Caltrans

State of California
Department of Transportation

Storm Water Quality Handbooks

Project Planning and Design Guide

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

Construction Site
Best Management Practices (BMPs) Guide

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TABLE OF CONTENTS

Section 1 Introduction 1-1

1.1 Overview 1-1

1.2 BMP Selection and Design Process 1-3

1.3 Storm Water Guidance Documents 1-4

1.4 Regulations and Permits 1-4

1.4.1 Federal Regulations 1-4
1.4.2 Caltrans NPDES Statewide Storm Water Permit 1-4
1.4.3 Construction General Permit 1-5
1.4.4 Waste Discharge Requirements and Other Permits 1-5
1.4.5 Caltrans Statewide Storm Water Management Plan 1-5
1.4.6 Statewide Storm Water Quality Practice Guidelines 1-6
1.4.7 Storm Water Pollution Prevention Plan 1-6
1.4.8 Water Pollution Control Program 1-6

1.5 Permit and SWMP Implementation 1-7

1.5.1 Regional Work Plans 1-7

1.6 Design Compliance Monitoring 1-7

1.7 Annual Reporting Requirements 1-8

Section 2 Best Management Practice Selection 2-1

2.1 Introduction 2-1

2.2 Background 2-1

2.3 Identification of Water Quality Requirements for Project Planning Purposes 2-2

2.3.1 State Water Resources Control Board and Regional Water Quality Control Boards 2-3
2.3.2 Resources for Identifying Water Quality Requirements 2-5
2.3.2.1 Regional Water Quality Control Board Basin Plans 2-5
2.3.2.2 Total Maximum Daily Loads and 303(d) Lists 2-5
2.3.2.3 Standard Urban Storm Water Mitigation Plans 2-6
2.3.3 Storm Water Documents 2-6
2.3.4 Types of Pollutants 2-6
2.3.4.1 Total Suspended Solids 2-7
2.3.4.2 Nutrients 2-7
2.3.4.3 Pesticides 2-8
2.3.4.4 Metals (Particulate and Dissolved) 2-8
2.3.4.5 Pathogens 2-8
2.3.4.6 Litter 2-8
2.3.4.7 Biochemical Oxygen Demand 2-9

TABLE OF CONTENTS

2.3.4.8 Total Dissolved Solids 2-9
2.4 Best Management Practices 2-9

2.4.1 Design Pollution Prevention BMPs 2-10
2.4.2 Treatment Best Management Practices 2-12
2.4.2.1 Site-Specific Determination of Feasibility 2-13
2.4.2.2 Treatment BMP Use and Placement Considerations 2-15
2.4.3 Construction Site Best Management Practices 2-18
2.4.4 Maintenance Best Management Practices 2-18
Section 3 Design Program Responsibilities 3-1

3.1 Introduction 3-1

3.2 Management 3-1

3.3 Storm Water Advisory Teams 3-1

3.4 Storm Water Coordinators 3-2

3.5 Responsibilities as they Relate to Encroachment Permits and Third-Party Activities 3-2

3.6 Responsibilities for Coordination with Municipal Storm Water Permittees (Local Agencies) 3-2

3.7 Consultation with Regional Water Quality Control Boards and Local Regulatory Agencies 3-3

3.8 Staff and Functional Units 3-3

3.8.1 Staff 3-3
3.8.2 Functional Units 3-4
3.9 Reporting Requirements 3-9

Section 4 Permanent Treatment Exemption 4-1

4.1 Introduction and Objectives 4-1

4.2 Project Exemption Process 4-1

Section 5 Project Initiation Document Process 5-1

5.1 Introduction and Objectives 5-1

5.2 Project Initiation Document 5-1

5.3 Project Initiation Document Process 5-2

5.4 Project Management/Coordination 5-4

TABLE OF CONTENTS

5.5 BMP Evaluation and Selection Process 5-6

5.5.1 Storm Water Data Collection 5-8
5.5.2 Identify Potential BMPs 5-13
5.5.3 Analyze Project Alternatives / Select BMPs 5-15
5.5.4 Prepare Preliminary Project Cost Estimates 5-17
5.6 Documentation Required For Project Initiation Document 5-19

Section 6 Project Approval/Environmental Document Process 6-1

6.1 Introduction and Objectives 6-1

6.2 Project Approval/Environmental Document 6-1

6.3 Project Approval/Environmental Document Process 6-2

6.4 Project Management/Coordination 6-3

6.5 BMP Selection Process 6-7

6.6 Documentation Required For Project Approval/Environmental Document 6-13

Section 7 Plans, Specifications and Estimates Process 7-1

7.1 Introduction and Objectives 7-1

7.2 Plans, Specifications & Estimates Process 7-1

7.2.1 Conceptual SWPPP and Water Pollution Control Plans 7-1
7.3 Project Management/Coordination 7-4

7.4 BMP Design Process 7-6

7.5 Documentation Required For Plans, Specifications & Estimates Package 7-17

Section 8 Final Project Development Procedures – Construction 8-1

8.1 Information for the Construction Phase of the Project 8-1

8.1.1 Vicinity Map of the Project Area 8-2
8.1.2 Soils/Geotechnical Report, Project Materials Report and/or Other Reports 8-3
8.1.3 Pre-Construction (Existing) Control Practices 8-3
8.1.4 Permanent (Post-Construction) Storm Water Control Measures 8-3
8.1.5 Layout Sheets Showing Suggested Construction Site BMP Locations 8-5
8.1.6 Explanation of Permanent BMPs Used as Temporary BMPs During Construction 8-5
8.1.7 Drainage Information 8-5
8.1.8 Construction Site Estimates 8-6

8.1.9 Other Information 8-8
8.2 Conceptual Storm Water Pollution Prevention Plan/Water Pollution Control Program 8-9

8.3 Preparation and Submittal of the Notification of Construction 8-9

List of Tables

Table 2-1 BMP Categories and Responsible Divisions 2-1
Table 2-2 Pollutants of Concern and Applicable Treatment BMPs 2-7
Table 2-3 BMP Descriptions 2-10
Table 2-4 Design Pollution Prevention BMPs 2-10
Table 2-5 Approved Treatment BMPs 2-12
Table 5-1 Project Features and Potential Impacts to be Considered During Project Planning 5-12
Table 7-1 Drainage Area Attributes and Their Effect on Storm Water BMPs 7-14
Table 8-1 Water Quality Information to be Included in the Resident Engineer File and/or Information Handout 8-2
Table 8-2 Computation Sheet for Determining Runoff Coefficients 8-6
Table 8-3 Runoff Coefficients for Undeveloped Areas, Watershed Types 8-7
Table 8-4 Runoff Coefficients for Developed Areas 8-8
Table A-1 Design Pollution Prevention BMPs A-1
Table B-1 Summary of Biofiltration (Strips and Swales) B-2
Table B-2 Summary of Infiltration Basin Siting and Design Criteria B-4
Table B-3 Typical Infiltration Rates For NRCS Type and HSG Classifications B-8
Table B-4 Summary of Detention Basin Siting and Design Criteria B-20
Table B-5 Summary of Traction Sand Trap Siting and Design Criteria B-23
Table B-6 Summary of Dry Weather Flow Diversion B-24
Table B-7 Summary of Gross Solids Removal Devices (Linear Radial and Inclined Screen) B-29
Table C-1 Construction Site BMPs By Construction Activity C-2
Table C-2 Temporary Soil Stabilization Criteria Matrix C-6
Table D-1 Relevant Storm Water Documents and Purpose D-1
Table D-2 Storm Water Related Web Sites D-2
Table F-1 Options for Cost Estimating Storm Water BMPs F-4
Table F-2 Estimating Options Available During the Project Development Process F-4
Table F-3 Percentage of Extra Project Cost Due to Construction Site BMPs F-5
Table F-4 Sample Table F-7
Table F-5 Erosion and Sediment Control of BMPs Installed and Effectiveness F-8
Table F-6 Treatment BMPs Installed Costs F-11

TABLE OF CONTENTS

List of Figures

Figure 1-1	Design Process Summary	1-3
Figure 2-1	Map of California with RWQCB and District Boundaries	2-4
Figure 2-2	Decision Process for Selecting Design Pollution Prevention BMPs	2-11
Figure 2-3	Decision Process for Selecting Treatment BMPs at Specific Sites	2-14
Figure 4-1	Project Exemption Criteria for Permanent Treatment BMPs Only	4-2
Figure 5-1	Project Initiation Document - Storm Water Task Categories	5-3
Figure 5-2	Flowchart for Consideration of Storm Water BMPs for the PID	5-7
Figure 6-1	Project Approval/Environmental Document - Storm Water Task Categories	6-4
Figure 6-2	Project Approval/Environmental Document – BMP Selection Process	6-8
Figure 7-1	Plans, Specification, and Estimates Document - Storm Water Task Categories	7-3
Figure 7-2	BMP Design Process Flowchart	7-7
Figure A-1	Ditches, Berms, Dikes and Swales	A-4
Figure A-2	Flared Culvert End Section	A-6
Figure A-3	Outlet Protection/Velocity Dissipation Device	A-7
Figure A-4	Slope Roughening, Terracing, Rounding and Stepping	A-9
Figure B-1	Example Schematic of an Infiltration Basin	B-3
Figure B-2	Pre-screening for the Infiltration Basins	B-6
Figure B-3	BMP Siting Procedure for Infiltration Basins	B-14
Figure B-4	Example Schematic of an Detention Basin (Not a Standard Plan)	B-15
Figure B-5	Example Schematic of Water Quality Outlet Structure (Not a Standard Plan)	B-17
Figure B-6	Example Schematic of Linear Radial Device (Not a Standard Plan)	B-26
Figure B-7	Partially Full Linear Radial Device	B-27
Figure B-8	Example Schematic of Inclined Screen (Not a Standard Plan)	B-28
Figure B-9	Inclined Screen	B-29

TABLE OF CONTENTS

Appendices

Appendix A - Approved Design Pollution Prevention BMPs **A-1**

A.1 Required Minimum Design Elements for Storm Water Control A-1

A.2 Consideration of Downstream Effects Related to Potentially Increased Flow A-1

A.3 Preservation of Existing Vegetation A-2

A.4 Concentrated Flow Conveyance Systems A-3

A.5 Slope/Surface Protection Systems A-7

Appendix B - Approved Treatment BMPs **B-1**

B.1 Treatment BMPs B-1

B.2 Biofiltration Strips and Swales B-1

B.3 Infiltration Basins B-2
- B3.1 Description and Applications B-2
- B3.2 Pre-Screening for the Infiltration BMP B-4
  - B.3.2.1 Information Collection B-4
  - B.3.2.2 Preliminary Determination for Appropriateness of Infiltration B-6
- B.3.3 Site Screening B-7
- B.3.4 Site Investigation B-9
  - B.3.4.1 Procedure for Preliminary Infiltration Basin Site Investigation B-9
  - B.3.4.2 Detailed Investigation B-12
- B.3.5 Preliminary Design B-13

B.4 Detention Basins Description B-15

B.5 Traction Sand Traps B-21

B.6 Dry Weather Flow Diversion B-23

B.7 Gross Solids Removal Devices: Linear Radial Device and Inclined Screen Device B-25
- B.7.1 Linear Radial Device B-25
- B.7.2 Inclined Screen Device B-27
- B.7.3 Factors Affecting Preliminary Design B-29

Appendix C - Approved Construction Site BMPs **C-1**

C.1 Construction Site Best Management Practices (BMPs) C-1
- C.1.1 Soil Stabilization BMPs C-5
  - C.1.1.1 Scheduling (SS-1) C-7

C.1.1.2 Preservation of Existing Vegetation (SS-2) C-8
C.1.1.3 Hydraulic Mulch (SS-3) C-8
C.1.1.4 Hydro Seeding (SS-4) C-9
C.1.1.5 Soil Binders (SS-5) C-9
C.1.1.6 Straw Mulch (SS-6) C-12
C.1.1.7 Geotextiles, Mats/Plastic Covers and Erosion Control Blankets (SS-7) C-12
C.1.1.8 Wood Mulching (SS-8) C-16
C.1.1.9 Earth Dikes/Drainage Swales and Ditches (SS-9) C-16
C.1.1.10 Outlet Protection/Velocity Dissipation Devices (SS-10) C-17
C.1.1.11 Slope Drains (SS-11) C-18
C.1.2 Sediment Control Practices C-18
C.1.2.1 Silt Fence (SC-1) C-18
C.1.2.2 De-silting Basin (SC-2) C-18
C.1.2.3 Sediment Trap (SC-3) C-19
C.1.2.4 Check Dams (SC-4) C-19
C.1.2.5 Fiber Rolls (SC-5) C-19
C.1.2.6 Gravel Bag Berm (SC-6) C-19
C.1.2.7 Street Sweeping and Vacuuming (SC-7) C-20
C.1.2.8 Sand Bag Barrier (SC-8) C-20
C.1.2.9 Straw Bale Barrier (SC-9) C-20
C.1.2.10 Storm Drain Inlet Protection (SC-10) C-20
C.1.3 Tracking Control Practices C-21
C.1.3.1 Stabilized Construction Entrances (TC-1) C-21
C.1.3.2 Stabilized Construction Roadway (TC-2) C-21
C.1.3.3 Entrance/Outlet Tire Wash (TC-3) C-21
C.1.4 Wind Erosion Control (WE-1) C-22

C.1.5 Non-Storm Water Controls C-22
C.1.5.1 Water Conservation Practices (NS-1) C-22
C.1.5.2 Dewatering Operations (NS-2) C-23
C.1.5.3 Paving and Grading Operations (NS-3) C-23
C.1.5.4 Temporary Stream Crossing (NS-4) C-23
C.1.5.5 Clear Water Diversions (NS-5) C-23
C.1.5.6 Illicit Connection/Illegal Discharge Detection and Reporting (NS-6) C-23
C.1.5.7 Potable Water/Irrigation (NS-7) C-23
C.1.5.8 Vehicle and Equipment Cleaning (NS-8) C-24
C.1.5.9 Vehicle and Equipment Fueling (NS-9) C-24
C.1.5.10 Vehicle and Equipment Maintenance (NS-10) C-24
C.1.5.11 Pile Driving Operations (NS-11) C-24
C.1.5.12 Concrete Curing (NS-12) C-24
C.1.5.13 Material and Equipment Use Over Water C-24
C.1.5.14 Concrete Finishing (NS-14) C-25
C.1.5.15 Structure Demolition/Removal Over Water (NS-15) C-25

C.1.6 Waste Management and Materials Pollution Control C-25
C.1.6.1 Material Delivery and Storage (WM-1) C-25
C.1.6.2 Material Use (WM-2) C-26
C.1.6.3 Stockpile Management (WM-3) C-26
C.1.6.4 Spill Prevention and Control (WM-4) C-26
C.1.6.5 Solid Waste Management (WM-5) C-26
C.1.6.6 Hazardous Waste Management (WM-6) C-26
C.1.6.7 Contaminated Soil Management (WM-7) C-27
C.1.6.8 Concrete Waste Management (WM-8) C-27
C.1.6.9 Sanitary/Septic Waste Management (WM-9) C-27
C.1.6.10 Liquid Waste Management (WM-10) C-27

Appendix D - Relevant Storm Water Documents and Web Sites D-1

Appendix E - Water Quality Summary Forms, Checklists and Decision Trees E-1
PID Process Summary Form E-1
PA/ED Process Summary Form E-3
PS&E Process Summary Form E-6
Exemption Documentation Form E-9
Storm Water Data Report E-10
Storm Water Checklist SW-1, Site Data Sources E-15
Storm Water Checklist SW-2, Storm Water Quality Issues Summary E-16
Storm Water Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts E-17
Design Pollution Prevention BMP Decision Tree DPP-1 E-18
Checklist DPP-1, Design Pollution Prevention BMPs E-19
Treatment BMP Decision Tree T-1 E-25
Checklist T-1, Treatment BMPs E-26

Appendix F - Cost Estimates F-1

Appendix G - Abbreviations, Acronyms, and Definition of Terms G-1

1.1 OVERVIEW

This Project Planning and Design Guide (PPDG) provides design guidance for incorporating storm water quality controls into projects during the planning and design phases. This document supercedes prior design guidance manuals and has been prepared in support of the Statewide Storm Water Management Plan (SWMP) and the Storm Water Quality Practice Guidelines (Guidelines). The PPDG addresses key regulatory, policy and technical requirements from these two documents by providing direction on the procedures to implement the storm water Best Management Practices (BMPs) into the design of all Caltrans projects.

The key objective of this PPDG is to provide the overall process for selecting and designing BMPs within the Caltrans planning and design processes and incorporating those BMPs into the appropriate documents. These documents include the Project Initiation Document (PID), the Project Approval/Environmental Document (PA/ED), and the Plans, Specifications and Estimates (PS&E). The planning and design approach described herein has been developed to fit within the appropriate Work Breakdown Structure (WBS) codes and activities identified in the Caltrans Project Development Procedures Manual (PDPM, 7/1/99) and the Guide to Caltrans Capital Project Work Breakdown Structure, Release 5.1. These documents can be found on the web at the following sites:

- http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm
- http://www.dot.ca.gov/hq/projmgmt/documents/wbs_5.1_final.pdf

Also, the Storm Water Data Report (SWDR), which summarizes the storm water quality issues of a project, its corresponding checklists, and several decision trees, is described in this manual. These documents are provided in Appendix E, and may be used for guidance in evaluating BMPs considered during the PID, PA/ED, and PS&E processes.

This PPDG is organized as follows:

Section 1 – Introduction: Provides an overview of the BMP selection and design process, the history of the existing storm water guidance documents, regulations and permits, SWMP implementation, design compliance monitoring and annual reporting requirements.

Section 2 – Best Management Practice Selection: Provides designers with background information and guidance necessary for the appropriate selection of BMPs.

Section 3 – Design Program Responsibilities: Identifies specific staff responsibilities.

Section 4 – Permanent Treatment Exemption: Provides guidance for determining the feasibility of implementing Treatment BMPs and identifies project exemption criteria.

Section 5 – Project Initiation Document Process: Describes the overall PID process, including the identification of water quality issues, evaluation of potential BMPs, the estimating of BMP costs, and the development of a Preliminary Environmental Assessment Report (PEAR).

Section 6 – Project Approval/Environmental Document Process: Describes the overall PA/ED process, including the evaluation of potential water quality impacts, the preparation of environmental and engineering studies for project alternatives, the selection of the preferred project alternative and its associated water quality BMPs, the development of a cost estimate, and the completion of a Project Report.

Section 7 – Plans, Specifications and Estimates Process: Describes the overall PS&E process, including the final design of the project incorporating permanent BMPs, obtaining environmental permits, the completion of a SWDR, and the completion of the PS&E package.

Section 8 – Final Project Development Procedures – Construction: Provides Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) information and Notification of Construction (NOC) information for the project construction phase.

Appendix A – Approved Design Pollution Prevention BMPs. Describes the Design Pollution Prevention BMPs that are considered during the planning and design phases of projects. These BMPs are then incorporated into the design of new facilities and the reconstruction or expansion of existing facilities.

Appendix B – Approved Treatment BMPs. Describes the Treatment BMPs that are considered during the planning and design phases of projects. These BMPs are then incorporated into the design of new facilities and major reconstruction of existing facilities. Appendix B also identifies BMP selection procedures, and provides information for determining the volume of water that must be treated by BMPs.

Appendix C – Approved Construction Site BMPs. Describes and lists the Construction Site BMPs that are applied during construction activities to reduce pollutants in storm water discharges throughout construction.

Appendix D – Relevant Storm Water Documents and Web Sites. Two tables provide a summary of the relevant storm water related documents and their purpose, and the web sites that are mentioned in this document.

Appendix E – Water Quality Summary Forms, Checklists and Decision Trees. Provides Process Summary Forms for the PID, PA/ED and the PS&E processes, the Exemption Documentation Form that correlates to Section 4, the SWDR that summarizes the storm water quality information, Checklist SW-1 that lists categories of pertinent information required for storm water planning and design, Checklist SW-2 which provides a guide to collecting information relevant to project storm water quality issues, Checklist SW-3 which provides direction to the designer during the project planning phase to avoid or reduce potential storm water impacts, and Checklists and Decision Trees DPP-1 and T-1 which are used for guidance in selecting Design Pollution Prevention and Treatment BMPs.

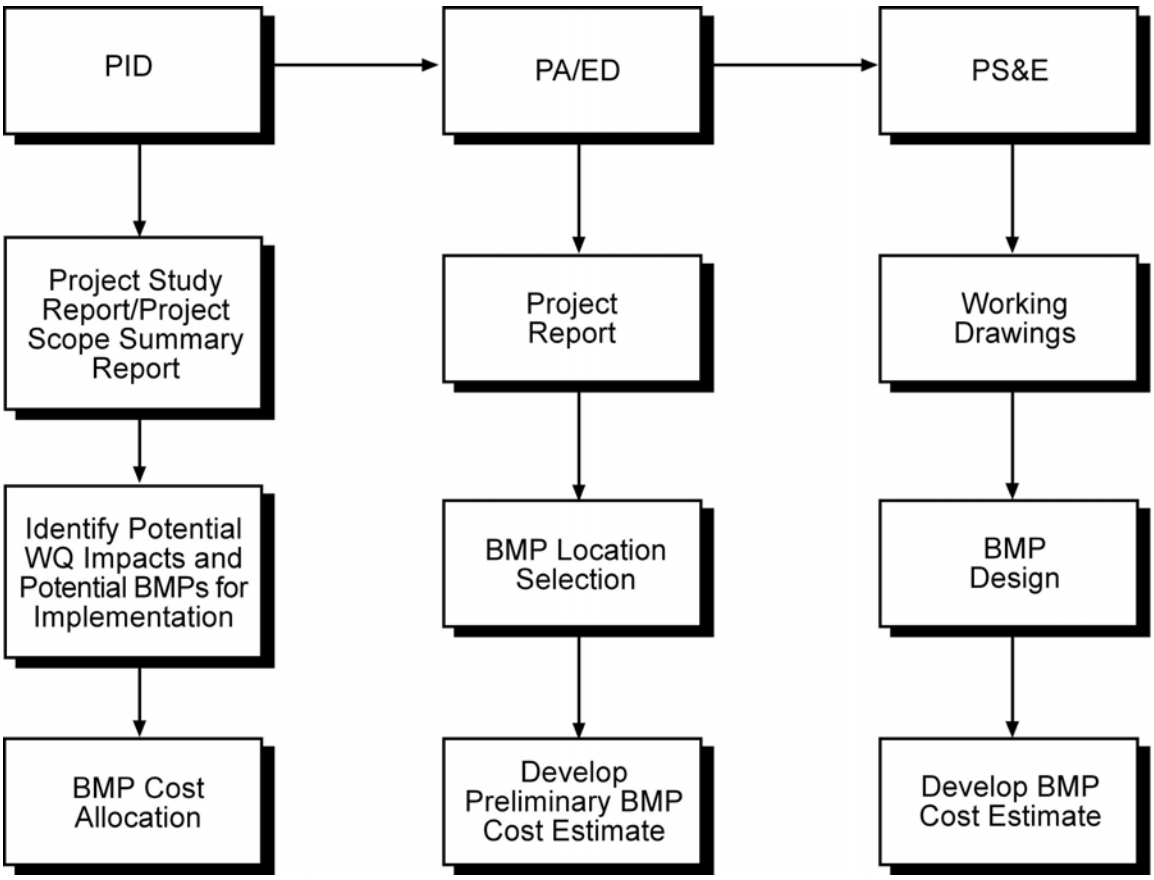
Appendix F – Cost Estimates. Provides guidance on how to include the cost of storm water BMPs into the overall project cost.

Appendix G – Abbreviations, Acronyms, Definition of Terms and References.

1.2 BMP SELECTION AND DESIGN PROCESS

The overall process to select BMPs as part of each of the project phases: PID, PA/ED, and PS&E, is shown in Figure 1-1. This figure shows the procedure for BMP implementation throughout the design process from securing funds in the PID, to selecting the preferred BMP alternative in the PA/ED and preparing detailed design in the PS&E. Each phase of the project is individually described in Sections 5, 6 and 7 of this PPDG. Implementation activities generally follow the procedures presented in the PDPM.

Figure 1-1: Design Process Summary



It is important to note that this document provides minimum guidelines and that additional requirements may have to be incorporated on a project-by-project basis to comply with special requirements from a Regional Water Quality Control Board (RWQCB), specific District guidelines, or as a result of other studies. Other storm water quality elements that designers may have to consider are included as a result of each District's Regional Work Plan (RWP).

Special site conditions may warrant variations from the guidance provided herein. The Project Engineer (PE) is responsible for recognizing site conditions that warrant variations in procedures, and for securing appropriate approvals for these variations before proceeding with design.

1.3 STORM WATER GUIDANCE DOCUMENTS

In order to meet the demands of the storm water management process in regards to controlling pollutant discharges and meeting permit requirements, several documents have been developed. Appendix D provides a list and a brief summary of these documents and their purposes.

1.4 REGULATIONS AND PERMITS

1.4.1 Federal Regulations

Federal regulations for controlling discharges of pollutants from municipal separate storm sewer systems (MS4s), construction sites, and industrial activities were incorporated into the National Pollutant Discharge Elimination System (NPDES) permit process by the 1987 amendments to the Clean Water Act (CWA) and by the subsequent 1990 promulgation of federal storm water regulations issued by the U.S. Environmental Protection Agency (EPA). The EPA regulations require municipal, construction and industrial storm water discharges to comply with an NPDES permit. In California, the EPA delegated its authority to the State Water Resources Control Board (SWRCB) to issue NPDES permits.

1.4.2 Caltrans NPDES Statewide Storm Water Permit

The SWRCB issued an NPDES Statewide Storm Water Permit (Caltrans Permit) to Caltrans in 1999 (Order No. 99-06-DWQ) (CAS000003), to regulate storm water discharges from Caltrans facilities. The Caltrans Permit requires the Caltrans to comply with the requirements of the Construction General Permit (General Permit) described in Section 1.4.3. The Caltrans Permit regulates storm water discharges from Caltrans rights-of-way both during and after construction, as well as from existing facilities and operations. The Caltrans Permit gives RWQCBs the option to specify additional requirements they may consider necessary to meet water quality standards. Copies of the Caltrans Permit can be downloaded from the SWRCB web site, at http://www.swrcb.ca.gov/stormwtr/docs/caltranspmt.pdf.

The Caltrans Permit requires Caltrans to implement a year-round program in all parts of the State to effectively control storm water and non-storm water discharges. Furthermore, the Caltrans Permit requires Caltrans storm water discharges to meet water quality standards through implementation of permanent and temporary (construction) BMPs and other measures. Discharges from Caltrans rights-of-way that are not composed entirely of storm water are prohibited. Therefore, appropriate BMPs must be installed to remove pollutants to the Maximum Extent Practicable (MEP). The permit language is "Any discharge from Caltrans right-of-way or Caltrans properties, facilities, and activities within those rights-of-way that is not composed entirely of 'Storm Water' to waters of the United States is prohibited unless authorized pursuant to…this NPDES Permit."

1.4.3 Construction General Permit

Recognizing the substantial administrative burden associated with permitting individual construction sites throughout California, the SWRCB elected to adopt a single statewide general permit for construction activities (General Permit) (Order No. 99-08-DWQ) (CAS000002) that applies to all storm water discharges from land where clearing, grading, and excavation result in soil disturbance of at least 2 hectares (5 acres) or more.[1] Construction activity that results in soil disturbances of less than 2 hectares (5 acres) is subject to this General Permit if the construction activity is part of a larger Common Plan of Development totaling 2 hectares (5 acres) or more of soil disturbing activities, or if there is the potential for significant water quality impairment resulting from the activity as determined by the RWQCB. The General Permit requires owners of land where construction activity occurs to develop a SWPPP (see Section 1.4.6).

In December 1999, the U.S. Environmental Protection Agency finalized the Phase II of the NPDES Program, which requires controls on a broader sector of municipalities, industries, and construction sites. Specifically, urbanized areas with a population of at least 10,000 and with a population density greater than 1,000 per square mile are required to obtain a storm water permit. For construction, the Phase II Rule requires construction sites disturbing a soil area equal to or greater than 0.4 hectare (one acre) and less than 2 hectares (5 acres) to control pollutants in storm water runoff. Phase II rules go into effect March, 2003.

In some areas of the state, the RWQCBs have issued permits directly to Caltrans Districts. The requirements for construction sites in these permits are generally similar and supersede the General Permit requirements. Copies of the General Permit can be downloaded from the SWRCB web site, at http://www.swrcb.ca.gov/stormwtr/construction.html.

1.4.4 Waste Discharge Requirements and Other Permits

In addition to implementing the Caltrans Permit, a RWQCB may issue separate Waste Discharge Requirements (WDRs) or additional permits. An example of this would be work that involves the reuse of soils that contain aerially deposited lead. Caltrans has applied for and received variances from the California Department of Toxic Substances Control (DTSC) for the reuse of some soils that contain lead. Under the Caltrans Permit, the District will provide written notification to the RWQCB at least 30 days prior to advertisement for bids of projects that involve soils subject to this variance. This notification period will allow a determination by the RWQCB(s) of the need for development of Waste Discharge Requirements (WDRs) or written conditional approvals by RWQCB staff. Other situations that may require WDRs or permits include dewatering discharges, disposal of concrete wastes, etc.

1.4.5 Caltrans Statewide Storm Water Management Plan

The Caltrans Permit directs Caltrans to implement and maintain an effective SWMP. The SWMP is the Caltrans policy document that describes how Caltrans conducts its storm water management activities (i.e., procedures and practices), provides descriptions of each of the major

[1] This disturbed soil area requirement may decrease in 2003. Consult your District Storm Water NPDES Coordinator for further information.

management program elements, discusses the processes used to evaluate and select appropriate BMPs, and presents key implementation responsibilities and schedules. The SWMP also contains a list of the approved BMPs that have been evaluated and selected to manage storm water discharges from Caltrans properties, facilities, and activities.

1.4.6 Statewide Storm Water Quality Practice Guidelines

The Guidelines describe each approved BMP included in the SWMP for Statewide application. This document provides Caltrans staff with instructions on implementing each approved storm water management practice or BMP.

1.4.7 Storm Water Pollution Prevention Plan

Section A of the General Permit outlines the required contents of a SWPPP. A SWPPP is a document that addresses water pollution controls for a specific project during construction. The General Permit requires that all storm water discharges associated with construction activities that result in soil disturbance of at least 2 hectares (5 acres)[2] of total land area must comply with the provisions specified in the Caltrans Permit, including development and implementation of an effective SWPPP. Designers are required to include pertinent SWPPP related information in the project file. In some cases, the RWQCB may view two or more small projects (individually less than 2 hectares [5 acres] of soil disturbance, but together totaling 2 hectares [5 acres] or more) in the same corridor to be part of a larger Common Plan of Development, thus making the small projects subject to the requirements of the General Permit to develop and implement a SWPPP. The Project Manager (PM) should be aware of other projects in the corridor.

At least 30 days prior to the start of construction, Caltrans will submit a Notification of Construction (NOC) to the appropriate RWQCB for all construction projects that require a SWPPP to be prepared for the site. The SWPPP is normally prepared by the contractor, and shall be approved by the Resident Engineer (RE) prior to commencement of soil-disturbing activities. When construction is complete and the construction site is stabilized, Caltrans will submit a Notification of Completion of Construction (NCC) to the appropriate RWQCB.

1.4.8 Water Pollution Control Program

Generally, construction projects with a disturbed soil area of less than 2 hectares (5 acres) are not covered under the General Permit and do not require a SWPPP. The exceptions to this rule would be (1) in the case of a Common Plan of Development, or (2) if the RWQCB requires a SWPPP for a smaller project based upon water quality concerns. For all projects that do not require preparation of a SWPPP, Caltrans requires that a Water Pollution Control Program (WPCP) be prepared. The WPCP is normally prepared by the contractor and shall be approved by the RE prior to commencement of soil-disturbing activities. Details on the preparation of the SWPPP or WPCP are found in the supplementary Storm Water Quality Handbook, "SWPPP and WPCP Preparation Manual, November 2000."

[2] This disturbed soil area requirement may decrease in 2003. Consult your District Storm Water NPDES Coordinator for further information.

1.5 PERMIT AND SWMP IMPLEMENTATION

The Headquarters (HQ) Environmental Program coordinates implementation of the SWMP with each District or Region and with other HQ functional units including Design, Maintenance, and Construction. Each District is responsible for implementing the SWMP within the District and complying with the Caltrans Permit and General Permit requirements and any District- or Region-specific requirements. Program responsibility matrices have been developed specifically for each District or Region and are available from District/Regional NPDES Storm Water Coordinators.

1.5.1 Regional Work Plans

The Caltrans Permit requires the submittal of Regional Work Plans (RWPs) as part of the Annual report. Caltrans, in coordination with the SWRCB and the RWQCBs, has developed a standard format for the development and submittal of these RWPs. Accordingly, each District is required to develop and submit a RWP to the appropriate RWQCB. These RWPs provide details on activities to be conducted by a District during the upcoming reporting period to comply with the Caltrans Permit and SWMP.

Caltrans will develop and submit RWPs to the SWRCB each year by April 1, as part of the Annual Report. The RWPs will also be forwarded to the appropriate RWQCB Executive Office for approval. The RWPs describe activities that will be conducted by the Districts during the upcoming fiscal year to implement the SWMP. These work plans are organized as follows:

- Section 1 – Introduction;
- Section 2 – District Personnel and Responsibilities;
- Section 3 – District Facilities and Water Bodies;
- Section 4 – High Risk Areas; and
- Section 5 – Implementation.

The Districts will coordinate and meet with the appropriate RWQCBs to discuss the proposed RWPs at least 30 days prior to the April 1 due date each year.

1.6 DESIGN COMPLIANCE MONITORING

Design Compliance Monitoring is a new SWMP element that will be developed by the HQ Project Design Storm Water Advisory Team (PDSWAT) and will be implemented by the Districts with the following objectives:

- Evaluate compliance of project planning and design activities with requirements of the Caltrans Permit and the approved SWMP;
- Identify activities or SWMP elements needing improvement, changes or revisions;
- Identify training needs; and
- Report compliance status to Caltrans management, the SWRCB and the RWQCBs.

Currently, each District is responsible for implementing a design review process based on local requirements and project needs. Elements of each District's compliance review program, and the implementation of that program, will be unique due to individual District organizational structures and staff responsibilities. The Design Compliance Monitoring that will be implemented through the SWMP is intended to address this variability. It will be developed by the PDSWAT, implemented through the Districts, and will require documentation and reporting of the review findings to HQ and in the Annual Report.

The key elements of the proposed Design Compliance Monitoring are:

- Project planning and design checklists as summarized by the SWDR;
- Compliance monitoring and reporting protocol;
- Feedback and program improvement; and
- Annual reporting.

1.7 ANNUAL REPORTING REQUIREMENTS

The information to be included in the Annual Report will be first reviewed by the PDSWAT as part of the process to annually update the SWMP. A summary of Design Compliance Monitoring activities will be provided in the Annual Report including:

- The design checklists used during the previous year;
- A new checklist for the upcoming year, if needed;
- A summary of the review findings; and
- A summary of lessons learned, trends, challenges encountered, and proposed program changes.

2.1 INTRODUCTION

This section of the Project Planning and Design Guide (PPDG) provides designers with background information and guidance necessary for the appropriate selection of Best Management Practices (BMPs). The following sections describe how the designer can identify pollutants of concern, define BMP placement and use considerations, and describe the various approved BMPs that can be used by designers.

2.2 BACKGROUND

The Caltrans Statewide Storm Water Management Plan (SWMP) identifies permanent and temporary BMPs that have been approved for statewide application. The BMPs fall into four categories as shown in Table 2-1:

Table 2-1: BMP Categories and Responsible Divisions

BMP	Description	Responsible Division for BMP Implementation
Design Pollution Prevention BMPs	Permanent soil stabilization systems, etc.	Division of Design
Treatment BMPs	Permanent treatment devices and facilities	Divisions of Design, Construction and Maintenance
Construction Site BMPs	Temporary soil stabilization and sediment control, non-storm water management, and waste management	Divisions of Design and Construction
Maintenance BMPs	Litter pickup, toxics control, street sweeping, etc.	Division of Maintenance

The BMPs that must be considered during the planning and design process include Design Pollution Prevention BMPs, Treatment, and Construction Site BMPs. Both Design Pollution Prevention and Construction Site BMPs must be considered for every project. Treatment BMPs must be considered for all projects not considered exempt (see Section 4). Consideration for the implementation of BMPs must begin in the planning process, and continue through the design process.

The descriptions, appropriate applications, siting criteria, and design factors for the approved Design Pollution Prevention and Treatment BMPs are provided in Appendices A and B of this document. Additional information regarding the selection process for these BMPs is provided in Sections 2.4.1 and 2.4.2 of this manual.

Only BMPs that have been approved as described in the SWMP, Section 3.3, should be incorporated into projects. If project conditions prohibit the use of approved BMPs, then the designer should consult with the District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator. The District does have the option of proposing the incorporation of a non-approved BMP as a pilot project. The Storm Water Advisory Teams

(SWATs) and the appropriate Headquarters' (HQ) functional units must approve this proposal. The District's proposal for a pilot project should include the following information:

- Description of project (including why approved BMPs cannot be implemented);
- Description of proposed BMP (including anticipated costs and benefits);
- Anticipated life-cycle maintenance requirements;
- Monitoring Program;
- Evaluation criteria; and
- Commitment by the District to prepare a final report on the pilot technology.

If the SWATs and the HQ functional units approve the pilot project, the District would be allowed to incorporate the non-approved BMP into their project. It should be noted that a pilot technology is normally approved only for deployment in a limited quantity within a given project. Pilot technologies are not deployed in large numbers within a single project, or deployed within multiple projects unless these multiple deployments are required to evaluate a pilot technology's performance under varying site conditions. The purpose of the pilot project is to evaluate the feasibility of that particular pilot technology, with further deployment being dependent upon the outcome of the pilot project (reference SWMP, Appendix B). This process applies to Design Pollution Prevention BMPs, Treatment BMPs, and Construction Site BMPs.

If it is found that a project cannot incorporate an approved Treatment BMP, and no pilot treatment technologies can be identified by the District or by HQ, then the Project Engineer (PE) shall prepare a technical report explaining why this is so. The technical report must be submitted to the Regional Water Quality Control Board (RWQCB) at least 180 days prior to the start of construction. This submittal should be made through the District/Regional NPDES Storm Water Coordinator.

2.3 IDENTIFICATION OF WATER QUALITY REQUIREMENTS FOR PROJECT PLANNING PURPOSES

The appropriate selection of BMPs requires the PE to have an understanding of the process used to identify water quality requirements and pollutants of concern for specific water bodies. The RWQCBs play an important role in identifying the pollutants of concern. Water quality standards, Total Maximum Daily Loads (TMDLs) and Basin Plans developed by the RWQCBs are important references for the identification of pollutants that need to be addressed.

The process of identifying water quality requirements includes close coordination with the District Environmental Unit. The PE should initiate the process of compiling information regarding water quality requirements as identified in the checklists provided in Appendix E, and should share this information with the Environmental Unit. Both the Environmental Unit and the PE shall exchange information necessary to prepare documents regarding the assessment of water quality impacts and needed to select and design BMPs. This information exchange continues to take place throughout the Project Initiation Document (PID), the Project

Approval/Environmental Document (PA/ED) and the Plans, Specifications and Estimates (PS&E) processes. The Environmental Unit will use the shared information to prepare the Storm Water Quality Assessment (SWQA), while the PE uses the information to complete the Storm Water Data Report (SWDR) as described in Appendix E.

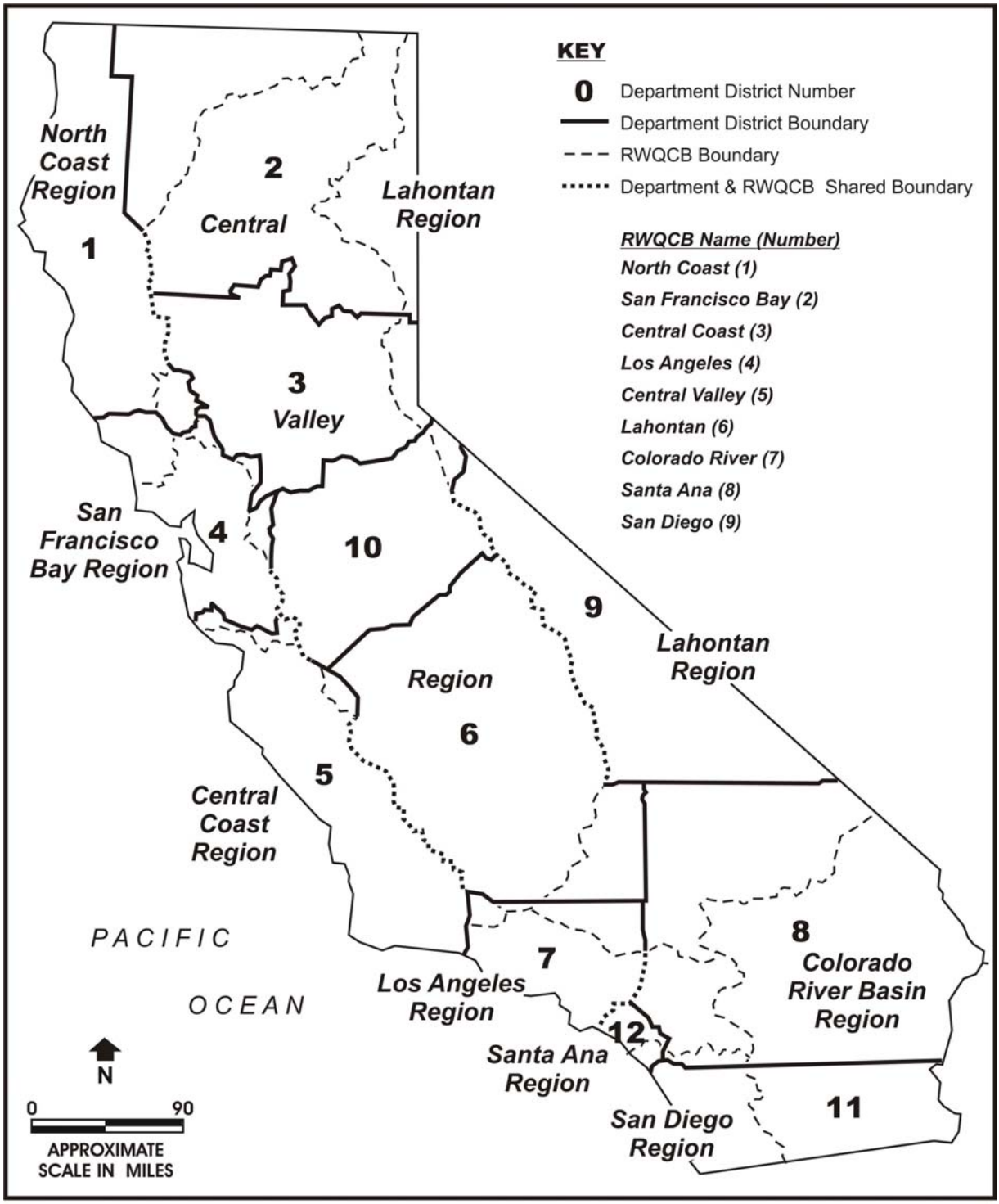
2.3.1 State Water Resources Control Board and Regional Water Quality Control Boards

The State Water Resources Control Board's (SWRCB's) mission is to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations. The **California Water Code** divides the state of California into nine RWQCBs, based on major drainage areas. Nine RWQCBs, with 12 offices, act to protect water quality within these regions. The nine regional boards and their offices are:

- Region 1- North Coast (Santa Rosa);
- Region 2- San Francisco Bay (Oakland);
- Region 3- Central Coast (San Luis Obispo);
- Region 4- Los Angeles (Los Angeles);
- Region 5- Central Valley (Redding);
- Region 5- Central Valley (Fresno);
- Region 5- Central Valley (Sacramento);
- Region 6- Lahontan (Victorville);
- Region 6- Lahontan (South Lake Tahoe);
- Region 7- Colorado River (Palm Desert);
- Region 8- Santa Ana River (Riverside); and
- Region 9- San Diego (San Diego).

Figure 2-1 is a map showing the RWQCB jurisdictions.

Figure 2-1: Map Of California With RWQCB And District Boundaries



In protecting water quality, each RWQCB:

- Adopts a region-specific Water Quality Control Plan or Basin Plan that contains water quality standards specific to the region's waters;
- Issues waste discharge requirements (WDRs) and water quality monitoring and reporting programs that implement the SWRCB's statewide policy and regulations along with the region-specific water quality standards specified in its Basin Plan; and
- Implements enforceable orders against violations of statewide and region-specific requirements.

2.3.2 Resources for Identifying Water Quality Requirements

Proper selection and design of BMPs requires an understanding of the applicable water quality requirements. Designers should coordinate with the District/Regional NPDES Storm Water Coordinators to ensure that all relevant water quality requirements are identified. Water quality requirements come from a variety of sources, including:

- RWQCB Basin Plans;
- TMDLs and 303(d) lists; and
- Standard Urban Storm Water Mitigation Plans (SUSMPs).

The following sub-sections provide a brief description of these sources of water quality requirements. While the designer normally obtains this information from the District/Regional NPDES Storm Water Coordinator, designers should be aware that Basin Plans, TMDLs, and SUSMPs can change over time and that it may be necessary to reconfirm the water quality requirements at different stages in the design process.

2.3.2.1 Regional Water Quality Control Board Basin Plans

Each RWQCB has developed a Basin Plan to identify designated beneficial uses and water quality objectives for their jurisdictional regions. The Basin Plans are available on line by accessing the SWRCB web site at www.swrcb.ca.gov and selecting the link for the appropriate RWQCB. Each individual RWQCB web page includes a link to access the corresponding Basin Plan.

A comprehensive database of all of the beneficial uses, water quality objectives and monitoring information can also be accessed using the **Water Quality Planning Tool** available at www.stormwater.water-programs.com.

2.3.2.2 Total Maximum Daily Loads and 303(d) Lists

Section 303(d) of the 1972 Federal Water Pollution Control Act requires priority rankings for water bodies for which the beneficial uses are listed as impaired by pollution, and also requires the establishment of TMDLs to protect water quality of these impaired water bodies from specific pollutants. In response to this requirement, the U.S. Environmental Protection Agency

(EPA) has developed a 303(d) list for each state that identifies specific pollutants causing impairment of specific receiving waters. A water quality planning tool, including 303(d) list information, has been developed for Caltrans and is available at www.stormwater.water-programs.com. Projects discharging to receiving waters with TMDLs may have to comply with additional discharge criteria. Response to TMDL criteria should be coordinated with the District/Regional NPDES Storm Water Coordinator.

2.3.2.3 Standard Urban Storm Water Mitigation Plans

Projects in urban areas may be subject to additional water quality requirements or additional BMP requirements if there is an applicable SUSMP. These plans contain special local requirements and are currently applicable in Los Angeles and Ventura counties; however, other urban areas may develop SUSMPs in the future.

2.3.3 Storm Water Documents

The Storm Water Quality Assessment (SWQA) and the Storm Water Data Report (SWDR) are the two project-specific Storm Water Documents prepared by a District. The District Environmental Branch prepares the SWQA, while the Project Engineer (PE) prepares the SWDR. These documents are prepared concurrently, and require extensive coordination between the PE, the Environmental staff person preparing the SWQA, and the District/Regional NPDES Storm Water Coordinator.

A Storm Water Quality Assessment (SWQA) will identify applicable storm water regulations and storm water impacts to be mitigated. The SWQA also identifies the receiving water, evaluates the existing surface water quality, identifies potential project-related storm water discharges, and evaluates the potential project-related storm water impacts on the receiving water quality. The SWQA is typically prepared by the Environmental Unit as support documentation during the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) environmental review phase of a project. For detailed information regarding the preparation of the SWQA, refer to the SWQA Guidance Document, Volume 5 of the Caltrans Standard Environmental Reference (web site http://www.dot.ca.gov/ser). In the absence of an SWQA, the designer will need to obtain individual water quality requirements from the District/Regional NPDES Storm Water Coordinator.

The SWDR is a form of documentation that enables the PE to provide key project information to environmental personnel responsible for preparing the SWQA, and also responsible for assessing water quality impacts as a result of the proposed project. The preliminary information in the SWDR prepared during the PID phase will be reviewed, updated, and confirmed by environmental personnel, and in turn, be provided to designers to revise the SWDR during the PA/ED phase. The information contained in the SWDR and the SWQA may be used to make more informed decisions regarding the selection of BMPs.

2.3.4 Types of Pollutants

Selection of BMPs requires an understanding of the types of pollutants that the BMPs are designed to remove. Brief descriptions of commonly encountered pollutants are provided in the

following sub-sections. Table 2-2 provides a list of theses pollutants and the types of Treatment BMPs that can be used to reduce the discharge of these pollutants.

Table 2-2: Pollutants of Concern and Applicable Treatment BMPs

	Biofiltration Systems	Infiltration Basin	Detention Devices	Dry Weather Flow Diversions[1]	Gross Solids Removal Devices	Traction Sand Traps
Total Suspended Solids	✓	✓	✓	✓		✓
Nutrients		✓		✓		
Pesticides		✓		✓		
Particulate Metals	✓	✓	✓	✓		
Dissolved Metals		✓		✓		
Pathogens		✓		✓		
Litter	✓	✓	✓	✓	✓	
Biochemical Oxygen Demand		✓		✓		
Total Dissolved Solids		✓		✓		

[1] Dry Weather Flow Diversions address nonstorm water flows only.

2.3.4.1 Total Suspended Solids

Solids can be present in the water column in a dissolved phase (Total Dissolved Solids [TDS]) or a suspended phase (Total Suspended Solids [TSS]). In general, suspended solids are considered a pollutant when they significantly exceed natural concentrations and have a detrimental effect on the beneficial uses designated for the receiving water.

Possible sources of TSS from Caltrans facilities include natural erosion, runoff from construction sites, and other operations where the surface of the ground is disturbed. In addition, increased runoff from new impervious surfaces can accelerate the process of channel erosion, which in turn can increase TSS (and TDS) in runoff.

2.3.4.2 Nutrients

Excessive inputs of nutrients such as phosphorus and nitrogen to receiving waters can over-stimulate the growth of aquatic plants to the detriment of other aquatic life and to some beneficial uses of the receiving water. Nutrients generally have more adverse effects in water bodies with slow flushing rates, such as slow moving streams and lakes. Also, nutrients attached to suspended solids in storm water runoff can cause problems where they settle out downstream.

Sources of phosphorus that may be present in highway runoff include tree leaves, surfactants and emulsifiers, and natural sources such as the mineralized organic matter in soils. Phosphorus may be present in storm water discharges as dissolved or particulate orthophosphate, polyphosphate, or organic phosphorous.

Potential sources of nitrogen in highway runoff include atmospheric fallout, nitrite discharges from automobile exhausts, fertilizer runoff, and natural sources such as mineralized soil organic matter. Nitrogen may be present in storm water discharges as nitrate, nitrite, ammonia/ammonium, or organic nitrogen.

2.3.4.3 Pesticides

A pesticide is a chemical agent designed to control pest organisms. The most common forms of pesticides are organic chemicals designed to target insects (insecticides) or vascular plants (herbicides). Pesticides have been repeatedly detected in surface waters and precipitation in the United States. Water is one of the primary media in which pesticides are transported from targeted applications to other parts of the environment. As the use of pesticides has increased, concerns about the potential adverse effects of pesticides on the environment and human health have also increased.

2.3.4.4 Metals (Particulate and Dissolved)

Metals in storm water runoff may be in a dissolved phase or a particulate form adsorbed to suspended solids. Some Treatment BMPs are effective for removing specific particulate metals, but not for removing dissolved metals. If there are special requirements to remove dissolved metals (e.g., to address a TMDL or other site-specific requirement), then the designer should contact the District/Regional NPDES Storm Water Coordinator to identify the appropriate BMP requirements. Metals in the particulate phase may be removed through sedimentation or biofiltration.

Possible sources of metals in highway runoff include the combustion products from fossil fuels, the wearing of brake pads, and the corrosion of metals, paints and solder. Metals can also reach receiving waters through the natural weathering of rock and soil erosion.

2.3.4.5 Pathogens

Pathogenic microorganisms including viruses, bacteria, protozoa, and helminth worms are of concern in storm water runoff. The direct measurement of specific pathogens in water is extremely difficult. For that reason, the coliform group of organisms is commonly used as an indicator of the potential presence of pathogens of fecal origin.

Sources of total and fecal coliforms in storm water runoff are ubiquitous (e.g., soil particles, droppings of wild and domestic animals, etc.). Human sources could include illicit sewer connections and seepage from septic tanks.

2.3.4.6 Litter

Litter in storm water is defined as manufactured objects made from paper, plastic, cardboard, glass, metal, etc. This definition does not include materials of natural origin such as gravel or vegetation. Litter is quantified by 24-hour air-dried volume and weight measurements. Litter within storm water is considered to be a significant problem in the municipal areas of Southern California as evidenced by the current listing of 38 water bodies as impaired due to trash on the

EPA 303(d) list. Litter in surface waters can inhibit the growth of aquatic vegetation, harm aquatic organisms by ingestion or entanglement, convey other pollutants, such as toxic substances, and cause aesthetic problems on shorelines.

2.3.4.7 Biochemical Oxygen Demand

The Biochemical Oxygen Demand (BOD) is a measure of quantity of oxygen required to biologically stabilize the organic matter present in a pollutant. Biochemical oxidation is a slow process, and theoretically takes an infinite time to reach 100% completion. Therefore, a 5-day BOD (BOD_5) test, wherein the oxidation reaches about 60 to 70% completion, is commonly used for practical purposes. The BOD_5 test measures the rate of oxygen required by microorganisms (i.e., a laboratory inoculation) to oxidize the biodegradable matter in a sample under controlled laboratory test conditions. High BOD values (usually the result of organic contamination) suggest that the dissolved oxygen levels in receiving water may be depleted.

2.3.4.8 Total Dissolved Solids

The TDS in water consist of inorganic and organic molecules and ions that are in solution. Elevated levels of dissolved solids can deleteriously affect surface water quality in a number of ways, most often because of the increased concentration (and perhaps increased number) of constituents that may be toxic to aquatic organisms.

2.4 BEST MANAGEMENT PRACTICES

BMPs are technology-based requirements in the federal storm water regulations that call for the implementation of controls to reduce the discharge of pollutants to the Maximum Extent Practicable (MEP) in municipal-type storm water systems. Caltrans drainage facilities are considered a municipal separate storm sewer system under the Caltrans permit and are, therefore, held to the MEP requirement. For construction projects that disturb areas of 2 hectares (5 acres) or more, the technology-based requirements include the use of Best Conventional Technology (BCT) and Best Available Technology (BAT).

As used in this document, the term BMP refers to operational activities or physical controls that are applied to reduce the discharge of pollutants and minimize potential impacts upon receiving waters. Accordingly, the term BMP refers to both structural and nonstructural controls that have direct effects on the release, transport or discharge of pollutants.

Four categories of BMPs (Design Pollution Prevention, Treatment, Construction Site, and Maintenance) are described in Table 2-3. Design Pollution Prevention BMPs, Treatment BMPs and Construction Site BMPs are discussed in further detail in Sections 2.4.1 through 2.4.3 of this document.

Table 2-3: BMP Descriptions

BMP	Description
Design Pollution Prevention BMPs	Preservation of existing vegetation, concentrated flow conveyance, slope/surface protection, etc.
Treatment BMPs	Permanent treatment devices and facilities.
Construction Site BMPs	Temporary soil stabilization and sediment control, non-storm water management, and waste management. Refer to the Construction Site BMP Manual.
Maintenance BMPs	Litter pickup, waste management, street sweeping, etc.

Designers should consider BMPs throughout the development of their project. Design Pollution Prevention and Treatment BMPs should be selected and designed to minimize life-cycle maintenance costs and resources. Adequate site access and maximum worker safety should be considered for maintenance of Design Pollution Prevention and Treatment BMPs. Construction Site BMPs should be considered when estimating the cost of a project so that adequate cost is projected and enough funding is allocated. Maintenance BMPs are related to typical maintenance activities and equipment, but are not otherwise discussed within this document. In addition to the above BMP categories, the designer must also be aware of, and address, non-storm water discharges associated with a project, such as pumping stations, tunnel washing, etc. The designer should coordinate with the District/Regional NPDES Storm Water Coordinator.

2.4.1 Design Pollution Prevention BMPs

Design Pollution Prevention BMPs are permanent measures to improve storm water quality (e.g., reduce erosion, manage non-storm water discharges, etc.) after construction is completed. The Design Pollution Prevention BMPs that are to be incorporated, as appropriate, into the design of new facilities and reconstruction or expansion of existing facilities are listed in Table 2-4. Design guidelines for Design Pollution Prevention BMPs are included in Appendix A.

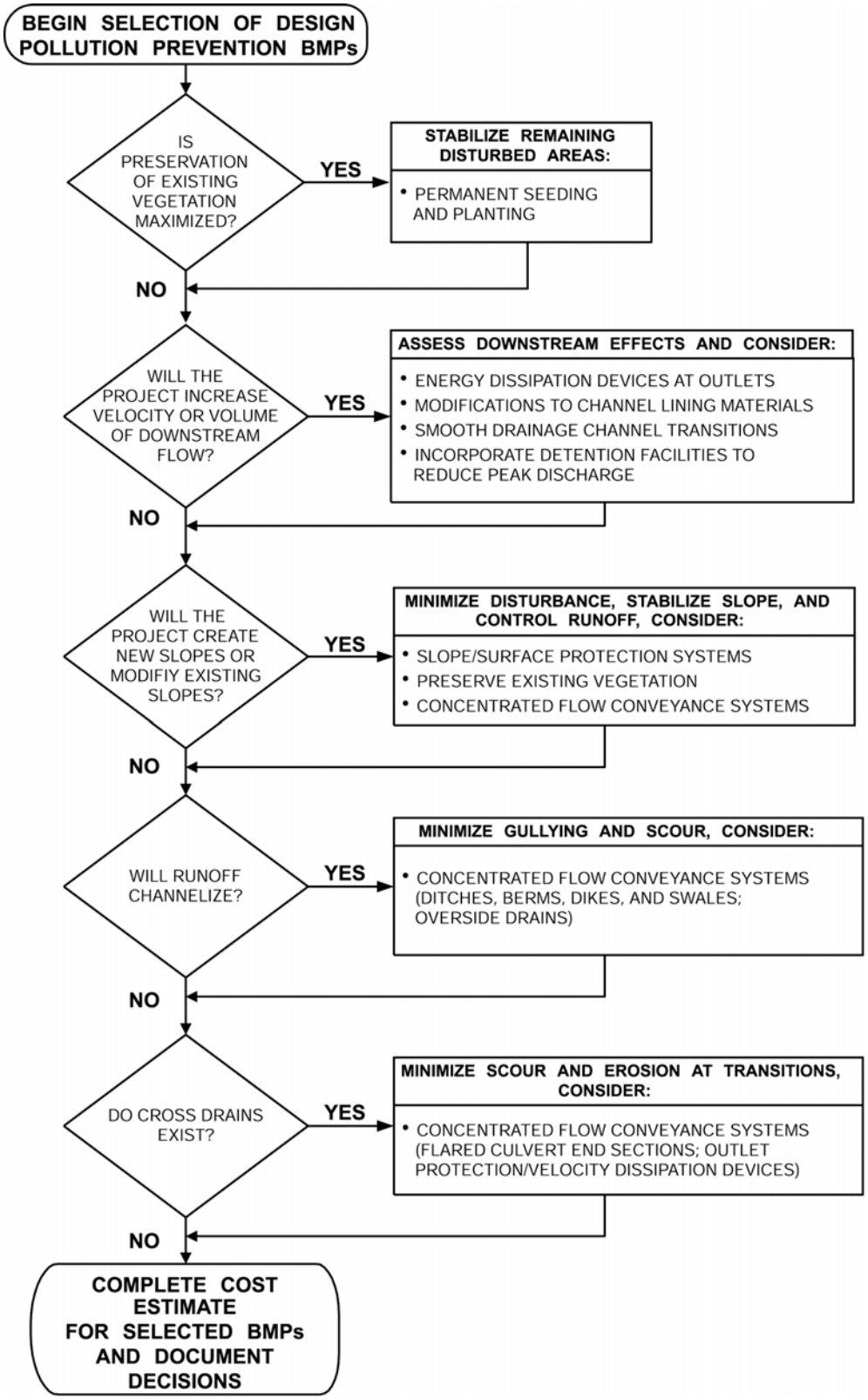
Table 2-4: Design Pollution Prevention BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow
Preservation of Existing Vegetation
Concentrated Flow Conveyance Systems
Ditches, Berms, Dikes and Swales
Overside Drains
Flared Culvert End Sections
Outlet Protection/Velocity Dissipation Devices
Slope/Surface Protection Systems
Vegetated Surfaces
Hard Surfaces

For all Caltrans projects, Caltrans will maximize vegetation-covered soil areas of a project.

A flow chart illustrating the Design Pollution Prevention BMP selection process for projects is shown in Figure 2-2.

Figure 2-2: Decision Process For Selecting Design Pollution Prevention BMPs



2.4.2 Treatment Best Management Practices

The Treatment BMPs listed in Table 2-5 will be considered for projects discharging directly or indirectly to receiving waters. These BMPs have been approved for statewide use and will be considered in all proposed new construction and major reconstruction projects. Appendix B provides design guidelines for the approved Treatment BMPs. Appendix E includes an Exemption Documentation Form for Treatment BMPs that designers are to use to determine if a project is exempt from incorporating Treatment BMPs (see discussion of exemption process in Section 4).

Table 2-5: Approved Treatment BMPS

Biofiltration: Strips/Swales
Infiltration Basins
Detention Devices
Traction Sand Traps
Dry Weather Flow Diversion
Gross Solids Removal Devices (GSRDs)

A flowchart illustrating the Treatment BMP selection process for non-exempt projects is shown in Figure 2-3. Designers are encouraged to consider combining approved BMPs (e.g., overflow from a detention basin may be discharged to a bioswale or an infiltration basin could be preceded by a traction sand trap).

Biofiltration strips and swales are to be implemented at all sites to the extent practicable and to the extent that implementation is consistent with existing Caltrans policies. In practice, this means maximizing the use of vegetation in the right-of-way wherever site conditions and climate allow vegetation to establish and where flow velocities are not high enough to cause scour.

Infiltration basins should be considered wherever site conditions allow and the design water quality volume exceeds 123 cubic meters (0.1 acre-foot). If infiltration basins are found to be feasible, funds for deployment should be requested from the funding authority. Additional right-of-way may be acquired for infiltration basins, but not for other Treatment BMPs. If infiltration is not feasible at a site, then detention devices should be evaluated.

Detention basins also require a design water quality volume of at least 123 cubic meters (0.1 acre-foot) to be considered feasible.

Traction sand traps should be considered at sites where traction sand or other traction-enhancing substances are commonly applied (at least once or twice a year) to the roadway.

Dry weather flow diversions to treat non-storm water flow may be feasible. They should only be considered if dry weather flow from Caltrans activities is persistent, or the result of an ongoing Caltrans activity. Additionally, dry weather diversions should only be considered if connection to a nearby sanitary sewer would not involve excessive measures to implement, and provided the local health department and the sanitary sewer authority are willing to allow the Department to connect to a nearby sanitary sewer.

The Gross Solids Removal Devices (GSRDs) should be considered for areas where receiving waters are on the 303(d) list for trash or areas where TMDLs that require trash removal have been adopted.

If no Treatment BMPs are feasible for a project that is not exempt, then the designer shall document the reasons in a technical report submitted to the RWQCB. This technical report must be submitted at a minimum of 180 days prior to the start of construction.

2.4.2.1 Site-Specific Determination of Feasibility

General criteria used during the evaluation of Treatment BMPs include relative effectiveness, technical feasibility, costs and benefits, and legal and institutional constraints.

Relative Effectiveness: A recommended BMP should generally demonstrate equal or greater pollution control benefits than a design without any BMP. Effectiveness may be assessed in terms of specific pollutants of concern (e.g., particulate metals, litter, etc.) or groups of pollutants. If there are no existing pollution or water quality control measures currently being implemented, then the recommended BMP will be expected to improve the effectiveness.

Technical Feasibility: A recommended BMP must be technically feasible. Caltrans must be able to implement the BMP within the context of the state highway system. Feasibility also includes health and safety concerns. BMPs that substantially increase the risk to Caltrans workers or the public will be considered not feasible.

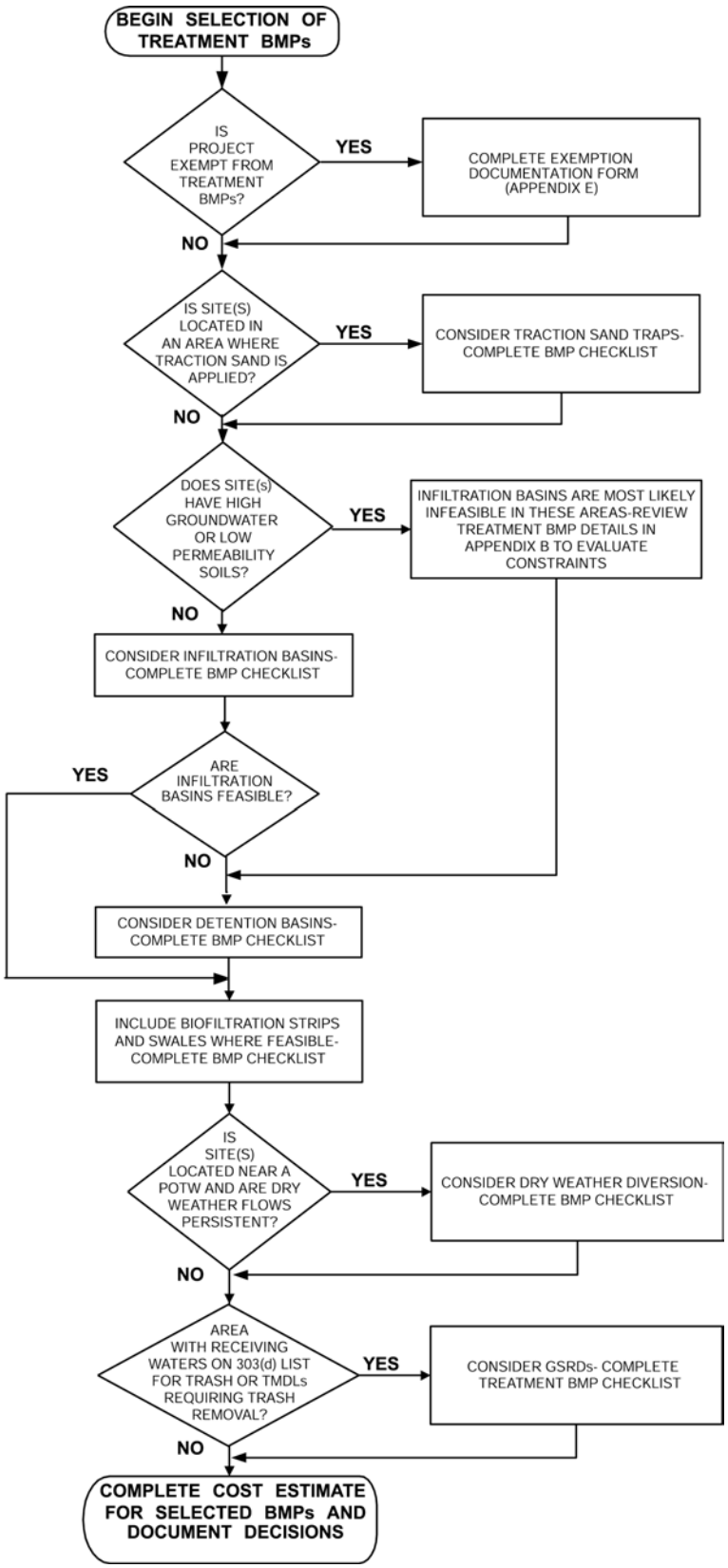
Costs and Benefits: The pollution control benefits must have a reasonable relationship to the costs. The costs and benefits analysis will consider the impacts to the receiving waters that are being reduced or eliminated through implementing the BMP.

Legal and Institutional Constraints: The recommended BMP cannot compromise Caltrans compliance with other laws. For example, Caltrans must provide drainage under roadways at regular intervals to prevent water from accumulating upgradient and threatening the integrity of the roadbed and to limit encroachment of captured water on the traveled way. Caltrans cannot legally block historic drainage patterns or systems (e.g., runoff from farmland).

Feasibility Assessment: The first step in assessing the feasibility of incorporating a potential BMP into a project is to gather the data needed to both determine the size and to estimate the cost of that specific BMP. In addition, it should be determined whether the site characteristics, particularly the soil characteristics, are appropriate (checklists are provided in Appendix E for this purpose).

The second step is to determine the Water Quality Volume (WQV) that must be treated. (See Section 2.4.2.2 for guidance.)

Figure 2-3: Decision Process For Selecting Treatment BMPs At Specific Sites



Next, for all BMPs except GSRDs and traction sand traps, calculate the size of the proposed BMP needed to treat the water quality volume (or flow). Use the procedures defined in Appendix B under Infiltration Basins and Detention Basins to evaluate the appropriate BMP, giving proper consideration to recovery zones, setbacks from structures, hydraulic head, and maintenance access roads and ramps. In very small drainage areas, it may be impractical to construct a BMP to treat the resulting small WQV (or flow). For projects where the WQV for a specific BMP is less than 123 cubic meters (m^3) (0.1 acre-foot), infiltration basins and detention basins are not cost effective, and should not be considered further.

Traction sand traps should be considered at sites where traction sand or other traction-enhancing substances are commonly applied (at least once or twice a year) to the roadway. Where traction sand traps are considered, they should be sized according to the procedure defined in Appendix B, Section B.5.

For GSRDs, the design process is different – the units are sized to convey the design peak flow while holding one year's worth of gross solids. Unless regional or site-specific data are available, the design gross solids loading should be 0.7 m^3/hectare/year (10 ft^3/acre/year). Appendix B provides more specific GSRD design information.

Sites requiring extraordinary plumbing to collect and treat runoff (e.g., jacking operations under a highway, bridge deck collection systems, etc.) are considered infeasible due to their associated costs and need not be considered. Sites requiring extraordinary features or construction practices, such as retaining walls and shoring, may also be infeasible due to their associated costs relative to the cost of the BMP itself. Extraordinary plumbing, features, or construction practices should be brought to the attention of the District/Regional NPDES Storm Water Coordinator for consideration on a project-by-project basis.

If a BMP is too large to fit at a site, it is considered infeasible. Caltrans and the RWQCB may, in some cases, agree to install a BMP that is smaller than what normal sizing procedures would dictate. Purchasing additional land for BMPs is generally not fiscally feasible. However, purchasing additional land to site infiltration basins can be considered, because of the high water quality benefits gained through the use of infiltration basins for storm water treatment. Even in this case, only the purchase of undeveloped land can be fiscally justified. Where land is needed for placement of an infiltration basin, purchasing low intensity developed land (such as storage yards or parking lots) can be considered. Again, these are issues to be brought to the attention of the District/Regional NPDES Storm Water Coordinator so that decisions can be made on a project-by-project basis.

2.4.2.2 Treatment BMP Use and Placement Considerations

Several factors must be considered to determine which BMPs are suitable for a given application. Site-specific conditions can affect operations, maintenance, construction costs, safety and aesthetics. The designer must determine if sufficient right-of-way is available for the desired BMP, or if the benefits associated with a potential BMP justify the consideration of acquiring additional right-of-way.

The physical dimensions of a BMP may have an important bearing on the factors identified in this section. The size of many BMPs is determined by the amount of runoff the system will be required to treat. The amount of runoff is affected by the location, land use, drainage area, storm intensity, topography, soil characteristics and the extent of impervious areas. For the design of infiltration or detention basins, the District's hydraulics staff should be consulted.

Both storm volume and peak flow conditions must be considered in the evaluation of runoff conditions. The "Design Storm" is the particular event that generates runoff rates or volumes that the drainage facilities are designed to handle. Unlike flood control measures that are typically designed to store or convey the peak volumes or flows of infrequent storm events, Treatment BMPs are designed to treat the lower volume or flow of more frequent storm events. The volume or flows associated with the frequent events are commonly referred to as the WQV for BMPs designed based on volume, and Water Quality Flow (WQF) for BMPs designed based on flow. Treatment BMPs are sized to accommodate the WQF or WQV from the contributing drainage area. Flows in excess of these values are diverted around or through the treatment BMP. Methods for determining the WQV are generally tied to an analysis of rainfall depths generated over 24-hour periods.

The WQV of Treatment BMPs is based on using any one of the following methods:

- Where they are established, sizing criteria from the RWQCB or local agency (whichever is more stringent) will be used; and
- Where the RWQCB or local agency does not have an established sizing criterion, Caltrans will use one of the following methods:
  - Option 1: The maximized detention volume determined by the 85th percentile runoff capture ratio. This method is described in Chapter 5 of the *Urban Runoff Management WEF Manual of Practice No. 23,* 1998, published jointly by the Water Environment Federation (WEF) and the American Society of Civil Engineers (ASCE). Designers should note, however, that the information presented in the WEF manual cannot be directly applied to Caltrans facilities because it is based on large watersheds and oversimplified hydrologic data for California. This method requires the designer to assume a drawdown time. Any drawdown time between 24 and 72 hours can be used (the 24-hour limit provides adequate settling and the 72-hour maximum addresses vector concerns). A design tool (Basin Sizer) that uses data from more than 700 California rainfall stations, has been created for Caltrans use. It is available at http://stormwater.water-programs.com. A detailed description of the method can also be found in: Guo, C.Y., and B.R. Urbonas (1996), "Maximized Detention Volume Determined by Runoff Capture Ratio," *Journal of Water Resources Planning and Management,* v. 122, n. 1, pp. 33-39.
  - Option 2: The volume of annual runoff based on unit basin storage WQV to achieve 80 percent or more volume of treatment based on the sizing methods provided in the *California Storm Water Municipal Best Management Practice Handbooks,* published by the California Storm Water Quality Task Force, March 1993. This method requires the assumption of a 40-hour drawdown time. A design tool has been created for Caltrans use. It is available at http://stormwater.water-programs.com.

Alternatively, a WQV may be established by Caltrans subject to the review and approval of the RWQCB if one of the following situations applies:

- The site area is limited and cannot accommodate a Treatment BMP sized according to the methods described in Options 1 or 2; or
- Sizing a Treatment BMP using Options 1 or 2 in areas of the State with significant annual precipitation results in excessively large treatment units.

The WQF is the primary design criteria used for various types of filtration treatment control devices under development. Caltrans, the SWRCB and the nine RWQCBs worked cooperatively to establish these values.

The following WQFs negotiated with the SWRCB and RWQCBs should be used as the basis for designing the approved filtration-type treatment BMPs. Where there are special circumstances or conditions, the PE, the District/Regional NPDES Storm Water Coordinator and the related RWQCB should discuss the potential need for modification of the criteria on a case-by-case basis.

In addition to designing for the WQF, the designer must also insure that the filtration treatment device includes a bypass or an overflow device to convey peak discharges from larger design storms consistent with Section 861.3 of the Highway Design Manual.

The listed values of rainfall intensity would be used in the Rational Formula (Q=CiA) to estimate runoff from areas that would discharge flow to the filtration treatment device. The resulting runoff rate would be the design WQF to be used at any specific site.

1. Region 1 (North Coast) – 0.56 centimeters/hour (cm/hr) (0.22 inches/hour ["/hr]) for Siskiyou and Modoc Counties, 0.69 cm/hr (0.27 "/hr) for Trinity and Mendocino Counties and 0.91 cm/hr (0.36 "/hr) for Del Norte, Humboldt and Sonoma Counties.
2. Region 2 (San Francisco) – 0.51 cm/hr (0.20 "/hr) regionwide.
3. Region 3 (Central Coast) – 0.56 cm/hr (0.22 "/hr) for Santa Cruz County, 0.51 cm/hr (0.20 "/hr) for Santa Clara County, 0.46 cm/hr (0.18 "/hr) for San Benito, Monterey and San Luis Obispo Counties and 0.66 cm/hr (0.26 "/hr) for Santa Barbara County.
4. Region 4 (Los Angeles) – 0.51 cm/hr (0.20 "/hr) regionwide.
5. Region 5 (Central Valley) – 0.41 cm/hr (0.16 "/hr) for portions of Lassen and Modoc Counties within the Region, all areas of Region below 305 meters (m) (1,000') elevation north of and including Sacramento and Amador Counties and below 610 m (2,000') elevation south of Sacramento and Amador Counties, and all elevations on the west side of the Region (rain shadow side of the Coast Range). 0.51 cm/hr (0.20 "/hr) for elevations in the Sierra Nevadas between 305 m (1,000') and 1,219 m (4,000') in the north and between 610 m (2,000') and 1,219 m (4,000') in the south. 0.61 cm/hr (0.24 "/hr) for all elevations above 1,219 m (4,000') in the Sierra Nevadas.

6. Region 6 (Lahontan) –

   a) Where there are location-specific requirements (Truckee River, East and West Forks Carson River, Mammoth Creek, and Lake Tahoe), the WQF will conform to the Basin Plan requirement for runoff from impervious areas. Where runoff from pervious areas contributes to the flow to the treatment device, the WQF value to be used will be as specified in the following two items.

   b) Other than as stated in item a), above, the WQF to be used for that portion of the Lahontan Region including Inyo County and areas southward will be 0.41 cm/hr (0.16 "/hr). The WQF to be used for pervious surface areas within the Mammoth Creek watershed above 2,133 m (7,000) feet will be 0.41 cm/hr (0.16 "/hr).

   c) For all other areas of the Lahontan Region other than as indicated in item a) above, the WQF to be used will be 0.51 cm/hr (0.20 "/hr.) This includes pervious surface areas of the Truckee River, Carson River East and West Forks and Lake Tahoe Hydrologic units.

7. Region 7 (Colorado River) – 0.41 cm/hr (0.16 "/hr) regionwide.
8. Region 8 (Santa Ana River) –0.51 cm/hr (0.20 "/hr) regionwide.
9. Region 9 (San Diego) – 0.51 cm/hr (0.20 "/hr) regionwide.

2.4.3 Construction Site Best Management Practices

Construction Site BMPs are deployed during construction activities to reduce pollutants in storm water discharges. Table C-1 in Appendix C is a matrix of approved Construction Site BMPs. Additional information on design, placement, and applicability of Construction Site BMPs can also be found in Appendix C of this document, the Construction Site BMP manual, and Section 4 of the Guidelines.

2.4.4 Maintenance Best Management Practices

The Department currently stencils messages at storm drain inlets located at highway facilities such as park and ride lots, rest areas and vista points to assist in educating the public about storm water runoff pollution. Additionally, all new inlets located within cities, towns, and communities with populations of 10,000 or more, or within designated MS4 areas, shall be stenciled when constructed. Design Engineers should contact the District Maintenance Storm Water Coordinator to identify stencil types, specifications and details for projects falling within these areas.

3.1 INTRODUCTION

The Caltrans design staff responsibilities regarding implementation of the storm water management program are described in the following sections. All Caltrans Districts have developed responsibility matrices to identify staff and divisional responsibility for duties assigned under the Storm Water Management Plan (SWMP).

The Caltrans Project Delivery Storm Water Management Program includes the Design Division, the Construction Division, and their associated functional units. Project Delivery Program provides guidance and direction to the District Design and Construction Divisions.

3.2 MANAGEMENT

The role of the Design Storm Water Management Program includes:

- **Coordination:** In coordination with the Water Quality Program, the Design Storm Water Management Program provides general guidance to the Districts on the implementation of water quality management practices;
- **Program Evaluation:** The Design Storm Water Management Program assesses District incorporation of storm water quality management features into facility designs;
- **Reporting:** The Design Storm Water Management Program assists the Water Quality Program in the preparation of the Annual Report to the State Water Resources Control Board (SWRCB), as it relates to Design activities.

The Design Program Manager is responsible for statewide implementation policies and procedures and the personnel of the Design program. This includes the responsibility for ensuring compliance with all elements of the SWMP that are required to be implemented by the Design Division.

3.3 STORM WATER ADVISORY TEAMS

Caltrans design staff provide valuable input and consultation to the Storm Water Advisory Teams (SWATs) as follows:

- The Project Design Storm Water Advisory Team (PDSWAT) is composed of District representatives from Design, Construction, and related functional units and representatives from the Headquarters (HQ) Project Development, Water Quality, and Maintenance Programs;
- The Water Quality Storm Water Advisory Team (WQSWAT) is composed of the District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinators; District representatives from Design, Construction, and Maintenance; and representatives from the HQ Project Development, Maintenance, and Water Quality Programs;

- The Maintenance Storm Water Advisory Team (MSWAT) is composed of District Maintenance Storm Water Coordinators and representatives from the Headquarters Maintenance, Water Quality and Project Delivery Programs. The MSWAT addresses the implementation of selected Best Management Practices (BMPs) for maintenance activities. These BMPs are categorized for the following maintenance activities: flexible pavement; rigid payment; slopes, drainage, and vegetation; litter, debris and graffiti; landscaping; bridges; other structures; electrical; traffic guidance; and snow and ice control. The MSWAT selects BMPs to minimize potential storm water pollution from accidental spills, illicit connections, and illegal discharges and dumping; and
- The Construction Storm Water Advisory Team (CSWAT) is composed of District Construction Storm Water Coordinators and representatives from the Construction Program.

3.4 STORM WATER COORDINATORS

All Districts/Regions have designated NPDES Storm Water Coordinators. Other functional unit Storm Water Coordinators exist in the Planning, Design, Construction and Maintenance Divisions. The District/Regional NPDES Storm Water Coordinators serve as liaisons with the Water Quality Program. Liaison activities also include regular communications with representatives of the Regional Water Quality Control Board (RWQCB).

3.5 RESPONSIBILITIES AS THEY RELATE TO ENCROACHMENT PERMITS AND THIRD-PARTY ACTIVITIES

Districts control third-party activities on Caltrans rights-of-way (e.g., utility construction) through the conditions associated with encroachment permits. These conditions require compliance with Caltrans standard plans and specifications. Encroachment permits require environmental compliance, including implementation of BMPs comparable to those required of Caltrans. For larger encroachments, project design is overseen by District Design and construction activities by District Construction. Smaller projects are managed by the Encroachment Permit Unit.

3.6 RESPONSIBILITIES FOR COORDINATION WITH MUNICIPAL STORM WATER PERMITTEES (LOCAL AGENCIES)

Coordination with Municipal Separate Storm Sewer System (MS4) permit holders and other municipalities (cities and counties) must take place whenever a proposed project would result in storm water discharges from the Department's storm water drainage systems to storm water drainage systems owned and operated by the MS4 or municipality, and vice versa. This coordination includes attending meetings, participating in special studies, identifying storm water run-on issues, etc. The Project Engineer (PE) should consult with the District/Regional NPDES Storm Water Coordinator to identify any MS4 permit requirements that may affect the project.

3.7 CONSULTATION WITH REGIONAL WATER QUALITY CONTROL BOARDS AND LOCAL REGULATORY AGENCIES

Consultation with the RWQCBs and local regulatory agencies is strongly recommended to coordinate project issues and develop consensus. The number of coordination meetings may vary depending upon the complexity of the storm water quality issues, storm water pollutants involved, and project site constraints. The District/Regional NPDES Storm Water Coordinator is the point of contact between the RWQCB and the Districts.

3.8 STAFF AND FUNCTIONAL UNITS

3.8.1 Staff

Project Manager

Typically, the Project Manager (PM) is responsible for all project development phases from project initiation to closeout of the construction contract. The PM has full authority, delegated from the District Division Chief for Program and Project Management, to produce the results that were intended, meet schedules, stay within budget and keep the sponsors and customers satisfied. The PM retains these responsibilities over the entire life of the project.

During project initiation, the PM identifies the needs and expectations of the project sponsors, including the need for permanent storm water BMPs. The PM also leads the Project Development Team (PDT) in the development of a "Project Work Plan" that defines the project scope, schedule, cost, and resource needs. Finally, the PM ensures that the Project Work Plan includes all the work required. Resources are assigned to a project based upon the Project Work Plan developed by the PM and the PDT.

During the design phase of a project, the PM monitors project performance and resolves problems that affect project scope, cost or schedule. This includes the BMP evaluation and selection process for incorporation into the project. The PM coordinates the efforts of the overall team, and typically chairs the PDT meetings. During the entire process, the PM controls the project budget (both support and capital).

Project Engineer

The Project Engineer (PE) is responsible for the preparation of a Project Initiation Document (PID) and a Project Report (PR) during the project-planning phase. The PE is also responsible for preparing plans, specifications and estimates (PS&E) documents (otherwise known as contract plans or bid documents) during the design phase. The PE determines whether a Storm Water Pollution Prevention Plan (SWPPP) or a Water Pollution Control Program (WPCP) is required for the construction project. Where the re-use of soils that contain lead is proposed, the PE will ensure that written notification is provided to the RWQCB 30 days prior to advertisement for bids.

The PE incorporates both Design Pollution Prevention and Treatment BMPs into project plans and specifications. The PE may also include specific Construction Site practices (including contaminated soil management BMPs) into the PS&E. In addition, the PE is responsible for

assembling information necessary to assist the Resident Engineer (RE) and contractor in preparing and reviewing the SWPPP/WPCP.

Project Development Team

For most projects, the Department uses a formalized Project Development Team (PDT) that acts as a steering committee in directing the course of studies required to evaluate the various project alternatives during the early phases of the project life cycle. The PDT uses an interdisciplinary approach that draws upon different disciplines in planning, developing, and evaluating alternatives. The PDT advises and assists the PM in directing the course of studies, makes recommendations to the PM and district management, and works to carry out the Project Work Plan. The PDT is responsible for the completion of studies and the accumulation of data throughout project development to PS&E.

The primary functions of the PDT are listed as follows:

- To determine logical project limits;
- To recommend studies, timetables, alternatives, type of environmental documentation, and the feasibility of project impact mitigation measures;
- To ensure thorough analysis of the social, economic, environmental (including visual and aesthetic) and engineering aspects of the project. The PDT calls upon representatives of various disciplines as needed;
- To ensure that state and federal requirements for project development studies have been met;
- To use information in reports (PSR, DPR-DED, etc.) when recommending a preferred alternative to District Management for project approval; and
- To document the project history and decisions.

Functional Managers

Functional Managers supervise the Department functional units that provide technical data and plans to the PE, and schedule and resource data to the PM. Functional Managers are responsible for assigning staff to work on a project, and for ensuring the delivery of product(s) within the schedule agreed upon in the Project Work Plan. Functional Managers also ensure that the products comply with all applicable standards, regulations, and policies.

3.8.2 Functional Units

Design

The District's Design Unit is responsible for the implementation of Caltrans policies, programs, and procedures concerning design of Caltrans facilities. This includes ensuring compliance with all design elements of the Highway Design Manual (HDM), the SWMP, the Project Development Procedures Manual (PDPM), the PPDG and other guidance documents. The Design Unit is responsible for the following water quality related activities:

- Preparation of a Project Initiation Document (PID) and a Project Report (PR) during the project planning phase, including evaluation and selection of potential BMPs that may be incorporated into the project;
- Preparation of plans, specifications and estimates (PS&E) documents during the design phase. This includes the selection and design of Design Pollution Prevention BMPs, Treatment BMPs and critical Construction Site BMPs into the plans and specifications;
- Determining whether an SWPPP or a WPCP is required for the project;
- Ensuring that written notification is provided to the RWQCB 30 days prior to advertisement for bids for projects that include the re-use of soils that contain lead; and
- Ensuring that a Notification of Construction is submitted to the appropriate RWQCB at least 30 days prior to the start of construction for projects that require a SWPPP.

Environmental

The District's Environmental Unit is responsible for the implementation of Caltrans policies, programs, and procedures concerning environmental considerations, analysis, and compliance with environmental laws and regulations under California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) as well as other state and federal regulations. Key responsibilities of the Environmental Unit include the following:

- Define storm water quality issues in coordination with the PE and the District/Regional NPDES Storm Water Coordinator;
- Identify receiving water bodies and their beneficial uses, 303(d) listed water bodies, project-related storm water discharges and quality; and
- Prepare the Preliminary Environmental Assessment Report (PEAR);
- Evaluate potential storm water impacts to the water quality of receiving waters.
- Prepare the Storm Water Quality Assessment (SWQA), when determined necessary from the PEAR;
- Provide input to the PE regarding information to be incorporated into the Storm Water Data Report (SWDR);

This functional unit is known by various names in different Districts, including, but not limited to, Environmental, Environmental Planning, Environmental Analysis, Environmental Technical Studies, Environmental Engineering, Environmental Oversight, and Environmental Reports. A representative from this unit is a required member of the PDT.

Surveys

The District's Surveys Unit is responsible for the implementation of Caltrans policies and procedures concerning surveys and for conducting surveys. The Surveys Unit is a liaison

between the Geometronics Branch of the Office of Engineering Technology in the Engineering Service Center.

Survey needs should be evaluated and identified early in the project initiation process and throughout the entire project development process when needed. After the first evaluation of survey needs, the PE should submit the initial survey request accompanied by a strip map. The extent of the survey will depend on the type of project, existing information available, sensitivity of the area of potential effect, and the number of viable project alternatives. The Right-of-Way Branch and the Environmental Unit require accurate mapping in order to properly carry out their functions, so their needs must be carefully considered when evaluating surveys.

Right-of-Way

The District's Right-of-Way Branch is responsible for the implementation of Caltrans policies, programs and procedures concerning right-of-way and utility considerations and compliance with state and federal laws and regulations. This function consists of various branches in the Districts under a District Division Chief for Right-of-Way, except for the Right-of-Way Engineering Unit which generally reports to another District Division Chief.

Since most transportation projects in California require right-of-way, utility easements, rights of entry, or some other right-of-way activity, the project development process requires close coordination between the PE, the PM, and representatives from the Right-of-Way Engineering Unit and the Right-of-Way Branch to determine schedules and cost estimates, and to assure the acquisition of all necessary property rights.

The Right-of-Way Branch provides valuable information at the initiation of studies. Once the project limits have been tentatively determined, property ownership maps can be developed by the Right-of-Way Engineering Unit. Preliminary right-of-way estimates are required to properly develop and analyze project alternatives. Adequate mapping is required, as well as realistic project scope. A representative of the Right-of-Way Branch is a required member of the PDT.

Materials and Geotechnical

Materials and geotechnical information is required for most projects. The PE uses these data to develop and analyze alternatives and estimate costs for use in project initiation and approval documents, and to prepare estimates, plans and specifications for both new construction and rehabilitation projects. The District Materials Unit is involved throughout the project development process.

If there are critical unanswered concerns such as stability of is, foundation problems, seismic, percolation, availability of materials, etc., preliminary studies should be performed by the District's Materials Unit or coordinated through the District Geotechnical liaison. After the project has been initiated, requests are made of the District's Materials Unit to update materials information and provide other useful information, such as side slope recommendations, slide locations, etc. It is essential that enough materials information is available so that all viable project alternatives are evaluated at all stages of the design process. If a project includes new slopes steeper than 1:2 (v:h), then a Geotechnical Design Report should be prepared. Projects

including slopes between 1:4 and 1:2 (v:h) should be coordinated with the District Geotechnical liaison.

Hydraulics

The District Division of Design is responsible for hydraulic design policies and procedures. The Design unit that performs the project drainage design is responsible for the implementation of these policies and procedures. District organizations differ, but for the purpose of this document, it is assumed that the PE is responsible for ensuring that proper project drainage design is performed. This will typically require the active participation in, or the review of, the design by the Hydraulics Unit.

Detailed drainage design, such as accurate sizing and location of culverts, storm drains, and roadway drainage, does not begin until after selection of the preferred alternative and approval of a project. However, the Hydraulics Unit should be involved during the entire project planning process. Their input in the project initiation process is invaluable, particularly in recommending facility types and estimating costs of large facilities.

The Hydraulics Unit should also be involved in the environmental studies. Early coordination between the two functional groups is important. Many projects, by necessity, will include water quality enhancement features or encroach on wetlands, floodplains, etc. When floodplain encroachment is involved, the Hydraulics Unit should be involved in preparing location hydraulic studies. Historical drainage maps often depict the extent of the encroachment and help determine which project alternatives should be considered. Documentation of these features must be included in the Draft Project Report (DPR).

Construction

The Construction Unit is responsible for administering a construction contract for the construction of a project by a contractor to ensure that the final product is in accordance with the plans and specifications, and to deal with any problems that arise in the process. The Construction Unit should review the project and BMP alternatives to determine if they are biddable and buildable. During environmental and project studies, the Construction Unit should be involved in the determination of measures to reduce or mitigate construction impacts.

During the design stage, the Construction Unit should review the project plans and specifications for such things as construction safety, logical staging, an analysis of the number of working days, supplemental funds, and special provisions usability.

Prior to start of construction, the PE, along with other involved District units, will go over the project with the RE. The review at this stage will aid in clearing up reasons for design decisions and commitments such as; right-of-way obligations, signing and traffic handling, materials sites, selected material, foundation treatment, potential slides, environmental commitments, drainage, potential maintenance problems, erosion control, public notification, proprietary materials, special considerations in contract provisions, etc.

On almost all construction projects, developments in the field will necessitate some design changes. For early resolution of these changes, the RE, the PM, and the PE must coordinate with

other functional units as needed to accommodate these changes without affecting scope, schedule, and budget.

Maintenance

The Maintenance Unit will be responsible for maintaining the highway and BMP facilities once the project is complete. It is essential that the Maintenance Unit be involved in the project development process from conception through construction.

The Maintenance Unit should also review the proposed geometric layouts, typical sections, and final plans. Maintenance Units may have input on shoulder backing materials, drainage concerns, areas with existing erosion problems, access to buildings, access for Treatment BMPs, access for landscape facilities, access to encroachments for utility facilities, access for maintenance of noise barriers, fence and excess land review, etc. Maintenance Units should also participate in the preparation of maintenance agreements (setting maintenance control limits).

The Maintenance Unit field representatives have a unique insight into local problems and maintenance and safety concerns. This insight must be utilized in the project development process. Coordination with maintenance staff during the design process can minimize future maintenance problems and the potential for future lawsuits.

Typical Maintenance Unit involvement would be to comment on features such as the following:

- Drainage patterns – particularly known areas of flooding, debris, etc.;
- Stability of slopes and roadbed: Help determine if the project can be built and maintained economically;
- Possible material borrow or spoil sites;
- Concerns of the local residents;
- Existing and potential erosion problems;
- Facilities within the right-of-way that would affect alternative designs;
- Special problems such as deer crossings, endangered species, etc.;
- Traffic operational problems such as unreported accidents, etc.;
- Facility that is safe to maintain;
- Known environmentally sensitive areas; and
- Frequency of traction sand use, and estimate of quantity applied annually.

Landscape Architecture

The Chief of the Office of Landscape Architecture is responsible for the development of Caltrans policies, programs, procedures, and standards for all aspects of landscape architecture (i.e., highway planting, highway planting restoration, replacement planting, revegetation, vegetative erosion control), safety roadside rest areas, vista points, scenic corridors, and noise barriers.

The Landscape Architect evaluates the implementation of mandatory storm water Design Pollution Prevention BMPs into the overall landscaping plan for the project. Erosion prevention

and storm water pollution prevention BMPs are incorporated into the project's landscaping and revegetation plan. All projects incorporating new slopes steeper than 1:4 (v:h) must have an erosion control plan developed or approved by the District Landscape Architect.

3.9 REPORTING REQUIREMENTS

Environmental

The Preliminary Environmental Assessment Report (PEAR) is prepared by the Environmental Unit. The purpose of the PEAR is to determine whether there are any potentially significant environmental issues that could affect the viability of the project alternatives. The PEAR identifies the environmental documents and supporting technical studies that would be required in subsequent project development processes to address potential environmental impacts. Based upon the potential for significant impacts, the PEAR would identify whether a California Environmental Quality Act (CEQA) Initial Study or Environmental Impact Report is needed and/or whether a National Environmental Policy Act (NEPA) Environmental Assessment or Environmental Impact Statement is needed. A screening level assessment of potential storm water quality impacts is included in the PEAR. The screening level assessment would identify the existing receiving water bodies and their beneficial uses, existing surface water quality, any impairments and unique environmental conditions, and a generalized assessment of potential project related storm water quality impacts. This screening level assessment evaluates the need for a full SWQA technical document.

A SWQA is prepared when the PEAR identifies that a more detailed technical study of storm water quality issues is necessary. The SWQA identifies potential storm water quality impacts and adherence to the SWMP as appropriate mitigation. This information presented in the SWQA will be utilized by Caltrans Design, Construction and Maintenance staff to develop and implement specific BMPs to mitigate any potential water quality impacts associated with storm water discharges from the proposed project. The information from the PEAR and the SWQA would be utilized to prepare the SWDR and associated checklists.

Surveys & Mapping

During a project evaluation, areas are identified as possible locations for Treatment BMPs. Therefore, surveys and vicinity mapping should be developed for these areas.

Right-of-Way

The right-of-way data sheet should be requested from the Right-of-Way functional unit as soon as possible after project alternatives have been developed. The right-of-way data sheet is prepared during the PID process and updated throughout the Project Approval/ Environmental Document (PA/ED) process, and is a required attachment to the PSR, the PR, and most other project initiation and project approval documents. The information in the right-of-way data sheet is vital to the project development process since it details all types of parcel information and the right-of-way estimate. The information from the right-of-way data sheet is also used to evaluate the feasibility of acquiring additional land for the incorporation of infiltration basins or drainage easements.

Hydraulics

Following project approval, a Drainage Report is typically prepared by the Hydraulics Unit. This report covers rainfall, runoff, existing flood records, gauging stations, debris, and any other pertinent drainage information. This report is transmitted to the PE so that pertinent drainage design can be started. The information in the Drainage Report is also used to evaluate and design storm water BMPs.

Maintenance

In addition to participating on the PDT, the Maintenance Unit should review all major engineering reports such as the PSR, DPR, PR, etc. The review shall include the evaluation of all proposed BMPs, including the maintainability of those BMPs. Maintenance is also required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. Additionally, Maintenance concurrence must be obtained on any new slope steeper than 1:2 (v:h).

Landscape Architecture

Landscape Architecture is required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. The District Landscape Architect must either prepare or approve an Erosion Control Plan for any project incorporating new slopes steeper than 1:4 (v:h).

Construction

The Construction Unit should review the project and BMP alternatives to determine if they are biddable and buildable. After completion of the construction contract, the PM is responsible for gathering the construction contract records from the RE and the project planning and design data from the PE to put in the Project History File.

District/Regional Design Storm Water Coordinator

The District/Regional Design Storm Water Coordinator is required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. The District Design Storm Water Coordinator may delegate this authority to the District/Regional NPDES Storm Water Coordinator.

District/Regional NPDES Storm Water Coordinator

The District/Regional NPDES Storm Water Coordinator verifies that the water quality issues are identified and addressed in the SWQA and the SWDR.

Project Manager

The Project Manager (PM) is required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. The PM also signs the PSR and the PR.

Project Engineer

The Project Engineer (PE) is responsible for the preparation of PSRs and PRs during the planning phase, and PS&E documents (otherwise known as contract plans or bid documents) during the design phase. Where the re-use of soils that contain lead is proposed, the PE will ensure that written notification is provided to the RWQCB 30 days prior to advertisement for

bids, as discussed in Section 4.3. The PE determines whether a SWPPP or a WPCP is required for the construction project and incorporates appropriate permanent BMPs in the project.

The PE incorporates permanent Design Pollution Prevention and Treatment control BMPs into project plans and specifications. The PE may also include specific Construction Site BMPs (including contaminated soil management BMPs) into the PS&Es. In addition, the PE is responsible for assembling information in the RE's file.

The PE also prepares and signs the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases.

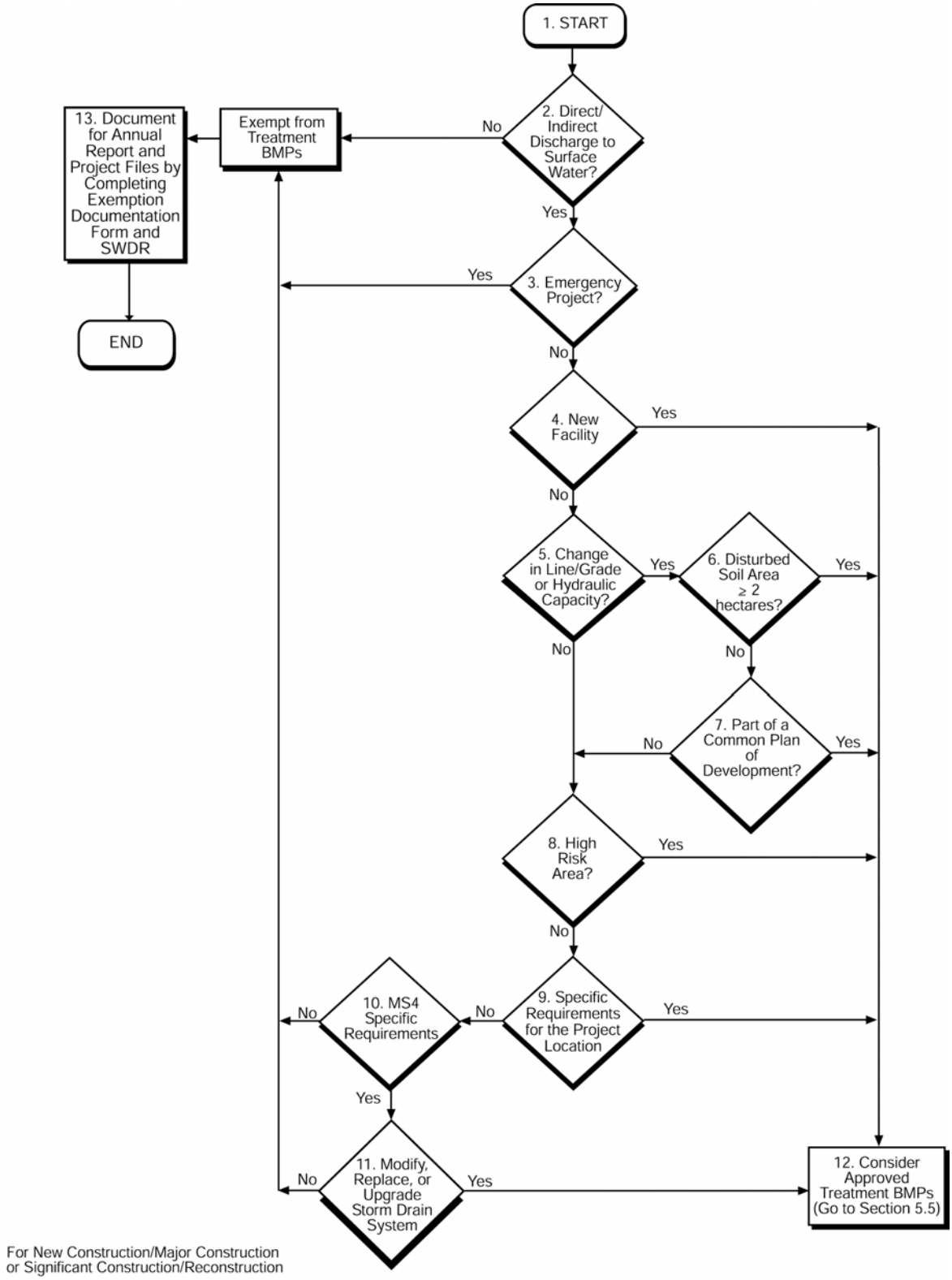
4.1 INTRODUCTION AND OBJECTIVES

The Caltrans Statewide Storm Water Management Plan (SWMP) requires Project Development personnel to assess the need for storm water Best Management Practices (BMPs) and incorporate these BMPs as appropriate during the initial planning and design phases of all Caltrans projects. Design Pollution Prevention BMPs must be considered for every project. Additionally, every project must evaluate the need to address critical Construction Site BMPs and the maintainability of all permanent BMPs incorporated into the project. This section, however, focuses on evaluating whether a project is exempt from incorporating Treatment BMPs. If a project is not determined to be exempt, then site by site determination of Treatment BMP feasibility is required.

4.2 PROJECT EXEMPTION PROCESS

The attached decision tree, Figure 4-1, provides general guidance to determine when a project is exempt from implementing Treatment BMPs. The corresponding Exemption Documentation Form is included in Appendix E of this document. The information in the following sub-sections is intended to supplement the attached decision tree by providing further detailed descriptions of the steps in the decision tree. The numbers in the descriptions correspond to the steps in the decision tree.

Figure 4-1: Project Exemption Criteria For Permanent Treatment BMPs Only



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Step 1 - Start

Many projects and activities are exempt from implementing permanent Treatment BMPs. These projects are considered exempt based on certain criteria. Caltrans should use the process shown in Figure 4-1 and the Exemption Documentation Form in Appendix E to determine if the project qualifies for "exemption" status for Treatment BMPs.

Step 2 - Is the project directly or indirectly discharging to Surface Waters?

Surface Waters are known as Waters of the United States and/or Waters of the State. In general, these include creeks, streams, rivers, oceans, wetlands, estuaries and lakes. They are broadly defined as:

- All waters that are currently used (or have been used in the past) for interstate or foreign commerce);
- All interstate waters, including wetlands;
- All other waters, the use or degradation of which would affect interstate or foreign commerce (including recreation, fishing, and industrial uses);
- All impoundments of waters;
- Tributaries of waters defined in this section;
- The territorial sea (the regulatory jurisdiction over the oceans of the United States); and
- Wetlands adjacent to waters defined in this section.

A direct discharge means a discharge of surface runoff directly to the surface water body without first flowing through a municipal separate storm sewer system (MS4). An indirect discharge means the discharge of surface runoff to the surface water body through an MS4 storm water conveyance system, unlisted tributary to the surface water, or a storm water discharge that otherwise reaches the water body.

If a project directly or indirectly discharges to surface water, the Project Engineer (PE) should consider the additional exemption criteria in the decision tree, step numbers 3-12. If not, the project is considered exempt and the PE should prepare the appropriate documentation to support the Annual Report.

Step 3 - Is the project an emergency project?

Throughout the year conditions may arise that require Caltrans to conduct emergency activities to protect public health, safety and property. Conditions during the emergency activities result in Caltrans being exempt from the requirement to implement Treatment BMPs during emergency activities. Such incidents will not be considered noncompliance.

Emergency projects may be retrofitted with Treatment BMPs after the objective to restore public health, safety and property has been completed.

Regardless of whether the project falls under an emergency status, Design Pollution Prevention and Construction Site BMPs need to be included in project design.

Step 4 - Is this a new facility or major reconstruction?

New construction and major reconstruction includes new routes, route alignments, route upgrades (e.g., from a two-lane conventional highway to four-lane expressway or freeway) and other such projects involving large construction grading equipment and right-of-way acquisitions for whole parcels or wide swaths. New construction activity does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility, nor does it include emergency construction activities required to protect public health and safety.

Consideration of Treatment BMPs and capacity to treat storm water runoff from the impervious areas within the Caltrans right-of-way is required in the design of new facilities and major reconstruction. These projects may include, but are not limited to:

- New highways and freeways;
- Highway-related facilities, including new maintenance facilities, safety roadside rest areas, toll plazas and inspection and weigh stations;
- Upgrading highways from two to four lanes;
- Construction activities conducted within highway rights-of-way in conjunction with a new facility;
- New interchanges;
- New bridges;
- Tunnels; and
- Drainage system improvements, including changes to pipes, conduits, channels, etc.

Projects containing the elements listed in this section are classified as new facilities for storm water purposes.

Step 5 - Is there a change in line/grade or hydraulic capacity?

If impacts on existing slopes cannot be avoided and there is a change in line, grade, or hydraulic capacity, the project must include the consideration of permanent Treatment BMPs and the selection and design of Design Pollution Prevention BMPs.

The first goal in project design, however, should be to minimize disturbance/impacts to existing slopes, particularly where the existing slopes have a well-established vegetative cover.

Projects that do not involve grading or changes or increases in hydraulic capacity are excluded from upgrades to storm water facilities and the need for treatment facilities.

If Treatment BMPs are determined not to be necessary, permanent Design Pollution Prevention BMPs should be considered.

Step 6 - Is the disturbed soil area greater than or equal to 2 hectares?

Projects that will disturb soil area of 2 hectares (5 acres) or more in locations that have a change in line or grade require Treatment BMPs. The District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator should be consulted if there is any ambiguity or question regarding the determination of the extent of the disturbed area or the applicable Treatment BMPs. The 2-hectare (5 acre) threshold for determining project exemption is independent from the 2-hectare threshold for when SWPPPs are required. Therefore, the 2-hectare threshold for exemption will not change in March 2003, when Phase II of the Clean Water Act goes into effect.

Step 7 - Is the project part of a Common Plan of Development?

Projects that will disturb less than 2 hectares (5 acres) but are part of a larger Common Plan of Development whose total land disturbing activities disturb 2 hectares (5 acres) or more must consider Treatment BMPs. In addition, projects designated as part of a Common Plan of Development by the permitting authority must also consider Treatment BMPs. A Common Plan of Development is broadly defined as any announcement on a piece of documentation or physical demarcation indicating that construction activities may occur on a specific plot. This requirement remains in effect regardless of any lapse in time between the initial grading or clearing of the area and the actual construction on a portion of the land that was graded.

Step 8 - Determine if the project is in a high risk area.

Locations where spills from Caltrans-owned rights-of-way, activities, or facilities that discharge directly to municipal or domestic water supply reservoirs or ground water percolation facilities discharging to aquifers designated as water supplies are defined as high risk areas. High risk areas are documented in each Regional Work Plan (RWP). Consult with the District/Regional NPDES Storm Water Coordinator to identify any high risk areas that may impact a proposed project.

Step 9 - Are there specific requirements for the project location?

The Statewide Permit requires Caltrans to implement the program specified in the SWMP. Caltrans is also required to implement additional location-specific requirements contained in Provision L of the Statewide Permit. These location-specific requirements reflect special conditions within the state (e.g., unique requirements due to geography, climate, terrain, local hydrology, sensitive receiving waters, Regional Water Quality Control Board [RWQCB]/Basin Plan requirements and/or specific types of facilities, areas under litigation, and Total Maximum Daily Loads [TMDLs].) More information on these location-specific requirements may be found in Section 10 of the SWMP.

Districts that have location-specific requirements are District 3 (Marysville), District 7 (Los Angeles), District 9 (Bishop), District 10 (Stockton), and District 11 (San Diego). Consult with

the District/Regional NPDES Storm Water Coordinator to identify any Location-Specific requirements that may impact a proposed project.

Step 10 - MS4 - Municipal Separate Storm Sewer System

The Phase I Rule of 40 Code of Federal Regulations (CFR) 121.26 established requirements for the permitting and management of storm water discharges from large (serving a population of 250,000 or more) and medium-sized (serving a population of 100,000 to 250,000) municipalities, numerous industries and construction sites disturbing 2 hectares (5 acres) or more.

In December 1999, the U.S. Environmental Protection Agency finalized the Phase II of the NPDES Program, which requires controls on a broader sector of municipalities, industries, and construction sites. Specifically, urbanized areas with a population of at least 10,000 and with a population density greater than 1,000 per square mile are required to obtain a storm water permit. For construction, the Phase II Rule requires construction sites disturbing a soil area equal to or greater than 0.4 hectare (one acre) and less than 2 hectares (5 acres) to control pollutants in storm water runoff. Phase II rules go into effect March, 2003.

Coordination with municipalities on storm water management responsibilities is the responsibility of the District Directors. In many cases, discharges from Caltrans storm water drainage systems flow to storm water drainage systems owned and operated by municipalities and vice versa. The municipalities and Caltrans are ultimately responsible for the quality of the discharges from their storm water drainage systems. To comply with its Permit, Caltrans will ensure pollutants are reduced or controlled in discharges from Caltrans storm water drainage systems into municipal systems. Permitted municipalities will do the same for discharges from their facilities into the Caltrans storm drain system.

Step 11 - Are you modifying, replacing, and/or upgrading the storm drain system?

The incorporation, modification, replacement or upgrade of drainage facilities within a project requires that the project continue with the consideration of Treatment BMPs. When a section of Caltrans right-of-way undergoes significant construction or reconstruction, it is required that Caltrans seek opportunities to retrofit its storm water drainage system for water quality improvements for systems in urban areas subject to an MS4 permit. As such, consideration of approved Treatment BMPs is required.

When considering projects for retrofit opportunities, Caltrans will:

- Undertake an inventory of all existing drainage pipe or collection ditch locations discharging into a receiving water or a downstream storm drain system owned by others in the area of the significant construction and reconstruction area;
- Evaluate impacts to stream hydrology and aquatic life and habitat resulting from the construction of and/or discharges from existing Caltrans facilities;
- Determine the feasibility of Design Pollution Prevention and Treatment BMPs; and
- Request that the appropriate funding authorities consider allocating funds for Treatment BMPs when such BMPs are determined to be feasible.

Step 12 - Consider Approved Treatment BMPs

Checklist T-1 provides guidance on which Treatment BMPs to consider. The Checklist also contains design questions that lead the designer through an evaluation of each approved Treatment BMP. Decision Tree T-1 is to be used in conjunction with Checklist T-1 and is used to identify which Treatment BMPs to consider. See Section 5.5 plus Checklist T-1 and Decision Tree T-1 in Appendix E.

Step 13 - Document for Annual Report and Project Files

All supporting data used to determine whether a project is exempt from incorporating Treatment BMPs should be summarized in tabular form for inclusion in the Annual Report and the Project Files. Complete the Exemption Documentation Form and the Storm Water Data Report (SWDR) in Appendix E.

5.1 INTRODUCTION AND OBJECTIVES

The purpose of this section is to provide a consistent approach in the preparation of the Project Initiation Document (PID) as it relates to incorporating storm water Design Pollution Prevention, Treatment and Construction Site Best Management Practices (BMPs) into a project. Although there are several types of PIDs (for a complete list of PIDs, see Chapter 9 of the Project Development Procedures Manual [PDPM], 7/1/99), the most common is the Project Study Report (PSR). Instructions for preparing PSRs are provided in Appendix L, titled, "Preparation Guidelines for Project Study Reports," of the PDPM. This section has been incorporated directly from Appendix L of the PDPM and is to be used only as a supplement to the PDPM.

This section references the Work Breakdown Structure (WBS) codes, the Storm Water Data Report (SWDR), checklists, and decision trees as they relate to the PID process. WBS codes are provided in Appendix E for specific storm water related tasks during the PID process. These codes are organized in the process form titled "Summary Process for Storm Water Activities for the PID." These codes follow the "Guide to Caltrans Capital Work Breakdown Structure – Release 5.1" document. The SWDR, its corresponding checklists and decision trees are described in this section and are included in Appendix E. These documents should be used for guidance in evaluating BMPs considered during the PID process.

5.2 PROJECT INITIATION DOCUMENT

The purpose of a PID is to develop consensus on the scope, schedule, and estimated cost of a project. The PID is used for programming the project, for proceeding to the environmental evaluation, and for selection of project alternatives. The overall objective of a PID is to gather pertinent information and to clearly define the design concept and design scope of project alternatives. Specific objectives of the PID process as it relates to storm water quality are listed as follows:

- Define need and purpose of the project;
- Estimate and program the design resources needed to prepare the Plans, Specifications and Estimates (PS&E) and project management costs;
- Define storm water quality issues and pollutants of concern;
- Form the Project Development Team (PDT), including the District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator;
- Develop project alternatives and evaluate potential storm water impacts;
- Develop a list of potentially feasible permanent storm water Design Pollution Prevention and Treatment BMPs to be evaluated during later phases of project design;
- Develop the preliminary costs for BMPs and the associated right-of-way costs for incorporating BMPs, and include these costs in the PID;

- Discuss the project with the Regional Water Quality Control Board (RWQCB) and local agencies, if advised by the District/Regional NPDES Storm Water Coordinator or requested by the RWQCB;
- Program the project construction costs, costs for right-of-way associated with construction, and storm water quality related costs;
- Perform and document the field review and research of other projects in the same general area; and
- Prepare the Preliminary Environmental Assessment Report (PEAR).

5.3 PROJECT INITIATION DOCUMENT PROCESS

The PID process is intended to obtain management approval of candidate projects, identify right-of-way acquisition needs and determine costs for programming. Therefore, it is essential that all work incidental to the project, including storm water quality items, be included in the scope and cost estimates. The outcome of the PID process is a well-defined, proposed project scope tied to a reliable cost estimate and schedule that is suitable for programming or local commitment, as well as for proceeding to the Project Approval/Environmental Document (PA/ED) process. It is understood, however, that a project's scope may change as environmental or other studies are completed.

A PEAR is prepared by the Environmental Unit when requested by the Design Unit, and is used to provide necessary information for the completion of a PID. The purpose of a PEAR is to determine whether there are any potentially significant environmental issues that could affect the viability of any project alternatives. A screening level assessment of potential water quality impacts, including potential storm water impacts, should be included in the PEAR. This screening level assessment would identify the existing receiving water bodies and their beneficial uses. The screening level assessment would also provide a generalized summary of existing surface water quality, any impairments and unique environmental conditions, and a generalized assessment of potential project-related storm water quality impacts on the receiving water quality. This screening level assessment evaluates the need for a full Storm Water Quality Assessment (SWQA) technical document, which is prepared during the PA/ED process by the Environmental Unit.

The Project Engineer (PE) should use the information from the PEAR during the PID process as a resource to prepare the SWDR when defining the storm water quality issues for the project. The PE should provide the SWDR to the designated Environmental Staff who prepared the PEAR to verify the information included in the SWDR.

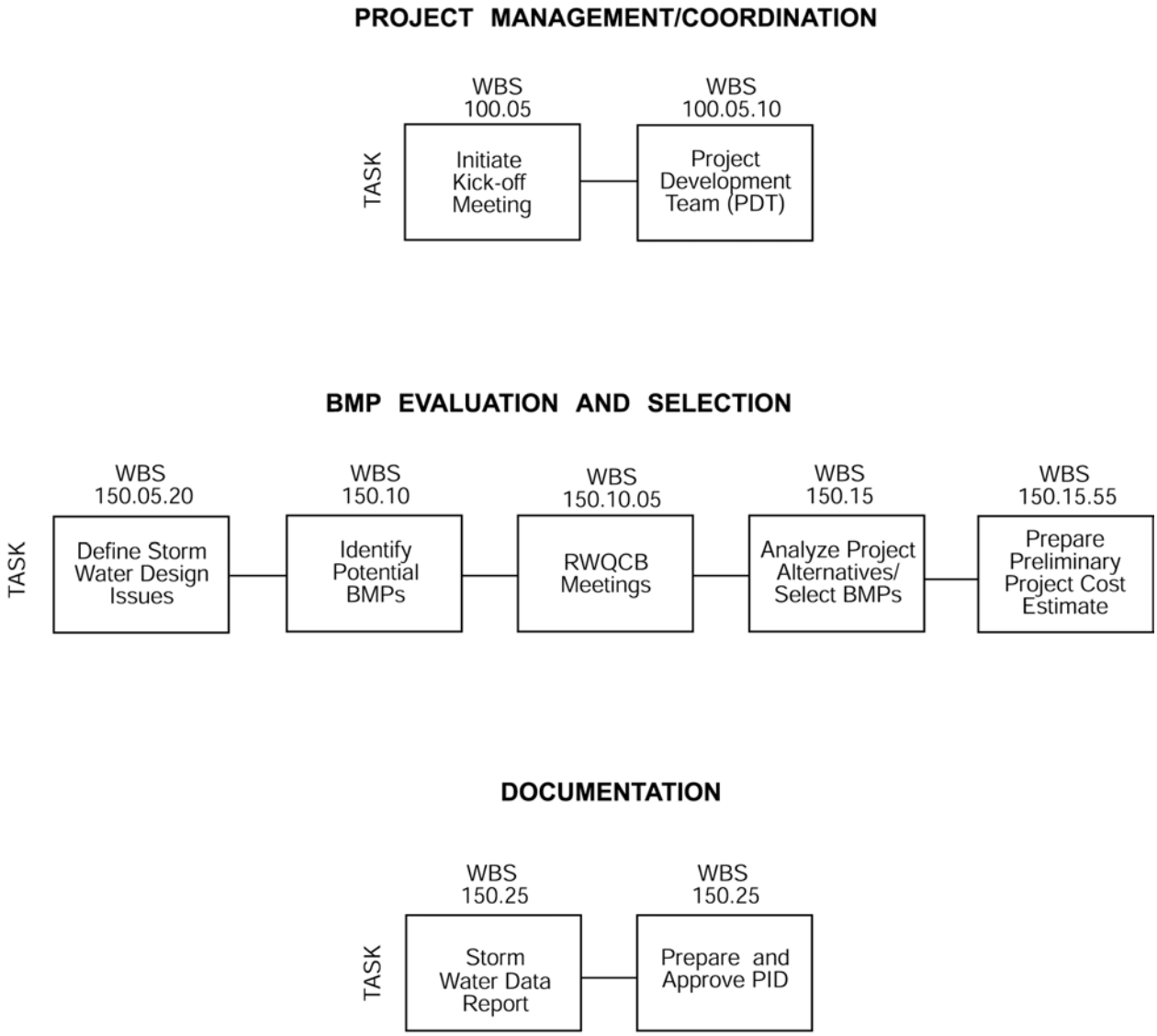
If the PEAR determines that a SWQA is required for the project, the PE should coordinate with the Environmental Unit and District/Regional NPDES Storm Water Coordinator during its preparation to update the SWDR as part of the PA/ED process.

Figure 5-1 is a flowchart that illustrates the overall primary task categories for the PID process. Included in the flowchart are WBS Codes for each task. Appendix E includes a process form

titled "Summary of Storm Water Activities for the PID" that provides a step-by-step process of the tasks described in this section.

The following sub-sections correspond to the task categories shown in Figure 5-1 and the PID Process Summary Form in Appendix E. Additional information is provided on the following pages detailing the recommended participants, discussion and decision topics, documentation, and verifications for each task to obtain final PID approval and funding for a project.

Figure 5-1: Project Initiation Document - Storm Water Task Categories



5.4 PROJECT MANAGEMENT / COORDINATION

This section describes the primary task categories involved with project management and the coordination in the PID process needed to obtain consensus between the different functional units regarding storm water issues.

Initiate Kickoff Meeting, WBS 100.05

Narrative: The kickoff meeting is typically initiated by the Project Manager (PM) to discuss the need and purpose of the project.

Responsible: Project Manager (PM)

Recommended Participants:
- Project Manager
- Project Engineer
- District/Regional NPDES Storm Water Coordinator
- Appropriate functional units
- Environmental Engineering Representative
- Environmental Planning Representative

Discussion Topics: Project Definition**:** Discuss the project purpose, type, location, schedule, size, and project alternatives.

Project cost estimate**:** Discussion is included early so that the necessary funds can be estimated as soon as possible. Obtain Preliminary Project Cost Estimate (PPCE) form for items to be included.

Discuss the potential need for additional right-of-way to incorporate Treatment BMPs.

Discuss any environmental concerns and/or issues**.**

Decisions/actions: Determine if additional functional units should be involved.

Documentation: Meeting minutes
Start PID

Verification: There is no verification required at this phase.

Project Development Team (PDT), WBS 100.05.10

Narrative: The PDT advises and assists the PE in directing the course of studies, makes recommendations to the PE and District management, and works to carry out the project work plan. Members of the PDT participate in major meetings, public hearings, and community involvement. The PDT is responsible for conducting studies and accumulating data throughout the project's development, from the beginning of the PID process through the

PS&E process. The PDPM, Chapter 8, Section 4 (7/1/99), provides a thorough description of the PDT and its functions.

Responsible: Project Manager

Recommended Participants:

Project Manager
Project Engineer
District/Regional NPDES Storm Water Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative
Environmental Planning Representative
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
Right-of-Way Representative
Hydraulics Representative
District Materials Engineer
Geotechnical Representative
Traffic Representative
Others as needed.

All Districts are not organized the same; therefore, the suggested PDT members may have different titles depending upon the District in which the project is located. The PM and the PE should consult the specific Regional Work Plan (RWP) to obtain the contacts listed in this section or the equivalent title or function in the District.

Discussion Topics: The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units.

The following storm water quality issues are examples of what should be discussed:

- Viable alternatives for projects including location and alignments;
- Evaluate approved BMPs for potential implementation;
- Determine if Treatment BMPs are exempt from implementation (see Section 4);
- Estimated project cost and BMP costs for various alternatives;
- Environmental issues;
- Site conditions and design constraints;
- Storm water quality requirements/Basin Plan objectives;
- Storm Water Pollution Prevention Plan (SWPPP) versus Water Pollution Control Program (WPCP);

- Identifying the appropriate RWQCB jurisdiction;
- Identifying water bodies potentially affected by the project;
- Any special requirements established by the RWQCB for those water bodies, including numeric effluent limits, TMDLs, or other requirements;
- Water quality volume and flow;
- Right-of-way impacts, location and size of Design Pollution Prevention and Treatment BMPs;
- Need for permanent or temporary dewatering;
- Presence of aerially deposited lead or other contaminants;
- Evaluation of slope stability;
- Presence of High-Risk Area; and
- Public access and need for drain inlet stenciling.

Decisions/actions: Document any decisions made during PDT meetings.

Documentation: Meeting minutes

Exemption Documentation Form, Checklists SW-1, SW-2, DPP-1 and T-1.

Verification: The PE verifies that all documentation is completed.

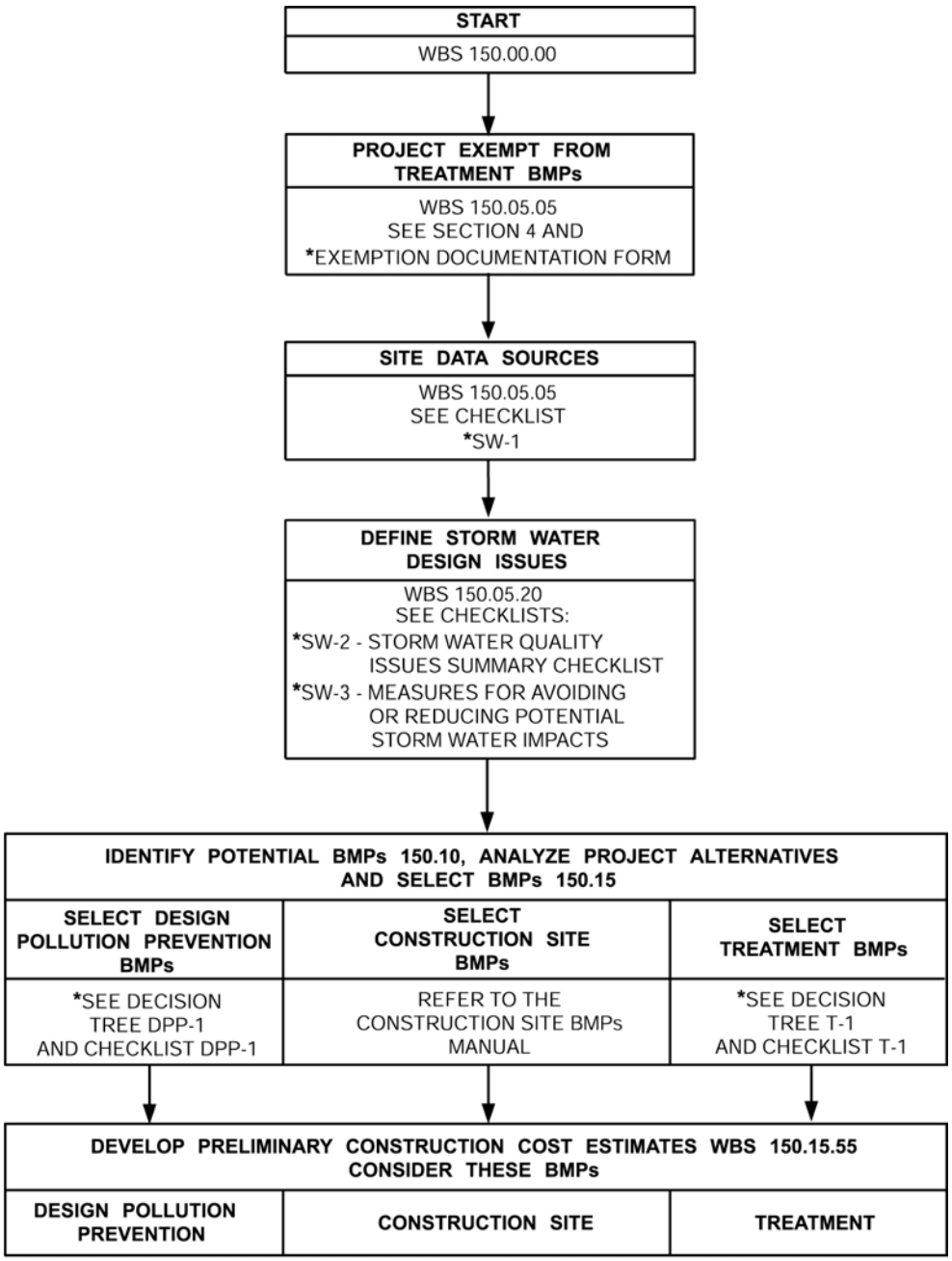
5.5 BMP EVALUATION AND SELECTION PROCESS

This section describes the primary task categories for the Design Pollution Prevention and the Treatment BMP selection procedures associated with the PID process. Refer to the Construction Site BMPs Manual for Construction Site BMPs (see Appendix D for web address). Figure 5-2 is a flowchart that illustrates the process development of considering BMPs in a project. A description of the corresponding decision trees and checklists listed in Figure 5-2 is provided in Section 5.5.1.

There are three goals for the evaluation and selection process. They are:

1. To obtain consensus between the different functional units and the RWQCB regarding preliminary BMP selection;
2. To facilitate the incorporation of the BMPs into the PID; and
3. To provide sufficient information regarding BMP evaluation and selection once the PA/ED process is initiated.

Figure 5-2: Flowchart for Consideration of Storm Water BMPs for the PID



* Located in Appendix E.

5.5.1 Storm Water Data Collection

Define Storm Water Design Issues, WBS 150.05.20

Narrative: Decision trees and checklists provided in Appendix E and described below are tools for designers to evaluate potential Design Pollution Prevention and Treatment BMPs for incorporation into a project.

The checklists can be attached to the SWDR, which is also described herein. The SWDR and the checklists are refined during the PA/ED and PS&E processes.

Responsible: Project Engineer

Recommended Participants:
Project Manager
Project Engineer
District/Regional NPDES Storm Water Coordinator
Primary functional units

Discussion Topics: The following items 1 – 5 are initiated during the PID Process.

1. **Exemption Documentation Form for Treatment BMPs, WBS 150.05.05**

   Following the directions provided in Section 4 of this document, determine if the project is exempt from incorporating Treatment BMPs. Complete the Exemption Documentation Form in Appendix E. If it is determined that the project is exempt from requiring Treatment BMPs, attach the Exemption Documentation Form to the SWDR. Continue with the selection of Design Pollution Prevention BMPs.

2. **Storm Water Data Report, WBS 150.25**

   The SWDR summarizes the information found in Checklists SW-1, SW-2 and SW-3 (described as follows). The checklists and the SWDR are initiated during the PID process, updated during the PA/ED process and updated again and completed during the PS&E process. During each process, the SWDR is signed by the PE, District Design Storm Water Coordinator, the designated Landscape Representative, designated Maintenance Representative, and approved by the PM to verify that storm water quality design issues have been addressed and the data are complete, current and accurate. The PE stamp is required at PS&E. This report is to be included in the final PS&E package (see Section 7). Checklists SW-1, SW-2 and SW-3 can be attached to the SWDR as backup and supportive information.

3. Site Data Resources: Checklist SW-1, WBS 150.05.05

Checklist SW-1 lists categories of pertinent information required for storm water planning and design. Checklist SW-1 should be completed citing the source and date of the information collected for each entry where appropriate.

The five main categories for site data collections are topographic, hydraulic, soils, climatic and water quality. These data should be collected from the various functional units. Field visits should also be conducted to gather pertinent data. The following provides some examples of data that can be collected pertaining to the aforementioned categories:

Topographic Data:

- United States Geological Survey (USGS) Quad Maps;
- Survey Reports and Maps – Survey needs should be evaluated and identified early in the PID process and throughout the entire project development process when needed. After the first evaluation of survey needs, the PE should submit the initial survey request accompanied by a location map;
- Aerial Mapping/Photo Mosaics;
- Vegetation – Existing cover and types of vegetation present should be documented; and
- Landscape/Aesthetic Analysis – The PE requests information from the Landscape Architect to Perform Landscape/Aesthetic Analysis. This helps to evaluate the implementation of mandatory storm water Design Pollution Prevention BMPs into the overall landscaping plan for the project. Erosion prevention and storm water pollution prevention BMPs should be incorporated into the project landscaping and revegetation plan.

Soils Data:

- Natural Resources Conservation Service (NRCS) Soil Survey Reports and Maps – Potential areas of serious erosion problems should be identified and provided; and
- Geotechnical Design Reports and Well Records – Well records and Geotechnical Design Reports can provide information regarding the depth from surface to seasonal high groundwater. The local Maintenance Supervisor should be consulted to identify existing drainage and/or erosion problems.

Hydraulic Data

- Groundwater Data;
- Stream Flow Data;
- Drainage Area – Routes and patterns (define subbasins); and
- Identification of drainage areas affecting or tributary to High Risk Areas.

Climatic Data

- Rainfall Intensities

Water Quality Data

- The PE should coordinate with the Environmental Unit and the District/Regional NPDES Storm Water Coordinator during the preparation of the PEAR. This coordination enables the PE to share project-specific information, and to ensure consistency between the evaluation of project alternatives, the completion of the Storm Water Checklists, and the water quality assessments included in the PEAR;
- Neighboring water bodies;
- Hazardous Material/Waste Information;
- RWQCB Jurisdiction and Basin Plan;
- Identifying TMDLs within project limits; and
- Water Quality Volume (WQV) and Water Quality Flow (WQF).

4. Storm Water Quality Issues Summary: Checklist SW-2

Checklist SW-2 provides a guide to collecting information relevant to project storm water quality issues. The PE should coordinate with the Environmental Unit when compiling and reviewing the information required by Checklist SW-2. This information is critical in facilitating the selection and design of the preferred BMPs. This activity includes the following tasks:

- Compile and review existing background information that may impact the alternatives or the scope of the alternatives under consideration, including existing storm water quality issues. Such background information will help identify specific District and RWQCB requirements as well as the possibility of sensitive receiving waters or valuable habitats; and
- Analyze future requirements to determine the project's need and purpose. This task requires the analysis of site-specific conditions or potential sources of pollution for effective soil stabilization and

sediment control. This task includes discussion with internal and external stakeholders.

5. Measures for Avoiding or Reducing Potential Storm Water Impacts: Checklist SW-3

Checklist SW-3 provides direction to the designer during the project planning phase to avoid or reduce potential storm water impacts. The planning phase represents the greatest opportunity to avoid adverse water quality impacts as alignments and right-of-way requirements are developed and refined. Avoiding impacts may reduce or eliminate the need for permanent Treatment BMPs and other mitigation-type BMPs. The PE should coordinate with the Environmental Unit when compiling and reviewing the information required by Checklist SW-3.

Table 5-1 identifies many of the project features and potential storm water impacts that should be considered. The PE should obtain or develop this information for each project or alternative. The PE must confer with other functional units, such as Landscape Architecture, Hydraulics, Environmental, Materials, Construction, Maintenance, Right-of-Way, and the NPDES office when necessary. This will usually be accomplished by submitting layouts/base maps, in conjunction with other information required by the functional units, to determine impacts and BMP requirements.

Table 5-1: Project Features And Potential Impacts To Be Considered During Project Planning

Features and Potential Impacts to be Considered	Reason Why They Must be Considered
Identify which RWQCB will have jurisdiction over the project(s). Does the RWQCB have any special requirements?	Requirements may vary by RWQCB. May impact permanent and temporary control requirements.
Identify receiving waters and all other waters that may affect or may be affected by the project. Consider aquifers, wells, streams, lakes, reservoirs, wetlands, and waters both fresh and saline. Consider impacts throughout the project lifecycle, including construction, maintenance, and operation.	First step in identifying impacts and potential control measure requirements.
Are any of the receiving waters impaired [303(d) listed]? (Discharges to impaired water bodies may be subject to strict numeric water quality standards and prescribed treatment controls.)	Supplemental controls may be required to further reduce pollutants to meet numeric water quality standards, waste load allocations or requirements of an adopted watershed plan.
Will construction require work in, above, or directly adjacent to the water bodies listed in this section?	Could require additional environmental permits/agreements and control measure requirements.
Are any sensitive fishery, wildlife, recreational, agricultural, or industrial aquatic resources located in the vicinity of the project?	Could require additional environmental permits/agreements and control measure requirements.
What is the unit cost for additional right-of-way should it be needed for treatment controls?	Used for budgeting and cost estimating.
Will the project increase the potential for downstream erosion by adding impervious surfaces, decreasing the time of concentration, or redirecting flows?	May need to implement detention devices or stabilized conveyance systems to prevent damage to off-site streambanks or channels.
Does the project discharge to lined, engineered drainage facilities or unlined, natural channels?	Will need to consider implementing detention devices or stabilized conveyance systems for streambank protection.
Identify general soil types and vegetation within the project site.	Basic information needed for slope design, slope protection plans and infiltration BMPs.
How difficult will it be to re-establish vegetation following construction?	May affect slope stabilizations plans.
How long will it take for the new vegetation to establish? What vegetation, if any, can be preserved?	Used to determine the need for separate vegetation establishment contract.
Are any slopes steeper than 1:4 vertical:horizontal (v:h)?	Slopes steeper than 1:4 require an erosion control plan prepared or approved by the District Landscape Architect.
Are any slopes as steep or steeper than 1:2 (v:h) ?	If yes, a Geotechnical Design Report must be prepared by Geotechnical Services. Additionally, the District Landscape Architect should prepare or approve an erosion control plan.
Determine the general climate, annual rainfall, and typical seasonal rainfall patterns for the project area.	Basic information needed for slope design, slope protection plans, BMP feasibility, plus conveyance system design and sizing of treatment controls.
Determine the proposed project slopes, and areas of cut and fill.	Basic information needed for slope design and slope protection plans.
Does the project include contaminated or hazardous soils as identified in the initial site assessment (ISA) and environmental documents?	May impact project construction activities and deployment of temporary controls during construction. May affect whether soil can be re-used.
Will the contractor's yard be located within the State's right-of-way or otherwise be arranged for or provided by Caltrans? If so, what are the potential impacts?	May impact responsibility for deployment of temporary controls during construction.
Do the regulatory agencies have seasonal construction restrictions?	May impact project construction activities and deployment of temporary controls during construction.
Identify High-Risk areas that fall within or are adjacent to project limits.	Could require additional features to minimize spills or intercept spills.

Decisions/actions: Identify potential storm water quality impacts or issues.

Estimate project cost of the potential BMPs.

Documentation: Exemption Documentation Form

Preliminary Checklists SW-1, SW-2, SW-3 and the SWDR. These will be first drafts since not all information will be available.

Verification: District/Regional NPDES Storm Water Coordinator or designated functional unit verifies that the SWDR and checklists are being completed appropriately.

5.5.2 Identify Potential BMPs, WBS 150.10

Narrative: This activity includes identifying potential Design Pollution Prevention and Treatment BMPs for implementation.

Responsible: Project Engineer

Recommended Participants:
- Project Manager
- Project Engineer
- District/Regional NPDES Storm Water Coordinator
- Design Storm Water Manager or Coordinator
- District Landscape Architect or Project Landscape Architect
- Environmental Engineering Representative
- Environmental Planning Representative
- Construction Storm Water Coordinator
- Maintenance Storm Water Coordinator
- Right-of-Way Representative
- Hydraulics Representative
- District Materials Engineer
- Geotechnical Representative
- Traffic Representative

Discussion topics: Potential BMPs

Checklists, SW-1, SW-2, SW-3

Environmental Impacts

Decisions/actions: Develop general scope and study limits of the potential BMPs selected for further evaluation. These potential BMPs are now ready for further analysis to determine project features, cost, and feasibility.

Documentation: Completed PID level Checklists SW-1, SW-2, SW-3

Project descriptions for potential BMPs (including maps of areas with potential impact)

Verification: The PE must verify that consensus is reached with internal/external stakeholders on the potential BMPs that will be addressed in the PID.

Regional Water Quality Control Board Meetings, WBS 150.10.05

Narrative: Consultation with the RWQCB, local regulatory agencies and MS4 Permit Holders is strongly recommended to coordinate project issues and develop consensus for controversial or complex storm water quality issues. The number of coordination meetings is dependent upon the complexity of the storm water quality issues, storm water pollutants involved, and project site constraints.

Responsible: PE and the District/Regional NPDES Storm Water Coordinator. The PE should consult with the District/Regional NPDES Storm Water Coordinator regarding the complexity of the project and the need to consult with the RWQCB at this early stage in the project.

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator (primary point of contact with the RWQCB)

RWQCB, MS4, and/or local agency representatives

Department of Fish and Game, if necessary

The Army Corps of Engineers, if necessary

County Health Department, if necessary

Discussion Topics: Present Project Information

- Site Conditions
- Project Alternatives
- Consider Approved Treatment BMPs
- Implement Design Pollution Prevention BMPs
- Storm Water Quality Impacts and Issues
- Right-of-Way Impacts

Decisions/actions: Complete project alternatives

Identify preliminary site conditions and storm water concerns

Complete preliminary evaluation of permanent BMPs

Documentation: Meeting minutes

Verification: The PE must verify that all comments are recorded and resolved.

5.5.3 Analyze Project Alternatives / Select BMPs, WBS 150.15

Narrative: The purpose of this activity is to develop a general overview of the estimated costs for BMPs for different project alternatives. It is anticipated that a general discussion of each BMP alternative will be included for each project alternative that is presented in the PID. Thus, analysis of the project alternatives is required for this activity.

One of the variables considered when selecting a preferred project alternative may be the potential BMPs required for that alternative. Thus, it is anticipated that BMPs must be considered as early as possible. Costs developed in this activity will be used for programming purposes; consequently, the analysis should be of sufficient detail to identify all potential BMP costs.

Note: The Statewide Storm Water Quality Practice Guidelines (Guidelines) are the design reference for all storm water quality BMPs. Appendices A and B of this PPDG contains specific information on Design Pollution Prevention BMPs and Treatment BMPs, respectively.

As described in Section 4 of this document, a project may be exempt from implementation of approved Treatment BMPs based on the established criteria displayed in Figure 4-1. If a project is exempt from deploying Treatment BMPs, continue with the selection of Design Pollution Prevention BMPs. If it has been determined that a project is not exempt from incorporating Treatment BMPs, the feasibility of the approved Treatment BMPs must be considered. If no approved Treatment BMPs can be deployed within a specific project, then the PE, in consultation with the District/Regional NPDES Storm Water Coordinator, will prepare a technical report documenting why Treatment BMPs could not be incorporated into the project.

Responsible: Project Engineer

Recommended Participants:
- Project Manager
- Project Engineer
- District/Regional NPDES Storm Water Coordinator
- Hydraulics Representative
- District Landscape Architect or Project Landscape Architect
- Geotechnical Representative
- Environmental Branch for coordination

- Coordination through the Environmental Branch includes NPDES review as part of the environmental process.

Maintenance Storm Water Coordinator

District Materials Engineer

Discussion Topics: Discuss Checklists and Decision Trees DPP-1 and T-1 (all Decision Trees and Checklists are located in Appendix E). These Decision Trees and Checklists are used for guidance in selecting Design Pollution Prevention and Treatment BMPs. The following is a description of each Design Checklist and Decision Tree.

- **Checklist and Decision Tree DPP-1, Design Pollution Prevention BMPs**

  All projects must incorporate certain minimum design elements with respect to water quality. The design goals for the Design Pollution Prevention BMPs include the following:

  – Minimize Impervious Surfaces: The intent of this goal is to reduce the volume of runoff.

  – Prevent Downstream Erosion: Storm water drainage systems will be designed to avoid causing or contributing to downstream erosion.

  – Stabilize Disturbed Soil Areas: Disturbed soil areas will be appropriately stabilized to prevent erosion.

  – Maximize Vegetated Surfaces: Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from storm water.

  Part 1 of Checklist DPP-1 is a list of questions that will help the PE determine which Design Pollution Prevention BMPs to consider. Once Part 1 is completed, the PE can refer to Parts 2 – 5 for design questions regarding the specific Design Pollution Prevention BMPs. Decision Tree DPP-1 is to be used in conjunction with Checklist DPP-1, and is used to identify which Design Pollution Prevention BMPs to consider.

- **Checklist and Decision Tree T-1, Treatment BMPs.**

  The design goals for the Treatment BMPs include the following:

  Part 1 of the checklist provides guidance on which Treatment BMPs to consider. Once Part 1 is completed, the PE can refer to Parts 2 – 7 for design questions regarding the specific Treatment BMPs. Decision Tree T-1 is to be used in conjunction with Checklist T-1 and is used to identify which Treatment BMPs to consider.

Other discussion topics include:

- General overview of estimated scope and cost for BMP deployments for different project alternatives;
- The location of permanent BMPs;
- Every SWPPP project is required to include separate bid items for Construction Site BMPs. See Appendix D for the most current Standard Special Provisions (SSP) web site;
- Acquisition of right-of-way, considered for funding allocation;
- Initiate Geotechnical Report, Materials Report and Drainage Report; and
- Determine quantities for BMPs, if possible. If quantities cannot be estimated at the PID stage, planning-level cost information (provided in Appendix F) is to be included in the PID to reference BMPs and their anticipated costs.

Decisions/actions: Establish project scope, cost, and feasibility for presentation in the PID and programming.

Determine all potentially feasible BMPs.

Documentation: Checklists DPP-1 and T-1

Preliminary Project Cost Estimate (PPCE), see Section 5.5.4

Preliminary Geotechnical Report

A final report on materials and geotechnical issues is not required at this stage, but a draft report would be appropriate

Preliminary SWDR

Verification: District/Regional NPDES Storm Water Coordinator or other designated person must verify documentation

5.5.4 Prepare Preliminary Project Cost Estimates, WBS 150.15.55

Narrative: A preliminary cost estimate is a required attachment for most PIDs. Because the PID cost estimate will most likely be used as the current PPCE, the importance of a reliable estimate at this stage cannot be overemphasized. The PPCE form to be filled out is located in Appendix L and Appendix AA of the PDPM, 7/1/99. It is the initial base against which following estimates are measured and has extremely high visibility. Chapter 20 of the PDPM provides guidance on the current method of cost estimating, the responsibilities of staff and functional units. Appendix F of this document provides greater detail on methods for cost estimating in order to include storm water BMPs as part of the overall project cost.

Responsible: Project Engineer

Recommended Participants:
- Project Manager
- Project Engineer
- Hydraulics Representative
- Environmental Engineering Representative
- Environmental Planning Representative
- District/Regional NPDES Storm Water Coordinator
- Construction Storm Water Coordinator
- Maintenance Storm Water Coordinator
- District Landscape Architect or Project Landscape Architect

Discussion Topics:
- Bid data from similar projects
- Sampling and Analysis Plans
- Potential Construction Site BMPs to be incorporated into the project.
- Sensitive Environments (such as 303(d) listed water bodies)
- Highway Planting contracts
- Supplemental funds
- Costs for SWPPP or WPCP development and implementation
- Costs for potential permanent storm water BMPs
- Available cost options (i.e., historical sample projects, percent of total project costs (see Appendix F)

Decisions/actions:
- Prepare, revise and update project cost estimates.
- Incorporate new or revised cost data from functional units in project cost estimate.
- Provide revised or updated current cost estimates and their respective dates for inclusion in the project management data base in a timely manner.
- Complete the PPCE

Documentation: Completed PPCE

Verification: The following functional units shall verify the completed PPCE:
- NPDES
- Landscape
- Hydraulics

Environmental

Maintenance

Construction

5.6 DOCUMENTATION REQUIRED FOR PROJECT INITIATION DOCUMENT

This section describes the documents necessary for completion of a PID.

Prepare and Approve PID, WBS 150.25

Narrative: The overall purpose of a PID is to develop a purpose and need statement that solves a transportation problem. Areas under consideration are right-of-way needs, environmental impacts, accurate cost estimates and required scheduling. As mentioned earlier, the PSR is the most common PID. Preparation guidelines of the PSR are included in Chapters 2 and 3 of Appendix L of the PDPM, 7/1/99. These guidelines are available on-line at http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm

The purpose of this section is to ensure that storm water quality issues are identified, and that all appropriate BMPs are being considered in the PID.

This activity includes all tasks required to develop the PID text and exhibits, as well as the effort required to circulate, review and update the PID (includes appropriate "constructibility review" for project initiation process). This activity also includes development and approval of any required design exceptions and/or a Federal Highway Administration (FHWA) access modification request. This WBS also includes the development and approval of any supplemental PIDs.

Responsible: Functional Manager overseeing preparation of the PID. The final PID is submitted to the Division Chiefs. The PE is required to route for signature and approval of PID.

Recommended Participants: Project Manager

Division Chiefs

Project Engineer

Contents: The following should be included in the PID package. Also refer to the PDPM, Appendix L, for the format and contents required.

- A brief discussion of the applicable storm water treatment goals;
- Descriptions of the anticipated permanent and Construction Site BMPs including their anticipated cost estimates;
- Exemption Documentation Form;

- General Overview of the Treatment BMPs considered by each viable alternative (i.e., infiltration basins, detention basins and/or traction sand traps where appropriate). That description shall include the anticipated location and size of any detention/infiltration basins and traction sand traps. See Appendix L of the PDPM, page L-25 No. 4, Alternatives (7/1/99);
- A summary of the engineering features for each alternative used to satisfy storm water pollution prevention measures described in Section 2;
- PEAR – The PE shall include a copy of the PEAR that identifies potentially significant project-related storm water quality impacts and assesses the need for a full SWQA technical document.
- Right-of-Way Data Sheet. The PE shall also identify the additional right-of-way and consider costs needed to satisfy storm water treatment;
- SWDR;
- Storm Water Checklists SW-1, SW-2, and SW-3 can be attached to the SWDR as supporting information.

Documentation: The PID package includes a copy of the PID, PEAR, Right-of-Way Data sheets, Advanced Planning Study (APS), the PPCE, and the SWDR. Incorporate "Storm Water Pollution Prevention Discussion (under "Considerations" heading) of planning document. See the "Summary Process for Storm Water Activities for PID" in Appendix E.

Verification: The following Division Chiefs shall approve the completed PID:

- The Functional Manager responsible for production of the PID;
- Program/Project Manager.

The District Division Chiefs are responsible for approving the project's scope, schedule, and cost within these established guidelines, and may exercise engineering judgment and flexibility in approving the PID. PIDs are to be approved by the District Director after review by the Division Chiefs, Functional Manager and the PDT.

Project Managers are to endorse the decision by "Approval Recommended By" or "Approved By" where such authority has been delegated.

The SWDR should be signed by the PE, the District/Regional Design Storm Water Coordinator, the designated Landscape Representative, the designated Maintenance Representative, and approved by the PM to verify that storm water quality design issues have been addressed, and the data is complete, current, and accurate.

This activity is complete with the approval and distribution of the PID.

6.1 INTRODUCTION AND OBJECTIVES

The purpose of this section is to provide a consistent approach in the Project Approval/Environmental Document (PA/ED) process as it relates to incorporating storm water Design Pollution Prevention, Treatment, and Construction Site Best Management Practices (BMPs) into a project. The PA/ED process results in a Project Report (PR). Instructions for preparing PRs are provided in Appendix K, "Preparation Guidelines for Project Reports" of the Project Development Procedures Manual (PDPM). The described process has been incorporated directly from Appendix K of the PDPM and is to be used only as a supplement to the PDPM.

This section references the Work Breakdown Structure (WBS) codes, the Storm Water Data Report (SWDR), checklists and decision trees as they relate to the PA/ED process. WBS codes are provided in Appendix E for specific storm water related tasks during the PA/ED process. These codes are organized as a process form, which is titled "Summary Process for Storm Water Activities for the PA/ED." These codes follow the "Guide to Caltrans Capital Work Breakdown Structure – Release 5.1" document. The SWDR, its corresponding checklists and decision trees are described both in this section and in Section 5 of this document and are included in Appendix E. These can be used for guidance in selecting BMPs for inclusion in the PA/ED process.

6.2 PROJECT APPROVAL/ENVIRONMENTAL DOCUMENT

The purpose of the PA/ED is to summarize the studies of the scope, cost, and overall environmental impact of alternatives so that the decision maker can make an informed decision about whether or not to proceed with the project, and also select appropriate Design Pollution Prevention, Treatment, and Construction Site BMPs.

The objective of a PA/ED process is to clearly refine the design concept and design scope of the project alternatives listed in the Project Initiation Document (PID), and to obtain the necessary environmental documents. As mentioned earlier, the PA/ED results in a PR. For a complete list of PRs, see the PDPM, Chapter 12, Section 4 (7/1/99). PIDs and PRs require similar information, acquired at different points in time. The PID is preliminary in nature and does not benefit from knowledge acquired from detailed environmental studies. When preparing a PR, appropriate PID data should be updated prior to its insertion in the PR; appropriate data from the environmental studies should be included.

The water quality goal of the PA/ED phase is to utilize updated and more detailed engineering and environmental data to continue the BMP selection process that was initiated during the PID process. The design team should also review the BMPs previously identified to determine whether they are still appropriate and whether they represent the best application of the BMPs approved for statewide use. The PE should investigate whether new storm water BMPs were approved for statewide use subsequent to the approval of the PID.

Specific objectives of the PA/ED process are listed as follows:

- Review and update project scope in the PID;

- Refine scope, estimate and Project Development Resources;
- Prior to initiating the environmental studies, prepare geometric plans and right-of-way maps in greater detail to identify the areas of potential effects;
- Begin the environmental studies to prepare and process the appropriate environmental document(s) and permits for the project;
- Complete detailed environmental and engineering studies for project alternatives;
- Select the preferred alternative and further define storm water pollution impacts. Chapter 12 of the PDPM describes the project development policies and procedures for selecting and approving the preferred alternative and for project approvals. Selection of the preferred alternative authorizes the completion of the PR for project approval;
- Develop General Cost Estimate for potential BMPs to be incorporated into the project;
- Initiate and complete PR after environmental studies and costs estimates are completed;
- Continue coordinating the project with the Regional Water Quality Control Board (RWQCB) and local agencies; and
- Obtain and review the Storm Water Quality Assessment (SWQA), if required. The information presented in the SWQA will be utilized by Caltrans Design, Construction and Maintenance staff to develop and implement specific BMPs to mitigate any potential water quality impacts associated with storm water discharges from the proposed project.

6.3 PROJECT APPROVAL/ENVIRONMENTAL DOCUMENT PROCESS

The PA/ED process is generally initiated after the PID is approved, and the project is programmed. It is intended to obtain management approval of a selected preferred alternative project, identify right-of-way acquisition needs, further define costs, and develop the necessary environmental documents, in accordance with the California Environmental Quality Act and National Environmental Policy Act (CEQA/NEPA).

A SWQA is prepared by the Environmental Unit if the Preliminary Environmental Assessment Report (PEAR), completed during the PID process, identifies that more detailed technical study of storm water quality issues is necessary. The SWQA would typically be a technical appendix to the CEQA/NEPA document.

The SWQA provides a thorough and detailed analysis of the potential for a project to result in a significant storm water quality impact. In general, the SWQA will identify applicable storm water regulations affecting the project, receiving water bodies and their beneficial uses, existing water quality, project-related storm water discharges and quality, and potential storm water impacts to water quality of receiving waters.

During the PA/ED process, the PE should coordinate with Environmental Unit staff to identify potential storm water impacts associated with the project. The PE should update the SWDR based on the detailed information provided in the SWQA, and as appropriate, incorporate Design Pollution Prevention and Treatment BMPs.

If the PEAR determines that a SWQA is not required, the PE should incorporate the BMPs as outlined in Section 2.4 using data gathered during PID process.

Figure 6-1 illustrates the overall primary task categories for the PA/ED process. Included in the flow chart are WBS codes for each task. Appendix E includes the form titled "Summary Process for Storm Water Activities for the PA/ED" that provides a step-by-step process of the tasks described in this section.

The following sub-sections correspond to the task categories provided in Figure 6-1 and the PA/ED process summary form in Appendix E. Additional information is provided on the following pages detailing the recommended participants, discussion and decision topics, documentation, and verifications for each task to obtain final PID approval and funding for a project.

6.4 PROJECT MANAGEMENT / COORDINATION

This section describes the primary task categories involved with project management and the coordination during the PA/ED process needed to obtain consensus between the different functional units and the RWQCB regarding storm water issues.

Initiate Kickoff Meeting, WBS 100.10

Narrative: The initial kickoff meeting is initiated by the PM to review and discuss the PID. This is particularly important for projects that have been on hold. Major scope changes may require a supplemental or new PID.

Responsible: Project Manager

Recommended Participants: Project Manager

Project Engineer

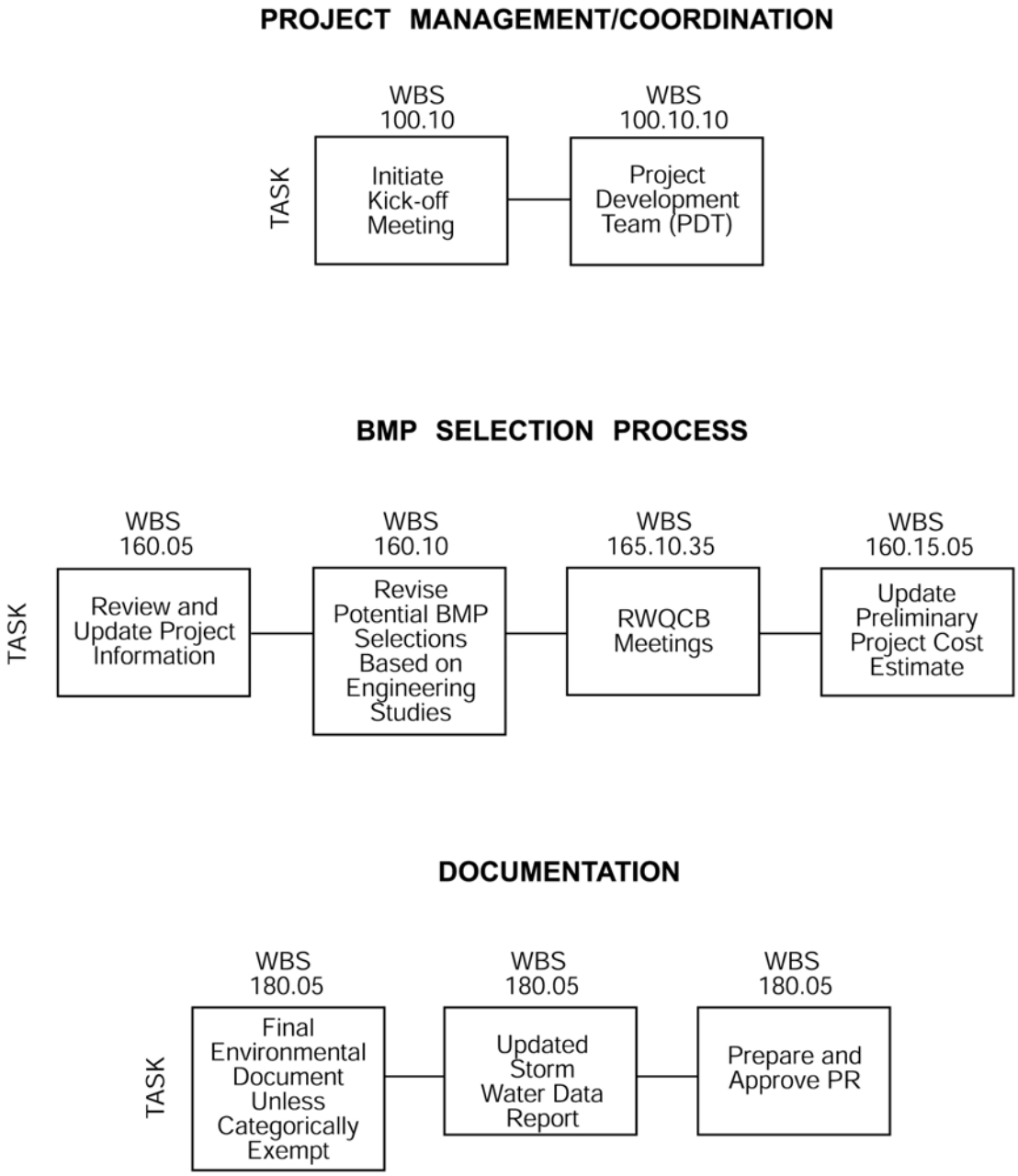
District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator

Appropriate functional units

Environmental Engineering Representative

Environmental Planning Representative

Figure 6-1: Project Approval/Environmental Document - Storm Water Task Categories



Discussion Topics: Project Definition**:** Review PID. Refine type of project, scope, and schedule.

Review the Preliminary Project Cost Estimate (PPCE).

Environmental Studies: Determine status of the Environmental Document.

Right-of-way requirements.

Right-of-entry requirements.

Decisions/actions: Determine additional functional units to be involved.

Determine if right-of-way concerns have changed since the PID process.

Confirm PID is still valid. If not, a supplemental or new PID will be needed.

Initiate the PR.

Documentation: Meeting Minutes

Initial PR

Verification: Project Development Team (PDT) verifies that the PID is still valid.

Project Development Team, WBS 100.10.10

Narrative: The PDT has the responsibility to direct and evaluate the project studies to determine if any project rescoping is needed, and to develop new alternatives, if required. When consensus is reached, the PDT determines the appropriate level of environmental evaluation. If an environmental document is required, the PDT directs its preparation. The PDPM, Chapter 8, Section 4, provides a thorough description of the PDT and its functions.

Responsible: Project Manager

Recommended Participants: Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

Design Storm Water Manager or Coordinator

District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative

Environmental Planning Representative

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

Right-of-Way Representative

Hydraulics Representative

District Materials Engineer

Geotechnical Representative

Traffic Representative

All Districts are not organized the same and some of the suggested PDT members may have different titles depending upon the District in which the project is located. The PE should consult with the specific Regional

Work Plan (RWP) to obtain the contacts listed in this section or the equivalent title or function in the District.

Discussion Topics: The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units. The following storm water quality issues should be discussed:

- Viable alternatives for projects including location and alignments;
- Potential Design Pollution Prevention BMPs;
- Consider approved Treatment BMPs;
- Environmental issues;
- Site conditions and design constraints, including Construction Site and Maintenance BMPs;
- Storm water quality BMP design criteria;
- Water quality volume and flow;
- Permanent BMP Locations: Identifying right-of-way impacts, utility conflicts and geotechnical issues;
- Landscape conflicts with conceptual plan;
- Permit requirements;
- Other agencies involved;
- BMPs to meet a prescribed Waste Load Allocation (WLA) and/or Total Maximum Daily Load (TMDL) for an impaired (303d listed) water body;
- Significant, unavoidable impacts to receiving waters;
- Mitigation measures prescribed by a Department of Fish & Game 1601 Streambed Alteration Agreement;
- Post Construction dewatering requirements. The RWQCB requires a separate Dewatering Permit under most conditions;
- Variance for lead contaminated soils, emphasizing the reuse of soils containing aerially deposited lead (ADL) due to vehicle emissions;
- Discharges of dredged or fill material into navigable waters (404 Permit/401 Certification);
- Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or potable water recharge facilities (i.e., High Risk Areas);
- Specific RWQCB requirements; and
- SWDR and SQWA, if required.

Decisions/actions: Tentatively select Design Pollution Prevention, Treatment and Construction Site BMPs for each project alternative.

Begin preliminary design of BMPs.

Determine necessary Environmental Documents (ED) and Permits.

Determine other agencies that should be involved.

Determine if an ED already exist. If not, the PDT initiates one.

Determine if project rescoping is necessary.

Update PR and ED

Document any decisions made during the PDT meetings.

Documentation: Meeting minutes

Updated PR and ED

Verification: The PE verifies that all documentation is completed

6.5 BMP SELECTION PROCESS

This section describes the primary task categories for the Design Pollution Prevention and Treatment BMP selection processes associated with the PA/ED process (see Figure 6-2). Refer to the "Construction Site BMPs Manual" handbook for information regarding the procedure for the Construction Site BMP identification process. There are three goals for the BMP identification process. They are: (1) to obtain consensus between the different functional units and the RWQCB regarding water quality issues; (2) to tentatively select Design Pollution Prevention and Treatment BMPs for each project alternative and incorporate them into the PA/ED, and (3) to provide sufficient information for the Plans, Specifications & Estimate (PS&E) process.

Review and Update Project Information, WBS 160.05

Narrative: Decisions for selecting the preferred project alternative, including the BMP alternatives, are the focus of the PA/ED process. Project alternatives, the Storm Water Data Report and Checklists SW-1, SW-2 and SW-3 that were initiated in the PID process are revisited and updated. The checklists should be updated continuously to provide documentation of storm water quality issues and decisions.

Responsible: Project Manager

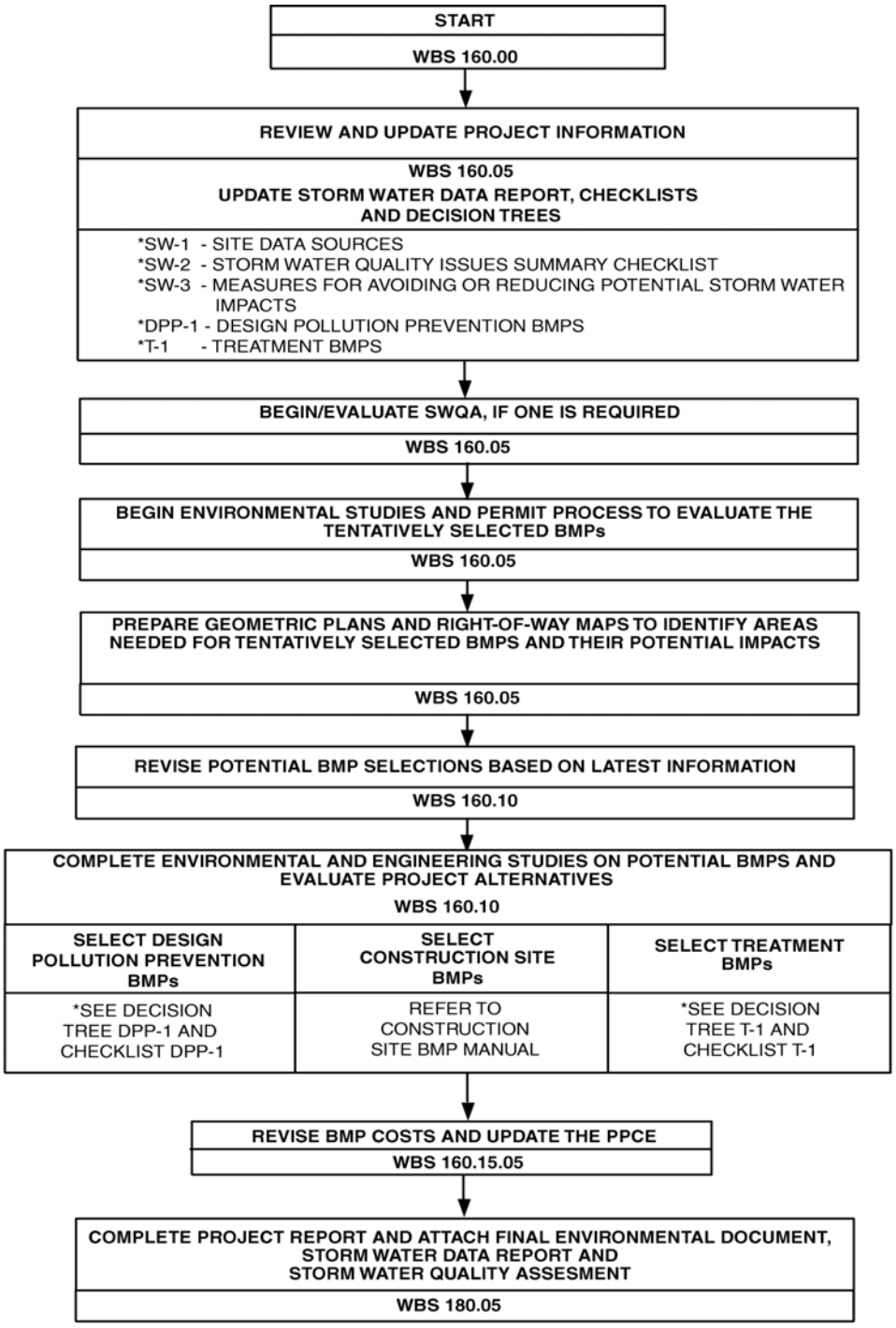
Recommended Participants: Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

District Materials Engineer

2101 **Figure 6-2: Project Approval/Environmental Document – BMP Selection Process**



*Located in Appendix E

Discussion Topics: Review of the Checklists and Decision Trees DPP-1 and T-1 and the SWDR that were initiated in the PID process.

Storm water quality impacts for each project alternative identified in the SWQA, if available.

Project Exemption Documentation Form for Treatment BMPs.

Decisions/actions: Review Project Alternatives, SWDR, Checklists and Decision Trees DPP-1 and T-1, and the PPCE.

Review the Exemption Documentation Form. If the project was determined exempt from incorporating Treatment BMPs in the PID process, confirm that it is still exempt.

Evaluate potential storm water quality impacts and options for avoiding or reducing these impacts for the various project alternatives:

- Update Checklist SW-1, Site Data Sources;
- Update Checklist SW-2, Storm Water Quality Issues Summary; and
- Update Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.

Prepare SWQA (if required).

Perform Field Review of the area.

Determine if the scope has changed since the PID and if so, how storm water quality issues are affected.

Begin environmental studies and permit process to evaluate the tentatively selected BMPs.

Evaluate project for types of storm water quality impacts.

Based on the SWDR, checklists and the SWQA (if required), evaluate Design Pollution Prevention, Treatment and Construction Site BMP applications.

Materials Unit to update materials information and provide other information, such a side slope recommendations, wetland locations, slide locations, etc.

Prepare Geometric Plans and Right-of-way maps to identify areas needed for tentatively selected BMPs and their potential impacts.

Documentation: Updated SWDR and Checklists SW-1, SW-2 and SW-3.

Exemption Documentation Form.

A final report on materials and geotechnical issues is still not required at this stage, but an updated draft report would be appropriate.

Verification: The PE verifies that all documentation is completed.

Revise BMP Selections Based on Engineering Studies, WBS 160.10

Narrative: Final decisions are made in regard to alternatives, costs, location, alignments, etc. Potential storm water BMPs that were identified during the PID process are developed in more detail through additional technical studies in the PA/ED process. The costs of the potential BMPs should be estimated and prepared in accordance with Appendix F.

Responsible: Project Engineer

Recommended Participants:
- Project Manager
- Project Engineer
- District/Regional NPDES Storm Water Coordinator
- Design Storm Water Manager or Coordinator
- District Landscape Architect or Project Landscape Architect
- Environmental Engineering Representative
- Environmental Planning Representative
- Construction Storm Water Coordinator
- Maintenance Storm Water Coordinator
- Right-of-Way Representative
- Hydraulics Representative
- District Materials Engineer
- Geotechnical Representative
- Traffic Representative

Discussion topics:
- Engineering studies and checklists
- Environmental impacts of proposed BMPs
- Potential permanent BMPs
- Construction Site BMPs

Decisions/actions:
- Revise the preferred project alternative(s) and the tentative selection of potential BMPs to be incorporated into the project.
- Review engineering studies and completed storm water checklists.
- Complete environmental and engineering studies on potential BMPs and evaluate project alternatives.
- Review potential BMP selections, evaluating the pros and cons of each, including the potential concerns of permitting entities.
- Review the SWQA and the SWDR to evaluate potential environmental impacts, and how those impacts are addressed during BMP selection and design.

Identify anticipated Construction Site BMPs.

Documentation: Descriptions of project alternatives, including those under consideration, those withdrawn from consideration and the "no-action" alternative. Describe tentative BMP strategies for the project alternatives under consideration. These descriptions will be the basis for the "Description of Alternatives" section of the environmental document.

Updated Checklists DPP-1, parts 1 through 5, and T-1, parts 1 through 7, for selecting BMPs at specific sites.

Updated SWDR.

Verification: PDT verifies the preferred project alternative(s) and preferred BMP selection(s) are feasible. The District/Regional NPDES Storm Water Coordinator must be in concurrence on BMP feasibility.

Regional Water Quality Control Board Meetings, 165.10.35

Narrative: Consultation with the RWQCB, local regulatory agencies and Municipal Separate Storm Sewer System (MS4) Permit Holders is strongly recommended to coordinate project issues and develop consensus for controversial or complex storm water quality issues. The number of coordination meetings is dependent upon the complexity of the storm water quality issues, storm water pollutants involved, and project site constraints.

Responsible: Project Engineer and District/Regional NPDES Storm Water Coordinator

Recommended Participants: Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator (primary point of contact with the RWQCB)

Other regulatory agency representatives

Discussion Topics: Present Project Information

- Site Conditions;
- Project Alternatives;
- Potential Implementation of Approved BMPs;
- Storm Water Quality Impacts and Issues; and
- Right-of-way Impacts.

Decisions/actions: Determine preliminary site conditions and storm water concerns

Documentation: Meeting minutes

Verification: The PE must verify that all comments are recorded and resolved.

Update Preliminary Project Cost Estimate, WBS 160.15.05

Narrative: The PR cost estimate is prepared as part of the project approval process. This generally occurs after completion of the public hearing, selection of the preferred project alternative, and completion of the environmental document.

The PR cost estimate is prepared using the same format as used for the other project planning cost estimates (see Appendix AA of the PDPM, 7/1/99 for current methods of cost estimating). However, since the initial preferred alternative(s) has been selected, the project cost estimate can now be more definitive.

Cost estimates for storm water BMP alternatives can now also be more definitive. The PPCE for the BMP alternatives are now updated to provide a more detailed cost estimate in helping to select the preferred BMP alternative. Appendix F in this document provides greater detail on methods for cost estimating to include storm water BMPs as part of the overall project cost.

Responsible: Project Engineer

Recommended Participants:
- Project Manager
- Project Engineer
- Hydraulics Representative
- Environmental Engineering Representative
- Environmental Planning Representative
- District/Regional NPDES Storm Water Coordinator
- Construction Storm Water Coordinator
- Maintenance Storm Water Coordinator
- District Landscape Architect or Project Landscape Architect
- Right-of-Way Representative

Discussion Topics: PPCE developed during the PID process.

Bid data from actual projects

Sampling and Analysis Plans

Temporary items listed and the costs for SWPPP or WPCP development and implementation.

Sensitive Environments

Highway Planting contracts

Supplemental funds

Costs for a SWPPP or WPCP

Costs for potential alternative storm water BMPs

Available cost options (see Appendix F)

Decisions/actions: Update and refine PPCE

Documentation: Completed PPCE

Verification: The following functional units shall verify the completed PPCE:

NPDES

Landscape

Hydraulics

Environmental

Maintenance

Right-of-Way

6.6 DOCUMENTATION REQUIRED FOR PROJECT APPROVAL/ENVIRONMENTAL DOCUMENT

This section describes the documents necessary for completion of a PA/ED package.

Prepare and Approve PR, WBS 180.05

Narrative: The purpose of the PR is to recommend approval of the selected preferred project alternative. Preparation Guidelines for a PR are included in Appendix K of the PDPM (7/1/99). The PID contained basic project data necessary for programming the project. These data have now been updated with the information that was developed during the environmental studies and included in the PR. The PR summarizes the studies of the scope, cost and overall impact of alternatives so that the decision maker can make an informed decision of whether or not to continue into the PS&E process.

Responsible: The final PR is submitted to the Division Chiefs by the Functional Manager responsible for production of the PR.

Recommended Participants: Project Manager

Division Chiefs

Contents: The following should be included in the PR. Also refer to the PDPM, Appendix K, 7/1/99, for the format, outline and contents.

- Final Environmental Document (FED) or CE if required;
- SWQA, if required;
- Updated SWDR. Checklists can be attached as supporting information;
- Exemption Documentation Form;
- Right-of-Way Data Sheet;
- Discussion of storm water quality issues under "Other Consideration.";
- PPCE;
- Description of project alternatives; and
- Recommendation for approval of the project.

Documentation: The PA/ED package includes a copy of the PR, the SWQA (if required) the SWDR, the FED or CE, the Exemption Documentation Form, Right-of-Way Data Sheets, and the PPCE.

Verification: The following Division Chiefs shall approve the completed PR:

- The Functional Manager of PA/ED Production;
- The Program/Project Management; and
- The Functional Manager responsible for the next phase, which is the PS&E process.

The SWDR should be signed by the PE, District/Regional Design Storm Water Coordinator, the designated Landscape Representative, the designated Maintenance Representative, and approved by the PM to verify that storm water quality design issues have been addressed, and the data is complete, current and accurate.

The Caltrans District Division Chiefs are responsible for approving the project's scope, schedule, and cost within these established guidelines, and may exercise engineering judgment and flexibility in approving the PA/ED document. PA/EDs are to be approved by the District Director after review by Division Chiefs, Functional Managers and the PDT.

Project Managers are to endorse the decision by "Approval Recommended By" or "Approved By" where such authority has been delegated.

7.1 INTRODUCTION AND OBJECTIVES

The purpose of this section is to provide a consistent approach in the Plans, Specifications and Estimates (PS&E) process as it relates to incorporating storm water Design Pollution Prevention, Treatment, and Construction Site Best Management Practices (BMPs) into a project. This section has been incorporated directly from Chapter 14 of the Project Development Procedures Manual (PDPM), (7/1//99) and is to be used only as a supplement to the PDPM.

This section references the Work Breakdown Structure (WBS) codes, the Storm Water Data Report (SWDR), checklists and decision trees as they relate to the PS&E process. WBS codes are provided in Appendix E for specific storm water related tasks during the PS&E process. These codes are organized as a process form, which is titled "Summary Process for Storm Water Activities for PS&E." These codes follow the "Guide to Caltrans Capital Work Breakdown Structure – Release 5.1" document. The SWDR, its corresponding checklists and decision trees are described in Sections 5 and 6 and are included in Appendix E. These can be used for guidance in selecting BMPs for inclusion in the PS&E process.

7.2 PLANS, SPECIFICATIONS & ESTIMATES PROCESS

The purpose of the PS&E is for eventual contract advertising and bidding on a project. The PS&E process is generally initiated after the Project Report (PR) approval. Base maps, plan sheets, accurate cost estimates and specifications are developed for the selected preferred project alternative including selected BMPs within the project limits. The objective of this section is to present how storm water quality issues are addressed within the overall PS&E process by the District functional unit personnel.

Figure 7-1 illustrates the primary task categories for the PS&E process. The "Summary Process for Storm Water Activities for PS&E" form in Appendix E provides a step-by-step process of these tasks.

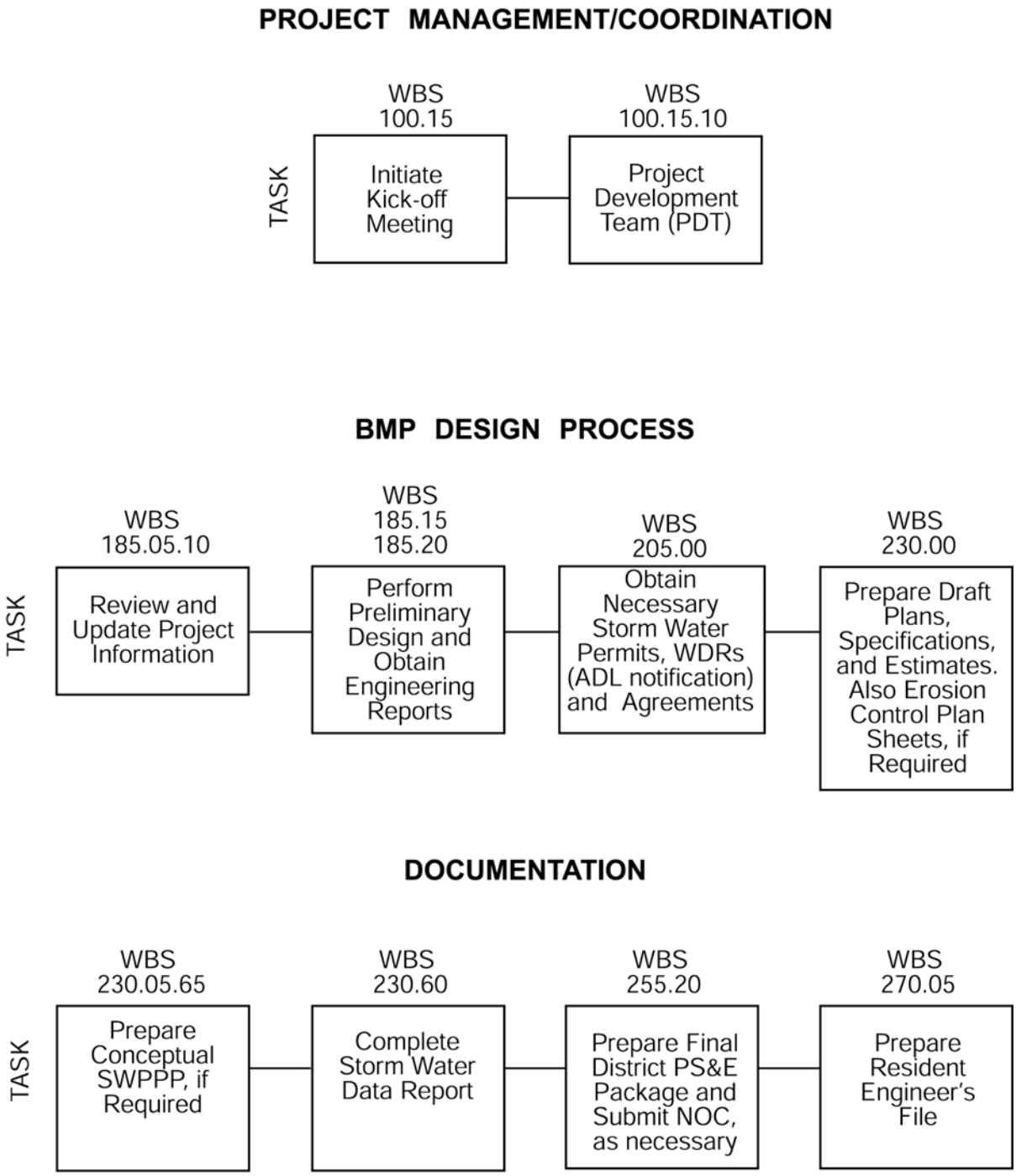
The following sub-sections correspond to the task categories provided in Figure 7-1 and the PS&E process summary form in Appendix E. Additional information is provided on the following pages detailing the recommended participants, discussion and decision topics, documentation and verifications for each task to develop the final PS&E package.

7.2.1 Conceptual Storm Water Pollution Prevention Plans and Water Pollution Control Plans

The designer may elect to prepare a Conceptual Storm Water Pollution Prevention Plan (CSWPPP) for a project. The CSWPPP will provide additional direction and convey specific BMP expectations to the contractor. However, the CSWPPP shall not be considered a complete SWPPP, and shall not replace the contractor's SWPPP, since CSWPPPs are prepared assuming standard construction practices, and may not reflect the contractor's actual methods of construction, access requirements, or project phases.

The designer may also elect to provide Water Pollution Control Plans showing the locations of critical Construction Site BMPs. Construction Site BMPs designated as critical must be deployed by the contractor to provide a minimal level of protection at specific locations within a project. The purpose of these Water Pollution Control Plans is to identify the deployment of critical Construction Site BMPs such as contractor staging areas, locations for concrete washouts, designated locations for storage of materials, etc. The Water Pollution Control Plans should be included as part of any Conceptual Storm Water Pollution Prevention Plan (CSWPPP) if provided, and as part of the contractor's Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Program (WPCP).

Figure 7-1: Plans, Specifications, and Estimates Document - Storm Water Task Categories



7.3 PROJECT MANAGEMENT/COORDINATION

This section describes the primary task categories involved with project management and the coordination in the PS&E process needed to obtain consensus between the different functional units as well as with the Regional Water Quality Control Board (RWQCB) regarding storm water quality issues and BMP deployment.

Initiate Kickoff Meeting, WBS 100.15

Narrative: The purpose of the initial kickoff meeting is to review the Project Initiation Document (PID) and the PR. It is the first step in the process of formally recognizing that the project should continue through the PS&E process.

Responsible: Project Manager (PM)

Recommended Participants:
- Project Manager
- Project Engineer (PE)
- District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator
- Appropriate functional units
- Environmental Engineering Representative
- Environmental Planning Representative

Discussion Topics:
- Data gathered during the PID and Project Approval/Environmental Document (PA/ED) process.
- Storm Water Quality Assessment (SWQA)
- SWDR and its corresponding checklists.

Decisions/actions:
- Determine if the project should continue into the PS&E process.
- Review PID and PR.
- Review the SWDR and its corresponding checklists.
- Coordinate Schedule.

Documentation: Meeting minutes

Verification: There is no verification required at this phase.

Project Development Team, WBS 100.15.10

Narrative: The Project Development Team (PDT) has the responsibility to direct and evaluate the project studies to determine if any project rescoping is

needed. The PDPM, Chapter 8, Section 4 (7/1/99) provides a thorough description of the PDT and its functions.

Responsible: Project Engineer

Recommended Participants:
Project Engineer
District/Regional NPDES Storm Water Coordinator
Design Storm Water Manager or Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative
Environmental Planning Representative
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
Right-of-Way Representative
Hydraulics Representative
District Materials Engineer
Geotechnical Representative
Traffic Representative

All Districts are not organized the same and some of the suggested PDT members may have different titles depending upon which District the project is located. The PE should consult with the specific Regional Work Plan (RWP) to obtain the contacts listed in this section or the equivalent title or function in the District.

Discussion Topics: Engineering Reports that must be prepared by different functional units of the PDT. This requires the functional units to develop project design reports needed to establish design parameters and complete design. Those related to storm water quality issues are:

- Hydrology and Hydraulic Reports;
- Geotechnical Design Report;
- Materials Report;
- Environmental Document (ED) (Completed during PA/ED process); and
- SWQA.

Decisions/actions: Update data gathered in the PID and PA/ED processes. Update Checklists SW-1, SW-2 and SW-3.

Review Geometric Base Maps - The appropriate functional unit in the PDT should identify problems that are easier to correct at early stages of

design and to establish a foundation for skeleton layouts. Comments from Maintenance, Hydraulics, Landscape Architecture, Structures (to determine railroad involvement and easement requirements) and Traffic are particularly useful.

Documentation: Checklists

Meeting minutes

Any decisions made during PDT meetings should be documented.

Verification: The PE verifies that all documentation is completed.

7.4 BMP DESIGN PROCESS

Figure 7-2 is a flowchart outlining the BMP design process. This section describes the primary task categories listed in this flowchart.

Review and Update Project Information, WBS 185.05.10

Narrative: Project design requires the continuous review and update of data from the PID and PA/ED processes. During the PA/ED process, a preferred project alternative was selected. The SWDR and checklists that were initiated in the PID and PA/ED are revisited and updated to further define the storm water quality issues. The checklists should continue to be used to provide documentation of these storm water quality issues and decisions. A field review should have also been completed during the PID and PA/ED processes as well. Continue to arrange site investigations and screening for Treatment BMPs as needed.

Responsible: Project Engineer

Recommended Participants: Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

Environmental Unit and other appropriate functional units

Discussion Topics: The SWDR and Checklists SW-1, SW-2, and SW-3 that were initiated in the PID and updated in the PA/ED.

Project Scope

Storm water impacts

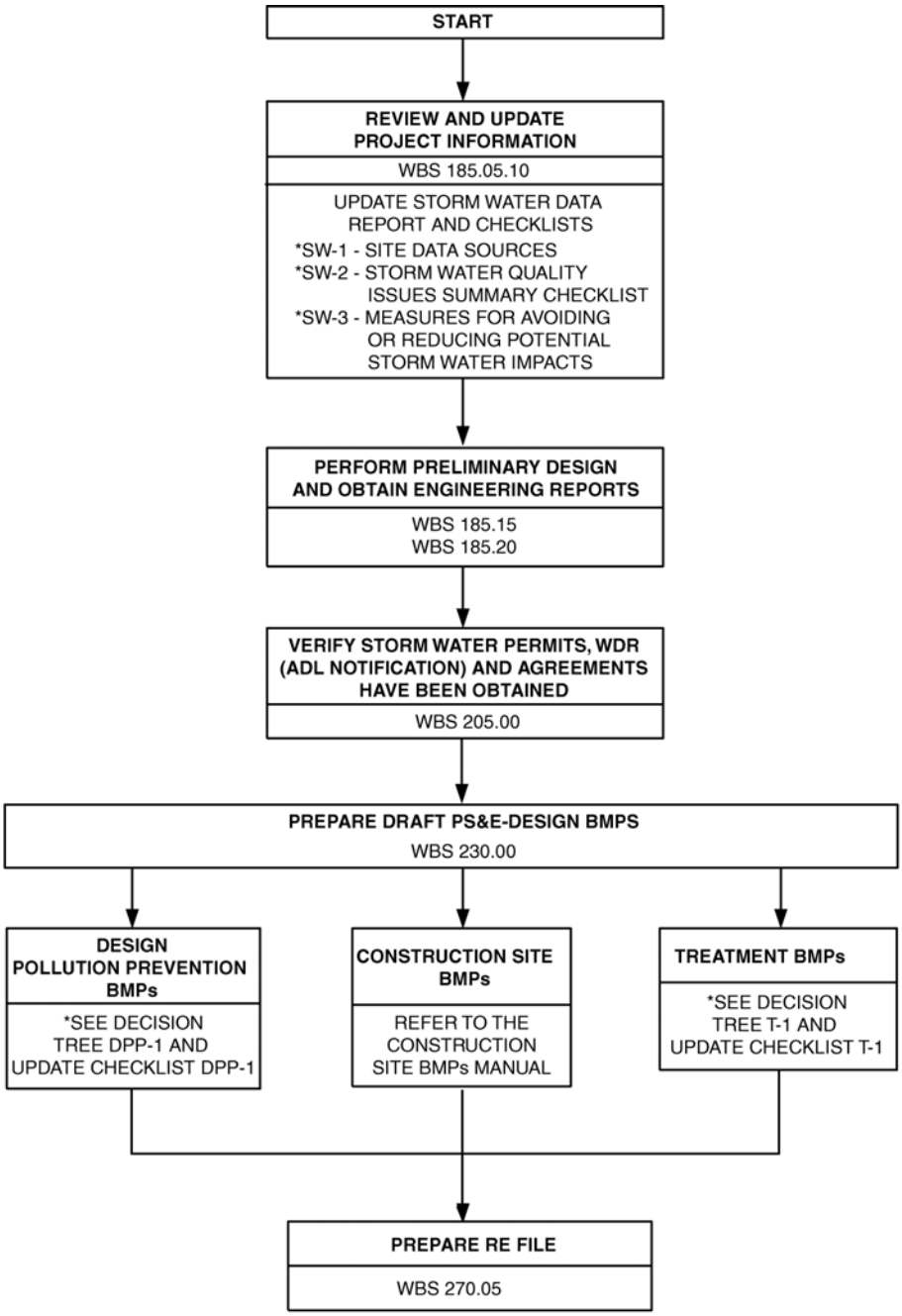
BMP deployment strategy plus siting and design criteria

Preliminary Project Cost Estimate (PPCE)

Design surveys and photogrammatic mapping

Utilities

Figure 7-2: BMP Design Process Flowchart



* Located in Appendix E.

Screening for Treatment BMP installations

Site investigations for design of Treatment BMPs

Necessary Permits and Agreements (i.e., 1601, 1604, 404/401)

Decisions/actions: Review the SWDR and Checklists SW-1, SW-2, and SW-3 that were initiated in the PID and updated in the PA/ED.

Review selected project alternative.

Determine if the project scope has changed since the PA/ED and, if so, how storm water quality issues are affected.

Evaluate project for types of storm water impacts.

Evaluate BMP applications plus design and siting criteria.

PPCE: Determine if the budget has changed since the PA/ED and if so, how storm water quality issues are affected.

Obtain updated design surveys and photogrammatic mapping.

Coordinate necessary agreements, permits, or actions.

Coordinate Utilities - Work involves identification, potholing, protection, removal and/or relocation of utility facilities as necessary to clear and certify right-of-way for deployment of storm water BMPs.

Complete site investigations and screening for Treatment BMP installations.

Documentation: N/A

Verification: There are no verifications required at this phase.

Perform Preliminary Design, WBS 185.15

Narrative: Many projects have revisions that may affect the project scope, length and description. Before starting detailed design, the project data should be updated to reflect the selected project alternative and selected BMPs within the project limits, as well as other revisions that may have occurred.

Responsible: Project Engineer

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

Design Storm Water Manager or Coordinator

District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative

Environmental Planning Representative
Maintenance Storm Water Coordinator
Right-of-Way Representative
Hydraulics Representative
District Materials Engineer
Geotechnical Representative
Traffic Representative

Discussion Topics: Preferred selected alternative from the PA/ED

Applicable storm water regulations

Decisions/actions: Analyze horizontal and vertical alignments, site data and storm water data, including depth to groundwater, infiltration rates, available right-of way, soils, utilities. etc. Much of the data are included in the Checklists SW-1, SW-2, SW-3, DPP-1 and T-1.

Review any changes to storm water regulations that may affect the project.

Perform or request additional field investigations as required.

Analyze any existing drawings, reports, checklists.

Update the SWDR, as needed.

Review the PA/ED. Determine if the preferred selected BMP alternative in the PA/ED is still valid.

Documentation: SWDR

Verification: The PE verifies that all documentation is completed.

PE and District/Regional NPDES Storm Water Coordinator to verify that selected BMP alternative is still valid.

Obtain Engineering Reports, WBS 185.20

Narrative: Several engineering reports must be prepared. This involves various functional units to develop project design reports needed to establish design parameters and complete design.

Responsible: Project Engineer

Recommended Participants: Project Manager
Project Engineer
District/Regional NPDES Storm Water Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative
Hydraulics Representative

District Materials Engineer
Right-of-Way Representative
Geotechnical Representative

Discussion Topics: Reports required and the information contained within those reports (e.g., site data, site investigations, soil analysis, vegetation, contamination, right-of-way, right-of-entry, discharge conditions, high risk areas, storm water drainage before and after construction, water bodies, vegetation issues, depth to groundwater, infiltration rates, etc.).

Decisions/actions: The functional units begin preparing the previously mentioned engineering reports as applicable.

Documentation: Hydrology and Hydraulic Report
Geotechnical Design Report
Materials Report

Verification: PE and District/Regional NPDES Storm Water Coordinator to verify that required storm water reports are prepared.

Each functional unit verifies that the project issues pertained to their functional specialty have been completely addressed.

Obtain Necessary Storm Water Permits, WDRs and Agreements, WBS 205.00

Narrative: This activity involves all work involved in obtaining permits. This work includes: Filing the Notification of Construction (NOC) for coverage under the Caltrans Permit and the General Permit; determining other necessary permits or agreements; discussions and negotiations with the permitting agencies, especially in regards to dewatering and other known discharges; preparation of the permit and attachments such as exhibits, maps, etc.; obtaining funds for any required permit fee; and submitting the permit application. Send notification to RWQCB regarding the reuse of soil containing aerially deposited lead (ADL). Consultation with the RWQCB, local regulatory agencies and Municipal Separate Storm Sewer System (MS4) Permit Holders is strongly recommended to coordinate project issues and develop consensus for controversial or complex storm water quality issues.

Responsible: Project Engineer

Recommended Participants: Project Engineer
District/Regional NPDES Storm Water Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative
Engineering Planning Representative

Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
Right-of-Way Representative
Geotechnical Representative

Discussion Topics: Significant, unavoidable impacts to receiving waters.

BMPs to meet a prescribed Waste Load Allocation (WLA) and Total Maximum Daily Load (TMDL) for an impaired 303(d) listed water body.

Mitigation measures prescribed by a Department of Fish & Game 1601 Streambed Alteration Agreement.

Dewatering requirements. The RWQCB requires a separate dewatering permit under most conditions.

Variance for lead-contaminated soils, emphasizing the reuse of soils containing ADL due to vehicle emissions.

Discharges of dredged or fill material into navigable waters (404 Permit/401 Certification).

Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or potable water recharge facilities (i.e., High Risk Areas).

Specific RWQCB requirements.

Potential impacts of unique maintenance activities or known discharges.

Decisions/actions: Obtain required permits and agreements. These permits may include but are not limited to the following:

U.S. Army Corps of Engineer Permit (404)
U.S. Coast Guard Permit
Department of Fish & Game (1601/1603)
Coastal Development Permit
U.S. Fish and Wildlife Service approval
RWQCB Permit (401)
National Marine Fisheries Permit

Other permits and agreements: Bay Conservation and Development Commission (BCDC) permit, Tahoe Regional Planning Agency (TRPA) permit, and flood control District permits.

Documentation: Permit Applications
Request for funding permit fee
Completed permits

Verification: Environmental Branch obtains the 401, 404, 1601, etc.

Completed Permits.

PE, District/Regional NPDES Storm Water Coordinator and District Environmental Office verify that required storm water permits are identified and obtained.

Prepare Draft Plans, Specifications and Estimates, WBS 230.00

Narrative: The main activities in producing a draft set of plans are the completion of geometric base maps, the submittal of structure site data, the submittal of right-of-way maps, and the circulation of skeleton layouts. The PE's responsibilities during the design process are to; prepare quality plans that meet Caltrans standards, practices, and policies; include storm water BMPs into the project; prepare project and BMP cost estimates and monitor costs to keep the project within budget; utilize available resources to maintain project schedules; monitor the project scope to ensure consistency with previous approvals; and inform the PM of any cost, scope, or schedule changes that may be required for the project.

Responsible: Project Engineer

Recommended Participants: Project Engineer

District/Regional NPDES Storm Water Coordinator

Design Storm Water Manager or Coordinator

District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

Right-of-Way Representative

Hydraulics Representative

District Materials Engineer

Geotechnical Representative

Discussion Topics: Plans to be obtained from the functional units include the following:

Traffic – Draft Roadway Plans

Landscape – Highway Planting Plans

Utility – Utility Relocation Plans

Hydraulics – Drainage Plans

Right-of-Way

Discuss drainage area information about the project site in order to select, locate, and design appropriate storm water BMPs. This is extremely important information during the PS&E.

Decisions/actions: Review storm water related activities to consider during project design, and complete the process form "Summary Process for Storm Water Activities for PS&E" found in Appendix E.

Review Checklist DPP-1 and determine Design Pollution Prevention BMPs.

Review Checklist T-1 and design Treatment BMPs.

Design Construction Site BMPs:

- See Storm Water Quality Handbook – Construction Site Best Management Practices Manual for additional guidance;
- North Region Design and Engineering Services Storm Water Quality Links (http://nrdesign/swmp) contains links to resources for developing a Storm Water Pollution Prevention Plan (SWPPP), a Water Pollution Control Program (WPCP), and storm water quality information to be included in the Information Handout. It is important to note that the PE is not responsible for preparing a Conceptual SWPPP (CSWPPP) for every project. The PE must provide tabular data identifying anticipated Construction Site BMP items and quantities, and provide the available Standard Special Provisions (SSPs) for those items;
- Include Erosion Control Plan Sheets, at discretion of Districts. These are developed by the Landscape Architect;
- Provide required documentation of quantities and deployment of Construction Site BMPs. Districts will need to determine what documentation is required; and
- Include rainy season data - The average rainfall in California varies greatly from region to region. To account for the various rainfall patterns (i.e., time frame, intensities, and amounts) the state is separated into several rainy seasons. These rainy seasons are used to identify the appropriate level of soil stabilization and sediment control protection.

Prepare Standard Special Provisions – More information can be obtained from the Web site located at:
http://www.dot.ca.gov/hq/esc/oe/specs_html/index.html

Identify physical attributes of site drainage areas that may affect the selection, siting, and design of BMPs (use Table 7-1). Attributes with an * in Table 7-1 are optional depending on the particular controls being considered for application. Required data can be gathered first, leaving optional data for later in the design process when the specific BMP is selected.

Table 7-1: Drainage Area Attributes and Their Effect on Storm Water BMPs

Attribute	Information Source	Effect on Design and Use of BMPs
Tributary Drainage Area Size	Topographic Maps Grading Plans Aerial Photos Survey Data	Used to select suitable Treatment BMPs and size them. Also used to determine need for and the design of stabilized conveyance systems, interception ditches, biofiltration swales, and to establish the need for energy dissipators.
Slopes	Vicinity Map Aerial Photographs Field Reconnaissance Contour Grading Plan	Used to identify slopes that require controls to prevent erosion. Limits use of certain controls on or adjacent to slopes.
Site permeability (runoff coefficients)	Aerial Photographs Satellite Imagery Field Reconnaissance Geographic Information Systems (GIS) Map Geotechnical Design Report	Used to determine runoff flows and therefore sizing of many controls. The percentage of the drainage area covered by pavement, buildings, concrete, or other impermeable materials significantly affects the size of controls.
Soil Texture and Saturated Soil Infiltration Rate *	Materials Report Geotechnical Design Report Natural Resources Conservation Service (NRCS) Soil Survey	Used to size the surface area of infiltration devices.
Depth to Seasonal High Groundwater *	Well Records Geotechnical Design Report Environmental Site Investigation for Hazardous Wastes	Limits use of infiltration at sites with shallow groundwater tables. In areas with shallow groundwater tables consider detention basins.
Existing Vegetation/Ground Cover *	Aerial Photographs Field Reconnaissance Landscape Record Drawings GIS Map Satellite Imagery	Used to identify drainage areas with significant amounts of unstabilized soil, which limits use of infiltration and retention basins. Infiltration basins can be used in areas where there is unstabilized soil, but it may require soil stabilization (vegetation or mechanical), and/or preceding forebays for the basins.

* These data are necessary only if Treatment BMPs (i.e., infiltration or detention basins) are being considered.

If infiltration or detention basins are being considered, then data regarding soil texture and saturated soil infiltration rate may be determined from a Soil Survey report. Aerial photographs and Geographic Information Systems (GIS) maps may provide information regarding the identification of drainage areas with significant amounts of unstabilized soil.

Documentation: From Traffic - Roadway Plans, WBS 230.05 – Includes all activities, from base maps (skeletons), such as design, delineation, field reviews, and internal/external coordination necessary to develop draft roadway plan sheets for the construction contract.

Conceptual Storm Water Pollution Prevention Plan and Water Pollution Control Plan Sheets

From Landscape - Highway Planting Plans, WBS 230.10 – All activities (such as design, field reviews, delineation, and internal/external coordination) necessary to develop highway planting plan sheets for construction contract.

From Utilities - Utility Relocation Plans, WBS 230.25.10

From Hydraulics - Draft Drainage Plans, WBS 230.30

Geometric Base Maps – A preferred alternative was selected during the PR approval process and must now be refined to produce geometric base maps, typical sections, and profiles. Preferably, the development of alternatives was performed using controlled aerial mapping, which can easily be transformed into geometric base maps. The geometric base maps must show existing topography and proposed engineering features. Accurate mapping is needed for all subsequent design activities, such as right-of-way needs, designing drainage facilities, etc.

Verification: PE, Hydraulics, Geotechnical, Structural and other appropriate members of the PDT verify that plans are being developed per Caltrans standards and that all necessary information is included in the plans.

Prepare Draft Specifications, WBS 230.35

Narrative: These activities are necessary to develop the project draft Standard Special Provisions (SSPs). SSPs must be incorporated into PS&E for all projects to ensure that the contract documents clearly set forth the contractor's responsibilities with respect to preparation and implementation of either a SWPPP or WPCP as required for the project.

Responsible: Project Engineer

Recommended Participants:

Project Manager
Project Engineer
Hydraulics Engineer
Environmental Engineering Representative
Environmental Planning Representative
District/Regional NPDES Storm Water Coordinator
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
District Landscape Architect or Project Landscape Architect

Discussion Topics: SSPs to make sure the most recent ones are being used.

CSWPPP. The PE is not responsible for preparing a Conceptual SWPPP for every project. The PE must provide tabular data identifying anticipated Construction Site BMP items and quantities, and provide the available SSPs and if available, include details and estimate codes for those items.

Decisions/actions: Complete Specifications.

Review the specifications to make sure they are complete and that they match the cost estimates and the plans.

Documentation: Standard Specifications including the following:

From Hydraulics – Hydraulic Specifications, WBS 230.35.30

From Landscape - Highway Planting Specifications, WBS 230.35.10

Water Pollution Control Specifications, WBS 230.35.35

Erosion Control Specifications, WBS 230.35.40

Verification: PE confirms that the Specifications are complete and are consistent with the cost estimate and plans.

Prepare Draft Estimates, WBS 230.40

Narrative: Project design cost estimates are initiated after the PR approval and are updated until completion of the PS&E process. These estimates are categorized as either preliminary or final. Project design cost estimates focus on the construction costs of the project and the storm water BMPs, and are input into the Basic Engineering Estimating System (BEES). BEES has two components: (1) the District Cost Estimate, and (2) Structures (Bridge) Cost Estimate, that, when combined, equal the total construction cost for the project. See Appendix AA of the PDPM, 7/1/99 for current methods of cost estimating.

Project design cost estimates, including storm water BMPs, should be considerably more detailed than project planning cost estimates. As engineering and environmental studies progress, more information, such as final contour mapping, materials and drainage information, and structure studies, becomes available. These data increase the ability to prepare a more detailed cost estimate. Appendix F of this document provides greater detail on methods for cost estimating to include storm water BMPs as part of the overall project cost.

Responsible: Project Engineer

Recommended Participants: Project Manager

Project Engineer

	Hydraulics Engineer
	Environmental Engineering Representative
	Environmental Planning Representative
	District/Regional NPDES Storm Water Coordinator
	Construction Storm Water Coordinator
	Maintenance Storm Water Coordinator
	District Landscape Architect or Project Landscape Architect
Discussion Topics:	Storm water related quantities and estimates
Decisions/actions:	PPCE developed during the PA/ED process.
	Calculate Drainage Quantities and Estimate, WBS 230.40.15
	Calculate Water Pollution Control Quantities and Estimate, WBS 230.40.35
	Calculate Erosion Control Quantities and Estimate, WBS 230.40
	Update quantities and estimates
	Costs for storm water BMPs
	Available cost options (see Appendix F)
Documentation:	Summary of Quantities
Verification:	The following functional units shall verify the completed Cost Estimate:
	NPDES
	Landscape
	Hydraulics
	Environmental
	Maintenance

7.5 DOCUMENTATION REQUIRED FOR PLANS, SPECIFICATIONS & ESTIMATES PACKAGE

This section describes the documents necessary for completion of a PS&E package. Preparation guidelines for the PS&E submittal are included in the PDPM, Chapter 14 (7/1/99). The PE works with the District Office Engineer to prepare the PS&E package. The following is a list of the storm water documentation items included in the PS&E package.

Storm Water Data Report, WBS 230.60

The SWDR is updated and completed. Checklists SW-1, SW-2 and SW-3 can be attached to the SWDR as supporting information. This report is to be included in the final PS&E package.

Final District PS&E, WBS 255.20

Narrative: The PS&E is submitted to the Office Engineer for most projects. Guidance to PS&E submittal and documentation is located in the PDPM, Chapter 14, Section 3, dated 7/1/99.

Responsible: The final PS&E is submitted to the Division Chiefs by the Functional Manager overseeing the production of the PS&E.

Recommended Participants:

Division Chiefs

PE

PM

District/Regional NPDES Storm Water Coordinator

Other functional units as required.

Contents: The following should be included in the PS&E package. Also refer to the PDPM Chapter 14, 7/1/99, for the format and contents required.

- Final Standard Plans, including Water Pollution Control Plan Sheets identifying critical Construction Site BMPs. Some Districts have adopted policies or procedures requiring designers to incorporate Construction Site BMPs into bidding information materials or into the PS&E;
- Advanced Planning Study;
- Quantities and Estimates;
- Right-of-Way Data Sheets;
- Copy of NOC, WDR and other permits;
- SWDR - finalized and completed. It is optional to include completed checklists as backup and supportive information. Copy to Resident Engineer (RE) File;
- SSPs must be incorporated into PS&E for all projects, to ensure that the contract documents clearly set forth the contractor's responsibilities with respect to preparation and implementation of the SWPPP or WPCP as required for the project;
- Layout sheets showing locations and limits for the BMPs identified in the PS&E; and
- A brief explanation of both the permanent and Construction Site BMPs that will be specified;

Contents: The PS&E package should include copies of the final plans, quantities and estimates, Right-of-Way data sheets, updated SWDR, SSPs, copies of

permits, and any additional information the designer feels is necessary for the contractor to bid the project accurately.

Verification: District/Regional NPDES Storm Water Coordinator or other designated person verifies the PS&E package is complete, in relation to storm water quality, with appropriate documentation and signatures on the SWDR.

The SWDR should be signed by the PE, District/Regional Design Storm Water Coordinator, designated Landscape Representative and designated Maintenance Representative. Approval is recommended by the PM to verify that storm water quality design issues have been addressed, and the data is complete, current, and accurate.

The full PS&E package is circulated throughout the District to the functional units for comments and questions to make sure that each functional unit agrees with the package. After circulation and changes have been made, the PS&E goes to Headquarters (HQ) for final reviews before it is advertised for bidders. HQ will either approve, make changes, or discuss with the District to make sure the project is "biddable" and "buildable."

Resident Engineer's File, WBS 270.05

This work involves preparing the District RE File/Structures RE File. It includes contacts with construction to transmit the file and determine what additional information may be required. Place information regarding storm water quality issues in the RE File. See Section 8.1, Table 8-1 for a typical list of information to be included in the RE File.

8.1 INFORMATION FOR THE CONSTRUCTION PHASE OF THE PROJECT

The Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Permit requires a Storm Water Pollution Prevention Plan (SWPPP) for every project that requires a Notification of Construction (NOC). Specifically, a SWPPP is required when one of the following conditions exist:

- The project involves 2 hectares (5 acres) or more of soil disturbance;
- The project involves less than 2 hectares (5 acres) of soil disturbance but is considered part of a Common Plan of Development (see Section 4.2, Step #7); or
- The Regional Water Quality Control Board (RWQCB) designates the project as requiring a SWPPP based upon water quality concerns, even if the project does not meet the preceding requirements.

All projects that do not require a SWPPP must have a Water Pollution Control Program (WPCP). The purpose of both the SWPPP and the WPCP is to identify construction/contractor activities that could discharge pollutants in storm water, and provide descriptions of measures or practices to control these pollutants. Both the SWPPP and the WPCP are the responsibility of the contractor to prepare, although the designer may elect to prepare a Conceptual SWPPP under certain circumstances (See the SWPPP and WPCP Preparation Manual, November 2000, Section 2.1.3).

In order to provide information for contractors to both bid on projects and prepare the SWPPP/WPCP, the design staff must supply certain water quality-related information. This information is incorporated into the Resident Engineer (RE) File (reference the Project Development Procedures Manual, Chapter 15, Section 2 and Section 7.5 of this manual) and may be included into the contractor's Information Handout. This information is in addition to any Construction Site Best Management Practices (BMPs) identified during the Plans, Specifications and Estimates (PS&E) process, and included in the plans and specifications.

Typical water quality information that must be in the RE File and may be included in the Information Handout is listed in Table 8-1.

Table 8-1: Water Quality Information to be Included in the Resident Engineer File and/or Information Handout

• Vicinity map of the project area.
• Soils/geotechnical report, project materials report and/or other reports for description of soils types, nature of fill materials and known buried hazardous or toxic materials.
• List of pre-construction (existing) control practices.
• List of and/or narrative description of permanent (post-construction) storm water control measures.
• Layout sheets showing locations and limits for the Construction Site BMPs identified in the PS&E.
• A brief explanation of permanent and Construction Site BMPs. The explanation shall identify locations for BMP deployment and substantiate the quantity estimates (may be in tabular format).
• Copy of drainage report or other documentation for identifying flow patterns and tributary areas.
• Construction site estimates such as area calculations, runoff coefficients and pervious area calculations.
• Copy of the submitted NOC for the project.
• Copy of any WDR or permits
• Any additional information the designer determines is necessary for the contractor to bid the project accurately and implement BMPs during the construction of the project.

Most of the information listed in Table 8-1 may be taken directly from the Storm Water Data Report (SWDR). **<u>However, the SWDR itself should not be provided to the contractors, as it is not appropriate to justify design decisions or provide construction cost estimates to the contractor.</u>** The following sub-sections provide a description of the items listed in Table 8-1 and where to collect them.

8.1.1 Vicinity Map of the Project Area

Provide a vicinity map extending approximately 400 meters (one-quarter mile) beyond the property boundaries of the construction site showing: the construction site, surface water bodies (including known springs and wetlands), known wells, an outline of off-site drainage areas that discharge into the construction site, general topography, and the anticipated discharge location(s) where the construction site's storm water discharges to a municipal storm drain system or other water body. It is recommended that a U.S. Geological Survey (USGS) quadrangle map be used for showing the project site and a 400 meters (one-quarter mile) extension beyond the property boundaries of the construction site. USGS maps display much of the required information; however, the map will need to be slightly modified to show anticipated drainage paths (onto and off the construction site) and construction site boundaries.

The following are additional recommended items that should be provided on the vicinity map:

- Legend;
- Measurement of the construction site area;
- Flow directions of nearby creeks, streams, and rivers; and
- North arrow and Scale.

8.1.2 Soils/Geotechnical Report, Project Materials Report and/or Other Reports

Toxic History of the Site*:* To the extent information is available from the soils/geotechnical report, include the project materials report, site investigation report developed by the Hazardous Waste Section, or other regulatory or environmental compliance documentation. Include any Waste Discharge Requirements (WDRs) issued from the RWQCB related to toxic materials.

The Nature of Fill Material and Existing Data Describing the Soil: Include a copy of the project materials report (geotechnical report). The Information Handout package must describe the conditions of the fill material and the soil that can be found at the construction site (i.e., types of soils, groundwater location and conditions, dewatering operations that may be necessary, etc.) A general description can usually be found in the project materials report or geotechnical report. Fill material should be described as whether it is native or non-native, contaminated or uncontaminated, and its coverage technique (i.e., native soil coverage, asphalt or concrete coverage, and/or landscape).

Show and/or describe existing site features that, as a result of known past usage, may contribute pollutants to storm water (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, or leaked onto the construction site.) Review the contract documents and associated environmental documents to determine the known site contaminants.

8.1.3 Pre-Construction (Existing) Control Practices

Provide written descriptions of existing pre-construction practices, if any, which are already in place to reduce sediment and other pollutants in storm water discharges. These permanent control practices may consist of rock slope protection, infiltration basins, detention basins, etc. If there are no pre-construction control practices, then this should be indicated. Existing features, structures, facilities, or practices that may be used by the contractor during construction should be clearly indicated. Conversely, if some or all may not be used, this likewise should be indicated (and consideration should be given to including such restrictions in the contract special provisions).

8.1.4 Permanent (Post-Construction) Storm Water Control Measures

Post-construction BMPs are permanent erosion and sediment control measures or Treatment BMPs that have been incorporated into the project plans. They include the minimization of land disturbance, minimization of impervious surfaces, treatment of storm water runoff using infiltration or detention devices, and appropriately designed and constructed energy dissipation

devices. Provide a list containing narrative descriptions of post-construction permanent BMPs that have been included in the project to reduce pollutants in storm water discharges after construction is completed. Narrative descriptions should also include Operation and Maintenance (O&M) procedures for the permanent BMPs, in which case the designer must coordinate with District Maintenance.

In some cases, these permanent BMPs will be designed to meet the requirements of other agencies, permit conditions, or other agreements. Any BMP to be included at the request of another agency should be discussed in the information presented in the RE File, and listed in the Information Handout. For example, if the Department of Fish & Game required the construction of a permanent detention basin, then this basin and its purpose would be described in this section. In addition, if a local agency were to require hard surfacing for the purpose of controlling erosion in a particular area, then the purposes and requirements of that agency would be described.

The following is sample post-construction requirements standard language, which could be included in the RE file.

> *"Post-construction (permanent) Best Management Practices (BMPs) have been designed by Caltrans District ___. The following list describes those permanent post-construction BMPs that have been incorporated into the project. Details describing the design of each of the BMPs listed can be found by referring to the plan sheet number listed to the right of the BMP. It is anticipated that the information provided is to be used by the construction contractor in the development of the SWPPP or WPCP for this project, but that no reduction in service life or operational characteristics shall be incurred to these BMPs by using them as temporary BMPs during the construction phase of the project.*

POST-CONSTRUCTION BMP	PLAN SHEET LOCATION(S)

> *Projects are covered under Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Permit, Order No. 99-06-DWQ, No. CAS000003, both during and after construction. The post-construction management plan, including BMP operating, maintenance and inspection procedures, are contained in the Caltrans Statewide Storm Water Management Plan (SWMP). Any additional requirements are described in the Caltrans District Regional Work Plan (RWP) submitted to the Regional Water Quality Control Board (RWQCB) that has jurisdiction over the project area.*

> *Short-term and long-term operation and maintenance of all post-construction (permanent) storm water pollution control BMPs constructed within the State right-of-way shall be funded by the District's Maintenance budget, unless other arrangements are made via a maintenance agreement. If such agreement has been entered into, a copy of the agreement is included in Appendix ___.*

Use the following paragraph only if needed:

Special operating, maintenance or inspection requirements for the project after construction have been developed by Caltrans District ___ and are shown in the Operation and Maintenance Plan dated _____, included in Appendix ___. The contact person for this maintenance plan is _____(Name and telephone number)_____."

8.1.5 Layout Sheets Showing Suggested Construction Site BMP Locations

The designer may elect to provide layout sheets showing the suggested locations of Construction Site BMPs. The purpose of these sheets is to show the contractor the designer's anticipated placement of Construction Site BMPs such as contractor staging areas, approximate location of concrete washouts, approximate locations for storage of materials, and preferred locations for vehicle and equipment maintenance. These are not intended to be highly detailed drawings. Typically, these layouts can be drawn on l:200 and l:500 scale drawings. Where multiple stages of construction are anticipated, the designer should use the stage construction sheets to show how deployment of the BMPs is expected to change over time. These locations and layouts will be, in most cases, subject to the contractor's phasing of the work and timing of operations. As a result, many of the suggested locations will be modified by the contractor in the SWPPP/WPCP. If provided, the layout sheet must also contain a disclaimer stating that the temporary BMP locations are suggested, and that the Contractor is ultimately responsible for developing a SWPPP that complies with the Permit. Additional information may be found in the "Caltrans Erosion Control Training for Designers" manual.

8.1.6 Explanation of Permanent BMPs Used as Temporary BMPs During Construction

The purpose of this section is to provide a brief explanation of the permanent BMPs that may be utilized to prevent pollutant discharges during construction. The designer should identify both existing permanent BMPs within the project limits, and any new permanent BMPs that could be constructed as a first order of work for use as a temporary BMP during construction. An example of this may be the deployment of a treatment basin as a first order of work to treat construction site discharges. All requirements listed in this section should be included in the contract special provisions.

8.1.7 Drainage Information

Include a copy of the drainage information, such as the drainage report, hydrology maps, delineation of drainage boundaries, concentrations of runoff, and runoff coefficients sufficient to determine peak discharges or run-on flowcharts.

8.1.8 Construction Site Estimates

Provide the following information to the RE File:

- An estimate of the construction site area in hectares (acres);
- An estimate of the percentage of the area of the construction site that is impervious (e.g., pavement, building, etc.) before and after construction;
- An estimate of the runoff coefficient of the construction site before and after construction (The form shown in Table 8-2 may be used to develop the necessary information for runoff coefficients. Tables 8-3 and 8-4 provide supporting information for the calculation of runoff coefficients.); and
- An estimate of the total disturbed area in hectares (acres).

Table 8-2: Computation Sheet for Determining Runoff Coefficients

Total Site Area	=	_____	(A)
Existing Site Conditions			
Impervious Site Area[1]	=	_____	(B)
Impervious Area Runoff Coefficient[2,4]	=	0.95	(C)
Pervious Site Area[3]	=	_____	(D)
Pervious Site Area Runoff Coefficient[4]	=	_____	(E)
Existing Site Area Runoff Coefficient = $\frac{(B \times C) + (D \times E)}{A}$	=	_____	(F)
Proposed Site Conditions (After Construction)			
Impervious Site Area[1]	=	_____	(G)
Impervious Site Runoff Coefficient[2,4]	=	0.95	(H)
Pervious Site Area[3]	=	_____	(I)
Pervious Site Area Runoff Coefficient[4]	=	_____	(J)
Proposed Site Area Runoff Coefficient = $\frac{(G \times H) + (I \times J)}{A}$	=	_____	(K)

Note: For sites with dissimilar drainage subareas, calculate the equivalent runoff coefficients for pervious and impervious areas by $C=(C_1A_1+C_2A_2+...+C_iA_i)/(A_1+A_2+....A_i)$ Refer to the HDM Section 819.2(1) for additional information.

[1] Includes paved areas, areas covered by buildings, and other impervious surfaces.
[2] Use 0.95 unless lower or higher runoff coefficients can be verified.
[3] Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.
[4] See Tables 8-3 and 8-4 for runoff coefficients.

Table 8-3: Runoff Coefficients for Undeveloped Areas Watershed Types

	Extreme	High	Normal	Low
Relief	0.28 -0.35 Steep, rugged terrain with average slopes above 30%	0.20 - 0.28 Hilly, with average slopes of 10 to 30%	0.14 -0.20 Rolling, with average slopes of 5 to 10%	0.08 - 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 - 0.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	0.08 - 0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	0.06 - 0.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	0.04 - 0.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	0.12 - 0.16 No effective plant cover, bare or very sparse cover	0.08 - 0.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	0.06 - 0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04 - 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	0.10 - 0.12 Negligible surface depression few and shallow; drainage-ways steep and small, no marshes	0.08 - 0.10 Low; well defined system of small drainageways; no ponds or marshes	0.06 - 0.08 Normal; considerable surface depression storage; lakes and basin marshes	0.04 - 0.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes

Reference: Caltrans Highway Design Manual, Section 819.2, Figure 819.2A, November 1, 2001

Example Determination of Runoff Coefficient for a watershed:

Given: An undeveloped watershed consisting of:
1) rolling terrain with average slopes of 5%,
2) clay type soils,
3) good grassland area, and
4) normal surface depressions.

Solution:

Relief	0.14
Soil Infiltration	0.08
Vegetal Cover	0.04
Surface Storage	0.06
C =	0.32

Find: The runoff coefficient, C, for the above watershed

Table 8-4: Runoff Coefficients for Developed Areas

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, Cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.25
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95

Reference: Caltrans Highway Design Manual, Section 819.2, Table 819.2B, November 1, 2001

8.1.9 Other Information

Include any other information that would explain the decisions or rationale behind the selection and deployment of both permanent and Construction Site BMPs chosen by the designer. Examples include the designer's estimated staging of the project and estimated time of year for those stages; any scheduling modifications included in the Order of Work specifications that were included to enhance water pollution control; and any specific BMP deployments that are considered to be critical to the success of the contractor's SWPPP/WPCP. The designer should verify that all requirements listed herein would be reflective of the contract special provisions.

Other Plans/Permits: Other agencies may have issued permits or have plan requirements for the construction of the project or imposed certain conditions. If so, a written description of the permit conditions and a copy of the permit must be provided for inclusion in an appendix to the SWPPP. For example, hazardous materials must be handled in accordance with specific laws and regulations and disposed of properly. If during the preparation of the PS&E, it is known that special permits for hazardous waste disposal are required, a written explanation must be provided

to the contractor to be incorporated within this section and it must be consistent with other specifications in the contract. In addition, information regarding other related permits such as California Department of Fish & Game or U.S. Army Corps of Engineers permits should also be included.

Information/Guidance for Maintenance Staff: Many of the permanent control measures will require ongoing inspection and maintenance once construction is completed and the project is operational. This information should include project-specific O&M procedures for the permanent BMPs. The design staff should assemble information to be included in the RE File to be turned over to District Maintenance upon project close-out.

8.2 CONCEPTUAL STORM WATER POLLUTION PREVENTION PLAN/WATER POLLUTION CONTROL PROGRAM

The Caltrans permit allows any RWQCB to request submission of a SWPPP up to 30 days prior to the start of construction. In order not to delay the start of construction, the District/Regional NPDES Coordinator should determine, through consultation with the local RWQCB, if the submittal of a "Conceptual SWPPP" (CSWPPP) would satisfy this requirement. In this case, the submission of the CSWPPP would be prior to the submittal of the PS&E package to the Office Engineer. This CSWPPP may be prepared by the District/Regional NPDES Storm Water Coordinator, the Project Engineer (PE), or by other designated personnel. If required, the Conceptual SWPPP should be developed and included with the Information Handout to the bidders. The District may also decide to develop a CSWPPP on any project for reasons other than a 30-day prior submittal request by a RWQCB.

The CSWPPP should contain all of the elements of a contractor prepared SWPPP, but it will not replace the contractor's SWPPP. The term conceptual is used because the designer does not know all aspects of the eventual contractor's actual methods of construction, access requirements, planned order of operations, or other items, processes, equipment, etc. that are under the purview and control of the contractor. When a CSWPPP has been prepared, the designer should make that information available to the contractor through the Construction Duty Senior and include the information in the RE File and in the Information Handout. The contractor may use the CSWPPP as a guide and reference tool to develop and submit the contract SWPPP.

8.3 PREPARATION AND SUBMITTAL OF THE NOTIFICATION OF CONSTRUCTION

The Permit requires that a NOC be submitted to the appropriate RWQCB for projects with a disturbed soil area (DSA) of at least 2 hectares (5 acres) of total land area. This NOC must be submitted at least 30 days prior to the start of construction. A copy of the NOC is contained in Attachment F of the SWPPP/WPCP Preparation Manual (this manual can be downloaded from the following web site: http://www.dot.ca.gov/hq/construc/stormwater.html). A copy of the NOC is included at the end of this section.

Designers should also be aware of the following information:

- The NOC form should be completed by the PE or Project Manager (PM), Environmental Unit or District/Regional NPDES Storm Water Coordinator, as determined by District procedure;
- The signed NOC shall be submitted to the appropriate RWQCB prior to advertisement and at a minimum of 30 days prior to construction. It is recommended that the NOC be submitted to the RWQCB when the PS&E package is transmitted to the Office Engineer;
- No filing fees are required to submit an NOC to the RWQCB;
- A signed copy of the NOC should be transmitted to the District Construction Division, and a copy should also be sent to the PE for the project file;
- At the time of the first submittal to the RWQCB, the District may elect to leave blank the information in Section IV, Construction Field Office, and resubmit a copy of the form with that information filled in at the time the RE is assigned, and the field office address and phone number are known. Alternatively, the District may wish to fill in a contact name of someone other than the RE, such as the Area Senior Construction Engineer or PM. This person will remain the contact for that project until the NOC is resubmitted with the new contact information, or until the Notification of Completion of Construction (NCC) is filed;
- In some cases, the RWQCB may deem two or more small projects (less than 2 hectares [5 acres] of soil disturbance) in the same corridor as part of a larger Common Plan of Development. The PM should be aware of other projects in the corridor. If needed, the other projects may be mentioned in the NOC;
- Caltrans has applied for and received a variance from the Department of Toxic Substances Control for the reuse of some soils that can contain lead. The Caltrans permit requires written notification to the RWQCB at least 30 days prior to advertisement for bids for projects that involve soils subject to this variance. The PE is encouraged to submit the notification early in design as the RWQCB may take as long as 180 days to issue WDRs. This notification period will allow a determination by the RWQCB(s) of the need for development of WDRs or written conditional approvals by RWQCB staff; and
- For areas in Regions 6 and 7 below 1,200 meters (3,937 feet) in elevation, the following additional requirements apply: (1) The Department will notify the RWQCB staff of construction projects in these areas at least 30 days prior to the start of construction, (2) During the 30-day notification period, RWQCB staff may request to review the SWPPP or meet with the Department to discuss the project, and (3) If Board staff does not respond within the 30-day review period, then the Department can proceed with its construction activities.

NOTIFICATION OF CONSTRUCTION

IN COMPLIANCE WITH CALTRANS STATEWIDE NPDES STORM WATER PERMIT Order No. 99-06 DWQ, NPDES No. CAS000003

I. IDENTIFICATION-Attach Vicinity Map, ½ size copy of Title Sheet

Project	*Check One:* ☐First Submittal or ___Amendment No. __	*Contract Number* *EA*	*Date MM/DD/YY*
City(if applicable)	*County*	*Tentative Start Date*	*Tentative End Date*
Route	*Post Mile*	*Kilometer Post*	*Tentative Date SWPPP Available*

II. CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

☐Region 1, North Coast	Region 5, Central Valley	Region 6, Lahontan	☐Region 7, Colorado River
☐Region 2, San Francisco Bay	☐Sacramento	☐South Lake Tahoe	☐Region 8, Santa Ana
☐Region 3, Central Coast	☐Fresno	☐Victorville	☐Region 9, San Diego
☐Region 4, Los Angeles	☐Redding		

III. CALTRANS DISTRICT

Name/Number	*Project Contact*
Address	*Position Title*
City *Zip*	*Phone* ( )

IV. CONSTRUCTION FIELD OFFICE- Attach Location Map

Street Address	*Construction Contact*
Physical Location if Different than address above	*Position Title*
City *State* *Zip*	*Phone* ( )

V. CONSTRUCTION SITE INFORMATION

Description and Type of Work	
Additional related required approvals: ☐ *DTSC Variance* ☐ *CWA 404/401* ☐ *DFG 1601* ☐ *NPDES/WDRs* ☐ *Other* *Describe:*	
Total Construction Area: *Acres* *Hectares*	*Total Disturbed Area:* *Acres* *Hectares*
Receiving Water Name:	*Project In Or Adjacent to Receiving Water?:* ☐ *Yes* ☐ *No*
Project Discharges to?: ☐ *Groundwater Infiltration* *Basin Location:*	☐*Municipal/Other System Name:*

VI. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is true, accurate, and complete to the best of my knowledge and belief. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment of knowing violations.

Signature: _____ Date:

Print/Type Name: Title:

Appendix A
Approved Design Pollution Prevention BMPs

A.1 REQUIRED MINIMUM DESIGN ELEMENTS FOR STORM WATER CONTROL

The PE must consider, and as appropriate, incorporate certain Design Pollution Prevention Best Management Practices (BMPs) into a project to minimize impacts to water quality. These BMPs were developed in response to the three following design objectives:

- *Prevent Downstream Erosion:* Storm water drainage systems will be designed to avoid causing or contributing to downstream erosion;
- *Stabilize Disturbed Soil Areas:* Disturbed soil areas will be appropriately stabilized to prevent erosion after construction; and
- *Maximize Vegetated Surfaces Consistent with Existing Caltrans Policies:* Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from storm water.

The Design Pollution Prevention BMPs listed in Table A-1 and described in the following sections are designed to accomplish these objectives.

Table A-1: Design Pollution Prevention BMPS

Consideration of Downstream Effects Related to Potentially Increased Flow
Preservation of Existing Vegetation
Concentrated Flow Conveyance Systems
Ditches, Berms, Dikes and Swales
Overside Drains
Flared Culvert End Sections
Outlet Protection/Velocity Dissipation Devices
Slope/Surface Protection Systems
Vegetated Surfaces
Hard Surfaces

A.2 CONSIDERATION OF DOWNSTREAM EFFECTS RELATED TO POTENTIALLY INCREASED FLOW

Description:

Changes in the velocity or volume of runoff, the sediment load or other hydraulic changes from stream encroachments, crossings or realignment may affect downstream channel stability.

Caltrans will evaluate the effects on downstream channel stability and the applicability of the mitigation measures described under Implementation for this BMP.

Appropriate Applications:

During the design of both new and reconstructed facilities, Caltrans may include new road surfaces or additional surface paving to enhance the operational safety and functionality of the facility. The designer must also consider the effect of collecting and concentrating flows in roadside ditches, storm drain systems, or the effect of re-directing flows to treatment BMPs. Diversions or overflows from large storm events in these instances may create concentrated discharges in areas that have not historically received these flows.

Implementation:

If these changes result in an increased potential for downstream effects in channels, Caltrans will consider the following:

- Modifications to channel lining materials (both natural and man-made), including vegetation, geotextile mats, rock and riprap;
- Energy dissipation devices at culvert outlets;
- Smoothing the transition between culvert outlets/headwalls/wingwalls and channels to reduce turbulence and scour; and
- Incorporating detention facilities into designs to reduce peak discharges.

Caltrans will implement appropriate measures to ensure that runoff from Caltrans facilities will not significantly increase downstream effects.

A.3 PRESERVATION OF EXISTING VEGETATION

Description:

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

Appropriate Applications:

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

Implementation:

The following general steps should be taken to preserve existing vegetation:

- Identify and delineate in contract documents all vegetation to be retained;
- Delineate the areas to be preserved in the field prior to the start of soil-disturbing activities;

- Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling; and
- When removing vegetation, consider impacts (increased exposure or wind damage) to the adjacent vegetation that will be preserved.

A.4 CONCENTRATED FLOW CONVEYANCE SYSTEMS

Concentrated flow conveyance systems consist of permanent design measures that are used alone or in combination to intercept and divert surface flows, and convey and discharge concentrated flows with a minimum of soil erosion. Concentrated flow conveyance systems may be used both within Caltrans rights-of-way (on-site) and downstream outside Caltrans rights-of-way.

Ditches, Berms, Dikes and Swales

Description:

These are permanent devices typically used to intercept and direct surface runoff to an overside (or slope) drain or stabilized watercourse.

Appropriate Applications:

Ditches, berms, dikes and swales are typically implemented:

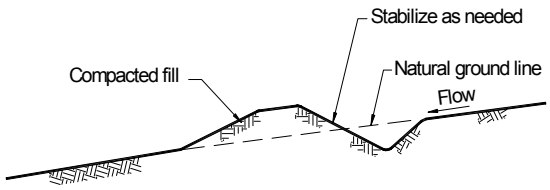
- At the top of slopes to divert run-on from adjacent slopes and areas;
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows;
- At other locations to convey runoff to overside drains, stabilized watercourses, and storm water drainage system inlets (catch basins), pipes and channels;
- To intercept runoff from paved surfaces; or
- Along roadways and facilities subject to flooding.

Implementation:

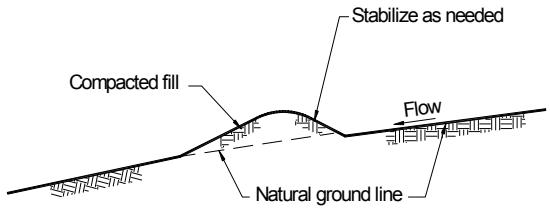
- Design must be in accordance with Chapter 800 of the Highway Design Manual (see Chapter 813, Topic 836 and Chapter 860);
- Select design flow and safety factors based on careful evaluation of risks due to erosion, overtopping, flow backups or washout;
- Consider outlet protection where localized scour is anticipated;
- Examine the site for run-on from off-site sources;
- Consider order of work provisions to install and utilize permanent dikes, swales and ditches early in the construction process;

- Conveyances must be lined when velocities exceed allowable limits for soil. Consider use of Rock Slope Protection (RSP), engineering fabric, vegetation, asphalt concrete or concrete;
- Riprap should not be used where there is a high probability that traction sand or abrasives may enter the channel; and
- Ditches, berms, dikes and swales are shown in Figure A-1.

Figure A-1: Ditches, Berms, Dikes and Swales



Conceptual Diversion Ditch/Drainage Swale
Not to Scale



Conceptual Diversion Dike/Berm
Not to Scale
Note: Actual layout determined by design.

Overside Drains

Description:

Overside drains are pipes, downdrains, flumes or asphalt concrete overside drains used to protect slopes against erosion by collecting surface runoff from the roadbed, the tops of cuts or from benches in cut or fill slopes, and conveying it down the slope to a stabilized drainage ditch or area.

Appropriate Applications:

Overside drains are typically used at sites where slopes may be eroded by surface runoff.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design manual (see Topic 834.4);
- Pipe downdrains are metal pipes adaptable to any slope. They are recommended where side slopes are 1:4 or steeper;
- Flume downdrains are rectangular corrugated metal flumes with a tapered entrance. They are best adapted for low flow rates on slopes that are 1:2 or flatter;
- Pipe and flume downdrains shall be securely anchored to the slope;
- Paved spillways are recommended on side slopes flatter than 1:4. On steeper slopes, a more positive type of overside drain (such as a pipe downdrain) should be used; and
- Drainage from benches in cut and fill slopes should be removed at intervals ranging from 100 to 150 meters.

An overside drain is shown in the Standard Plans, July 1999, Figure D87D, page 118.

Flared Culvert End Sections

Description:

These are devices typically placed at inlets and outlets of pipes and channels to improve the hydraulic operation, retain the embankment near pipe conveyances, and to help prevent scour and minimize erosion at these inlets and outlets.

Appropriate Applications:

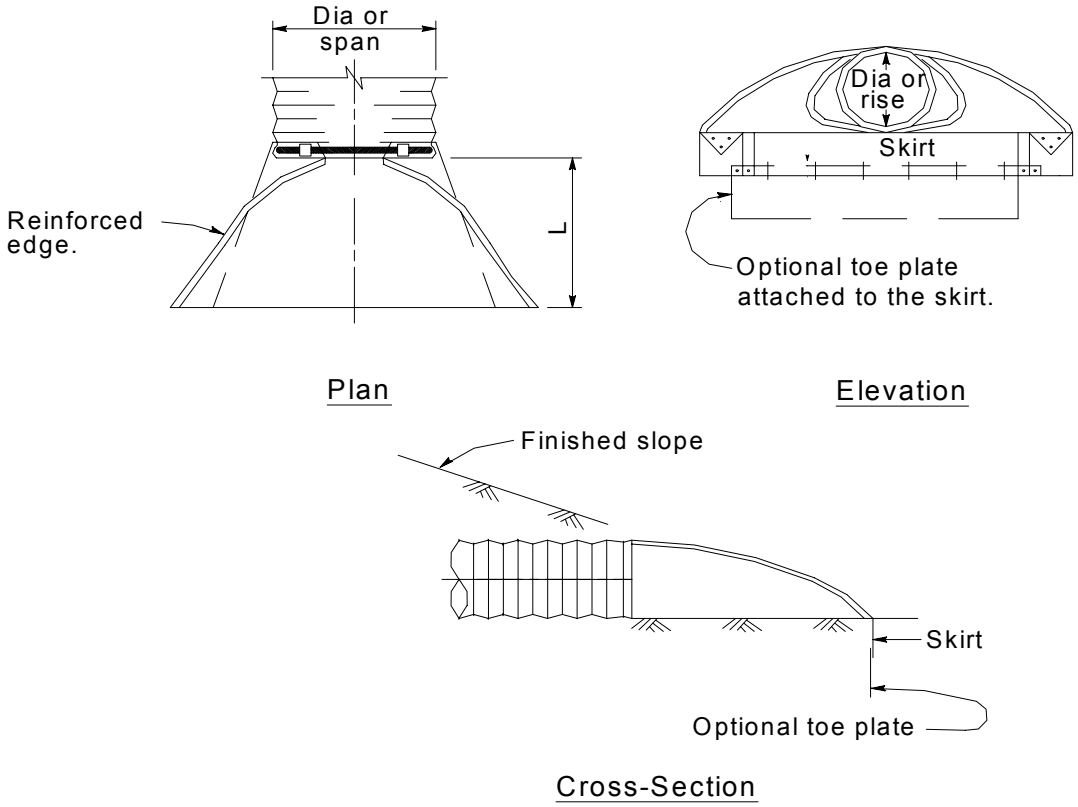
Use flared culvert end sections at outlets and inlets of slope drains and culverts.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design Manual (see Topic 827); and
- Use with other outlet protection/velocity dissipation devices as appropriate.

A flared culvert end section is shown in Figure A-2 (see Standard Plans, July 1999, Figures D94A and D94B, Pages 126 and 127).

Figure A-2: Flared Culvert End Section



Note: Actual layout determined by design.

Outlet Protection/Velocity Dissipation Devices

Description:

These devices are typically placed at pipe outlets to prevent scour and reduce the outlet velocity and/or energy of exiting storm water flows.

Appropriate Applications:

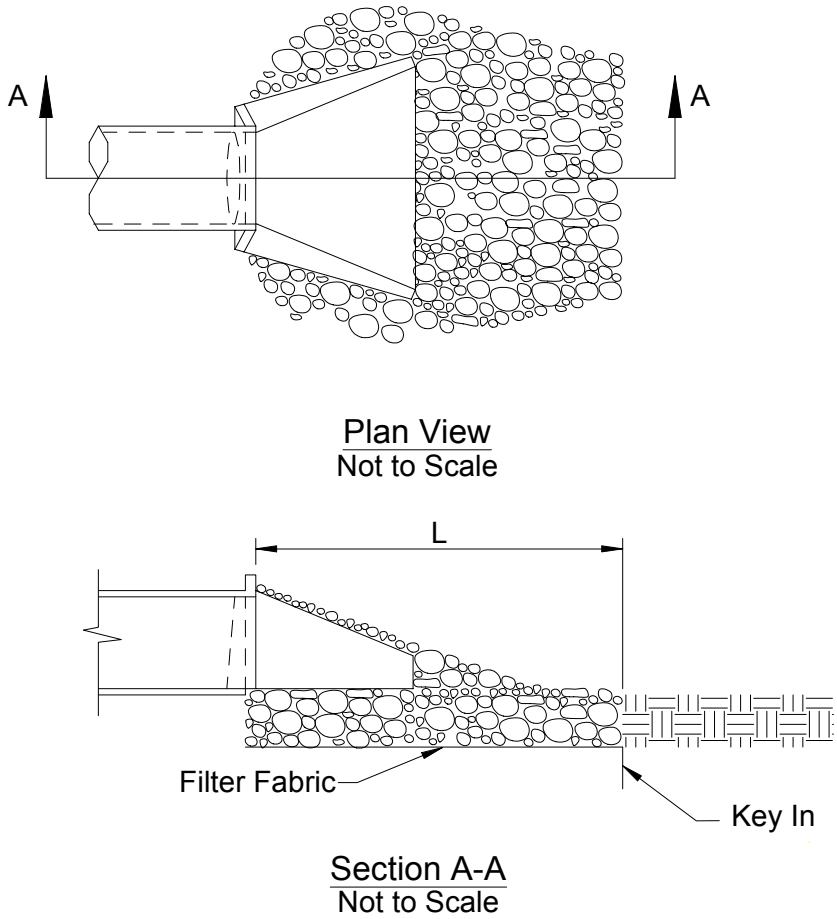
These devices are typically used at the outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, where localized scouring is anticipated.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design manual (see Topic 827 and Chapter 870);
- Install riprap, grouted riprap, or concrete apron at selected outlet;
- Apron length (L) is related to outlet flow rate and tailwater level; and
- For proper operation of apron, align apron with receiving stream and keep straight throughout its length.

An outlet protection/velocity dissipation device is shown in Figure A-3.

Figure A-3: Outlet Protection/Velocity Dissipation Device



A.5 SLOPE/SURFACE PROTECTION SYSTEMS

Surface protection consists of a selection of permanent design measures that are used alone or in combination to minimize erosion from completed, disturbed surfaces. Vegetated surfaces may offer several advantages to paved surfaces, including lower runoff volumes and slower runoff velocities, increased times of concentration and lower cost. However, where site or slope-specific conditions would prevent adequate establishment and maintenance of a vegetative cover, hard surfacing should be considered.

Vegetated Surfaces

Description:

A vegetated surface is a permanent perennial vegetative cover on areas that have been disturbed. The purpose of a vegetated surface is to prevent erosion and remove pollutants in storm water and non-storm water runoff.

Appropriate Applications:

Vegetated surfaces should be established on areas of disturbed soil after construction related activities in that area are completed, and after the slope has been prepared. Vegetated surfaces should only be considered for areas that can support the selected vegetation long-term. Consult the District's Landscape Architect regarding vegetated surfaces and appropriate applications.

Implementation:

The following steps are typically implemented by the Landscape Architect:

- The site should first be evaluated to select the appropriate vegetation and planting strategy. The site evaluation should consider soil type and condition; site topography; climate and season; types of appropriate native and adapted vegetation suited to the site; and maintenance;
- Vegetated surfaces shall be designed to minimize overland and concentrated flow depths and velocities, and maximize contact time between water and vegetated surfaces. This will enhance infiltration and pollutant removal opportunities; and
- When determined feasible, strip and stockpile topsoil (duff) and removed vegetation during construction. Use stockpiled materials in the surface preparation prior to seeding operations.

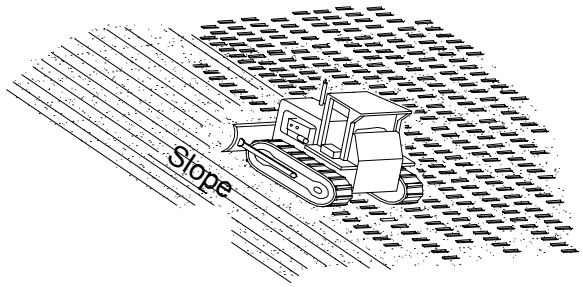
Long-term maintenance of these vegetated surfaces is discussed in Section 2 of the Guidelines.

Slope Roughening/Terracing/Rounding/Stepping:

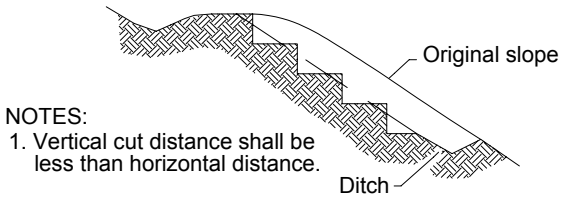
- Roughening and terracing are techniques for creating furrows, terraces, serrations, stair-steps or track-marks on the soil surface to increase the effectiveness of temporary and permanent soil stabilization practices. Slope rounding is a design technique to minimize the formation of concentrated flows; and
- Use on embankment or cut slopes, prior to the application of temporary soil stabilization or permanent seeding.

Slope roughening, terracing, rounding, and stepping, should be implemented as shown in Figure A-4.

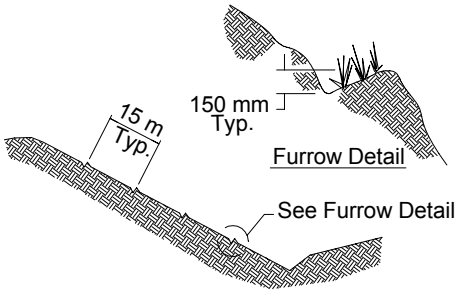
Figure A-4: Slope Roughening, Terracing, Rounding and Stepping



Tracking

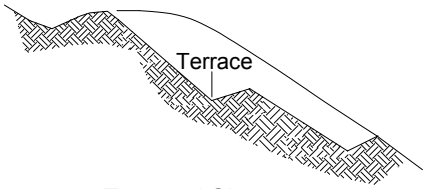


Stepped Slope
Not to Scale

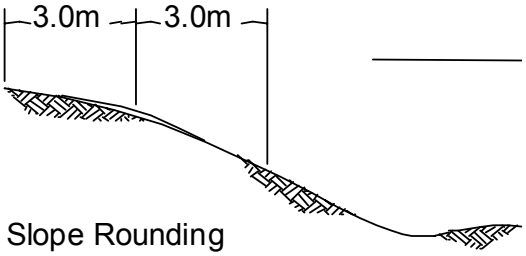


Contour Furrows
Not to Scale

Note: Actual layout determined by design.



Terraced Slope
Not to Scale



Slope Rounding

Hard Surfaces

Description:

Hard surfaces consist of placing concrete, rock, or rock and mortar slope protection. The designer needs to consider the effects of increased runoff from impervious areas.

Appropriate Applications:

Apply on disturbed soil areas where vegetation would not provide adequate erosion protection. Hard surfaces are also considered where it is difficult to maintain vegetation.

Implementation:

- Rock Slope Protection (RSP) (See the California Bank and Shore Rock Slope Protection Design Manual. Web site: http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm):
  - Angular rock of specified size is placed over fabric and used as rip rap to armor slopes, steambanks, etc.;
  - RSP consists of placing revetment-type rock courses;
  - Remove loose, sharp, or extraneous material from the slope to be treated;
  - Place underlayment fabric loosely over the surface so that the fabric conforms to the surface without damage. Equipment or vehicles should not be driven directly on the fabric;
  - Excavate a footing trench along the toe of the slope; and
  - Local surface irregularities should not vary from the planned slope by more than 0.3 meters (m) (0.1 feet [ft]) as measured at right angles to the slope.
- Concreted RSP:
  - Angular rock of specified size is placed over fabric;
  - Concrete is placed into the rock interstices by gravity flow and a minimum of brushing and troweling; and
  - Used to armor streambanks.
- Rock Blanket:
  - Consists of round cobble rock placed as a landscape feature in areas often inundated with water.
- Sacked Concrete Slope Protection:
  - Bags are filled with concrete mix and stacked against the slope to cure. Rebar can be driven into the wet mix and bags.
  - Used to create revetment or bank protection. (This is aesthetically less desirable.)

- Slope Paving:
  - Used almost exclusively below bridge decks at abutments.
  - Provides erosion control and soil stabilization in areas too dark for vegetation to establish.
  - May be constructed of finish poured Portland Cement Concrete (PCC), shotcrete, or masonry paving units.
  - Foundation areas should be evenly graded and thoroughly compacted, with moisture sufficient to allow a firm foundation and to prevent absorption of water from the concrete or mortar. Work should be scheduled so that the work (including placing, finishing, and application of curing compound) between timber borders is started and completed in the same day. There should not be any construction joints between timber spacers.
- Articulated Revetments:
  - Mattresses composed of concrete units that are interlocked or interconnected with cables.
- Gabions:
  - Wire cages filled with rock. These units are then constructed into structures of various configurations.

Appendix B
Approved Treatment BMPs

B.1 TREATMENT BMPS

The Treatment Best Management Practices (BMPs) listed in Table 2-5 of this document will be considered for projects discharging directly or indirectly to receiving waters. These BMPs have been approved for statewide use and will be considered in all proposed new construction and major reconstruction projects. This Appendix provides design guidelines for the approved Treatment BMPs.

B.2 BIOFILTRATION STRIPS AND SWALES

(VEGETATED TREATMENT SYSTEMS)

Description:

Biofiltration swales are vegetated channels that receive directed flow and convey storm water. Biofiltration strips, also known as vegetated buffer strips, are vegetated sections of land over which storm water flows as overland sheet flow.

Pollutants are removed by filtration through the grass, sedimentation, adsorption to soil particles, and infiltration through the soil. Strips and swales are mainly effective at removing debris and solid particles, although some dissolved constituents are removed by adsorption onto the soil.

Appropriate Applications and Siting Criteria:

Strips and swales should be considered wherever site conditions and climate allow vegetation to be established and where flow velocities are not high enough to cause scour. Even where strips cannot be sited to accept directed sheet flow, vegetated areas provide treatment of rainfall and reduce the overall impervious surface.

Factors Affecting Preliminary Design:

Swales have two design goals: 1) maximize treatment, and 2) provide adequate hydraulic function for flood routing, adequate drainage and scour prevention. Treatment is maximized by designing the flow of water through the swale to be as shallow and long as site constraints allow. No minimum dimensions are required for treatment purposes, as this could exclude swales from consideration at some sites. Swales should also be sized as a conveyance system calculated according to Caltrans procedures for flood routing and scour.

To maximize treatment efficiency, strips should be designed to be as long (in the direction of flow) and as flat as the site will allow. No minimum lengths are required for treatment purposes and no maximum slope has been established. The maximum length will be the sheet flow regime length dependent on site conditions (not more than 0.1 km [300 feet {ft}] and normally much less). The area to be used for the strip should be free of gullies or rills that can concentrate overland flow and cause erosion.

Vegetation mixes appropriate for various climates and locations will be developed by the District Landscape Architect. Table B-1 summarizes preliminary design factors for biofiltration.

Table B-1: Summary of Biofiltration (Strips And Swales)

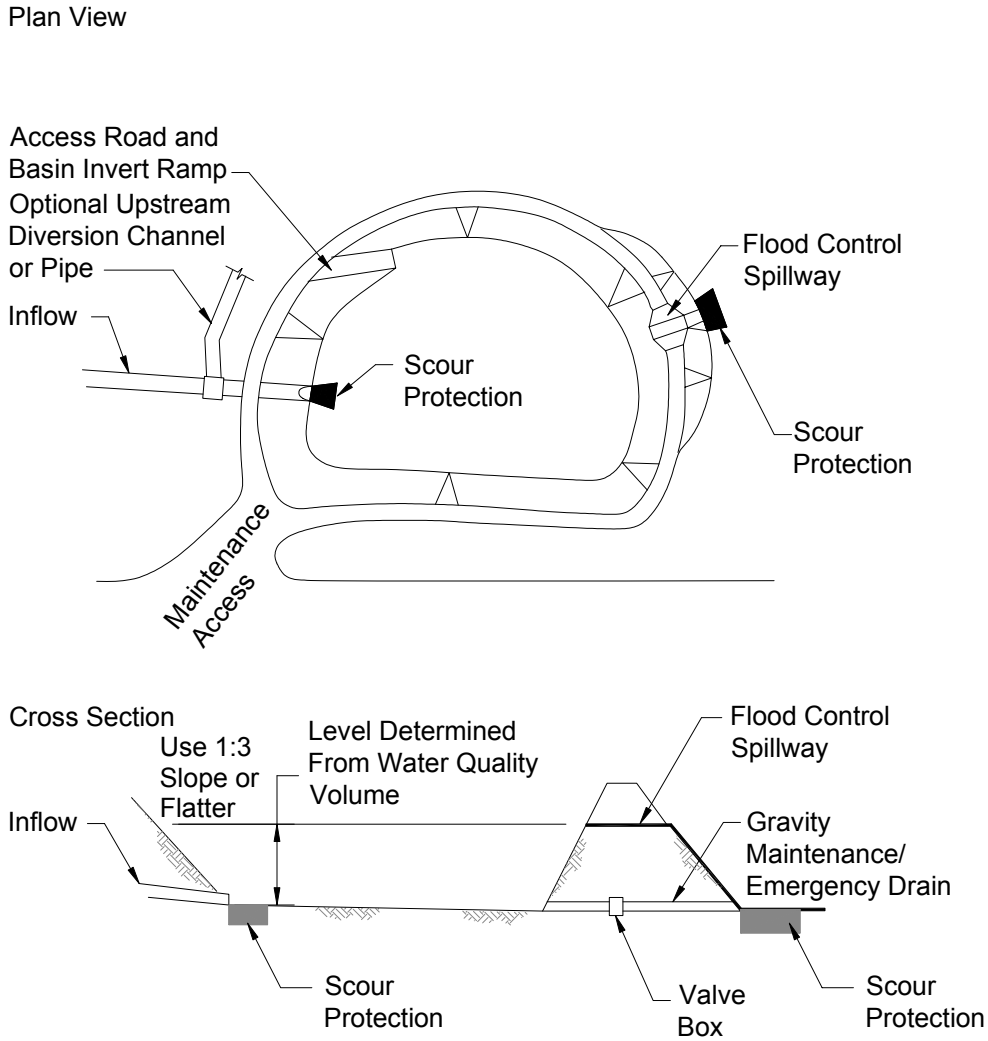
Description	Applications/Siting	Preliminary Design Factors
Swales are vegetated channels that receive and convey storm water. Strips are vegetated buffer strips over which storm water flows as sheet flow. Treatment Mechanisms: • Filtration through the grass • Sedimentation • Adsorption to soil particles • Infiltration Pollutants removed: • Debris and solid particles • Some dissolved constituents	• Site conditions and climate allow vegetation to be established • Consider where flow velocities will not cause scour	• Swales sized as a conveyance system (per Caltrans flood routing and scour procedures) • Swale water depth as shallow as the site will reasonably permit • Strips sized as long (in direction of flow) and flat as the site will reasonably allow up to sheet flow boundaries • Strips should be free of gullies or rills • Strips should be as wide as possible, subject to Caltrans drainage standards • No minimum dimensions or slope restrictions for treatment purposes • Vegetation mix appropriate for climates and location • Maximum length of Bio Strip is 91 m (300 ft)

B.3 INFILTRATION BASINS

B.3.1 Description and Applications

An infiltration basin is a device designed to remove pollutants from surface discharges by capturing the Water Quality Volume (WQV) and infiltrating it directly to the soil rather than discharging to receiving waters. A conceptual schematic illustration of an infiltration basin is shown in Figure B-1.

Figure B-1: Example Schematic of an Infiltration Basin



Appropriate Applications and Siting Criteria:

Infiltration basins should be considered wherever site conditions allow and the design water quality volume exceeds 123 cubic meters (0.1 acre-foot). Appropriate sites for infiltration basins should have sufficient soil permeability (both vertical and horizontal), have a sufficiently low water table, do not present a threat to local groundwater quality and are at a sufficient elevation to allow gravity drainage (of the basin) for maintenance purposes. The Regional Water Quality Control Board (RWQCB) having jurisdiction may impose additional requirements.

Factors Affecting Preliminary Design:

The following steps are recommended for determining the feasibility of infiltration BMPs. The major components are Pre-screening, Site Screening, Site Investigation and Preliminary Design. Siting and design criteria are summarized in Table B-2.

Table B-2: Summary of Infiltration Basin Siting and Design Criteria

Applications/Siting	Preliminary Design Factors
• > 3 m (10 ft) to seasonally high water table (≥ 1.2 m [4 ft] if justified by adequate groundwater observations for a minimum of 1 year) • Soil infiltration rate ≥ 1.3 centimeters per hour (0.5 in/hr) • Clay content < 30%, and < 40% clay and silt combined • Site should not be located in area containing fractured rock • Infiltrated water is unlikely to affect the stability of downgradient structures, slopes, or embankments • Runoff quality is ≥ standards for infiltration to local groundwater • If pretreatment is required, only approved BMPs should be considered • Consult with RWQCB, water agencies, vector control authorities, and local utilities	• Maintenance access (road around basin and ramp to basin invert) • Optional upstream diversion channel or pipe, or downstream overflow structure • Flood control spillway • Scour protection on inflow and spillway • Size to capture the 24-hour WQV • Infiltrate WQV within 48 hours • Use ½ the measured infiltration rate to size the basin • > 3 m (10 ft) downgradient and 30 m (100 ft) upgradient from structural foundations • ≥ 30 m (100 ft) from drinking water wells • Provide emergency/maintenance gravity drain, if practicable • Use 1:3 side slope ratios or flatter for side slopes

B.3.2 Pre-Screening for the Infiltration BMP

Pre-screening for the infiltration BMP involves collecting site-specific information necessary to determine whether infiltration is an appropriate storm water treatment for the site and meets criteria established by the RWQCB. Consult with the District/Regional National Pollutant Discharge Elimination System (NPDES) Coordinator to obtain RWQCB criteria. No field testing is anticipated during this phase. The steps involved in pre-screening include:

- Information collection; and
- Preliminary determination of infiltration appropriateness.

The following sub-sections describe the steps involved.

B.3.2.1 Information Collection

Some of the basic site-specific data required for the determination of the appropriateness of the infiltration BMP are found in the sources listed as follows. Additional data may be required for local conditions. Data collected by Caltrans project engineering staff and Caltrans District/Regional NPDES Storm Water Coordinators include, but may not be limited to:

- Outfall inventory data (if available), project alignment, right-of-way, annual average daily traffic (ADT), Caltrans outfall locations, and other basic project maps and data;
- Tributary drainage areas and surrounding land uses (from outfall inventory, as-builts, aerial photographs, Geographic Information System (GIS) data from Caltrans and local planning agencies);
- Site surface hydrology data: tributary drainage area, runoff coefficients, drainage network, travel times, etc., needed to design facilities to Caltrans hydrologic/hydraulic criteria;
- Basin Plan groundwater beneficial uses and known impairments (RWQCB).
- Caltrans runoff quality data for appropriate Caltrans land use in catchment area (Caltrans Statewide Storm Water Quality Database at www. stormwater.water-programs.com, Caltrans Annual Research Summary Report); and
- WQV calculated in accordance with Section 2. The Basin Sizer program satisfying the requirements of Section 2 is available at www.stormwater.water-programs.com.

Site soil characteristics:

- Indigenous soil types: Natural Resources Conservation Services (NRCS) soil maps and corresponding hydrologic soil classes;
- Soil infiltration rates (estimated and from any existing on-site testing in the vicinity by others); and
- Caltrans project grading plans or as-built plans (if retrofit), if available.

Existing groundwater and hydrogeology information:

- Maps of local aquifers underlying the alignment or location of the proposed Caltrans project; and
- Aquifer groundwater quality and seasonal groundwater levels: monitoring well data, U.S. Geological Survey (USGS), Department of Water Resources (DWR), and local public agency maps and databases (e.g., http://www.swrcb.ca.gov/cwphome/land/gama/webpages/gamahome.htm)

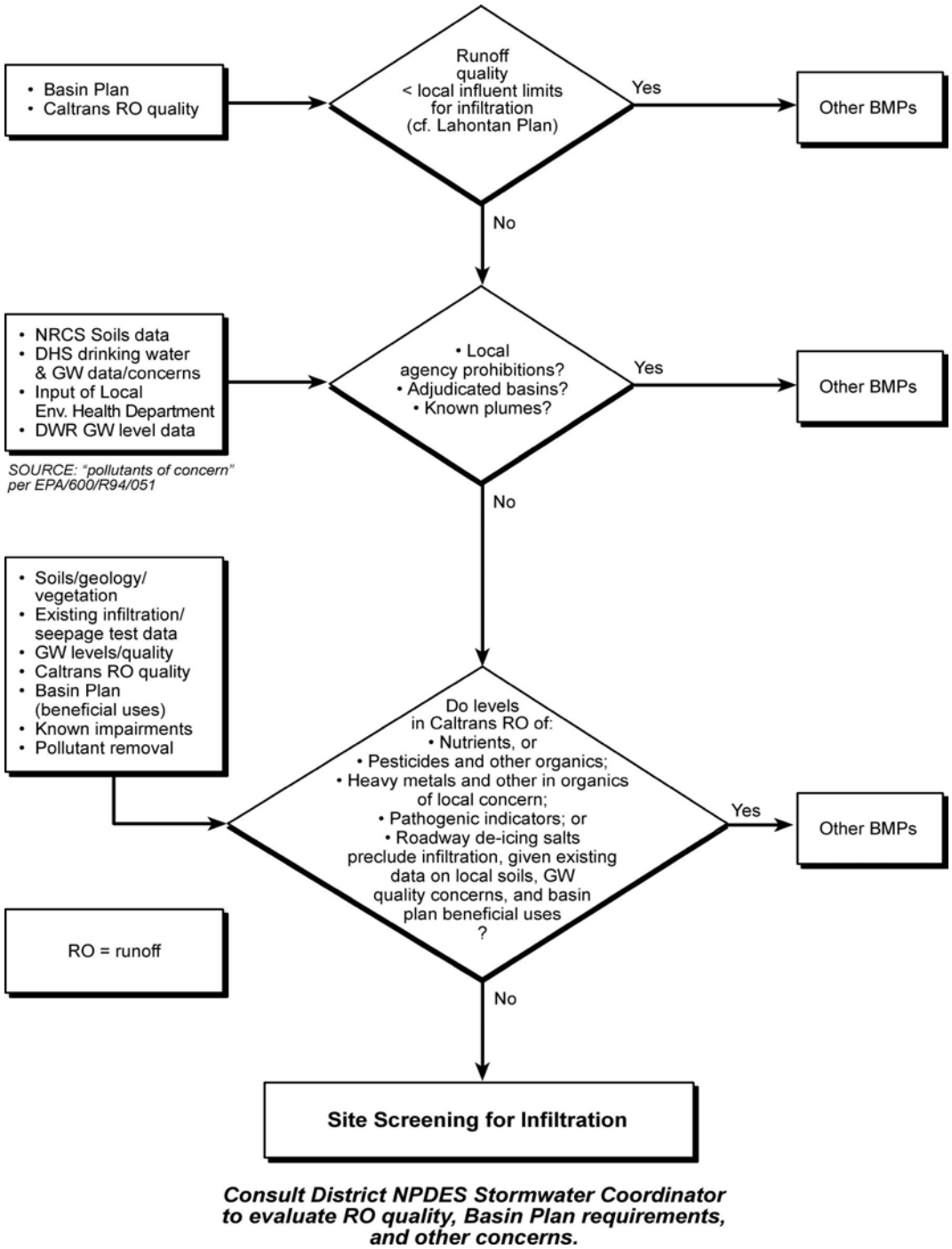
Local groundwater quality concerns: Consult RWQCB, California Department of Health Services (DHS), local environmental/health department (city/county);

- Site hydrogeology (from any existing boring logs: lenses, hardpan, etc.);
- Known contaminated groundwater plumes (RWQCB);
- Groundwater rights data: adjudicated basins, other rights (RWQCB, DHS); and
- State Water Information Management System data for project area (State Water Resources Control Board [SWRCB]).

B.3.2.2 Preliminary Determination for Appropriateness of Infiltration

Once the data have been collected and placed in the context of the alignment and/or location of the Caltrans facility being considered for infiltration basins, the Project Engineer and the District/Regional NPDES Storm Water Coordinator will use the data collected and follow the procedure outlined in Figure B-2.

Figure B-2: Pre-screening for the Infiltration Basins



Salient steps include:

1) Determine if local Basin Plan or other local ordinances provide influent limits on quality of water that can be infiltrated. Compare with Caltrans runoff quality, and determine if infiltration is permissible. If not, consider detention basins.
2) Determine if local agencies, public health authorities, legal restrictions, or other concerns preclude consideration of infiltration of storm water runoff. Consult with District/Regional NPDES Storm Water Coordinator and representatives of appropriate authorities as needed. If infiltration into the aquifer is not acceptable to local authorities, consider detention basins.
3) Estimate the quality of runoff from the Caltrans facility draining into the proposed infiltration basin using data from the Caltrans storm water database and annual research summaries.
4) Compare the estimated Caltrans runoff water quality with available groundwater quality data, using receiving water objectives from the RWQCB Basin Plan, for each groundwater beneficial use. Determine if the separation between the maximum anticipated seasonal high groundwater table and the proposed basin invert is at least 3 m (10 ft). Tabulate the results and make a preliminary determination of the appropriateness of the infiltration BMP.

If the determination is negative (infiltration *not* appropriate), consider detention basins. If determination is positive (infiltration potentially appropriate), proceed to infiltration site screening.

B.3.3 Site Screening

Using data gathered in the pre-screening process, perform an initial desktop screening of sites to narrow the number of potential sites to those that can be considered for field investigations. As needed, collect additional information, and follow these procedures:

- Estimate soil type (consider NRCS Hydrologic Soil Groups [HSG] A, B, or C only, as shown in Table B-3) from soil maps and/or U.S. Department of Agriculture (USDA) soil survey tables and/or background information. In areas where septic systems are in widespread use, the County Environmental Health Department should have information on appropriate soil types for infiltration of on-site wastewaters;
- Also review other key available data: percent silt and clay, presence of a restrictive layer, permeable layers interbedded with impermeable layers, and seasonal high water table. Other geotechnical considerations include location in seismic impact zones, unstable areas, such as landslides and Karst terrains, and those with soil liquefaction and differential settlement potential. Generally, sites should not be constructed in fill, or on any slope greater than 15 percent; and

- The minimum acceptable spacing between the proposed infiltration basin invert and the maximum seasonal high groundwater table is 3 m (10 ft). If a separation of less than 3 m (10 ft) is proposed, the approval of the local RWQCB is required.

Table B-3: Typical Infiltration Rates for NRCS Type and HSG Classifications

NRCS Soil Type	HSG Classification	Infiltration Rate	
		cm/hr	(in/hr)
Sand	A	20	(8.0)
Loamy sand	A	5.1	(2.0)
Sandy loam	B	2.5	(1.0)
Loam	B	1.3*	(0.5)*
Silt loam	C	0.6	(0.25)
Sandy clay loam	C	0.4	(0.15)
Clay loam & silty clay loam	D	<0.2	(<0.09)
Clays	D	<0.1	(<0.05)

* Minimum rate for infiltration basins. Silt loams may also be acceptable (HSG C) if geotechnical investigations demonstrate adequate infiltration rates.

Infiltration basins should not be sited in locations over previously identified contaminated groundwater plumes. Setback distance should be determined in coordination with the RWQCB.

Estimate infiltration rate for maximum infiltration for soil type using Table B-3.

Estimate the area required for infiltration as follows:

$$A_{est} = 100SF \cdot WQV / k_{est} \cdot t \qquad \text{(Eq. 1)}$$

Where:

A_{est} = estimated area of invert of basin, m^2
100 = conversion factor from centimeters to meters
SF = safety factor of 2.0
WQV = water quality volume calculated from the design storm, m^3
k_{est} = estimated infiltration rate, cm/hr
t = drawdown time, 48 hours

or,

$$A_{est} = 12 \cdot SF \cdot WQV / k_{est} \cdot t \qquad \text{(Eq. 1a)}$$

Where:

A_{est} = estimated area of invert of basin, ft^2
12 = conversion factor from inch to feet
SF = safety factor of 2.0
WQV = water quality volume calculated from the design storm, ft^3
k_{est} = estimated infiltration rate from Table B-2, in/hr
t = drawdown time, 48 hours

The infiltration basin should be located outside the 9 m (30 ft) Clear Recovery Zone, 300 m (1,000 ft) from any municipal water supply well, 30 m (100 ft) from any private well, septic tank or drain field, and 60 m (200 ft) from a Holocene fault zone.

B.3.4 Site Investigation

After the desktop screening of sites has been completed, proceed with field investigations of the remaining potential sites. Both sites within and outside existing Caltrans rights-of-way that passed the screening process should be considered.

- Perform site investigation to identify any: (a) Regulatory permit required, (b) Major underground utility interference, (c) Transportation improvement plan conflicts, or (d) General plan land use data for tributary area;
- If the parcel is outside of right-of-way, for planning to proceed, Caltrans must generate greater than 50% of the total tributary runoff. Otherwise, investigate opportunities for a cooperative agreement to share storm water treatment facilities with the other agency, county, or city responsible for the additional flow;
- Assess the feasibility (degree of plumbing and available area) of directing runoff from additional tributary area to the site. (Additional Caltrans area has priority; other off-site areas are secondary). Consider potential downstream impacts from diversions and cost of diverting additional flow. Diversions of tributary area to unimproved conveyances (creeks/streams) are prohibited. Diversions to improved conveyances may be permitted if it can be demonstrated that the conveyance has sufficient capacity to accommodate the additional flow;
- Investigate feasibility of infiltration using criteria and the procedure in Section B.3.4.1. Recalculate and verify area requirements using the collected field data. Use Equation 1 (see Section B.3.3) and the lowest measured or anticipated infiltration rate to calculate area of basin; and
- If an infiltration basin is feasible, proceed to Section B.3.5, Preliminary Design.

B.3.4.1 Procedure for Preliminary Infiltration Basin Site Investigation

The following scope of work defines the steps for infiltration basin feasibility studies necessary to determine if an infiltration basin may be feasible on the subject site. The screening procedure is terminated if the site does not meet the criteria for any step, and assessment of the site continues for a detention basin. Geotechnical site investigations may be difficult to schedule, and might be conducted during the Design phase.

The depth to groundwater must be known as the first step in feasibility because a high groundwater table can lead to infiltration failure and potential contamination of the groundwater table. The *in situ* infiltration rate at the basin invert must also be known to ensure that infiltration of the calculated WQV is possible within 48 hours. Due to the extreme variability of site conditions, field investigation is required to determine the depth to groundwater and *in situ* infiltration rate.

The scope of work comprises two phases:

- Initial Investigation; and
- Detailed Investigation as follows.

Initial Investigation

The initial investigation comprises two parts: A) Initial technical field screening and determination of groundwater elevations, and B) Geotechnical investigation for soil lithology and select chemical testing. To streamline the initial investigation phase, Part A will be performed first, followed by Part B if the Part A criterion of at least 3 m (10 ft) clearance for the groundwater elevation below the basin invert is satisfied and the PE approves the site for further consideration. Consult the local RWQCB for approval of proposed groundwater separation less than 3 m (10 ft).

Part A: Initial Technical Field Screening and Determination of Groundwater Elevation

A local or regional groundwater review will be performed based on the available data, including, but not necessarily limited to:

- Previously compiled databases on potential BMP sites (such as outfall inventory databases);
- Data and maps available from regional government databases, DWR, other local agencies and internal Caltrans sources;
- Local soil survey data from the NRCS and other sources;
- Soil lithology, infiltration rate and groundwater depth data from the county or other specialists that approve septic system installations in the local area;
- Information on local groundwater beneficial uses and groundwater quality issues from the RWQCBs and other water agencies; and
- Information on local groundwater-related drinking water issues from DHS.

An initial indication of the seasonal high groundwater water table elevation will be determined by using a piezometer, previous studies, or other accepted geotechnical means. The piezometer will be installed to a depth of at least 6 m (20 ft) below the proposed basin invert using the direct push or other suitable method. Groundwater levels will be observed for at least 24 hours after installation. As part of this task, a geotechnical professional will conduct a site reconnaissance to evaluate the site conditions. Site screening criteria in Section B.3.3 should be considered.

The geotechnical professional will make a determination on a site-by-site basis, whether the groundwater elevation determined after 24 hours can be considered to be a reasonable indication of the seasonal high water table for the purposes of the evaluation of the groundwater depth criteria, described as follows. If such determination cannot be made reasonably based on the available data, the site will be recommended for a longer period of water table elevation monitoring, as necessary.

If the initial seasonal high groundwater elevation indication is within 3 m (10 ft) of the invert of the proposed infiltration basin, the site will be eliminated from further consideration unless the local RWQCB requires installation of an infiltration basin with less than 3 m (10 ft) separation to groundwater. If there is not a reliable indication that the seasonal high water table is at least 3 m (10 ft) below the invert of the proposed infiltration basin (i.e., if there is reason to believe the water table may rise to within 3 m (10 ft) of the proposed invert), a more extensive groundwater table elevation investigation will be performed as described in Section B.3.4.2, Part C. If the groundwater elevation at the site clearly exceeds 3 m (10 ft) from the proposed basin invert and all other criteria in the initial investigation are satisfied, a detailed groundwater elevation determination will not be required.

Part B. Geotechnical Investigation for Soil Lithology and Select Chemical Testing

An initial soil investigation will be performed to adequately evaluate soil lithology and determine:

- If there are potential problems in the soil structure that would inhibit the rate or quantity of infiltration desired; or
- If there are potential adverse impacts that could result from locating the infiltration basin at the site to either structures, slopes or groundwater.

Geotechnical trenches (or at the option of the geotechnical professional, a boring may be used) will be dug using a backhoe at one or two locations within each site, depending on the site conditions. Clearance of the site for hazardous contaminants through the appropriate District should be done prior to drilling by the geotechnical professional conducting the work. Underground Service Alert (USA) clearance will also be obtained. The trenches will be at least 2 m (6 ft) long and 2 m (6 ft) deep below the proposed basin invert. The soil profiles will be carefully logged to determine variations in the subsurface profile. Of greatest importance is the presence of fine-grained materials such as silts and clays, which should be determined by direct measurement of particle size distribution. Two to four soil samples should be collected for determination of the soil particle size distribution at each site. Samples should be collected from the soil profiles at different horizons and transported to a laboratory for soil texture and chemical testing described as follows:

- Soil textures that tend to promote infiltration include sands, loamy sands, sandy loams, and loams (and possibly some of the coarser silt loams) in the NRCS classification system, or GW, GM, SP, SW and GC, SC, SM, ML (Unified Soil Classification System), subject to clay and clay/silt percentages shown and the judgement of the field engineer or soil scientist; and
- The soil in the first 300 mm (12 inches) below the basin invert will be tested for organic content (OC), pH, and cation exchange capacity (CEC). Values that promote pollutant capture in the soil are: OC > 5 percent, pH in the range of 6-8, and CEC > 5 meq/100 g of soil. In general, the soil should not have more than 30 percent clay or more than 40 percent of clay and silt combined.

In addition, the trenches should be examined for other characteristics that may adversely affect infiltration. These include evidence of significant mottling (indicative of high groundwater),

restrictive layer(s), and significant variation in soil types horizontally and vertically. A summary report will be prepared addressing the issues noted in this section, with recommendations on the suitability of the site for infiltration and the necessity of carrying out the next phase of the investigation. (All the site reports will ultimately be combined in a single report.) Caltrans will develop instructions for the detailed investigation phase for the sites deemed acceptable from the initial investigation.

B.3.4.2 Detailed Investigation

If the site conditions still appear favorable to infiltration after the geotechnical review and soil investigations, a detailed field investigation will be undertaken, which includes Part A, Detailed Subsurface Soil Investigation, Part B, In-Hole Conductivity Testing, and Part C, Detailed Groundwater Elevation Determination.

Part A. Detailed Subsurface Soil Investigation

Borings will be drilled to a maximum depth of 15 m (50 ft) (or refusal) for each detailed investigation location at the discretion of the geotechnical professional. Samples will be obtained at 1.5-m (5-ft) intervals for soil characterization and laboratory testing. Bulk samples will also be collected at shallow depths to verify information collected in Parts A and B of the Initial Investigation.

Part B. In-hole Infiltration Rate Testing

Infiltration rate tests or another method approved by the Geotechnical Representative will be performed at the proposed basin invert. The tests will be located to measure infiltration rates in the bed of the proposed basin.

The minimum acceptable infiltration rate as measured in any of the test holes is 1.3 cm/hr (0.5 in/hr). If any test hole shows less than the minimum value, the site will be disqualified from further consideration. If the infiltration rate at the site is significantly greater than 6.4 cm/hr (2.5 in/hr), the RWQCB must be consulted, and the RWQCB must conclude that the groundwater quality will not be compromised, before approving the site for infiltration.

If the site is constructed in fill or partially in fill, it will be excluded from consideration unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed, rather than flocculated state, greatly impacting permeability.

The geotechnical investigation will be sufficient to develop an adequate understanding of how the storm water runoff will move in the soil (horizontally or vertically), and if there are any geological conditions that could inhibit the movement of water.

Part C. Detailed Groundwater Elevation Determination

If a detailed investigation to determine the groundwater elevation is required per the guidance and, in the opinion of the engineer, the seasonal high groundwater elevation may come within 3 m (10 ft) of proposed basin invert, at least one and possibly two (per the recommendation of the geotechnical professional) groundwater monitoring wells will be installed. One well will be installed within the proposed basin footprint and the other, if needed, will be installed near the basin but downgradient by about 10 m (30 feet). The wells will be observed over a wet and dry

season. This observation period will be extended to a second wet season (at the direction of Caltrans) if the first wet season produces rainfall less than 80% of the historical average. The minimum acceptable spacing between the proposed infiltration basin invert and the seasonal high water table, as measured at either of the two established monitoring wells, is 3 m (10 ft), unless, in coordination with the RWQCB, it can be demonstrated that the groundwater will not be adversely impacted. A geotechnical professional will oversee the detailed investigation and must also consider other potential factors that may influence the groundwater elevation, such as local or regional groundwater recharge projects, future urbanization or agriculture. The geotechnical professional shall also examine the soil borings for indications of previous high water.

A final geotechnical report, overseen by a geotechnical professional, summarizing the findings of the investigation will be prepared. The report will include all results from the initial as well as detailed investigation phases of the feasibility study.

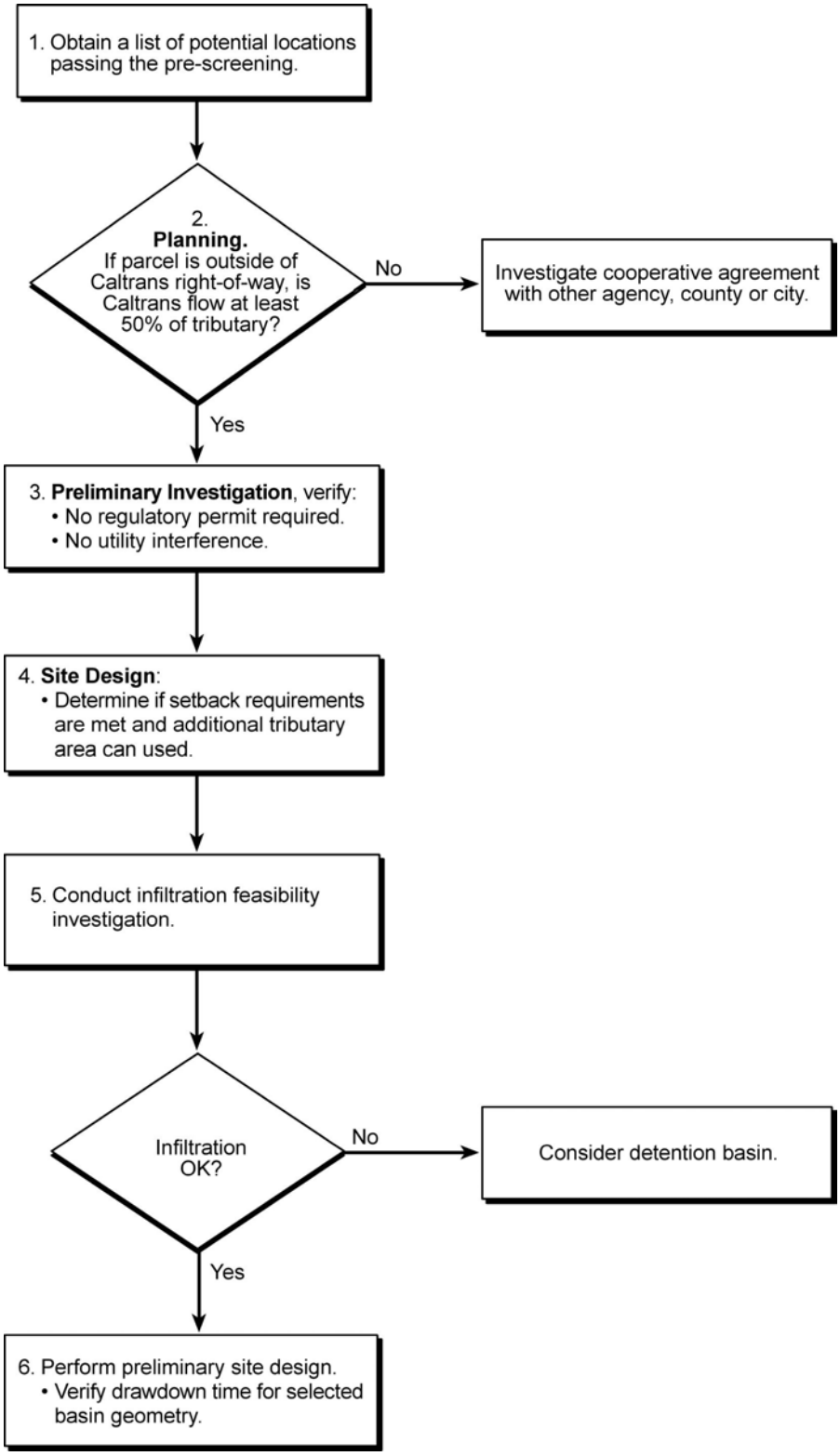
B.3.5 Preliminary Design

Table B-2 summarizes preliminary design factors for infiltration basins. Preliminary design includes the following:

- Obtain site topography (one-half meter contours, 1:500 scale). Extend topography to show where runoff leaves Caltrans right-of-way, enters a drainage channel owned by others, or enters a receiving water;
- Develop a conceptual grading plan for improvements showing basin, maintenance access, basin outlet and extent of right-of-way requirements to accommodate the improvements. The basin invert must not have a slope of greater than 3%;
- Develop unit cost-based cost estimate to construct the infiltration basin. Include allowances for hazardous/unsuitable materials, traffic management and storm drain system improvements as needed and determined by the PE; and
- Develop single paragraph assessments of; nonstandard design features, impact on utilities, hydrology (WQV, peak flow, land use), right-of-way total area needed, current ownership, highway planting and lighting, permits, hazardous materials, environmental clearance and traffic management.

Figure B-3 summarizes the BMP siting procedure for infiltration basins.

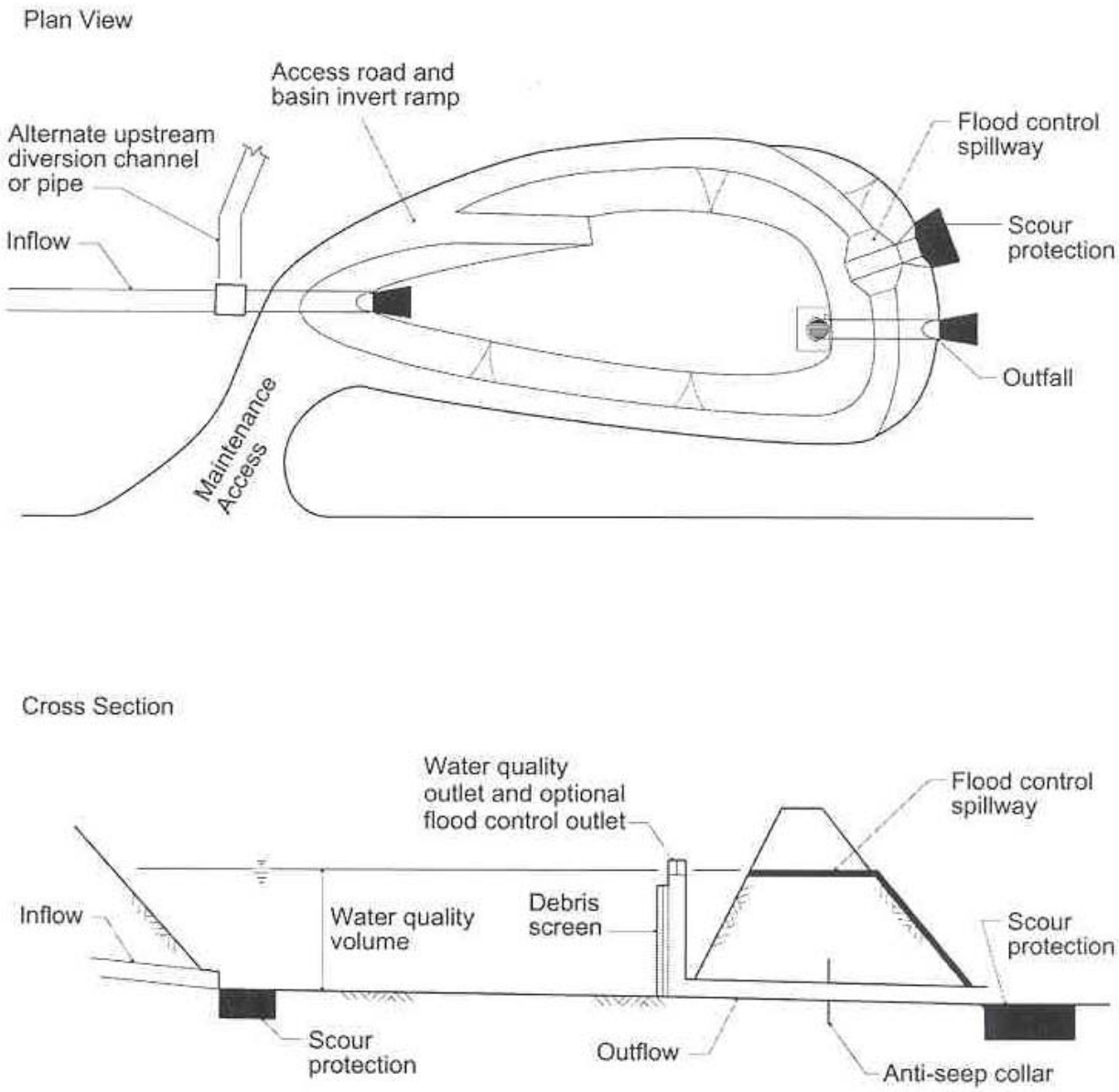
Figure B-3: BMP Siting Procedure for Infiltration Basins



B.4 DETENTION BASINS DESCRIPTION:

A detention basin is a permanent device formed by excavating and/or constructing an embankment so that runoff from the water quality design storm (WQV) is temporarily detained under quiescent conditions, allowing sediment and particulates to settle out before the runoff is discharged. A conceptual schematic of a detention basin is shown in Figure B-4.

Figure B-4: Example Schematic of an Detention Basin (Not a Standard Plan)



Detention basins remove litter, settleable solids (debris), total suspended solids (TSS) and pollutants that are attached (adsorbed) to the settled particulate matter.

Appropriate Applications and Siting Criteria:

Detention basins should be considered for implementation wherever infiltration basins are not feasible, the WQV is at least 123 cubic meters (0.1 acre-foot), and site conditions allow.

One important siting requirement is that sufficient head is available so that water stored in the basin does not cause an objectionable backwater condition in the storm drain system, which would adversely impact its ability to convey design storms as required in the HDM. A second siting requirement is that seasonally high groundwater be no higher than the bottom elevation of the basin for reasons described as follows.

Factors Affecting Preliminary Design:

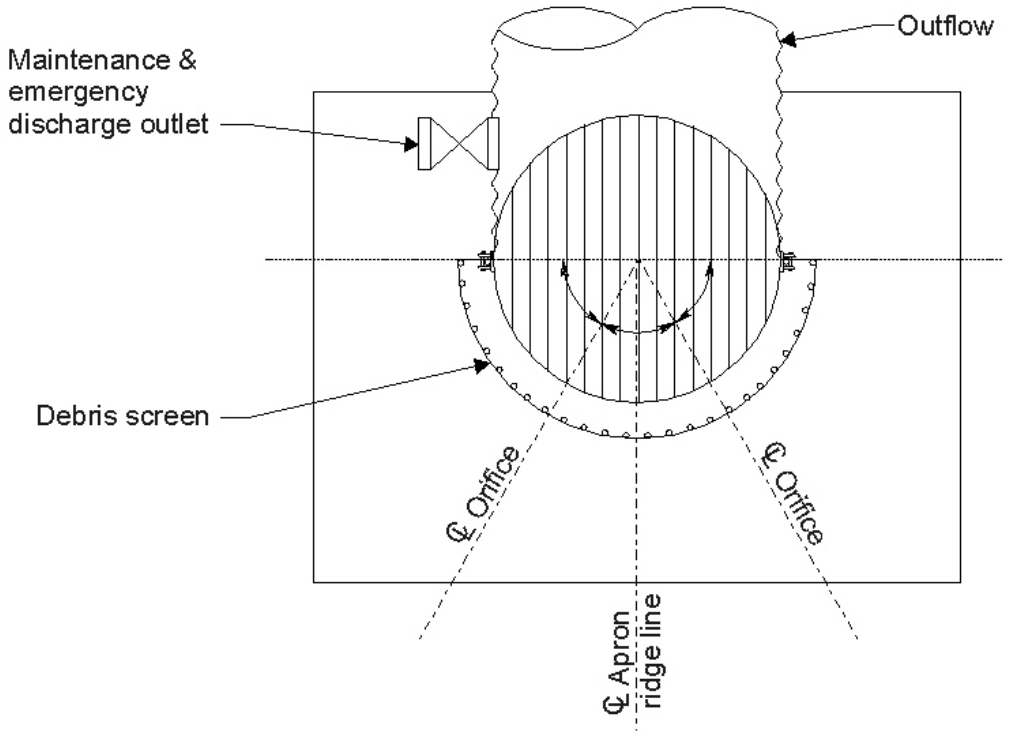
Detention basins should be designed with a volume equal to at least the WQV determined using the methods described in Section 2.4.2.2. The maximum water level in the detention device should not cause seepage of water under the roadway within 0.2 m (8 in) below the roadway subgrade. A flow-path-to-width ratio of at least 2:1 is recommended. This ratio can be accomplished by baffles or interior berms to accommodate the geometry of the site.

Liners are not generally required for detention basins. However, they may be used to facilitate maintenance and to protect groundwater. Infiltration is permissible if the infiltrated water does not surface in an undesirable place off-site or threaten the stability of a slope or embankment downgradient of the basin. To protect groundwater quality and to ensure dry conditions for maintenance of unlined basins, the distance between the basin invert and seasonally high groundwater should be at least 3 m (10 ft). Where the groundwater is higher than this, the basin side slopes and invert should be provided with an impermeable liner. In no case should the seasonally high groundwater be higher than the bottom elevation of the detention device to prevent uplift of tanks or liners.

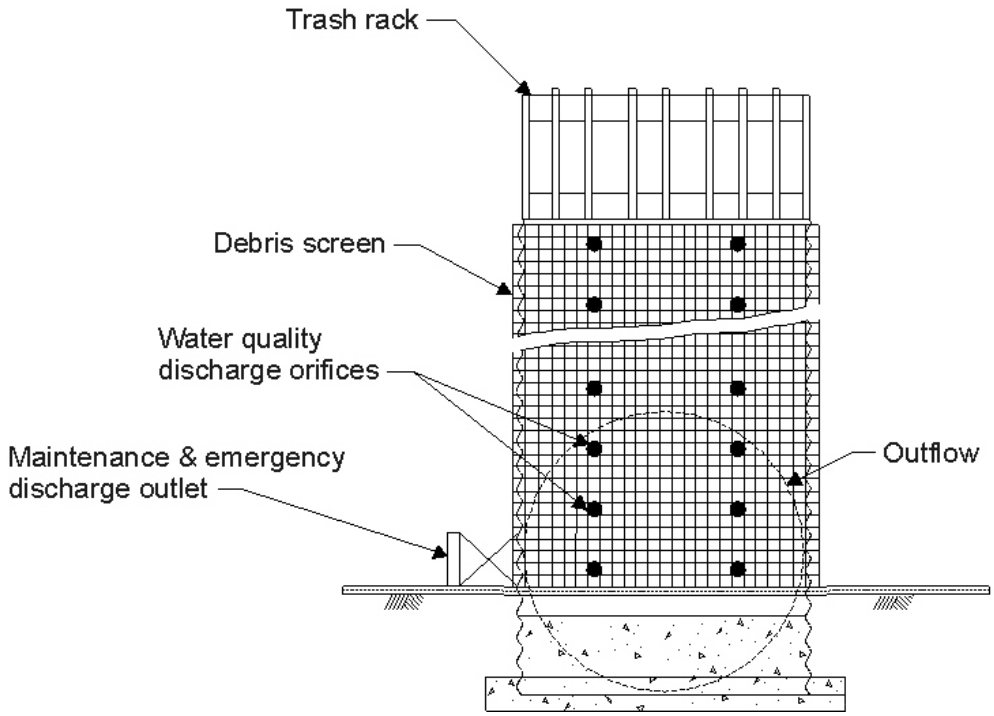
Discharge should be accomplished through a water quality outlet. An example is shown in Figure B-5. A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.

Proper hydraulic design of the outlet is critical to achieving good performance of the detention basin. The water quality outlet should be designed to empty the device within 24 to 72 hours (also referred to as “drawdown time”). (The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.)

Figure B-5: Example Schematic of Water Quality Outlet Structure (Not a Standard Plan)



Plan



Profile

The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. A V-notch weir can also be used, but is not recommended. The V-notch weir will not clog, but it is difficult to maintain small release rates at low heads. The perforated riser, if properly designed and gravel packed, gives much better control and is recommended over the V-notch weir. Design guidance for single orifice and perforated riser outlets follow:

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

$$a = \frac{2A(H-Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H-Ho)^{0.5}}{CT} \qquad \text{(Eq. 2)}$$

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

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

$$a = \frac{(1.75x10^{-6})A(H-Ho)^{0.5}}{C} \qquad \text{(Eq. 3)}$$

For a riser orifice having multiple openings (see Figure B-5), use:

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

with terms as shown in this section except:

- a_t = total area of orifices;
- h_{max} = maximum height from lowest orifice to the maximum water surface (ft);
- $h_{centroid\ of\ orifices}$ = height from the lowest orifice to the centroid of the orifice configuration (ft).

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

If the WQV (specifically Options 1 and 2 in Section 2.4.2.2) was determined using an assumed drawdown time, then use the same value for drawdown time (T) in equations 2 and 3. Because detention basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Assuming an average release rate at one half the basin depth (a common approach in several design manuals) may lead to considerable error if the basin has a significant variation of surface area with depth. If this is true, consult HEC-22, Chapter 10, for the design of detention facilities.

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

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

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

Drilling the orifice into an outlet structure that is made of concrete can result in considerable impact on the coefficient, as does the beveling of the edge.

Three alternative outlet structures that use single orifice outlets are suggested. The concrete block structure is appropriate for large basins. The riser pipe is suggested for small to large basins to prevent orifice clogging. Hole size and placement are not critical in this case because the orifice will control the discharge rate. Placing the outlet control in the berm or in a manhole located downstream of the facility is most suitable for small basins as long as other outlets/spillways are provided for storms larger than the water quality design storm. For small facilities, place the control orifice in the outlet manhole downstream of the filter, or use a "T-pipe" to submerge the orifice. Variations of this alternative may include gates, valves, or weirs. The PE should consult with both the District Maintenance Storm Water Coordinator and the District Hydraulics Branch regarding these outfall structures.

Flow Control Using the Perforated Riser: For outlet control using the perforated riser as the outlet control, as shown on Figure B-4. This design incorporates flow control for the small storms in the perforated riser, and also provides an overflow outlet for large storms. If properly designed, the facility can be used for both water quality and drainage control by: (1) sizing the perforated riser as indicated for water quality control; (2) sizing the outlet pipe to control peak outflow rate from the 2-year storm; and (3) using a spillway in the basin berm to control the discharge from larger storms up to the 100-year storm.

To prevent clogging of the bottom orifices of the riser pipe, wrap the bottom three rows of orifices with filter fabric per Section 88 of Standard Specifications and a cone of 25 mm (1 in) to 75 mm (3 in) rock.

Public health and vector control authorities should be consulted to verify the acceptability of detention basins and to establish the maximum drawdown time allowed in order to avoid mosquito problems.

The inlet structure of the basin should be designed to divert the peak hydraulic flow (calculated according to Caltrans procedures for flood routing and scour) when the basin is full. Alternatively, an overflow structure sized according to these criteria can be provided in one of the downstream walls or berms. A third alternative is to include a flood control outlet in the top of the water quality outlet. In this case, an additional outlet (riser or spillway) should be supplied to prevent overtopping of the walls or berms. Entering flows should be distributed uniformly at low velocity to prevent re-suspension of settled materials and to encourage quiescent conditions.

The site must have sufficient area for a perimeter maintenance road and safe access to and from the site from local roads. Basin side slopes must be shallow enough to permit tracked vehicles to access the basin invert for maintenance. Alternatively, an access ramp should be provided. Preliminary design factors for detention basins are summarized in Table B-4.

Table B-4: Summary Of Detention Basin Siting And Design Criteria

Description	Applications/Siting	Preliminary Design Factors
Impoundments where the WQV is temporarily detained Treatment Mechanisms: • Sedimentation • Infiltration (if basin unlined) Pollutants removed: • Sediment and particulates • Litter • Sorbed pollutants (heavy metals, oil and grease [O&G])	• Sufficient head to prevent objectionable backwater condition in the storm drain system • Seasonally high groundwater below basin invert • Consult public health and vector control authorities • Minimum orifice size of 13 mm (0.5 in)	• Size to capture the water quality volume according to Section 2.4.2.2 • Flow-path-to-width ratio of at least 2:1 recommended • Maximum water level should not cause groundwater to occur under the roadway within 0.2 m (0.7 ft) of the roadway subgrade • Basin invert ≥ 3 m (10 ft) above seasonally high groundwater or else a impermeable liner is required • Maintenance access (road around basin and ramp to basin invert) • Upstream diversion channel or pipe, downstream overflow structure or flood control outlet • Discharge through a water quality outlet with debris screen (or equivalent) • Outlet design to empty basin within 24 to 72 hrs (consistent with basin sizing method, as appropriate) • Flows should enter at low velocity. Use scour protection on inflow, outfall and spillway if necessary. • Use 1:3 side slope ratios or flatter for earthen berms

B.5 TRACTION SAND TRAPS

Description:

Traction sand traps are sedimentation devices that temporarily detain runoff and allow traction sand that was previously applied to snowy or icy roads to settle out. In this document, traction sand refers to sand and other abrasives. These traps may take the form of basins, tanks, or vaults.

Appropriate Applications and Siting Constraints:

Traction sand traps should be considered at sites where sand or other traction-enhancing substances are commonly applied to the roadway. If sand is used only rarely (less than once or twice a year), traction sand traps need not be considered for installation.

Traction sand traps should be considered only where detention basins are not feasible. The local RWQCB should be consulted to ensure that the traction sand trap is not classified as a regulated underground injection well.

Factors Affecting Preliminary Design:

Traction sand traps should have sufficient volume to store the settled sand through the winter (or some other period of time chosen by the District) with enough depth over the stored sand to prevent scouring and to promote relatively calm pool conditions. The volume required to store traction sand is calculated by starting with the estimated amount of traction sand spread in a given area and applying reduction factors to account for sand that has been recovered by other means or that cannot be captured. The equation for calculating the volume of traction sand storage is:

$$V = (S \times R \times L \times E)/F$$

Where:

V= The total volume of traction sand that must be stored (m^3).
S = The estimated volume of sand applied (m^3/yr).
R= A reduction factor to account for sand recovered by roadway sweeping.
L= A factor to account for other miscellaneous losses/accumulations.
E= An estimated recovery efficiency.
F= The number of times the trap will be cleaned (times/yr).

Guidelines for defining the variables in this equation are as follows:

S: Typical sand application rates range from 47 m^3/lane/km/yr for areas with average application rates to 95 m^3/lane/km/yr for areas with high application rates. To estimate the total volume of traction sand applied, select an appropriate application rate from the range listed in this section, and multiply it by the total number of lanes (e.g., one lane in each direction equals two lanes) and the length

of highway tributary to the sand trap. Because some areas track sand usage by post mile, a more accurate estimate may be obtained by consulting with District maintenance staff. In any event, consider the following guidelines when estimating the volume of sand that is spread annually in the tributary area:

Exposure: Roadways on north facing slopes generally require more traction sand than similar south facing slopes. The surrounding vegetation may also significantly affect exposure and traction sand application.

Roadway grade: Steeper grades generally receive more traction sand.

Other climatic and geographic factors, such as elevation, will affect the traction sand application rate for a specific area.

Other sources of similar material: Adjacent cut slopes and other non-paved tributary areas may contribute similar-sized sediment or other debris that will be retained in the trap.

R: This is a reduction factor to account for traction sand that is recovered through roadway sweeping. Estimate a value between 1.0 (no roadway sweeping) and 0.6 (aggressive winter roadway sweeping) based on interviews with District maintenance staff. If actual sweeping records are available, these may provide a more accurate estimate.

L: This is a factor to account for traction sand that has been carried into or out of the tributary area by miscellaneous means such as wind (smaller particles), sand thrown out of the tributary area by snow clearing equipment, and sand splashed or carried by vehicles. Estimate an appropriate value in the range of 0.8 (high losses from known sources such as snow blowers) to 1.2 (high accumulation from known sources). Use a factor of 1.0 for no miscellaneous losses/accumulations.

E: This reduction factor is provided to account for traction sand that passes through the sand trap without settling out. Because of particle size limitations, settling inefficiencies, and other factors, it may not be realistic or practicable to recover all of the traction sand that reaches the sand trap. Until empirical information is obtained from pilot studies, a value of 1.0 should be used for this factor.

F: This is the number of times the sand trap will be cleaned each season. Usually, the value for F is 1 as most basins are cleaned once per year, usually in the summer. If obtaining the required storage volume is difficult, it may be possible to implement mid-season cleaning (F greater than 1), but District maintenance staff should be consulted to make sure this is practicable. Mid-season cleaning requirements will also likely affect trap design, as maintenance equipment will have to access the trap under wet or snowy conditions.

Provisions should be made to divert the peak hydraulic flow (calculated according to Caltrans procedures for flood routing and scour).

Traction sand traps require a small hydraulic head for gravity flow operation. The inlet and outlet devices should be arranged or baffled to minimize short-circuiting of the flow through the device. Weep holes should be provided and the trap invert should be sufficiently high above groundwater (1 to 2 m) (3 to 6 ft) to allow for proper drainage. Traction sand traps that do not drain may create vector problems in the spring.

Traction sand traps require sufficient space and/or access ramps for maintenance by large equipment to remove the accumulated sand. Traps should also be located so that water is not introduced above the roadway subgrade should the trap become blocked or fail to drain. Preliminary design factors for traction sand traps are summarized in Table B-5.

Table B-5: Summary of Traction Sand Trap Siting and Design Criteria

Description	Applications/Siting	Preliminary Design Factors
Sedimentation devices that temporarily detain runoff and allow traction sand to settle out. May be basins, tanks, or vaults. Treatment Mechanisms: • Sedimentation Pollutants removed: • Sand or other traction-enhancing substances	• Sites where sand or other traction-enhancing substances are commonly applied to the roadway • Not considered where sand is used only rarely (less than once or twice a year) • Where detention basins are not feasible • Consult District/Regional NPDES Storm Water Coordinator to ensure device not classified as a regulated underground injection well • Locate device so water is not introduced above the roadway subgrade in case of blockage	• Design for anticipated sand recovery • Divert peak hydraulic flow • Sufficient volume to store the settled sand through the winter and avoid scour • Sufficient hydraulic head for gravity flow • Inlet and outlet arrangement to minimize short-circuiting of the flow • Weep holes to allow proper drainage • Invert 1 to 2 m (3 to 6 ft) above groundwater • Maintenance space and/or access ramps for large equipment

B.6 DRY WEATHER FLOW DIVERSION

Description:

Dry weather diversion devices direct flow through a pipe or channel to a local municipal sanitary sewer system for conveyance and treatment at a local wastewater treatment plant during dry weather.

Appropriate Applications and Siting Criteria:

- Dry weather flow diversion should only be considered when all of the following conditions apply:

- Dry weather flow is persistent (i.e., present over a significant length of time at a relatively consistent flow rate);
- An opportunity for connecting to a sanitary sewer is reasonably close and would not involve excessive measures to implement (e.g., jacking under a freeway);
- The sanitary sewer authority is willing to accept the flow during the dry season; and
- Diversion is recommended by local health officials because of public use of the receiving water near the Caltrans facility.

Factors Affecting Preliminary Design:

- Typically, a berm or wall is constructed across the dry weather flow drainage channel and the dry weather flows are diverted to a pipe or channel leading to the sanitary sewer. A gate, weir, or valve should be installed to stop the diversion during the wet season. Accordingly, the conveyance to the sanitary sewer should be sized for the dry weather flow only. Wet weather flow is diverted back to the storm water conveyance system; and
- If possible, a screen should be installed at the diversion to reduce the likelihood of clogging the diversion pipe or channel. Maintenance vehicle access should be provided, especially if a screen is installed. Preliminary design factors for dry weather flow diversions are summarized in Table B-6.

Table B-6: Summary of Dry Weather Flow Diversion

Description	Applications/Siting	Preliminary Design Factors
Direct flow during dry weather to local municipal sanitary sewer and wastewater treatment plant Treatment Mechanisms: • Wastewater treatment plant Pollutants removed: • All constituents	Only when the conditions below apply: • Dry weather flow is persistent (consistent flow rate and significant length of time) • Reasonably close connection to a sanitary sewer • Connection would not involve excessive construction measures to implement • Sanitary sewer authority willing to accept dry weather flow • Recommended by local health officials (public use of receiving water near Caltrans facility)	• Berm or wall across channel to divert dry weather flow to the sanitary sewer • Gate, weir, or valve to stop diversion during wet season • Conveyance to sanitary sewer sized only for dry weather flow • Maintenance vehicle access

B.7 GROSS SOLIDS REMOVAL DEVICES: LINEAR RADIAL DEVICE AND INCLINED SCREEN DEVICE

Description:

Gross Solids Removal Devices (GSRDs) include physical/mechanical methods of removing litter and solids 5 mm (0.25 inch nominal)[3] and larger from the storm water runoff using various screening technologies.

Appropriate Applications and Siting Criteria:

GSRDs should be considered for areas where receiving waterbodies are on the 303(d) impaired water body list for trash. GSRDs should also be installed in the areas where Total Maximum Daily Loads (TMDLs) require trash removal.

The Linear Radial Device requires very little head to operate and is well suited for narrow and relatively flat rights-of-way with limited space. The Inclined Screen requires about 1.5 m (5 ft) of head and is well suited for fill sections of the highways.

GSRDs require sufficient space and/or access ramps for maintenance and inspection including the use of vactor trucks or other large equipment to remove accumulated trash.

B.7.1 Linear Radial Device

The Linear Radial Device (Figure B-6) utilizes modular well casings with 5 mm (0.25-inch nominal) louvers to remove litter. The louvered well casings are contained in a concrete vault. Flows pass radially through the louvers trapping litter and solids in the casing and passing flows into the vault for discharge via an outlet pipe. The bottom of the casing is smooth to allow trapped litter to move to the downstream end of the well casing. The device requires very little head to operate and has been pilot tested for 1% slope. Flatter slopes may work but have not been tested. The Linear Radial Device is designed to work in-line with the existing storm drain system or could be placed in an off-line configuration. In-line configuration incorporates overflow/bypass if the unit becomes plugged. As shown in Figure B-7, the first half-meter of the linear well casing is non-louvered with an open top to allow for influent bypass should the device become clogged with litter. The circular louvered sections have access doors that can be easily opened to facilitate cleaning with a vacuum truck or other equipment if necessary. The device is covered with a load-bearing grating appropriate to the location.

[3] 5 mm size is based on requirements set forth in Los Angeles river watershed trash TMDL. Other sizes may be necessary as required by other TMDLs.

Figure B-6: Example Schematic of Linear Radial Device (Not a Standard Plan)

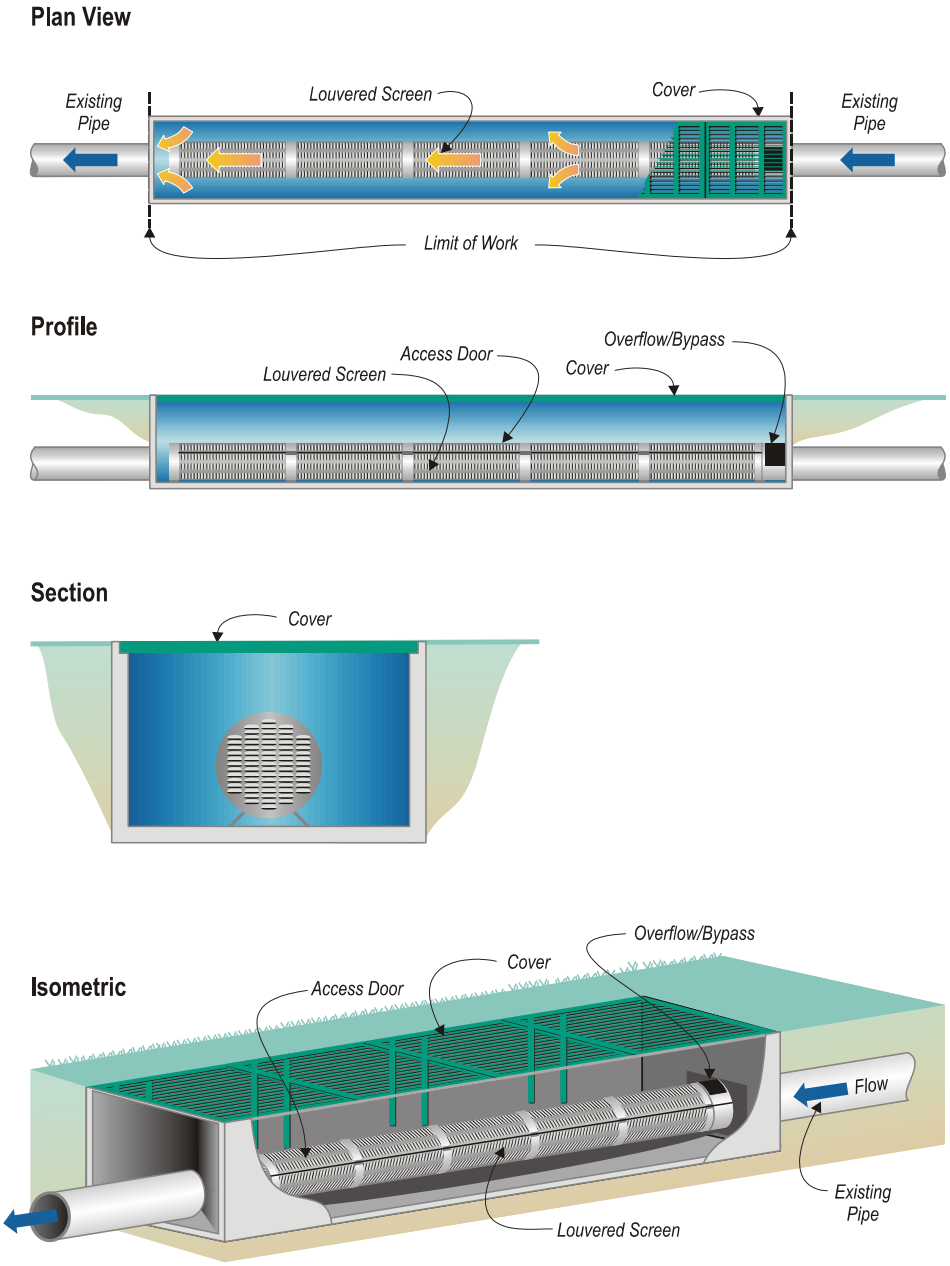


Figure B-7: Partially Full Linear Radial Device

B.7.2 Inclined Screen Device

In the Inclined Screen Device, the flow overtops a weir and falls through an inclined bar rack (wedge-wire screen) with a 3-mm (0.125-inch nominal)[4] maximum spacing between the bars, located after the influent trough. After passing through the rack, the flow exits the device via the discharge pipe. A distribution trough is provided to allow influent to be distributed along the length of the Inclined Screen. The litter captured by the bar rack is pushed down toward the litter storage area by the storm water runoff. Parabolic wedge-wire screen inclined at 60 degrees and 1 m (3 ft) high was tested in pilot studies and worked effectively. Other configurations with different inclinations and heights of the screen may work but have not been pilot tested. In order to minimize the footprint of the device, a 90-degree elbow configuration of the screen (Figure B-8) was used in the pilot study. Other configurations of the screen can be used on a site-specific basis. The gross solids storage area is sloped and is provided with a drain to prevent standing water. As shown in Figure B-9, an opening above the litter storage area is provided to allow for overflow/bypass if the device becomes plugged. The device should be designed for litter and debris storage for a period of one year. The device is covered with a load-bearing grating appropriate to the location.

[4] This screen size was pilot tested; other screen sizes up to 5 mm (0.25 inch) may be used if available.

Figure B-8: Example Schematic of Inclined Screen (Not a Standard Plan)

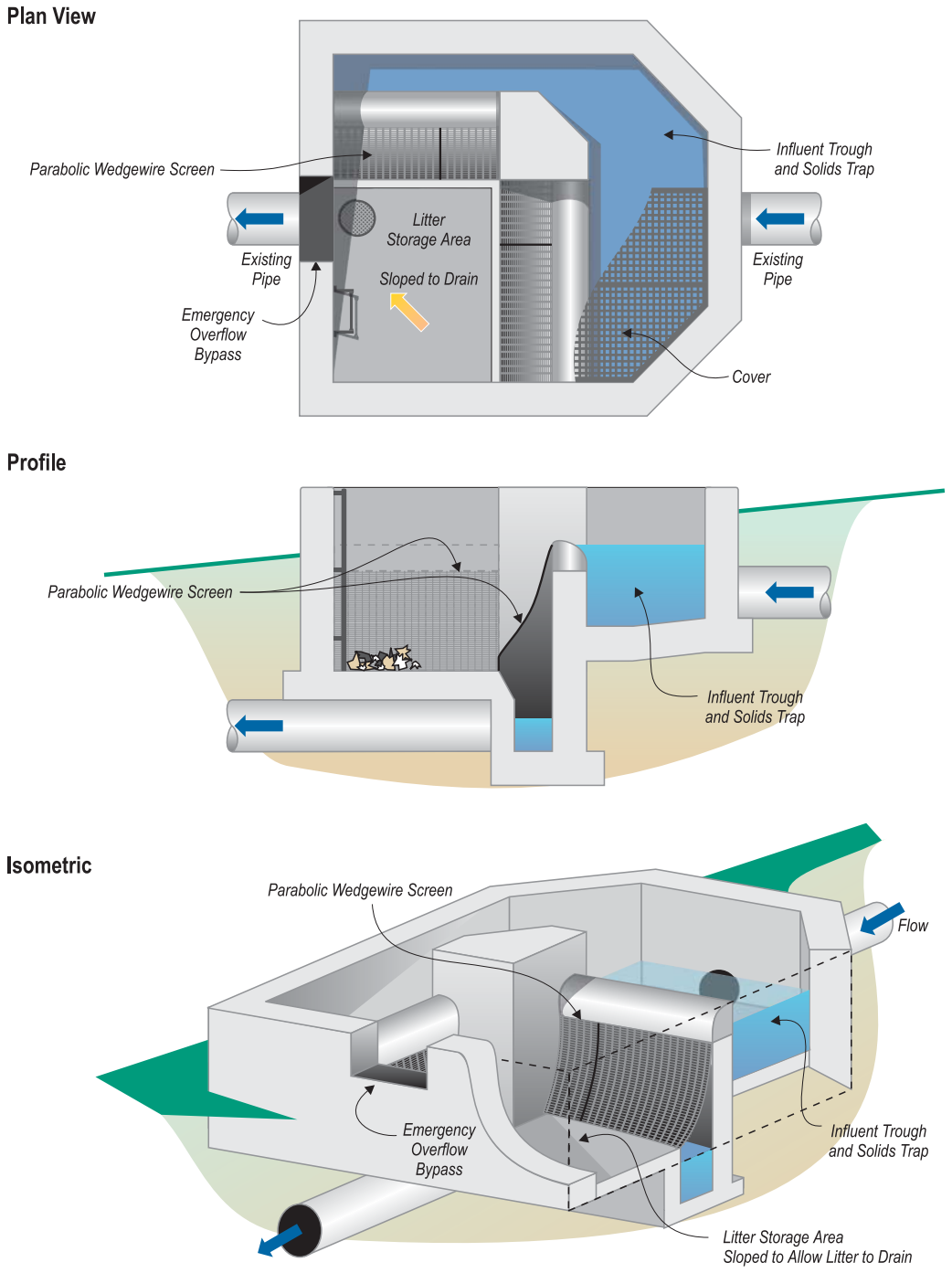


Figure B-9: Inclined Screen

B.7.3 Factors Affecting Preliminary Design:

The two most important factors affecting the design of these devices are: (1) the need to be sized to accommodate both gross pollutants storage for a given maintenance period (typically one year), and (2) the hydraulic capacity of the drainage system in which it is to be installed. Litter and debris accumulation data need to be available to properly size the devices for the given drainage area. If regional debris accumulation data are not available, then 0.7 m^3/ha/yr may be used. These devices can be designed both in-line and off-line. In-line configuration incorporates overflow/bypass if the unit becomes plugged. A summary of preliminary design factors is presented in Table B-7.

Table B-7: Summary of Gross Solids Removal Devices (Linear Radial and Inclined Screen)

Description	Applications/Siting	Preliminary Design Factors
Treatment Mechanisms: • Filtration through screens Pollutants removed: • Litter and solid particles greater than 5 mm (0.25 inch nominal)	• Site conditions must have adequate space for device and maintenance activities. • Sites that drain to litter sensitive receiving waters on 303(d) list for trash or areas where TMDLs require trash removal. • The Linear Radial Device requires little head to operate and is well suited for flat sections of highway. • The Inclined Screen requires 1.5 m (5 ft) of head and it is well suited for fill sections.	• Regional litter accumulation data are desirable, otherwise use 0.7 m^3/hectare/year. • Devices must be sized for peak design flow while carrying design gross solids load. • The Linear Radial Device well casing is available up to 900 mm (36 inch) diameter. • Devices can be placed in-line incorporating bypass/overflow or it may be placed offline.

Appendix C
Approved Construction Site BMPs

C.1 CONSTRUCTION SITE BEST MANAGEMENT PRACTICES (BMPS)

Construction Site Best Management Practices (BMPs) are applied during construction activities to reduce the pollutants in storm water discharges throughout construction. These Construction Site BMPs provide both temporary erosion and sediment control. There are six categories of BMPs suitable for temporary erosion and sediment control on construction sites. They are:

- Soil Stabilization Practices;
- Sediment Control Practices;
- Tracking Control Practices;
- Wind Erosion Control;
- Non-storm Water Controls; and
- Waste Management and Material Pollution Controls.

It is generally accepted that practices that perform well by themselves can be complemented by other practices to raise the collective level of erosion control effectiveness and sediment retention. Effective erosion and sediment control planning relies on a system of BMPs (e.g., mulches for source control, fiber rolls on slopes for reducing runoff velocities, silt fence at the toe of slopes for capturing sediment, etc.).

To meet regulatory requirements and protect the site resources, every project must include an effective combination of erosion and sediment control measures. These measures must be selected from all of the BMP categories presented in this section: soil stabilization practices, sediment control practices, tracking control practices, and wind erosion control practices. Additionally, the project plan must include non-storm water controls, waste management and material pollution controls.

Table C-1 is a matrix of the Construction Site BMPs that have been approved for use during construction. Detailed descriptions and guidance regarding implementation of these BMPs may be found in the Construction Site Best Management Practices Manual and Section 4 of the Statewide Storm Water Quality Practice Guidelines (Guidelines).

The individual BMPs designated by an “X” in Table C-1 as being applicable to a particular typical construction activity, will not necessarily be appropriate for all projects involving the noted activity. For example, not all projects will have on-site vehicle fueling and maintenance operations; however, those that do will be required to conduct those operations in a manner consistent with the intent of the BMP description contained in Appendix B of the Storm Water Management Plan (SWMP) and BMP implementation detailed in the Guidelines.

Table C-1 shows the Construction Site BMPs by construction activity.

Table C-1: Construction Site BMPS By Construction Activity

	Typical Highway Construction Activities																											
	Demolish Pavement/Structures	Clear and Grub	Construct Access Roads	Grading (inc. cut and fill slopes)	Channel Excavation	Channel Paving	Trenching/ Underground Drainage	Underground Drainage Facility Installation	Drainage Inlet Modification	Utility Trenching	Utility Installation	Subgrade Preparation	Base Paving	AC Paving	Concrete Paving	Saw Cutting	Joint Sealing	Grind/Groove	Structure Excavation	Erect Falsework	Bridge/Structure Construction	Remove Falsework	Striping	Miscellaneous Concrete Work	Sound Walls/Retaining Walls	Planting and Irrigation	Contractor Activities	Treatment BMP Construction
Best Management Practices																												
Temporary Sediment Control																												
Silt Fence	X	X	X	X	X		X			X		X							X		X					X		X
Sandbag Barrier	X	X	X	X	X		X			X		X							X		X					X		X
Straw Bale Barrier	X	X	X	X	X		X			X		X							X		X					X		X
Fiber Rolls	X	X	X	X	X		X			X											X					X		X
Gravel Bag Berm	X	X	X	X	X		X			X											X					X		X
Check Dam	X	X		X	X		X																					X
Desilting Basin	X	X	X	X	X																X					X		X
Sediment Trap	X	X	X	X	X		X			X		X							X		X					X		X
Sediment Basin		X		X	X																X					X		X
Temporary Soil Stabilization																												
Hydraulic Mulch	X	X		X	X																X					X		X
Hydroseeding	X	X		X	X																X					X		X
Soil Binders	X	X		X	X														X		X					X		X
Straw Mulch	X	X	X	X	X		X	X		X		X							X		X					X		X
Geotextiles, Mats/Plastic Covers and Erosion Control Blankets	X	X	X	X	X		X	X		X		X							X		X					X		X
Scheduling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X
Preservation of Existing Vegetation		X	X	X			X	X		X									X	X		X			X			
Temporary Concentrated Flow Conveyance Controls																												

Table C-1: Construction Site BMPS By Construction Activity

	Typical Highway Construction Activities																										
	Demolish Pavement/Structures	Clear and Grub	Construct Access Roads	Grading (inc. cut and fill slopes)	Channel Excavation	Channel Paving	Trenching/ Underground Drainage	Underground Drainage Facility Installation	Drainage Inlet Modification	Utility Trenching	Utility Installation	Subgrade Preparation	Base Paving	AC Paving	Concrete Paving	Saw Cutting	Joint Sealing	Grind/Groove	Structure Excavation	Erect Falsework	Bridge/Structure Construction	Remove Falsework	Striping	Miscellaneous Concrete Work	Sound Walls/Retaining Walls	Planting and Irrigation	Contractor Activities	Treatment BMP Construction
Best Management Practices (Cont'd)																											
Earth Dikes/Drainage Swales & Lined Ditches		X	X	X																	X							
Outlet Protection/Velocity Dissipation Devices		X	X	X																	X							
Slope Drains				X																	X							
Temporary Stream Crossing			X				X	X		X	X									X	X	X		X				
Clear Water Diversion	X		X		X	X														X	X	X			X			X
Wind Erosion Control		X	X	X	X		X			X		X	X	X	X											X		X
Sediment Tracking Control	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X		X				X	X	X	X
Street Sweeping and Vacuuming	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X		X				X	X	X	X
Stabilized Construction Roadway		X	X	X																								
Entrance/Outlet Tire Wash		X	X	X																						X	X	
Waste Management																												
Spill Prevention and Control	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Solid Waste Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hazardous Waste Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Contaminated Soil Management	X	X		X			X	X		X	X									X								
Concrete Waste Management	X		X			X		X			X		X		X	X		X	X		X			X	X	X	X	X
Sanitary/Septic Waste Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table C-1: Construction Site BMPS By Construction Activity

	Typical Highway Construction Activities																										
	Demolish Pavement/Structures	Clear and Grub	Construct Access Roads	Grading (inc. cut and fill slopes)	Channel Excavation	Channel Paving	Trenching/ Underground Drainage	Underground Drainage Facility Installation	Drainage Inlet Modification	Utility Trenching	Utility Installation	Subgrade Preparation	Base Paving	AC Paving	Concrete Paving	Saw Cutting	Joint Sealing	Grind/Groove	Structure Excavation	Erect Falsework	Bridge/Structure Construction	Remove Falsework	Striping	Miscellaneous Concrete Work	Sound Walls/Retaining Walls	Planting and Irrigation	Contractor Activities	Treatment BMP Construction
Best Management Practices (Cont'd)																											
Liquid Waste Management														X		X	X		X		X		X				X	X
Materials Handling																												
Material Delivery, and Storage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Material Use	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Operations																												
Vehicle and Equipment Cleaning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Fueling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Maintenance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Paving Operations			X			X			X				X	X	X	X	X	X			X							
Stockpile Management	X		X					X		X	X		X	X	X			X										
Water Conservation Practices	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X		X			X		X	X	X
Potable Water/Irrigation																												
Dewatering Operations	X			X	X	X	X	X	X	X	X								X		X			X	X	X		X
Illicit Connection/Illegal Discharge Detection and Reporting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Storm Drain Inlet Protection	X	X	X	X	X		X	X	X	X		X	X			X	X	X	X								X	X
Stabilized Construction Entrance/Exit		X	X	X																						X		X

X BMP may be applicable to activity

4003

C.1.1 Soil Stabilization BMPs

Examples of Soil Stabilization BMPs include:

- SS-1 Scheduling;
- SS-2 Preservation of Existing Vegetation;
- SS-3 Hydraulic Mulch;
- SS-4 Hydroseeding;
- SS-5 Soil Binders;
- SS-6 Straw Mulch;
- SS-7 Geotextiles, Plastic Covers and Erosion Control Blankets;
- SS-8 Wood Mulching;
- SS-9 Earth Dikes/Drainage Swales and Ditches;
- SS-10 Outlet Protection/Velocity Dissipation Devices; and
- SS-11 Slope Drains.

Provided on Table C-2 are selection criteria information and ratings for temporary soil stabilization BMPs. The BMPs are described in detail following Table C-2.

Table C-2: Temporary Soil Stabilization Criteria Matrix

CLASS	TYPE	TEMPORARY SOIL STABILIZATION CONTROL CRITERIA													
		Antecedent Moisture	Availability	Ease of Clean-Up	Installed Cost Per Ha	EC Effectiveness (%)	Degradability	Length of Drying Time (hrs)	Time to Effectiveness (days)	Longevity	Mode of Application	Residual Impact	Native	Runoff Effect	Water Quality Impact
CATEGORY: STANDARD BIODEGRADABLE MULCHES (SBM)															
Straw Mulch	Wheat Straw	D	S	H	$5,200	90-95	B	0	1	M	L/M	M		+	M
	Rice Straw	D	S	H	$5,200	90-95	B	0	1	M	L/M	M		+	L
Wood Fiber Mulch	Wood Fiber	D	S	H	$2,200	50-60	B	0-4	1	M	H	L		+	M
Recycled Paper Mulch	Cellulose Fiber	D	S	H	$2,100	50-60	B	0-4	1	S	H	L		+	L
Bonded Fiber Matrix	Biodegradable	D	S	H	$13,600	90-95	B	12-18	1	M	H	M		+	H
CATEGORY: ROLLED EROSION CONTROL PRODUCTS (RECP)															
Biodegradable	Jute Mesh	D	S	H	$16,000	65-70	B		1	M	L	M		+	UNK
	Curled Wood Fiber	D	S	H	$26,000	85-90	P/B		1	M	L	M		+	L
	Straw	D	S	H	$22,000	85-90	P/B		1	M	L	M		+	H
	Wood Fiber	D	S	H	$22,000	85-90	P/B		1	M	L	M		+	L
	Coconut Fiber	D	S	H	$32,000	90-95	P/B		1	L	L	M		+	L
	Coconut Fiber Mesh	D	S	H	$77,000	85-90	B		1	L	L	M		+	UNK
	Straw Coconut Fiber	D	S	H	$27,000	90-95	P/B		1	L	L	M		+	M
Non-Biodegradable	Plastic Netting	D	M	H	$5,000	<50	P		1	L	L	H		+	UNK
	Plastic Mesh	D	M	H	$8,000	75-80	P		1	L	L	H		+	UNK
	Synthetic Fiber with Netting	D	M	H	$86,000	90-95	P		1	L	L	H		+	UNK
	Bonded Synthetic Fibers	D	M	H	$121,000	90-95	P		1	L	L	H		+	UNK
	Combination with Biodegradable	D	M	H	$79,000	85-90	P		1	L	L	H		+	UNK
CATEGORY: TEMPORARY SEEDING (TS)															
High-Density	Ornamentals		S-M	H	$1000 - $4000	50-60			28	M-L	H	L-M	N/E	+	UNK
	Turf species		S	H	$900	50-60			28	L	H	M-H	N/E	+	UNK
	Bunch grasses		S-M	H	$750 - $3200	50-60			28	L	H	L-M	N	+	UNK
Fast-Growing	Annual		S	H	$900 - $1,600	50-60			28	L	H	L-H	N/E	+	UNK
	Perennial		S	H	$800 - $2000	50-60			28	L	H	M	N/E	+	UNK
Non-Competing	Native		S-M	H	$700 - $4000	50-60			28	L	H	L-M	N	+	UNK
	Non-Native		S-M	H	$1000 - $1200	50-60			28	L	H	L-H	E	+	UNK
Sterile	Cereal Grain		S	H	$1,200	50-60			28	L	H	L	E	+	UNK
CATEGORY: IMPERVIOUS COVERS (IC)															
Plastic	Rolled Plastic Sheeting		S		$17,000	100	P		1	M	L	H		-	UNK
	Geotextile (Woven)		S		$14,800	90-95	P		1	M	L	H		-	UNK
CATEGORY: HYDRAULIC SOIL STABILIZERS (HSS)															
(PBS) Plant Material Based- Short Lived	Guar	D	S	H	$1,000	80-85	B	12-18	Same as Length of	S	B	L		0/+	M/L
	Psyllium	P	S	H	$1,000	25-35	B	12-18		M	B	L		0	L/H
	Starches	D	S	H	$1,000	25-30	B	9-12		S	H	L		0	L
(PBL) Plant Material Based- Long Lived	Pitch/ Rosin Emulsion	D	S	M	$3,000	60-75	B	19-24		M	B	M		-	H
(PEB) Polymeric Emulsion Blends	Acrylic polymers and copolymers	D	S	M	$3,000	35-70	P/C	19-24		L	B	M		+/-	L/M
	Methacrylates and acrylates	D	M	M	$1,000	35-40	P/C	12-18		S	W	L		0/+	L
	Sodium acrylates and acrylamides	D	M	M	$1,000	20-70	P/C	12-18		S	H	L		+/-	L/M
	Polyacrylamide	D	M	M	$1,000	55-65	P/C	4-8		M	H	L		0/+	L
	Hydro-colloid polymers	D	M	H	$1,000	25-40	P/C	0-4		M	H	L		0/+	L/M
(PRB) Petroleum/ Resin-Based Emulsions	Emulsified Petroleum Resin	D	M	L	$3,000	10-50	P/C	0-4		M	B	M		0/-	H
(CBB) Cementitious Based Binders	Gypsum	D	S	M	$2,000	75-85	P/C	4-8		M	H	L		-	M/H

= not applicable for category, class or type

UNK = unknown

Table C-2: Temporary Soil Stabilization Criteria Matrix (continued)

Antecedent Moisture	**D** **P**	Soil should be relatively dry before application Soil should be pre-wetted before application
Availability	**S** **M**	A short turn-around time between order and delivery, usually 3-5 days A moderate turnaround time, between 1-2 weeks
Ease of Clean-Up	**L** **M** **H**	Require pressure washing, a strong alkali solution, or solvent to clean up Requires cleanup with water while wet; more difficult to clean up once dry May be easily removed from equipment and overspray areas by a strong stream of water
Installed Cost		Dollars per hectare
Degradability	**C** **P** **B**	Chemically degradable Photodegradable Biodegradable
Length of Drying Time		Estimated hours
Time to Effectiveness		Estimated days
Erosion Control Effectiveness		Percent reduction in soil loss over bare soil condition.
Longevity	**S** **M** **L**	1 - 3 months 3 – 12 months > than 12 months
Application Mode	**L** **W** **H** **B** **M**	Applied by hand labor Applied by water truck Applied by hydraulic mulcher Applied by either water truck or hydraulic mulcher Applied by a mechanical method other than those listed above (e.g., straw blower)
Residual Impact	**L** **M** **H**	Projected to have a low impact on future construction activities Projected to have a moderate impact on future construction activities Projected to have a significant impact on future construction activities
Native	**N** **E**	Plant or plant material native to the State of California Exotic plant not native to the State of California
Runoff Effect	**+** **0** **-**	Runoff is decreased over baseline (bare soil) No change in runoff from baseline Runoff is increased over baseline
Water Quality Impact	**L** **M** **H**	Low potential to impact water quality Moderate potential to impact water quality Higher potential to impact water quality

C.1.1.1 Scheduling (SS-1)

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

C.1.1.2 Preservation of Existing Vegetation (SS-2)

Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits. Whenever practical, existing vegetation should be preserved. Plants and trees act as effective soil stabilization and sediment control devices, particularly around the perimeter of construction sites. Areas that will not be disturbed as part of construction activities should be clearly marked on plans and protected in the field with fencing prior to clearing and grubbing. Access limitations should also be shown on the plans and described in the Special Provisions. Any damage to preservation areas should be repaired immediately.

Items to consider when preserving existing vegetation include:

- Preserve existing vegetation to provide effective erosion control;
- Consider the age, life expectancy, health, aesthetic value, and habitat benefits of vegetation to be preserved;
- Areas containing vegetation to be preserved must be shown on the plans; and
- Preserve native plants on the site wherever possible.

C.1.1.3 Hydraulic Mulch (SS-3)

Hydraulic mulch consists of applying a water-based mixture of wood or paper fiber and stabilizing emulsion with hydro-mulching equipment. This will protect disturbed soil from erosion by raindrop impact or wind. Specifications for mulch can be found in Caltrans Standard Specifications, Section 20-2.08.

Type: <u>Wood Fiber</u>

Wood fiber mulch is generally used as a component of hydraulic applications. It is usually used in combination with seed, fertilizer and other materials, and is typically applied at the rate of 2,250 to 4,500 kilograms per hectare (kg/ha).

Wood fiber mulch can be specified with or without a tackifier. Previous work has shown that wood fiber mulches with tackifiers have better erosion control performance.

Type: <u>Recycled Paper</u>

Recycled paper mulch is generally used in hydraulic applications. It is usually used in combination with seed and fertilizer and is typically applied at the rate of 2,250 to 4,500 kg/ha.

Type: <u>Cellulose Fiber</u>

Cellulose fiber mulch contains fibers of shorter length than wood fiber mulches and is typically made from recycled newsprint, magazine, or other waste paper sources. It can be specified with or without a tackifier.

Type: **Bonded Fiber Matrix**

A bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion-resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,400 to 4,500 kg/ha based on the manufacturer's recommendation.

The biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall so that the matrix will have an opportunity to dry for 24 hours after application.

C.1.1.4 Hydro seeding (SS-4)

Hydro seeding consists of applying a water-based mixture of wood or paper fiber, stabilizing emulsion, and seed with hydro-mulching equipment. This is usually a multi-step process with a layer of straw. Often fertilizer and compost are added to the hydraulic mixture. This will protect disturbed soil from erosion by raindrop impact or wind. Hydraulic mulches are typically combined with a seed mixture for achieving longer term temporary soil stabilization than by hydraulic mulching alone. The selection of plant materials to be included in the seed mixture can be based, in part, on the length of time temporary stabilization is required.

Temporary Erosion Control with perennial grasses, especially California native species, is not appropriate for Caltrans projects. The most effective method is to use straw and tackifier with cereal barley (50 kg/ha). Temporary seeding on construction projects should last one to two seasons before the grass is removed and the slopes re-graded.

If a follow-up planting project is to re-vegetate an area, it might be possible to seed with natives and perennials. The key here is that there will be another project. The seeding on the first project would not be temporary; it would be permanent, as it would continue beyond project completion.

C.1.1.5 Soil Binders (SS-5)

Soil binders, also known as soil stabilizers, are adhesives that stabilize soil by binding soil particles together. This will protect disturbed soil from erosion by raindrop impact or wind. Soil binders can also be used in combination with hydraulic mulches to improve their erosion control effectiveness.

There are five types of soil binders:

- Plant Material-Based (Short-Term);
- Plant Material-Based (Long-Term);
- Polymeric Emulsion Blends;
- Petroleum or Resin-Based Emulsions; and
- Cementitious-Based Binders.

Type: **Plant-Material Based (Short-Term)**

Guar

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

Application Rates for Guar Soil Stabilizer

Slope (V:H):	Flat	1:4	1:3	1:2	1:1
Kg/ha:	45	50	56	67	78

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 re-wettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates are generally 90 to 225 kg/ha, with enough water in solution to allow for a uniform slurry flow.

Starch

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

Type: **Plant-Material Based (Long-Term)**

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 as follows:

For clayey soil: 5 parts water to 1 part emulsion
For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion/product mixture applied at the rate specified by the manufacturer.

Type: **Polymeric Emulsion Blends**

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 have a minimum shelf life of one year. 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 should air cure within a maximum of 36 to 48 hours. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and applied to soil at a rate of 11,000 liters/hectare.

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 and applied with a hydraulic seeder at the rate of 190 liters per hectare. Drying time is 12 to 18 hours after application.

Copolymers of Sodium Acrylates and Acrylamides

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

Slope Gradient (V:H)	Kg/ha
Flat to 1:5	3.4 – 5.6
1:5 to 1:3	5.6 – 11.2
1:2 to 1:1	11.2 – 22.4

Poly-Acrylamide and Copolymer of Acrylamide

Linear copolymer poly-acrylamide is packaged as a dry-flowable solid. When used as a stand-alone stabilizer, it is diluted at a rate of 1.2 kg/1,000 liters of water and applied at the rate of 5.6 kg/ha.

Hydro-Colloid Polymers

Hydro-colloid polymers are various combinations of dry-flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 60 to 70 kg/ha. Drying times are 0 to 4 hours.

Type: **Petroleum or Resin-Based Emulsions**

Emulsified Petroleum Resin

This material is a concentrated petroleum hydrocarbon emulsion that is mixed with water and applied to the soil surface at a rate of 23,000 liters per hectare. Dilution rates vary with the type of soil and other site conditions, and should be provided by the manufacturer. They typically range from 12:1 to 20:1 parts water to emulsion.

Type: **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 percent. It is mixed in a hydraulic seeder and applied at rates 4,500 to 13,500 kg/ha. Drying time is 4 to 8 hours.

Comparative testing of Hydraulic Soil Stabilizers has been conducted at the Caltrans/SDSU Soil Erosion Research Laboratory for application on two soil types, sandy clay and clayey sand ("Soil Stabilization for Temporary Slopes," URSGWC, October 1, 1999). Both erosion control effectiveness and water quality were evaluated for soil stabilizers representing the available classes and types.

C.1.1.6 Straw Mulch (SS-6)

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller, or anchoring it with a tackifier. Straw mulch is used for soil stabilization, as a temporary surface cover, on disturbed areas until soils can be prepared for re-vegetation. It is also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Loose straw is the most common mulch material used in conjunction with direct seeding of soil. Straw mulching is generally the second part of multi-step process where seed and fertilizer is first applied, then straw mulch applied as the second step. The final step of the process involves holding the loose straw in place by a) using netting, b) applying a liquid tackifier, or c) punching it into the soil by a process known as "crimping" or "incorporating."

Type: **Wheat or Rice Straw**

Straw can be hand applied or machine applied. The fiber length of the straw should be typically greater than 150 millimeters (mm) (6 inches [in]).

C.1.1.7 Geotextiles, Mats/Plastic Covers and Erosion Control Blankets (SS-7)

This BMP involves the placement of geotextiles, plastic covers, or erosion control blankets/mats to stabilize disturbed soil areas (DSAs) and protect soil from erosion by wind or water. These measures are typically used when DSAs are particularly difficult to stabilize, around Environmentally Sensitive Areas (ESAs), and as a temporary quick stopgap measure.

Type: Biodegradable Rolled Erosion Control Products

Biodegradable Rolled Erosion Control Products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. For an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that hold the biodegradable mulch fibers together must also be biodegradable.

Jute Mesh

Jute is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Curled Wood Fiber

Excelsior (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80% of the fiber 150 mm (6 in) or longer. The excelsior blanket should be of consistent thickness. The wood fiber should 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 shall be non-toxic and non-injurious to plant and animal life. Excelsior blanket should be furnished in rolled strips, a minimum of 1,220 mm (48 in) wide, and should have an average weight of 0.5 kilograms per square meter (Kg/m^2), ±10 percent, at the time of manufacture. Excelsior blankets should be secured in place with wire staples. Staples should be made of 3.05-mm (0.12 in) steel wire and should be U-shaped with 200-mm (7.9 in) legs and 50-mm (2 in) crown.

Straw

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. The straw blanket should be furnished in rolled strips a minimum of 2 meters (m) (6.6 feet [ft]) wide, a minimum of 25 m (82 ft) long and a minimum of 0.27 kg/m^2. Straw blankets should be secured in place with wire staples. Staples should be made of 3.05-mm (0.12 in) steel wire and should be U-shaped with 200-mm (7.9 in) legs and 50-mm (2 in) crown.

Wood Fiber

Wood fiber blanket is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance revegetation. The material is furnished in rolled strips, which should be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Coconut Fiber

The coconut fiber blanket should be machine-produced mats of 100% 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. The coconut fiber blanket should be furnished in rolled strips with a minimum of 2 m (6.6 ft) wide, a minimum of 25 m (82 ft) long and a minimum of 0.27-kg/m^2. Coconut fiber blankets should be secured in place with wire staples. Staples should be made of 3.05-mm (0.12 in) steel wire and should be U-shaped with 200-mm (7.9 in) legs and 50-mm (2 in) crown.

Coconut Fiber Mesh

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 should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Straw Coconut Fiber

The straw coconut fiber blanket should be machine-produced mats of 70% straw and 30% coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber 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. The straw coconut fiber blanket should be furnished in rolled strips a minimum of 2 m (6.6 in) wide, a minimum of 25 m (82 ft) long and a minimum of 0.27 kg/m^2. Straw coconut fiber blankets should be secured in place with wire staples. Staples should be made of 3.05-mm (0.12 in) steel wire and should be U-shaped with 200-mm (7.9 in) legs and 50-mm (2 in) crown.

Type: <u>Non-Biodegradable Rolled Erosion Control Products</u>

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

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 should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Plastic Mesh

Plastic mesh is an open-weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than 0.5 centimeters (cm) (0.2 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 should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Synthetic Fiber with Netting

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 vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Bonded Synthetic Fibers

This type of product consists of a three-dimensional, geomatrix nylon (or other synthetic) matting. Typically it has more than 90% open area, which facilitates root growth. Its tough root-reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Combination Synthetic and Biodegradable

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 should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Rolled Plastic Sheeting

Plastic sheeting should have a minimum thickness of 6 mm (0.24 in), and should be firmly held in place with sandbags or other weights placed no more than 3 m (9.8 ft) apart. Seams are typically taped or weighted down their entire length, and there should be at least a 300 mm (12 in) to 600 mm (24 in) overlap of all seams. Edges should be embedded a minimum of 150 mm (6 in) in native soil.

All sheeting should be inspected periodically after installation and after significant rainstorms to check for erosion and undermining. Any failures shall be repaired

immediately. If washout or breakages occurs, the material should be re-installed after repairing the damage to the slope.

Geotextile (Woven)

Woven geotextile material should be a woven polypropylene fabric with a minimum thickness of 15 mm (0.6 in), a minimum of 3.7 m (12ft) wide and should have a minimum tensile strength of 0.67 KN (warp) 0.36 KN (fill) in conformance with the requirements in American Society of Testing and Materials (ASTM) Designation: D 4632. The permittivity of the fabric shall be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D 4491. The fabric should have an ultraviolet (UV) stability of 70% in conformance with the requirements in ASTM designation: D 4355. Geotextile blankets should be secured in place with wire staples or sandbags and by keying into tops of slopes and edges to prevent infiltration of surface waters under geotextile. Staples should be made of 3.05-mm (0.12 in) steel wire and shall be U-shaped with 200-mm (7.9 in) legs and 50-mm (2 in) crown.

Geotextile (Non-Woven)

Non-woven geotextile shall be manufactured from polyester, nylon, or polypropylene material, or any combination thereof. The fabric shall be permeable, non-woven, shall not act as a wicking agent. The fabric shall weigh a minimum of 135 grams per square meter (per ASTM Designation: D 3776), have a minimum grab tensile strength of 0.22 KN in each direction (per ASTM Designation: D 4632), have a minimum elongation at break of 10% (per ASTM Designation: D 4632), have a minimum toughness of 13 KN (percent elongation x grab tensile strength), and a minimum permittivity of 0.5 sec^{-1} (per ASTM Designation: D 4491).

C.1.1.8 Wood Mulching (SS-8)

Wood mulching consists of applying shredded wood, bark, or green material. The primary function of wood mulching is to reduce erosion by protecting bare soil from raindrop impact and reducing runoff. Use is limited to slopes that are less than 1:3 and depth of the mulch blanket is typically 8 to 10 cm (3 – 4 inches). The material is typically spread by hand, although pneumatic methods are available. Wood mulching is primarily applicable for landscape projects.

C.1.1.9 Earth Dikes/Drainage Swales and Ditches (SS-9)

The primary function of earth dikes, drainage swales and ditches is to prevent erosion and reduce pollutant loading. They are structures that intercept, divert, and convey surface runoff in a controlled, non-erosive manner. Top, toe, and mid-slope diversion ditches, berms, dikes, and swales should be used to intercept runoff and direct it away from critical slopes without allowing it to reach the roadway.

Typically, mid-slope diversion ditches should have a cross-slope of at least 2%, and should be concrete or rock-lined. Top of slope diversions should be paved along cut slopes where the slope length above the cut is greater than 12.2 m (40 ft). Earthen diversion ditches, berms, dikes, and

swales channelize flow and should be stabilized with vegetation or other materials to prevent erosion.

Alternatively, drop structures can be placed along the diversion to maintain a grade sufficiently mild to prevent erosive velocities, or a paved chute can be placed down the side of the fill before the accumulated runoff in the diversion is sufficient to cause erosive velocities.

Design guidelines include:

- Select design flow and safety factor based on careful evaluation of the risk due to erosion of the measure, over topping, flow backups, or wash out;
- Examine the site for run-on from off-site sources. These off-site flows should be diverted from the right-of-way;
- Select flow velocity limit of unlined conveyance systems based on soil types and drainage flow patterns for each project site. Establish a maximum flow velocity for using earth dikes and swales, above which a lined ditch must be used (see Highway Design Manual Table 862.2). Consider use of rip-rap, engineering fabric, vegetation or concrete lining;
- Consider outlet protection where localized scour is anticipated;
- Consider order of work provisions early in the construction process to effectively install and use the permanent ditches, berms, dikes, and swales; and
- A sediment-trapping device should be used in conjunction with conveyances where sediment-laden water is expected.

C.1.1.10 Outlet Protection/Velocity Dissipation Devices (SS-10)

Outlet protection/velocity dissipation devices are rock, riprap, or other materials placed at pipe outlets to reduce flow velocity and the energy of exiting storm water flows and to prevent scour. They are used where localized scouring is anticipated, such as outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels. They are also used where lined channels or ditches discharge to unlined conveyances.

Appropriate applications include:

- 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 from flash floods; and
- Where lined conveyances discharge to unlined conveyances.

C.1.1.11 Slope Drains (SS-11)

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

Slope drains should be sized to convey large, infrequent storms down or around the slope (see the Highway Design Manual for additional information). Design the top and toe of slope diversion ditches/berms/dikes/swales to direct flow into the drain. Provide for outlet protection/velocity dissipation devices at the outlet of the drain, as needed.

C.1.2 Sediment Control Practices

Sediment control is required along the site perimeter at all operational internal inlets and at all times during the rainy season.

Sediment control devices function by:

- Slowing water velocities, thereby allowing soil particles to settle out; and
- Attenuating the flood peak by detaining flow and releasing water at a slower rate.

All sediment control devices require continued maintenance to function properly. Excess sediment not removed reduces capacity and efficiency.

Examples of sediment control practices include:

SC-1 Silt Fence
SC-2 Desilting Basin
SC-3 Sediment Trap
SC-4 Check Dam
SC-5 Fiber Rolls
SC-6 Gravel Bag Berm
SC-7 Street Sweeping and Vacuuming
SC-8 Sand Bag Barrier
SC-9 Straw Bale Barrier
SC-10 Storm Drain Inlet Protection

C.1.2.1 Silt Fence (SC-1)

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

Silt fences are placed below the toe of exposed and erodible slopes, downslope of exposed soil areas, around temporary stockpiles and along streams and channels. Silt fences should not be used to divert flow or in streams, channels or anywhere flow is concentrated.

C.1.2.2 De-silting Basin (SC-2)

A de-silting basin is a temporary basin formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

De-silting basins shall be considered for use:

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

C.1.2.3 Sediment Trap (SC-3)

A sediment trap is a temporary basin with a controlled release structure, formed by excavating or constructing an earthen embankment across a waterway or low drainage area. As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

Sediment traps may be used on construction projects during the rainy season when the contributing drainage area is less than 2 ha (5 acres). Traps would be placed where sediment laden storm water may enter a storm drain or watercourse, and around and/or up-slope from storm drain inlet protection measures.

C.1.2.4 Check Dam (SC-4)

A check dam is a small device constructed of rock, sand bags, or fiber rolls, placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment dropout.

Check dams may be installed:

- In small open channels that drain 4 ha (10 acres) or less;
- In steep channels where storm water runoff velocities exceed 1.5 meters per second (m/s) (5 feet per second [ft/s]);
- During the establishment of grass linings in drainage ditches or channels; and
- In temporary ditches where a short length of services does not warrant establishment of erosion-resistant linings.

C.1.2.5 Fiber Rolls (SC-5)

A fiber roll consists of straw, flax or other similar materials inserted into a tube of netting. Fiber rolls are placed on the face of slopes at regular intervals and/or at the toe of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide some removal of sediment from the runoff. Fiber rolls may be used along the top, face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

C.1.2.6 Gravel Bag Berm (SC-6)

A gravel bag berm consists of a single row of gravel bags that are installed end-to-end to form a barrier across a slope to intercept runoff, reduce runoff velocity, release runoff as sheet flow and

provide some sediment removal. The gravel bag berm should be installed along a level contour with the bags tightly abutted.

C.1.2.7 Street Sweeping and Vacuuming (SC-7)

Street sweeping and vacuuming are practices to remove tracked soil particles from paved roads to prevent the sediment from entering a storm drain or watercourse. Street sweeping and vacuuming are implemented anywhere sediment is tracked from the project site onto public or private paved roads, typically at points of egress.

C.1.2.8 Sand Bag Barrier (SC-8)

A sand bag barrier is a temporary linear sediment barrier consisting of stacked sand bags, designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sand bag barriers allow sediment to settle from runoff before water leaves the construction site.

Sand bags can also be used:

- Where flows are moderately concentrated to divert and/or detain flows;
- Along the perimeter of a site;
- Along streams and channels;
- Below the toe of exposed and erodible slopes; and
- Around stockpiles.

C.1.2.9 Straw Bale Barrier (SC-9)

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

Typical applications for straw bale barriers include:

- Along the perimeter of a site;
- Along streams and channels;
- Below the toe of exposed and erodible slopes;
- Downslope of exposed soil areas; and
- Around stockpiles.

C.1.2.10 Storm Drain Inlet Protection (SC-10)

Storm drain inlet protection is a practice to reduce sediment from storm water runoff discharging from the construction site prior to entering the storm drainage system. Effective storm drain inlet protection allows sediment to settle out of water or filters sediment from the water before it

enters the drain inlet. Storm drain inlet protection is the last line of sediment control defense prior to storm water leaving the construction site.

Storm drain inlet protection is used:

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

C.1.3 Tracking Control Practices

Tracking control practices prevent or reduce off-site tracking of sediment by vehicles. Tracking is a common source of complaints, and can result the discharge of sediment to storm drains or watercourses. These measures include:

- TC-1 Stabilized Construction Entrance;
- TC-2 Stabilized Construction Roadway; and
- TC-3 Entrance/Outlet Tire Wash.

C.1.3.1 Stabilized Construction Entrance (TC-1)

A stabilized construction entrance is a designated point of access (ingress and egress) to a construction site that is stabilized to reduce tracking of sediment (mud and dirt) onto public roads by construction vehicles. Stabilized construction entrances are an effective method to limit the migration of sediment from the construction site, especially when combined with street sweeping and vacuuming. The stabilized entrance is typically composed of a crushed aggregate layer over a geotextile fabric or constructed of steel plates with ribs.

C.1.3.2 Stabilized Construction Roadway (TC-2)

A stabilized construction roadway is a temporary access road connecting existing public roads to a remote construction area. It is designed for the control of a dust and erosion created by vehicular traffic. A stabilized construction roadway may be constructed of aggregate, asphalt concrete, or concrete based on the desired longevity.

C.1.3.3 Entrance/Outlet Tire Wash (TC-3)

A tire wash is an area located at stabilized construction access points to remove sediment from tires and undercarriages, and to prevent tracking of sediment onto public roads. The tire wash typically includes a wash rack on a pad of coarse aggregate. The runoff water from the wash area must be conveyed to a sediment trap or basin.

C.1.4 Wind Erosion Control (WE-1)

Wind erosion control consists of applying water or other dust palliatives as necessary to prevent or alleviate wind-blown dust. Dust control must be applied in accordance with Caltrans standard practices. Water or dust palliatives should be applied so no runoff occurs.

The California General Construction Permit (General Permit) requires that special attention be paid to stockpiles. Stockpiles may be covered with plastic, mats, blankets, mulches, or sprayed with water or soil binders. It may also be prudent to surround the base of a stockpile with a row of fiber rolls, silt fence, or other sediment barrier.

Another means to reduce the potential for wind erosion of stockpiles is to keep the height of stockpiles low, and to adjust the shape and orientation of the stockpiles to reduce the area of exposure to the prevailing wind.

C.1.5 Non-Storm Water Controls

The National Pollutant Discharge Elimination System (NPDES) storm water regulations for construction sites also require that BMPs be included in the project plans for control of non-storm water discharges. Non-storm water management measures are source controls that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with storm water. These BMPs are also known as "good housekeeping practices." These BMPs must be in place throughout the grading and construction phases. The measures include:

NS-1	Water Conservation Practices	NS-6	Illicit Connection/Illegal Discharge Detection and Reporting
NS-2	Dewatering Operations	NS-7	Potable Water/Irrigation
NS-3	Paving and Grinding Operations	NS-8	Vehicle and Equipment Cleaning
NS-4	Temporary Stream Crossing	NS-9	Vehicle and Equipment Fueling
NS-5	Clear Water Diversion	NS-10	Vehicle and Equipment Maintenance

During preparation of the project plans, it is not always possible to know where a contractor will be performing certain activities. To provide the contractor with flexibility, but to assure that proper control measures are implemented, it is appropriate to identify in the project plans that specific BMPs will be implemented for certain activities regardless of where on the site those activities are performed.

C.1.5.1 Water Conservation Practices (NS-1)

Water conservation practices are activities that use water during the construction of a project in a manner that avoids erosion caused by runoff and the transport of pollutants off the site. If less water is used, the potential for erosion decreases and the transport of construction-related pollutants off site is less likely. Water conservation practices must be implemented on all construction sites wherever water is used. It includes preventing water leaks, avoid vehicle washing on site, sweeping in lieu of hosing areas, and applying water for dust control to minimize runoff.

C.1.5.2 Dewatering Operations (NS-2)

This BMP is intended to prevent the discharge of pollutants from construction site dewatering operations associated with storm water (accumulated rain) and non-storm water (groundwater, water from a diversion or cofferdam, etc.). Dewatering effluent that is discharged from the construction site to a storm drain or receiving water is subject to the requirements of the applicable NPDES permit. Refer to the Caltrans Field Guide to Construction Site Dewatering for detailed guidance for management of dewatering operations. The District Storm Water Coordinator is also available for assistance.

C.1.5.3 Paving and Grading Operations (NS-3)

Procedures that minimize pollution of storm water runoff during paving operations include new paving and preparation of existing paved surfaces for overlays. Paving and grinding operations include handling materials, wastes and equipment associated with pavement removal, paving, surfacing, resurfacing, pavement preparation, thermoplastic striping and placing pavement markers.

C.1.5.4 Temporary Stream Crossing (NS-4)

A temporary stream crossing is a structure placed across a waterway that allows vehicles to cross the waterway during construction without contacting the water, thus reducing erosion and the transport of pollutants into the waterway. Temporary stream crossings are typically conditions of regulatory permits for work near live streams. Installation may require dewatering or temporary diversion of the stream. Types of temporary stream crossings include culverts, fords, and bridges. Their design requires knowledge of stream flows, soils, and wildlife.

C.1.5.5 Clear Water Diversion (NS-5)

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a construction site, transport it around the site, and discharge it downstream with minimal water quality impact. A common example is a temporary creek diversion system that consists of a sandbag cofferdam and a flexible plastic pipe to divert the water around the construction site. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, drainage, and interceptor swales.

C.1.5.6 Illicit Connection/Illegal Discharge Detection and Reporting (NS-6)

These procedures and practices are designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents to the Resident Engineer (RE).

C.1.5.7 Potable Water/Irrigation (NS-7)

Potable water/irrigation consists of practices and procedures to reduce the discharge of potential pollutants generated from irrigation water lines, landscape irrigation, lawn or garden watering, potable water sources, water line flushing, and hydrant flushing. These practices include reusing

discharges for landscaping, automatic shut-off valves, prevention of impacts to downstream drainage systems, leak detection, inspection of equipment and lines, and repair of broken pipes.

C.1.5.8 Vehicle and Equipment Cleaning (NS-8)

This BMP consists of procedures and practices used to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drains or watercourses. On most construction sites, vehicle and equipment cleaning on site should be discouraged.

If vehicle or equipment cleaning is allowed, then soap, solvents, or steam shall not be used unless approved by the RE. Vehicle and equipment wash water must be contained for percolation or evaporation, and must not be discharged off site.

C.1.5.9 Vehicle and Equipment Fueling (NS-9)

This BMP consists of measures and practices to minimize or eliminate the discharge of fuel spills and leaks into the storm drain system or to watercourses. These measures include containment of fueling areas, spill prevention and control, drip pans or absorbent pads, automatic shut-off nozzles, vapor recovery nozzles, topping off restrictions, and leak inspection and repair.

C.1.5.10 Vehicle and Equipment Maintenance (NS-10)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants to the storm drain system or to watercourses from vehicle and equipment maintenance procedures. Practices include drip pans or absorbent pads, spill kits, dedicated maintenance areas, proper waste disposal, leak repair, and secondary containment.

C.1.5.11 Pile Driving Operations (NS-11)

The construction of bridges and retaining walls often includes driving piles for foundation support. Piles are typically constructed of cast in place 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 the discharge of potential pollutants to the storm drain system or watercourses. These procedures apply to all construction sites where permanent and temporary pile driving operations take place.

C.1.5.12 Concrete Curing (NS-12)

This BMP consists of procedures that minimize pollution of storm water runoff during concrete curing. Concrete curing includes the use of both chemical and water methods. Concrete curing is used for the construction of structures such as bridges, retaining walls, and pump houses. Any element of the structure (i.e., footings, columns, abutments, stem and soffit, decks) may be subject to curing requirements.

C.1.5.13 Material and Equipment Use Over Water (NS-13)

This BMP consists of 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. These procedures shall be implemented for construction materials and wastes (solid and liquid), soil or dredging materials, or any other materials that may be detrimental if released and apply where equipment is used over or adjacent to a watercourse.

C.1.5.14 Concrete Finishing (NS-14)

This BMP consists of procedures to minimize the impact that concrete finishing methods may have on storm water runoff. Methods include sand blasting, lead shot blasting, grinding, or high pressure water blasting. Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances.

C.1.5.15 Structure Demolition/Removal Over Water (NS-15)

This BMP consists of procedures to protect water bodies from debris and wastes associated with structure demolition or removal over or adjacent to watercourses. These procedures shall be implemented for full bridge demolition and removal, partial bridge removal (i.e., barrier rail, edge of deck) associated with bridge widening projects, concrete channel removal, or any other structure removal that could potentially affect water quality.

C.1.6 Waste Management and Materials Pollution Control

The NPDES storm water regulations for construction sites also require that BMPs be included in the project plans for waste management and materials pollution control. These are source control BMPs that prevent pollution by reducing pollutants at their source, and require a clean, well-kept site. The measures include:

WM-1 Material Delivery and Storage	WM-6 Hazardous Waste Management
WM-2 Material Use	WM-7 Contaminated Soil Management
WM-3 Stockpile Management	WM-8 Concrete Waster Management
WM-4 Spill Prevention and Control	WM-9 Sanitary/Septic Waste Management
WM-5 Solid Waste Management	WM-10 Liquid Waste Management

As with the non-storm water management measures, it is important to provide the contractor with flexibility, but to identify that in the plans, that specific BMPs will be implemented for certain activities regardless of where on the site those activities are performed.

C.1.6.1 Material Delivery and Storage (WM-1)

This BMP consists of procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses. These procedures include secondary containment, spill prevention and control, product labeling, quantity reduction, proper storage, material covering, training, and inventory control.

C.1.6.2 Material Use (WM-2)

This BMP consists of procedures and practices for use of construction material in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or watercourses. These procedures include proper waste disposal, product labeling, proper cleaning techniques, recycling materials, reducing quantities, and application rates, spill prevention and control, training, and reduction of exposure to storm water.

C.1.6.3 Stockpile Management (WM-3)

This BMP consists of procedures and practices to eliminate pollution of storm water from stockpiles of soil and paving materials (such as concrete rubble, aggregate, and asphalt concrete). These procedures include locating stockpiles away from drainages, providing perimeter sediment barriers, and wind erosion control measures.

C.1.6.4 Spill Prevention and Control (WM-4)

This BMP consists of procedures and practices implemented to prevent and control spills in a manner that minimizes or prevents the discharge of spilled material to storm drain systems or watercourses. Spill prevention and prompt appropriate spill response reduce the potential for polluting receiving waters with spilled contaminants. Spills of concern include chemicals and hazardous wastes such as soil stabilizers/binders, dust palliatives, herbicides, growth inhibitors, fertilizers, de-icing products, fuels, lubricants, paints, and solvents. Spill prevention practices include education as well as cleanup and storage procedures that address small spills, semi-significant spills, and significant/hazardous spills.

C.1.6.5 Solid Waste Management (WM-5)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants to storm drain systems or watercourses as a result of the creation, stockpiling or removal of construction site wastes. Solid wastes include such items as used brick, mortar, timber, steel, vegetation/landscaping waste, empty material containers, and litter. Measures include education as well as collection, storage, and disposal practices.

C.1.6.6 Hazardous Waste Management (WM-6)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants from construction site hazardous waste to the storm drain system or watercourses. Hazardous wastes should be collected, stored, and disposed of using practices that prevent contact with storm water. The following types of wastes are considered hazardous; petroleum products, concrete curing compounds, palliatives, septic wastes, paints, stains, wood preservatives, asphalt products, pesticides, acids, solvents, and roofing tar. There may be additional wastes on the project that are considered hazardous. It is also possible that non-hazardous waste could come into contact with these hazardous wastes, such that they become contaminated and are therefore considered hazardous waste. Measures include education, storage procedures, and disposal procedures.

C.1.6.7 Contaminated Soil Management (WM-7)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants to the storm drain system or watercourses from contaminated soil. Typical soil contamination is due to spills, illicit discharges, and underground storage tank leaks, or aerially deposited lead (ADL). Contaminated soils tend to occur on projects in urban or industrial areas. Soil contaminants and locations are often identified in the project plans and specifications. Measures include identifying contaminated areas, education, handling procedures for material with ADL, handling procedures for contaminated soils, procedures for underground storage tank removals, and water control.

C.1.6.8 Concrete Waste Management (WM-8)

This BMP consists of procedures and practices that are implemented to minimize or eliminate the discharge of concrete waste materials to the storm drain system or to watercourses. These measures include education, concrete slurry waste handling procedures, on-site concrete washout facility, transit truck washout procedures, and procedures for removal of temporary concrete washout facilities.

C.1.6.9 Sanitary/Septic Waste Management (WM-9)

This BMP consists of procedures and practices to minimize or eliminate the discharge of construction site toilet facilities to the storm drain system or watercourse. Measures include education, and storage and disposal procedures.

C.1.6.10 Liquid Waste Management (WM-10)

This BMP includes procedures to prevent pollutants related to non-hazardous liquid wastes from entering storm drains or receiving waters. Liquid wastes include drilling slurries, drilling fluids, wastewater that is free from grease and oil, dredgings, and other non-storm water liquid discharges not covered by separate permits. This BMP does not apply to the following:

- Dewatering operations (see NS-2);
- Solid wastes (See WM-5);
- Hazardous wastes (See WM-6);
- Concrete slurries (See WM-8);
- Liquid wastes covered by specific laws or permits; and
- Non-storm water discharges permitted by any Caltrans NPDES permit unless Caltrans determines that the discharge contains pollutants.

Appendix D
Relevant Storm Water Documents and Web Sites

Table D-1: Relevant Storm Water Documents and Purpose

Date	Document	Purpose
May 2001	Caltrans Erosion Control Training for Designers	The purpose for this manual is to train designers to address the principles of erosion control, site-specific design considerations, and the selection and design of permanent erosion control Best Management Practices (BMPs) for incorporation into the project Plans, Specifications & Estimates.
August 2001	Storm Water Management Plan (SWMP) – approved May 17th by the State Water Resources Control Board (SWRCB).	Policy Document that ties the functional area activities together and describes the procedures and practices to address storm water quality statewide. It identifies how Caltrans will comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) permit.
Jan. 17, 2002	Statewide Storm Water Quality Practice Guidelines. (Guidelines)	Provides descriptions of all the specific BMPs. This is intended to provide Caltrans staff with details of the implementation expectations associated with each approved storm water Best Management Practice (BMP).
November 2000	Storm Water Quality Handbooks: Construction Site Best Management Practices (BMPs) Manual	Provides instructions for the selection and implementation of Construction Site BMPs. Caltrans requires contractors to identify and utilize these BMPs in the preparation of their SWPPP or WPCP.
November 2000	Storm Water Quality Handbooks: Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual	Guides contractors and Caltrans staff through the process of preparing a SWPPP and WPCP. This manual provides detailed step-by-step procedures, instructions, examples and a template that contractors shall use to prepare the SWPPP/WPCP.
Pending	Storm Water Quality Assessment (SWQA) Guidance Document, Volume 5 Standard Environmental Reference	Provides guidance on preparing SWQA as well as methods for assessing storm water discharge impacts on water quality in support of preparing the PA/ED. It is the intention that SWQAs will be prepared by Caltrans Environmental Unit or consultants.
Current edition. Updated annually	Regional Work Plans (RWP)	Describes how Caltrans will specifically implement the SWMP within the jurisdiction of each RWQCB as required by the Caltrans Permit. The RWP provides region-specific information on Caltrans facilities, water bodies, BMPs and monitoring programs. It also includes a list of personnel titles and responsibilities.

Table D-2: Storm Water Related Web Sites

Web Sites	Description
http://www.swrcb.ca.gov/stormwtr/docs/caltranspmt.pdf	Caltrans NPDES Statewide Storm Water Permit (Caltrans Permit)
http://www.swrcb.ca.gov/stormwtr/construction.html	Construction General Permit (General Permit)
http://stormwater.water-programs.com	This web site contains a water quality planning tool that provides information on water quality standards, and also contains a Basin Sizer program that calculates the WQV for Treatment BMPs located within California.
http://nrdesign/swmp (This is an intranet site)	A North Region Design and Engineering Services Storm Water Quality Link. Contains links to resources for developing SWPPP, WPCP, and the Storm Water Quality Information Handout.
http://www.dot.ca.gov/hq/esc/oe/specs_html/index.html	Current Standard Special Provisions (SSPs)
http://www.dot.ca.gov/hq/projmgmt/documents/wbs_5.1_final.pdf	Guide to Caltrans Capital Project Work Breakdown Structure (WBS), Release 5.1, April 2001
http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm	The Project Development Procedures Manual
http://www.dot.ca.gov/hq/construc/stormwater.htm	Storm Water Pollution Prevention Plan/Water Pollution Control Program Preparation Manual
http://www.epa.gov	U.S. Environmental Protection Agency (EPA)
http://www.dhs.cahwnet.gov/index.htm	California Department of Health Services (DHS)
http://www.epa.gov/epahome/cfr40.htm	Code of Federal Regulations (CFR)
http://www.ceres.ca.gov/ceqa	California Environmental Quality Act (CEQA)
http://ceres.ca.gov/topic/env_law/ceqa/guidelines/art19.html	CEQA web site that lists Categorical Exemptions
http://projdel/design/stormwater	Web site in development for the Design Office of Storm Water Management. (Will eventually provide construction details on the Construction Site BMPs.)
http://www.dot.ca.gov/hq/env/stormwater/annual_report/index.htm	Contains lines to the April 2002 Annual Report, the Revised 2002 SWMP, and the 2002 Regional Work Plans
http://www.swrcb.ca.gov/cwphome/land/gama/webpages/gamahome.htm	Aquifer groundwater quality and seasonal groundwater levels: monitoring well data, U.S. Geological Survey (USGS), Department of Water Resources (DWR) and local public agency maps and databases.
http://www.dot.ca.gov/ser/	This website is the Standard Environmental Reference (SER) which is an on-line resource to help state and local agency staff plan, prepare, submit, and evaluate environmental documents for transportation projects. The site includes five Environmental Handbooks, as well as guidance, forms, templates and memos pertaining to the environmental process at Caltrans. Volume 5 of the SER is the Storm Water Quality Assessment document.
http://wwwdwr.water.ca.gov	California Department of Water Resources web site that provides data regarding: Water quality; groundwater level; climatology, and surface water.
http://www.dot.ca.gov/hq/oppd/hydrology/hrdroidx.htm	California Bank and Shore Rock Slope Protection.

Appendix E

Water Quality Summary Forms, Checklists, and Decision Trees

- PID Process Summary Forms
- PA/ED Process Summary Forms
- PS&E Process Summary Form
- Exemption Documentation Form
- Storm Water Data Report
- Storm Water Checklist SW-1, Site Data Sources
- Storm Water Checklist SW-2, Storm Water Quality Issues Summary
- Storm Water Checklist SW-3, Measures for Avoiding or Reducing Storm Water BMPs
- Design Pollution Prevention Decision Tree DPP-1
- Checklist DPP-1, Parts 1–5 (Design Pollution Prevention BMPs)
- Treatment Decision Tree T-1
- Checklist T-1, Parts 1–7 (Treatment BMPs)

Summary Process for Storm Water Activities for Project Initiation Document (PID)

WORK BREAKDOWN STRUCTURE (WBS) CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PID PHASE	DATE (S) COMPLETED	COMPLETED BY
100.05	Project Management – PID Process	**Invite National Pollutant Discharge Elimination System (NPDES) Coordinator to project kickoff meeting and to participate in the Project Development Team (PDT).**		
100.05.10	PDT meetings	**The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units throughout the project.** Any decisions made during the PDT meetings should be documented.		
150.05.05	Site Data Sources	**Complete Checklist SW-1 (Site Data)** **From Section 4, determine if project is exempt from incorporating Treatment BMPs.** ▪ Complete Exemption Documentation Form (Appendix E). ▪ If determined exempt, verify with District/Regional NPDES Storm Water Coordinator. Continue with the PID process with the selection of Design Pollution Prevention and Construction Site Best Management Practices (BMPs). ▪ If not exempt, select Treatment, Design Pollution Prevention and Construction Site BMPs.		
150.05.20	Define Storm Water Design Issues	**Obtain any existing available data.** **After obtaining existing data and selecting project alternatives, determine potential storm water quality impacts and issues. Obtain additional data from the different functional units.** ▪ Complete Checklist SW-2 (Storm Water Quality Issues Summary Checklist) **Perform Field Review of the Area** **Begin Filling out the Storm Water Data Report (SWDR).** **Coordinate with Environmental Unit during preparation of the PEAR.** **Evaluate options for avoiding or reducing potential impacts.** Begin to fill out Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.		

WORK BREAKDOWN STRUCTURE (WBS) CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PID PHASE	DATE (S) COMPLETED	COMPLETED BY
150.10	Identify Potential BMPs	**Determine Potential/Likely BMPs for each site of impact to receiving waters.** ▪ Complete Checklist DPP-1 (including all applicable parts 1-5) thru T-1 (including all applicable parts 1-7) for selecting BMPs at specific sites (Appendix E). Also see decision trees. ▪ Complete decision tree for Pre-Screening for the Infiltration BMP – Appendix B.		
150.10.05	RWQCB Meetings	**Consultation with the Regional Water Quality Control Board (RWQCB) is strongly recommended to coordinate project issues and develop consensus for controversial or complex storm water quality issues.** Initiate meetings with the RWQCB as necessary. Number of coordination meetings is entirely dependent upon the complexity of the storm water quality issues, storm water pollutants involved, and project site constraints. District/Regional NPDES Storm Water Coordinator serves as the single point of contact with the RWQCB.		
150.15	Analyze Project Alternatives	**Discuss BMPs with District/Regional NPDES Storm Water Coordinator, Landscape Architecture and Maintenance Storm Water Coordinator**.		
150.15.55	Preliminary Project Cost Estimate (PPCE)	**Develop preliminary BMP costs and incorporate into the PID cost estimate.**		
150.25	Storm Water Data Report (SWDR)	**Route SWDR for functional units signature.** **Coordinate with the Environmental Unit.** **Complete the SWDR using available data.**		
150.25	Prepare and Approve PID	**Incorporate "Storm Water Pollution Prevention Discussion" under "Considerations" heading of the planning document.**		
150.25.20	Circulate, Review, and Approve PID	**Attach signed SWDR cover sheet to PID and circulate to obtain functional unit concurrence. Original copy of SWDR should be kept in the project file.**		

Summary Process for Storm Water Activities for Project Approval/Environmental Document (PA/ED)

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PA/ED PHASE	DATE (S) COMPLETED	COMPLETED BY
100.10	Project Management Process (PA/ED)	**Invite District/Regional NPDES Storm Water Coordinator to project kickoff meeting and to participate in the PDT.**		
100.10.10	PDT meetings	**The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units throughout the project.** Any decisions made during the PDT meetings should be documented.		
160.05	Review and Update Project Information	**Confirm whether or not project is exempt from incorporating treatment BMPs.** ▪ Complete/Update Exemption Documentation Form (Appendix E). ▪ If determined exempt, verify with NPDES Coordinator. Continue with selection of Design Pollution Prevention and Construction Site BMPs. If not exempt, select Treatment, Design Pollution Prevention and Construction Site BMPs. **Review Information Developed in the PID Process.** **Determine potential storm water quality impacts and issues for project alternatives.** **Obtain updated data and reports from the different functional units.** ▪ Update Checklist SW-1 (Site Data) ▪ Update Checklist SW-2 (Storm Water Quality Issues Summary). **Consult with Environmental Unit to initiate the SWQA, if necessary (WBS 165.10.35).** **Perform Field Review of the Area.** **Update SWDR.** ▪ **Evaluate options for avoiding or reducing potential impacts.** Update Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.		

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PA/ED PHASE	DATE (S) COMPLETED	COMPLETED BY
160.10	Revise Potential BMP Selections Based on Engineering Studies	**Select Potential/Likely BMPs for each site of unavoidable impact to receiving waters.** ▪ Complete Checklist DPP-1 (including all applicable parts 1-5) and T-1 (including all applicable parts 1-7) for selecting BMPs at specific sites (Appendix E). Also see decision trees. ▪ Complete decision tree for Pre-Screening for the Infiltration BMP – Appendix B. **Coordinate with Environmental Unit during preparation of the SWQA.** **Discuss BMPs with District/Regional NPDES Storm Water Coordinator and Maintenance Storm Water Coordinator and obtain concurrence.** **Evaluate potential Construction Site BMPs.** ▪ See Construction Site BMPs Manual. ▪ Meet with District/Regional NPDES Storm Water Coordinator to discuss BMPs for project required by RWQCB or other agency. ▪ Meet with Construction on inclusion of Construction Site BMPs.		
165.10.35	RWQCB Meetings	**Consult with the RWQCB to coordinate project issues and develop consensus for controversial or complex storm water quality issues.** Initiate meetings with the RWQCB through the District/Regional NPDES Storm Water Coordinator, as necessary. The number of coordination meetings is entirely dependent upon the complexity of the storm water quality issues, storm water pollutants involved, and project site constraints.		
160.15	Prepare Draft Project Report (DPR) (this is done only if the project does not have categorical exemption and has an Environmental Document (ED)) (see Figure 6-2 in Section 6)	**Incorporate "Storm Water Pollution Prevention Discussion" under "Considerations" heading of the planning document.**		
160.15	Storm Water Data Report (SWDR)	**Route SWDR for functional units signature.** **Coordinate with the Environmental Unit.** **Complete the SWDR using available data.**		
160.15.05	Update Preliminary Project Cost Estimates	**Develop preliminary BMP costs and incorporate into PA/ED cost estimate.**		

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PA/ED PHASE	DATE (S) COMPLETED	COMPLETED BY
180.05	Prepare and Approve Project Report (PR)	**Attach signed SWDR cover sheet to PR and circulate to obtain functional unit concurrence. Original copy of SWDR should be kept in the project file.**		

Summary Process for Storm Water Activities for Plans, Specifications & Estimates (PS&E)

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PS&E PHASE	DATE (S) COMPLETED	COMPLETED BY
100.15	Project Management Process (PS&E)	**Invite District/Regional NPDES Storm Water Coordinator to project kickoff meeting and to participate in the PDT.**		
100.15.10	PDT Meetings	**The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units throughout the project.** Any decisions made during the PDT meetings should be documented.		
205.10.40	RWQCB Meetings	**Consultation with the RWQCB to coordinate project issues and develop consensus for controversial or complex storm water quality issues.** Initiate meetings with the RWQCB as necessary. The number of coordination meetings is entirely dependent upon the complexity of the storm water quality issues, storm water pollutants involved, and project site constraints.		
185.05.10	Review and update project information	**Review Information Developed in the PID and PA/ED Process.** ▪ Update Checklist SW-1 (Site Data) ▪ Update Checklist SW-2 (Storm Water Quality Issues Summary) **Consult with Environmental Unit to obtain permits.** **Perform Field Review of the Area.** **Review and Update the SWDR.** **Evaluate options for avoiding or reducing potential impacts.** Update Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.		
185.15	Perform Preliminary Design	**Perform Preliminary Design.** ▪ Delineate drainage areas and define total disturbed area. ▪ Review and update need to consider treatment BMPs. ▪ Obtain Engineering Reports, WBS 185.20, from the different functional units.		

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PS&E PHASE	DATE (S) COMPLETED	COMPLETED BY
205.00	Obtain Necessary Permits, WDRs and Agreements	**Obtain NPDES Storm Water Permits and Local Agency Agreements.** ▪ File Notification of Construction (NOC) for coverage under the Caltrans Permit. ▪ Obtain Waste Discharge Requirement (WDR) for Aerially Deposited Lead (ADL) reuses. ▪ Coverage for dewatering activities under separate NPDES permit. Contact your District/Regional NPDES Storm Water Coordinator. ▪ Obtain other agreements with RWQCB and other agencies.		
230.00 230.30 230.40	Prepare Draft PS&E - Design Pollution Prevention BMPs	**Prepare Draft PS&E - Design Pollution Prevention BMPs.** ▪ Update Checklist DPP-1 (and all applicable Parts 2-5) ▪ Incorporate Design Pollution Prevention BMPs in all applicable plans, specifications, and estimates. ▪ Review with District Landscape Architect and Maintenance as necessary. ▪ Calculate quantities, estimates, and prepare Standard Special Provisions (SSPs).		
230.00 230.35 230.40	Prepare Draft PS&E – Treatment BMPs	**Prepare Draft PS&E – Design Treatment BMPs.** ▪ Update Checklist T-1 (and all applicable Parts 2-7) ▪ Incorporate Treatment BMPs in all applicable plans, specifications, and estimates. ▪ Hydraulics to design or review design as per Highway Design Manual (HDM) requirements. ▪ Review treatment BMPs and maintenance with District/Regional NPDES Storm Water Coordinator and Storm Water Maintenance Coordinator. ▪ Calculate quantities, estimates, and prepare SSPs.		
230.00 230.35 230.40	Prepare Draft PS&E – Construction Site BMPs	**Prepare Draft PS&E - Construction Site BMPs.** ▪ Review Appendix C of the PPDG and the Construction Site BMP Manual. ▪ Meet with District/Regional NPDES Storm Water Coordinator to discuss BMPs for project required by RWQCB or other agency. ▪ Meet with Construction on inclusion of Construction Site BMPs. ▪ Calculate quantities, estimates, and prepare SSPs.		
230.05.65	Prepare Conceptual SWPPP	**Prepare Conceptual Storm Water Pollution Prevention Plan (CSWPPP).** ▪ Includes preparing a Water Quality (WQ) information handout for bidders if necessary, Storm Water Pollution Prevention Plan (SWPPP), or Water Pollution Control Program (WPCP). ▪ Includes how to develop estimates and deployment of BMPs.		
230.60	Storm Water Data Report	**Complete and stamp SWDR. Route for functional unit concurrence.**		

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PS&E PHASE	DATE (S) COMPLETED	COMPLETED BY
255.20	Prepare Final District PS&E Package	**Attach signed SWDR cover sheet for the PS&E package and obtain functional unit signature. Original copy of the SWDR should be kept in the project file.**		
270.05	Prepare RE File	**Submit Storm Water Information to Resident Engineer (RE) File. See Section 7.5.**		

DATE:_____

See Section 4, Figure 4-1, Project Exemption Criteria for Treatment BMPS Only. EA: _____

NO.	CRITERIA	YES ✓	NO ✓	SUPPLEMENTAL INFORMATION FOR EXEMPTION
1.	Start			Go to 2
2.	Will there be direct or indirect discharge to surface water?			If yes, go to 3 If no, project is exempt. Comment on location of project relative to nearest receiving water.
3.	Is this an emergency project?			If yes, project is exempt If no, go to 4
4.	Is it a new facility?			If yes, go to 12 If no, go to 5. Document why it is or not considered a new facility (new construction, major reconstruction, significant construction or reconstruction projects are considered new.)
5.	Will there be a change in line/grade or hydraulic capacity?			If yes, go to 6 If no go to 8. Briefly describe existing and new slope.
6.	Is disturbed soil area greater than or equal to 2 hectares?			If yes, go to 12 If no, go to 7. Provide disturbed soil area in hectares.
7.	Part of a common plan of development?			If yes, go to 12 If no, go to 8.
8.	Do the project limits encroach upon a High Risk Area?			If yes, go to 12 If no, go to 9. Document source.
9.	Are there location specific requirements established by the RWQCB or other local agencies?			If yes, go to 12 Briefly describe. If no, go to 10.
10.	Are there Municipal Separate Storm Sewer System (MS4) specific requirements?			If yes, go to 11. Briefly describe. If no, project is exempt.
11.	Will the storm drain system be modified, replaced or upgraded?			If yes, go to 12 If no, project is exempt, go to 13.
12.	Consider approved Treatment BMPs.			Project is not exempt based on this criteria. Go to Section 5.5 for BMP Evaluation and Selection Process and Checklist T-1 and Decision Tree T-1 in this Appendix.
13	Document for Annual Report and project files by completing this Exemption Documentation Form and the SWDR.			Attach this form to the Annual Report and the SWDR.
14	End			

Caltrans Metric

Dist-County-Route
Kilometer Post (Post Mile) Limits
Project Type
EA: _____
RU: _____
Program Identification: _____
Phases: ❑ PID
❑ PA/ED
❑ PS&E

Regional Water Quality Control Board(s): _____

Project Manager: _____

Is the Project exempt from incorporating Treatment BMPs? Yes ❑ No ❑ N/A ❑
If yes, attach the Exemption Documentation Form

Estimated Construction Start Date: _____

Notification of Construction (NOC) Date to be Submitted: _____

Notification of ADL reuse (if yes, provide date) Yes ❑ Date_____ No ❑ N/A ❑

Separate Dewatering Permit (if yes, permit no.) Yes ❑ Permit #_____ No ❑ N/A ❑

I have reviewed the storm water quality design issues contained in the Storm Water Data Report and Attachments attached hereto, and find the data to be complete, current, and accurate:

This Storm Water Data Report has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based. PE stamp required at PS&E.

_____
Registered Project Engineer *Date*

_____
Design District/Regional Storm Water Coordinator or Designee *Date*

_____
Designated Landscape Representative *Date*

_____
Designated Maintenance Representative *Date*

APPROVAL RECOMMENDED:

_____
Project Manager *Date*

STORM WATER DATA INFORMATION

1. Project Description

- Briefly describe the type of project and major engineering features, including description of soil disturbance area and cut/fill slopes.
- Include soil classifications and geology information, if pertinent.

2. Define Site Data and Storm Water Quality Design Issues (refer to Checklists SW-1, SW-2, and SW-3)

(Project Engineer (PE) should also confer with NPDES Coordinator, Landscape Architecture, Maintenance, Hydraulics, and Environmental Unit to define design issues); Summarize pertinent information contained in the Preliminary Geotechnical Report (PGR) and other source documents identified on SW-1. Compilation of answers to question in SW-2 and SW-3 should be provided below. Not all information listed is required or available at each phase for all projects depending on conditions.)

- Receiving water bodies/303(d) list/Pollutants of concern (SW-2, Questions 1-4)
- RWQCB special requirements/concerns (SW-2, Question 5)
- Local agency requirements/concerns (SW-2, Questions 6 and 7)
- Project design considerations (climate, soil, topography, geology, groundwater, right-of-way requirements, slope stabilization) (SW-2, Questions 8-16)
- Right-of-way BMP costs and funding (SW-2, Questions 17 and 18)
- Measures for avoiding or reducing potential storm water impacts (SW-3)

3. Regional Water Quality Control Board Agreements

Briefly describe any key negotiated understandings or agreements with RWQCB pertaining to this project, including project exemptions or exclusion of permanent treatment BMPs. Include any specific meeting dates and contact names that design related recommendation or agreements were addressed.

4. Describe Proposed Design Pollution Prevention BMPs to be used on the Project.

(Summarize responses to Checklist DPP-1, Parts 1-5)

Downstream Effects Related to Potentially Increased Flow, Parts 1 and 2

- Velocity or volume of downstream flow
- Existing
- Post Construction
- Channels condition and design
- Sediment loading potential
- Hydraulic changes (realignment, encroachment)

Slope/Surface Protection Systems, Parts 1 and 3

- Cut and fill requirements
- Existing slope conditions
- Total BMP area (before and after construction)
- Vegetated surfaces (plants, soils, mulch, blankets, establishment periods)
- Hard surfaces (rock blankets, paving)

Concentrated Flow Conveyance Systems, Parts 1 and 4

- See Drainage Quantity Sheet

- List locations and unit volume of protection/velocity dissipation devices BMPs. Reference the current Construction Cost Data Book or local source for applicable unit costs.

Preservation of Existing Vegetation, Parts 1 and 5

- Areas of clearing and grubbing identified and defined in the contract plans
- Maximize preservation (floodplains, wetlands, problem soils, steep slopes)
- Documentation of preservation areas

5. Describe Proposed Permanent Treatment BMPs to be used on the Project

(Summarize responses to Checklist T-1, Parts 1-7)

Biofiltration Swales/Strips, Parts 1 and 2

- Project Definition of New Construction or Major Construction
- Tributary Area
- Design Storm Flow Velocities
- Scour Velocity
- Natural or low cut sections

Dry Weather Diversion, Parts 1 and 3

- Persistence of dry weather flows
- Proximity to sanitary sewer
- Publicly Owned Treatment Works (POTW) and local health agencies acceptance
- Need for existing sanitary sewer pipeline upgrade.

Infiltration Basins, Parts 1 and 4

- Approximate tributary area of impervious surface per infiltration basin.
- Water Quality Volume (WQV) treated per treatment infiltration basin.
- Soil permeability
- Groundwater depth
- Threat to local groundwater quality
- Infiltration rate
- Slopes

Detention Basins, Parts 1 and 5

- Approximate tributary area of impervious surface per treatment detention basin.
- WQV treated per treatment detention basin.
- Geotechnical Integrity
- Groundwater depth
- Hydraulic head sufficiency

Gross Solids Removal Devices, Parts 1 and 6

- Receiving water on a 303(d) list for trash or Total Maximum Daily loads (TMDLs) and requires trash removal.
- Sufficient access for maintenance and large equipment.
- Peak design flow

Traction Sand Traps, Parts 1 and 7

- Estimated volume of traction sand applied (S) (m^3/yr)
- Sand trap cleaning frequency and Maintenance operational needs.
- Estimate volume of traction sand: (V) (m^3)
- Estimated volume of traction sand trap:

6. Construction Cost Information

Summarize construction costs included in the Preliminary Project Construction Cost Estimate Summary (PPCE) associated with storm water pollution prevention and treatment. Summary shall include the following:

Roadway Items

- Section 1: Earthwork
  - Roadway Excavation (Treatment Basins)
  - Imported Borrow (Treatment Basins)
- Section 3: Drainage
  - Storm Drains
  - Drainage Inlets (Traction Sand Traps)
  - Overside Drains
  - Flared End Section (FES)
  - Other (List)
- Section 4: Specialty Items
  - Erosion Control
  - Basin Liner
  - Landscaping/Irrigation
    - I. Biofiltration Strips and Swales
  - Slope Protection
    - II. Slope/Surface Protection Systems-Vegetated Surfaces
    - III. Concentrated Flow Conveyance Systems
    - IV. Slope/Surface Protection Systems-Hard Surfaces
  - Other (List)
    TOTAL STORM WATER TREATMENT & PREVENTION: $X,XXX,XXX
    TOTAL RIGHT-OF -WAY FOR TREATMENT BASINS: $X,XXX,XXX

7. Maintenance BMPs (Drain Inlet Stenciling)

Briefly describe locations where drain inlet stenciling is required, such as within cities, towns, and communities with populations of 10,000 or more, or within designated MS4 areas. Include any specific stencil types and names of contacts that recommended stencil types or locations.

ATTACHMENTS:

⇒ Vicinity Map
⇒ Pertinent Correspondence with RWQCB, if required
⇒ Checklist SW-1, Site Data Sources

- ⇒ Checklists SW-2, Storm Water Quality Issues Summary
- ⇒ Checklist SW-3, Measures for Avoiding or Reducing Storm Water BMPs
- ⇒ Checklist DPP-1, Parts 1–5 (Design Pollution Prevention BMPs)
- ⇒ Checklist T-1, Parts 1–7 (Treatment BMPs)
- ⇒ Backup BMP cost information for PPCE. PPCE form can be found on-line in Appendix L of the PDPM http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm
- ⇒ CSWPPP and Layout Sheets, if available

Drainage Course

Conceptual Drainage Map

Checklist SW-1, Site Data Sources

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Information for the following data categories should be obtained, reviewed and referenced as necessary throughout the project planning phase. Collect any available documents pertaining to the category and list them and reference your data source. For specific examples of documents within these categories, refer to Section 5.5 of this document.

DATA CATEGORY/SOURCES	Date
Topographic	
•	
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•	
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Soils	
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Water Quality	
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Other Data Categories	
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Checklist SW-2, Storm Water Quality Issues Summary

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

The following questions provide a guide to collecting critical information relevant to project storm water quality issues. Complete responses to applicable questions, consulting other Caltrans functional units (environmental, landscape architecture, maintenance) and the District/Regional NPDES Coordinator as necessary. Refer to Checklist SW-1 for data sources to develop responses. Attach pertinent information to the SWDR.	Complete	Not Applicable
1. What are the receiving waters that may be affected by the project throughout the project life cycle (i.e., construction, maintenance and operation)?	❑	❑
2. For the project limits, list the 303(d) impaired receiving water bodies and their constituents of concern.	❑	❑
3. What are the pollutant sources within the right-of-way to be treated and/or hazardous materials of concern?	❑	❑
4. Are there any locations where spills from Caltrans owned rights-of-way, activities or facilities can discharge directly to municipal or domestic water supply reservoirs or groundwater percolation facilities? Consider appropriate spill contamination and spill prevention control measures for these new areas.	❑	❑
5. What are the RWQCB special requirements, including beneficial uses of receiving waters and groundwater, TMDLs, or effluent limits?	❑	❑
6. Do regulatory agencies have seasonal construction restrictions? If so, list restrictions applicable to the project.	❑	❑
7. Are there any specific rainy season dates and construction work exclusion dates required by state or local regulatory agencies?	❑	❑
8. What is the general climate of the project area? Identify annual rainfall and rainfall intensity curves.	❑	❑
9. What is soil classification, permeability, erodibility, and depth to groundwater?	❑	❑
10. What contaminated or hazardous soils were identified within the project area?	❑	❑
11. What is the total disturbed soil area of the project?	❑	❑
12. Describe the topography of the project site.	❑	❑
13. List any areas outside of the Caltrans right-of-way that will be included in the project (e.g. contractor's staging yard, work from barges, easements for staging, etc.).	❑	❑
14. Will additional right-of-way acquisition or easements and right-of-entry be required for design, construction and maintenance of BMPs. If so, how much?	❑	❑
15. Are there any slope stabilization concerns?	❑	❑
16. Describe the local land use within the project area and adjacent areas.	❑	❑
17. Is dry weather flow present?	❑	❑
18. What are the estimated unit costs for right-of-way should it be needed for Treatment BMPs, stabilized conveyance systems, lay-back slopes, or interception ditches?	❑	❑
19. Is there adequate funding (including supplemental funds) for storm water pollution control (SWPPP or WPCP) during construction?	❑	❑

Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts

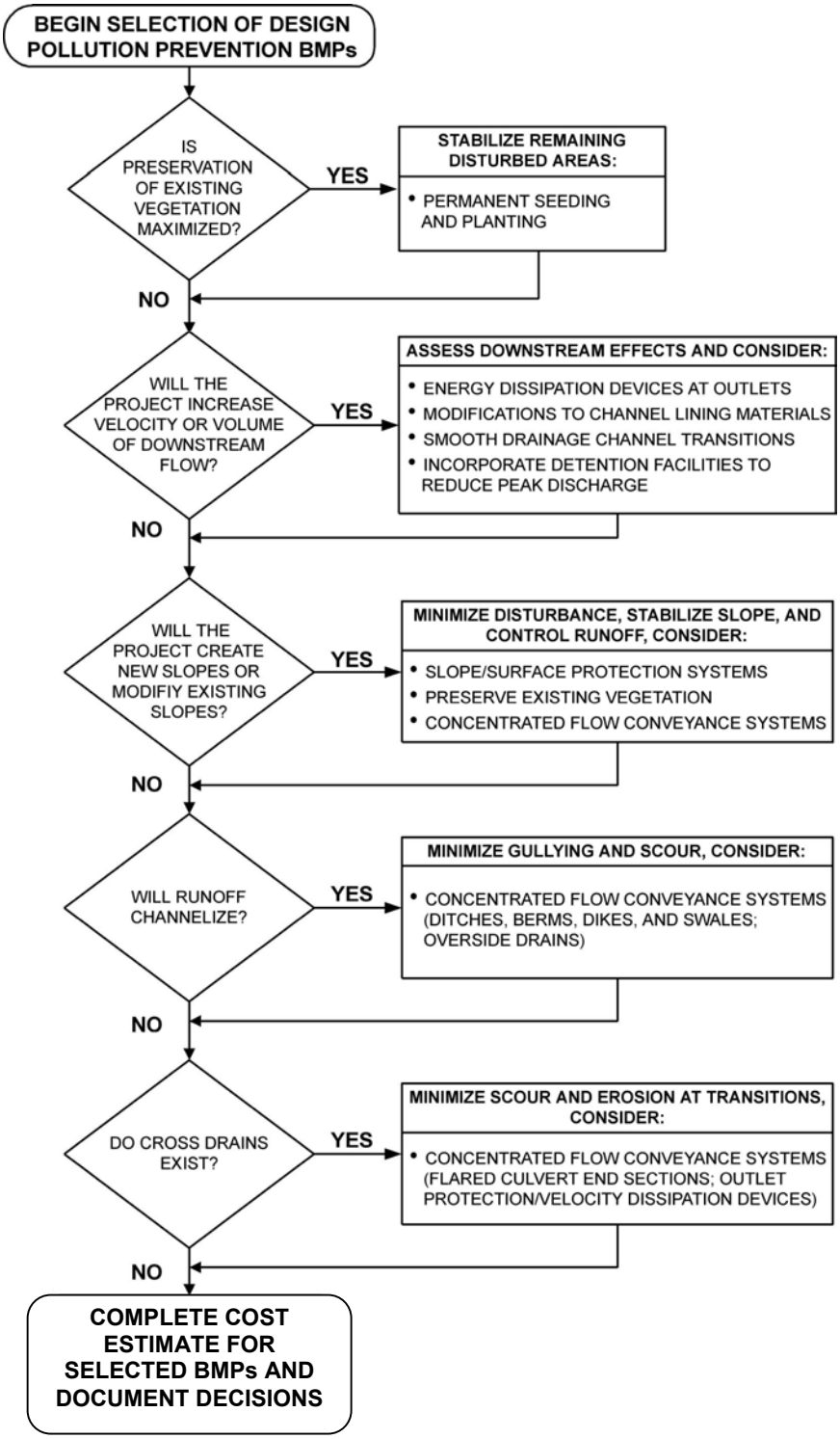
Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

The PE must confer with other functional units, such as Landscape Architecture, Hydraulics, Environmental, Materials, Construction and Maintenance, as needed to assess these issues. Attach pertinent information to the SWDR.

Options for avoiding or reducing potential impacts during project planning include the following:

1. Can the project be relocated or realigned (while upholding safe design standards) to avoid or reduce impacts to receiving waters?	❑ Yes	❑ No	❑ NA
2. Can structures and bridges be designed or located to reduce work in live streams and minimize construction impacts?	❑ Yes	❑ No	❑ NA
3. Can the horizontal and vertical alignments be adjusted, without jeopardizing safe design standards, to minimize erosion from slopes by the following methods:			
a. Disturbing existing slopes only when necessary?	❑ Yes	❑ No	❑ NA
b. Minimizing cut and fill areas to reduce slope lengths?	❑ Yes	❑ No	❑ NA
c. Incorporating retaining walls to reduce steepness of slopes or to shorten slopes?	❑ Yes	❑ No	❑ NA
d. Acquiring right-of-way easements (such as grading easements) to reduce steepness of slopes?	❑ Yes	❑ No	❑ NA
e. Avoiding soils or formations that will be particularly difficult to re-stabilize?	❑ Yes	❑ No	❑ NA
f. Providing cut and fill slopes flat enough to allow re-vegetation and limit erosion to pre-construction rates?	❑ Yes	❑ No	❑ NA
g. Providing benches or terraces on long cut and fill slopes to reduce concentration of flows?	❑ Yes	❑ No	❑ NA
h. Rounding and shaping slopes to reduce concentrated flow?	❑ Yes	❑ No	❑ NA
i. Collecting concentrated flows in stabilized drains and channels?	❑ Yes	❑ No	❑ NA
j. Retaining natural vegetation where feasible?	❑ Yes	❑ No	❑ NA
4. Can alternative materials or facilities be utilized to reduce future maintenance impacts on water quality (i.e., use of textured concrete in lieu of painted materials)?	❑ Yes	❑ No	❑ NA
5. Does design allow for ease of maintenance?	❑ Yes	❑ No	❑ NA
6. Can the project be scheduled or phased to minimize soil-disturbing work during the rainy season?	❑ Yes	❑ No	❑ NA
7. Can permanent storm water pollution controls such as slurry-paved slopes, vegetated slopes, basins, and conveyance systems be installed early in the construction process to provide additional protection and to possibly utilize them in addressing construction storm water impacts?	❑ Yes	❑ No	❑ NA

Decision Tree DPP-1



Design Pollution Prevention BMPs
Checklist DPP-1, Part 1

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____OUTFALL:_____

Consideration of Design Pollution Prevention BMPs for the PID

This checklist is for use in conjunction with Decision Tree DPP-1

1. Consideration of Downstream Effects Related to Potentially Increased Flow?

(a) Will project increase velocity or volume of downstream flow?	❑ Yes	❑ No	❑ NA
(b) Will the project discharge to unlined channels?	❑ Yes	❑ No	❑ NA
(c) Will project increase potential sediment load of downstream flow?	❑ Yes	❑ No	❑ NA
(d) Will project encroach, cross, realign, or cause other hydraulic changes to a stream that may affect downstream channel stability?			
(If yes was answered to any of the above questions, consider downstream effects related to potentially increased flow and attach Part 2 of this BMP checklist)	❑ Yes	❑ No	❑ NA

2. Slope/Surface Protection Systems

(a) Will project create new slopes or modify existing slopes?	❑ Yes	❑ No	❑ NA
(If yes was answered to the above question; consider ***Slope/Surface Protection Systems***, complete and attach Part 3 of this BMP checklist)	❑ Yes	❑ No	❑ NA

3. Concentrated Flow Conveyance Systems

(a) Will runoff from project channelize and potentially cause gullying and scour?	❑ Yes	❑ No	❑ NA
(b) Will project create new slopes or modify existing slopes?	❑ Yes	❑ No	❑ NA
(c) Are roadways or facilities on site subject to flood drainage?	❑ Yes	❑ No	❑ NA
(d) Will it be necessary to direct or intercept surface runoff?	❑ Yes	❑ No	❑ NA
(e) Do cross drains exist?	❑ Yes	❑ No	❑ NA
(If yes was answered to any of the above questions, consider ***Concentrated Flow Conveyance Systems***; complete and attach Part 4 of this BMP checklist)			

4. Preservation of Existing Vegetation

(a) Will project maximize protection of desirable existing vegetation to provide erosion and sediment control benefits?	❑ Yes	❑ No	❑ NA
(If yes, vegetation at areas on site where no construction activity is planned or will occur at a later date will be identified and preserved and remaining disturbed areas must be stabilized; consider ***Preservation of Existing Vegetation***, complete and attach the Part 5 of this checklist)			
(If no, document justification or consider ***Preservation of Existing Vegetation***, complete and attach Part 5 of this checklist)			

5. Cost Estimate for selected BMPs. ❑ Completed

Design Pollution Prevention BMPs
Checklist DPP-1, Part 2

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____OUTFALL:_____

Downstream Effects Related to Potentially Increased Flow

1. **Review total paved area and reduce to the Maximum Extent Possible (MEP).** ❑ Completed
2. **Review channel lining materials and design for stream bank erosion control.** ❑ Completed
   (a) See Chapters 860 and 870 of the HDM. ❑ Completed
   (b) Consider natural and man-made alternatives for channel lining materials. ❑ Completed
   (c) Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity. ❑ Completed
3. **Include, where appropriate, energy dissipation devices at culvert outlets.** ❑ Completed
4. **Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour.** ❑ Completed
5. **Include, if appropriate, detention facilities to reduce peak discharges.** ❑ Completed

Design Pollution Prevention BMPs
Checklist DPP-1, Part 3

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____OUTFALL:_____

Slope / Surface Protection Systems

DESIGN

1.	What are the proposed areas of cut and fill? (attach plan or map)		❑ Completed	
2.	Is erosion minimized from completed, disturbed surfaces?	❑ Yes	❑ No	❑ NA
3.	Is redesign possible?	❑ Yes	❑ No	❑ NA
4.	Are existing slopes disturbed?	❑ Yes	❑ No	❑ NA
5.	Are new slopes created?	❑ Yes	❑ No	❑ NA
6.	Are slopes > 1:4 vertical:horizontal (v:h) (If yes, an erosion control plan must be prepared or approved by the District Landscape Architect, and verified by District/Regional NPDES Storm Water Coordinator. Coordinate with District Geotechnical Liaison.)	❑ Yes	❑ No	❑ NA
7.	Are slopes > 1:2 (v:h) (If yes, a Geotechnical Design Report must be prepared by Geotechnical Services. Additionally, the District Landscape Architect should prepare or approve an erosion control plan that must also be verified by the District Maintenance Storm Water Coordinator and District/Regional NPDES Coordinator.)	❑ Yes	❑ No	❑ NA
8.	Review and incorporate Working Details and appropriate SSPs listed below for Vegetated Surface and Hard Surface Protection Systems.		❑ Complete	
9.	Estimate the total area in hectares (before construction/after construction) of vegetated surface BMPs and hard surface BMPs to be used on the project (excluding existing vegetation or preserved areas).		❑ Complete	

VEGETATED SURFACES

1.	Identify existing vegetation.	❑ Complete
2.	Evaluate site to determine appropriate vegetation and planting strategy.	❑ Complete
3.	What are the soil types within the planting area?	❑ Complete
4.	What are the vegetation types within the project limits? How long will it take for vegetation to re-establish?	❑ Complete
5.	Minimize overland and concentrated flow depths and velocities.	❑ Complete
6.	Maximize contact time between water and vegetated surfaces.	❑ Complete

Slope/Surface Protection Systems – Vegetated Surfaces	Working Detail in PPDG	Standard Special Provision	Estimated Quantity (ha)
• Earthwork (Slope Roughening/Terracing/ Rounding/Stepping)	√		
• Seeding and Planting	√	20-350 20-030 20-040	
• Temporary Erosion Control		07-350	
• Mulching	√	20-352 07-380	
• Erosion Control Blankets, and other geotextiles		20-010 07-390	
• Jute Mesh		20-356	
• Native Topsoil • Duff		20-170 20-005	
• Soil Bioengineering: Willow Cuttings (Plant Group W)		20-090	
• Fiber Rolls		20-060 07-420	
• Turf (Sod)		20-504	
• Track Walking			
• Erosion Control Type C, D or drill seed		20-030, 20-040 and 20-050, respectively	
• Bonded Fiber Matrix			

HARD SURFACES

1. Are hard surfaces required? (Safety, maintenance, soil stabilization, etc.) ❑ Yes ❑ No

Slope/Surface Protection Systems –Hard Surfaces	Working Detail in PPDG	Standard Special Provision	Estimated Quantity (ha)
• Rock Blanket	√	20-080	
• Rock Slope Protection	√	72-010	
• Concreted Rock Slope Protection	√		
• Sacked Concrete Slope Protection	√		
• Slope Paving	√	72-200	
• Articulated Revetments			
• Gabions			

Design Pollution Prevention BMPs
Checklist DPP-1, Part 4

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Concentrated Flow Conveyance Systems

1. Review Working Details and SSPs listed below for Vegetated Surface and Hard Surface Protection Systems. ❑ Complete
2. Estimate quantity of BMPs to be used on the project ❑ Complete

Concentrated Flow Conveyance Systems	Working Detail in PPDG	Standard Special Provision	Estimated Quantity (ha)
• Ditches, Berms, Dikes, and Swales	√	None available	
• Overside Drains	√	69-010, 69-020, 69-030, 69-100, 69-500	
• Flared Culvert End Sections	√	70-1.02C	
• Outlet Protection/Velocity Dissipation Devices	√	None available	

Ditches, Berms, Dikes and Swales

1. Evaluate risks due to erosion, overtopping, flow backups or washout. ❑ Complete
2. Consider outlet protection where localized scour is anticipated. ❑ Complete
3. Examine the site for run-on from off-site sources. ❑ Complete
4. Consider channel lining when velocities exceed scour velocity for soil. ❑ Complete

Overside Drains

1. Consider downdrains, as per HDM 834.3, paragraph 2. ❑ Complete
2. Consider paved spillways for side slopes flatter than 1:4. ❑ Complete

Flared Culvert End Sections

1. Install flared end sections on culvert inlets and outlets ❑ Complete

Outlet Protection/Velocity Dissipation Devices

1. Use outlet protection/velocity dissipation devices at outlets. ❑ Complete
2. Design apron at outlet. ❑ Complete
3. Design apron length appropriate to outlet flow and tailwater level. ❑ Complete

Design Pollution Prevention BMPs
Checklist DPP-1, Part 5

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

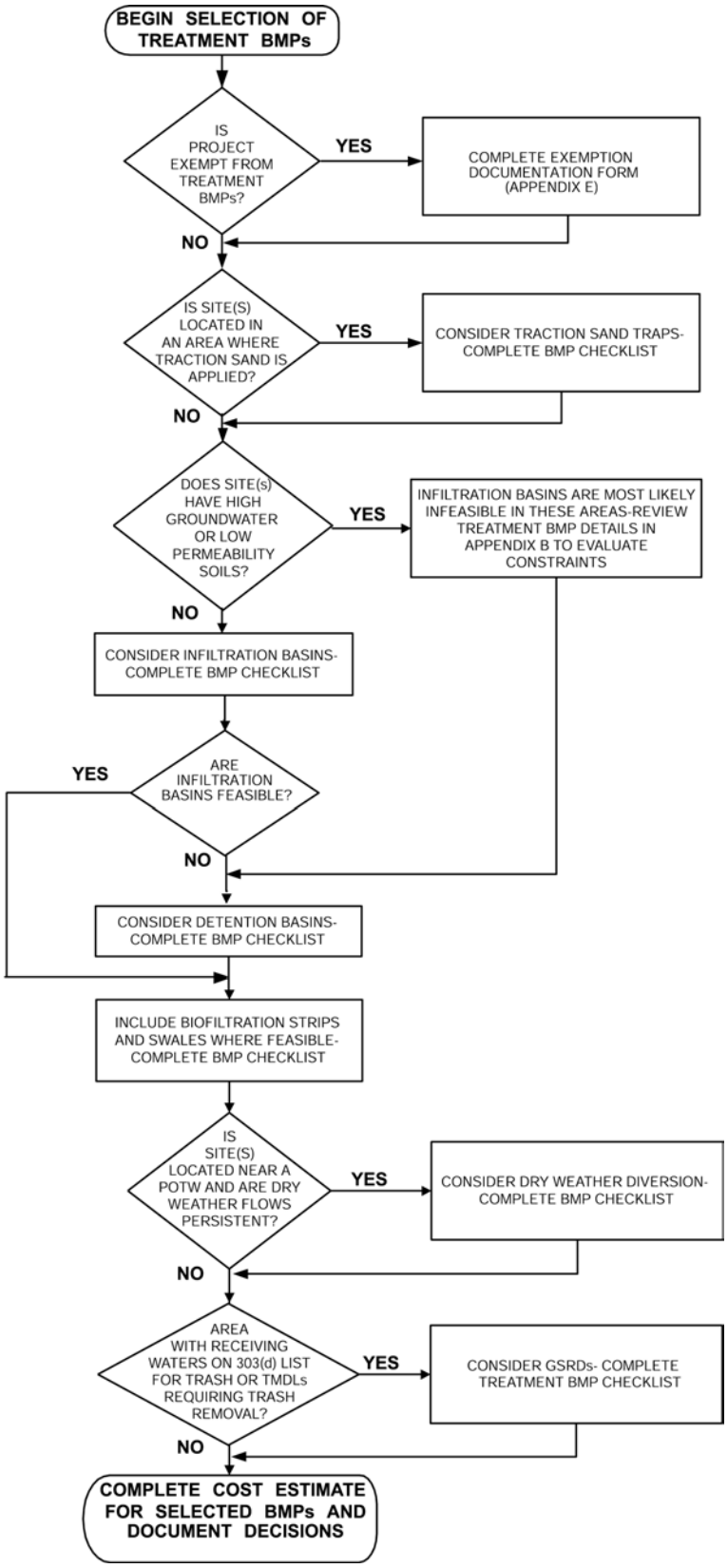
Preservation of Existing Vegetation

1. Review preservation of property, Standard Specifications 16-1.01 and 16-1.02 (clearing and grubbing) and Working Detail for Preservation of Existing Vegetation to reduce clearing and grubbing and maximize preservation of existing vegetation. ❑ Complete

2. Consider project changes (route/alignment modifications) to increase preservation or preserve critical areas such as floodplains, steep slopes, wetlands, and areas with problematic soil conditions. ❑ Complete

3. Have the following steps been taken?
   - (a) Has all vegetation to be retained been coordinated with Environmental, and identified and defined in the contract plans? ❑ Yes ❑ No
   - (b) Are all areas to be preserved marked and required to be protected with orange polypropylene fencing during construction? ❑ Yes ❑ No
   - (c) Have steps been taken to minimize disturbed areas, such as locating temporary roadways to avoid stands of trees and shrubs and following existing contours to reduce cutting and filling? ❑ Yes ❑ No
   - (d) Have impacts to preserved vegetation been considered while work is occurring in disturbed areas? ❑ Yes ❑ No

Decision Tree T-1



Treatment BMPs
Checklist T-1, Part 1

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Consideration of Treatment BMPs

This checklist is for use in conjunction with Decision Tree T-1, Treatment BMPs

1.	(a) Is the project defined as a new construction or major reconstruction project?	❑ Yes	❑ No
	(b) Is the project in an urban area subject to a MS4 permit? (If yes to either a or b, ***Treatment BMPs*** must be considered and checklist must be completed)	❑ Yes	❑ No
2.	(a) Are site conditions and climate favorable to allow suitable vegetation to be established? (If yes, consider Biofiltration Strips and Swales, complete and attach **Part 2** of the checklist)	❑ Yes	❑ No
	(b) Have Biofiltration strips and swales been considered to the extent practicable? (If no, document justification)	❑ Yes	❑ No
3.	(a) Are dry weather flows persistent or anticipated?	❑ Yes	❑ No
	(b) Is a sanitary sewer located on or near the site?	❑ Yes	❑ No
	(c) Is the domestic wastewater treatment authority willing to accept flow?	❑ Yes	❑ No
	(d) Do local health officials recommend a dry weather flow diversion?	❑ Yes	❑ No
	(e) Are dry weather diversions feasible? (If yes was answered to all of these questions consider ***Dry Weather Flow Diversion***; complete and attach **Part 3** of this checklist)	❑ Yes	❑ No
4.	(a) Is soil type within NRCS Hydrologic Soil Group D?	❑ Yes	❑ No
	(b) Is site located over a previously identified contaminated groundwater plume?	❑ Yes	❑ No
	(c) Is estimated infiltration rate below 1.3 centimeters (0.5 inches) per hour? (If yes to 4a, 4b or 4c, infiltration basins are considered infeasible.)	❑ Yes	❑ No
	(d) Is estimated infiltration rate greater than 6.4 centimeters (2.5 inches) per hour? (If yes, the RWQCB must be consulted, and the RWQCB must conclude that the groundwater quality will not be compromised, before approving the site for infiltration)	❑ Yes	❑ No
	(e) Is the design water quality volume less than 123 m^3 (0.1 acre-foot) for the identified drainage area? (If yes, detention basins and infiltration basins are not cost effective, other Treatment BMPs should be considered)	❑ Yes	❑ No

(f) Would infiltration pose a threat to local groundwater quality as determined by the District/Regional NPDES Storm Water Coordinator?
(If no, consider ***Infiltration Basins***; complete and attach **Part 4** of this checklist)
(If yes, consider a treatment BMP other than ***Infiltration Basins***) ❑ Yes ❑ No

(g) Are there local influent limits for infiltration or Basin Plan restrictions or other local agency prohibitions? ❑ Yes ❑ No

5. If infiltration basins are infeasible, consider detention basins and complete **Part 5** of the BMP checklist. ❑ Complete

6. Is the receiving water on the 303(d) list for trash or TMDLs and requires trash removal?
(If yes, ***Gross Solids Removal Devices*** **(GSRDs)** can be considered but must be a pilot project. Complete and attach **Part 6** of this checklist)
(If no, be aware that GSRDs can still be considered but must be deemed pilot.) ❑ Yes ❑ No

7. Is project located in an area (e.g., mountain regions) where traction sand is applied more than twice a year?
(If yes, consider ***Traction Sand Traps***, complete and attach **Part 7** of this checklist.) ❑ Yes ❑ No

7a. Is Traction Sand Trap utilized more than 7.62 cm (3 inches). ❑ Yes ❑ No

8. Have treatment BMPs been considered for use in parallel or series to accomplish water quality objectives?
(If yes, complete and attach checklists for all BMPs in the treatment train.) ❑ Yes ❑ No

9. Complete cost estimate for selected BMPs. ❑ Complete

Treatment BMPs
Checklist T-1, Part 2

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Biofiltration Swales / Strips

1. Can swales be located in natural or low cut sections to prevent structural problems caused by burrowing animals? ❑ Yes ❑ No
2. Is the tributary area for swales less than 4 hectares (10 acres)? ❑ Yes ❑ No
3. Have swales been considered as part of a treatment train? ❑ Yes ❑ No
4. Determine possible locations of biofiltration strips and swales. ❑ Complete
5. Are vegetation mixes appropriate for climate and location? ❑ Yes ❑ No
6. Design with adequate hydraulic function for flood routing and drainage. ❑ Complete
7. Design swale water depth as shallow as the site will permit. ❑ Complete
8. Size strips as long and flat as the site allows. ❑ Complete
9. Are expected design storm flow velocities low enough to prevent scour)? ❑ Yes ❑ No
10. Determine scour velocity for type of soil. ❑ Complete

Treatment BMPs
Checklist T-1, Part 3

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Dry Weather Diversion

1.	Are there any specific tributaries within the project limits that are in proximity to a sanitary sewer pipeline that is routed to a POTW?	❑ Yes	❑ No
2.	Is dry-weather flow acceptable to POTW and local health officials?	❑ Yes	❑ No
3.	Does the sanitary sewer pipeline have capacity to accept project dry weather flows?	❑ Yes	❑ No
4.	Is an upgrade to the existing sanitary sewer pipeline upgrade required to handle project dry weather flows?	❑ Yes	❑ No
5.	Is an upgrade to the existing sanitary sewer pipeline feasible per project budget and objectives?	❑ Yes	❑ No
6.	Design gate, weir, or valve to stop diversion during storm events.	❑ Yes	❑ No
7.	Design inlet to reduce chances of clogging the diversion pipe or channel.	❑ Complete	
8.	Design diversion to sanitary sewer for dry weather flow only.	❑ Complete	
9.	Design back flow prevention to prevent sanitary sewage from entering storm drain.	❑ Complete	

Treatment BMPs
Checklist T-1, Part 4

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Infiltration Basins

Feasibility

1. Has pre-screening information been collected and the appropriateness of infiltration determined? ❑ Yes ❑ No
2. Has the District/Regional NPDES Storm Water Coordinator been consulted to determine appropriateness of infiltration BMP at the site? ❑ Yes ❑ No
3. Does local Basin Plan or other local ordinance provide influent limits on quality of water that can be infiltrated? ❑ Yes ❑ No
4. Per survey data, does adequate area exist within the right-of-way to place infiltration basin? ❑ Yes ❑ No

   If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site infiltration basins? ❑ Yes ❑ No
5. Has a detailed investigation been conducted, including subsurface soil investigation, in-hole conductivity testing and groundwater elevation determination? ❑ Yes ❑ No ❑ Complete
6. (a) Does site have groundwater within 3 m (10 ft) of basin invert?

   (If yes, ***Infiltration Basins*** are eliminated from further consideration unless the local RWQCB requires installation of an infiltration basin with less than 3 meters separation to groundwater, and that provides adequate groundwater protection.) ❑ Yes ❑ No

   (b) Does site investigation indicate that the soil permeability below 1.3 centimeters (0.5 inch) per hour? ❑ Yes ❑ No

   (If yes, infiltration basins are considered infeasible.)

   (c) Does site investigation indicate that the infiltration rate is significantly greater than 6.4 centimeters (2.5 inches) per hour? ❑ Yes ❑ No

   (If yes, the RWQCB must be consulted, and the RWQCB must conclude that the groundwater quality will not be compromised, before approving the site for infiltration.)
7. Does infiltration at the site compromise the integrity of any slopes in the area? ❑ Yes ❑ No
8. Per survey data or U.S. Geological Survey (USGS) Quad Map, are slopes at site greater than 15%? ❑ Yes ❑ No

   (If yes to #7 or #8 above, infiltration basins are not feasible)

Design Elements

9. Can vegetation be established in the basin? ❑ Yes ❑ No

10. Can flow diversion be designed, constructed, and maintained to bypass flows exceeding the WQV? ❑ Yes ❑ No

11. Has preliminary site design been performed to determine draw down time for selected basin geometry? ❑ Yes ❑ No

    ❑ Complete

12. Can the basin infiltrate the water quality volume within 48 hours? ❑ Yes ❑ No

13. Has a flood control spillway with scour protection been provided? ❑ Yes ❑ No

14. Is the basin size sufficient to capture the WQV (WQV must be >123 m^3 (0.1 acre-feet)? ❑ Yes ❑ No

Treatment BMPs
Checklist T-1, Part 5

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Detention Basins

Feasibility

1. Review survey data to determine if adequate area exists within the right-of-way to place Detention basin. ❑ Complete
2. Review survey data or USGS Quad Map to determine if sufficient head exists to prevent objectionable backwater conditions in the upstream drainage systems. ❑ Complete
3. Is volume of basin equal to at least the WQV? (Note: the WQV must be at least 123m^3 [0.1 acre-feet]) ❑ Yes ❑ No
4. Is basin invert 3 m or greater above groundwater or designed with an impermeable liner? ❑ Yes ❑ No

If no to any of the above, then Detention Basins are not feasible.

Design Elements

5. Has the geotechnical integrity of the site been evaluated to determine potential impacts to surrounding slopes due to infiltration? If infiltration is a concern, consider using an impermeable liner. ❑ Yes ❑ No
6. Can vegetation be established for erosion control and to minimize re-suspension? ❑ Yes ❑ No
7. Is flow path as long as possible ($\geq$ 2:1 length to width recommended)? ❑ Yes ❑ No
8. Is the draw down time of the detention basin within 24 to 72 hours? ❑ Yes ❑ No
9. Have public health and vector control authorities been consulted to prevent mosquito problems? ❑ Yes ❑ No
10. Is the inlet structure designed to prevent scour, re-suspension of settled materials, and encourage quiescent conditions? ❑ Yes ❑ No
11. Is the basin outlet designed to minimize clogging? ❑ Yes ❑ No
12. If the detention basin is being used to capture traction sand, then the detention basin volume must be at least the WQV plus the total volume of traction sand that must be stored. In this case, the detention basin volume does not have to be greater than or equal to 123 m^3 (0.1 acre-feet). ❑ Complete

Treatment BMPs
Checklist T-1, Part 6

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Gross Solids Removal Devices

1. Is there sufficient access for maintenance and large equipment (vacuum truck)? ❑ Yes ❑ No
2. Size devices for peak design flow while carrying design gross solids load. (Refer to Appendix B, Section B.7) ❑ Complete
3. Design for gross pollutant (litter and vegetation) storage for a period of one year. (Refer to Appendix B, Section B.7) ❑ Complete

Linear Radial Device

1. Design with modular well casings with 5-mm (0.25-inch nominal) louvers to remove litter. ❑ Complete
2. Contain well casings in a concrete vault. ❑ Complete
3. Access doors should be provided for cleaning. ❑ Complete

Inclined Screen

1. Design with wedge-wire screen with maximum screen spacing of 3-mm (0.125-inch nominal). ❑ Complete
2. Provide an opening above the litter storage area to allow for overflow/bypass if the device becomes plugged. ❑ Complete

Treatment BMPs
Checklist T-1, Part 7

Prepared by:_____Date:_____District-Co-Route:_____
Reviewed by:_____Date:_____KP (PM):_____EA:_____
RWQCB:_____

Traction Sand Traps

1. Can a detention basin be used to capture traction sand and store water quality volume. If yes, then no additional sand traction trap is required. Refer to Checklist T-1, Part 5. ❑ Yes ❑ No

2. Contact local Caltrans Maintenance Station to determine amount of traction sand used at location. ❑ Complete

3. Locate survey data to determine site elevations. ❑ Complete

4. Contact the District/Regional NPDES Storm Water Coordinator to ensure that the traction sand trap is not classified as a regulated underground injection well. ❑ Complete

5. Does traction sand trap have enough volume to store settled sand over the winter? ❑ Yes ❑ No

   $V = (S \times R \times L \times E) / F$

   Where:

   V = The total volume of traction sand that must be stored (m^3)

   S = The estimated volume of sand applied (m^3/yr.)

   R = A reduction factor to account for sand recovered by roadway sweeping.

   L = A factor to account for other miscellaneous losses/accumulations.

   E = An estimated recovery efficiency.

   F = The number of times the trap will be cleaned (times/yr)

   (Refer to Appendix B, Section B.4 for more details regarding this equation)

6. Was a factor of 0.8 to 1.2 used for L to determine the amount of expected sand to enter the traction sand trap? ❑ Yes ❑ No

7. Is the device 1 to 2 m above groundwater (GW)? ❑ Yes ❑ No

8. Design inlet and outlet to minimize short-circuiting of the flow. ❑ Complete

9. Allow enough space for maintenance and access ramps for large equipment. ❑ Complete

Appendix F

Cost Estimates

F.1 INTRODUCTION

The reliability of project cost estimates at every stage in the project delivery process is necessary for responsible fiscal management. (See Chapter 20 of the Project Development Procedures Manual (PDPM, 7/1/99) for additional information.) Unreliable cost estimates can result in severe problems in Caltrans programming and budgeting, in local and regional planning, and it results in staffing and budgeting decisions that could impair effective use of resources. This, in turn, affects Caltrans relations with the California Transportation Commission (CTC), the Legislature, local and regional agencies, and the public, and results in loss of credibility. Storm Water Quality Best Management Practices (BMPs) are an integral part of a project, and need to be accurately estimated during the Project Initiation Document (PID), Project Approval/Environmental Document (PA/ED), and Plans, Specifications and Estimates (PS&E) phases.

F.2 GOAL AND OBJECTIVE

Caltrans goal is to avoid cost overruns on projects. One objective is to anticipate “unforeseen items of work” before the project concept, scope, and cost have been determined; thus minimizing the differences between cost estimates during the PID process, the PA/ED process and the PS&E process. The objective of this appendix is to provide general guidance on incorporating the cost of storm water BMPs into the project delivery process; however, it is understood that local district procedures for cost estimating may vary.

F.3 METHODOLOGY

Although cost estimating is not an exact science, Caltrans must strive for reliable project cost estimates, so that projects can be delivered "within budget." To this end, it is required that project cost estimates be prepared using a consistent and comprehensive methodology. Even with a consistent and comprehensive methodology, careful attention is needed to ensure a quality cost estimate. The cost estimator needs to research, compare and, above all, use their professional judgment to prepare a quality cost estimate.

F.3.1 Categories of Project Cost Estimates

There are two categories of project cost estimates: Project Planning Cost Estimates (PPCE) and Project Design Cost Estimates (PDCE). PPCEs are used for project justification, analysis of alternatives, approval, and for programming. PDCEs are used to summarize the cost of a project's contract items of work and will be part of the construction contract for the project.

PPCEs are cost estimates prepared in advance of project approval. The initial programmed cost (see PDPM, Chapter 6, Article 2) that appears the first time a project is listed is based on an escalation of a PPCE. PPCEs are categorized as: (1) Project Feasibility; (2) Project Summary Report (PSR); (3) Draft Project Report (DPR); and (4) Project Report (PR).

PDCEs are design cost estimates made after PR approval and until completion of the PS&E process. These estimates are categorized as either preliminary or final. PDCEs focus on the construction costs of the project and are input into the Basic Engineering Estimating System (BEES). BEES has two components: (1) the District (Highway) Cost Estimate, and (2) the

Structures (Bridge) Cost Estimate, that, when combined, equal the total construction cost for the project.

PDCEs should be considerably more detailed than PPCEs. As engineering and environmental studies progress, more information, such as final contour mapping, materials and drainage information, and structure studies, becomes available. This data increases the ability to prepare a more detailed cost estimate.

Cost estimates, in a sense, are never completed. They are not static, but have to be reviewed continually to keep them current. Other functional units (Division of Structures, Right-of-Way, Traffic Operations, Materials, Maintenance, Construction, Environmental, Landscape Architecture, etc.) and local entities should be involved, as appropriate, in the preparation of both PPCEs and PDCEs. The designer should gather as much information as possible for the project and its various alternatives. It is better to have too much information than not enough. Coordination between the PPCEs, the PDCEs, and the Standard Specifications that will be used to construct the project is required.

F.3.2 Systematic Field Reviews

During the planning phase, it is essential that project alternatives be adequately scoped. This is best accomplished by performing systematic field reviews to obtain factual data. This data is used to backup the cost estimates so that the estimates can be used with confidence. In addition, a systematic field review will help to ensure that the project is adequately scoped. Systematic field reviews are an essential part of the project delivery process. They provide an important perspective that supplements the mapping, photos, survey data and other sources of information about the project that are used in the office. Systematic field reviews will minimize the possibility of overlooking significant features that could affect project design.

While in the field, project personnel should be on the lookout for high cost items (i.e., retaining walls, major storm drains, additional rights-of-way required for installation of Treatment BMPs, utility obstructions, traffic handling, etc.). If high cost items are present or need to be designed into the project alternatives, then they must be quantified. The "worse probable case" should always be assumed, particularly on reconstruction projects. Existing facilities thought to be adequate may have become inadequate because of changes to standards, new data, etc. Design feature decisions, project constructability, construction staging, are among a variety of issues that should be evaluated in the field. Notes should be taken to document decisions and to identify limits, boundaries, and other conditions.

F.3.3 Technical Information

Technical information that must be obtained to prepare a PPCE includes, but is not limited to: geotechnical design information (particularly where infiltration is being considered or slope stability problems can be anticipated); materials information; hazardous waste assessment; potential environmental issues and mitigation; right-of-way and utilities data sheets; traffic handling and transportation management plans; etc. The designer should refer to as-built drawings or other references to see what information is available early in the project delivery process. If necessary information is not available, then it should be requested from the appropriate source unit.

F.3.4 Use Groupings from Standard Cost Estimate Format

Individual contract items are difficult to identify at the early project development stages, but it is possible to group basic work functions together to form a systematic approach to project cost estimating. Most projects have Design Pollution Prevention BMPs, Treatment BMPs, and Construction Site BMPs that are relatively easy to recognize and quantify. The standard cost estimating format (see Section F.7) provides for this approach by using such groupings. Coordination between the planning cost estimate and the Standard Specifications is essential, since these elements will directly influence construction of the project. A thorough knowledge of the Standard Specifications is essential.

F.3.5 Contingencies Versus Confidence Factor

Contingency factors for project planning cost estimates vary depending on the cost estimate type. Contingencies are intended to compensate for the use of limited information. The percentage goes down as the project becomes more defined and thus less unknown. Contingencies are not intended to take the place of complete design work. Project alternatives and their associated cost estimates must be thoroughly compiled by diligently using all of the available data, modifying that data with good judgment and using past cost estimating experience so that the cost estimates can be used with confidence.

F.3.6 Construction Seasons

Consideration should be given when a project is anticipated to extend beyond a single construction season. If the project cannot be finished before the end of the construction season and the project needs to be suspended, contractors will increase their bid prices to cover their overhead during the winter (i.e. “rainy” or “wet” season) and repair any damage that may occur. Even if contractors reasonably expect to finish before the winter, they may protect themselves to allow for an early winter. This can especially be true if construction involves work on items that may be affected by winter weather (i.e., drainage channels, earthwork, slope stabilization, etc.), or that requires deployment of additional Construction Site BMPs. Therefore, if a construction project is anticipated to extend over two or more construction seasons, add 25% to the estimated cost for Construction Site BMPs as determined by Section F.6.1 or Section F.6.3.

F.4 SUPPLEMENTAL WORK

Supplemental work is work of an uncertain nature or amount and, therefore, it is not done on a contract item basis. Work that is known but cannot be predetermined and provided for under contract items of work should be included as supplemental work. Supplemental work is not intended to take the place of complete design work, nor is it to be used for contingencies. The designer should not add supplemental work items for "possible additional work" for any major area of work (i.e. drainage, traffic items, etc.). Additional funds for undeterminable changes, such as increased dewatering operations, additional soil stabilization, or increased maintenance of Construction Site BMPs due to unusual weather (i.e. early winter or heavier than normal rainfall), should be included as supplemental work.

Extra work identified in the contract special provisions must be itemized as supplemental work. Contingencies are a percentage of the subtotal of the cost of contract items, supplemental work,

and state-furnished materials and expenses, and are included in the grand total of the District Cost Estimate to allow for unforeseen increases.

F.5 STANDARD SPECIFICATIONS, CONTRACT PLANS AND SPECIAL PROVISIONS

All District Cost Estimates are to be based on the *Standard Specifications*, Contract Plans and Special Provisions. These documents form the basis for determining contract items. The *Standard Specifications*, along with the Contract Plans and Special Provisions for a specific project, prescribe the details for construction and completion of the work that the Contractor undertakes to perform in accordance with the terms of the contract. Coordination between the District Cost Estimate, the *Standard Specifications*, Contract Plans and Special Provisions is required.

F.6 ESTIMATING OPTIONS

There are three estimating options that may be used to establish prices for Storm Water BMPs considered during the PID, PA/ED, and PS&E processes of a project. These options may be used individually or in combination, and are shown in Table F-1:

Table F-1: Options for Estimating Storm Water BMPs

Option	Description
1	Percent of Total Project Cost
2	Historical Project Information
3A	Estimated Unit Cost Sample
3B	Actual Unit Cost

Although the cost estimating procedures may vary for each District, Table F-2 lists the options that are generally available during the different project delivery processes:

Table F-2: Estimating Options Available During the Project Development Processes

Project Process	Option	Documentation
PID	1 or 2	Storm Water Data Report (SWDR) / Preliminary Project Cost Estimate (PPCE)
PA/ED	2 or 3B	Updated PPCE
PS&E	3A or 3B	PDCE

The designer must provide estimates for the following Storm Water – related items:

- Design Pollution Prevention BMPs;
- Treatment BMPs;
- Construction Site BMPs;
- Cost for the contractor to prepare a SWPPP or WPCP; and
- Right-of-way Acquisition.

Design Pollution Prevention BMPs are normally covered under bid line items for excavation, grading, backfill, etc. Treatment BMPs may also be covered under bid line items, but are difficult to estimate during the planning phase. Construction Site BMPs are normally estimated as a percentage of the total project cost due to the uncertainty of the contractor's schedule. In addition, costs for right-of-way acquisitions to accommodate infiltration basins or drainage easements need to be incorporated into the estimate. The designer should base the estimated cost for land acquisition upon the unit right-of-way costs established by the District Right-of-Way Branch for the specific project area (see Section F.7.3).

F.6.1 Option 1: Percent of Total Cost Method

The Percent of Total Project Cost method can be used during the PID process when no unit costs or sample historical project costs are available. Table F-3 lists the percentage of cost for Construction Site BMPs based on the total project costs. Note that the percentage of the Total Construction Cost decreases for larger highway projects.

Table F-3: Percentage of Extra Cost to Project Due to Construction Site BMPs

Type of Project	% Of Total Construction Cost for Projects less than $2,000,000	% Of Total Construction Cost for Projects over $2,000,000
Projects that involve work near 303d listed water body		
Minor work such as resurfacing	3%	2%
Work that will require structural (treatment) BMPs	4%	3%
New facilities/renovations if TMDLs have been established (includes treatment BMPs)	6%-10%	4% - 7%
Construction of Highway projects		
New project with a large percentage of structure work	3%	2%
Freeway highway widening in rural areas	4%	3%
Freeway/highway widening in urban areas	5%	3% - 4%
Projects with considerable staging, borrow/fill sites and unbalance projects	6%	4%
Landscaping projects		
Projects with new planting and irrigation that involve large areas of clearing and grubbing for new ground cover planting	10%	10%
Projects (new and rehabilitation) that involve clearing and grubbing adjacent to water bodies	15%	15%

Other cost criteria percentages include the following:

- Costs for development and implementation of a SWPPP or WPCP;
  - For a planning-level estimate, assume the typical preparation cost of a SWPPP to be about $5,000 to $10,000 ($2,000 to $4,000 for a WPCP), plus $200 per each water pollution control sheet (the number of water pollution control sheets can be estimated by the using a number equal to the estimated number of drainage sheets in each construction staging plan set).

- Sensitive Environments;
  - The estimate percentage can exceed 10% when working near a 303(d) listed water body or other sensitive area.
- Highway Planting Contracts;
  - The total can be estimated at 4 to 7% of total highway planting construction costs (A higher percentage is used because the total cost of the contract is lower per area unit than highway contracts). Use 10% of total project costs when contract includes clearing, grubbing, or removing ground cover.
- Supplemental Funds
  - May be needed to give the contract enough contingency money to handle the need for additional BMPs over the estimated amount. This would usually occur on contracts that will be under construction during more than one winter season. In accordance with Section F.3.6, the Project Engineer should add 25% to the cost of the Construction Site BMPs for those projects anticipated to extend beyond a single construction season. Supplemental funds also cover the costs for the Sampling Analysis Plan (SAP) discussed in Section F.7.4.

As previously mentioned, the Design Pollution Prevention BMPs are normally covered under individual bid line items. The Treatment BMPs, however, are not normally defined enough at the PID stage to estimate as excavation, backfill, etc. For New Construction or Major Reconstruction Projects, an additional $100,000 to $250,000 per lane mile should be added to cover costs associated with incorporating Treatment BMPs. The lower end of this range would apply to projects in rural areas that are not adjacent to a 303(d) listed water body. Conversely, the higher end of this range would be for projects that fall within urban areas, or are adjacent to 303(d) listed water bodies. This price does not include right-of-way acquisition costs for constructing infiltration basins or for establishing drainage easements.

F.6.2 Option 2: Historical Project Method

The Historical Project method uses historical project cost information and updates that information to present day costs using the cost indexes in the Engineering News Record. This method can be generally used during the PID and PA/ED processes.

The following guidelines apply when using Historical Project costs:

- Similar size projects should be used and quantities for individual items should be similar;
- Consider using the average of the five lowest bidders, or possibly applying an increase factor to the low bid;

- Previous bid prices should be revised by the projected change in the California Construction Cost Index between the date of the old bid and the date of the anticipated new bid;
- The reference bid price should be adjusted to reflect different conditions between the reference project and the project for which the cost estimate is being prepared. This would include considerations of differences in type of terrain, geographical location, soil, traffic and specifications; and
- Lump sum bid prices or unit prices for items of work (e.g. culverts) that include varying amounts of other related work should not be used.

Table F-4 is a sample table that may be used to list the project, description of BMP(s), and corresponding unit price (if available) and the total dollar amount of specific BMPs. This table should be used separately to complete cost estimates for Design Pollution Prevention, Treatment and Construction Site BMPs. The total costs for each can then be added together.

Table F-4: Sample Table

Historical Project Name/EA	BMP Description	Unit of Measurement	Unit Price	Total Dollar Amount

F.6.3 Option 3, Unit Costs

The Unit Cost method uses estimated (Option 3A) and actual (Option 3B) unit costs. Both Options 3A and 3B can be used during the PS&E process. However, Option 3B is preferred.

Sources for estimating unit cost include the following:

- Design Pollution Prevention BMPs – See Table F-5;
- Sampling Analysis Plan – See section F.7.4;
- Construction Site BMPs – See Construction Site BMP Manual;
- Treatment BMPs - Pilot Studies or Table F-6; and
- Basic Engineering Estimating System (BEES).

Table F-5 lists a range of unit costs for erosion and sediment control BMPs along with their related effectiveness. Table F-6 lists costs per unit WQV for Treatment BMPs. Neither of these tables includes costs for additional right-of-way acquisitions, if needed.

Table F-5: Installed Costs and Effectiveness of BMPs

BMP	Unit Cost Installed	Estimated Relative Erosion/ Sediment Control Effectiveness
SEDIMENT CONTROL		
Silt Fence	$9.80 – 13.00 per linear meter ($3.00 – 4.00 per lineal foot)	UNK
Fiber Rolls	$11.50 – 14.00 per linear meter ($3.50 – 4.25 per lineal foot)	58%
Gravel/Sand Bags Barrier	$1.50 – 3.00 per linear meter ($0.45 – 0.90 per linear foot)	UNK
Temporary Straw Bale Barrier	$7.50 – 15.00 per linear meter ($2.30 – 4.50 per linear foot)	UNK
TRACKING CONTROL		
Stabilized Construction Entrance/Exit	$1,500 – 2,500 each	UNK
NON-STORM WATER CONTROL		
Temporary Concrete Washout Facility	$1,500 – 3,000 each	UNK
SOIL STABILIZATION		
Vegetative:		
Fertilizer	$1,100-1,360 per hectare ($450 – 550 per acre)	N/A
Seeding	$2,150-5,360 per hectare ($870 – 2,170 per acre)	50%
Stolonizing	$5,400 per hectare ($2,200 per acre) + cost of stolons	90%
Hydraulic Mulching	$2,220-2,960 per hectare ($900 – 1,200 per acre)	50 – 60%
Compost Application	$2,220-2,960 per hectare ($900 – 1,200 per acre)	40 – 50%
Straw Mulching	$4,450-5,200 per hectare ($1,800 – 2,100 per acre)	90 – 95%
Mulch (Bark/Wood Chips – 50 mm (2 inch) layer	$11,000 – 22,500 per hectare ($4,000 – 9,000 per acre)	UNK
Erosion Control (Type C) {reference application of 50 kg seed, 450 kg fertilizer, 300 kg fiber, and 4 tonnes incorporated straw}	$4,500 – 11,500 per hectare ($1,800 – 4,600 per acre)	UNK (assume 90 – 95% as per straw mulching)
Erosion Control (Type D) {reference application of 50 kg seed, 200 kg fertilizer, 2000 kg compost, 600 kg fiber, 4 tonnes straw, and 135 kg tackifier}	$5,400 – 13,800 per hectare ($2,200 – 5,600 per acre)	UNK (assume 90 – 95% as per straw mulching)

Table F-5: Installed Costs and Effectiveness of BMPs

Non-Vegetative:		
Temporary Cover/Plastic Sheeting	$2.00 – 3.00 per square meter ($2.00 – 3.00 per square yard)	UNK
Slope Roughening, Trackwalking, Imprinting	$0 – 900 per hectare ($0 – 350 per acre)	12 – 76%
Rock Blanket (Cobble)	$30,000 – 70,000 per hectare ($12,000 – 28,000 per acre)	UNK
Rock Slope Protection (RSP-Light)	$38,500 – 63,500 per hectare ($15,600 – 25,700 per acre)	UNK
Rock Slope Protection (RSP-1/4 Ton)	$40,000 – 100,000 per hectare ($16,200 – 40,500 per acre)	UNK
Rock Slope Protection (RSP-1/2 Ton)	$60,000 – 110,000 per hectare ($24,300 – 44,500 per acre)	UNK
Rock Slope Protection (RSP-1 Ton)	$75,000 – 120,000 per hectare ($30,400 – 48,500 per acre)	UNK
Slope Paving (Concrete)	$400,000 – 750,000 per hectare ($162,000 – 304,000 per acre)	UNK
Soil Binders		
Plant Material-Based (Short-Term)	$1,700 – 2,200 per hectare ($700 – 900 per acre)	80 – 85%
Plant Material-Based (Long-Term)	$3,000 – 3,700 per hectare ($1,200 – 1,500 per acre)	60 – 65%
Polymeric Emulsion Blends	$1,700 – 3,700 per hectare ($700 – 1,500 per acre)	30 – 70%
Petroleum Resin-Based	$3,000 – 3,700 per hectare ($1,200 – 1,500 per acre)	25 – 20%
Cementitious Binder-Based	$2,000 – 3,000 per hectare ($800 – 1,200 per acre)	80 – 85%
Bonded Fiber Matrices	$12,500 – 16,000 per hectare ($5,000 – 6,500 per acre)	90 – 95%
Rolled Erosion Control Products		
Biodegradable:		
Jute	$14,800 – 17,300 per hectare ($6,000 – 7,000 per acre)	65 – 70%
Curled Wood Fiber	$19,800 – 25,900 per hectare ($8,000 – 10,500 per acre)	85 – 90%
Straw	$19,800 – 25,900 per hectare ($8,000 – 10,500 per acre)	85 – 90%
Wood Fiber	$19,800 – 25,900 per hectare ($8,000 – 10,500 per acre)	85 – 90%
Coconut Fiber	$32,000 – 35,000 per hectare ($13,000 – 14,000 per acre)	90 – 95%
Coconut Fiber Net	$74,000 – 82,000 per hectare ($30,000 – 33,000 per acre)	85 – 90%
Straw Coconut	$25,000 – 30,000 per hectare ($10,000 – 12,000 per acre)	90 – 95%
Non-Biodegradable:		
Plastic Netting	$12,400 – 16,000 per hectare ($5,000 – 6,500 per acre)	< 50%
Plastic Mesh	$7,400 – 8,600 per hectare ($3,000 – 3,500 per acre)	75 – 80%

Table F-5: Installed Costs and Effectiveness of BMPs

Synthetic Fiber w/Netting	$84,000 – 99,000 per hectare ($34,000 – 40,000 per acre)	90 – 95%
Bonded Synthetic Fibers	$111,000 – 136,000 per hectare ($45,000 – 55,000 per acre)	90 – 95%
Combination Synthetic and Erosion Control	$74,000 – 89,000 per hectare ($30,000 – 36,000 per acre)	85 – 90%
STABILIZED CONVEYANCE SYSTEMS		
Culverts, Ditches, Berms, Dikes, Swales, Bio-strip*, Bio-swales* *Listed in this section for convenience but listed in the SWMP as Treatment BMPs	See Contract Cost Data or District Office Engineer (OE)	
TREATMENT BMPs		
Infiltration Basin; Detention Basin; Gross Solids Removal Device; Dry Weather Flow Diversion; Traction Sand Trap	Estimate using individual components of entire system, e.g.: Infiltration Basin would require earthwork, minor concrete, asphalt concrete; various landscape items, various hydraulic items. See Contract Cost Data or District OE	
NEW AND/OR UNAPPROVED BMPs		
	Contact District/Regional NPDES Storm Water Coordinator, Headquarters Environmental Analysis, Headquarters Design Storm Water Management, Headquarters Construction Storm Water	
MISCELLANEOUS		
Dewatering (Sediment Removal Only)	$100 per day per discharge	N/A
Temporary Creek Diversion System	$15,000 – 35,000	N/A

Sources: Erosion Control Pilot Study Report, URS Greiner Woodward Clyde, June 2000, Table 4-1; Caltrans Costs Data

Table F-6: Treatment BMPs Installed Costs

	Construction Cost/m^3 of the Water Quality Volume*
Biofiltration Strip	$ 750
Biofiltration Swale	$ 750
Infiltration Basin	$ 400
Detention Basin	$600
Traction Sand Trap (Basin Type)	$ 600
Traction Sand Trap (Vault Type)	$1,500
Dry Weather Flow Diversion	**
Gross Solids Removal Device	**

* Cost does not include acquisition of rights-of-way

****** The costs for Dry Weather Flow Diversions are dependent upon flow rates, not the WQV, and are also dependent upon depth of piping, utility relocation, and distance to the Publicly Owned Treatment Works (POTW). Therefore, the unit costs for piping, excavation and backfill must be combined to estimate the cost associated with a Dry Weather Flow Diversion. For Gross Solids Removal Devices (GSRDs), the price of a Linear Radial GSRDs is estimated at $37,500 per hectare ($15,000 per acre) of tributary area, while the Inclined Screen GSRDs is $87,500 per hectare ($35,000 per acre) of tributary area.

F.7 STANDARD FORMAT FOR PROJECT PLANNING COST ESTIMATES

The standard format included at the end of the PDPM (Appendix AA) may be used for all project planning cost estimates. For many projects, the form can be used as is by completing a cover sheet and "filling-in" the blanks. However, if needed, extra lines are provided for items not listed. Additional lines may be added as necessary.

The standard format is broken into four components:

- Cover Sheet;
- Roadway Items;
- Structure Items; and
- Right of Way.

Although the standard format was not written specifically for estimating Storm Water BMPs, Sections 3 (Drainage) and 4 (Specialty Items) may be used for this purpose. The concept behind the standard format requires that the cost estimator determine quantities and costs for groups of related work as previously discussed in Sections F.1 through F.5 of this Project Planning and Design Guide (PPDG). Identification of contract items is not necessary (but would be beneficial) to obtain a realistic cost estimate for each viable project alternative. Calculation sheets, maps and sketches used to determine costs and quantities for the cost estimate should be retained in the project files until the project has been completed and finalized.

F.7.1 Drainage

Large drainage facilities (i.e., reinforced concrete boxes, etc.) should be estimated separately and the *Standard Plans* should be consulted for quantities. Drainage items for widening and rehabilitation projects can be estimated by determining extensions to existing culverts and the number of other features, such as inlets, and overside drains, that will be affected. Be aware of any additional right-of-way that may be needed for drainage easements. Bid sheets from adjacent or similar type projects can be evaluated for estimating unit costs. Cost estimates for drainage on new alignment projects can be quantified by comparisons with similar types of projects.

F.7.2 Specialty Items

Items such as erosion control or slope protection (both during construction and permanent) can be estimated by using slope information obtained from the field review. Items such as hazardous wastes and environmental mitigation require consultation with other functional units in the District, the Engineering Service Center, and Headquarters. It is important to deal with hazardous waste and environmental issues immediately and design the project avoid them if possible, since they often adversely affect project cost estimates.

F.7.3 Right-of-Way Items

The right-of-way portion of the cost estimate should be obtained from the District Right-of-Way Branch. The Right-of-Way Branch prepares its cost estimate based on current procedures and guidelines contained in the *Right of Way Manual*. Costs for the listed right-of-way items are to be obtained from the Right-of-Way Data Sheet (see Appendix JJ of the PDPM). The Right-of-Way Data Sheet should be referred to in the project cost estimate as backup information.

"Construction Contract Work" (contractual obligations made by the Right-of-Way Branch with the property owner, such as the costs to relocate fencing, reconstruct gates, reconstruction of road approaches) should be described briefly and the estimated cost to perform this work given. The estimated cost should only be shown in this portion of the PPCE, not included. Construction contractual obligations are to be included in the project cost estimate as construction items of work.

F.7.4 Sampling Analysis Plan

Implementation of the Sampling and Analysis Plan (SAP) will be paid for as extra work. All SAPs will require sampling for non-visible pollutants and can be estimated at $15,000.00 to $30,000 per year depending upon size of project. If sampling for turbidity and sediment is required, add $10,000.00 to $20,000.00 per year depending upon size of project. These costs may be decreased by 50% for drier regions of the state. Small projects may be defined as having one stream crossing and/or small DSA (0.40 ha). Large projects would have multiple stream crossings (3+) and/of large DSA (10+ ha).

F.7. 5 Cost Estimate

The following pages contain excerpts from Appendix AA of the PDPM. These sheets may be used to track estimates relating to costs for incorporating storm water BMPs. The reader should refer to the PDPM for more specific guidance on using these forms.

(Enter Type of Project Planning Cost Estimate as Title)

Caltrans Metric

District-County-Route _____

KP (PM) _____

EA _____

Program Code _____

PROJECT DESCRIPTION:

Limits _____

_____

Proposed Improvement (Scope) _____

_____

Alternate _____

SUMMARY OF PROJECT COST ESTIMATE

TOTAL ROADWAY ITEMS	$_____
TOTAL STRUCTURE ITEMS	$_____
SUBTOTAL CONSTRUCTION COSTS	$_____
TOTAL RIGHT OF WAY ITEMS	$_____
TOTAL PROJECT CAPITAL OUTLAY COSTS	$_____

Reviewed by District Program Manager _____
(Signature)

Approved by Project Manager _____ Date _____
(Signature)

Phone No. _____ Page No. ____ of ____

District-County-Route _____
KP (PM) _____
EA _____

Section 3 Drainage	Quantity	Unit	Unit Price	Item Cost
Large Drainage Facilities	_____	____	$_____	$_____
Storm Drains	_____	____	$_____	$_____
Pumping Plants	_____	____	$_____	$_____
Project Drainage (X-Drains, overside, etc.)	_____	____	$_____	$_____
_____	_____	____	$_____	$_____
_____	_____	____	$_____	$_____
_____	_____	____	$_____	$_____
_____	_____	____	$_____	$_____

Subtotal Drainage $_____

*Reference sketch showing typical pavement structural section elements of the roadway. Include (if available) T.I., R-Value and date when tests were performed.

NOTE: Extra lines are provided for items not listed, use additional lines as appropriate.

Page No. ___ of ___

District-County-Route _____
KP (PM) _____
EA _____

Section 4 Specialty Items	Quantity	Unit	Unit Price	Item Cost
Retaining Walls	_____	____	$_____	$_____
Noise Barriers	_____	____	$_____	$_____
Barriers and Guardrails	_____	____	$_____	$_____
Equipment/Animal Passes	_____	____	$_____	$_____
Highway Planting	_____	____	$_____	$_____
Replacement Planting	_____	____	$_____	$_____
Irrigation Modification	_____	____	$_____	$_____
Relocate Private Irrigation Facilities	_____	____	$_____	$_____
Erosion Control	_____	____	$_____	$_____
Slope Protection	_____	____	$_____	$_____
Water Pollution Control	_____	____	$_____	$_____
Hazardous Waste Mitigation Work	_____	____	$_____	$_____
Environmental Mitigation	_____	____	$_____	$_____
Resident Engineer Office Space	_____	____	$_____	$_____
_____	_____	____	$_____	$_____
_____	_____	____	$_____	$_____

Subtotal Specialty Items $_____

NOTE: Extra lines are provided for items not listed, use additional lines as appropriate.

District-County-Route _____

KP (PM) _____
EA _____

III. RIGHT OF WAY ITEMS ESCALATED VALUE

A. Acquisition, including excess lands, damages to remainder(s) and Goodwill $_____

B. Utility Relocation (State share) $_____

C. Relocation Assistance $_____

D. Clearance/Demolition $_____

E. Title and Escrow Fees $_____

TOTAL RIGHT OF WAY ITEMS $_____
(Escalated Value)

Anticipated Date of Right of Way Certification $_____
(Date to which Values are Escalated)

F. Construction Contract Work

Brief Description of Work:

_____

_____

_____

Right of Way Branch Cost Estimate for Work * $_____

* This dollar amount is to be included in the Roadway and/or Structures Items of Work, as appropriate. Do not include in Right of Way Items.

COMMENTS:

Estimate Prepared By _____ Phone# _____

Date _____ _____
(Print Name)

NOTE: If appropriate, attach additional pages and backup.

Appendix G

Abbreviations, Acronyms and Definition of Terms

G.1 ABBREVIATIONS

cm	centimeter
cm/hr	centimeters per hour
’ or ft	feet
ft^2	square feet
ft^3	cubic feet
g	gram
ha	hectares
” or in	inches
”/hr or in/hr	inches per hour
hr(s)	hour(s)
kg/ha	kilograms per hectare
kg/m^2	kilograms per square meter
km	kilometer
l	liter
m	meter
mg	milligram
meq	milliequivalents
min	minute
mm	millimeter
m/s	meters per second
m^3	cubic meters
m^3/yr	cubic meters/year
v:h	vertical : horizontal
yd^3	cubic yard
yr	year
^oC	degrees Celsius
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to

G.2 ACRONYMS

ADL	Aerially Deposited Lead
ADT	Annual Average Daily Traffic
APS	Advanced Planning Study

ASCE	American Society of Civil Engineers
ASTM	American Society of Testing and Materials
BAT	Best Available Technology
BCT	Best Conventional Technology
BCDC	Bay Conservation and Development Commission
BEES	Basic Engineering Estimating System
BFM	Bonded Fiber Matrix
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BOD_5	5-Day BOD
Caltrans	California Department of Transportation
CE	Categorical Exemption/Exclusion
CEC	Cation Exchange Capacity
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CSWAT	Construction Storm Water Advisory Team
CSWPPP	Conceptual Storm Water Pollution Prevention Plan
CTC	California Transportation Commission
CWA	Clean Water Act
DED	Draft Environmental Document
DHS	California Department of Health Services
DPR	Draft Project Report
DTSC	Department of Toxic Substances Control
DSA	Disturbed Soil Area
DWR	California Department of Water Resources
EA	Expenditure Authorization
ED	Environmental Document
EPA	U.S. Environmental Protection Agency
ESA	Environmentally Sensitive Area
FED	Final Environmental Document
FES	Flared End Section
FHWA	Federal Highway Administration
GIS	Geographic Information System
GSRD	Gross Solids Removal Device
GW	Groundwater
HDM	Highway Design Manual
HOV	High Occupancy Vehicle
HSG	Hydrologic Soil Group
HQ	Headquarters
ISA	Initial Site Assessment
KP	Kilometer Post
MCL	Maximum Contaminant Level
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
MSWAT	Maintenance Storm Water Advisory Team

N	Nitrogen (elemental)
N_2	Nitrogen (molecular) or Nitrogen gas
NCC	Notice of Completion of Construction
NEPA	National Environmental Policy Act
NH_3	Ammonia
NH_4^+	Ammonium ion
NO_3^-	Nitrate ion
NOC	Notification of Construction
NPDES	National Pollutant Discharge Elimination System
NPRPD	National Pollutant Removal Performance Database
NRCS	Natural Resources Conservation Service
NSBMDB	National Storm Water Best Management Database
OC	Organic Content
OE	Office Engineer
O&G	Oil and Grease
O&M	Operation and Maintenance
PA/ED	Project Approval/Environmental Document
PCC	Portland Cement Concrete
PDCE	Project Design Cost Estimate
PDPM	Project Development Procedures Manual
PDSWAT	Project Design Storm Water Advisory Team
PDT	Project Development Team
PE	Project Engineer
PEAR	Preliminary Environmental Assessment Report
PEE	Preliminary Environmental Evaluation
PGR	Preliminary Geotechnical Report
PID	Project Initiation Document
PM	Project Manager
POTW	Publicly Owned Treatment Works
PPCE	Preliminary Project Cost Estimate
PPDG	Project Planning and Design Guide (Storm Water Quality Handbooks)
PR	Project Report
PS&E	Plans, Specifications and Estimates
PSR	Project Study Report
RE	Resident Engineer
RECP	Rolled Erosion Control Products
RO	Runoff
RRR	Resurfacing, Restoration & Rehabilitation projects
RSP	Rock Slope Protection
RWP	Regional Work Plan
RWQCB	Regional Water Quality Control Board
SAP	Sampling Analysis Plan
SSP	Standard Special Provisions
SUSMP	Standard Urban Storm Water Mitigation Plan
SW	Storm Water
SWAT	Storm Water Advisory Team

SWDR	Storm Water Data Report
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWQA	Storm Water Quality Assessment
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
Total Ortho-P	Total Ortho Phosphate
TP	Total Phosphorous
TRPA	Tahoe Regional Planning Agency
TSS	Total Suspended Solids
UNK	Unknown
USA	Underground Service Alert
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UV	Ultraviolet
WBS	Work Breakdown Structure
WDR	Waste Discharge Requirement
WEF	Water Environment Federation
WLA	Waste Load Allocations
WPCP	Water Pollution Control Program
WQ	Water Quality
WQF	Water Quality Flow
WQSWAT	Water Quality Storm Water Advisory Team
WQV	Water Quality Volume

G.3 DEFINITION OF TERMS

Bolded items in the following text signify that their definition can be found in this Appendix.

5-Day Biochemical Oxygen Demand (BOD) Test:

BOD refers to the oxygen used in meeting the metabolic needs of aerobic microorganisms in water containing in organic matter. The higher the level of organic matter, the higher the BOD. For example, water polluted with sewage would have a high BOD.

The 5-day BOD test (BOD_5) measures the rate of oxygen required by microorganisms (i.e., a laboratory inoculation) to oxidize the biodegradable matter in a sample under controlled laboratory test conditions. High BOD results (usually the result of organic contamination) suggest that the dissolved oxygen levels in **receiving water** may be depleted.

303(d) List:

The 303(d) list is a list of **water bodies** that have a **beneficial use** that is impaired by one or more pollutants. The 303(d) list is required by Section 303(d) of the federal **CWA**. Water bodies included on this list are referred to as "impaired waters." The state must take appropriate action to improve impaired water bodies, such as development of **TMDLs.**

Aerially Deposited Lead (ADL):

ADL is the lead that is frequently found in urbanized highway corridors due to historic emissions from automobile exhaust. These emissions are the result of past use of leaded gasoline. Soil impacted by ADL must be addressed to prevent it from impacting the quality of storm water runoff from Caltrans projects. Caltrans has applied for and received variances from the **DTSC** for the reuse of soils containing hazardous concentrations of lead. However, as per provision H(8) of the **Caltrans Permit**, the **RWQCB** must be notified at least 30 days prior to advertisement for bids to allow a determination by the RWQCB of the need for the development of **WDRs.**

Basin Plan:

A Basin Plan is a water quality control plan developed by each **RWQCB** to identify designated **beneficial uses** and water quality objectives for the **water bodies** and watershed areas within that specific region.

Beneficial Uses:

The beneficial uses of waters in California are described in the **Basin Plans** adopted by the nine California **RWQCBs.** Section 13240 of the California Water Code requires adoption of water quality control plans, called Basin Plans, for the protection of water quality within the State's watersheds. **Discharges** from storm water drainage systems may convey **pollutants** to waters of the State, and therefore may have an adverse impact on the beneficial uses of that water resource. Beneficial uses fall into one or more of the following categories:

- Agricultural Supply – water used for irrigation, leaching of salts, stock watering, etc.;
- Industrial Service Supply – use of water for industrial activities that do not depend primarily on water quality;
- Industrial Process Supply – uses of water that depend primarily on water quality;
- Groundwater Recharge – replenishment of **groundwater** by percolation from surface waters;
- Municipal and Domestic Supply – water supply systems including drinking water supply;
- Freshwater Replenishment – maintenance of surface water quality or quantity;
- Cold Freshwater Habitat – maintenance of cold water ecosystems;
- Warm Freshwater Habitat – maintenance of warm water ecosystems;

- Estuarine Habitat – habitat resulting from commingling of freshwater and saltwater;
- Wildlife Habitat - water used to support terrestrial or aquatic ecosystems;
- Preservation of Biological Habitats of Special Significance – water used to support designated areas such as refuges, parks or sanctuaries;
- Spawning, Reproduction, and/or Early Development - water used to support aquatic habitats suitable for reproduction and early development of fish;
- Migration of Aquatic Organisms – water used to support migration or other temporary aquatic organism uses;
- Rare, Threatened, or Endangered Species – water used to support aquatic habitats necessary for the survival and maintenance of rare, threatened or endangered species;
- Aquaculture – using water for the propagation, cultivation, maintenance, or harvesting of aquatic plants or animals;
- Shellfish Harvesting – water used to support habitats for the maintenance of filter feeding shellfish;
- Commercial and Sport Fishing – collecting fish for commercial or recreational purposes;
- Hydropower Generation – water used to produce electricity;
- Navigation – the use of water for shipping or travel;
- Body Contact Recreation – recreational activities involving body contact with water; and
- Non-Body Contact Recreation – recreational activities involving proximity to water, but generally no body contact or ingestion of water.

Best Available Technology (BAT):

BAT is a term derived from Section 301(b) of the **CWA** and refers to **BMPs** to reduce toxic and non-conventional **pollutants** in **discharges** from **construction sites**. Toxic pollutants are those defined in Section 307 (a)(1) of the **CWA** and include heavy metals and man-made organics. Non-conventional pollutants are those not covered by conventional and toxic pollutants, such as ammonia, chloride, toxicity and nitrogen.

Best Conventional Technology (BCT):

BCT is a term derived from Section 301(b) of the federal **CWA** and refers to **BMPs** to reduce conventional **pollutants** in **discharges** from **construction sites**. Conventional pollutants include **TSS**, oil and grease, fecal coliforms, pH and other pollutants.

Best Management Practice (BMP):

A BMP is a measure that is implemented to protect water quality and reduce potential for pollution associated with storm water **runoff**. Any program, technology, process, siting criteria, operating method, or device that controls, prevents, removes, or reduces

pollution. There are four categories of BMPs: Maintenance, Design Pollution Prevention, Construction Site, and Treatment:

Maintenance:

Maintenance BMPs are water quality controls used to reduce pollutant discharges during highway maintenance activities and activities conducted at maintenance facilities. These BMPs are technology-based controls that attain MEP pollutant control. This category of BMPs includes litter pickup, toxics control, street sweeping, etc.

Design Pollution Prevention:

Design Pollution Prevention BMPs are permanent water quality controls used to reduce pollutant discharges by preventing **erosion**. These BMPs are standard technology-based, non-treatment controls selected to reduce pollutant discharges to the **MEP** requirements. They are applicable to all projects. This category of BMPs includes preservation of existing vegetation; concentrated flow conveyance systems, such as ditches, berms, dikes, swales, overside drains, outlet protection/velocity dissipation devices; and slope/surface protection systems such as vegetated surfaces and hard surfaces.

Construction Site:

Construction site BMPs are temporary controls used to reduce pollutant discharges during construction. These controls are best conventional technology/best available technology **BCT/BAT** based BMPs that may include **soil stabilization**, sediment control, wind **erosion** control, tracking control, non-storm water management and waste management.

Treatment:

Treatment BMPs are permanent water quality controls used to remove pollutants from storm water **runoff** prior to being discharged from Caltrans right-of-way. These controls are used to meet **MEP** requirements and are considered for projects discharging directly or indirectly to **receiving waters**. This category of BMPs includes: traction sand traps, infiltration basins, detention devices, biofiltration strips/swales, dry weather flow diversion, and **GSRDs**.

California Department of Health Services (DHS):

The California DHS (http://www.dhs.cahwnet.gov/index.htm) is a State Government department created to protect and improve the health of Californians. DHS is concerned about the potential of any **BMP** device creating a public hazard by increasing habitat availability for aquatic stages of mosquitoes, and by creating harborage, food, and moisture for other reservoirs and nuisance species.

California Environmental Quality Act (CEQA):

The CEQA of 1970 requires public agencies to prevent significant, avoidable damage to the environment by regulating activities that may affect the quality of the environment. Public agencies accomplish this by requiring projects to consider the use of alternatives or mitigation measures. Regulations for the implementation of CEQA are found in the

CEQA Guidelines and are available online by the California Resources Agency at http://ceres.ca.gov/ceqa.

Caltrans Permit:

Caltrans Permit refers to the **NPDES** Statewide Storm Water Permit issued to Caltrans in 1999 (Order No. 99-06-DWQ) (CAS000003), to regulate storm water discharges from Caltrans facilities.

Categorical Exemption (CE):

A CE is a list of classes of projects that have been determined not to have a significant effect on the environment and which shall, therefore, be exempt from the provisions of **CEQA**. For a list of classes of projects and further information see the web site: http://ceres.ca.gov/topic/env_law/ceqa/guidelines/art19.html.

Clean Water Act (CWA):

The CWA, originally enacted by Congress in 1972, is a federal law that requires states to protect, restore, and maintain the quality of the waters of the United States, including lakes, rivers, aquifers and coastal areas. The CWA, as amended in 1987, is the enabling legislation for the **NPDES** permitting process.

Code of Federal Regulations (CFR):

The CFR is a document that codifies all rules of the executive departments and agencies of the federal government. It is divided into 50 volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) contains all environmental regulations. 40 CFR is available from bookstores operated by the Government Printing Office and online at: http://www.epa.gov/epahome/cfr40.htm.

Common Plan of Development:

Although not clearly defined by statute, a Common Plan of Development is generally a contiguous area where multiple, distinct construction activities may be taking place at different times under one plan. A plan is broadly defined as any piece of documentation or physical demarcation that indicates that construction activities may occur on a common plot. For Caltrans, such documentation could consist of the ED, the PSR, condemnation plans or contract documents. Any of these documents could delineate the boundaries of a common plan area.

Construction General Permit (General Permit):

The General Permit is a Statewide General Permit for construction activities (Order No. 99-08-DWQ) (CAS000002) that applies to all storm water discharges from activities that result in a **DSA** of at least 2 hectares (5 acres) or more. Construction activity that results in a DSA of less than 2 hectares (5 acres) is subject to this General Permit if the construction activity is part of a larger **Common Plan of Development** that encompasses two or more hectares of DSA or if there is the potential for significant water quality impairment resulting from the activity as determined by the **RWQCB**.

Construction Site:

The term "construction site" should apply to all areas both within the construction limits on state right-of-way and areas that are directly related to the construction activity, including but not limited to staging areas, storage yards, material borrow areas and storage areas, access roads, barges or platforms, etc., whether or not they reside within the Caltrans right-of-way.

Construction Site Best Management Practices Manual:

The Construction Site Best Management Practices Manual provides instructions for the selection and implementation of Construction Site **BMPs**. Caltrans requires contractors to identify and utilize these BMPs in preparation of their **SWPPP** or **WPCP**.

Department of Toxic Substances Control (DTSC):

The DTSC (http://www.dtsc.ca.gov/) is the department within the California EPA that has responsibility for regulating the generation, management and disposal of hazardous wastes. Caltrans has applied for and received variances from the DTSC for the reuse of some soils that can contain lead. Caltrans will provide written notification to the **RWQCB** at least 30 days prior to advertisement for bids for projects that involve soils subject to this variance.

Department of Water Resources (DWR):

The California DWR (http://wwwdwr.water.ca.gov/) is a State Government department created to manage the water resources of California in cooperation with other agencies in such a way as to benefit the State's people, and to protect, restore, and enhance the natural and human environments. The DWR is a source for hydrology data, **groundwater** information, water maps, etc.

Discharge:

The term "discharge" refers to the amount of water flowing out of a drainage structure or facility. It is measured in cubic meters/second. It is any release, spill, leak, pump, flow, escape, dumping, or disposal of any liquid, semi-solid or solid substance.

Disturbed Soil Area (DSA):

DSAs are areas of exposed, erodible soil, including stockpiles, that are within the construction limits and that result from construction activities.

Erosion:

Erosion is the wearing away of earth surfaces by the action of external forces. In the case of drainage terminology, this term generally refers to the wearing away of the earth's surface by flowing water.

Existing Vegetation:

Existing vegetation is any plant material within the project limits that is present prior to the beginning of construction.

Geographic Information System (GIS):

GIS is a system of hardware and software used for storage, retrieval, mapping, and spatial analysis of geographic data.

Groundwater (GW):

GW is defined as the water that is naturally occurring under the earth's surface. It is situated below the surface of the land, irrespective of its source and transient status. Subterranean streams are flows of GW parallel to and adjoining stream waters, and usually determined to be integral parts of the visible streams. GW is considered a jurisdictional water of the State under the Porter-Cologne Water Quality Act (California Water Code, Division 7).

High Risk Areas:

High risk areas are defined in the **Caltrans Permit** (Provisions E.2) to include locations where spills from Department owned rights-of-way, activities or facilities can discharge directly to municipal or domestic water supply reservoirs or **groundwater** percolation facilities discharging to aquifers designated as water supply sources. The locations of High Risk Areas within each District are tabulated in the appropriate **RWP** as they are identified.

Highway Design Manual (HDM):

The HDM is a Caltrans document that establishes uniform policies and procedures to carry out the highway design functions of Caltrans.

Litter:

Litter in storm water is defined by Caltrans as manufactured objects made from paper, plastic, cardboard, glass, metal, etc. This definition does not include materials of natural origin such as gravel or vegetation. Litter in surface waters can inhibit the growth of aquatic vegetation, harm aquatic organisms by ingestion or entanglement, convey other **pollutants** and cause aesthetic problems on shorelines.

Maximum Contaminant Level (MCL):

The MCL is the highest level of a contaminant that is allowed in drinking water.

Maximum Extent Practicable (MEP) Analysis:

The MEP analysis is the process of evaluating the selected **BMPs** based on legal and institutional constraints, technical feasibility, relative effectiveness, and cost/benefit ratio.

Metals (Total and Dissolved):

Metals, both total and dissolved, are commonly monitored constituents and, next to **TSS** and **nutrients**, are the most common constituents cited in the literature as being present in storm water **runoff.**

Trace quantities of many metals are necessary for biological growth and may naturally occur in runoff. Most metals, however, have numeric water quality standards because of their toxicity to aquatic organisms at high concentrations.

The toxicity of some metals is inversely related to water hardness. The numeric water quality standards for cadmium, chromium, copper, lead, nickel, silver and zinc are hardness-dependent. Copper, lead and zinc are the metals most commonly found in highway runoff.

Municipal Separate Storm Sewer System (MS4):

MS4s are storm drain systems regulated by the federal Phase I and Phase II storm water regulations. Municipal combined sewer systems are regulated separately. MS4s are defined in the federal regulations at 40 **CFR** 122.26(b)(8). Caltrans is designated as an MS4 permittee.

National Environmental Policy Act (NEPA):

The NEPA of 1969 establishes policies and procedures to bring environmental considerations into the planning process for federal projects. NEPA requires all federal agencies to identify and assess reasonable alternatives to proposed actions that will restore and enhance the quality of the human environment and avoid or minimize adverse environmental impacts. The NEPA process is an overall framework for the environmental evaluation of federal actions.

National Pollutant Discharge Elimination System (NPDES) Permit:

The NPDES Permit is **EPA's** program to control the **discharge** of **pollutants** to waters of the United States. NPDES is a part of the federal **CWA**, which requires point and non-point source dischargers to obtain permits. These permits are referred to as NPDES permits.

Natural Resources Conservation Service (NRCS):

As part of the USDA, the NRCS provides leadership in a partnership effort to help people conserve, maintain, and improve natural resources and the environment. Soil types and local soil survey data can be obtained from the NRCS soil maps. The soil type and soil survey data are used during the desktop screening of potential infiltration basin sites.

New Construction/Major Reconstruction:

New construction and major reconstruction includes new routes, route alignments, route upgrades (i.e., from two-lane conventional highway to four-lane expressway or freeway), and right-of-way acquisitions for whole parcels or wide swaths. New construction activity does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility, nor does it include emergency construction activities required to protect public health and safety.

Notice of Completion of Construction (NCC):

The NCC is a formal notification submitted by Caltrans to the appropriate **RWQCB** upon completion of the construction activities and stabilization of a site for which an **NOC** was previously submitted.

Notification of Construction (NOC):

The NOC is a formal notification submitted by Caltrans to the appropriate **RWQCB** at least 30 days prior to the start of a construction project that will result in the disturbance of 2 or more hectares (5 acres) of soil. Information on the tentative start date, tentative duration, location of construction, description of project, estimated number of affected acres and the address and phone number of the construction field office is provided.

Nutrients:

Nutrients are nutritive substances such as phosphorous and nitrogen whose excessive input into **receiving waters** can over-stimulate the growth of aquatic plants.

Algae and vascular plants can cause numerous deleterious effects. Algae and vascular aquatic plants produce oxygen during the day via photosynthesis and consume oxygen during the night via respiration. The pH of the water is linked to this phenomenon through the carbonate cycle: the pH rises during the day when carbon dioxide (CO_2) is consumed for the photosynthetic production of plant tissue and falls at night when CO_2 is released by respiration. Algal blooms due to inputs of nitrogen or phosphorus can cause wide fluctuations in this dissolved oxygen and pH cycle during a 24-hour period, which can cause fish kills and mass mortality of benthic organisms. In addition, excessive algal and vascular plant growth can accelerate eutrophication, interfere with navigation, and cause unsightly conditions with reduced water clarity, odors, and diminished habitat for fish and shellfish.

Other trace nutrients, such as iron, are also needed for plant growth. In general, however, phosphorus and nitrogen are the nutrients of importance in aquatic environments.

Phosphorus. Phosphorus is taken up by algae and vascular aquatic plants and, when available in excess of the plant's immediate needs for metabolism and reproduction, can be stored in the cells. With bacterial decomposition of plant materials, relatively labile pools of phosphorus are later released and recycled within the biotic community. The refractory portion (i.e., compounds relatively resistant to biodegradation) tends to sink to the bottom, where it degrades slowly over time.

Analytical tests for the minimum constituent list include TP, which is the sum of the dissolved and particulate orthophosphate, polyphosphate and organic phosphorus; and Total Ortho-P, which is the sum of the dissolved and particulate orthophosphate.

Nitrogen. Transformation of nitrogen compounds can occur through several key mechanisms: fixation, ammonification, synthesis, nitrification, and denitrification. Nitrogen fixation is the conversion of nitrogen gas into nitrogen compounds that can be assimilated by plants; biological fixation is the most common, but fixation can also occur by lightning and through industrial processes. Ammonification is the biochemical degradation of organic-N into NH_3 or NH_4^+ by heterotrophic bacteria under aerobic or anaerobic conditions. Synthesis is the biochemical mechanism in which NH_4^+-N or NO_3^--N is converted into plant protein (Organic-N); nitrogen fixation is also a unique form of synthesis that can be performed only by nitrogen-fixing bacteria. Nitrification is the biological oxidation of NH_4^+ to NO_3^- through a two-step autotrophic process by the

bacteria *Nitrosomonas* and *Nitrobacter*; the two-step reactions are usually very rapid, and hence it is rare to find nitrite levels higher than 1.0 mg/l in water. The nitrate formed by nitrification is, in the nitrogen cycle, used by plants as a nitrogen source (synthesis) or reduced to N_2 gas through the process of denitrification; NO_3^- can be reduced, under anoxic conditions, to N_2 gas through heterotrophic biological denitrification.

Analytical tests for the minimum constituent list include NH_3/NH_4^+-N, NO_3^--N, and Total TKN. TKN is a measure of NH_3/NH_4^+-N plus organic-N; the concentration of organic-N is thus obtained by subtracting the concentration of NH_3/NH_4^+-N found in the sample from that of the TKN value.

Pathogens:

Pathogens include viruses, bacteria, protozoa, and possibly helminth worms and are a concern in storm water **runoff**. The direct measurement of specific pathogens in water is extremely difficult. The coliform group of organisms is commonly used as an indicator of the potential presence of pathogens of fecal origin.

Sources of total and fecal coliforms in storm water runoff are ubiquitous (e.g., soil particles, droppings of wild and domestic animals, etc.). Human sources could include illicit sewer connections and seepage from septic tanks.

Pesticides:

A pesticide is a chemical agent designed to control pest organisms. The most common forms of pesticides are organic chemicals designed to target insects (insecticides) and vascular plants (herbicides).

Chlorpyrifos and Diazinon. Chlorpyrifos and Diazinon are organophosphate pesticides that have been detected in storm water **runoff**. Organophosphates exhibit a high pesticidal activity and relatively low persistence in the environment. They also exhibit acute toxicity effects to humans and animals by inhibiting the acetylcholinesterase enzyme activity at nerve endings, which affects the proper functioning of the nervous system. Absorption through the skin is a major route of exposure for all organisms.

Pollutant:

Any constituent present in sufficient quantity to impair the **beneficial uses** of a **receiving water body.**

Project Development Procedures Manual (PDPM):

The PDPM describes the policies and procedures to be followed by Caltrans for State highway project development.

Project Development Team (PDT):

The PDT guides and develops specific projects. The PDT is typically managed by a District PM and is supported by Functional Managers and units.

Receiving Water:

A river, lake, ocean, stream or other watercourse into which wastewater or treated effluent is discharged as provided in the "Terms of Environment" (U.S. EPA Office of Communications, Education, and Public Affairs; December 1997).

Resident Engineer (RE):

The RE administers the construction contract, makes decisions regarding acceptability of material furnished and work performed, and exercises contractual authority to direct the contractor. The RE may impose sanctions if the contractor fails to follow the appropriate actions specified in the contract to correct deficiencies.

Regional Water Quality Control Board (RWQCB):

The RWQCB means any California RWQCB for a region as specified in Section 13200 of the California Water Code. There are nine RWQCBs that serve under the **SWRCB.** These nine RWQCBs are located in California and are responsible for enforcing water quality standards within their boundaries. A map of these boundaries is located in Section 2, Figure 2-1.

Regional Work Plan (RWP):

RWPs are annual detailed plans subject to the approval of the **RWQCB** that describe when and how the various programs and **BMPs** contained in the **SWMP** will be implemented by each District in each **RWQCB** jurisdictional area.

Runoff (RO):

RO is comprised of surface waters that exceed the soil's infiltration rate and depression storage. It includes that portion of precipitation that appears as flow in streams, and also includes drainage or flood discharges that leave an area as surface flow or as pipeline flow, having reached a channel or pipeline by either surface or subsurface routes.

Slope/Soil Stabilization:

Soil stabilization is described as vegetation, such as grasses and wildflowers, and other materials, such as straw, fiber, stabilizing emulsion, protective blankets, etc. Soil stabilization is placed to stabilize areas disturbed by grading operations, to reduce loss of soil due to the action of water or wind, and to prevent water pollution.

Source Controls:

Source controls are control measures used on disturbed areas to reduce the introduction of sediment or other **pollutants** into storm water **runoff**. Source controls prevent or limit the exposure of materials to storm water at the source of those materials.

Standard Urban Storm Water Mitigation Plan (SUSMP):

SUSMPs are special local requirements that designate **BMPs** that must be used for specific categories of development projects. Designers should contact the District/Regional **NPDES** Storm Water Coordinator to see if an SUSMP is applicable for projects in urban areas.

State Water Resources Control Board (SWRCB):

As delegated by the **EPA**, the SWRCB is a California agency that implements and enforces the **CWA** Section 401 (p) **NPDES** permit requirements, and is the issuer and administrator of the **Caltrans Permit**. The SWRCB's mission is to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations.

Statewide Storm Water Quality Practice Guidelines (Guidelines):

The Caltrans Guidelines describe each approved **BMP** included in the **SWMP** for Statewide application. This document provides Caltrans with instructions on implementing each approved storm water management practice or BMP.

Storm Water Advisory Teams (SWAT):

Caltrans has established four Department-wide SWATs to evaluate new or modified **BMPs** and to develop procedures and guidance for implementing the SWMP:

- The Maintenance SWAT (MSWAT) is composed of District Maintenance Storm Water Coordinators and representatives from the Headquarters Maintenance, Water Quality and Project Delivery Programs.
- The Project Design SWAT (PDSWAT) is composed of District representatives from Design, Construction and related functional units and representatives from the Headquarters Project Design, Water Quality and Maintenance Programs.
- The Construction SWAT (CSWAT)is composed of the District Construction Storm Water Coordinators and representatives from the Construction Program.
- The Water Quality SWAT (WQSWAT) is composed of the District/Regional **NPDES** Storm Water Coordinators; District representatives from Design, Construction, Maintenance and Traffic Operations; and representatives from the Headquarters Project Delivery, Maintenance and Water Quality Programs.

Storm Water Data Report (SWDR):

The SWDR is a document prepared by the PE that summarizes storm water information. It is used to document decisions and to provide key project information to the Environmental Unit. The Environmental Unit uses the SWDR to assess the potential water quality impacts that may result from the proposed project, and will also use the project information to prepare the **SWQA**, if one is required. This report is to be included in the final PS&E package.

Storm Water Management Plan (SWMP):

The SWMP is the Caltrans policy document that describes how Caltrans conducts its storm water management activities (i.e., procedures and practices). The SWMP provides descriptions of each of the major management program elements, discusses the processes used to evaluate and select appropriate **BMPs**, and presents key implementation responsibilities and schedules.

Storm Water Pollution Prevention Plan (SWPPP):

The **General Permit** requires all construction projects that result in a **DSA** of at least 2 hectares (5 acres) to develop and implement an effective SWPPP. The SWPPP is a plan that includes site map(s), an identification of construction/contractor activities that could cause pollutants in storm water, and a description of measures or practices to control these **pollutants**. A **RWQCB** may require a SWPPP for projects which do not meet the DSA acreage requirements based upon water quality concerns, or if it is determined that a project is part of a larger **Common Plan of Development.**

Storm Water Quality Assessment (SWQA):

The SWQA is a technical report prepared by the Caltrans Environmental Unit staff during the PA/ED process, for inclusion into the **CEQA/NEPA** documents. The SWQA provides input to the PE for completing the **SWDR**.

Total Dissolved Solids (TDS):

TDS refers to the sum of all cations or anions (sometimes measured in parts per million as calcium carbonate). TDS comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and small amounts of organic matter that are dissolved in water.

In fresh water the total dissolved solids concentration typically ranges from 20 to 1,000 mg/l; in seawater it ranges from 30,000 to 35,000 mg/l. High levels of dissolved solids concentrations can adversely affect drinking water quality.

Total Maximum Daily Load (TMDL):

TMDLs are pollutant load allocations for all point sources and nonpoint sources, and are intended to achieve a pollutant reduction goal along with a safety factor. TMDLs are developed in response to identification of **pollutants** as impairing a specific body of water identified in the 303(d) list.

Total Suspended Solids (TSS):

TSS is the weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles.

United States Environmental Protection Agency (EPA):

The EPA (http://www.epa.gov/) provides leadership in the nation's environmental science, research, education and assessment efforts. The EPA works closely with other federal agencies, state and local governments, and Indian tribes to develop and enforce regulations under existing environmental laws. The EPA is responsible for researching and setting national standards for a variety of environmental programs and delegates to states and tribes responsible for issuing permits, and monitoring and enforcing compliance. The EPA issued regulations to control pollutants in storm water **runoff discharges**, such as the **CWA**. (The CWA and **NPDES** permit requirement.)

Waste Discharge Requirement (WDR):

A WDR is a set of conditions issued by a **RWQCB** for a specific activity. The conditions may include numeric effluent criteria, monitoring requirements, reporting requirements, and other narrative criteria for discharge. WDRs may be required for any non-exempt non-storm water **discharge.**

Waste Load Allocations (WLA):

A WLA represents the maximum load of **pollutants** each discharger of waste is allowed to release into a particular waterway for which a **TMDL** has been established. **Discharge** limits are usually required for each specific water quality criterion being, or expected to be, violated for that particular **water body.**

Water Body:

Water bodies refer to the waters of the United States. These include (a) All waters, which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; (b) All interstate waters, including interstate wetlands; (c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters: (1) which are or could be used by interstate or foreign travelers for recreational or other purposes; (2) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (3) which are used or could be used for industrial purposes by industries in interstate commerce; (d) All impoundments of waters identified in paragraphs (a) through (d) of this definition; (f) The territorial sea; and (g) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Water Pollution Control Program (WPCP):

A WPCP is a plan to identify water quality management practices to be implemented that must be prepared for all construction projects that do not require preparation of a **SWPPP.** For Caltrans projects disturbing more than 2 hectares (5 acres), a SWPPP satisfies the requirement for a WPCP.

Water Quality Flow (WQF):

The WQF is a design criteria used for types filtration treatment control devices currently under development. Caltrans has cooperatively developed rainfall intensity values with the **SWRCB** that can be used in the Rational Formula to calculate the WQF.

Water Quality Volume (WQV):

The WQV is the volume of flows associated with the frequent storm events that must be treated. The WQV of treatment **BMPs** is based upon, where established, the sizing criteria from the **RWQCB** or local agency (whichever is more stringent). If no sizing criterion has been established, Caltrans will do one of the following: maximize detention volume determined by the 85th percentile **runoff** capture ratio or; use volume of annual

runoff based on unit basin storage WQV to achieve 80 percent or more volume of treatment. For further detail, refer to Section 2.4.2.2.

Work Breakdown Structure (WBS):

The WBS is a product-oriented grouping of project elements that organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services. The WBS defines the work elements, not the staff or resources who will perform the work.