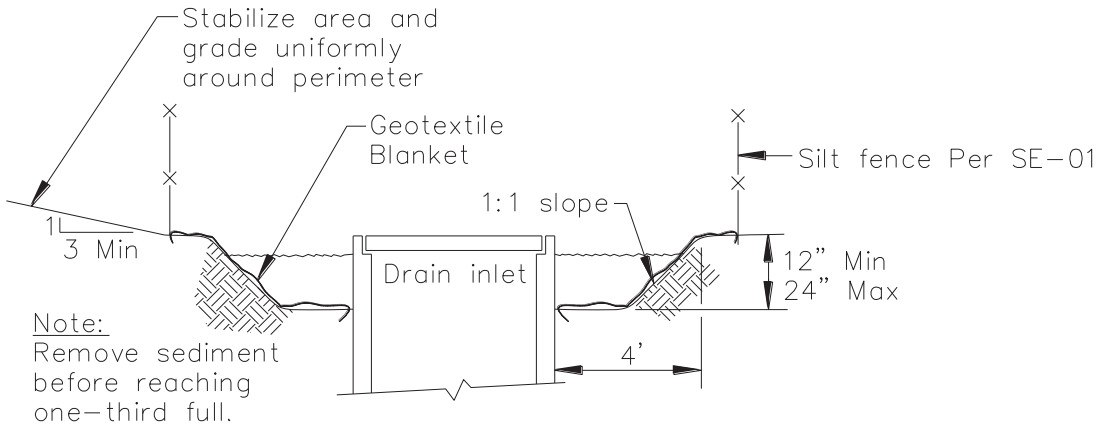


PLAN

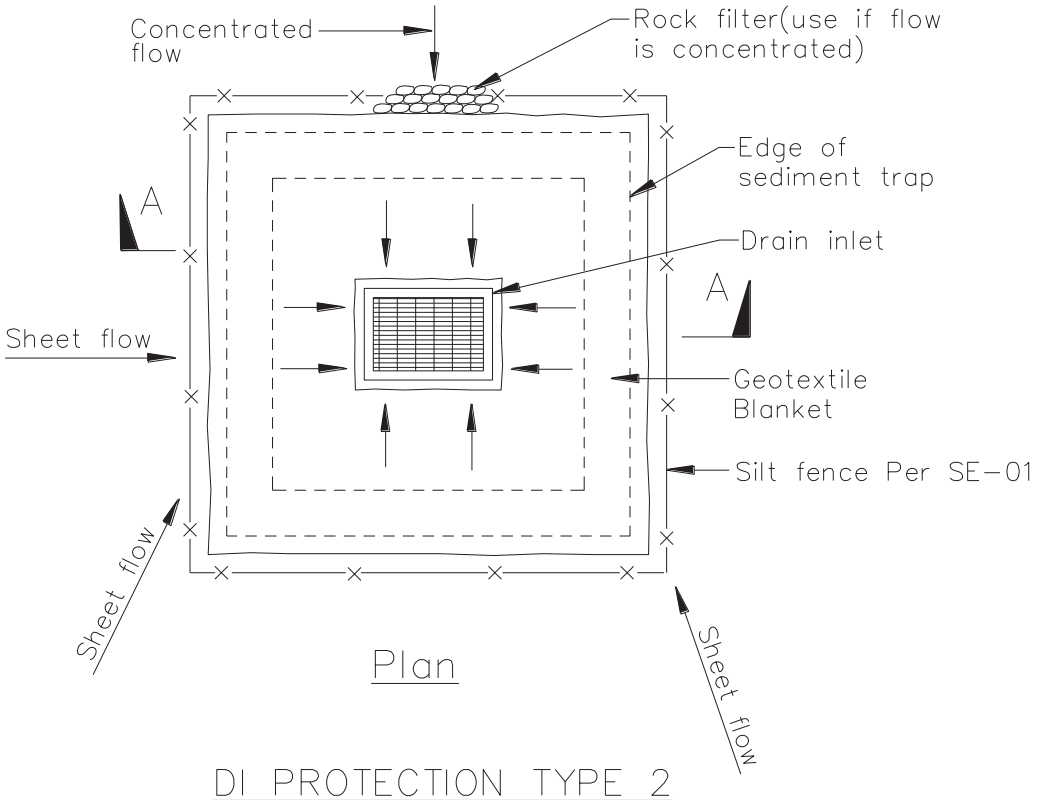
DI PROTECTION TYPE 1
NOT TO SCALE

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.



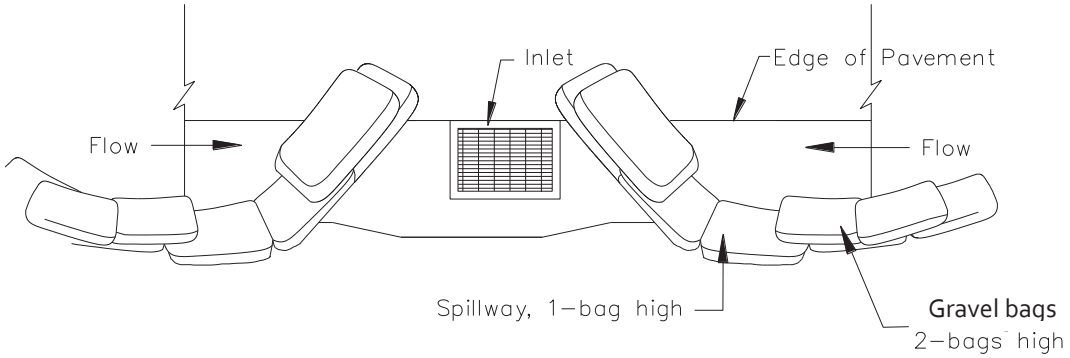
Section A–A



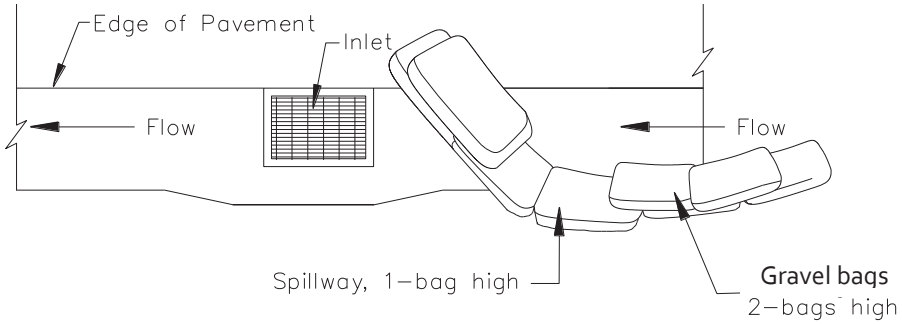
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

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 ON SUMP

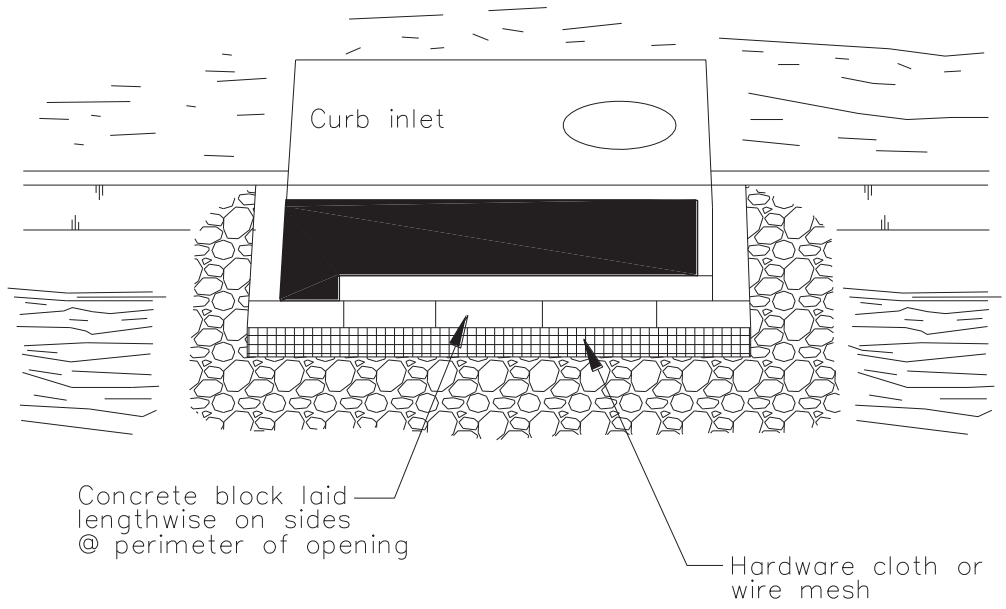


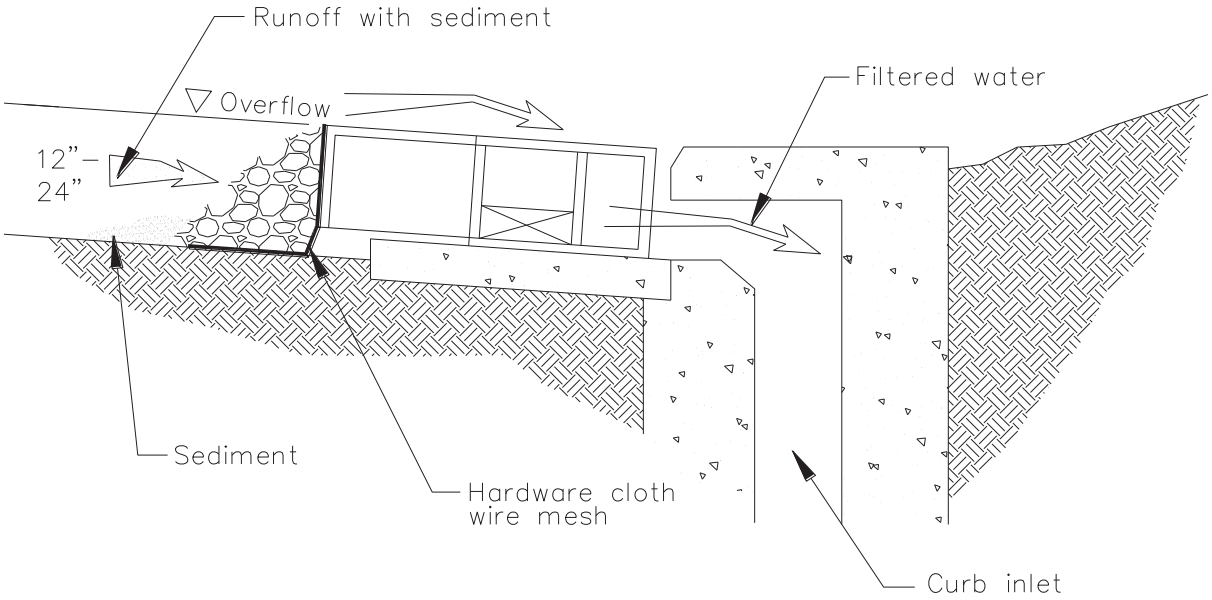
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.
6. Protection can be effective even if it is not immediately adjacent to the inlet provided that the inlet is protected from potential sources of pollution.

DI PROTECTION TYPE 3
NOT TO SCALE

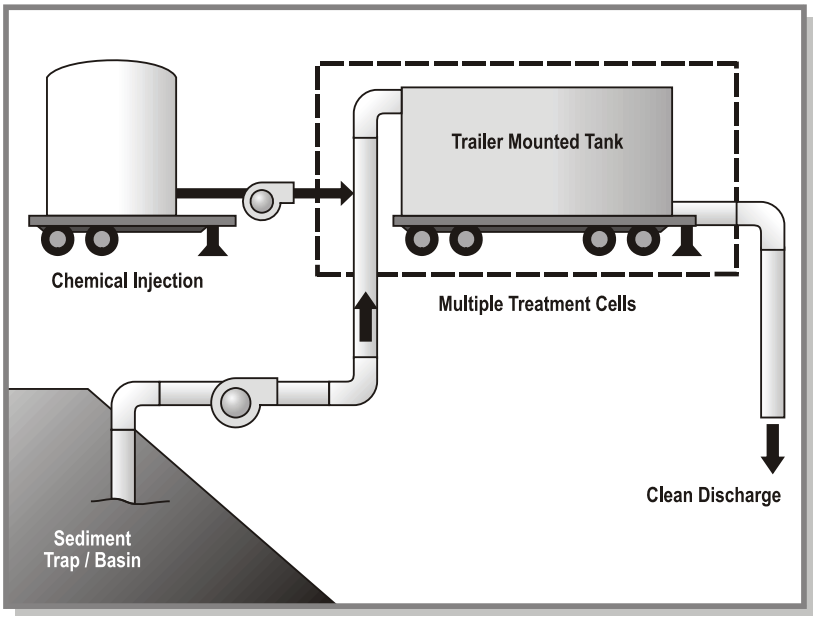




DI PROTECTION – TYPE 4

NOT TO SCALE

Active Treatment Systems SE-11



Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Active Treatment Systems (ATS) reduce turbidity of construction site runoff by introducing chemicals to stormwater through direct dosing or an electrical current to enhance flocculation, coagulation, and settling of the suspended sediment. Coagulants and flocculants are used to enhance settling and removal of suspended sediments and generally include inorganic salts and polymers (USACE, 2001). The increased flocculation aids in sedimentation and ability to remove fine suspended sediments, thus reducing stormwater runoff turbidity and improving water quality.

Suitable Applications

ATS can reliably provide exceptional reductions of turbidity and associated pollutants and should be considered where turbid discharges to sediment and turbidity sensitive waters cannot be avoided using traditional BMPs. Additionally, it may be appropriate to use an ATS when site constraints inhibit the ability to construct a correctly sized sediment basin, when clay and/or highly erosive soils are present, or when the site has very steep or long slope lengths.

Limitations

Dischargers choosing to utilize chemical treatment in an ATS must follow all guidelines of the Construction General Permit Attachment F – Active Treatment System Requirements. General limitations are as follows:

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Numeric Effluent Limit (NEL) for all discharges (10 NTU daily flow-weighted average)
- Limited availability of chemical residual testing procedures that meet permit requirements for flow-through treatment
- Specific field and classroom ATS training required to operate equipment
- Batch treatment requires extensive toxicity testing of effluent
- Batch treatment requires large footprint to accommodate treatment cells
- Requires additional filtration to remove residual floc and treatment chemicals prior to discharge
- Petroleum based polymers should not be used
- Requires site-specific design and equipment
- Limited discharge rates depending on receiving water body
- Labor intensive operation and maintenance
- ATS costs are higher on a unit basis for smaller sites that would be expected to have a lower volume of treated runoff
- ATS costs are seasonably variable due to increases or decreases in rainfall volumes

Implementation

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling, but are ineffective at removing smaller particulates such as clay and fine silt. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). ATS may be used to reduce the turbidity of stormwater runoff. With an ATS, very high turbidities can be reduced to levels comparable to what is found in streams during dry weather.

Criteria for ATS Product Use

Chemically treated stormwater discharged from construction sites must be non-toxic to aquatic organisms. The following protocol should be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- An ATS Plan, which includes an Operation and Maintenance component, a Monitoring, Sampling and Reporting component, a Health and Safety component, and a Spill Prevention component must be prepared and submitted to the Regional Water Quality Control Board (RWQCB).

- Treatment chemicals should be approved by EPA for potable water use or otherwise be demonstrated to be protective of human health and the environment. Chemical residual or whole effluent toxicity testing is required.

- Prior to field use of chemical treatment, jar tests are to be conducted to demonstrate that turbidity reduction necessary to meet the NELs and receiving water criteria can be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions. Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability. A minimum of six site-specific jar tests must be conducted per chemical.

- The proposed maximum dosage should be at least a factor of five lower than the no observed effects concentration (NOEC).

- Effluent discharge from an ATS to a receiving water is conditional upon the favorable results of full-scale whole effluent bioassay/toxicity testing for batch treatment systems and upon chemical residuals testing for flow-through systems.

- Contact the RWQCB for a list of treatment chemicals that may be pre-approved for use.

Active Treatment System Design Considerations

The design and operation of an ATS should take into consideration the factors that determine optimum, cost-effective performance. While site characteristics will influence system design, it is important to recognize the following overriding considerations:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is an optimum dosage rate. This is a situation where the adage "adding more is always better" is not the case.

- The coagulant must be mixed rapidly into the water to insure proper dispersion.

- The mixing system for batch treatment must be sized to provide adequate mixing for the design storage volume. Lack of adequate mixing during the flocculation phase results in flocs that are too small and/or insufficiently dense. Too much mixing can rapidly destroy floc as it is formed.

- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a filtration system such as sand, bag, or cartridge filter that would catch any unintended floc discharge.

- ATS is also regulated for pH of the discharge. A pH-adjusting chemical should be added into the treated water to control pH if the selected coagulant requires alteration of the pH of the discharge outside of the acceptable range.

Active Treatment System Design

ATS can be designed as batch treatment systems using either ponds or portable trailer-mounted tanks, or as flow-through systems using any number of proprietary designed systems.

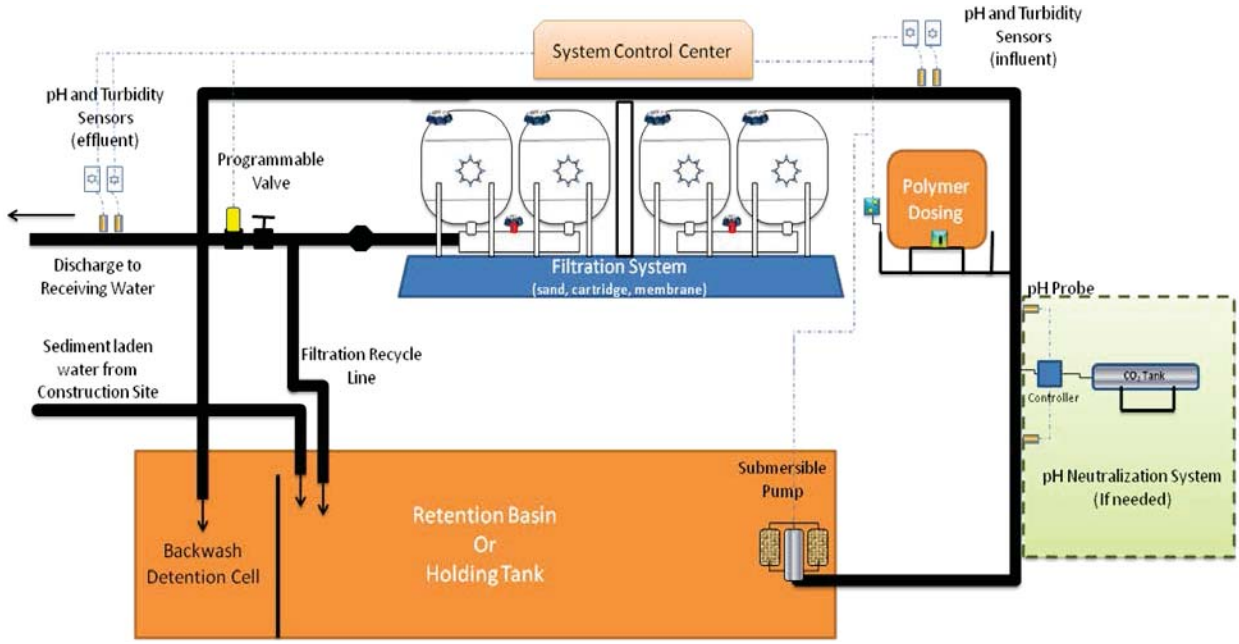


Figure has been adapted from Port of Seattle response to Washington Dept. of Ecology Action Order 2948

Batch Treatment

Batch Treatment systems consist of the stormwater collection system (either temporary diversion or the permanent site drainage system); a sediment basin, trap or holding tanks; pumps; a chemical feed system; treatment cells; and, interconnecting piping.

Batch treatment systems should use a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be basins, traps, or tanks. Portable tanks may also be suitable for some sites.

The following equipment should be located in a secured, covered location:

- The chemical injector
- Secondary contaminant for acid, caustic, buffering compound, and treatment chemical
- Emergency shower and eyewash
- Monitoring equipment which consists of a pH meter and a turbidimeter (if not already within the instrumentation panel of the chemical injector)

Flow-through Treatment

At a minimum, a flow-through ATS system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), an untreated stormwater storage pond or holding tank, and a chemically enhanced filtration system.

Stormwater is collected at interception point(s) on the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area.

The stormwater is stored until treatment occurs. It is important that the holding pond be large enough to provide adequate storage.

Stormwater is then pumped from the untreated stormwater storage pond to the chemically enhanced filtration system where polymer is added. Adjustments to pH may be necessary before chemical addition. The filtration system continually monitors the stormwater for turbidity and pH. If the discharge water is out of the acceptable turbidity or pH range, the water is recycled to the untreated stormwater pond (or holding tank) where it can be retreated. Flow through systems must ensure that:

- Cumulative flow volume shall be recorded daily. The data recording system shall have the capacity to record a minimum of seven days of continuous data.
- Instrumentation systems are interfaced with system control to provide auto shutoff or recirculation in the event that effluent measurements exceed turbidity or pH.
- Upon system upset, power failure, or other catastrophic event, the ATS will default to a recirculation mode or safe shut down.
- The instrumentation system provides a method for controlling coagulant dose, to prevent potential overdosing.

Sizing Criteria

An ATS shall be designed and approved by a Certified Professional in Erosion and Sediment Control (CPESC), a Certified Professional in Storm Water Quality (CPSWQ); a California registered civil engineer; or any other California registered engineer.

ATS must be designed to capture and treat (within 72 hours) runoff from the 10-year 24-hour storm event. The runoff volume of the watershed area to be treated from this size storm event is required to be calculated using the Rational Method with a runoff coefficient of 1.

If sediment basins are used to capture flow-through or batch treatment, see SE-2, Sediment Basin, for design criteria. Bypass should be provided around the ATS to accommodate extreme storm events. Primary settling should be encouraged in the sediment basin/storage pond. A forebay with access for maintenance may be beneficial.

The permissible discharge rate governed by potential downstream effect should be used to calculate the recommended size of the treatment cells. Local requirements related to Phase I or Phase II NPDES permit thresholds should be considered in developing maximum discharge rates the ATS Plan.

Costs

Costs for ATS may be significant due to equipment rental requirements and cost of chemicals. ATS cost is lower on a treated unit-basis for large construction sites with large volumes of runoff.

Inspection and Maintenance

ATS must be operated and maintained by individuals with experience in their use and trained in accordance with training requirements below. ATS should be monitored continuously while in

use. A designated responsible person shall be on site daily at all times during treatment operations. Daily on-site visual monitoring of the system for proper performance shall be conducted and recorded in the project data log. The name, phone number, and training documentation of the person responsible for system operation and monitoring shall be included in the project data log.

The following monitoring requirements and results should be recorded in the data log:

Operational and Compliance Monitoring

- Effluent flow rate and volume shall be continuously monitored and recorded at 15- minute or less intervals.
- Influent and effluent pH must be continuously monitored and recorded at 15-minute or less intervals.
- Influent and effluent turbidity (expressed in NTU) must be continuously monitored and recorded at 15-minute or less intervals.
- The type and amount of chemical used for pH adjustment, if any, shall be monitored and recorded.
- Dose rate of chemical used in the ATS system (expressed in mg/L) shall be monitored and reported 15-minutes after startup and every 8 hours of operation.
- Laboratory duplicates – monthly laboratory duplicates for residual coagulant analysis must be performed and records shall be maintained onsite.
- Effluent shall be monitored and recorded for residual chemical/additive levels.
- If a residual chemical/additive test does not exist and the ATS is operating in a batch treatment mode of operation refer to the toxicity monitoring requirements below.

Toxicity Monitoring

Batch Treatment

Toxicity testing for systems operated in batch treatment mode should be made in accordance with the following:

- Acute toxicity testing on effluent samples representing effluent from each batch prior to discharge shall be undertaken. All bioassays shall be sent to a laboratory certified by the Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP). The required field of testing number for Whole Effluent Toxicity (WET) testing is E113.
- Acute toxicity tests shall be conducted with the following species and protocols. The methods to be used in the acute toxicity testing shall be those outlined for a 96-hour acute test in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, USEPA-841-R-02-012" for Fathead minnow, *Pimephales promelas*. Rainbow trout, *Oncorhynchus mykiss*, may be used as a substitute for fathead minnow.

All toxicity tests shall meet quality assurance criteria and test acceptability criteria in the most recent versions of the EPA test method for WET testing.

Flow-through Treatment

Toxicity testing for systems operated in flow-through treatment mode should be made in accordance with the following:

- A residual chemical test method shall be used that has a method detection limit (MDL) of 10% or less than the maximum allowable threshold concentration (MATC) for the specific coagulant in use and for the most sensitive species of the chemical used. The MATC is equal to the geometric mean of the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) Acute and Chronic toxicity results for most sensitive species determined for the specific coagulant.
- The residual chemical test method shall produce a result within one hour of sampling.
- A California State certified laboratory shall validate the selected residual chemical test. Specifically the lab will review the test protocol, test parameters, and the detection limit of the coagulant. The discharger shall electronically submit this documentation as part of the ATS Plan.

Numeric Effluent Limit (NEL) Compliance:

All chemically treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits have been established by the Construction General Permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity limits have been set as 10 NTU as a daily flow-weighted average or 20 NTU from a single sample. pH must be within the range of 6.0 to 9.0 standard units. It is often possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements should be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water should not be taken from the treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training:

Operators shall have training specific to using an ATS and liquid coagulants for stormwater discharges in California. The training shall be in the form of a formal class with a certificate and requirements for testing and certificate renewal. Training shall include a minimum of eight hours classroom and 32 hours field training.

Standard BMPs:

Erosion and sediment control BMPs should be implemented throughout the site to prevent erosion and discharge of sediment to the ATS. Some types of chemical coagulation and flocculation are only achievable in water below a certain turbidity; therefore minimizing the amount of sediment reaching the system will increase the likelihood of meeting effluent limits and will potentially lower costs of chemical dosing.

Sediment Removal and Disposal

- Sediment shall be removed from the storage or treatment cells as necessary to ensure that the cells maintain their required water storage (i.e., volume) capability.
- Handling and disposal of all solids generated during ATS operations shall be done in accordance with all local, state, and federal laws and regulations.
- If sediment is determined to be non-toxic, it may be incorporated into the site away from drainages.

References

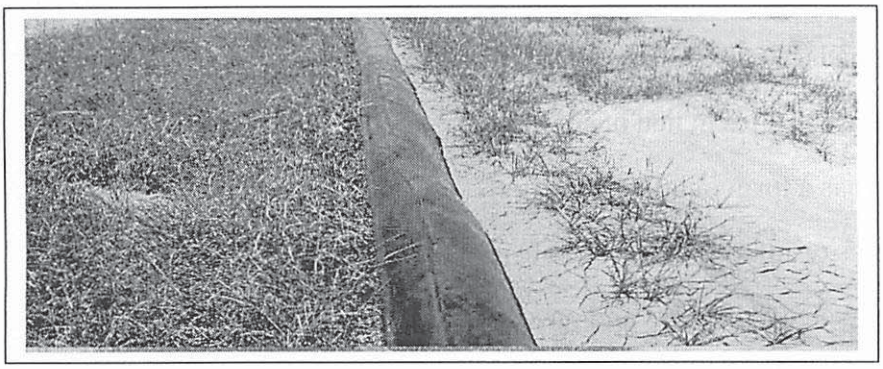
Engineering and Design – Precipitation/Coagulation/Flocculation. United States Army Corps of Engineers, EM 1110-1-4012, 2001.

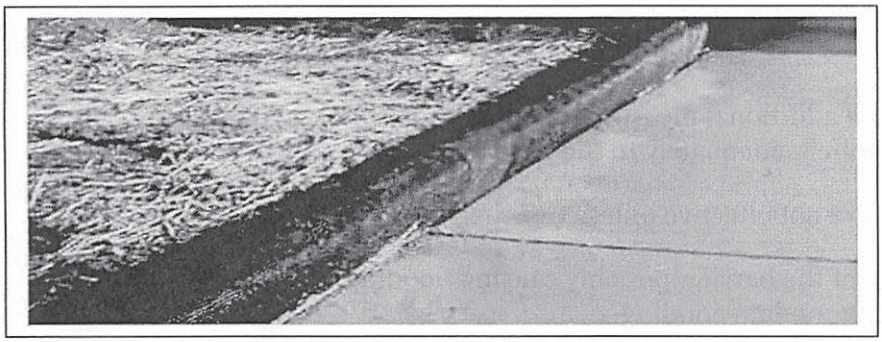
Evaluation of Active Treatment Systems (ATS) for Construction Site Runoff. California Building and Industry Association (prepared by Geosyntec Consultants), 2008.

Stormwater Management Manual for Western Washington, Volume II – Construction Stormwater Pollution Prevention, Washington State Department of Ecology, August 2001.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Temporary Silt Dike SE-12





Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

Description and Purpose

Temporary silt dikes are pre-manufactured devices that are typically specified and installed for drainage and sediment control on the perimeter of disturbed sites or stockpiles and as check dams within channels. Manufactured products include flexible and rigid silt dikes. Both types of temporary silt dikes can be reused. Flexible temporary silt dikes typically consist of a triangular foam or recycled rubber core covered in geotextile fabric. Rigid temporary silt dikes typically consist of an outer jacket made of a rigid High Density Polyethylene (HDPE) matrix and contain an integrated HDPE or polypropylene geotextile filter or a tubular assembly of overlapping layers of porous synthetic materials (frequently called synthetic sediment control rolls). Temporary silt dikes come in a variety of profiles including triangular, round, rectangular, L-shaped, I-shaped, and T-shaped.

Suitable Applications

Temporary silt dikes are generally used in areas as a substitute for fiber rolls and silt fences in sediment control applications to slow down runoff water, divert drainage or contain fines and sediment. Temporary silt dikes are a linear control and application suitability varies based on the specific product type. They may be suitable for:

- On paved surfaces for perimeter protection.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- As check structures in channels.
- Along the perimeter of disturbed sites in lieu of silt fence.
- At operational storm drains as a form of inlet protection.
- Around temporary stockpiles or material/equipment storage areas.
- At the interface between graveled driveways and pavement.
- Along the toe of exposed and erodible slopes.

Limitations

- Temporary silt dikes require additional measures to adhere to asphalt in cold and windy climates, as glue may not adhere adequately to the pavement.
- Rigid temporary silt dikes are not effective unless trenched-in and staked.
- Runoff will pond upstream of the barrier, possibly causing flooding or bypass if sufficient space does not exist to accommodate ponding.
- Temporary silt dikes may require frequent maintenance especially when used near vehicle traffic or to detain concentrated flows (e.g. check dams or inlet protection).
- When used to detain concentrated flows, maintenance requirements increase.
- Temporary silt dikes are not biodegradable and should be removed after construction activities are complete and disturbed soil areas have been stabilized.
- Temporary silt dikes may not be suitable for application as linear slope controls (slope interruptions).
- Temporary silt dikes should not be used on slopes subject to creep, slumping, or landslide.

Implementation

General

When appropriately placed, temporary silt dikes intercept and slow sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The device is porous, which allows the ponded runoff to flow slowly through the silt dike, releasing the runoff as sheet flows. Generally, temporary silt dikes should be used in conjunction with temporary soil stabilization controls up-slope to provide an effective combination of erosion and sediment control.

Design and Layout

- Temporary silt dikes used on soil should be trenched or attached to the ground per manufacturer specifications in a manner that precludes runoff or ponded water from flowing around or under the silt dike.
- Temporary silt dikes used on asphalt or concrete may be attached using a variety of methods, including nailing the dikes to the pavement, or using a high strength adhesive.

- Follow manufacturer specifications when installing temporary silt dikes.
- Allow sufficient space up slope from the silt dike to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, temporary silt dike should be set back three feet from the slope toe to facilitate cleaning. Where site conditions do not allow set back, the silt dike may be constructed on the toe of the slope. To prevent flows behind the barrier, sand or gravel bags can be placed perpendicular and between the silt dike and slope to serve as a barrier to parallel flow.
- Drainage area should not exceed 5 acres.
- Butt ends of temporary silt dike tightly. Overlaps should be sealed in accordance with the manufacturer's detail.
- Ends of runs should be sloped uphill to prevent concentrated end-around flows.
- For installations as check dams, see SE-4.

Materials

- Several manufactured products are available.

Costs

- Flexible silt dike averages $35-45 per 7 ft. section.
- Rigid silt dike averages $1.80-$7.00 per foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Temporary silt dike exposed to sunlight will need to be replaced more frequently due to photo-degradation.
- Reshape or replace sections of damaged temporary silt dike as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove temporary silt dikes when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of properly.

References

City of Elko Construction Site Best Management Practices Handbook, December 2005

Construction Site Best Management Practices Handbook, June 2008 Update, Truckee Meadows Regional Stormwater Quality Management Program, June 2008

Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices, Texas Commission on Environmental Quality, Revised July 2005, Addendum Sheet, January26, 2011

Stormwater Management Manual for Western Washington Volume II, Construction Stormwater Pollution Prevention, Washington State Department of Ecology, February 2005

Compost Socks and Berms SE-13



Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☒
Bacteria	☒
Oil and Grease	☒
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Compost socks and berms act as three-dimensional biodegradable filtering structures to intercept runoff where sheet flow occurs and are generally placed at the site perimeter or at intervals on sloped areas. Compost socks are generally a mesh sock containing compost and a compost berm is a dike of compost, trapezoidal in cross section. When employed to intercept sheet flow, both BMPs are placed perpendicular to the flow of runoff, allowing filtered runoff to pass through the compost and retaining sediment (and potentially other pollutants). A compost sock can be assembled on site by filling a mesh sock (e.g. with a pneumatic blower). The compost berm should be constructed using a backhoe or equivalent and/or a pneumatic delivery (blower) system and should be properly compacted. Compost socks and berms act as filters, reduce runoff velocities, and in some cases, aid in establishing vegetation.

Compost is organic, biodegradable, and renewable. Compost provides soil structure that allows water to infiltrate the compost medium which helps prevent rill erosion and the retained moisture promotes seed germination and vegetation growth, in addition to providing organic matter and nutrients important for fostering vegetation. Compost improves soil quality and productivity, as well as erosion and sediment control.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

The compost of the compost sock or berm can be selected that targets site specific objectives in capturing sediment and other pollutants, supporting vegetation, or additional erosion control.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Greenwaste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly compost selection is an important design consideration in the application of this type of erosion and sediment control.

Suitable Applications

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow (compost berms should only be used at the top of slopes or on slopes 4:1 (H:V) or flatter, all other slope applications should use compost socks)
- Along the perimeter of a project
- As check dams in unlined ditches (compost socks only)
- Down-slope of exposed soil areas
- At operational storm drains as a form of inlet protection (compost socks only)
- Around temporary stockpiles

Compost socks and berms do not require special trenching or BMP removal compared to other sediment control methods (e.g. silt fence or fiber rolls). Compost socks and berms can remain in place after earth disturbing activities are completed or the compost components can be spread over the site providing nutrients for plant growth and augmenting soil structure. BMPs that remain in place are particularly advantageous below embankments, especially adjacent streams, by limiting re-entry and the disturbance to sensitive areas.

Compost can be pre-seeded prior to application (recommended by the EPA for construction site stormwater runoff control and required for compost socks) or seeded after installation (for compost berms only). The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons.

Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Compost should be obtained from a supplier certified by the California Integrated Waste Management Board or compost should otherwise meet the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7. Carefully consider the qualifications and experience of any compost producer/supplier.

- Application by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost effective method of assembly.
- Compost socks and berms should not be employed at the base of slopes greater than 2:1 (H:V). They can be employed with other erosion control methods for steeper slopes.
- Difficult to move once saturated.
- Compost berms should not be applied in areas of concentrated flows.
- Compost socks and berms are easy to fix; however, they are susceptible to damage by frequent traffic. Compost socks can be used around heavy machinery, but regular disturbance decreases sock performance.

Implementation

Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in **Table 1**, taken from Caltrans Standard Special Provision 10-1 (SSP 10-1), Erosion Control (Compost Blanket).
- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.
- Compost medium parameter specifications for compost socks and berms have been developed to assist in compost selection, such as those provided by the American Association of State Highway Transportation Officials (AASHTO).
- Particle size is important parameter for selecting compost. Well consolidated coarser grades of compost (e.g. small and large pieces) perform better for filtration objectives, while finer grades better support vegetation. Particle size of the compost should be selected based on site conditions, such as expected precipitation, and filtration goals and / or long term plant nutrients.
- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.

- If vegetation establishment is a desired function of the compost, a compost sample should be inspected by a qualified individual. Vegetation has different nutrient and moisture needs.
- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.
- Compost should not be derived from mixed municipal solid waste and should be reasonably free of visible contaminates.
- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.
- Compost should not possess objectionable odors.
- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	*TMECC 04.11-A Elastometric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30-60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	 80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inch 90-100% Passing, 1 inch 65-100% Passing, 3/4 inch 0 - 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Installation

- Prior to application, prepare locations for socks and berms by removing brush and thick vegetation. The compost of the sock and/or berm should be allowed to come in full contact with the ground surface.

- Select method to apply the compost sock or berm. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.

- The compost of the berm should be distributed evenly to the surface, compacted, and shaped trapezoidal in cross section. Berm design is generally consists of a base two times the height. AASHTO specification MP 9-03 provides compost berm dimensions based on anticipated

site precipitation (AASHTO, 2003 and USEPA, 2009). State agencies, such as Oregon Department of Environmental Quality (ODEQ) have developed berm dimension based on slope steepness and length (ODEQ, 2004).

- Compost socks can be assembled on site by filling mesh socks with the selected compost. Mesh socks can be tied at one end, filled, and then tied at the other end. The ends of socks can be interlocked until the desired length is achieved. The sock diameter is a function of slope steepness and length. Again, ASSHTO provides specifications for various parameters. Compost socks range from 8" to 18", but are typically 12" to 18" in diameter.

- Compost socks are typically placed in contours perpendicular to sheet flow. They can also be placed in V formation on a slope. Compost socks need to be anchored, typically stakes, through the center of the sock. To prevent water flowing around them, the ends of compost socks should be placed upslope.

- Locate compost socks and berms on level contours spaced as follows:

  - Slope inclination of 4:1 (H:V) or flatter: Socks and/or berms should be placed at a maximum interval of 20 ft.

  - Slope inclination between 4:1 and 2:1 (H:V): Socks should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).

  - Slope inclination 2:1 (H:V) or greater: Socks should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).

- Place perimeter socks and berms using a j-hook installation. Use of vegetation will also provide additional anchoring.

- Compost socks and berms can be placed around the perimeter of an affected area, like a silt fence, if the area is flat or on a contour. Do not place these socks and berms where ponded water could become an issue.

- If used at the toe of slopes, the compost sock or berm should at a minimum of 5 to 10 feet away.

- Use additional anchoring and erosion control BMPs in conjunction of the compost socks and berms as needed.

- Consider using compost berms or socks as necessary at the top and/or bottom of the slope for additional erosion control performance.

- Compost socks and berms can also be effective over rocky and frozen ground if installed properly.

- It is recommended that the drainage areas of these compost BMPs do not exceed 0.25 acre per 100 feet placement interval and runoff does not exceed 1 cubic foot per second.

Costs

Recently obtained vendor costs indicated $3.50 per linear foot for compost berm application and $2.00 per linear foot for 8" socks and $2.50 per linear foot for 12"socks. Costs do not include final compost sock or berm functions at the end of construction activities, including spreading or removal, if required. ODEQ estimates that compost berms cost 30 percent less than silt fences to install.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Once damage is identified, mend or reapply the sock or berm as needed. Washed out areas should be replaced. If the sock or berm height is breached during a storm, an additional sock can be stacked to increase the sock height and similarly the berm dimensions can be increased, as applicable. An additional sock or berm may be installed upslope, as needed. It may be necessary to apply an additional type of stormwater BMP, such as a compost blanket.

- Sediment contained by the sock or berm should be removed prior reaching 1/3 of the exposed height of the BMP. The sediment can be stabilized with the compost sock or berm with vegetation at the end of construction activities.

- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

- Limit traffic to minimize damage to BMPs or impede vegetation establishment.

References

An analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, pubs.caes.uga.edu/caespubs/pubcd/B1200.htm, Faucette, B. and Risse, M., 2001.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Standard Special Provision 10-1, Erosion Control (Compost Blanket), State of California Department of Transportation (Caltrans). 2007 Update.

Evaluation of Environmental Benefits and Impacts of Compost and Industry Standard Erosion and Sediment Controls Measures Used in Construction Activities, Dissertation, Institute of Ecology, University of Georgia, Faucette, B., 2004.

National Pollutant Discharge Elimination System (NPDES), Compost Blankets, U.S. Environmental Protection Agency (USEPA). http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118, 2009.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Designation MP-9, Compost for Erosion/Sediment Control (Filter Berms), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

Stormwater Best Management Practices (BMPs) Field Trials of Erosion Control Compost in Reclamation of Rock Quarry Operations, Nonpoint Source Protection Program CWA §319(h), Texas Commission on Environmental Quality, Adams, T., McFarland, A., Hauck, L., Barrett, M., and Eck, B., 2008.

Biofilter Bags SE-14



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

- SE-1 Silt Fence
- SE-4 Check Dams
- SE-5 Fiber Roll
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-10 Storm Drain Inlet Protection

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Biofilter bags, or bio-bags, are a multi-purpose sediment control BMP consisting of a plastic mesh bag filled with 100% recycled wood product waste. Biofilter bags come in a variety of sizes (30" x 18" and 30" x 9" being common) and generally have between 1-2 cubic yards of recycled wood waste (or wood chips). Biofilter bags work by detaining flow and allowing a slow rate of discharge through the wood media. This action removes suspended sediment through gravity settling of the detained water and filtration within the bag.

Suitable Applications

Biofilter bags are a short-term BMP that can be rapidly deployed, maintained, and replaced. Biofilter bags can be an effective short-term solution to place in developed rills to prevent further erosion until permanent measures can be established. Suitable short-term applications include:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - Below other small cleared areas
  - Along the perimeter of a site (with low-expected flow)
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas

- Along streams and channels

- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
  - At the top of slopes to divert runoff away from disturbed slopes
  - As check dams across mildly sloped construction roads
- Inlet Protection (See SE-10)
- Supplement to silt fences or other sediment control devices

Limitations

- Short life-span (maximum usefulness of 2-3 months and should be replaced more frequently if needed); regular maintenance and replacement required to ensure effectiveness. Bags will rapidly fill with sediment and reduce permeability.
- Easily damaged by construction vehicles.
- If not properly staked, will fail on slope applications.
- If improperly installed can allow undercutting or side-cutting flow.
- Not effective where water velocities or volumes are high.
- Potentially buoyant and easily displaced if not properly installed.

Implementation

General

Biofilter bags are a relatively low cost temporary BMP that are easily deployed and have a simple installation that can be performed by hand. Without proper installation, however, biofilter bags can fail due to their light weight, potential displacement, and multiple joint locations. One of the benefits of utilizing biofilter bags is that the media (wood-product) can be recycled or used onsite when no longer needed (where acceptable).

Design and Layout – Linear control

- Locate biofilter bags on level contours.
  - Slopes between 20:1 and 4:1 (H:V): Biofilter bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slopes between 4:1 and 2:1 (H:V): Biofilter bags should be placed at a maximum interval of 15 ft, with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Biofilter bags should be placed at a maximum interval of 10 ft., with the first row placed the slope toe.

- Turn the ends of the biofilter bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the biofilter bag berm to allow ponding, and to provide room for sediment storage.
- Stake biofilter bags into a 1 to 2 in. deep trench with a width equal to the bag.
  - Drive one stake at each end of the bag.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- Biofilter bags should be overlapped (6 in.), not abutted.

Costs

Pre-filled biofilter bags cost approximately $2.50-$3.50 per bag, dependent upon size.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Biofilter bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace biofilter bags as needed.
- Repair washouts or other damage as needed.
- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove biofilter bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Biofilter media may be used on-site, if allowed.

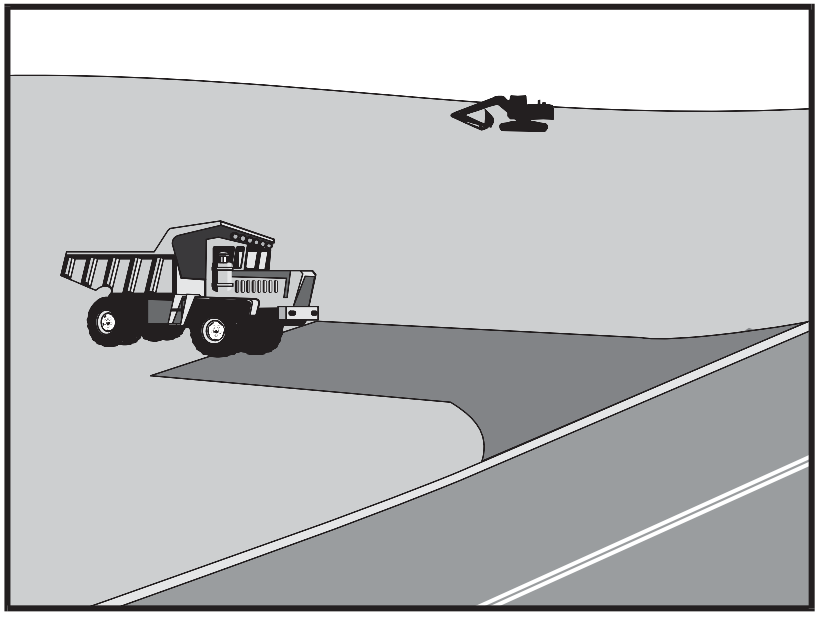
References

Catalog of Stormwater Best Management Practices for Idaho Cities and Counties. Volume 2, Section 7, BMP 34 – Biofilter Bags, Idaho Department of Environmental Quality, 2005.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stabilized Construction Entrance / Exit TC-1



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description 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.

Suitable 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.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft or maximum site will allow, and 10 ft minimum width or to accommodate traffic.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- 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 heaviest vehicles and equipment that will use it.

- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

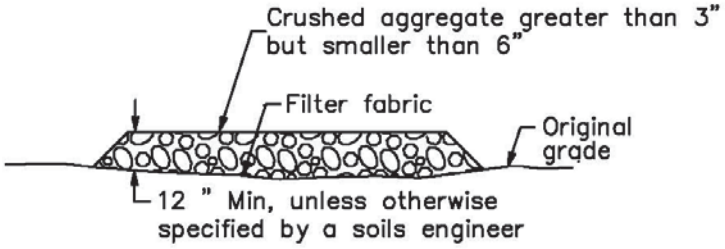
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

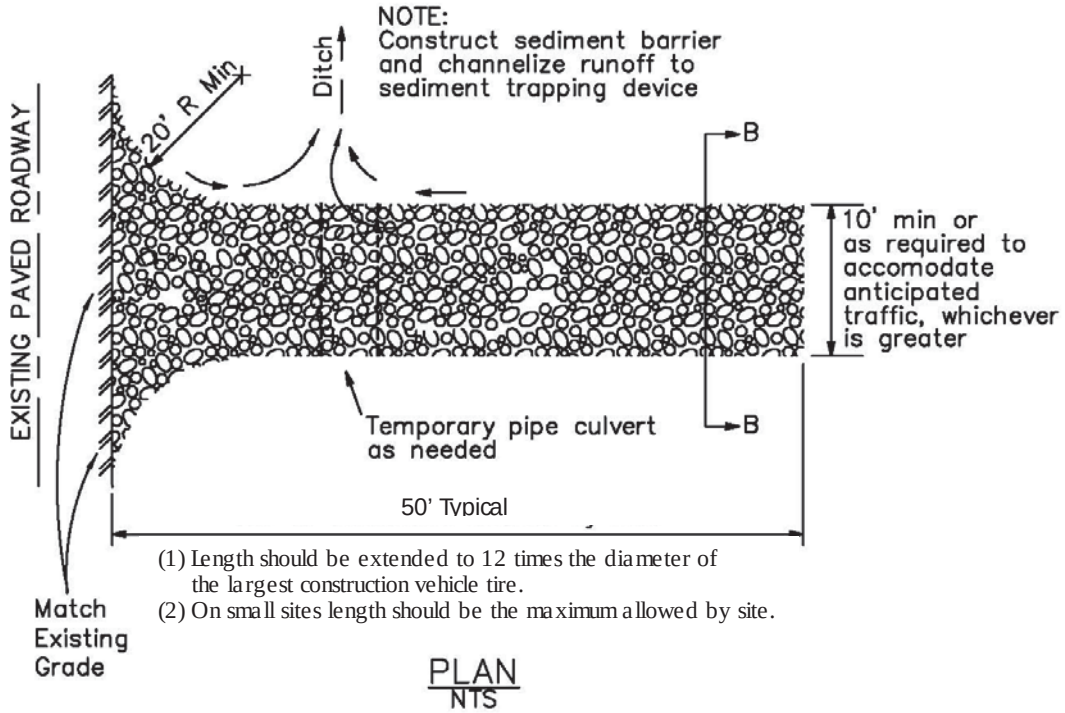
Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



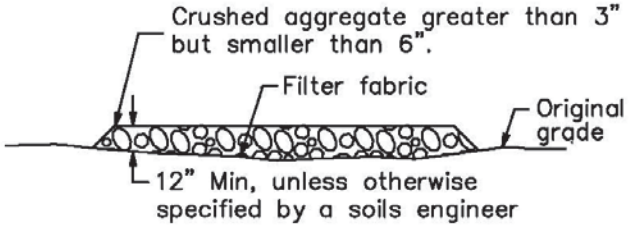
SECTION B–B
NTS



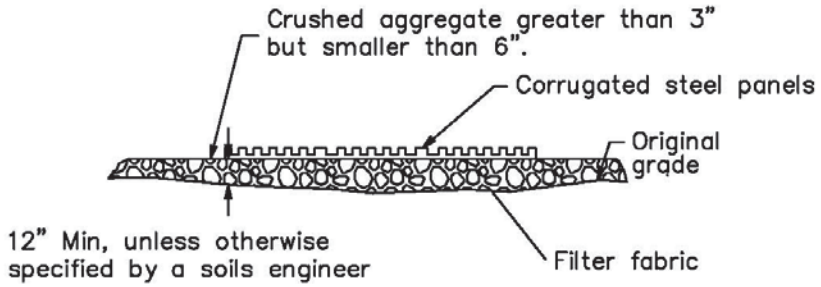
(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS

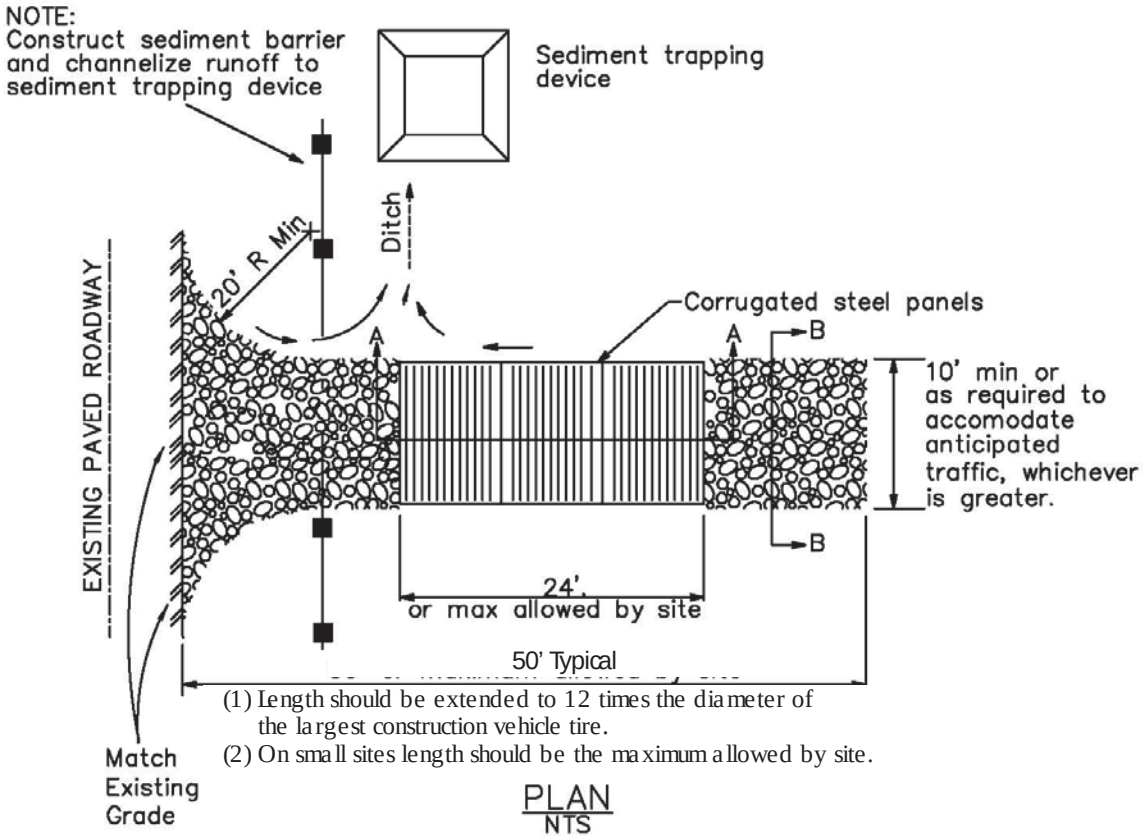
Stabilized Construction Entrance / Exit TC-1



SECTION B–B
NTS



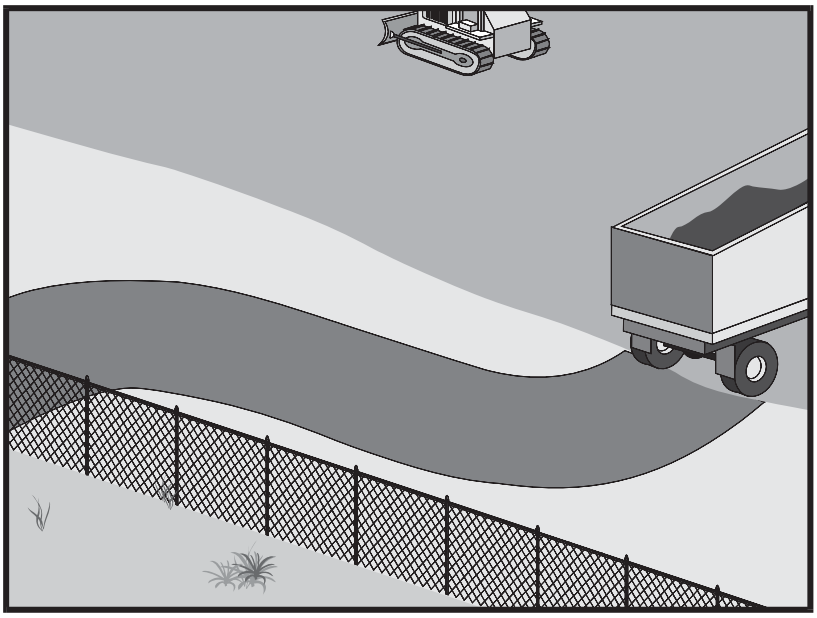
SECTION A–A
NOT TO SCALE



(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS

Stabilized Construction Roadway TC-2



Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and 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

Limitations

- The roadway must be removed or paved when construction is complete.

- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support 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 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.
- Periodically apply additional aggregate on gravel roads.
- Active dirt construction roads are commonly watered three or more times per day during the dry season.

Costs

Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay. No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

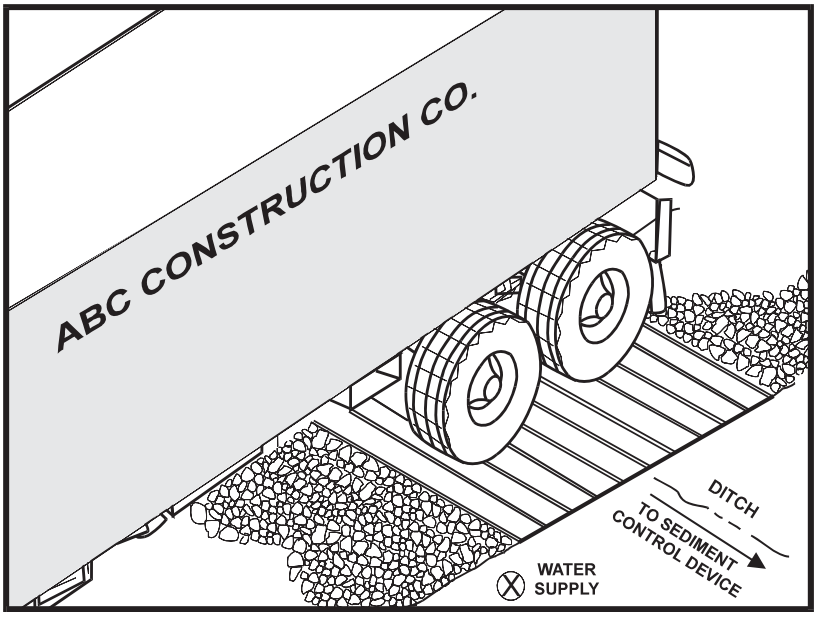
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Entrance/Outlet Tire Wash TC-3



Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Suitable Applications

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

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

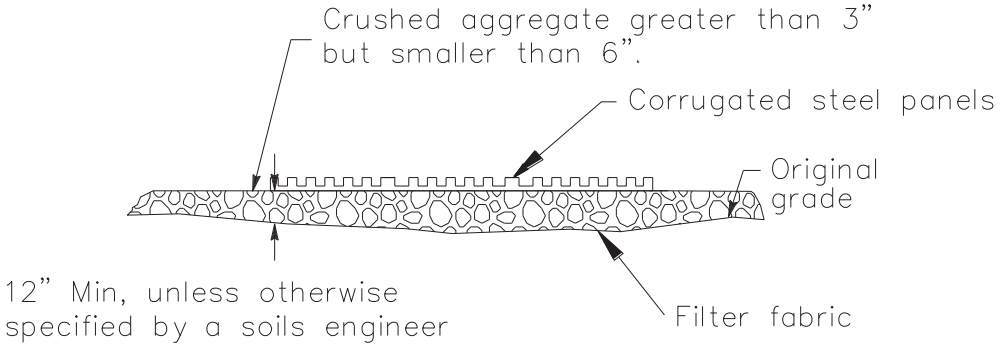
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

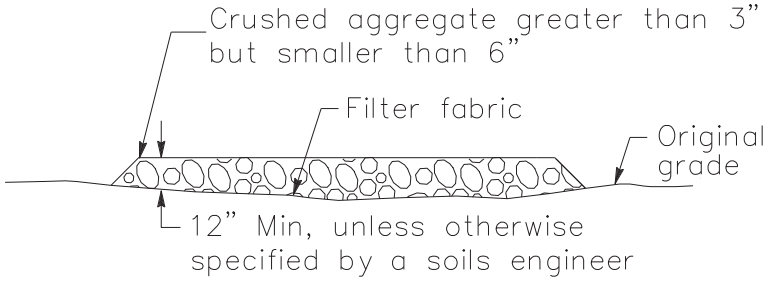
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

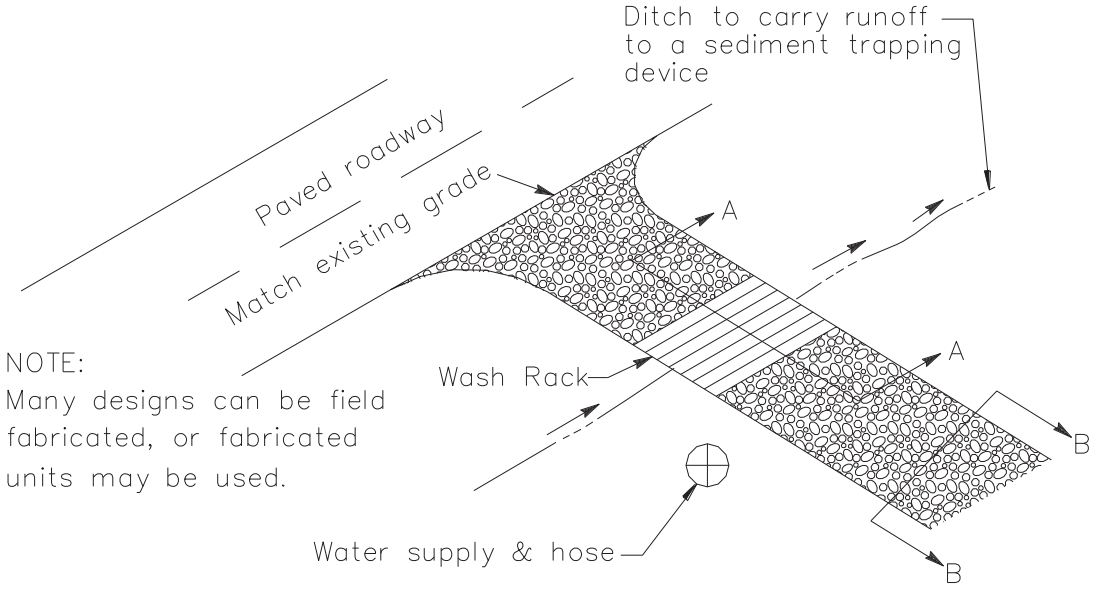
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A–A
NOT TO SCALE

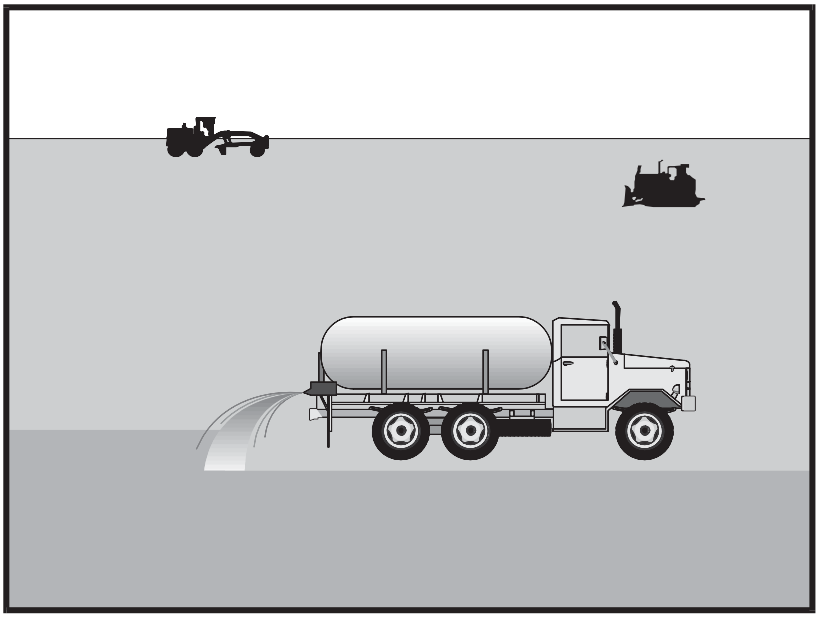


SECTION B–B
NTS



TYPICAL TIRE WASH
NOT TO SCALE

Wind Erosion Control WE-1



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

Implementation

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyls, acrylic), clay additives (e.g. bentonite, montimorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	x	x	x	x	x			x
Disturbed Areas Subject to Traffic			x	x	x	x		x
Material Stockpiles		x	x	x			x	x
Demolition			x			x	x	
Clearing/ Excavation			x	x				x
Truck Traffic on Unpaved Roads			x	x	x	x	x	
Tracking					x	x		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- Water should 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 should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality

Control Board (RWQCB) requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."

- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater and should meet all applicable regulatory requirements.

Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

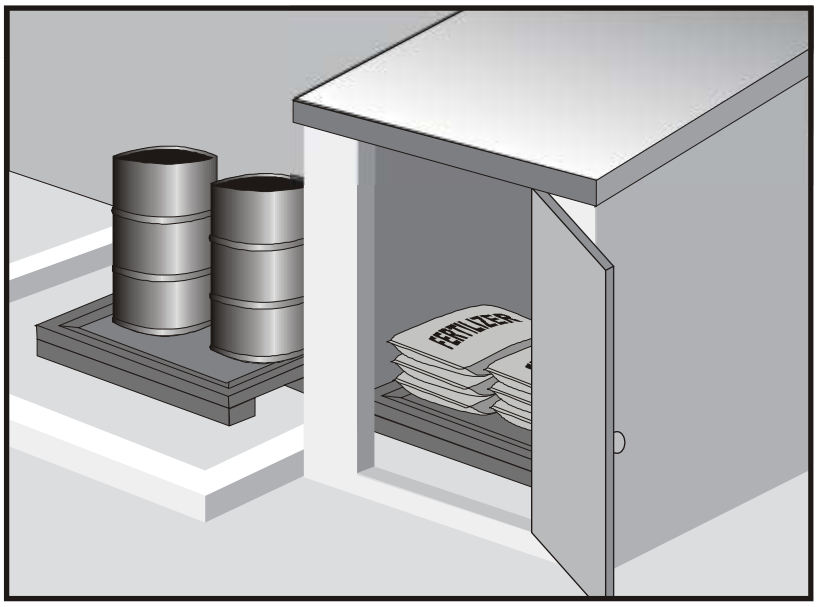
California Air Pollution Control Laws, California Air Resources Board, updated annually.

Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Material Delivery and Storage WM-1



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
    - Avoid transport near drainage paths or waterways.
    - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
    - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 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 should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

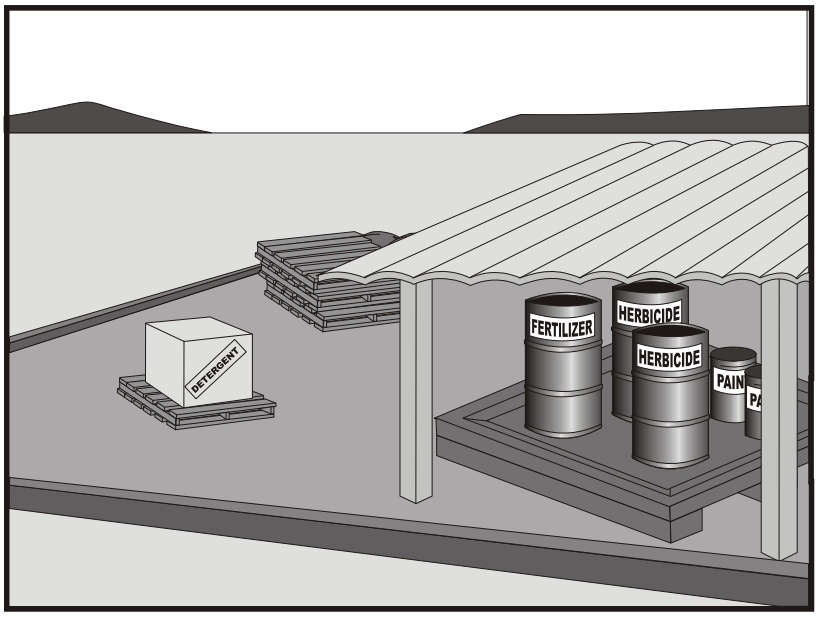
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use WM-2



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, 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 practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, 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 onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- 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.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

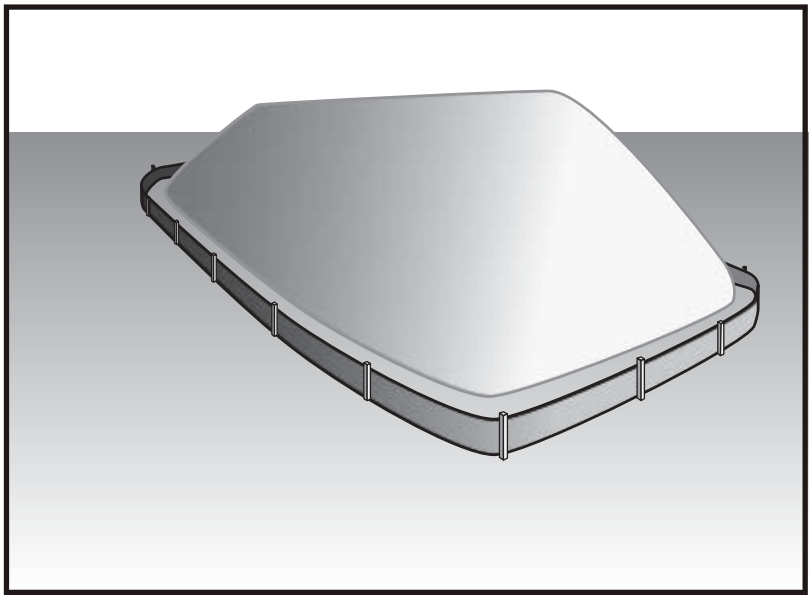
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management WM-3



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- After 14 days of inactivity, a stockpile is non-active and requires further protection described below. All stockpiles are required to be protected as non-active stockpiles immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater runon using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

A stockpile is considered non-active if it either is not used for 14 days or if it is scheduled not to be used for 14 days or more. Stockpiles need to be protected immediately if they are not scheduled to be used within 14 days. Non-active stockpiles of the identified materials should be protected as follows:

Soil stockpiles

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Stockpiles of fly ash, stucco, hydrated lime

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

Stockpiles/Storage of wood (Pressure treated with chromated copper arsenate or ammoniacal copper zinc arsenate

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

A stockpile is active when it is being used or is scheduled to be used within 14 days of the previous use. Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

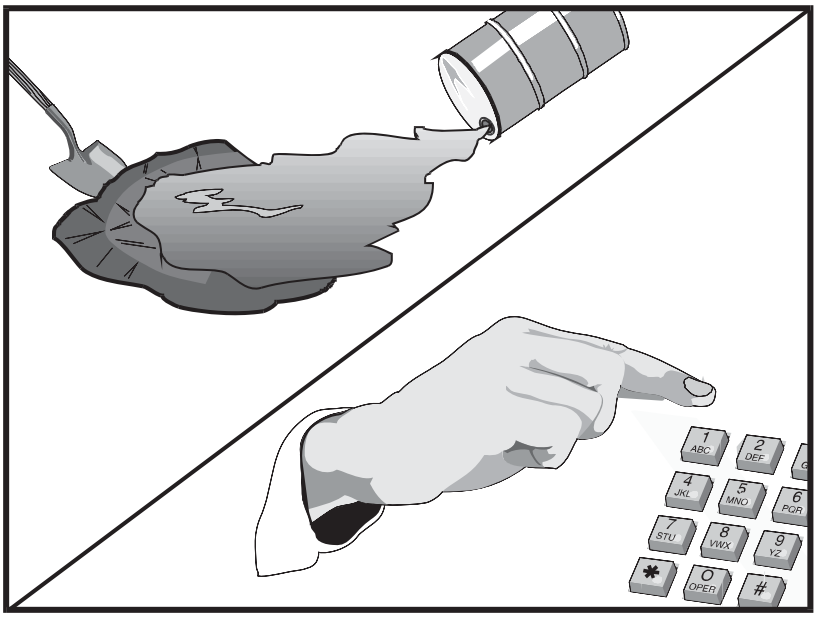
Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.
- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Spill Prevention and Control WM-4



Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows 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.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- 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 should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

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.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and 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.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - 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 should be taken:
  - 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, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs 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, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

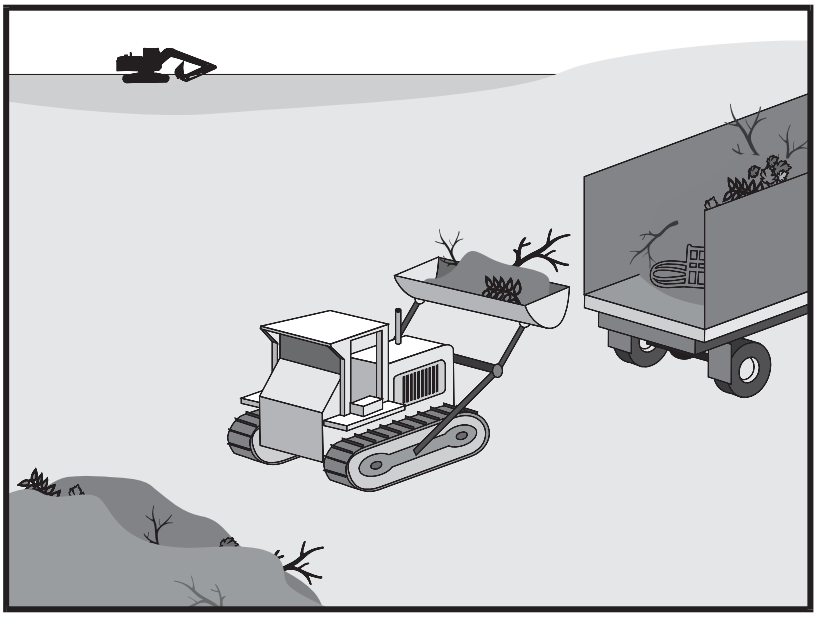
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, 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

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.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Cover waste containers at the end of each work day and when it is raining.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management 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.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should 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 should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should 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 should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see 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 surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

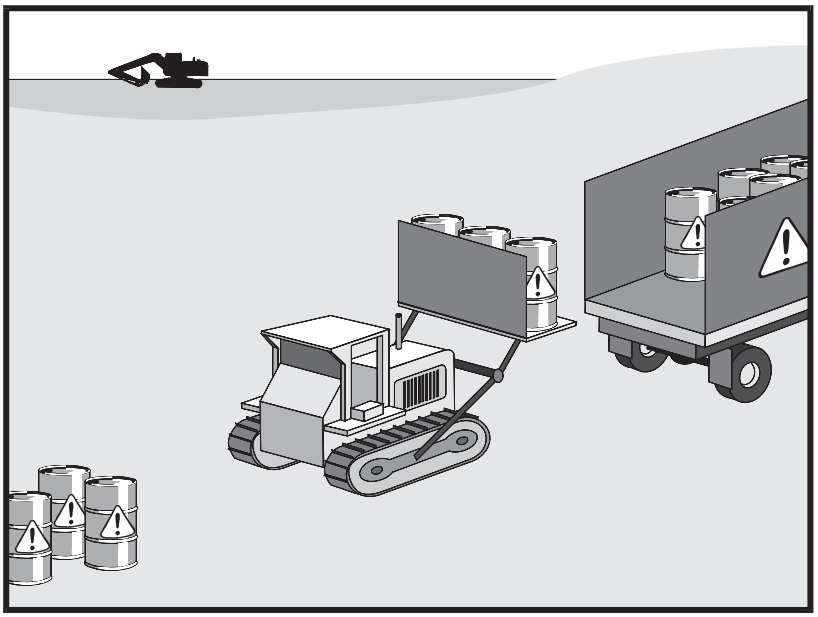
References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable 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
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- 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 WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 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 should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

- Throughout the rainy season, temporary containment facilities should 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.

- Drums should not be overfilled and wastes should not be mixed.

- Unless watertight, containers of dry waste should be stored on pallets.

- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.

- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.

- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

- The following actions should be taken with respect to temporary contaminant:

  - Ensure that adequate hazardous waste storage volume is available.

  - Ensure that hazardous waste collection containers are conveniently located.

  - Designate hazardous waste storage areas onsite 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.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should 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 certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

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 superintendent or representative should 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.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

- Hazardous spills should 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, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

References

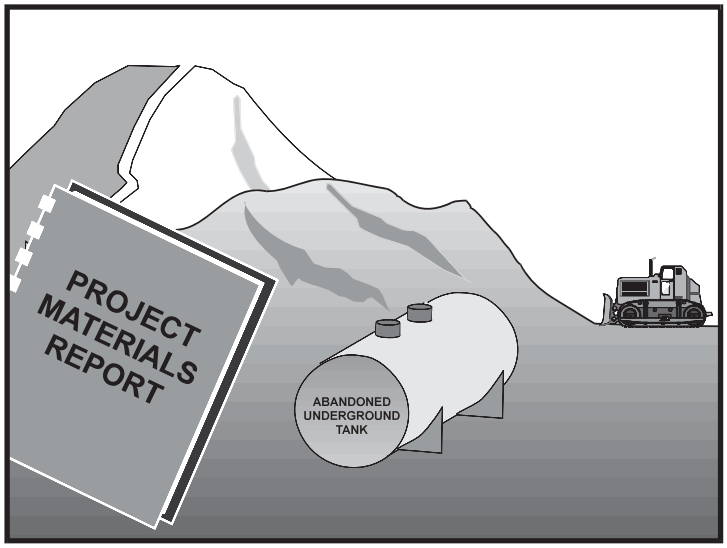
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Contaminated Soil Management WM-7



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

Suitable 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, aerial deposition, past use and leaks from underground storage tanks.

Limitations

Contaminated soils that cannot be treated onsite must be disposed of offsite by a licensed hazardous waste hauler. The presence of contaminated soil may indicate contaminated water as well. See NS-2, Dewatering Operations, for more information.

The procedures and practices presented in this BMP are general. The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered onsite.

Implementation

Most owners and developers conduct pre-construction environmental assessments as a matter of routine. Contaminated soils are often identified during project planning and development with known locations identified in the plans, specifications and in the SWPPP. The contractor should review applicable reports and investigate appropriate call-outs in the

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

plans, specifications, and SWPPP. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil highlight the need for contractors to confirm a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough, pre-construction inspections of the site and review documents related to the site. If inspection or reviews indicated presence of contaminated soils, develop a plan before starting work.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills. Contaminated soil can be expensive to treat and dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- 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
  - Contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
  - Suspected soils should be tested at a certified laboratory.

Education

- Have employees and subcontractors complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified, prior to performing any excavation work at the locations containing material classified as hazardous.
- 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 should result in no visible dust.
- Caution should be exercised to prevent spillage of lead containing material during transport.

- Quality should be monitored during excavation of soils contaminated with lead.

Handling Procedures for Contaminated Soils

- Minimize onsite storage. Contaminated soil should be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 66265.250 to 66265.260.
- Test suspected soils at an approved certified laboratory.
- Work with the local regulatory agencies to develop options for treatment or disposal if the soil is contaminated.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- Take the following precautions if temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.
- Remove contaminated material and hazardous material on exteriors of transport vehicles and place either into the current transport vehicle or into 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 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.
- Excavate, transport, and dispose of contaminated material and hazardous material 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 that have jurisdiction over such work.
- To determine if it contains hazardous substances, arrange to have tested, any liquid or sludge found in the underground tank prior to its removal.
- 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 or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal and transported to disposal facilities permitted to accept such waste.

Water Control

- All necessary precautions and preventive measures should be taken 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, should be discharged to clean, closed top, watertight transportable holding tanks, treated, and disposed of in accordance with federal, state, and local laws.

Costs

Prevention of leaks and spills is inexpensive. Treatment or disposal of contaminated soil can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for contractor's Water Pollution Control Manager, foreman, and/or construction supervisor to monitor onsite 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.

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

References

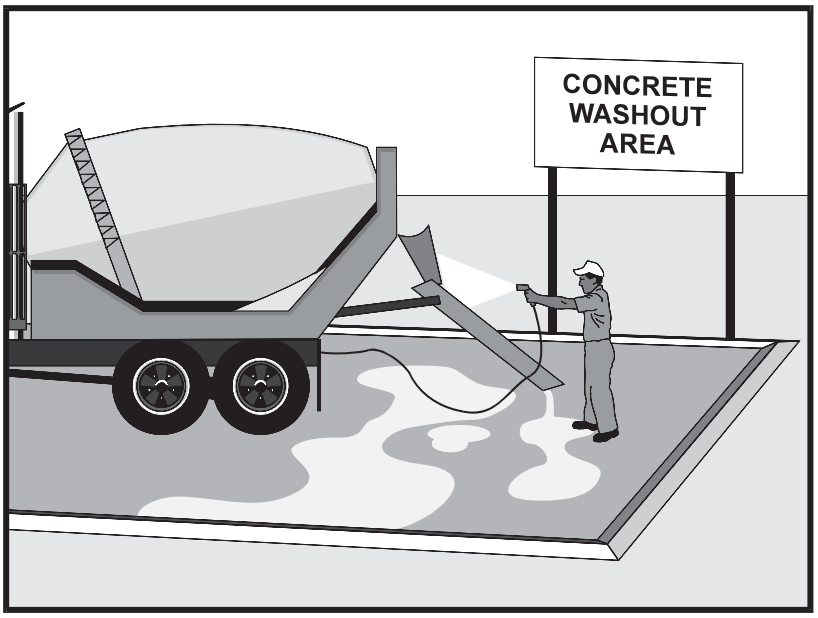
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Prevent the discharge of pollutants to stormwater from concrete waste by conducting washout onsite or offsite in a designated area, and by employee and subcontractor training.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

Suitable 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.
- Slurries containing portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.
- Concrete trucks and other concrete-coated equipment are washed onsite.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Mortar-mixing stations exist.
- Stucco mixing and spraying.
- See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washouts shall be implemented in a manner that prevents leaching to underlying soils. Washout containers must be water tight and washouts on or in the ground must be lined with a suitable impervious liner, typically a plastic type material.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.
- See typical concrete washout installation details at the end of this fact sheet.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.

- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.

- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.

Concrete Demolition Wastes

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.

- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

Concrete Slurry Wastes

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

- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).

- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.

- Saw-cut concrete slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine or by sweeping. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.

- Concrete slurry residue should be disposed in a temporary washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.

- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.

- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of or recycled offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of or recycle hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
  - Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag Barrier).
  - Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
  - Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a “roll-off”; this concrete washout facility should be properly sealed to prevent leakage, and should be removed from the site and replaced when the container reaches 75% capacity.
- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations..

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures. Roll-0ff concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and properly disposed or recycled in accordance with federal, state or local regulations.

- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

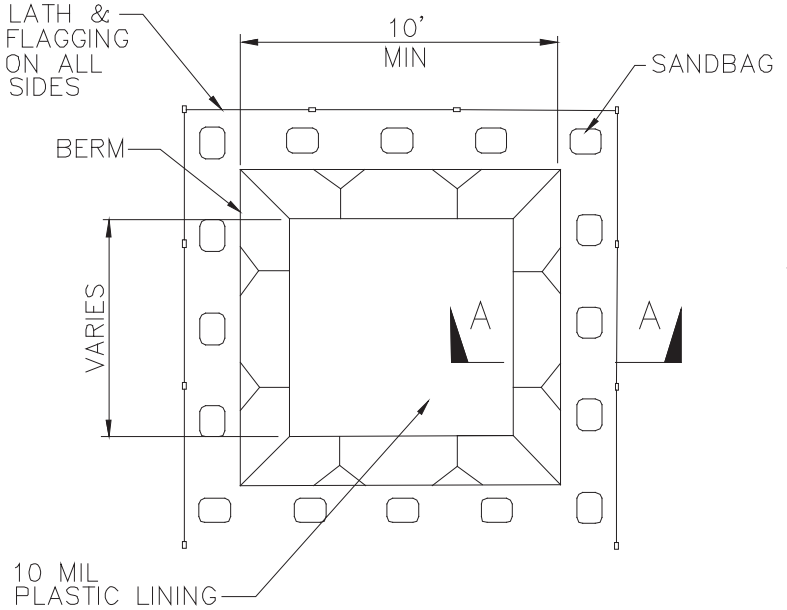
- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

References

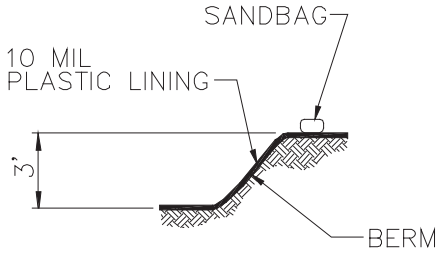
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000, Updated March 2003.

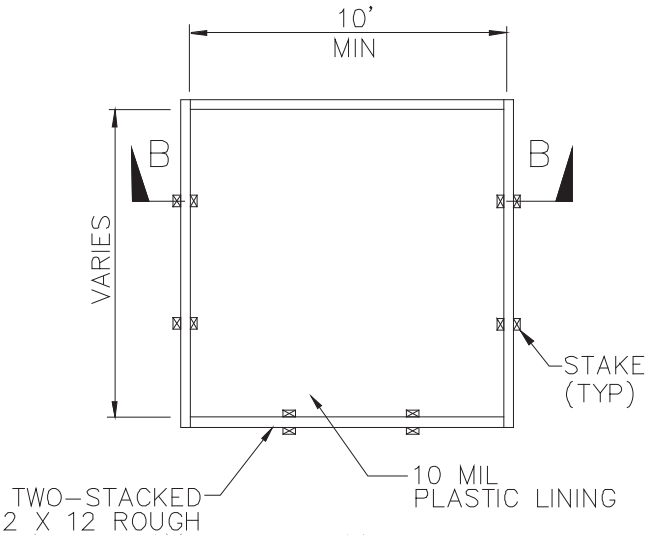
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



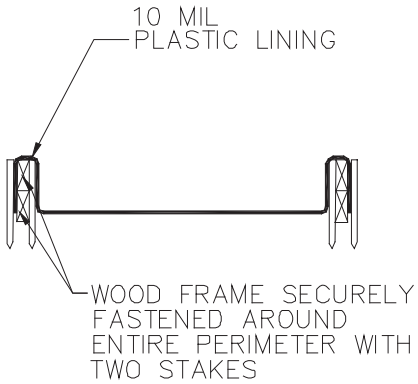
PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



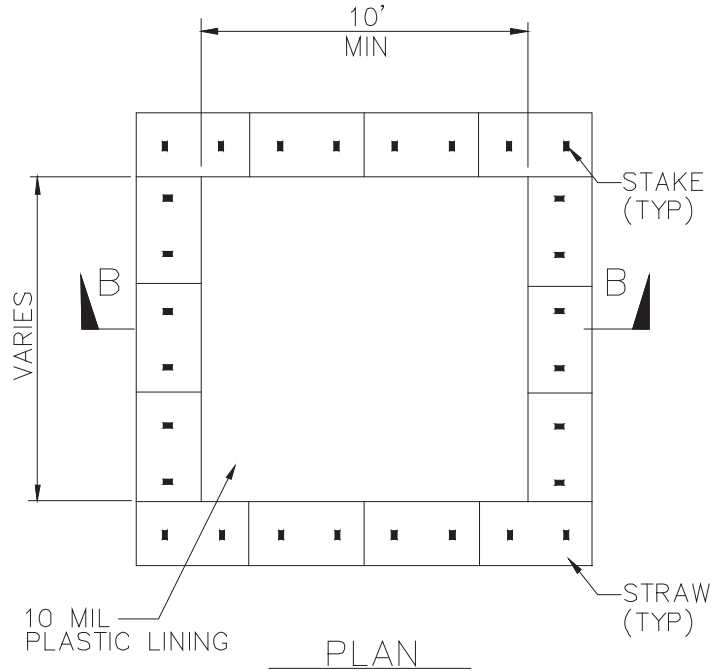
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"



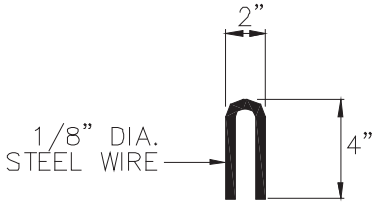
SECTION B–B
NOT TO SCALE

NOTES

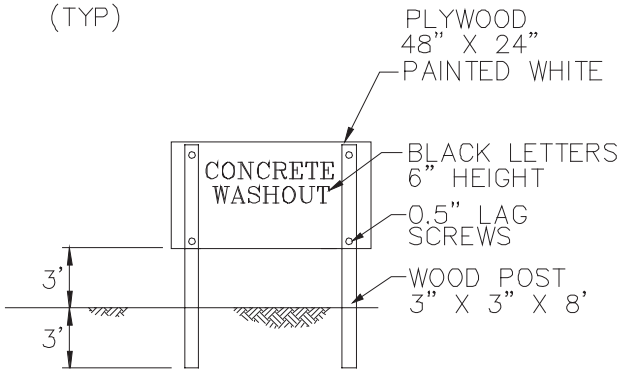
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



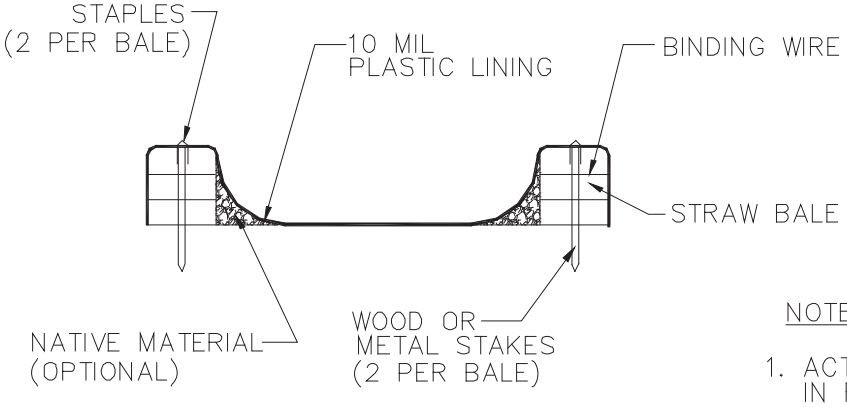
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

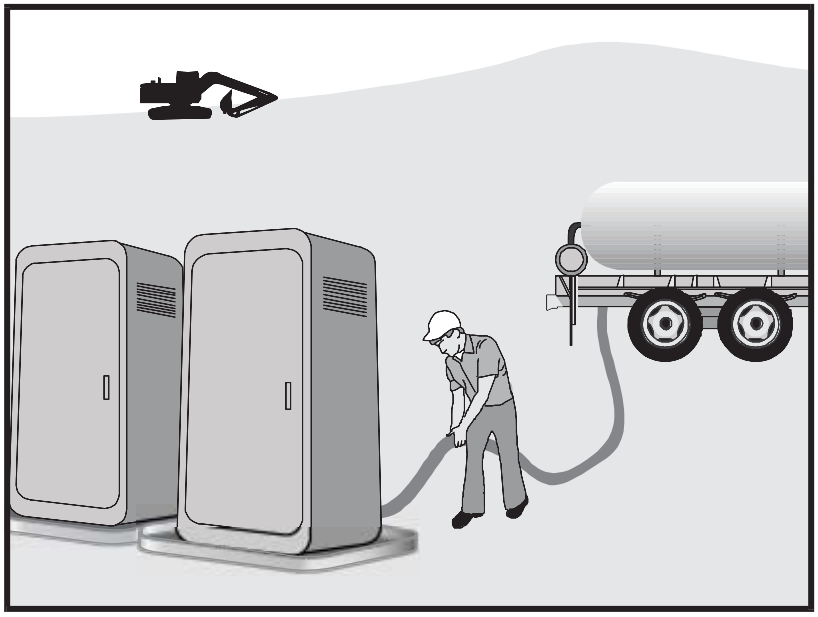


SECTION B–B
NOT TO SCALE

NOTES

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

Sanitary/Septic Waste Management WM-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

Education

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

Costs

All of the above are low cost measures.

Inspection and Maintenance

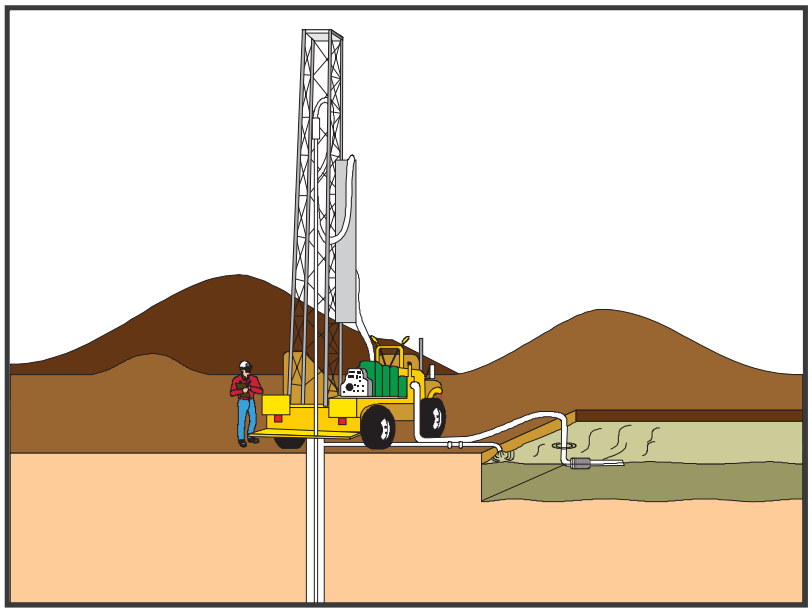
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Liquid Waste Management WM-10



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

Liquid waste management includes 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.

Suitable Applications

Liquid waste management is applicable to construction projects that generate any of the following non-hazardous by-products, residuals, or wastes:

- Drilling slurries and drilling fluids
- Grease-free and oil-free wastewater and rinse water
- Dredgings
- Other non-stormwater 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., NPDES permits, Army Corps permits, Coastal Commission permits, etc.).
- Liquid waste management does not apply to dewatering operations (NS-2 Dewatering Operations), solid waste management (WM-5, Solid Waste Management), hazardous wastes (WM-6, Hazardous Waste Management), or

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

concrete slurry residue (WM-8, Concrete Waste Management).

- 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.

Implementation

General 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 device, 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 statewide NPDES permit; different regions might have different requirements not outlined in this permit.
- Apply NS-8, Vehicle and Equipment Cleaning for managing wash water and rinse water from vehicle and equipment cleaning operations.

Containing Liquid Wastes

- Drilling residue and drilling fluids should not be allowed to enter storm drains and watercourses and should be disposed of.
- If an appropriate location is available, drilling residue and drilling fluids that are exempt under Title 23, CCR § 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 WM-8, Concrete Waste Management.
- Liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.
- Liquid wastes should be contained 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.

- Precautions should be taken to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in WM-4, Spill Prevention and Control.

- Containment areas or devices should not be located 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 that have the potential to affect the storm drainage system (such as wash water and rinse water from cleaning walls or pavement), before they run off a surface.

- 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.

- Use a sediment trap (SE-3, Sediment Trap) for capturing and treating sediment laden liquid waste or capture in a containment device and allow sediment to settle.

Disposing of Liquid Wastes

- A typical method to handle liquid waste is to dewater the contained liquid waste, using procedures such as described in NS-2, Dewatering Operations, and SE-2, Sediment Basin, and dispose of resulting solids per WM-5, Solid Waste Management.

- Methods of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 or 404 permits, and local agency discharge permits, etc. Review the SWPPP to see if disposal methods are identified.

- 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 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.

Costs

Prevention costs for liquid waste management are minimal. Costs increase if cleanup or fines are involved.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- 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 WM-5, Solid Waste Management.
- Inspect containment areas and capturing devices and repair as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Exhibit A-8.II

Construction Inspection Checklist

CITY OF LAGUNA NIGUEL
27781 LA PAZ ROAD (949) 362-4360
MUNICIPAL STORMWATER PROGRAM
CONSTRUCTION SITE INSPECTION FORM
FOR INSPECTION OF PRIVATE PROJECT'S ISSUED GRADING & BUILDING PERMITS

SECTION I - GENERAL

PERMIT # _____ INSPECTOR(S): _____

ADDRESS: _____

ARRIVAL TIME: _____ _____ PHOTOGRAPHS TAKEN: ☐ Y ☐ N

WEATHER CONDITION: _____ INSPECTION DATE: _____

SITE PRIORITY (Check Applicable)
☐ HIGH PRIORITY ☐ MEDIUM PRIORITY
☐ LOW PRIORITY ☐ PRIORITY UNKNOWN

SEASON (Check Applicable)
☐ WET (OCTOBER 1 THROUGH APRIL 30) ☐ DRY (MAY 1 THROUGH SEPTEMBER 30)

NAME OF SITE REPRESENTATIVE PRESENT DURING INSPECTION: _____ PHONE No: _____

DEVELOPMENT SIZE: _____ ESTIMATED % OF DISTURBED AREA: _____

TYPE OF CONSTRUCTION:
☐ RESIDENTIAL ☐ COMMERCIAL ☐ INDUSTRIAL ☐ RECONSTRUCTION ☐ OTHER

SECTION II - RESULTS OF INSPECTION

Erosion Control Practices	Y	N	N/A	COMMENTS
1. Are erosion controls being implemented and maintained on inactive and active disturbed soil areas (sheeting, mulch, hay, soil stabilizers, etc.), in accordance with Erosion and Sediment Control Plans (ESCPs) and provisions of the Grading Ordinance?				
2. Erosion observed? *If YES, describe the evidence of the erosion and whether it is major or minor.*				
Sediment Control Practices	**Y**	**N**	**N/A**	**COMMENTS**
3. Are sediment controls being implemented and maintained on all significant slopes (silt fences, fiber rolls, etc. at the base of slopes) and the downstream perimeter, in accordance with Erosion and Sediment Control Plans (ESCPs) and provisions of the Grading Ordinance?				
4. Sediment discharge observed? *If YES, describe the evidence of the discharge and whether it is major or minor. (If the discharge could impact wildlife, sensitive habitat/endangered species, an impaired water body (303d listed), ESA or ASBS area, go to the "Evaluation of Potential Impacts to Human or Environmental Health" form.)*				
Tracking Controls	**Y**	**N**	**N/A**	**COMMENTS**
5. Are the entrances and exits to the construction site adequately protected (tire washout, stabilized entrances, rumble strips)?				
6. Are roads free of sediment?				
Waste and Disposal Management	**Y**	**N**	**N/A**	**COMMENTS**
7. Are activities such as concrete/plastering, painting and fueling resulting in a discharge to the storm drain in violation of provisions of the Water Quality Ordinance? *If YES, describe the evidence of the discharge and whether it is major or minor.*				
8. Are containers for construction waste and debris being utilized and are they adequate?				
9. Are there potential water quality problems that have been identified on the site, which may be in violation of provisions of the Water Quality Ordinance and may require further inspection by an Authorized Water Quality Ordinance Inspector?				
10. Are there any discharges or spills of sewage, oil, or toxic/hazardous materials, which may be in violation of provisions of the Water Quality Ordinance? *If YES, go to the "Evaluation of Potential Impacts to Human or Environmental Health" form.*				

SECTION III - ENFORCEMENT ACTIONS

☐ Issued a Notice of Non-compliance
☐ Issued an Administrative Compliance Order
☐ Issued a Cease and Desist Order
☐ Issued a Stop Work Order
☐ No Action Required
☐ Request Inspection by an Authorized Water Quality Ordinance Inspector
☐ Other (Please Explain):

OTHER/COMMENTS _____

White: Building Division Copy Yellow: Planning Division Copy Pink: Owner/Contractor Copy

A-9.0 EXISTING DEVELOPMENT

A-9.1 INTRODUCTION

The City of Laguna Niguel requires industrial and commercial premises to implement pollution prevention BMPs and properly maintain any structural incorporated at development or re-development. Businesses are inventoried and the City ensures BMPs are implemented through education, inspections, and enforcement. A parallel program is implemented in residential areas with an emphasis on education and outreach rather than inspections. This local regulatory oversight of the built environment supports both the principal requirements of the Fifth Term Permit and effectively addresses two of the HPWQCs identified in the WQIP, specifically, unnatural water balance in dry weather and pathogen health risk.

A-9.1.1 Overview

The existing development component of this plan is comprised of eight programs: industrial, commercial, food facility, mobile business, residential, common interest and homeowner association areas, retrofitting existing development, and a training program.

The following outlines and describes City departments and staff that are responsible for implementation of the existing development component.

Public Works Department
Contact Name: Jacki Scott
Title: Public Works Director
Telephone: 949.362.4377
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Responsible for the operation and maintenance of flood control facilities. Field crews should receive training to identify industrial and commercial facilities and activities and residential activities that have potential to threaten receiving water quality.

Community Development Department
Contact Name: Jonathan Orduna
Title: Community Development Director
Telephone: 949.362.4357
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Staff oversees community development within City and assists residents with implementation of residential program.

Contact Name: Jonathan Orduna
Title: Community Development Director
Telephone: 949.362.4357
Address: 30111 Crown Valley Parkway, Laguna Niguel, CA 92677

Code enforcement inspectors are responsible for inspecting industrial and commercial facilities for compliance with the industrial/commercial program and City code, and residential areas for compliance with the residential program and City codes.

Fire Services (*Orange County Fire Authority)*
Contact Name: Jeff Adams
Title: Fire Chief, Division 5
Telephone: 949.389.0055
Address: 1 Fire Authority Road, Irvine, CA 92602, CA 92856

Inspects businesses within City for compliance with Uniform Fire Code and responds to 911 emergencies involving industrial and commercial discharges, spills, accidents, etc.

Public Agencies

In addition to the City Departments described, the City relies on certain public agencies for successful implementation of the industrial program.

Wastewater
Contact Name: Moulton Niguel Water District
Title: Water District, Independent from the City
Telephone: 949. 831.2500
Address: 27500 La Paz Rd, Laguna Niguel, CA 92677

Wastewater inspectors are trained to inspect, monitor, and evaluate commercial/industrial facilities and activities. The department is also responsible for promoting water conservation practices within residential areas, an effective form of pollution prevention.

Orange County Health Care Agency
Environmental Health Division
Certified Unified Program Agency (CUPA)

The Environmental Health Division of the Orange County Health Care Agency inspects businesses within the City that generate hazardous waste for compliance with State and Federal regulations. Proper storage and care of hazardous waste is an important component of pollutant source control.

Orange County Health Care Agency
Environmental Health
Food Facility Inspection

Conducts inspections of all food facilities within the City.

A-9.1.2 Program Commitments

The major program commitments and the subsections in which they are described in detail include:

- Inspection of industrial and commercial facilities **(A-9.2);**
- Inspection of Food Service Establishments **(A-9.3)**
- Regulation of mobile businesses **(A-9.4)**
- Oversight of residential areas **(A-9.5)**
- Oversight of Common Interest Area/Homeowners Assoc. Activities Program **(A-9.6)**
- Existing development retrofitting **(A-9.7)**
- Training **(A-9.8)**

A-9.1.3 Regulatory Requirements

The program described in this section confirms with Section E.5. of the Fifth Term Permit, which requires the City to implement an existing development management program in accordance with the strategies in the South OC WQIP.

A-9.2 INDUSTRIAL/COMMERCIAL PROGRAM

The City of Laguna Niguel's Industrial/Commercial Program includes specifications for pollution-prevention methods for industrial and commercial areas and activities located within the City. Specific pollution prevention practices that are generally recognized in each Discharger's industry or business, or for that Discharger's activity, as being effective and economically advantageous, were certified by the City (see **Section A-9.2.3**). The City through an inspection program summarized in **Section A-9.2.4** will verify implementation of pollution-prevention methods by industries and commercial facilities. Inspectors will use a checklist for their inspections, which will also include appropriate pollution-prevention methods.

A-9.2.1 Source Identification and Facility Inventory

The City of Laguna Niguel develops and annually updates a watershed-based inventory of all industrial sites within its jurisdiction, regardless of site ownership. The components that comprise the inventory include:

- All industrial facilities located within the City's jurisdiction
- All commercial facilities listed below from **DAMP Section 9.2.1** that are located within the City's jurisdiction.
    - Automobile mechanical repair, maintenance, fueling, or cleaning
    - Automobile and other vehicle body repair or painting
    - Mobile automobile or other vehicle washing
    - Mobile carpet, drape or furniture cleaning
    - Mobile high pressure or steam cleaning
    - Painting and coating
    - Nurseries and greenhouses
    - Landscape and hardscape installations
    - Pool, lake and fountain cleaning

- Eating and drinking establishments

- Watersheds where each industrial or commercial facility is located
- Identified potential pollutants and activities with the potential to discharge pollutants
- Identified industrial or commercial discharges into, or adjacent to, an Environmentally Sensitive Area (ESA).
- Identified industrial or commercial discharges into an ESA that include pollutants of concern.

The City's inventory database includes the following information about each identified industry or commercial facility within the City's jurisdiction:

- Business Name;
- Physical Address Information;
- Mailing Address Information;
- Business Contact Name
- Emergency Contact
- Lot Size
- SIC Code;
- Industrial-Specific Information
- Commercial-Specific Information
- Watershed;
- GIS Information;
- Local Licensing/Permits
- Potential pollutants
- Proximity to and/or discharge to ESA;/ASBS
- Pollutants of concern into an ESA
- Comments/Notes.

Copies of the most current inventory are available, upon request, from the City's Community Development Department.

A-9.2.2 Prioritization for Inspection

The City of City of Laguna Niguel prioritizes industrial and commercial facilities within its inventory as needed based on the findings of the City's inspection program and the following factors:

1. Type of activity conducted and SIC code;
2. Materials used at the facility;
3. Amount and type of wastes generated;
4. Pollutant discharge potential;
5. Non-stormwater discharges;
6. Size of facility;
7. Proximity to receiving water bodies;
8. Sensitivity of receiving water bodies;

9. Whether the facility is subject to the Industrial General Permit or an individual NPDES permit;
10. Whether the facility has filed a No Exposure Certification/Notice of Non-Applicability;
11. Facility design;
12. Total area of the site, area of the site where industrial or commercial activities occur, and area of the site exposed to rainfall and runoff;
13. The facility's compliance history; and
14. Any other relevant factors

A-9.2.3 BMP Implementation

The City of Laguna Niguel has designated a minimum set of activity-specific BMPs for industrial and commercial facilities that are appropriate to prevent or mitigate pollution generated from the specific activities at each site. The corresponding fact sheets are presented in **Exhibit A-9.II.**

Table 9.1
Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs)
For Commercial & Industrial Activities

Activity	**Minimum Designated BMPs/PPMs**	
IC1. Animal Handling Areas	BMP1	Do not dispose of animal waste, animal food, or any other byproducts in the parking lots, streets, gutters, storm drains, natural watercourses, or landscaping areas.
	BMP2	Provide employee training.
	BMP3	Prevent wash/rinse water from interior and exterior areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
	BMP4	Pick up and dispose of animal waste regularly.
	PPM1	Keep site free of trash & debris.
IC2. Building Maintenance	BMP1	Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Use extra precautions to prevent dirt, construction debris and other solids from entering the streets, gutters, storm drains, and natural watercourses.
	PPM1	Keep site free of trash & debris.
IC3. Carpet Cleaning	BMP1	Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Properly maintain fleet of vehicles and equipment.
	PPM1	Keep site free of trash & debris.
IC4. Concrete & Asphalt Production, Application & Cutting	BMP1	Do not dispose of process water from production, pouring, equipment cleaning, and cuffing activities in the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Pre-heat, transfer or load hot bituminous material away from storm drain inlets.

Activity	Minimum Designated BMPs/PPMs	
	PPM1	Sweep the production, pouring and cutting areas regularly to collect loose materials.
IC5. Contaminated or Erodible Surface Areas	BMP1	Protect contaminated or erodible surface areas from rainfall and wind dispersal.
	BMP2	Provide employee & contractor training.
	BMP3	Protect contaminated or erodible surfaces areas from stormwater run-on and runoff.
	PPM1	Keep site free of trash & debris.
IC6. Landscape Maintenance	BMP1	Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Use extra precautions when applying pesticides, herbicides and fungicides.
	BMP4	Use extra precautions when applying fertilizers.
	BMP5	Use extra precautions when applying soil amendments.
	PPM1	Keep site free of trash & debris.
IC7. Nurseries & Greenhouses	BMP1	Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Use extra precautions when applying pesticides, herbicides and fungicides.
	BMP4	Use extra precautions when applying fertilizers.
	BMP5	Use extra precautions when applying soil amendments.
	PPM1	Keep site free of trash & debris.
IC8. Outdoor Drainage from Indoor Areas	BMP1	Do not dispose of wash/rinse water in the parking lots, streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee training.
	BMP3	Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
	PPM1	Keep site free of trash & debris.
IC9. Outdoor Loading/Unloading of Materials	BMP1	Prevent materials, products and other pollutants associated with loading and unloading activities from entering the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Properly maintain fleet of vehicles and equipment.
	PPM1	Keep loading & unloading areas free of trash & debris.
IC10. Outdoor Process Equipment Operations & Maintenance	BMP1	Prevent materials, products and other pollutants associated with outdoor processing activities from entering the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Properly maintain fleet of vehicles and equipment.
	PPM1	Keep processing areas free of trash & debris.
IC11. Outdoor Storage of Raw Materials, Products and Containers	BMP1	Prevent materials, products and other pollutants associated with the outdoor storage area from entering the streets, gutters, storm drains, or natural watercourses.

Activity	Minimum Designated BMPs/PPMs	
	BMP2	Provide employee & contractor training.
	BMP3	Properly maintain fleet of vehicles and equipment.
	PPM1	Keep site free of trash & debris.
IC12. Painting, Finishing, & Coatings of Vehicles, Boats, Buildings and Equipment	BMP1	Prevent paints, finishing, and coating materials, toxic substances and liquid waste from entering the streets, gutters, storm drains, and natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Properly clean, store, and dispose of painting, finishing and coating materials.
	PPM1	Keep site free of trash & debris.
IC13. Parking & Storage Area Maintenance	BMP1	Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
	PPM1	Keep site free of trash & debris.
IC14. Pool & Fountain Cleaning	BMP1	Discharge pool & fountain water properly.
	BMP2	Provide employee training.
	BMP3	Prevent algae problems with regular cleaning, consistent adequate chlorine levels, and well maintained filtration and circulation systems.
	PPM1	Properly clean and/or dispose of filters.
IC15. Spill Prevention & Cleanup	BMP1	Clean up leaks and spills immediately.
	BMP2	Provide employee & contractor training.
	BMP3	Properly store and handle chemical materials.
	PPM1	Keep storage areas free of trash & debris.
IC16. Vehicle & Equipment Fueling	BMP1	Prevent fuel from entering the streets, gutters, storm drains, and natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Utilize fueling safeguards.
	PPM1	Keep fuelling area clean and free of trash and debris.
IC17. Vehicle & Equipment Maintenance and Repair	BMP1	Prevent materials, products and other pollutants associated with maintenance and repair activities from entering the streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Properly maintain fleet of vehicles and equipment.
	PPM1	Keep maintenance and repair areas free of trash & debris.
IC18. Vehicle & Equipment Washing & Steam Cleaning	BMP1	Prevent wash/rinse water from entering the streets, gutters, storm drains or natural watercourses.
	BMP2	Provide employee & contractor training.
	BMP3	Properly maintain fleet of vehicles and equipment.
	PPM1	Keep wash areas clean of trash and debris.

Activity	Minimum Designated BMPs/PPMs	
IC19. Waste Handling & Disposal	BMP1	Prevent waste from coming into direct contact with wind, rain and stormwater runoff.
	BMP2	Provide employee & contractor training.
	BMP3	Prevent wash/rinse water from waste collection areas from entering the streets, gutters, storm drains or natural watercourses.
	PPM1	Keep waste collection areas clean.
IC20. Eating & Drinking Establishments	BMP1	Do not dispose of wash/rinse water in the parking lots, streets, gutters, storm drains, or natural watercourses.
	BMP2	Provide employee training.
	BMP3	Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural water courses.
	BMP4	Properly dispose of grease.
	PPM1	Keep site free of trash & debris.
IC21. Irrigation Runoff	BMP1	Implement all feasible measures to eliminate surface runoff of landscape irrigation water.
	BMP2	Comply with water conservation, drought response and waste prohibition regulations of the water district.
IC22. Power Washing	BMP1	Prevent wastewater or wash water from exterior power washing or other exterior surface cleaning activity from entering parking lots, streets, gutters, storm drains, and natural water courses.
IC23. Mobile Businesses	BMP1	Prevent wastewater or wash water from entering parking lots, streets, gutters, storm drains, and natural water courses.
	BMP2	Properly store and handle chemical materials.
	BMP3	Provide employee & contractor training.
IC24. Special Events	BMP1	Keep site free of trash & debris.
	BMP2	Provide employee & contractor training.

The City encourages the implementation of the designated BMPs at each industrial and commercial facility based on site-specific conditions in order to limit that facility's impact upon receiving water quality.

A-9.2.4 Inspection, Monitoring and Enforcement

A-9.2.4.1 Inspection

The City of Laguna Niguel annually inspects at least 20 percent of the industrial and commercial sites inventoried as described in **Section A-9.2.1,** excluding food facilities and mobile businesses, which are addressed by **Section A-9.3 A-9.4**, respectively. Other inspection frequencies are based on the factors described in **Section A-9.2.2** and Provision E.5 of the Fifth Term Permit.

In addition, the City investigates all complaints of illegal discharges from industrial facilities made by the public or by another agency or those violations arising from the results or dry-weather field screening or analytical monitoring program. In the event that a site is found to be non-compliant, inspection frequency is increased. Once a facility has been brought into compliance, follow-up inspections are conducted as needed.

The City inspects industrial facilities to determine if they are in compliance with City ordinances, to review BMP implementation, to assess BMP effectiveness and to verify inventory information used for facility prioritization. Such inspections include review of:

- Material and waste handling and storage practices,
- Pollution control BMP implementation and maintenance, and
- Evidence of past or present unauthorized, non-stormwater discharges.

City inspection forms, provided in Exhibit 9.II, are used to document inspection results and to provide notice to the property owner and/or business operator of required corrective action(s), if any. Photographs are also taken to document any observed violations.

Businesses notified of the need for corrective action(s) are re-inspected within 30 days of the prior inspection. At the City's discretion, continued failure by notified businesses to rectify violations of City water quality regulations are forwarded to the City's Code Enforcement Division for resolution.

Should an inspected site demonstrate non-compliance, the City will coordinate the notification of appropriate agencies. An incident or practice of non-compliance that requires a hazardous materials emergency response will be considered a threat to human or environmental health and will be reported to the RWQCB and to appropriate hazardous waste management agencies. The City will provide oral notification to the RWQCB within 24 hours of the discovery of a non-compliant site meeting the criteria listed below. This will also be followed by written notification within 5 days of the discovery.

Criteria to be used to determine whether an event of non-compliance poses a threat to human or environmental health include the following:

- The event poses a significant or imminent threat to the quality of surface or ground waters and/or their beneficial uses.
- The event results in a spill or discharge of hazardous materials in excess of reportable quantities (as listed in 40 CFR Part 117 or 302).
- The event results in a spill or discharge of hazardous materials requiring a hazardous materials emergency response.

A-9.2.4.2 Monitoring

The City may require its industries to conduct monitoring for high threat water quality industrial sites. These facilities are noted in the inventory database contained in **Exhibit A-9.I**. Industries that conduct monitoring in accordance with the monitoring requirements of the Industrial General Permit will meet the City requirements. Industries also have the option of participating in a group monitoring program in accordance with the guidelines specified in the Industrial General Permit, to meet the requirements of the City.

The purpose of the runoff monitoring will be to characterize the nature of stormwater and non-stormwater discharges from industrial facilities, track changes in these characteristics over time, target management actions to address any identified problems, and assess the effectiveness of those management actions implemented. As a result there will be two efforts: non-stormwater monitoring and stormwater monitoring.

For stormwater monitoring, the City may require a facility to conduct a program to help ensure that:

- The effectiveness of BMPs implemented to prevent or reduce pollutants in stormwater discharges is assessed.
- The stormwater discharges are reported and described annually as part of the annual report from the industrial facility to the City.

In this context the monitoring program for industrial sites may as a minimum include data collection from two storm events per year on the following constituents:

- Any pollutant listed in effluent guidelines subcategories where applicable;
- Any pollutant for which an effluent limit has been established in an existing NPDES permit for the facility;
- Oil and grease or total organic carbon (TOC);
- pH;
- Total suspended solids (TSS);
- Specific conductance;
- Toxic chemicals and other pollutants that are likely to be present in stormwater discharges; and

- Any pollutant that may be used, stored, or generated at the facility, which may be discharged to a water body or a tributary to a 303(d) water body, unless the facility can demonstrate approval of No Exposure Certification or Notice of Non-Applicability.

A-9.2.4.3 Enforcement

City inspectors with enforcement authority will issue enforcement actions to industrial and commercial facility owners and operators determined to be out of compliance. The inspectors will document each observed violation. Depending on the severity of the violation, enforcement actions can range from a verbal warning to civil or criminal court actions with monetary fines.

If a City inspector observes a significant and/or immediate threat to water quality, action will be taken to require the facility owner and/or operator to immediately cease the discharge.

City inspectors will apply or recommend any of the enforcement steps as appropriate based on the Enforcement Response Plan. The City will ensure that violations of a similar nature are subjected to similar types of enforcement remedies.

A-9.2.4 Outreach and Education

The outreach strategy for reaching industrial businesses includes efforts such as providing stormwater information on the City's conducting mass mailings, holding workshops, and development and distribution of brochures, posters, fact sheets, etc.

A-9.3 FOOD SERVICE FACILITIES INSPECTION PROGRAM

In accordance with F.3.b(3)(d) of the San Diego Order, the Orange County Health Care Agency (OCHCA), on behalf of the Permittees conducts initial water quality inspections on all food service facilities. Water quality issues are documented and included in the OCHCA's monthly reports. The Permittees are responsible for conducting follow-up inspection on facilities with water quality issues to confirm the implementation of BMPs for pollution prevention and to address the following activities:

1. Trash storage and disposal;
2. Grease storage and disposal;
3. Maintenance of trash collection area and grease interceptors;
4. Proper discharge of wash water (e.g., from floor mats, driveways, sidewalks, etc.);
5. Identification of outdoor sewer and MS4 connections; and
6. Education of property managers when grease and/or trash facilities are shared by multiple facilities.

A-9.4 MOBILE BUSINESS PROGRAM

To address Section F.3.b(3)(a) of the Fifth Term Permit the City will respond to complaints about mobile surface cleaner business. The mobile surface cleaner businesses addressed in this program are those which provide one or more of the following services:

1. Cleaning (e.g., power sweeping, washing) driveways and parking lots;
2. Cleaning building exteriors (except sand blasting, window cleaning);
3. Driveway cleaning (e.g., power sweeping, washing) services;
4. Parking lot cleaning (e.g., power sweeping, washing); services;
5. Power washing building exteriors;
6. Pressure washing (e.g. buildings, decks, fences); and
7. Steam cleaning building exteriors

A-9.4.1 Mobile Business Inventory

The City does not require a permit for mobile vendors but does monitor the County's inventory of mobile businesses.

A-9.4.2 Best Management Practice (BMP) Implementation

The City has designated a minimum set of activity-specific BMPs for mobile surface cleaner businesses, which are presented in the form of a Surface Cleaner BMP Fact Sheet which describes options for wastewater disposal and is available here: http://www.ocwatersheds.com/civicax/filebank/blobdload.aspx?BlobID=10201.

A-9.4.4 Enforcement

City inspectors with enforcement authority will issue enforcement actions to mobile business owners and operators determined to be out of compliance as detailed in **DAMP Section 9.2.4**. The inspectors will document each observed violation. Depending on the severity of the violation, enforcement actions can range from a verbal warning to civil or criminal court actions with monetary fines.

If a City inspector observes a significant and/or immediate threat to water quality, action will be taken to require the mobile business owner and/or operator to immediately cease the discharge.

The enforcement mechanisms available to inspectors, as detailed in **DAMP Section 9.2.4**, are as follows (in increasing order of severity):

- Verbal Warning;
- Notice of Violation;
- Administrative Citations;
- Infractions and Misdemeanors.

While these measures typically escalate in enforcement action, they are not required to be issued in the exact order presented here. City inspectors will apply or recommend any of the enforcement steps as appropriate based on the enforcement consistency guide (Included as **DAMP Exhibit 4.I**). The City will ensure that violations of a similar nature are subjected to similar types of enforcement remedies.

A-9.5 RESIDENTIAL PROGRAM

The program described in this section was developed pursuant to Provision E.5. of the Fifth Term Permit and **DAMP Section 9.5**. Defined Residential Management Areas (RMAs) as part of the existing development inventory are depicted in Exhibit 9.IV.

A-9.5.1 Program Overview

The City's Residential Program includes specifications for pollution-prevention methods for residential areas and activities located within the City. Specific pollution prevention practices that are recognized for each residential activity with high potential to pose a threat to water quality, as being effective and economically advantageous, are provided in the activity fact sheets presented in **Exhibit A-9.II**. The City will use the implementation strategies discussed in **Section A-9.5.4** to encourage pollution prevention.

A-9.5.2 Source Identification and Inventory

The City has identified the following potential areas and activities that pose a high threat to water quality by following the procedure outlined in **DAMP Section 9.5.2**.

- Automobile repair, maintenance, washing and parking;
- Home and garden care activities and product use (pesticides, herbicides, and fertilizers);
- Disposal of trash, pet waste, green waste, and household hazardous waste (e.g., paints, cleaning products);
- Any other residential source that the City determines may contribute a significant pollutant load to the MS4;
- Any residential areas tributary to a CWA section 303(d) impaired water body, where the residence generates pollutants for which the water body is impaired; and
- Any residential areas within or directly adjacent to or discharging directly to a coastal lagoon, the ocean, or other receiving waters within an environmentally sensitive area.

These residential activities are assumed to occur with equal likelihood in all residential areas within the City's jurisdiction. The implementation of the residential program is designed to address these activities on a citywide basis.

A-9.5.3 Best Management Practice Requirements

The City has designated a minimum set of activity-specific BMPs for residential activities, as set forth in **DAMP Section 9.5** and modified according to City requirements. The City has selected the BMPs shown in **Table A-9.3** below that are appropriate to prevent or mitigate pollution generated from the specific activities typical of residences within the jurisdiction. The corresponding BMP fact sheets are included as **Exhibit A-9.II** The City requires the implementation of the designated BMPs at each residence to limit the potential impact of the residential activities on receiving water quality.

Table A-9.3
Designated Residential Activities BMPs

Activity	BMP Fact Sheet
Automobile Repair and Maintenance	R-1
Automobile Washing	R-2
Automobile Parking	R-3
Home and Garden Care Activities	R-4
Disposal of Pet Wastes	R-5
Disposal of Green Wastes	R-6
Household Hazardous Waste BMPs	R-7
Irrigation Runoff	R-8

A-9.5.4 Program Implementation

The implementation of the residential program will rely on education and outreach to notify and urge residents to observe the designated sets of BMPs for each of the high threat activities. The City will encourage the implementation of the designated BMPs for each residence within its jurisdiction by conducting the following as appropriate:

- *Training City Personnel* who have regular contact with residential areas (e.g. inspectors, code enforcement officers, etc.) to serve as informal inspectors performing field reviews.
- *Providing the BMP fact sheets* and information on residential stormwater pollution prevention through the H2OC.org website: https://h2oc.org/resources/pollution-prevention-for-residents/.
- *Conducting Annual Mailings* which include the BMP fact sheets as well as information on household hazardous waste collection sites, and dates and times of operation. Included in mailings will be the City's contact information, the County hotline number 1-877-89SPILL or *www.myoceservices.ocgov.com*, and a statement to call 911 in an emergency situation.
- *Public Service Announcements* reminding residents that the storm drain system conveys untreated water to the ocean using the established theme, "The Ocean begins at your front door." Announcements shall also include reminders that the County hotline number is a 24-hour service.

▪

A-9.5.5 Enforcement

Enforcement actions may be initiated by the City as a response to complaints, or by observations by City representatives. All enforcement actions will be documented and recorded for subsequent inclusion in the City's annual progress report. The enforcement mechanisms available to field reviewers, as detailed in the Water Quality Ordinance are as follows (in increasing order of severity):

- Verbal Warning;
- Notice of Violation;
- Administrative Citations;
- Infractions and Misdemeanors.

While these measures typically escalate in enforcement action, they need not be issued in the exact order presented here. City officials will apply or recommend any of the enforcement steps as appropriate based on the enforcement consistency guide**.** The City will ensure that violations of a similar nature are subjected to similar types of enforcement remedies. Samples of the enforcement forms to be used by City staff are included in **Exhibit A-9.III**.

A-9.6 COMMON INTEREST AREAS/HOMEOWNERS ASSOCIATION ACTIVITIES PROGRAM

The common interest area and homeowners association (CIA/HOA) program described in this section was developed pursuant to Provision E.5 of the Fifth Term Permit and **DAMP Section 9.6**.

A-9.6.1 Program Overview

The City's CIA/HOA Activities Program includes specifications for pollution-prevention methods for CIA/HOA areas and activities located within the City. Specific pollution prevention practices that are recognized for each CIA/HOA activity with high potential to pose a threat to water quality, as being effective and economically advantageous, are provided in the activity fact sheets presented in **Exhibit A-9.II**. The City will use the implementation strategies discussed in **Section A-9.6.5** to encourage pollution prevention.

A-9.6.2 Current Practices and Activities of Concern

DAMP Section 9.6.2.2 lists high priority activities that commonly occur in CIA/HOA areas, and describes the potential pollutants generated by these activities. **Table A-9.9**, presented below, illustrates the relationship of these activities and the potential pollutants they generate.

Table A-9.4
Potential Pollutants from CIA/HOA Activities

Activity	Potential Pollutants								
	Sediments	Nutrients [a]	Pathogens/ Coliform [b]	Foaming Agents	Metals	Hydrocarbons	Hazardous Materials [c]	Pesticides and herbicides	Other [d]
Sidewalk, plaza and fountain cleaning	X	X	X	X			X		
Landscape maintenance	X	X	X				X	X	
Home and garden care	X	X	X	X	X		X	X	X
Pet waste	X	X	X						
Garden waste	X	X	X				X	X	
Automobile parking	X				X	X	X		
Community center O&M	X	X	X						X
Recreation area O&M	X	X	X					X	
Maintenance yard operation	X	X	X	X	X	X	X	X	X

[a] *Nitrogen and Phosphorous compounds.*
[b] *Including fecal and total coliform, E. coli, etc.*
[c] *Including chlorinated hydrocarbons, paint, etc.*
[d] *Including bleach, etc.*

A-9.6.3 Prioritization of Locations

Due to the substantial overlap in source activities and constituents of concern for the ESA and 303(d) tributary areas, all residential areas Citywide are treated as a high-threat-to-water quality areas. Therefore, enhanced BMP implementation is required for all residential uses citywide. If particular BMPs are infeasible at any specific site, other equivalent BMPs shall be implemented.A-9.6.4 Best Management Practices Implementation

The City has designated a minimum set of activity-specific BMPs for CIA/HOA areas listed in **Table A-9.5** and **Table A-9.6**, and presented in the fact sheets included in **Exhibit A-9.II**. Each CIA/HOA area is expected to implement those BMPs that are associated with the activities being conducted. If the desired result is not being achieved, the BMPs will be assessed and modified or, if necessary, changed.

Table A-9.5
BMPs for CIAs/HOAs with Publicly-Owned and Maintained Streets and Storm drains

ACTIVITY	BMP	Fact Sheet[1]
Parking vehicles on residential streets, in driveways, or in common area parking lots	Automobile parking BMPs	R-3
Washing vehicles in residential driveways or street	Automobile washing BMPs	R-2
Disposal of household hazardous wastes such as paint, bleach, etc.	Household Hazardous waste BMPs	R-7
Cleaning of CIA/HOA sidewalks, plaza, and entry monuments and fountains	Sidewalk, plaza, and entry monument and fountain maintenance BMPs	FP-4
Landscape maintenance including irrigation and fertilization	Landscape maintenance BMPs	FP-2 IC-7
Operation and maintenance of community pools	Pool cleaning BMPs	IC-16
Operations and maintenance of recreation areas such as stables, golf courses, and parks	Disposal of Pet Waste BMPs Landscape Maintenance BMPs Disposal of Green Waste BMPs	R-5 FP-2 R-6

Table A-9.6
BMPs for CIAs/HOAs with Privately-Owned and Maintained Streets and Storm Drains

Includes all the BMPs listed for Publicly-owned CIAs/HOAs from Table 9-11 of the DAMP plus the following:

ACTIVITY	BMP	Fact Sheet[1]
Street sweeping	Street sweeping BMPs	FP-3
Trash collection, recycling, and disposal	Solid waste handling BMPs	FF-13
Inspection and cleaning of storm drains	Drainage system operation and maintenance BMPs	DF-1
Operation and maintenance of water and sewer lined (not controlled by utility company)	Water and sewer utility operation and maintenance BMPs	FP-6

A-9.6.5 Implementation Strategy

The City's plan for implementing the CIA/HOA Program follows the process outlined in **DAMP Section 9.6.5.2**. The City's implementation plan includes education and outreach as described both in that section and in **DAMP Section 6.0**.

Implementation efforts will vary depending on whether high priority activities occur within a CIA/HOA area, or if the area is located within an area selected for enhanced implementation as part of the residential program.

The following implementation efforts will be utilized for all CIAs/HOA areas within the City's jurisdiction :

- Mail letter explaining CIA/HOA program to association governing board. The letter will explain activities of concern and their environmental impacts, BMPs to reduce the impact, and consequences of not complying with the CIA/HOA program.
- Mail BMP fact sheets to maintenance association governing board
- Mail questionnaire to all residents based on BMPs appropriate for that CIA/HOA.

A-9.6.6 Enforcement

Enforcement mechanisms available to the City, as detailed in **DAMP Section 10.0**, are as follows (in increasing order of severity):

- Warnings (verbal and/or written warnings, to individual resident or CIA/HOA Board)
- Notice of Violation (written notice to CIA/HOA Board)
- Administrative Citation (written notice to CIA/HOA Board)
- Civil or Criminal Enforcement (includes fines and assessments levied on CIA/HOA Board and/or individual resident)

While these measures typically escalate in enforcement action, they need not be issued in the exact order presented here. City officials will apply or recommend any of the enforcement steps as appropriate based on the enforcement consistency guide, Section 10 of the DAMP. The City will ensure that violations of a similar nature are subjected to similar types of enforcement remedies.

A-9.7 RETROFITTING EXISTING DEVELOPMENT PROGRAM

The Fifth Term Permit requires the City to identify existing development areas that are potential candidate for retrofit and/or rehabilitation projects to address sources of pollutants and/or stressors that contribute to HPWQC in the South OC WMA, which are unnatural water balance, pathogen health risk and stream erosion. As part of WQIP development, the Permittees elected to perform the optional Watershed Management Area Analysis (WMAA) described in Permit Provision B.3.b.(4) to develop an integrated approach for their land development stormwater

planning programs by promoting evaluation of multiple strategies for water quality improvement and development of watershed-scale solutions for improving overall water quality in the watershed.

Through the WMAA the following three components were conducted:

1. Perform analysis and develop Geographic Information System (GIS) layers (maps) by gathering information pertaining to the physical characteristics of the WMA (referred to herein as WMA Characterization). This includes identifying hydrologic and infiltration features of the watersheds, land uses, stormwater conveyance and management facility locations that affect the watershed hydrology.
2. Using the WMA Characterization results, compile a list of candidate projects that could potentially be used as alternative compliance options for Priority Development Projects. Such projects may include opportunities for stream or riparian area rehabilitation, opportunities for retrofitting existing infrastructure to incorporate stormwater retention or treatment, or opportunities for regional BMPs, among others.
3. Additionally, using the WMA Characterization maps, identify areas within the watershed management area where it is appropriate to allow for exemptions from hydromodification management requirements that are in addition to those already allowed by the Permit for Priority Development Projects.

Exhibits developed as part of the WMAA are located in Appendix K of the WQIP. The exhibits include hydrologic and infiltration features of the watersheds, land uses, stormwater conveyance and management facility locations. Additionally, existing and potential retrofit locations for each subwatershed are also located in Appendix K of the WQIP and identified as the following:

- Figure 6.11 – Laguna Coastal Watershed,
- Figure 7.11 – Aliso Creek Watershed,
- Figure 8.11 – Dana Point Watershed,
- Figure 9.11 – San Juan Creek Watershed, and,
- Figure 10.11 – San Clemente Creek Watershed

Prior to implementing these retrofit projects the Permittees must demonstrate that implementing such a retrofit project would provide greater overall benefit to the watershed than requiring implementation of the onsite structural BMPs through the implementation of the WQIP. The Permittees are currently implementing a number of WQIP strategies such as:

- Development of the Comprehensive Human Waste Source Reduction Strategy Work Plan
- Outfall Capture Feasibility Studies,
- Flow Regime Special Study,
- Reach Rehabilitation Alternatives And Feasibility Studies And Associated Upland Flow Control Opportunity Evaluation, etc.

The completion of these strategies will further assist in identifying source and/or stressors that contribute to HPWQC. Overall, the City will employ a range of strategies to facilitate the

implementation or construction of retrofit and rehabilitation projects in accordance with the WQIP. The City may also consider partnering with other neighboring jurisdictions to install regional BMPs where retrofit projects are deemed to provide a greater net benefit to the City than projects implemented only by the City.

A-9.8 TRAINING PROGRAM

For an effective stormwater program to be efficiently implemented, its staff must have sufficient knowledge, experience, and skills. he Principal Permittee will coordinate, develop and present a number of different training modules in accordance with *The Orange County Stormwater Program Training Program Framework: Core Competencie*s . The City will support this effort by requiring the appropriate employees to attend training sessions, and conduct applicable train-the-trainer sessions, if necessary.

Exhibit A-9.I

Minimum Designated Best Management Practices

IC 1. Animal Handling Areas

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of animal waste, animal food, or any other byproducts in the parking lots, streets, gutters, storm drains, natural watercourses, or landscaping areas.
2.	Provide employee training.
3.	Prevent wash/rinse water from interior and exterior areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of animal waste, animal food, or any other byproducts in the parking lots, streets, gutters, storm drains, natural watercourses, or landscaped areas.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all animal waste, food, and other byproducts. Do not wash these materials into the street, gutters or storm drains.
   B. Dispose of animal waste, food products and other byproducts as garbage in appropriate trash containers for disposal to the landfill.

2. **Provide employee training.**

   A. Educate and train employees on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Prevent wash/rinse water from interior and exterior areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.**

   A. Interior floor drains in kennel areas should be plumbed to the sanitary sewer.
   B. Mop, rather than hose kennel and animal areas.
   C. Dispose of mop water from cleaning floors in a mop sink, toilet or other drain that is plumbed to the sanitary sewer.
   D. Do not hose out dumpsters or fill them with liquid waste.
   E. Regularly inspect, repair, and/or replace dumpsters.

4. **Pick up and dispose of animal waste regularly.**

   A. Pick-up on a regular basis and properly dispose of any animal waste in the planters, parking lot or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep site free of trash & debris**

   A. Pick-up on a regular basis and properly dispose of any trash, litter, and other debris that may have accumulated in the planters, parking lot or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Keep animals in covered areas.**

2. **Keep animals in areas where BMPs are in use.**

3. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

   The following pollution prevention principles apply to most industries:
   - Affirmative Procurement - Use alternative, safer, or recycled products.
   - Redirect storm water flows away from areas of concern.
   - Reduce use of water or use dry methods.
   - Reduce storm water flow across facility site.
   - Recycle and reuse waste products and waste flows.
   - Move or cover potential pollution from storm water contact.
   - Provide on-going employee training in pollution prevention.

IC 2. Building Maintenance

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Use extra precautions to prevent dirt, construction debris and other solids from entering the streets, gutters, storm drains, and natural watercourses.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum to clean hardscape areas, including streets & gutters. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly.
   C. Clean paint brushes and tools in sinks connected to sanitary sewers or in portable containers that can be dumped into a sink, toilet, or other drain that is plumbed to the sanitary sewer.
   D. Paint brushes and tools covered with non-water based materials must be cleaned in a manner that enables collection of uses solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and landscape contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Educate and train employees and landscape contractors on the use of pesticides and fertilizers.
   D. Train employees on proper spill containment and cleanup methods.

3. **Use extra precautions to prevent dirt, construction debris and other solids from entering the streets, gutters, storm drains, and natural watercourses.**

   A. Properly prepare work area before conduction building maintenance.
   B. Use ground drop cloths underneath outdoor painting, scraping, sandblasting and cutting work. Property dispose of collected materials in the garbage in appropriate trash containers.
   C. When working near drain inlets, use storm drain covers, filter fabric or similarly effective device to prevent materials from entering the storm drain system.
   D. Use sweeping and pick-up methods or vacuum to clean work areas from construction debris daily. Do not wash work areas into the parking lot, street, gutters or storm drains.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep site free of trash & debris**

   A. When doing routine maintenance, pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the building, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.
   B. Regularly inspect, repair and/or replace dumpsters. Do not hose out dumpsters or fill them with liquid waste.

Other Beneficial Tips & Techniques

1. **Properly store equipment, chemicals and waste.**

   A. Store equipment indoors or in covered areas to avoid exposure to rain.
   B. Implement storage requirements for chemicals indoors or in covered areas with guidance from the local fire department.
   C. Dispose of empty containers according to the instructions on the container label.

2. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

      The following pollution prevention principles apply to most industries:
      - Affirmative Procurement - Use alternative, safer, or recycled products.
      - Redirect storm water flows away from areas of concern.
      - Reduce use of water or use dry methods.
      - Reduce storm water flow across facility site.
      - Recycle and reuse waste products and waste flows.
      - Move or cover potential pollution from storm water contact.
      - Provide on-going employee training in pollution prevention.

IC 3. Carpet Cleaning

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
2. Provide employee & contractor training.
3. Properly maintain fleet of vehicles and equipment.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.**

   A. Never dispose of wash water to a street, gutter, parking lot, or storm drain. Either empty the spent cleaning fluid tank into a utility sink or other indoor sewer connection at the service provider's home base, or arrange with the customer to discharge into a toilet or utility sink on their premises. This also applies to cleaning products labeled "nontoxic" and "biodegradable."
   B. Check the local wastewater authority's requirements for discharge.
   C. Filter wash water before discharging to the sanitary sewer to avoid clogging pipes. Dispose of filtered material in the garbage, provided the carpet was not contaminated with hazardous materials.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and landscape contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Properly maintain fleet of vehicles and equipment.**

   A. Conduct regular inspections of vehicles and equipment for fluid leaks and malfunctions.
   B. Ensure all vehicles and equipment are in good working order.
   C. Promptly repair and clean up any fluid leaks from vehicles and equipment.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep site free of trash & debris**

   A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated as a result of the cleaning operation to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. Properly store equipment, chemicals and waste.

A. Store equipment indoors or in covered areas to avoid exposure to rain.
B. Implement storage requirements for chemicals indoors or in covered areas with guidance from the local fire department.
C. Dispose of empty containers according to the instructions on the container label.

2. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

IC 4. Concrete & Asphalt Production, Application & Cutting

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of process water from production, pouring, equipment cleaning, and cuffing activities in the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Sweep the production, pouring and cutting areas regularly to collect loose materials.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of process water from production, pouring, equipment cleaning, and cuffing activities in the streets, gutters, storm drains, or natural watercourses.**

   A. Discharge process water from production, pouring, equipment cleaning, and cutting activities to a sump, process water treatment or recycling system, or sanitary sewer system if allowed.
   B. Do not allow concrete and concrete pumping vehicles to discharge concrete, slurry, or rinse water into gutters, storm drains, or drainage ditches.
   C. Protect production, pouring, and cutting areas from stormwater runoff and runon by constructing a berm around the perimeter of the area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Pre-heat, transfer or load hot bituminous material away from storm drain inlets.**

   A. Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc.
   B. Clean covers regularly.
   C. Leave covers in place until job is complete and clean any debris for proper disposal.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Sweep the production, pouring and cutting areas regularly to collect loose materials.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all loose material. Do not wash these materials into the street, gutters or storm drains.
   B. Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.

Other Beneficial Tips & Techniques

1. **Conduct surface repair work during dry weather to prevent contamination from contacting stormwater runoff.**

2. **To avoid runoff, use only as much water as necessary for dust control.**

3. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

   The following pollution prevention principles apply to most industries:
   - Affirmative Procurement - Use alternative, safer, or recycled products.
   - Redirect storm water flows away from areas of concern.
   - Reduce use of water or use dry methods.
   - Reduce storm water flow across facility site.
   - Recycle and reuse waste products and waste flows.
   - Move or cover potential pollution from storm water contact.
   - Provide on-going employee training in pollution prevention.

IC 5. Contaminated or Erodible Surface Areas

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Protect contaminated or erodible surface areas from rainfall and wind dispersal.
2. Provide employee & contractor training.
3. Protect contaminated or erodible surfaces areas from stormwater runon and runoff.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. Protect contaminated or erodible surface areas from rainfall and wind dispersal.

A. Use at least one of the following to protect contaminated or erodible surfaces:

- Preserve natural vegetation.
- Re-plant or landscaping bare ground surfaces.
- Use chemical stabilization or geosynthetics to stabilize bare ground surfaces.
- Remove contaminated soils.
- Cover materials with a fixed roof or a temporary waterproof covering made of polyethylene, polypropylene or hypalon. Keep covers in place at all times when work is not occurring. If areas are so large that they cannot feasibly be covered and contained, implement erosion control practices at the perimeter of the area and at any catch basins to prevent dispersion of the stockpiled material.

2. Provide employee & contractor training.

A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
C. Train employees on proper spill containment and cleanup methods.

3. Protect contaminated or erodible surfaces areas from stormwater runon and runoff.

A. Construct a berm around the perimeter of the area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. Keep site free of trash & debris.

A. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all loose material. Do not wash these materials into the street, gutters or storm drains.
B. Properly dispose of waste material.

Other Beneficial Tips & Techniques

1. **Paved areas should be sloped in a manner that minimizes the pooling of water in the area. A minimum slope of 1.5 percent is recommended.**

2. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

   The following pollution prevention principles apply to most industries:
   - Affirmative Procurement - Use alternative, safer, or recycled products.
   - Redirect storm water flows away from areas of concern.
   - Reduce use of water or use dry methods.
   - Reduce storm water flow across facility site.
   - Recycle and reuse waste products and waste flows.
   - Move or cover potential pollution from storm water contact.
   - Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 6. Landscape Maintenance

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Use extra precautions when applying pesticides, herbicides and fungicides.
4.	Use extra precautions when applying fertilizers.
5.	Use extra precautions when applying soil amendments.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all grass clippings, leaves, sticks, and other collected vegetation. Do not wash these materials into the street, gutters or storm drains.
   B. Dispose of grass clippings, leaves, sticks, and other collected vegetation as garbage in appropriate trash containers, at the landfill or by using appropriate composting methods.
   C. Place temporary stockpiled material away from watercourses, gutters and storm drain inlets.

2. **Provide employee & contractor training.**

   A. Educate and train employees and landscape contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and landscape contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Educate and train employees and landscape contractors on the use of pesticides and fertilizers.
   D. Train employees on proper spill containment and cleanup methods.

3. **Use extra precaution when applying pesticides, herbicides and fungicides.**

   A. Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
   B. Follow manufacturers' recommendations and label directions.
   C. Do not apply pesticides if rain is expected or if wind speeds are above 5 mph.
   D. Do not mix or prepare pesticides for application near storm drains. Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the targeted pest.
   E. Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
   F. Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
   G. Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
   H. Clean pavement and sidewalk if chemicals are spilled on these surfaces before applying irrigation water.
   I. Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
   J. Dispose of empty containers according to the instructions on the container label.

4. Use extra precautions when applying fertilizers.

A. Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers.
B. Follow manufacturers' recommendations and label directions.
C. Employ techniques to minimize off-target application (e.g. spray drift) of fertilizer, including consideration of alternative application techniques. Calibrate fertilizer distributors to avoid excessive application.
D. Periodically test soils for determining proper fertilizer use.
E. Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
F. Clean pavement and sidewalk if chemicals are spilled on these surfaces before applying irrigation water.
G. Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
H. Use slow release fertilizers whenever possible to minimize leaching.
I. Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
J. Dispose of empty containers according to the instructions on the container label.

5. Use extra precautions when applying soil amendments.

A. When applying or supplementing plant material, soil or soil amendments, place temporary stockpiled material in existing planters or turf area away from watercourses, gutters and storm drain inlets.
B. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all excess materials and debris. Do not wash these materials into the street, gutters or storm drains.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. Keep site free of trash & debris

A. When doing routine landscape maintenance, pick-up and properly dispose of any trash, litter and other debris that may have accumulated in planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Properly manage irrigation systems.**

   A. Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
   B. Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
   C. If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
   D. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
   E. Use automatic timers to minimize runoff.
   F. Use popup sprinkler heads in areas with a lot of activity or where pipes may be broken. Consider the use of mechanisms that reduce water flow to broken sprinkler heads.

2. **Reduce landscape maintenance requirements.**

   A. Where feasible, retain and/or plant native vegetation with features that are determined to be beneficial. Native vegetation usually requires less maintenance than planting new vegetation.
   B. When planting or replanting consider using low water use flowers, trees, shrubs, and groundcovers.

3. **Use mulch or other erosion control measures on exposed soils.**

4. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

      The following pollution prevention principles apply to most industries:
      - Affirmative Procurement - Use alternative, safer, or recycled products.
      - Redirect storm water flows away from areas of concern.
      - Reduce use of water or use dry methods.
      - Reduce storm water flow across facility site.
      - Recycle and reuse waste products and waste flows.
      - Move or cover potential pollution from storm water contact.
      - Provide on-going employee training in pollution prevention.

IC 7. Nurseries & Greenhouses

Site Address: _____
Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Use extra precautions when applying pesticides, herbicides and fungicides.
4.	Use extra precautions when applying fertilizers.
5.	Use extra precautions when applying soil amendments.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including display areas, parking lots, streets & gutters of all grass clippings, leaves, sticks, and other collected vegetation. Do not wash these materials into the parking lot, street, gutters or storm drains.
   B. Dispose of grass clippings, leaves, sticks, and other collected vegetation as garbage in appropriate trash containers, at the landfill or by using appropriate composting methods.
   C. Place temporary stockpiled material away from watercourses, gutters and storm drain inlets.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Educate and train employees and contractors on the use of pesticides and fertilizers.
   D. Train employees on proper spill containment and cleanup methods.

3. **Use extra precautions when applying pesticides, herbicides and fungicides.**

   A. Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
   B. Follow manufacturers' recommendations and label directions.
   C. Do not apply pesticides if rain is expected or if wind speeds are above 5 mph.
   D. Do not mix or prepare pesticides for application near storm drains. Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the targeted pest.
   E. Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
   F. Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
   G. Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
   H. Clean pavement and sidewalk if chemicals are spilled on these surfaces before applying irrigation water.
   I. Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
   J. Dispose of empty containers according to the instructions on the container label.

4. Use extra precautions when applying fertilizers.

A. Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers.
B. Follow manufacturers' recommendations and label directions.
C. Employ techniques to minimize off-target application (e.g. spray drift) of fertilizer, including consideration of alternative application techniques. Calibrate fertilizer distributors to avoid excessive application.
D. Periodically test soils for determining proper fertilizer use.
E. Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
F. Clean pavement and sidewalk if chemicals are spilled on these surfaces before applying irrigation water.
G. Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
H. Use slow release fertilizers whenever possible to minimize leaching.
I. Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
J. Dispose of empty containers according to the instructions on the container label.

5. Use extra precautions when applying soil amendments.

A. When applying or supplementing plant material, soil or soil amendments, place temporary stockpiled material in existing planters or turf area away from watercourses, gutters and storm drain inlets.
B. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all excess materials and debris. Do not wash these materials into the street, gutters or storm drains.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. Keep site free of trash & debris

A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the building, display area, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.
B. Regularly inspect, repair and/or replace dumpsters. Do not hose out dumpsters or fill them with liquid waste.

Other Beneficial Tips & Techniques

1. Properly manage irrigation systems.

A. Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
B. Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
C. Group plants with similar water needs together to improve irrigation efficiency.

2. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

IC 8. Outdoor Drainage from Indoor Areas

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of wash/rinse water in the parking lots, streets, gutters, storm drains, or natural watercourses.
2.	Provide employee training.
3.	Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent wash/rinse water from interior areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.**

   A. Interior floor drains should be plumbed to the sanitary sewer.
   B. Mop, rather than hose indoor areas.
   C. Dispose of mop water from cleaning floors in a mop sink, toilet or other drain that is plumbed to the sanitary sewer. Do not pour wash water outside or into a parking lot, street, gutter, or storm drain.

2. **Provide employee & contractor training.**

   A. Educate and train employees on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including patios, parking lots, sidewalks, common area, and other outdoor areas. Do not wash these areas.
   B. Do not hose out dumpsters or fill them with liquid waste.
   C. Regularly inspect, repair, and/or replace dumpsters.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep site free of trash & debris**

   A. Pick-up on a regular basis and properly dispose of any trash, litter, and other debris that may have accumulated in the planters, parking lot or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

IC 9. Outdoor Load/Unloading of Materials

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Prevent materials, products and other pollutants associated with loading and unloading activities from entering the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Properly maintain fleet of vehicles and equipment.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep loading & unloading areas free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent materials, products and other pollutants associated with loading and unloading activities from entering the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum to clean loading areas, including parking lots, streets & gutters. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials.
   C. Clean oily spots with absorbent materials. Do not allow discharges to enter the street, gutters or storm drains.
   D. Dispose of collected runoff and solids properly.
   E. Avoid placing loading/unloading areas near storm drain inlets.
   F. Park vehicles and conduct loading/unloading only in designated loading/unloading areas so that spills or leaks can be contained.
   G. Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Properly maintain fleet of vehicles and equipment.**

   A. Conduct regular inspections of vehicles and equipment for fluid leaks and malfunctions.
   B. Ensure all vehicles and equipment are in good working order.
   C. Promptly repair and clean up any fluid leaks from vehicles and equipment.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep loading & unloading areas free of trash & debris.**

   A. Do not hose out dumpsters or fill them with liquid waste.
   B. Regularly inspect, repair, and/or replace dumpsters.

C. Properly dispose of any trash, litter and other debris that may have accumulated around the loading area, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Properly design loading/unloading areas to prevent storm water runon, runoff of spills, etc.**

   A. Grade and/or berm the area to prevent runon.
   B. Position roof downspouts to direct stormwater away from the area.
   C. Grade and/or berm the loading/unloading area to a drain that is connected to a dead-end.
   D. The area where truck transfers take place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.

2. **Reduce exposure of materials to rain.**

   A. Cover the loading/unloading areas.
   B. If a cover is unfeasible, use overhangs, seals or door skirts to enclose areas.

3. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

      The following pollution prevention principles apply to most industries:
      - Affirmative Procurement - Use alternative, safer, or recycled products.
      - Redirect storm water flows away from areas of concern.
      - Reduce use of water or use dry methods.
      - Reduce storm water flow across facility site.
      - Recycle and reuse waste products and waste flows.
      - Move or cover potential pollution from storm water contact.
      - Provide on-going employee training in pollution prevention.

IC 10. Outdoor Process Equipment Operations & Maintenance

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Prevent materials, products and other pollutants associated with outdoor processing activities from entering the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Properly maintain fleet of vehicles and equipment.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep processing areas free of trash & debris.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent materials, products and other pollutants associated with outdoor processing activities from entering the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum to clean outdoor processing areas, including parking lots, streets & gutters. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials.
   C. Clean oily spots with absorbent materials. Do not allow discharges to enter the street, gutters or storm drains.
   D. Dispose of collected runoff and solids properly.
   E. Design process area to prevent stormwater runon such as grade and/or berm the area to prevent runon. Position roof downspouts to direct stormwater away from the area.
   F. Design process area to contain spills.
   G. Place equipment on an impervious surface, or install a drip pan under potential leak points.
   H. Construct a berm around the process equipment to contain spills.
   I. Install drains connected to the public sewer or the facility's process wastewater system within these contained areas. DO NOT discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Properly maintain fleet of vehicles and equipment.**

   A. Conduct regular and frequent inspection of fleet vehicles and equipment for leaks, malfunctions, staining on and around equipment, and other evidence of leaks.
   B. Develop a standard methodology for reporting inspection results.
   C. Develop a procedure for taking action on items in the report, responding to leaks, cleaning up spills, and completing repairs to prevent future leaks.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep loading & unloading areas free of trash & debris.**

   A. Do not hose out dumpsters or fill them with liquid waste.
   B. Regularly inspect, repair, and/or replace dumpsters.
   C. Properly dispose of any trash, litter and other debris that may have accumulated around the processing area, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Reduce exposure of materials to rain.**

   A. Cover the loading/unloading areas.
   B. If a cover is unfeasible, use overhangs, seals or door skirts to enclose areas.

2. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

      The following pollution prevention principles apply to most industries:
      - Affirmative Procurement - Use alternative, safer, or recycled products.
      - Redirect storm water flows away from areas of concern.
      - Reduce use of water or use dry methods.
      - Reduce storm water flow across facility site.
      - Recycle and reuse waste products and waste flows.
      - Move or cover potential pollution from storm water contact.
      - Provide on-going employee training in pollution prevention.

B. Eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:
   - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
   - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
   - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
   - Choose cleaning agents that can be recycled.

IC 11. Outdoor Storage of Raw Materials, Products & Containers

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Prevent materials, products and other pollutants associated with the outdoor storage area from entering the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Properly maintain fleet of vehicles and equipment.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. <u>Prevent materials, products and other pollutants associated with the outdoor storage area from entering the streets, gutters, storm drains, or natural watercourses.</u>

A. Use sweeping and pick-up methods or vacuum to clean outdoor processing areas, including parking lots, streets & gutters. Do not wash materials into the street, gutters or storm drains.
B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials.
C. Clean oily spots with absorbent materials. Do not allow discharges to enter the street, gutters or storm drains.
D. Dispose of collected runoff and solids properly.
E. Design storage areas to prevent stormwater runon such as grade and/or berm the area to prevent runon. Position roof downspouts to direct stormwater away from the area.
F. Design storage area to contain spills.
G. Protect materials stored outside from stormwater runon. Construct a berm around the perimeter of the material storage area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.
H. Minimize pooling of water. Slope paved areas to minimize the pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5 percent is recommended.
I. All materials stored outside should have a secondary containment system.
   - Surround storage tanks with a berm or other secondary containment system.
   - Slope the area inside the berm to a drain.
   - Drain liquids to the sanitary sewer if available.
   - DO NOT discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.
J. Properly store and handle chemical materials.
   - Designate a secure material storage area that is paved free of cracks and gaps, and impervious in order to contain leaks and spills.
   - Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.
   - Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all the containers or 110 percent of the volume of the largest container, whichever is greater.
   - Keep chemicals in their original containers, if feasible, and keep them well labeled.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Properly maintain fleet of vehicles and equipment.**

   A. Conduct regular and frequent inspection of fleet vehicles and equipment for leaks, malfunctions, staining on and around equipment, and other evidence of leaks.
   B. Develop a standard methodology for reporting inspection results.
   C. Develop a procedure for taking action on items in the report, responding to leaks, cleaning up spills, and completing repairs to prevent future leaks.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep site free of trash & debris.**

   A. Do not hose out dumpsters or fill them with liquid waste.
   B. Regularly inspect, repair, and/or replace dumpsters.
   C. Properly dispose of any trash, litter and other debris that may have accumulated around the storage areas, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Keep outdoor storage containers in good condition.**

   A. Keep storage areas clean and dry.
   B. Sweep and maintain routes to and from storage areas.

2. **Reduce exposure of materials to rain.**

   A. Store materials indoors, if feasible.
   B. Store materials on paved or impervious surfaces.
   C. Protect materials stored outside from rainfall and wind dispersal.
      - Cover materials with a fixed roof or a temporary waterproof covering made of polyethylene, polypropylene, or hypalon.
      - Keep covers in place at all times when work is not occurring.

- If areas are so large that they cannot feasibly be covered and contained, implement erosion control practices at the perimeter of the area and at any catch basins to prevent dispersion of the stockpiled material.
- If a cover is unfeasible, use overhangs, seals or door skirts to enclose areas.

3. Conduct regular inspections of storage areas.

A. Check for external corrosion of material containers, structural failures, spills and overfills due to operator error, failure of piping system, etc.
B. Inspect tank foundations, connections, coatings, tank walls, and piping system.
C. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken tanks or container systems.

4. If drums are stored in an area where unauthorized persons may gain access secure them in such a manner as to prevent accidental spillage, pilferage, or any unauthorized use.

5. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:
- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

IC 12. Painting, Finishing, & Coating of Vehicles, Boats, Buildings & Equipment

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Prevent paints, finishing, and coating materials, toxic substances and liquid waste from entering the streets, gutters, storm drains, and natural watercourses.
2.	Provide employee & contractor training.
3.	Properly clean, store, and dispose of painting, finishing and coating materials.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent paints, finishing, and coating materials, toxic substances and liquid waste from entering the streets, gutters, storm drains, and natural watercourses.**
   A. Properly prepare work area.
   B. Use ground drop cloths underneath outdoor painting, scraping, sandblasting and cutting work, outdoor mixing of paint, solvents and tool cleaning. Property dispose of collected materials in the garbage in appropriate trash containers.
   C. Hang wind-blocking tarps to prevent sand blasting dust and overspray from escaping. Do not conduct these activities when wind conditions are such that containment is rendered ineffective.
   D. Do not conduct sand blasting or spray painting over open waters.
   E. When working near drain inlets, use storm drain covers, filter fabric or similarly effective device to prevent materials from entering the storm drain system.
   F. Use sweeping and pick-up methods or vacuum to clean work areas from construction debris daily. Do not wash work areas into the parking lot, street, gutters or storm drains.
   G. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Properly clean, store, and dispose of painting, finishing and coating materials.**
   A. Clean paint brushes and tools in sinks connected to sanitary sewers or in portable containers that can be dumped into a sink, toilet, or other drain that is plumbed to the sanitary sewer.
   B. Paint brushes and tools covered with non-water based materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. <u>Keep site free of trash & debris</u>

A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the work area, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.
B. Cover materials left outdoors at the end of the workday with a temporary waterproof covering made of polyethylene, polypropylene or hypalon.

Other Beneficial Tips & Techniques

1. Properly store equipment, chemicals and waste.

A. Store equipment indoors or in covered areas to avoid exposure to rain.
B. Implement storage requirements for chemicals indoors or in covered areas with guidance from the local fire department.
C. Dispose of empty containers according to the instructions on the container label.

2. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 13. Parking & Storage Area Maintenance

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
2.	Provide employee & contractor training.
3.	Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum to clean hardscape areas, including parking lots, streets & gutters. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials.
   C. Clean oily spots with absorbent materials. Do not allow discharges to enter the street, gutters or storm drains.
   D. Dispose of collected runoff and solids properly.

2. **Provide employee & contractor training.**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including patios, parking lots, sidewalks, common area, and other outdoor areas. Do not wash these areas.
   B. Do not hose out dumpsters or fill them with liquid waste.
   C. Regularly inspect, repair, and/or replace dumpsters.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep site free of trash & debris**

   A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the building, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **See IC04. Concrete & Asphalt Production, Application & Cutting, for requirements for conducting parking lot surface repairs.**

2. **Conduct inspections on a regular basis.**

   A. Designate personnel to conduct inspections of the parking lot facilities and stormwater conveyance systems associated with them.
   B. Inspect cleaning equipment/sweepers for leaks on a regular basis.

3. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

   The following pollution prevention principles apply to most industries:
   - Affirmative Procurement - Use alternative, safer, or recycled products.
   - Redirect storm water flows away from areas of concern.
   - Reduce use of water or use dry methods.
   - Reduce storm water flow across facility site.
   - Recycle and reuse waste products and waste flows.
   - Move or cover potential pollution from storm water contact.
   - Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 14. Pool & Fountain Cleaning

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Discharge pool & fountain water properly.
2. Provide employee training.
3. Prevent algae problems with regular cleaning, consistent adequate chlorine levels, and well maintained filtration and circulation systems.
Minimum Designated Pollution Prevention Methods PPMs
1. Properly clean and/or dispose of filters.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. Discharge pool & fountain water properly.

A. Consider hiring a professional pool-draining service to collect all pool water for off-site disposal.
B. Drain pools or fountains to the sanitary sewer if permitted to do so.
C. If draining a pool to the sanitary sewer, prevent backflow by maintaining an "air gap" between the discharge line and the sewer line (do not seal the connection between the hose and sewer line). Be sure to call the local sewer authority for guidance on flow rate restrictions, back-flow prevention, and handling special cleaning waste (such as acid wash). Keep discharge flows to the low levels. Higher flow rates may be prohibited by local ordinance.
D. If water is de-chlorinated with a neutralizing chemical or by allowing chlorine to dissipate for a few days (do not use the facility during this time), the water may be recycled/reused by draining it gradually onto a landscaped area or directly to a storm drain inlet. Water must be tested prior to discharge to ensure that chlorine is not present.

2. Provide employee training.

A. Educate and train employees on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
B. Educate and train employees on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
C. Train employees on proper spill containment and cleanup methods.
D. Train employees and maintenance personnel on the proper techniques for testing chlorine levels and applying neutralizing chemicals.

3. Prevent algae problems with regular cleaning, consistent adequate chlorine levels, and well maintained filtration and circulation systems.

A. Do not use copper-based algaecides.
B. Control algae with chlorine or other alternatives, such as sodium bromide.
C. Manage pH and water hardness to minimize corrosion of copper pipes.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. <u>Properly clean and/or dispose of filters</u>.

A. Never clean a filter in the street or near a storm drain.
B. Rinse cartridge filters onto a dirt area, and work filter residue into soil.
C. Backwash diatomaceous earth filters onto dirt. Dispose of spent diatomaceous earth in the garbage. Diatomaceous earth cannot be discharged to surface waters, storm drainage systems, septic systems, or on the ground.
D. If there is not a suitable dirt area, discharge filter backwash or rinse-water to the sanitary sewer if permitted to do so by the local sewer agency.

Other Beneficial Tips & Techniques

1. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 15. Spill Prevention & Clean Up

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Clean up leaks and spills immediately.
2. Provide employee & contractor training.
3. Properly store and handle chemical materials.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep storage areas free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. Clean up leaks and spills immediately.

A. Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use brooms, shovels, sweepers, or plows.
B. Place a stockpile of spill cleanup materials where they will be readily accessible (e.g. near storage and maintenance areas).
C. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly. Never hose down or bury dry material spills.
D. Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
E. For larger spills, a private spill cleanup company or Hazmat team may be necessary.

2. Provide employee & contractor training.

A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
C. Train employees on proper spill containment and cleanup methods.

3. Properly store and handle chemical materials.

A. Designate a secure material storage area that is paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
B. Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers.
C. Keep chemicals in their original containers, if feasible.
D. Keep containers well labeled according to their contents (e.g., solvent, gasoline).
E. Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
F. Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep storage areas free of trash & debris.**

   A. Properly dispose of any trash, litter and other debris that may have accumulated around the processing area, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Utilize secondary containment systems for liquid materials.**

   A. Surround storage tanks with a berm or other secondary containment system.
   B. Slope the area inside the berm to a drain.
   C. Drain liquids to the sanitary sewer if available.
   D. Pass accumulated stormwater in petroleum storage areas through an oil/water separator.
   E. **DO NOT** discharge wash water to sanitary sewer until contacting the local sewer authority to find out if pretreatment is required.
   F. If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collect runoff from the storage tank area.

2. **Protect materials stored outside from stormwater runon.**

   A. Construct a berm around the perimeter of the material storage area to prevent the runon of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the material.

3. **Identify key spill response personnel.**

4. **Reporting**

   A. Report spills that pose an immediate threat to human health or the environment to local agencies.

   B. Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

5. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

B. Eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

- Use non-caustic detergents instead of caustic cleaning for parts cleaning.
- Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
- Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
- Choose cleaning agents that can be recycled.

IC 16. Vehicle & Equipment Fueling

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Prevent fuel from entering the streets, gutters, storm drains, and natural watercourses.
2. Provide employee & contractor training.
3. Utilize fueling safeguards.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep fuelling area clean and free of trash and debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent fuel from entering the streets, gutters, storm drains, and natural watercourses**

   A. Cover the fuel dispensing area with a canopy for weather protection such that the cover's minimum dimensions are equal to or greater than the area within the grade break or concrete fuel dispensing area. Position roof downspouts to direct water away from fueling areas.
   B. Grade fuel dispensing area with a 2 to 4 percent slope to prevent ponding. Pave fuel area with Portland cement concrete or equivalent smooth impervious surface.
   C. Use secondary containment and interruptible drainage. Direct drainage from the concrete fuel dispensing area and fuel storage tank(s) to an underground clarifier/sump/tank equipped with a shut-off valve that can stop the further draining of spilled fuel to the street or storm drain system.
   D. If conducting mobile fueling, designate mobile fueling areas and bring equipment to these areas. Use secondary containment and cover storm drains in the vicinity during fueling.

2. **Provide employee & contractor training**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Utilize fueling safeguards**

   A. Use overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
   B. Install protective guards around tanks and piping to prevent vehicle or forklift damage.
   C. Clearly tag or label all valves to reduce human error.
   D. Place spill kits at fueling areas and/or on vehicles.
   E. Install vapor recovery nozzles to help control drips as well as air pollution.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep fuelling area clean and free of trash and debris**

   A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the fueling area, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

B. Use sweeping and pick-up methods or vacuum to clean fueling areas. Use rags and absorbents for leaks and spills. Do not wash materials into the street, gutters or storm drains.
C. If pressure washing, use a collection device that enables collection of wash/rinse water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials.

Other Beneficial Tips & Techniques

1. Conduct regular inspections of fueling equipment

A. Check fueling equipment for external corrosion and structural failure.
B. Check for spills and overfills due to operator error.
C. Check for failure of piping system.
D. Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or visa versa.
E. Visually inspect new tank or container installation for loose fittings, poor welding, and/or improper or poorly fitting gaskets.
F. Inspect tank foundations, connections, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
G. Report leaking vehicles to fleet maintenance.

2. Pollution Prevention

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 17. Vehicle & Equipment Maintenance & Repair

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Prevent materials, products and other pollutants associated with maintenance and repair activities from entering the streets, gutters, storm drains, or natural watercourses.
2. Provide employee & contractor training.
3. Properly maintain fleet of vehicles and equipment.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep maintenance and repair areas free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent materials, products and other pollutants associated with maintenance and repair activities from entering the streets, gutters, storm drains, or natural watercourses**

   A. Use sweeping and pick-up methods or vacuum to clean maintenance and repair areas. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash/rinse water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials.
   C. Inspect incoming vehicles and equipment for leaks. Place vehicles and equipment on an impervious surface and install a drip pan under potential leak points.
   D. Clean oily spots with absorbent materials. Do not allow discharges to enter the street, gutters or storm drains.
   E. Dispose of collected runoff and solids properly. Store waste and/or recycling drums in designated areas with spill containment
   F. Conduct maintenance and repair work in a designated area designed to contain spills.
   G. Design the maintenance and repair area to prevent stormwater runon such as grade, intercept trench and/or berm the area to prevent runon. Position roof downspouts to direct stormwater away from the area.
   H. Install drains connected to the public sewer or the facility's process-wastewater system within these contained maintenance and repair areas. DO NOT discharge to a public sewer until contacting the local sewer authority to find out if pretreatment is required. If discharge to the sanitary sewer is not allowed, pump water to a tank and dispose of properly.

2. **Provide employee & contractor training**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees and contractors on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Properly maintain fleet of vehicles and equipment**

   A. Conduct regular and frequent inspection of fleet vehicles and equipment for leaks, malfunctions, staining on and around equipment, and other evidence of leaks.
   B. Develop a standard methodology for reporting inspection results.
   C. Develop a procedure for taking action on items in the report, responding to leaks, cleaning up spills, and completing repairs to prevent future leaks.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **<u>Keep maintenance and repair areas free of trash & debris</u>**

   A. Do not hose out dumpsters or fill them with liquid waste.
   B. Regularly inspect, repair, and/or replace dumpsters.
   C. Properly dispose of any trash, litter and other debris that may have accumulated around the maintenance and repair area to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. **Reduce exposure of maintenance and repair area to rain.**

   A. Cover the maintenance and repair areas.

2. **Completely drain oil filters before recycling/disposal.**

3. **Remove all fluids from retired, wrecked, or salvaged vehicles.**

4. **Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.**

5. **Pollution Prevention.**

   A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

      The following pollution prevention principles apply to most industries:
      - Affirmative Procurement - Use alternative, safer, or recycled products.
      - Redirect storm water flows away from areas of concern.
      - Reduce use of water or use dry methods.
      - Reduce storm water flow across facility site.
      - Recycle and reuse waste products and waste flows.
      - Move or cover potential pollution from storm water contact.
      - Provide on-going employee training in pollution prevention.

B. Eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:
   - Use non-caustic detergents instead of caustic cleaning for parts cleaning.
   - Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
   - Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
   - Choose cleaning agents that can be recycled.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 18. Vehicle & Equipment Washing & Steam Cleaning

Site Address: _____
Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Prevent wash/rinse water from entering the streets, gutters, storm drains or natural watercourses.
2. Provide employee & contractor training.
3. Properly maintain fleet of vehicles and equipment.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep wash areas clean of trash and debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent wash/rinse water from entering the streets, gutters, storm drains or natural watercourses**

   A. If possible, use off-site commercial washing and/or steam cleaning businesses. These businesses are better equipped to handle and properly dispose of the wash waters.

   B. Use mobile commercial washing and/or steam cleaning businesses capable of disposing of wastewater off-site. Mobile cleaning businesses must use a leak proof cover device that will catch and contain all wastewater runoff for later disposal in a manner that complies with all city, county, state, and federal codes.

   C. If washing occurs onsite, clearly mark and designate an impervious indoor or outdoor area to be used solely for vehicle and equipment washing/steam cleaning. Construct a berm around the designated area and grade to collect wash water as well as to prevent storm water run-on. Use a collection device that enables collection of wash water and associated solids (i.e. portable containment such as ground cover devices). Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly.

   D. Use hoses with nozzles that automatically turn off when left unattended.

2. **Provide employee & contractor training**

   A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees in proper waste handling and disposal.
   C. Educate and train staff on the proper maintenance of the wash area.
   D. Train employees on proper spill containment and cleanup methods.

3. **Properly maintain fleet of vehicles and equipment**

   A. Conduct regular inspections of vehicles and equipment for fluid leaks and malfunctions.
   B. Ensure all vehicles and equipment are in good working order.
   C. Promptly repair and clean up any fluid leaks from vehicles and equipment.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. **Keep the wash area free of trash & debris**

A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the wash area to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. Properly use and store chemicals and waste

A. Implement storage requirements for chemicals indoors or in covered areas with guidance from the local fire department.
B. Use all of a product before disposing of the container.
C. Dispose of empty containers according to the instructions on the container label.
D. Label and store hazardous wastes according to hazardous waste regulations.
E. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers.

2. Inspect and maintain equipment (such as ground cover devices) regularly to ensure proper and effective functioning

3. Pollution Prevention

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 19. Waste Handling & Disposal

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Prevent waste from coming into direct contact with wind, rain and stormwater runoff.
2. Provide employee & contractor training.
3. Prevent wash/rinse water from waste collection areas from entering the streets, gutters, storm drains or natural watercourses.
Minimum Designated Pollution Prevention Methods PPMs
1. Keep waste collection areas clean.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. Prevent waste from coming into direct contact with wind, rain and stormwater runoff

A. If feasible, cover the waste management area with a permanent roof.
B. Cover temporary waste piles with a sturdy non-permeable covering material.
C. Cover dumpsters to prevent rain from washing out waste materials.
D. Place dumpsters or other waste receptacles on an impervious surface.
E. Position roof downspouts to direct stormwater away from waste handling areas.
F. Design waste handling and disposal areas to prevent contact with stormwater runoff, including the use of berms to divert water away from the area.

2. Provide employee & contractor training

A. Educate and train employees and contractors on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
B. Educate and train employees in proper waste handling and disposal.
C. Train employees on proper spill containment and cleanup methods.

3. Prevent wash/rinse water from entering the streets, gutters, storm drains or natural watercourses

A. Use sweeping and pick-up methods or vacuum to clean waste collection areas, including streets & gutters. Do not wash materials into the street, gutters or storm drains.
B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly.
C. Regularly inspect, repair and/or replace dumpsters. Do not hose out dumpsters or fill them with liquid waste.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. Keep site free of trash & debris

A. Pick-up and properly dispose of any trash, litter and other debris that may have accumulated around the building, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.
B. Post “No Littering” signs.

Other Beneficial Tips & Techniques

1. Properly use and store equipment, chemicals and waste

A. Store equipment indoors or in covered areas to avoid exposure to rain.
B. Implement storage requirements for chemicals indoors or in covered areas with guidance from the local fire department.
C. Use all of a product before disposing of the container.
D. Dispose of empty containers according to the instructions on the container label.
E. Secure solid waste containers when not in use.
F. Segregate wastes by type and label and date wastes.
G. Label and store hazardous wastes according to hazardous waste regulations.
H. Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
I. Ensure that only appropriate solid wastes are added to solid waste containers.
J. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers.

2. Pollution Prevention

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

IC 20. Eating & Drinking Establishments

Site Address: _____

Business Name: _____

The table below identifies activity-specific Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs and PPMs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP and PPM, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs/PPMs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs/PPMs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs/PPMs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of wash/rinse water in the parking lots, streets, gutters, storm drains, or natural watercourses.
2.	Provide employee training.
3.	Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.
4.	Properly dispose of grease.
Minimum Designated Pollution Prevention Methods PPMs	
1.	Keep site free of trash & debris.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of wash/rinse water in the parking lots, streets, gutters, storm drains, or natural watercourses.**

   A. Clean equipment (floor mats, grease filters, grills, garbage cans, etc.) indoors or in a covered outdoor wash area that is plumbed to the sanitary sewer.
   B. Clean equipment in a mop sink if possible (never in a food preparation sink). If there is no mop sink, dedicate an indoor cleaning area where a drain is plumbed to the sanitary sewer.
   C. Dispose mop water from cleaning floors in a mop sink, toilet or other drain that is plumbed to the sanitary sewer.
   D. Do not pour wash water outside or into a parking lot, street, gutter, or storm drain

2. **Provide employee & contractor training.**

   A. Educate and train employees on the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train employees on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Train employees on proper spill containment and cleanup methods.

3. **Prevent wash/rinse water from trash dumpster, patio, sidewalk and other hardscape areas from entering the parking lots, streets, gutters, storm drains, and natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including drive-thur areas, patios, parking lots, sidewalks, common area, and outdoor eating areas. Do not wash these areas.
   B. Do not hose out dumpsters or fill them with liquid waste.
   C. Regularly inspect, repair, and/or replace dumpsters.

4. **Properly dispose of grease.**

   A. Collect and dispose of concentrated waste oil and grease and disposed of by a certified waste grease hauler. NEVER pour grease or oil into a sink, floor drain, storm drain or dumpster.
   B. Dispose of all wastewater containing oil and grease in a grease trap or interceptor.

Suggested Implementation Strategies for Minimum Designated Pollution Prevention Methods (PPMs)

1. <u>Keep site free of trash & debris</u>

A. Pick-up on a regular basis and properly dispose of any trash, litter, food products and other debris that may have accumulated in the planters, parking lot or other parts of the site to prevent them from entering the streets, gutters and storm drains.

Other Beneficial Tips & Techniques

1. Pollution Prevention.

A. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

IC 21. Irrigation Runoff

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Implement all feasible measures to reduce and eliminate surface runoff of irrigation water.
2.	Comply with water conservation, drought response and waste prohibition regulations of the water district.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. <u>Implement all feasible measures to reduce and eliminate surface runoff of irrigation water.</u>

A. Ensure that persons responsible for landscape maintenance are aware of irrigation management techniques for pollution prevention.
B. Replace irrigation controller batteries in the spring and fall.
C. Inspect the irrigation system regularly, while it is operating, to identify leaks and to determine if runoff is occurring.
D. Promptly repair any leaks or breaks. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
E. Adjust sprinkler heads and nozzles to avoid over-spray onto pavement and/or other impervious areas.
F. Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded. This can occur in less than 2 minutes depending on landscaping, soil type and topography.

G. Adjust the watering schedule seasonally to reflect reduced winter water demand.
H. Do not water when rain is predicted, or when the ground is already moist from rainfall.

2. <u>Comply with water conservation, drought response and waste prohibition regulations of the water district.</u>

A. Adhere to the watering schedule restrictions designated by the water district, as appropriate to drought conditions. For more information on water district requirements contact Moulton Niguel Water District at (949) 831-2500 or visit their website at www.mnwd.com.

Other Beneficial Tips & Techniques

1. <u>Consider upgrading irrigation system components to increase irrigation efficiency and reduce runoff.</u>

A. Replace old timer-based irrigation controllers with new evapotranspiration-driven self-adjusting controllers.
B. Install sprinkler heads with a low precipitation rate and/or a more adjustable spray pattern or radius as needed.
C. Install popup sprinkler heads in areas with a lot of activity and/or where risers may be broken.
D. Install water-efficient drip irrigation systems for trees, shrubs and flowers.
E. Install a sensor that will reduce flow in case of breakages in the system.
F. Install an automatic rain shut-off sensor.
G. Install check valves for sprinkler heads at the bottom of slopes to eliminate low-head drainage.

2. <u>Consider reducing the need for irrigation.</u>

A. Add 2-3 inches of mulch around trees and plants to minimize runoff and reduce evaporation.
B. Replace turf areas adjacent to pavement and/or other impervious areas with drought tolerant shrubs and groundcover.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

IC 22. POWER WASHING



The checklist below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for power washing and surface cleaning activities, based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the Minimum Designated BMPs is a listing of suggested implementation strategies that may be utilized where appropriate.

A surface cleaning business is considered to be any operation that provides the following services:

- Cleaning (e.g., power sweeping, washing) driveways and parking lots
- Cleaning building exteriors (except sand blasting, window cleaning)
- Driveway cleaning (e.g., power sweeping, washing) services
- Parking lot cleaning (e.g., power sweeping, washing) services
- Power washing building exteriors
- Pressure washing (e.g., buildings, decks, fences)
- Steam cleaning building exteriors

Minimum Designated BMPs: Prevent wastewater or wash water from exterior power washing or other exterior surface cleaning activity from entering parking lots, streets, gutters, storm drains, and natural water courses.

SUGGESTED IMPLEMENTATION STRATEGIES

The suggested implementation strategies presented below are intended ensure compliance with the Minimum Designated BMP. The following strategies, or equivalently protective techniques, must be observed by all surface cleaners, regardless of the surface to be cleaned or the type of cleaning operation to be performed:

What needs to be done prior to conducting a job?

- Evaluate the chemicals and compounds used for cleaning and reduce or eliminate the use of those that contain solvents, heavy metals, high levels of phosphates, or very high/very low pH.
- Walk through the area where the cleaning will occur prior to the start of the job and identify all area drains, yard drains, and catch basins where wastewater could potentially enter the street or storm drain system.
- Block/seal off identified drains or catch basins using sand bags, plugs, rubber mats, or temporary berms.
- Collect all trash and debris from the area and place in a trash bin for disposal.
- Clean the area of debris prior to cleaning to minimize the amount of suspended solids, soil, and grit in the resulting wastewater.

- Identify where surface washing will occur. Avoid washing whole areas; spot clean where feasible and necessary.
- Identify the wastewater disposal option that will be used. Whether you are discharging to landscaping or sanitary sewer, make sure that the requirements will be met and/or the necessary contacts have been made, as discussed below.
- Inventory spill cleanup equipment to ensure that it is available for immediate use, if needed.
- Conduct surface cleaning in accordance with all operating instructions provided by the equipment supplier. Maintain equipment in good working order and routinely check and test all safety features.

What methods can be used to collect wastewater at a site?

There is no specific containment method that must be used for wastewater collection/diversion. However, the system must be adequately designed so that the wastewater does not flow into an on-site or off-site storm drain inlet or into the street. All surface cleaners should use one of the following methods, regardless of the surface to be cleaned or the type of cleaning operation to be performed:

- Portable containment areas can be made from waterproof tarps, heavy-duty plastic, or rubber matting equipped with berms to prevent wastewater from running into on-site or off-site storm drain inlets or into the street. Materials that have been used for berms include sand bags or water-filled tubing. Whatever containment material is used, it must seal tightly to the ground so that none of the wastewater can pass under or over the berms.
- When power washing smaller pieces of equipment, containment devices to use may include portable vinyl swimming pools, plastic 55-gallon drums on casters, and flat metal or plastic containment pads.
- Depending on the volume of wastewater generated, it may be necessary to use a pump system, which may range in size from a wet-dry vacuum to a sump pump. A basin from which to pump wastewater can also be created by establishing a slightly sloped containment area.
- Stationary or more permanent containment areas can be constructed with cement. Berms and pump systems may be used to contain wastewater and divert it to a holding tank.
- Commercial wastewater collection systems are also available for power washing. These systems can range from portable wash pits to self-contained water recycling systems. A list of companies selling this type of equipment can usually be found in the telephone book under “Pressure Washing Services and Equipment”.
- Storm drain covers can be made of an impermeable barrier such as a heavy-duty vinyl or plastic secured in place with materials such as concrete blocks, gravel bags, or sand bags. Storm drain covers may also be available though commercial vendors.

Note: Blocking storm drain inlets in the public right-of-way is prohibited as a method of containment, unless expressly permitted by the municipality, typically through an encroachment permit process. Wastewater should be contained on-site prior to entering the public right-of-way. Contact the local municipality for more information.

Wastewater Disposal Options

How can wastewater be safely disposed?

Wastewater generated by surface cleaners is not allowed in the storm drain or street. However, the wastewater may be discharged to a landscaped area, the sanitary sewer, or it may be picked up and disposed of by a waste hauler. Please note that laboratory chemical analysis of wastewater may be required

to establish the proper disposal method. A wastewater disposal option should be selected based on the conditions outlined below:

Discharge Wastewater to a Landscaped Area

The wastewater must meet the following requirements if discharging to landscaping:

- The pH must be between 6.5 and 8.5. This can be checked quickly and easily through the use of pH paper test strips.
- The wastewater should not contain large volumes or concentrations of:
    - Toxic materials
    - Degreasers
    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel)
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow
    - Petroleum oil, or other products of mineral oil origin
    - Paint
- Prior to surface washing, you must exercise any reasonable means to eliminate large volumes or concentrations of the above listed pollutants. Common methods to eliminate standing pools of pollutants include the placement of absorbent to adsorb the pollutant, dry-sweeping the absorbent, and disposing of the absorbent properly.
- Wastewater from cleaning food-related vehicles or areas, vehicle exteriors or engines, and buildings with lead- or mercury-based paint should not be discharged to landscaping.
- Filter the wastewater if it contains debris, fibers, or other suspended solids.
- Ensure that the wastewater is fully contained within the landscaped area and will fully infiltrate into the ground prior to leaving the job site.

Sanitary Sewer

If discharging to the sanitary sewer, the following conditions apply:

- The wastewater temperature must be less than 140°F (60°C).
- The pH must be between 6.0 and 12.0. This can be checked quickly and easily through the use of pH paper test strips. Adjust the wastewater to a pH that is between 6.0 and 12.0. Dilution is not an effective or acceptable pretreatment method.
- The wastewater quality must comply with the sanitary sewer facility's local discharge limits and should not contain:
    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel).
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
    - Petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.
    - Oil based paint.
- No wastewater shall be discharged into any publicly owned manholes that directly or indirectly connect to the sanitary sewer system without express authorization from the appropriate agency.

When discharging to the sanitary sewer:

- Filter the wastewater if it contains debris, fibers, or other suspended solids.

- If chemicals (e.g., solvents or acids) are used during the cleaning process, additional precautions may be needed. Contact your local sanitation district to learn if wastewater containing these chemicals requires pretreatment before discharge to the sanitary sewer or if it needs to be treated as hazardous waste.
- Ensure that the wastewater is released at a flow rate and/or concentration that will not cause problems, pass through, or interference with the sanitary sewer facilities.
- Utilize an approved discharge point such as:
    - Privately owned cleanout (or sink, toilet or floor drain), oil/water separator, or below ground clarifier at the client's property where the wastewater is generated,
    - Privately owned industrial sewer connection at the client's property where the wastewater is generated,
    - Wastehauler station at sanitary sewer facility, and
    - Any other disposal points approved by sanitary sewer facility.
- Maintain a logbook of all discharges.

Waste Hauler

If using a waste hauler, the following types of wastewater may be disposed if it:

- Is corrosive (as indicated by a pH value of less than 5.5) or caustic (as indicated by a pH value of greater than 10.0).
- Contains a pollutant that may create a fire or explosion hazard (e.g., gasoline, diesel).
- Contains solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
- Contains petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.

When using a waste hauler:

- Ensure that the waste hauler is certified by appropriate sanitary sewer and local health care agencies, is Hazardous Waste DOT certified, and complies with applicable discharge regulations, which may include obtaining necessary permits and conducting water quality monitoring requirements.
- Identify the wastes involved and determine if a hazardous waste has been generated. Examples of situations that may potentially generate hazardous wastes include:
    - Power washing old paint off a building. Old paint stripped off commercial buildings may contain metals (e.g., lead, chromium, cadmium, and mercury), causing it to be a regulated hazardous waste. Paint chips cannot be left on the ground at the job site. Paint chips need to be collected, evaluated, and disposed of properly.
    - The use of certain solvents as degreasing agents, which may cause the wastewater to be classified as a listed or characteristic hazardous waste.
- Maintain a logbook of all discharges and hazardous waste manifests, if applicable.

IC 23. Mobile Businesses



The checklist below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for the proper disposal of wastewater generated by mobile business operations. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and to limit impact on stormwater surface water quality to the maximum extent practicable. Below the Minimum Designated BMPs is a listing of suggested implementation strategies that may be utilized where appropriate.

Minimum Designated BMPs:

1. Prevent wastewater or wash water from entering parking lots, streets, gutters, storm drains, and natural water courses.
2. Properly store and handle chemical materials.
3. Provide employee & contractor training.

SUGGESTED IMPLEMENTATION STRATEGIES

The suggested implementation strategies presented below are intended ensure compliance with the Minimum Designated BMP. The following strategies, or equivalently protective techniques, must be observed by all mobile businesses:

What needs to be done prior to conducting a job?

- Evaluate the chemicals and compounds used for cleaning and reduce or eliminate the use of those that contain solvents, heavy metals, high levels of phosphates, or very high/very low pH.
- Walk through the area where the cleaning will occur prior to the start of the job and identify all area drains, yard drains, and catch basins where wastewater could potentially enter the street or storm drain system.
- Block/seal off identified drains or catch basins using sand bags, plugs, rubber mats, or temporary berms.
- Collect all trash and debris from the area and place in a trash bin for disposal.
- Clean the area of debris prior to cleaning to minimize the amount of suspended solids, soil, and grit in the resulting wastewater.
- Identify the wastewater disposal option that will be used. Whether you are discharging to landscaping or sanitary sewer, make sure that the requirements will be met and/or the necessary contacts have been made, as discussed below.
- Inventory spill cleanup equipment to ensure that it is available for immediate use, if needed.
- Conduct surface cleaning in accordance with all operating instructions provided by the equipment supplier. Maintain equipment in good working order and routinely check and test all safety features.

What methods can be used to collect wastewater at a site?

There is no specific containment method that must be used for wastewater collection/diversion. However, the system must be adequately designed so that the wastewater does not flow into an on-site or off-site storm drain inlet or into the street. All mobile businesses should use one of the following methods, regardless of the e type of cleaning operation to be performed:

- Portable containment areas can be made from waterproof tarps, heavy-duty plastic, or rubber matting equipped with berms to prevent wastewater from running into on-site or off-site storm drain inlets or into the street. Materials that have been used for berms include sand bags or water-filled tubing. Whatever containment material is used, it must seal tightly to the ground so that none of the wastewater can pass under or over the berms.
- When power washing smaller pieces of equipment, containment devices to use may include portable vinyl swimming pools, plastic 55-gallon drums on casters, and flat metal or plastic containment pads.
- Depending on the volume of wastewater generated, it may be necessary to use a pump system, which may range in size from a wet-dry vacuum to a sump pump. A basin from which to pump wastewater can also be created by establishing a slightly sloped containment area.
- Stationary or more permanent containment areas can be constructed with cement. Berms and pump systems may be used to contain wastewater and divert it to a holding tank.
- Commercial wastewater collection systems are also available for power washing. These systems can range from portable wash pits to self-contained water recycling systems. A list of companies selling this type of equipment can usually be found in the telephone book under “Pressure Washing Services and Equipment”.
- Storm drain covers can be made of an impermeable barrier such as a heavy-duty vinyl or plastic secured in place with materials such as concrete blocks, gravel bags, or sand bags. Storm drain covers may also be available though commercial vendors.

Note: Blocking storm drain inlets in the public right-of-way is prohibited as a method of containment, unless expressly permitted by the municipality, typically through an encroachment permit process. Wastewater should be contained on-site prior to entering the public right-of-way. Contact the local municipality for more information.

Wastewater Disposal Options

How can wastewater be safely disposed?

Wastewater generated by mobile businesses is not allowed in the storm drain or street. However, the wastewater may be discharged to a landscaped area, the sanitary sewer, or it may be picked up and disposed of by a waste hauler. Please note that laboratory chemical analysis of wastewater may be required to establish the proper disposal method. A wastewater disposal option should be selected based on the conditions outlined below:

Discharge Wastewater to a Landscaped Area

The wastewater must meet the following requirements if discharging to landscaping:

- The pH must be between 6.5 and 8.5. This can be checked quickly and easily through the use of pH paper test strips.
- The wastewater should not contain large volumes or concentrations of:
    - Toxic materials
    - Degreasers

    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel)
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow
    - Petroleum oil, or other products of mineral oil origin
    - Paint
- Prior to surface washing, mobile businesses must exercise any reasonable means to eliminate large volumes or concentrations of the above listed pollutants. Common methods to eliminate standing pools of pollutants include the placement of absorbent to adsorb the pollutant, dry-sweeping the absorbent, and disposing of the absorbent properly.
- Wastewater from cleaning food-related vehicles or areas, vehicle exteriors or engines, and buildings with lead- or mercury-based paint should not be discharged to landscaping.
- Filter the wastewater if it contains debris, fibers, or other suspended solids.
- Ensure that the wastewater is fully contained within the landscaped area and will fully infiltrate into the ground prior to leaving the job site.

Sanitary Sewer

If discharging to the sanitary sewer, the following conditions apply:

- The wastewater temperature must be less than 140°F (60°C).
- The pH must be between 6.0 and 12.0. This can be checked quickly and easily through the use of pH paper test strips. Adjust the wastewater to a pH that is between 6.0 and 12.0. Dilution is not an effective or acceptable pretreatment method.
- The wastewater quality must comply with the sanitary sewer facility's local discharge limits and should not contain:
    - Pollutants that may create a fire or explosion hazard (e.g., gasoline, diesel).
    - Solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
    - Petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.
    - Oil based paint.
- No wastewater shall be discharged into any publicly owned manholes that directly or indirectly connect to the sanitary sewer system without express authorization from the appropriate agency.

When discharging to the sanitary sewer:

- Filter the wastewater if it contains debris, fibers, or other suspended solids.
- If chemicals (e.g., solvents or acids) are used during the cleaning process, additional precautions may be needed. Contact your local sanitation district to learn if wastewater containing these chemicals requires pretreatment before discharge to the sanitary sewer or if it needs to be treated as hazardous waste.
- Ensure that the wastewater is released at a flow rate and/or concentration that will not cause problems, pass through, or interference with the sanitary sewer facilities.
- Utilize an approved discharge point such as:
    - Privately owned cleanout (or sink, toilet or floor drain), oil/water separator, or below ground clarifier at the client's property where the wastewater is generated,
    - Privately owned industrial sewer connection at the client's property where the wastewater is generated,
    - Wastehauler station at sanitary sewer facility, and

- Any other disposal points approved by sanitary sewer facility.

- Maintain a logbook of all discharges.

Waste Hauler

If using a waste hauler, the following types of wastewater may be disposed if it:

- Is corrosive (as indicated by a pH value of less than 5.5) or caustic (as indicated by a pH value of greater than 10.0).
- Contains a pollutant that may create a fire or explosion hazard (e.g., gasoline, diesel).
- Contains solid or viscous pollutants in amounts sufficient to cause obstruction or blockage of flow.
- Contains petroleum oil, non-biodegradable cutting oil, or other products of mineral oil origin.

When using a waste hauler:

- Ensure that the waste hauler is certified by appropriate sanitary sewer and local health care agencies, is Hazardous Waste DOT certified, and complies with applicable discharge regulations, which may include obtaining necessary permits and conducting water quality monitoring requirements.
- Identify the wastes involved and determine if a hazardous waste has been generated.
- Maintain a logbook of all discharges and hazardous waste manifests, if applicable.

CITY OF LAGUNA NIGUEL

IC 24. SPECIAL EVENTS

The matrix below identifies required activity-specific Minimum Designated Best Management Practices (BMPs) and Pollution Prevention Methods (PPMs) for Special Events, based on priorities determined by site location and operational characteristics. Minimum Designated (required) BMPs shall be implemented to eliminate prohibited discharges and limit impact on stormwater surface water quality to the maximum extent practicable.

DESIGNATED MINIMUM BEST MANAGEMENT PRACTICES (BMPs)

1. Keep site free of trash & debris.
2. Provide employee & contractor training.

Suggested Implementation Strategies for Minimum Designated BMPs	
Trash/ Litter Management	• Ensure that an adequate number of receptacles are provided for use by vendors and guests. Any overflowing containers observed shall be managed and serviced in a timely manner. • Release of balloons (rubber, latex, mylar or other material) is not allowed. • All waste receptacles shall be leak tight and equipped with lids or covers. Dumpsters shall be closed when not in use. • Pick up litter at least once daily. Litter should not be allowed to be blown away by blowers or wind. • Hazardous and liquid waste shall not be disposed of in dumpsters or trash bins. Hazardous waste shall be disposed of properly at a hazardous waste facility. Liquid waste, such as cooking grease or other food related materials, shall be properly disposed of off-site by generator. Other non-hazardous liquids, such as left over beverages, ice bin residual, etc, should be disposed of in the sanitary sewer system through a sink or toilet, or poured on a pervious area, such as a landscaped or dirt/gravel area, where the liquids can be fully absorbed prior to leaving the site. • If commercial vendors/sales are involved, provide required recycling containers as set forth by City contract waste hauler. • After the event is over and any temporary event facilities are removed, inspect the site for litter or spills, and provide for prompt cleanup and disposal.
Portable Toilets	• Require the vendor to provide a secondary containment pan or storm drain inlet protection, if a spill could reach the storm drain. • Do not place portable toilets near or over a storm drain without secondary containment. • The contact information for the company responsible for the portable facilities must be clearly marked on or near the facilities. • Ensure adequate servicing to prevent overflows or leaks. • It is recommended that vendors be requested to stake down the portable toilets to prevent them from tipping over from wind or vandals, if appropriate.

Car Wash Fundraisers	• The use of an experienced car wash fundraiser vendor, with proper containment equipment such a Prontowash, or dry methods are encouraged. • All car wash water must be contained on site and not allowed to drain to adjacent property or storm drains without treatment BMPs. • If there is adequate on-site area, car wash water may be allowed to absorb into a pervious (i.e. landscaped or gravel/dirt) area. The event water must be fully absorbed prior to leaving site. • If draining to a vegetated area, a filtering device, such as sand or gravel bags shall be used to collect sediment and debris prior to draining to the vegetated area. The collected debris shall be removed and disposed of properly at the end of the event. • A high pressure hose nozzle is encouraged to minimize water use and runoff. An automatic shut off nozzle is required per water district regulations. • A non-toxic, biodegradable soap shall be used.
Pressure Washing / Wet Washing	• All water or wastewater discharges from any washing activities must be prevented from entering streets, storm drains and gutters and collected for proper disposal. • Storm drain inlets (or low points of the site) must be protected with a temporary berm where washwater is contained and then collected for proper disposal. • If contractors (such as powerwashers) are used for wet washing services, they must contain, collect and properly dispose of washwater (most likely offsite). Include this requirement in your contract. • Small amounts of water can be dumped into a sanitary sewer connection, such as a utility sink or toilet, if available, or could be diverted to a pervious (ie. landscaped or gravel/dirt) area, and allowed to soak into the ground. The water must be fully absorbed into the ground prior to leaving site.
Spill Clean Up & Reporting	• Prior to start of event, organizers & staff should assess the event location, and identify the nearby catch basins, that would receive any trash, debris or spills from the event. • Spills of drinks, food, and any other material on a paved area must be cleaned. Liquid spills can be cleaned by using absorbent materials such as paper towels, mops, or an absorbent material. Food or other solid materials may be swept up, and placed in the trash. • Regularly inspect storm drains during the event to assure that pollutants are not entering them. • If pollutants enter a storm drain or if a hazardous material spill occurs, please call Police Dispatch at 949-770-6011 immediately.
Post-Event Clean Up	• All streets, sidewalks, and public areas must be cleaned (sweeping, litter pickup, etc.) and returned to the pre-event condition. • Remove temporary public art (chalk, paint, charcoal, clay, etc). Any wet washing conducted should follow BMPs as noted above. • All storm drain inlet protection devices must be removed.
Contracts & Leases	• Provide adequate language in contracts with vendors to ensure compliance with these rules. • Discuss and distribute information about these water quality requirements during staff (including contractor) training and vendor registration.

R 1. Automobile Repair & Maintenance

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Prevent materials, products and other pollutants associated with maintenance and repair activities from entering the streets, gutters, storm drains, or natural watercourses.
2.	Clean up leaks and spills immediately.
3.	Properly store and handle chemical materials.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Prevent materials, products and other pollutants associated with maintenance and repair activities from entering the streets, gutters, storm drains, or natural watercourses**

   A. Use sweeping and pick-up methods or vacuum to clean maintenance and repair areas. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash/rinse water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected liquids in a mop sink, toilet or other drain that is plumbed to the sanitary sewer. Dispose of collected solids in the trash. Do not dispose of in the street, gutter or storm drain.
   C. Inspect vehicles for leaks. Place vehicles on an impervious surface and install a drip pan under potential leak points.
   D. Clean oily spots with absorbent materials. Do not allow discharges to enter the street, gutters or storm drains.
   E. Properly dispose of chemicals and fluids as household hazardous waste at the Prima Deschecha HHW Collection Center. For details, visit their web site www.oclandfills.com or call (714) 834-6752 for recorded information.
   F. Properly dispose of used motor oil at a used oil recycling center or at the above mentioned HHW Collection Center.

2. **Clean up leaks and spills immediately.**

   A. Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use brooms, shovels, sweepers, or plows.
   B. Place a stockpile of spill cleanup materials where they will be readily accessible (e.g. near storage and maintenance areas).
   C. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly. Never hose down or bury dry material spills.
   D. Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
   E. For larger spills, a private spill cleanup company or Hazmat team may be necessary.

3. **Properly store and handle chemical materials.**

   A. Store materials indoors or under cover to prevent exposure to rain or wind.
   B. Keep chemicals and vehicle fluids in their original containers, if feasible.
   C. Keep containers well labeled according to their contents (e.g., solvent, gasoline).
   D. Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
   E. Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

Other Beneficial Tips & Techniques

1. **Reduce exposure of maintenance and repair activities to rain.**

   A. Conduct maintenance and repair activities in the garages or in enclosed areas.

2. **Completely drain oil filters before recycling/disposal.**

3. **Remove all fluids from retired, wrecked, or salvaged vehicles.**

4. **Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.**

5. **Pollution Prevention.**

   A. Keep site free of trash & debris. Properly dispose of any trash, litter and other debris that may have accumulated around the site to prevent them from entering the streets, gutters and storm drains.

   B. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

      The following pollution prevention principles apply to most industries:
      - Affirmative Procurement - Use alternative, safer, or recycled products.
      - Redirect storm water flows away from areas of concern.
      - Reduce use of water or use dry methods.
      - Reduce storm water flow across facility site.
      - Recycle and reuse waste products and waste flows.
      - Move or cover potential pollution from storm water contact.
      - Provide on-going employee training in pollution prevention.

   C. Eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

- Use non-caustic detergents instead of caustic cleaning for parts cleaning.
- Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
- Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
- Choose cleaning agents that can be recycled.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

R 2. Residential Automobile Washing

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Minimize wash/rinse water from entering the streets, gutters, storm drains, or natural watercourses.
2.	Properly maintain vehicles.
3.	Properly store and handle chemical materials.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Minimize wash/rinse water from entering the streets, gutters, storm drains, or natural watercourses**

   A. When possible, use a commercial car wash facility where proper management practices and water recycling are utilized.
   B. Use sweeping and pick-up methods or vacuum to clean interior of vehicles. Do not wash materials into the street, gutters or storm drains.
   C. If pressure washing, use a collection device that enables collection of wash/rinse water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected liquids in a mop sink, toilet or other drain that is plumbed to the sanitary sewer. Dispose of collected solids in the trash. Do not dispose of in the street, gutter or storm drain.
   D. Turn off hose when not actively washing down vehicle. Rinse in small sections to allow rinse water to be absorbed on site or evaporate before leaving the site.

2. **Properly maintain vehicles.**

   A. Conduct regular inspections of vehicles for fluid leaks and malfunctions.
   B. Ensure all vehicles are in good working order.
   C. Promptly repair and clean up any fluid leaks from vehicles and equipment..

3. **Properly store and handle chemical materials.**

   A. Store materials indoors or under cover to prevent exposure to rain or wind.
   B. Keep chemicals and vehicle fluids in their original containers, if feasible.
   C. Keep containers well labeled according to their contents (e.g., solvent, gasoline).
   D. Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
   E. Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

Other Beneficial Tips & Techniques

1. **Pollution Prevention.**

   A. Keep site free of trash & debris. Properly dispose of any trash, litter and other debris that may have accumulated around the site to prevent them from entering the streets, gutters and storm drains.

B. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

R 3. Residential Automobile Parking

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Adhere to applicable parking regulations, including parking restrictions to allow for street sweeping.
2.	Properly maintain vehicles.
3.	Properly store and handle chemical materials.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Adhere to applicable parking regulations, including parking restrictions to allow for street sweeping.**

   A. Park vehicles in garages and driveways where possible. Park vehicles only in designated parking areas.
   B. Observe all parking regulations.
   C. Remove vehicles from the street during posted street sweeping times.

2. **Properly maintain vehicles.**

   A. Conduct regular inspections of vehicles for fluid leaks and malfunctions.
   B. Ensure all vehicles are in good working order.
   C. Promptly repair and clean up any fluid leaks from vehicles and equipment..

3. **Properly store and handle chemical materials.**

   A. Store materials indoors or under cover to prevent exposure to rain or wind.
   B. Keep chemicals and vehicle fluids in their original containers, if feasible.
   C. Keep containers well labeled according to their contents (e.g., solvent, gasoline).
   D. Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
   E. Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

Other Beneficial Tips & Techniques

1. Pollution Prevention.

A. Keep site free of trash & debris. Properly dispose of any trash, litter and other debris that may have accumulated around the site to prevent them from entering the streets, gutters and storm drains.

B. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

R 4. Home & Garden Care Activities

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.
2. Provide contractor training.
3. Use extra precautions when applying pesticides, herbicides, fungicides, fertilizers and soil amendments.

Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of wash or wastewater in the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum to clean hardscape areas, including streets & gutters. Do not wash materials into the street, gutters or storm drains.
   B. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly.
   C. Clean paint brushes and tools in sinks connected to sanitary sewers or in portable containers that can be dumped into a sink, toilet, or other drain that is plumbed to the sanitary sewer.
   D. Paint brushes and tools covered with non-water based materials must be cleaned in a manner that enables collection of uses solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
   E. Dispose of mop and wash water from cleaning in a mop sink, toilet or other drain that is plumbed to the sanitary sewer.

2. **Provide contractor training.**

   A. If you hire a contractors or employees to do work or clean in your house, educate and inform them of the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train contractors and employees on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Educate contractors and employees on proper spill containment and cleanup methods.

3. **Use extra precautions when applying pesticides, herbicides, fungicides, fertilizers and soil amendments.**

   A. Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of pesticides and herbicides and training of applicators and pest control advisors.
   B. Follow manufacturers' recommendations and label directions.
   C. Do not apply pesticides if rain is expected or if wind speeds are above 5 mph.
   D. Do not mix or prepare pesticides for application near storm drains. Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the targeted pest.
   E. Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.
   F. Do not apply any chemicals directly to surface waters, unless the application is approved and permitted by the state. Do not spray pesticides within 100 feet of open waters.
   G. Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

H. Clean pavement and sidewalk if chemicals are spilled on these surfaces before applying irrigation water.
I. Implement storage requirements for pesticide products with guidance from the local fire department and/or County Agricultural Commissioner.
J. Dispose of empty containers according to the instructions on the container label.
K. When applying or supplementing plant material, soil or soil amendments, place temporary stockpiled material in existing planters or turf area away from watercourses, gutters and storm drain inlets.
L. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all excess materials and debris. Do not wash these materials into the street, gutters or storm drains.

Other Beneficial Tips & Techniques

1. Pollution Prevention.

A. Keep site free of trash & debris. When doing routine landscape maintenance, pick-up and properly dispose of any trash, litter and other debris that may have accumulated in planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.
B. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

R 5. Disposal of Pet Waste

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Do not dispose of animal waste, animal food, or any other byproducts in the streets, gutters, storm drains, natural watercourses, or landscaping areas.
2. Pick up and dispose of animal waste regularly.
3. Prevent wash/rinse water from interior and exterior areas from entering the streets, gutters, storm drains, and natural watercourses.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of animal waste, animal food, or any other byproducts in the streets, gutters, storm drains, natural watercourses, or landscaped areas.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all animal waste, food, and other byproducts. Do not wash these materials into the street, gutters or storm drains.
   B. Dispose of animal waste, food products and other byproducts as garbage in appropriate trash containers for disposal to the landfill.

2. **Prevent wash/rinse water from interior and exterior areas from entering the streets, gutters, storm drains, and natural watercourses.**

   A. Wash pets in bathtubs, showers or other areas where the drains are plumbed to the sanitary sewer. Sweep or mop, rather than hose kennel and animal areas.
   B. Dispose of mop water from cleaning in a mop sink, toilet or other drain that is plumbed to the sanitary sewer.
   C. When possible, have pets groomed at a commercial facility.

3. **Pick up and dispose of animal waste regularly.**

   A. Pick-up on a regular basis and properly dispose of any animal waste in the planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.
   B. While walking pets, carry bags, pooper-scoopers, or equivalent to safely pick up pet waste. Dispose of collected wastes properly in the trash or in a toilet.

Other Beneficial Tips & Techniques

1. Animal Care Products.

A. Consider using less toxic shampoos.
B. Properly use and dispose of flea control products, including collars, sprays and liquids.

2. Pollution Prevention Methods

A. Keep site free of trash & debris. Pick-up on a regular basis and properly dispose of any trash, litter, and other debris that may have accumulated in the planters, parking lot or other parts of the site to prevent them from entering the streets, gutters and storm drains.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

R 6. Disposal of Green Waste

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs
1. Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.
2. Provide landscape contractor and gardener training.
3. Remove on a regular basis, any accumulated dead or dying vegetation and debris from on-site drainage devices, v-ditches and natural watercourses.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of gardening waste (green waste) in the streets, gutters, storm drains, or natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all hardscape areas, including streets & gutters of all grass clippings, leaves, sticks, and other collected vegetation. Do not wash these materials into the street, gutters or storm drains.
   B. Dispose of grass clippings, leaves, sticks, and other collected vegetation as garbage in appropriate trash containers, at the landfill or by using appropriate composting methods.
   C. Place temporary stockpiled material away from watercourses, gutters and storm drain inlets.

2. **Provide landscape contractor and gardener training.**

   A. If you hire a landscape contractor or gardener to take care of your landscaping, educate and inform them of the required BMPs, storm water discharge prohibitions, and wastewater requirements.
   B. Educate and train landscape contractors and gardeners on site-specific drainage facilities such as locations of streets, gutters, storm drain inlets, v-ditches and other drainage courses.
   C. Educate landscape contractors and gardeners on proper spill containment and cleanup methods.

3. **Remove on a regular basis, any accumulated dead or dying vegetation and debris from on-site drainage devices, v-ditches and natural watercourses.**

   A. Use sweeping and pick-up methods or vacuum all v-ditches, drainage swales and other hardscape drainage devices to remove grass clippings, leaves, sticks, and other collected vegetation. Do not wash these materials into the street, gutters or storm drains.
   B. Remove dead or dying vegetation from natural watercourses.

Other Beneficial Tips & Techniques

1. **Properly manage irrigation systems.**

   A. Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded.
   B. Inspect irrigation system regularly for leaks and to ensure that excessive runoff is not occurring.
   C. If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
   D. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

E. Use automatic timers to minimize runoff.
F. Use popup sprinkler heads in areas with a lot of activity or where pipes may be broken. Consider the use of mechanisms that reduce water flow to broken sprinkler heads.

2. Reduce landscape maintenance requirements.

A. Where feasible, retain and/or plant native vegetation with features that are determined to be beneficial. Native vegetation usually requires less maintenance than planting new vegetation.
B. When planting or replanting consider using low water use flowers, trees, shrubs, and groundcovers.

3. Use mulch or other erosion control measures on exposed soils.

4. Pollution Prevention.

A. Keep site free of trash & debris. When doing routine landscape maintenance, pick-up and properly dispose of any trash, litter and other debris that may have accumulated in planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

B. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

R 7. Household Hazardous Waste

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are the minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Do not dispose of household hazardous waste in the streets, gutters, storm drains, or natural watercourses.
2.	Clean up leaks and spills immediately.
3.	Properly store and handle chemical materials.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. **Do not dispose of household hazardous waste in the streets, gutters, storm drains, or natural watercourses.**

   A. Properly dispose of household hazardous waste at the Prima Deschecha HHW Collection Center. For details, visit their web site www.oclandfills.com or call (714) 834-6752 for recorded information.
   B. Properly dispose of used motor oil at a used oil recycling center or at the above mentioned HHW Collection Center.
   C. Clean paint brushes and tools in sinks connected to sanitary sewers or in portable containers that can be dumped into a sink, toilet, or other drain that is plumbed to the sanitary sewer.
   D. Paint brushes and tools covered with non-water based materials must be cleaned in a manner that enables collection of uses solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

2. **Clean up leaks and spills immediately.**

   A. Utilize dry cleaning methods to clean up spills to minimize the use of water. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use brooms, shovels, sweepers, or plows.
   B. Place a stockpile of spill cleanup materials where they will be readily accessible (e.g. near storage and maintenance areas).
   C. If pressure washing, use a collection device that enables collection of wash water and associated solids. Use a sump pump, wet vacuum or similarly effective device to collect runoff and loose materials. Dispose of collected runoff and solids properly. Never hose down or bury dry material spills.
   D. Clean up chemical materials with absorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
   E. For larger spills, a private spill cleanup company or Hazmat team may be necessary.

3. **Properly store and handle household chemicals.**

   A. Store materials indoors or under cover to prevent exposure to rain or wind.
   B. Keep household chemicals in their original containers, if feasible.
   C. Keep containers well labeled according to their contents (e.g., solvent, gasoline).
   D. Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
   E. Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

Other Beneficial Tips & Techniques

1. Reporting

A. Report spills that pose an immediate threat to human health or the environment to local agencies. Emergencies related to HHW, call 911.

B. Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

2. Pollution Prevention.

A. Keep storage areas free of trash & debris. Properly dispose of any trash, litter and other debris that may have accumulated around the processing area, parking lot, landscape planters or other parts of the site to prevent them from entering the streets, gutters and storm drains.

B. Consider pollution prevention measures at all times for improving pollution control. Implementation of pollution prevention measures may reduce or eliminate the need to implement other more costly or complicated procedures.

The following pollution prevention principles apply to most industries:

- Affirmative Procurement - Use alternative, safer, or recycled products.
- Redirect storm water flows away from areas of concern.
- Reduce use of water or use dry methods.
- Reduce storm water flow across facility site.
- Recycle and reuse waste products and waste flows.
- Move or cover potential pollution from storm water contact.
- Provide on-going employee training in pollution prevention.

B. Eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

- Use non-caustic detergents instead of caustic cleaning for parts cleaning.
- Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.
- Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
- Choose cleaning agents that can be recycled.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

R 8. Irrigation Runoff

The table below identifies activity-specific Best Management Practices (BMPs) that are appropriate to prevent or mitigate pollution generated from the subject activity. These are minimum designated BMPs that must be implemented to eliminate prohibited discharges and limit impact on water quality to the maximum extent practicable. Below the matrix and following each BMP, is a listing of suggested implementation strategies to consider that may help achieve compliance with the minimum designated BMPs. However, please be aware that satisfaction of these strategies by themselves does not necessarily guarantee compliance with the minimum designated BMPs. Additional actions and efforts may be needed to fully achieve compliance with the minimum designated BMPs. The "Other Tips & Techniques" Section provides additional items to consider that promote pollution prevention, conservation and good house keeping ideas that ultimately benefit water quality and our environment.

Minimum Designated Best Management Practices BMPs	
1.	Implement all feasible measures to reduce and eliminate surface runoff of irrigation water.
2.	Comply with water conservation, drought response and waste prohibition regulations of the water district.

Suggested Implementation Strategies for Minimum Designated Best Management Practices (BMPs)

1. <u>Implement all feasible measures to reduce and eliminate surface runoff of irrigation water.</u>

A. Ensure that persons responsible for landscape maintenance are aware of irrigation management techniques for pollution prevention.
B. Replace irrigation controller batteries in the spring and fall.
C. Inspect the irrigation system regularly, while it is operating, to identify leaks and to determine if runoff is occurring.
D. Promptly repair any leaks or breaks. If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
E. Adjust sprinkler heads and nozzles to avoid over-spray onto pavement and/or other impervious areas.
F. Irrigate slowly or pulse irrigate so the infiltration rate of the soil is not exceeded. This can occur in less than 2 minutes depending on landscaping, soil type and topography.

G. Adjust the watering schedule seasonally to reflect reduced winter water demand.
H. Do not water when rain is predicted, or when the ground is already moist from rainfall.

2. <u>Comply with water conservation, drought response and waste prohibition regulations of the water district.</u>

A. Adhere to the watering schedule restrictions designated by the water district, as appropriate to drought conditions. For more information on water district requirements contact Moulton Niguel Water District at (949) 831-2500 or visit their website at www.mnwd.com.

Other Beneficial Tips & Techniques

1. <u>Consider upgrading irrigation system components to increase irrigation efficiency and reduce runoff.</u>

A. Replace old timer-based irrigation controllers with new evapotranspiration-driven self-adjusting controllers.
B. Install sprinkler heads with a low precipitation rate and/or a more adjustable spray pattern or radius as needed.
C. Install popup sprinkler heads in areas with a lot of activity and/or where risers may be broken.
D. Install water-efficient drip irrigation systems for trees, shrubs and flowers.
E. Install a sensor that will reduce flow in case of breakages in the system.
F. Install an automatic rain shut-off sensor.
G. Install check valves for sprinkler heads at the bottom of slopes to eliminate low-head drainage.

2. <u>Consider reducing the need for irrigation.</u>

A. Add 2-3 inches of mulch around trees and plants to minimize runoff and reduce evaporation.
B. Replace turf areas adjacent to pavement and/or other impervious areas with drought tolerant shrubs and groundcover.



Only Rain in the Storm Drain.
The Ocean begins at your front door.

For more information, please contact:

City of Laguna Niguel
27801 La Paz Road
Laguna Niguel, CA 92677

Public Works Department 949.362.4337
Community Development Department 949.362.4360
Orange County 24 hr Water Quality Hotline: 714.567.6363
www.ocwatersheds.com www.ci.laguna-niguel.ca.us

Exhibit A-9.II

City Inspection Form

CITY OF LAGUNA NIGUEL
WATER QUALITY PROGRAM
Commercial Business
POLLUTION PREVENTION BMP INSPECTION FORM

www.CityofLagunaNiguel.org

City of Laguna Niguel
Community Development Dept.
30111 Crown Valley Pkwy
Laguna Niguel, CA 92677
(949)362-4300
www.CityofLagunaNiguel.org

BUSINESS NAME: _____ PHONE: _____

ADDRESS: _____

CONTACT PERSON: _____ EMAIL: _____

DATE OF INSPECTION: _____ DATE OF FOLLOW- UP INSPECTION: (if needed) _____

WASTE STORAGE & DISPOSAL AREA:

☐ DEFICIENCY(IES) : _____

Trash enclosure area clean, free of litter? ☐ Yes ☐ No

Trash bin good condition and non-leaking? ☐ Yes ☐ No

Trash area shared by more than 1 business? ☐ Yes ☐ No If yes, Property contact/phone: _____

Used kitchen grease storage location: ☐ indoor ☐ outdoor, location: _____ clean, non-leaking: ☐ Yes ☐ No

☐ self-contained system (brand): _____

SPILL RESPONSE/DRAINAGE:

☐ DEFICIENCY : _____

Spill clean-up materials available & easily accessible? ☐ Yes ☐ No Location: _____

Person in charge aware of emergency # for sewer and other spills? ☐ Yes ☐ No Water District (circle): SCWD MNWD SJC

ACTIVITIES:

☐ DEFICIENCY(IES) : _____

Where are mats washed? ☐ Outdoor designated area ☐ no mats ☐ indoor mop sink ☐ Designated area clearly marked with signage

Are sidewalks or parking or patios powerwashed? ☐ Yes ☐ No

If yes, who does the cleaning? ☐ in-house staff ☐ contractor Name of contractor: _____

Method of washwater containment & disposal: ☐ berm, wet vac to sewer ☐ closed-loop system ☐ berm, contractor haul off site ☐ other:

SITE / STORM DRAIN /SITE DRAINAGE /DISCHARGES:

☐ DEFICIENCY(IES) : _____

Site generally clean, free of litter, no ponding water? ☐ Yes ☐ No

Site drainage: ☐ On-site inlet/storm drain system: Note general location: _____

Is inlet labeled? ☐ Yes ☐ No (suggested labeling) stencil provided to borrow: ☐ Yes ☐ No

☐ Sheet flow to right-of-way

☐ Site drain system to curb core

Any discharges or potential discharges observed? ☐ Yes ☐ No ☐ Pollutant discharge or active illicit connection reported to City.

Any illicit connections observed: ☐ Yes ☐ No

Is there a sprinkler system: ☐ Yes ☐ No Was runoff observed during inspection? ☐ Yes ☐ No

Is there a hose? ☐ Yes ☐ No If yes, what is the hose used for? _____

☐ Person understands that hosing into storm drain, streets, and gutters is prohibited?

ADDITIONAL COMMENTS/SUGGESTIONS/CORRECTIVE ACTIONS:

Photos Taken: ☐ (Provide to City)

_____

_____

_____

_____

MANAGER'S / OWNER'S SIGNATURE:

INSPECTOR'S SIGNATURE: DATE:

Exhibit A-9.III

Enforcement Form

City of Laguna Niguel
30111 Crown Valley Parkway
Laguna Niguel, California 92677
(949) 362-4320

NOTICE OF VIOLATION

This WARNING is issued for the violation of the Laguna Niguel Municipal Code ("LNMC").

_____
CE CASE #

Department
☐**ComDev**
☐**PW**

Date Notice Issued: _____ Date/Time Violation Observed: _____

Correction Required By Date: _____
Warning: *The corrections stated below are required to be completed by the above date. This warning is notice that if you fail to make the stated corrections by the above date; an administrative* ***citation may be issued.*** *The fines are $100 for the first citation, $200 for the second citation, and $500 for the third and subsequent citations. The fines are cumulative.*

Violation Address/Parcel Number:	
Mailing Address (if different):	
Business Name (if applicable):	
Name of Person Cited: Last, First	
Person Cited Relation to Property:	☐ Property Owner ☐Tenant ☐Business Owner ☐Other:

Checkmark below where applicable:
☐ Served In Person ☐ Served via Certified and First-Class Mail
☐ **STOP WORK NOTICE:** Pursuant to Section 8-1-12 of the LNMC (Adoption of California Building Code), you are ordered to stop work as described below.
☐ Prior citation(s) for same code violation(s), if known by the issuing officer.
☐ This is a continuing violation for which a citation may be issued each day the violation is not corrected.

LNMC Section(s) Violated:	Description of Violation(s):
1.	
2.	
3.	
4.	

Corrections Required: *The correction of the violation can be verified by contacting the issuing officer for an inspection.*

_____	_____	949-362-4320	_____
Signature of Issuing Officer	*Print Name of Issuing Officer and Department*	*Telephone No.*	*Date*
_____	_____	_____	_____
Signature of Person Cited	*Print Name of Person Cited*	*Telephone No.*	*Date*

READ REVERSE SIDE FOR IMPORTANT INFORMATION

Notice of Violation

For certain types of violations of the LNMC, a Notice of Violation may be issued. This is a warning that the violation has to be corrected and if not corrected an administrative citation may be issued. A Notice of Violation does not impose a fine. The date by which the violation is required to be corrected is noted on the Notice. The citee may request an extension of this date. The request must be in writing and it must be filed with the Director of the issuing department before the end of the correction period. The request must include sufficient evidence showing that the correction cannot be reasonably made within the stated period. The filing for such an extension does not, unless granted, extend the correction period. The Director's decision will be in writing and is final.

Consequences of Failure to Correct Violations

There are numerous enforcement options that can be used to encourage the correction of violations. These options include, but are not limited to: civil penalties, abatement, criminal prosecution, civil litigation and recording the violation with the County Recorder or State Franchise Tax Board. These options can empower the City to collect fines, to demolish structures or to make necessary repairs at the owner's expense. Any of these options or others may be used if the administrative citations do not achieve compliance.

Administrative Citations

Laguna Niguel Municipal Code (LNMC) Section 1-3-11 *et seq.* authorizes the issuance of administrative citations for violations of the LNMC. There are three levels of citations that can be issued progressively for a violation. The fines are $100 for the first citation, $200 for the second citation and $500 for the third and subsequent citations. These fines are cumulative. For continuing violations, a citation may be issued each day the violation is in existence.

If you need further information about the violations and/or how to correct the violations, please call 949-362-4320 or email code@CityofLagunaNiguel.org

A copy of City Ordinance No. 2006-142 providing for the issuance of administrative citations may be obtained from the issuing department or the City Clerk.

A-10.0 ILLEGAL DISCHARGES/ILLICIT CONNECTIONS COMPONENT

A-10.1 INTRODUCTION

Since illegal discharges and illicit connections (ID/ICs) are potential significant sources of pollutants for the municipal storm drain system, the City is implementing a comprehensive program for detecting, responding to, investigating and eliminating ID/ICs in an efficient and timely manner. Abating ID/IC directly supports both the principal requirements of the Fifth Term Permit and effectively addresses two of the HPWQCs identified in the WQIP, specifically, unnatural water balance in dry weather and pathogen health risk.

A-10.1.1 Program Overview

The ID/IC Program provides guidance for City staff when identifying, responding, mitigating and enforcing the ID/ICs for the protection of public health and the environment. In addition, it provides the framework and a process for conducting the following NPDES permit compliance activities for the Illicit Discharge Detection and Elimination (IDDE)Program:

- Program administration
- Detection of illegal discharges and illicit connections
- Responding to water pollution incidents and complaints
- Inspections/investigations
- Education/Enforcement
- Training

A-10.1.2 Program Commitments

The major program commitments and the subsections in which they are described in detail include:

- Investigation and abatement of ID/ICs **(A-10.2)**;
- Education and Enforcement **(A-10.3)**; and
- Training **(A-10.4)**

A-10.1.3 Regulatory Requirements

The program described in this section was developed pursuant to Provision E.2- IDDE and E.6-Enforcement Response Plans of the Fifth Term Permit, and **Section 10** of the DAMP.

Provision E.2 requires each Copermittee to implement a program to actively detect and eliminate discharges and improper disposal into the MS4, or otherwise require the discharger to apply for and obtain a separate NPDES permit. The City's ID/IC program confirms with the strategies in the WQIP and addresses non-stormwater discharges as illicit discharges unless the non-stormwater discharge is identified as a discharge authorized by a separate NPDES permit.

Provision E.6 requires that the City to implement an Enforcement Response Plan as part of its LIP/JRMP. The Enforcement Response Plan describes the applicable approaches and options to

enforce the City's legal authority pursuant to Provision E.1, as necessary, to achieve compliance with the requirements of the Fifth Term Permit.

A-10.2 ILLEGAL DISCHARGES/ILLICIT CONNECTIONS PROGRAM

A-10.2.1 Program Introduction

The ID/IC Program establishes a process through which illegal discharges and illicit connections to the MS4 are actively detected and eliminated. In order to be effective, the ID/IC Program has been integrated with the municipal, industrial, commercial, residential, and construction inspection programs so that if an illegal discharge or illicit connection is discovered during an inspection it can be properly addressed and eliminated. In addition, on behalf of the Permittees, the Principal Permittee implements the water quality monitoring programs, which can also assist in identifying illegal discharges and illicit connections. Illegal discharges and illicit connections that are discovered as a result of integrated efforts will be addressed pursuant to this Section.

A-10.2.2 Program Administration and Implementation

Assigning roles and responsibilities reduces the duplication of efforts and increases program efficiency and effectiveness.

Roles and Responsibilities

The key roles and assigned staff for the ID/IC Program include the following:
Authorized Inspectors

The Authorized Inspector(s) (AI) are assigned to investigate compliance with and detect incidences of violations of the Ordinance. The designated AI are City employees, including Code Enforcement, Building Inspectors and Public Works staff and inspectors, including contracted staff, assigned to duties involving permits and other City approvals, inspections, investigations, and enforcement related to this Section :

Spill Responder

The Spill Responder (SR) can be an AI or other authorized personnel responsible for coordinating with the fire department for the immediate response to any accidental spills, leak or prohibited discharge of pollutants requiring clean up. The City's street maintenance and emergency response contractor supports this function in the City, under the direction of and in coordination with the Program Manager and Authorized Inspectors. Spill response activities by the City's contractor are coordinated with the Orange County Fire Authority and/or the separate water, sewer, or power utilities where necessary for public safety.

Enforcing Attorney

The Enforcing Attorney is the City Attorney acting as counsel for the Permittee, and their appointee. For purposes of criminal prosecution, only the District Attorney or designee should act as the Enforcing Attorney between the City and the County of Orange.

For a more detailed discussion regarding the primary roles and responsibilities, the City's Water Quality Ordinance (**Section A-4**), Enforcement Response Plan (**DAMP Section 7.0, Exhibit**), and/or the Model Investigative Guidance Manual (**DAMP Section 10, Exhibit 10.I**) should be referenced.

Although the City is responsible for responding to water pollution complaints and incidents within its jurisdiction, City has available resources to implement the spill response and Ordinance enforcement portions of the stormwater program. The City provides 24-hour in-house response to Ordinance violations and spill incidents through the countywide water pollution reporting hotline number 1-877-89SPILL or www.myoceservices.ocgov.com.

A-10.2.3 Detection and Elimination of Illegal Discharges

The City has a number of programs that facilitate the proactive detection of sources of illegal discharges and illicit connections. These programs include the following:

- Municipal Activities (**DAMP Section A-5**) – field inspectors and facility managers assist in the identification of illegal discharges and illicit connections during their daily activities. For example, during the routine maintenance of a drainage facility, a field inspector will report any dumped materials and/or undocumented connections to the NPDES representative.

- Public Education (**DAMP Section 6**) – assists with the distribution of public education materials that provide phone numbers and encourage the reporting of spills.

- Construction Activities (**DAMP Section 8**) - assists with the identification of illegal discharges from construction sites.

- Existing Development Programs (**DAMP Section 9**) – assists with the identification of actual or threatened illegal discharges from industrial, commercial and residential areas.

- Water Quality Monitoring Program (**DAMP Section 11**) – assists with the identification of problem areas through the collection of water quality data.

- Active participation in the Orange County Hazardous Materials Strike Force.

- Encourage the public to report water pollution problems to the countywide 24-hour problem reporting hotline at 1-877-89SPILL or www.myoceservices.ocgov.com. Residents may also report issues using the City's website, www.cityoflagunaniguel.org/etrakit or use the City's mobile app.

A-10.2.4 Model Spill Response Procedures

In addition to the proactive detection and elimination of threatened or occurring discharges, a large portion of the City'sID/IC Program is responding to water pollution complaints and incidents.

While all spills to municipal storm drain system are important and responses are often the same, sewage spills have merited special regulatory attention as coordination with other public agencies, as well as private owners is often involved; for this reason sewage spill response procedures are covered separately in **Section A-10.2.5**.

The response procedures consist of the following elements:

- Record Keeping
- Notifications and Response Requests
- Response
- Investigations
- Clean-Up
  - Trauma Scene Cleanup
  - Cleanup Costs
  - Follow-up
  - Decontamination
  - Waste Storage and Disposal
- Reporting
- Education and Enforcement
- Program Effectiveness Evaluation

The Investigative Guidance Manual (DAMP Section 10, Exhibit 10.I) was developed for the AI to specifically address the investigative portion of an ID/IC response. The Manual outlines the fundamental techniques that should be followed during investigations in order to collect legally defensible data. The Manual addresses record keeping, site entry, interviewing, photographs, sample collection, and report writing.

A-10.2.4.1 Record Keeping

To ensure that the necessary information from a complaint, notification, or response request is accurately documented throughout the entire process, the City uses a form similar to the County's Pollution Notification and Investigation Request (PNIR) form **(Exhibit A-10.I**)

This form collects information on the:
- Initial notification/response request;
- The location and specific details about the complaint or spill;
- Information about the alleged responsible party;
- The results of the investigation; and
- The actions that were taken as a result.

Documentation may also include photographs, the collection of samples, detailed notes on observations, witness interviews, discussions on decisions made and other information relevant

to the investigation.

After the initial entry of the information on the PNIR or related form, the information is entered into a database so that the data can be analyzed and future enforcement activities focused on problematic responsible parties, either locations or constituents. In addition, the use of the database allows the city to quickly and accurately provide the information that is necessary for the annual progress reports.

A-10.2.4.2 Notifications and Response Requests

In order to have a successful ID/IC program, the City needs to obtain information about potential or existing complaints and spills as soon as possible so that the problem can be mitigated as quickly as possible.

In order to facilitate the reporting of problems by the general public, the city advertises the County's 24 hour water pollution problem reporting hotline number (1-877-89-SPILL), the website reporting form (myoceservices.ocgov.com) on all of the public education brochures and posters.

The County's 24-hour hotline number and web address are included in the H2OC.org website under report pollution.

The City also coordinates with internal staff and other agency and emergency response personnel so that they understand how to identify a problem and who to report it.

A-10.2.4.3 Response

After receiving a notification of a water pollution problem or spill, the City either refers the problem to their internal AI and/or SR or to the OCFCD's AI and/or SR. Each complaint or spill is investigated as soon as possible and according to **DAMP Section 10** to ensure that valuable information is not lost and to minimize any potential human health and environmental impact.

The response typically consists of:

- On-Scene Assessment;
- Notifications; and
- Containment.

After conducting an on-scene assessment, several notifications may be necessary.
Notifications may include:

- Notification to Other Agencies—Notifications need to be made to any agencies or entities that may be affected by or have jurisdiction over the pollutant or discharge.

- Requesting Assistance—If it is determined that the incident requires a multi-agency response, it may be necessary to request additional assistance from the other agencies.

The Agency Notification List is included in **Exhibit A-10.II.**

A-10.2.4.4 Investigations

The City'sInspector or Responder will try to determine why the incident occurred and whether the discharge or release was deliberate or accidental and if the incident is, a repeat occurrence and carefully document the investigation to ensure that accurate information is obtained and all evidentiary requirements are met. The types of equipment, supplies and forms that may be used in the field during the investigations are listed in **Exhibit A-10.I**.

The investigation may include collection of samples, photographic documentation, interviews and/or an incident report, per **DAMP Section 10.2.4.5**.

The *Investigative Guidance Manual* (Manual) (**DAMP Section 10, Exhibit 10.I**) was developed for the AI to specifically address the investigative portion of an ID/IC response. The Manual outlines the fundamental techniques that should be followed during investigations in order to collect legally defensible data. The Manual addresses record keeping, site entry, interviewing, photographs, sample collection, and report writing. Each City will submit a summary of the non-stormwater discharges and illicit discharges and connections investigated and eliminated within its jurisdiction with each WQIP Annual Report under the Provision F.3.b.(3) of the Fifth Term Permit.

A-10.2.4.5 Clean Up

The main objective in the cleanup operation is to restore the impacted area back to its original state (to the maximum extent practicable) and prevent further environmental degradation in the surrounding area of the incident. It is important that the cleanup be completed in a timely and cost-effective manner.

During this phase of the response, the Inspector or Responder is generally overseeing and directing the cleanup, re-evaluates the resources necessary to perform the cleanup and ensures that they are being prepared and sent to the site. The general responsibilities are:

- Provide list of clean-up companies for the responsible party (RP) to contact (**Exhibit A-10.I**);
- Oversee cleanup—Provide cleanup directions and verify pollutant removal;
- Document cleanup company's activities (proper and safe procedures) to verify appropriate cleanup charges; and
- Document amount of waste or pollutant removed to verify disposal costs.

The AI may also deliver to the owner or occupant of any property, or any other Person who becomes subject to an Administrative Remedy, an Invoice for Costs. The Invoice for Costs is immediately due and payable to the City for the actual costs incurred by the City in responding to, overseeing the cleanup of and issuing and enforcing any notice or order.

A-10.2.4.5.1 Trauma Scene Clean Up

Trauma scene wastes (i.e. blood and human tissue) may be encountered at various incidents including crime and/or accident scenes. Since trauma scene wastes require the implementation of special procedures in addition to the general clean up procedures that are followed, the City implements the procedures that are outlined in **DAMP Section 10.2.4.6**.

A-10.2.4.6 Reporting

The ID/IC program has a number of reporting requirements. The requirements include:

- Proposition 65 Notification – Health and Safety Code 25180.7 provides that:

  "Any designated government employee who obtains information in the course of his official duties revealing the illegal discharge or threatened illegal discharge of a hazardous waste within the geographical area of his jurisdiction, and who knows that such discharge or threatened discharge is likely to cause substantial injury to public health or safety, must, within 72 hours, disclose such information to the local health officer."

  The Proposition 65 Hotline telephone number in Orange County is (714) 433-6403; fax number is (714) 754-1768.

- Regional Board Notifications – If a spill, leak or illegal dumping is determined to pose a threat to human or environmental health the City will provide oral notification to the Regional Board by phone or e-mail within 24 hours of the discovery, followed by a written report within 5 days.

A-10.2.5 Model Sewage Spill Response Procedures

While all spills to the municipal storm drain system are important and responses are often the same, sewage spills have merited special regulatory attention as coordination with other public agencies as well as private owners is often involved.

While the protocols used in responding to any type of spill are essentially the same, the specific differences for sewage spills are described within this section.

The primary response procedures for sewage spills are the same as for other types of spills and consist of the following elements:

- Record Keeping;
- Notifications and Response Requests;
- Response;
- Investigations;
- Clean Up; and
- Reporting.

The current City Ordinance requires that private sewer laterals and septic systems be designed and operated in accordance with industry standards. The Ordinance also requires the proper

maintenance of these facilities in order to minimize possible spills, breakages, and failures. As outlined in the Pathogen Health Risk HPWQC within the WIQP, the City will enforce these requirements if a spill from private property or source is, or cannot be, effectively remedied by the owner or other responsible party.

A-10.2.5.1 Record Keeping

To ensure that the necessary information is collected, the **City** forms similar to the County's Pollution PNIR form **(Exhibit A-10.VII).**

In addition to the information that is collected on the PNIR form, the following pieces of information are collected when documenting a sewage spill:

- Information regarding whether a sewage spill entered a storm drain (i.e. where sewage is observed running into a drain, or directly to a receiving water, creek, channel, etc. or there is residual evidence thereof), including the location and name of the receiving water;
- Determination of spill start and stop time; and
- A determination of spill volume

A-10.2.5.2 Response

Although there are instances where the municipal storm drain and sanitary sewage collection systems are under the same public agency (City) ownership, there are also many situations where the jurisdictions are not the same. Responding to overflows that reach the municipal storm drain system is, in these instances, a joint or shared responsibility of both (stormwater and wastewater) Permittees.

The Moulton Niguel Water District currently has jurisdiction within the Cityservice area and is responsible for preventive and corrective sewer maintenance programs. This program consists of procedures and methodologies provided for the operation, maintenance, repair and replacement of sewer mains, manholes, and pump stations. The program provides for routine monitoring, inspection, cleaning, and related maintenance of all components of the municipal sanitary sewer system in order to reduce the potential of sanitary sewer overflows (SSOs) and structural failures.

Regardless of where the spill originates, if the spill has entered or may enter the storm drain system the Permittees respond to assist with the cleanup and remediation of the area.

If not already completed upon arriving on scene, the discharge or release of sewage should be discontinued and contained as close to the originating site as possible after the initial assessment has been completed. This is critical in preventing further contamination or degradation downstream and ultimately results in an easier and less expensive cleanup effort.

The order of preference for the containment is:

- On-site at the point of origination;
- In the curb/gutter or street;

- In the catch basin;
- In the storm drain system; and
- In the channels/streams.

A-10.2.5.3 Clean Up

The main objective in the cleanup operation is to restore the impacted area back to its original state (to the maximum extent practicable) and prevent further environmental degradation in the surrounding area of the incident. During this phase of the response, the Inspector or Responder generally oversees and directs the cleanup, re-evaluates the resources necessary to perform the cleanup and ensures that they are being prepared and sent to the site.

The City will ensure that the general cleanup responsibilities outlined in **DAMP Section 10.2.5.4** are followed by the Inspector or Responder overseeing the cleanup.

A-10.2.5.4 Reporting

Sewage spill reporting to various regulatory agencies has parallel and overlapping requirements. However, reporting spills to one regulatory agency will not necessarily satisfy the requirements of the other. Therefore, the City reports to the following agencies:

Storm Drain Discharges

- Regional Board Notifications – If a spill, leak or illegal dumping is determined to pose a threat to human or environmental health the Permittees report this information to the Regional Boards by phone or e-mail within 24 hours of the discovery followed by a written report within 5 days. (See Section A-10.5.6 above)

Sewage Discharger Notifications

- Orange County Health Care Agency (HCA) - California Health and Safety Code Section 5411.5 requires that all sewage spills be immediately reported to the HCA 24-hours a day. During standard work hours (M-F, 8:00 a.m. to 5:00 p.m.) sewage spills that may affect beaches or the ocean should be called in by phone directly to Regulatory Health Services, Environmental Health, Ocean Water Protection Program staff personnel at (714) 433-6000. After hours, reports for emergency spills can be phoned in through the County Communications number (714) 628-7008.

- State Office of Emergency Services (OES) - California Water Code Section 13271 and the CCR Section 2250 require that the State OES be notified immediately of all sewage spills of 1,000 gallons or more from public sewer systems by telephone (800) 852-7550.

- Santa Ana Regional Board - Order No. 2002-0014 requires that sewage dischargers immediately report all SSOs entering a storm drain, drainage channel, or surface water body to the Board by telephone, voice mail, e-mail, or FAX. Completed SSO Report Forms, or equivalent, for each overflow event must be submitted within five days of the initial notice. Full reports for each SSO occurrence including photos and mitigation

measures must be submitted electronically to the RWQCB at the end of each month. Submittal of SSO Summary Reports and certification statements are also required 30 days following the spill report period.

- San Diego Regional Board - Order No. 96-50 requires that sewage dischargers report spills of at least 1,000 gallons, or to surface waters (all, of any volume), within 24-hours by FAX or telephone. In all instances, the discharger must fax a SSO Report Form to the Board within five days of the spill. The completed SSO Form must also be faxed to the Department of Health Services (DHS). A quarterly report of all sanitary sewer spills, including those not meeting the criteria stated above, must be submitted electronically to the Regional Board.

A-10.2.5.5 Sewage Spill Response Planning

The City also participates in the Countywide Area Spill Control (CASC) Program as described **DAMP Section 10.2.5.6**.

A-10.2.6 Illicit Connection Investigations

As part of the municipal stormwater program, the Citydetects and eliminates illicit connections within its municipal storm drain system.

Any illicit connection identified by the City during routine inspections is investigated. Appropriate actions are then taken to approve undocumented connections by permit procedure and/or pursue removal of those connections that are determined to be illicit connections and not permissible.

If evidence of an illegal discharge is detected and the source does not appear to be evident, a source investigation may be conducted as described in **Section A-10.2.7** and **DAMP Section 10.2.7** to determine if the discharge is being conveyed through an illicit connection.

A-10.2.7 Source Investigations

Source investigations may be conducted when an ID/IC is detected or suspected, and the source is not readily identifiable. The purpose of the investigation is to locate the source so that measures to eliminate the ID/IC can be implemented. Source investigations will be initiated when appropriate information suggests evidence of an ID/IC, including:

- Reports made by City staff, government agencies, or the general public
- Triggers established by the data from the water quality monitoring program
- Professional judgment of water quality monitoring personnel

In order to facilitate the determination of when source investigation studies are warranted, the Dry Weather Monitoring Program (**DAMP Section 10.0**) includes a set of criteria that will trigger focused ID/IC studies by the City when the monitoring data indicate the presence of a problem.

When data from the routine Dry Weather Monitoring Program exceeds these criteria, this triggers a consideration that follow-up investigations are necessary. With this trigger, the County Dry Weather Monitoring Program will have identified a stormdrain that exceeded the criteria, and the City will be notified that a follow-up ID/IC investigation may be necessary. For extreme conditions that represent a clear and immediate risk to human health or receiving water quality then the appropriate Inspector will be notified immediately. This situation may require a hazardous materials response.

In instances, where the monitored site is near a jurisdictional boundary and the upstream drainage network for the site extends into a neighboring jurisdiction(s), all appropriate jurisdictions will be notified.

A-10.2.7.1 Tracking a Pollutant Upstream

Once the City AI is notified of the potential problem and it is determined that a source investigation is warranted, the approach used for tracking a pollutant source upstream or identifying an illicit connection will primarily involve the steps as outlined in the **DAMP Section 10.2.7** including:

- Step One - Initial Screening
- Step Two - Source Evaluations and Inspections
- Step Three – Monitoring
- Step Four – Document, Notify and Report

A-10.2.7.2 Documentation

Thorough and accurate documentation will be maintained by the AI throughout the investigation process to ensure that an accurate record is maintained and legal/evidentiary requirements are met. Documentation is also intended to ensure that the required regulatory reporting is completed, enforcement and cost recovery actions can be justified, repeat offenders and other areas of concern can be identified, program improvements can be made, and program effectiveness assessments can be prepared.

Investigative documentation includes:

Initial notification or investigation/response request
The location and specific details about the complaint
Information about the alleged responsible party
The results of the investigation
The actions that were taken as a result

Additional documentation may include interviews, photographs, samples, observation notes, and other information relevant to the investigation.

A-10.2.7.3 Elimination of ID/ICs

Depending on the type of ID/IC detected, the City will eliminate any discharge or connection

by means of appropriate legal procedures. ID/ICs will be eliminated by contacting the appropriate supervisor who oversees the activities resulting in the discharge and notifying the individual of necessary actions.

In the event that the City's determines that the individual responsible for the ID/IC is incapable of performing the actions by the compliance date, or if the individual chooses not to perform the activities, the City may conduct the necessary measures, and charge the resulting costs to the individual.

Follow-up will be conducted to ensure that abatement activities have been successfully and adequately implemented. A summary of the non-stormwater discharges and illicit discharges and connections investigated and eliminated must be included in the WQIP Annual Report as required by Provision F.3.b.(3) for the Fifth Term Permit.

A-10.3 EDUCATION AND ENFORCEMENT

A-10.3.1 Introduction

Enforcement activities within the Cityare undertaken according to the adopted Water Quality Ordinance and accompanying Enforcement Response Plan (**DAMP Exhibit 4.I).** Water pollution cases may be handled administratively or in more serious instances, be prepared for prosecution.

The City has formally designated the staff responsible for carrying out the enforcement services according to the Enforcement Response Plan and updates these designations every year as a part of Program Effectiveness Assessment.

The City generally utilizes four types of remedies including:

- Educational letters;
- Administrative Remedies - Notices of Violation, Administrative Citations, Criminal Remedies – Misdemeanors, Infractions, Issuance of Citations; and
- Other civil or criminal remedies as appropriate

A-10.3.2 Choosing the Type of Enforcement

The Enforcement Response Plan provides a framework to the City for selecting the type of enforcement that should be pursued. Some of the factors that influence this decision include the duration and significance of the violation of threat, the cooperativeness and willingness of the responsible party to remedy the conditions, whether the incident is isolated or re-occurring and whether the violation or threat will affect or harm human health or the environment.

In order to be consistent countywide, City staff will use the Enforcement Response Plan (**Exhibit A-4.1**) to assist them in determining which type of enforcement action should be used for any given incident.

Although the discussion below provides some guidelines on the use of various enforcement tools, the Enforcement Response Plan is the primary document for the enforcement procedures and processes and is consulted when enforcement options are being considered or appeals of enforcement remedies are initiated.

A-10.3.2.1 Educational Letters

Although the AI primarily rely on the administrative remedies as discussed below, there are still a few occasions when the City uses educationalt letters.

These situations may occur when:

- An AI believes that the water pollution complaint may be valid, but does not have evidence to substantiate it; and/or

- A second party, or resident, hires a contractor who causes an incident. In this case, the contractor should receive the administrative remedy and the resident should receive an educational letter.

Examples of educational materials that are distributed may include the following:

- Carpet Cleaners
- Restaurant Cleaning
- Automotive Service Center
- Gas Station
- Horse and Livestock
- Dog Waste
- Mobile Car Wash
- Pool Maintenance
- Waste Oil Collection
- Pest Control Products
- Permitted Lot and Pool Drains
- Car Wash Fundraisers

A-10.3.2.2 Administrative Remedies

The Citygenerally utilizes four types of administrative remedies **(Exhibit A-10.II)** including:

- Notices of Non-compliance – This is the least onerous enforcement tool and constitutes a basic request that the RP rectify the condition causing or threatening to cause non-compliance with the Ordinance.

  The Notice of Violation may be issued when one or more of the following circumstances exist:

  - The violation or threat is not significant and has been short in duration

  - The RP is cooperative and has indicated a willingness to remedy the conditions

  - The violation or threat is an isolated incident

  - The violation or threat does not affect and will not harm human health or the environment

Prior to the issuance of an Administrative Citation to a RP, the City will first issues a Notice of Violation, which states the act or acts constituting the violation and directs that the violation be corrected.

The Notice of Violation should provide the RP with a reasonable time to correct the violation before further proceedings are brought against the RP. However, a Notice of Violation should not be the first enforcement method used if egregious or unusual circumstances indicate that a stronger enforcement method is appropriate.

- Administrative Citation – This is an appropriate enforcement tool in the following circumstances:
    - An actual condition of Non-compliance exists, but the condition cannot be remedied within a relatively short period of time
    - The owner of the property or facility operator has indicated willingness to come into compliance by meeting milestones established in a reasonable schedule
    - The violation does not pose an immediate threat to human health or the environment
- Other Administrative Procedures or Civil Actions
    - Where the City has issued a local permit, the AI may elect to initiate administrative proceedings to suspend, revoke or modify the permit if the permit terms are violated or if changed conditions occur.
    - In consultation with the Enforcing Attorney, the AI may also consider the use of an injunction or other civil enforcement proceedings

A-10.3.2.3 Criminal Remedies

Criminal enforcement is appropriate when evidence indicates that the responsible party has acted willfully with intent to cause, allow continuing, or concealing a discharge in violation of the Ordinance.

The Permittees generally utilize three types of criminal remedies

- Issuance of Citation - Where criminal enforcement is indicated, the AI may cause issuance of a citation to the responsible party. The citation shall include:
    - The name and address of the violator
    - The provisions of the Ordinance violated
    - The time and place of required appearance before a magistrate

The responsible party must sign the citation thereby promising to appear. If the cited party refuses to sign the citation, the AI may cause the arrest of the discharger, or may refer the matter to the Enforcing Attorney for issuance of a warrant for arrest.

- Infractions - At the discretion of the Enforcing Attorney, misdemeanor acts may be treated as infractions. Factors that the EA may use in determining whether the misdemeanor is more appropriately treated as an infraction may include:
    - The duration of the violation or threatened violation
    - The compliance history of the person, business or entity
    - The effort made to comply with an established compliance schedule
    - The existence of prior enforcement actions
    - The actual harm to human health or the environment from the violation

    An infraction is punishable by a fine of not more than $100 for a first violation, $200 for a second violation, and a fine not exceeding $500 for each additional violation occurring within one year.

- Misdemeanors – Criminal enforcement is appropriate when evidence of non-compliance indicates that the violator of the Ordinance has acted willfully with intent to cause, allow continuing or concealing a discharge in violation of the Ordinance.

A-10.3.2.4 Administrative Hearings

The ordinance provides for appeals of the AI decisions to a designated Hearing Officer. The final decisions of Hearing Officers are appealable to the court with proper jurisdiction under statutory review procedures. For further information on the administrative hearing process, see the Enforcement Consistency Guide.

A-10.4 TRAINING

For an effective stormwater program to be efficiently implemented, its staff must have sufficient knowledge, experience, and skills. he Principal Permittee will coordinate, develop and present a number of different training modules in accordance with the *The Orange County Stormwater Program Training Program Framework: Core Competencie*s. The City will support this effort by requiring the appropriate employees to attend training sessions, and conduct applicable train-the-trainer sessions, if necessary.

A-10.4.1 Training Records

The City maintains records of training provided to staff.

Exhibit A-10.I

Pollution Notification and Investigation Request Form

City of Laguna Niguel

Incident Date: ___/___/_____
Time: _____:____ A.M. - P.M.

POLLUTION NOTIFICATION / INVESTIGATION REQUEST FORM

Notification/Request: **Category:** G Notification G Compliant G Response Request G Reconnaissance

From:_____(G Agency / G Department / G Public / G Private Company)
Contact: _____ Phone: (___)_____
Contact Address: _____
City: _____ State _____ Zip:_____
Comments :_____ Phone: (___)_____

Location:
Affected Address: _____
City: _____ State _____ Zip:_____
Extent of Impact_____ Map Page/Grid _____
Reference: _____

Complaint:
Complaint/Incident: _____

Notification / Request received by: _____ Date: _____

Responsible Party:
Suspect / RP: _____ Phone:(___)___
Contact: _____ Phone:(___)___
Contact Address: _____
City: _____ State _____ Zip:_____

Investigation Results:
Investigated by: _____ Date:____/____/____ Time: ___:___ A.M. - P.M.
Material/Waste Involved: _____ Estimated Volume/Quantity: _____
Investigation results : _____

Hours spent on investigation: _____ \ _____ \ _____ Job Code : _____ G **OC** G **RH**
Complainant/Requester Contacted: G In Person G By Telephone Date: _____

Action:
G Referred to County
G Hazardous Materials Incident - HMI Report _____
G Enforcement action G Enforcement letter G Prosecution case Date: _____
G Correction required: _____

G Non-**ER** Responsibility - Referred to: _____
Contact: _____ Phone: (___)_____
Date: _____ Time: ___:___ A.M. - P.M.
G No action - Reason: _____

Exhibit A-10.II

Administrative Remedies

City of Laguna Niguel
30111 Crown Valley Parkway
Laguna Niguel, California 92677
(949) 362-4320

NOTICE OF VIOLATION

This WARNING is issued for the violation of the Laguna Niguel Municipal Code ("LNMC").

_____
CE CASE #

Department
☐**ComDev**
☐**PW**

Date Notice Issued: _____ Date/Time Violation Observed: _____

Correction Required By Date: _____
Warning: *The corrections stated below are required to be completed by the above date. This warning is notice that if you fail to make the stated corrections by the above date; an administrative* ***citation may be issued.*** *The fines are $100 for the first citation, $200 for the second citation, and $500 for the third and subsequent citations. The fines are cumulative.*

Violation Address/Parcel Number:	
Mailing Address (if different):	
Business Name (if applicable):	
Name of Person Cited: Last, First	
Person Cited Relation to Property:	☐ Property Owner ☐Tenant ☐Business Owner ☐Other:

Checkmark below where applicable:
☐ Served In Person ☐ Served via Certified and First-Class Mail
☐ **STOP WORK NOTICE:** Pursuant to Section 8-1-12 of the LNMC (Adoption of California Building Code), you are ordered to stop work as described below.
☐ Prior citation(s) for same code violation(s), if known by the issuing officer.
☐ This is a continuing violation for which a citation may be issued each day the violation is not corrected.

LNMC Section(s) Violated:	Description of Violation(s):
1.	
2.	
3.	
4.	

Corrections Required: *The correction of the violation can be verified by contacting the issuing officer for an inspection.*

_____	_____	949-362-4320	_____
Signature of Issuing Officer	*Print Name of Issuing Officer and Department*	*Telephone No.*	*Date*
_____	_____	_____	_____
Signature of Person Cited	*Print Name of Person Cited*	*Telephone No.*	*Date*

READ REVERSE SIDE FOR IMPORTANT INFORMATION

Notice of Violation

For certain types of violations of the LNMC, a Notice of Violation may be issued. This is a warning that the violation has to be corrected and if not corrected an administrative citation may be issued. A Notice of Violation does not impose a fine. The date by which the violation is required to be corrected is noted on the Notice. The citee may request an extension of this date. The request must be in writing and it must be filed with the Director of the issuing department before the end of the correction period. The request must include sufficient evidence showing that the correction cannot be reasonably made within the stated period. The filing for such an extension does not, unless granted, extend the correction period. The Director's decision will be in writing and is final.

Consequences of Failure to Correct Violations

There are numerous enforcement options that can be used to encourage the correction of violations. These options include, but are not limited to: civil penalties, abatement, criminal prosecution, civil litigation and recording the violation with the County Recorder or State Franchise Tax Board. These options can empower the City to collect fines, to demolish structures or to make necessary repairs at the owner's expense. Any of these options or others may be used if the administrative citations do not achieve compliance.

Administrative Citations

Laguna Niguel Municipal Code (LNMC) Section 1-3-11 *et seq.* authorizes the issuance of administrative citations for violations of the LNMC. There are three levels of citations that can be issued progressively for a violation. The fines are $100 for the first citation, $200 for the second citation and $500 for the third and subsequent citations. These fines are cumulative. For continuing violations, a citation may be issued each day the violation is in existence.

If you need further information about the violations and/or how to correct the violations, please call 949-362-4320 or email code@CityofLagunaNiguel.org

A copy of City Ordinance No. 2006-142 providing for the issuance of administrative citations may be obtained from the issuing department or the City Clerk.