JANUARY 2025

JURISDICTIONAL RUNOFF MANAGEMENT PROGRAM

Executive Summary

The Port of San Diego (Port) has prepared and annually updated this Jurisdictional Runoff Management Program (JRMP) document in accordance with the requirements of the San Diego Regional Water Quality Control Board (Regional Board) Order No. R9-2013-0001, as amended by Order No. R9-2015-0001 (NPDES Permit #CAS0109266), herein referred to as the Municipal Permit. This document describes the activities that the Port has undertaken, is undertaking, or will undertake, to reduce discharges of pollutants and urban runoff flow to the municipal separate storm sewer system (MS4) to the maximum extent practicable (MEP). The three major phases of urban development addressed by this program are the planning, the construction, and the existing development or existing use phases.

The Port JRMP document serves as an informational document that provides an overall account of the program to be conducted by the Port during the five-year life of the Municipal Permit. The Port JRMP has been developed to meet the conditions of the Municipal Permit and to assist the Port in achieving the goals identified in the San Diego Bay Watershed Water Quality Improvement Plan (WQIP). Port-specific WQIP based strategies have been incorporated into the JRMP. The JRMP program's focus is on controlling discharges from upstream sources and areas within the Port jurisdictional boundary to the MS4 that the Port owns and operates with the overall goal of achieving receiving water quality improvements. The JRMP utilizes Port-specific activities as well as watershed-based strategies. The main emphasis of the program is education. The programs described herein have been in effect since June 27, 2015 with minor updates in subsequent years that have been tracked in the WQIP Annual Reports.

The Port JRMP Document contains a signed certified statement, this executive summary, the Port's organizational structure, the program components, as well as conclusions and recommendations. It discusses the program components required by the Municipal Permit: namely, illicit discharge detection and elimination activities and non-stormwater discharges, development planning, construction management and existing development including pollutant generating activities from the Port's municipal facilities and areas as well as from industrial and commercial facilities. The Port JRMP also includes a fiscal analysis section that describes the budget and funding requirements. A copy of the updated Port stormwater ordinance (Article 10), the Port's Enforcement Response Plan, facility inventories, and maps of the Port-owned and –maintained MS4, are all included as appendices to the JRMP Document. In addition, a table containing a list of the WQIP strategies incorporated into the JRMP has been included as an appendix.

In accordance with the Municipal Permit, the Port will submit a JRMP Annual Report summarizing the program activities conducted for the year. Each JRMP Annual Report will cover the fiscal period from July 1 of the previous year to June 30 of the current year. The JRMP Annual Report will follow the format provided by the Regional Board found in Attachment D of the Municipal Permit. A proposed budget for the upcoming year and assessment of the JRMP activities will be reported in the WQIP Annual Report as required by the Municipal Permit.

Activities that comprise the JRMP are expected to evolve and be modified as part of an iterative process whereby activities are planned and implemented to meet defined watershed-based water quality goals; they are assessed annually and modified as needed. Additionally, the JRMP will be updated as characteristics, policies, and procedures continue to change in the Port's tidelands. Updates or modifications to the JRMP document will be submitted to the Regional Board as required as an attachment to the WQIP Annual Report.

Acknowledgements

The development and production of this Jurisdictional Runoff Management Program Document is a result of the talents and experience of several individuals. Special recognition and acknowledgement are thereby expressed to the following individuals for their contributions and insights to making this document a collective success for the environment and the Port of San Diego:

Karen Holman
Environmental Protection Department Director
Port of San Diego

Allison Vosskuhler
Stormwater Program Director
Port of San Diego

Stephanie Bauer
Program Manager
Port of San Diego

Melissa Dailey
Program Manager
Port of San Diego

Kevin Carr
Senior Environmental Specialist
Port of San Diego

Phil Barlow
Associate Environmental Specialist
Port of San Diego

Annabelle Burress
Associate Environmental Specialist
Port of San Diego

Emily Christiansen
Assistant Environmental Specialist
Port of San Diego

Joely Habib
Senior Management Analyst
Port of San Diego

Tom Ortiz
Lead Mapping and Outreach
Port of San Diego

John Carter
Senior Deputy General Counsel
Port of San Diego

Alice Ayala
Executive Assistant I
Port of San Diego

Alexa Mojica
Staff Assistant II
Port of San Diego

The Port of San Diego also wishes to recognize and thank the public for their continued expressed concern for the protection and conservation of San Diego Bay's environmental resources.

Table of Contents

APPENDICES

TABLES

FIGURES

Acronym/Abbreviation	Definition
303(d)	Clean Water Act Section 303(d) Limited of Water Quality Segments
ASBS	Area(s) of Special Biological Significance
BMP	Best Management Practice
CAP	Climate action Plan
CASQA	California Stormwater Quality Association
CCC	California Coastal Commission
CCTV	Closed Circuit Television
CEQA	California Environmental Quality Act
CGP	SWRCB Construction General Permit, Order No. 2099-0009-DWQ,as amended by Order No. 2010-0014-DWQ and Order No. 2012-006-DWQ
CIP	Capital Improvement Project
Copermittess	18 municipalities in San Diego County, the County of San Diego, the San Diego County Regional Airport Authority, and the City of San Diego
CTR	California Toxics Rules
CWA	Federal Water Pollution Control Act (Clean Water Act)
DEH	County of San Diego Department of Environmental Health
DSA	Disturbed Soil Area
EP	Environmental Protection
EPA	Environmental Protection Agency
ERP	Enforcement Response Plan
ESA	Environmentally Sensitive Area
FY	Fiscal Year

Acronym/Abbreviation	Definition
GIS	Geographic Information System
HHW	Household Hazardous Waste
HMP	Hydromodification Management Plan
HOA	Home Owners Association
HSA	Hydrological Subarea
HU	Hydrologic Units
IC/ID	Illicit Connections and Illicit Discharge
IDDE	Illicit Discharge Detection and Elimination
IGP	SWRCB Industrial General Permit No. 2014-0057-DWQ
IPM	Integrated Pest Management
JRMP	Jurisdictional Runoff Management Program
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
MS4 Outfall Monitoring Program	Dry Weather Major MS4 Outfall Discharge Monitoring Program
NCMT	National City Marine Terminal
NOI	Notice of Intent
NOT	Notice of Termination
NOV	Notice of Violation
NPDES	National Pollution Discharge Elimination System
O&M	Operational and Maintenance
PDP	Priority Development Project

Acronym/Abbreviation	Definition
Permit	RWQCB Order No. R9-2013-0001, as amended by Order No. R9-2015-001 and Order No. R9-2015-0100
PGA	Polluting Generating Area
PMP	Port Master Plan
Port	Port of San Diego
Program	Integrated Waste Management Program
PSA	Public Service Announcement
PTS	Project Tracking System
QA/QC	Quality Assurance/Quality Control
RARE	Rare and Endangered Species
Regional Board	San Diego Regional Quality Control Board
REP	Rain Event Plan
RWQCB	Regional Water Quality Control Board
SAL	Stormwater Action Levels
SDCRRA	San Diego County Regional Airport Authority
SIC	Standard Industrial Classification
SMARTS	Storm Water Multiple Application and Report Tracking System
SOP	Standard Operating Procedure
SUSMP	Standard Urban Storm Water Management Program
SWMP	Storm Water Mitigation Plan
SWPPP	Storm Water Pollution Prevention Plan
SWQMP	Storm Water Quality Management Plan
SWRCB	State Regional Water Quality Control Board

Acronym/Abbreviation	Definition
TAMT	Tenth Avenue Marine Terminal
The Act	San Diego Unified Port District Act
Tidelands	The Port's Jurisdiction
TMDL	Total Maximum Daily Load
TTWQ	Threat to Water Quality
USEPA	United States Environmental Protection Agency
USMP	Urban Stormwater Management Program
WDID	Waste Discharge Identification
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan

Chapter 1 Introduction

1.1 Introduction

The San Diego Bay is a treasured resource for local businesses, residents, and visitors. People come to the bay to fish, swim, and boat in its waters, view its wildlife and enjoy the diverse shoreline. The Bay is also used by maritime operations to import and export goods into the region and as a location for ship building and repair. The Bay is also the receiving water for discharges originating from within the 444-square miles of the San Diego Bay Watershed. Controlling urban runoff or discharge that is not entirely composed of rainwater is critical to preserving the Bay's resources.

As environmental steward and manager of State lands surrounding San Diego Bay, the Port of San Diego (Port) works to improve and protect bay water quality. This Jurisdictional Runoff Management Program (JRMP) is just one in a series of efforts the Port is undertaking to protect water quality. The program's focus is on controlling discharges from sources and areas within the Port jurisdictional boundary to the stormwater conveyance system that the Port owns and operates. The JRMP utilizes Port-specific activities as well as watershed-based strategies. The main emphasis of the program is education. The activities that comprise the JRMP are expected to evolve and be modified as part of an iterative process whereby activities are planned and implemented to meet defined watershed-based water quality goals; they are assessed annually and modified as needed.

Over the past two decades of JRMP implementation, the Port has observed measured improvements in preventing pollutant discharges to the Bay and in best management practice (BMP) implementation in all major activity areas (new development, construction and existing development). Although general awareness about stormwater pollution prevention has increased among businesses and the general population, there is still work to be done. Many of the industrial, construction, residential, and municipal activities occurring today continue to be contributors of pollutants which may discharge to the storm water conveyance system. The most common types of pollutants found in runoff include sediment, heavy metals, petroleum products, nutrients, pesticides, herbicides, bacteria, and trash.

This JRMP document is a written workplan to be conducted by the Port during the term of San Diego Regional Water Quality Control Board (Regional Board) Order No. R9-2013-0001, as amended by Order No. R9-2015-0001 (NPDES Permit # CAS0109266). It has been developed to assist the Port in tracking the existing development, new development, and construction activities, and to implement to the maximum extent practicable (MEP) BMPs to reduce or eliminate pollutants from reaching receiving water within the Port's jurisdiction.

1.2 Port of San Diego

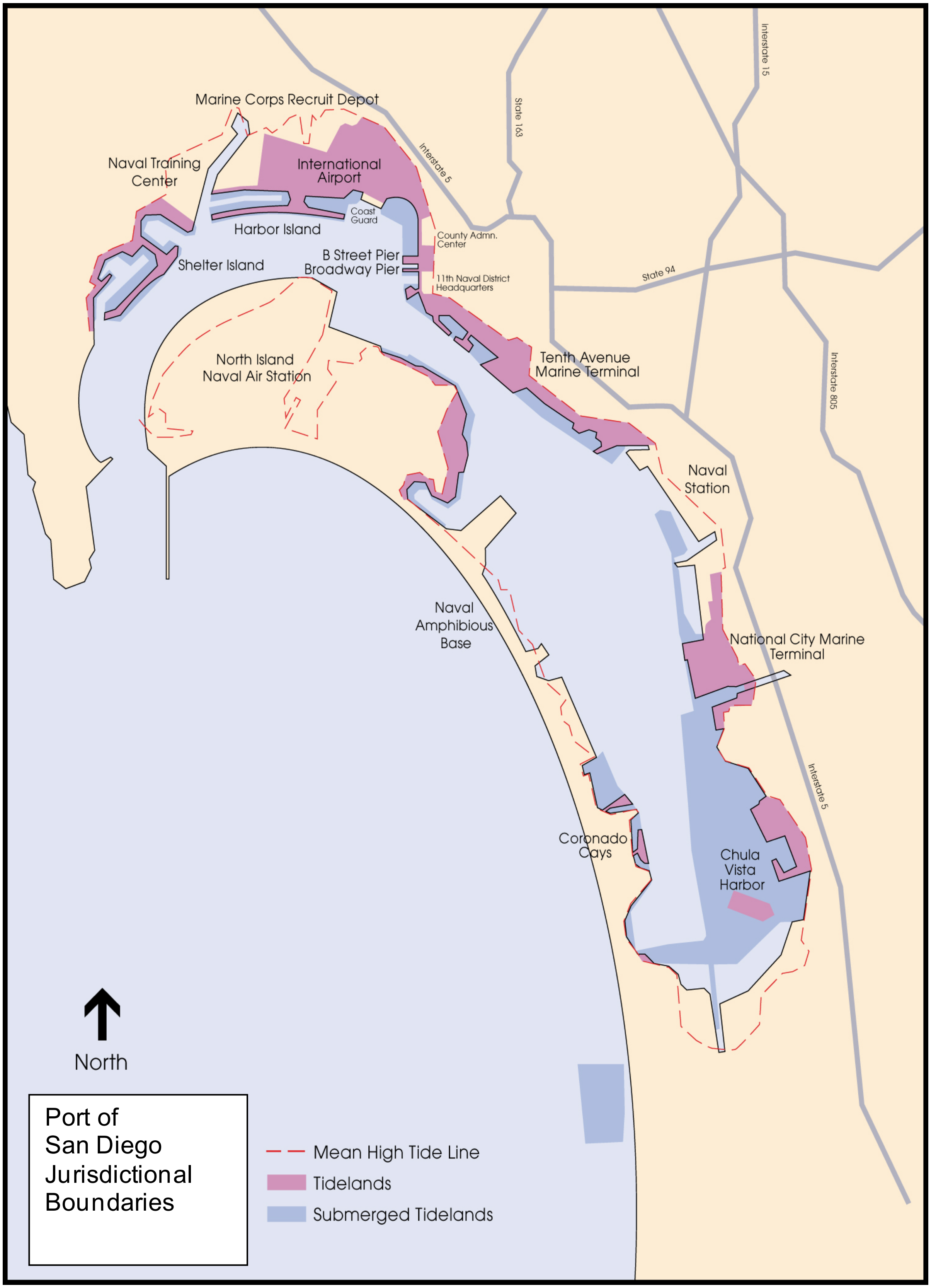
The Port is a special district, created in 1962 by an act of the California legislature. The legislature passed the San Diego Unified Port District Act (the Act) in order to create an entity to manage San Diego Harbor, and to administer approximately 5,483 acres of public lands along San Diego Bay. It is the policy of the State of California to develop the harbors and ports of the State for multiple purpose use for the benefit of the people. The Port was created to fulfill this commitment. The Act defines the Port as a public corporation that holds those lands granted to it in public trust. To that end, the Port has been granted both police powers and the authority to levy taxes.

The Port's jurisdictional boundary is limited to a portion of San Diego Bay and the San Diego Bay tidelands[1]. Of the 5,483 acres that has been granted to the Port, about 2,491 acres is land area and 2,992 acres are submerged lands. The Port controls approximately 33 miles, or 61% of the total bay shoreline. The remaining tidelands around the Bay is either owned or controlled by the Federal Government, the State of California, the County of San Diego, or the cities of San Diego and Coronado. Figure 1-1 depicts the Port jurisdictional boundaries. The Port's jurisdiction is both referred to as "Port tidelands" or "tidelands" throughout this JRMP document.

.

[1] "Tidelands", properly speaking, are lands between the lines of mean high tide and mean low tide. By contrast, "submerged lands" are those lands seaward of the low tide and not uncovered in the ordinary ebb and flow of the tide. The area of San Diego Bay encompassed by the historic mean high tide line is approximately 15,000 acres of filled and submerged lands and with an existing shoreline of approximately 54.01 miles in length.

Figure 1-1. Port Of San Diego Jurisdictional Boundaries.



The Port's jurisdiction overlays portions of the cities of Chula Vista, Coronado, National City, Imperial Beach, and San Diego (collectively referred to as "member cities"). The Port defers to the member cities for processing several ministerial permits such as building permits, grading permits, and business licensing. The member cities have also retained ownership of MS4 that existed prior to the formation of the Port which cross the Port tidelands and discharge into San Diego Bay. The majority of the Port-owned and maintained stormwater conveyance system serves the Tenth Avenue Marine Terminal, the National City Marine Terminal, the Cruise Ship Terminal, Shelter Island, Harbor Island, Bayside Park in Chula Vista, Dunes Park in Imperial Beach, and Tidelands Park in Coronado.

The Port manages municipal areas such as public parks, parking lots, piers, boat launches, and marine terminals and leases other tideland areas using long term leases, temporary occupancy permits and other agreements. Tenant businesses include hotels, restaurants, marinas and yacht clubs, retail shopping villages, boat repair and shipbuilding, manufacturing, seafood processing, sportfishing landings, and other commercial, recreational, and industrial waterfront-related business activities. There are no residential uses on Port tidelands.

1.3 San Diego Bay Watershed

The Port's jurisdiction lies completely within the San Diego Bay Watershed Management Area (WMA). This WMA is comprised of three of hydrologic units listed in the San Diego Basin Plan, adopted by the Regional Water Quality Control Board, each of which drains to San Diego Bay. The hydrologic units (HUs) are the Pueblo San Diego (908.00), the Sweetwater (909.00), and the Otay (910.00). The San Diego Bay WMA encompasses a 444 square mile area (284,500 acres) that extends approximately 50 miles to the east - all the way to the Laguna Mountains. The Port's jurisdiction is at the base of the watershed and comprises less than 1% of the watershed acreage. The major surface water features in these three hydrologic units include San Diego Bay, the Sweetwater River, the Otay River, and the Pacific Ocean. In addition to those waters, other tributaries to San Diego Bay include Chollas Creek, Paleta Creek, Paradise Creek, and Switzer Creek.

The municipalities and agencies within the San Diego bay WMA include the cities of Chula Vista, Imperial Beach, Lemon Grove, San Diego, Coronado, National City, La Mesa, County of San Diego, the San Diego County Regional Airport Authority, and the Port. These agencies collectively are referred to as the San Diego Bay Watershed Copermittees throughout this document.

1.4 Regulatory Background

The Federal Clean Water Act (CWA) Section 402 prohibits the discharge of pollutants into waters of the United States from any point source without a National Pollution Discharge Elimination System

(NPDES) permit. In 1983, the United States Environmental Protection Agency (EPA) reported in a summary of the Nationwide Urban Runoff Program (NURP) that urban storm water was one of the primary causes of water quality impairment across the nation. As such, the US EPA used the authorities of the CWA to adopt regulations for urban runoff and stormwater.

In many states, the US EPA has delegated administration of the NPDES permit program to the state water quality control authority. In California, the State Water Resources Control Board (SWRCB) and its Regional Boards administer the NPDES permit program. The Regional Boards implement the municipal urban runoff NPDES permit program. The Regional Boards generally issue area-wide permits for urban areas that are considerable sources of pollutants or contribute to water quality standard violations. Regardless of population, the area-wide permits cover all municipalities within the defined urban area.

1.4.1 Municipal Stormwater Permit

On May 8, 2013, the Regional Board adopted Order R9-2013-0001, NPDES Permit and Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region (Municipal Permit or Permit). The Municipal Permit requires the owners of storm drain systems to implement management programs to limit discharges of non-storm water runoff and pollutants from the storm drain systems. The Municipal Permit is regional permit, including the cities and County of San Diego, the Port, the San Diego Regional Airport Authority, as well as cities and the counties of Riverside and Orange as “Copermittees”. The Order was amended by R9-2015-0001 on April 1, 2015.

Although the Municipal Permit contains specific activities to be conducted by the Copermittees, the Permit’s focus is outcome-based. The Permit requires municipalities, in each of the region’s watersheds, to develop Water Quality Improvement Plans (WQIPs) that establish watershed-level priorities and goals aimed at achieving improved water quality in MS4 discharges and receiving waters. The Permit also requires the development of strategies to achieve the water quality goals to be used as a foundation and guide for individual JRMPs.

The Permit requires the Copermittees to update their JRMPs in accordance with the Water Quality Improvement Plan in the following areas:

- Illicit Discharge Detection and Elimination
- Development Planning
- Construction Management
- Existing Development

The updates to the JRMP to comply with the Permit were required to be implemented by June 27, 2015. During the Permit term, Copermittees are to annually assess their individual JRMPs and identify additional updates, as-needed. A list of the updates is provided in the jurisdiction-specific information in an appendix to the San Diego Bay Watershed Water Quality Improvement Plan Annual Report.

1.4.2 San Diego Bay Watershed Water Quality Improvement Plan

In response to the requirements of the Municipal Permit, the Port along with the other San Diego Bay Watershed copermittees developed the San Diego Bay Watershed WQIP. The WQIP focuses on assessing the WMA in its entirety as well as at the subwatershed and jurisdictional level. The goal of the WQIP is to reduce pollutants and other stressors from the MS4 discharges in order to achieve water quality improvements in the receiving waters.

The WQIP guides the Copermittees' jurisdictional programs to achieve improved water quality in MS4 discharges and receiving waters by concentrating efforts on the Highest Priority Conditions and Focused Priority Conditions in the WMA. Numeric goals, strategies, and schedules are developed for Highest Priority Conditions and Focused Priority Conditions by the Copermittees with public input. Information and conclusions made in the WQIP is a result of reviews and analysis of existing water quality-related plans and monitoring data and findings from previous JRMP annual reports, and substantial input gathered through public participation and outreach opportunities.

Table 1-1 is taken from the WQIP and indicates the highest and focused priority conditions selected for the San Diego Bay WMA. The conditions and pollutants/stressors listed in the table are where the jurisdictions will focus their JRMPs and resources. The Port is focusing its resources on addressing bacteria, dissolved copper, lead and zinc in the Pueblo HU; trash in the Sweetwater HU and Otay HUs; and bacteria in the Otay HU.

Table 1-1. San Diego Bay WMA Summary of Highest and Focused Priority Conditions.

HU	Condition	Pollutant/ Stressor	Geographic Extent (HU/HA)	Responsible Parties
Pueblo (908)	**Water Quality[1]**	**Bacteria; Dissolved copper, lead, and zinc**	**Chollas Creek (908.22)**	**City of La Mesa City of Lemon Grove City of San Diego County of San Diego Port of San Diego Caltrans**
	Water Quality	Copper and zinc (Wet Weather)	Airport Authority jurisdiction within 908.21	Airport Authority
Sweetwater (909)	Riparian Area Quality	Various	Paradise Creek—lower Sweetwater, HA 909.1[2]	City of National City
	Physical Aesthetics	Trash	The western portion of the City of Chula Vista within HA 909.1	City of Chula Vista Port of San Diego
Otay (910)	Swimmable Waters (Beaches)	Bacteria	Applicable RP jurisdiction within HA 910.1	City of Coronado City of Imperial Beach Port of San Diego
	Physical Aesthetics	Trash	Applicable RP jurisdiction in HA 910.2	City of Chula Vista City of Imperial Beach Port of San Diego

Notes:
1 **The conditions in bold are the Highest Priority Conditions for the San Diego Bay WMA**. Pollutants in regular font are the Focused Priority Conditions.
2. For the purposes of the Water Quality Improvement Plan, Paradise Creek is considered to be part of the lower Sweetwater area, for which the San Diego Bay priority condition analysis has identified potential impacts to beneficial uses such as habitat and non-contact recreation.

The WQIP contains a list of strategies for each jurisdiction that will be implemented by through their respective JRMPs. The Port's strategies are integrated into this JRMP document. A table containing a list of the Port's strategies and additional information as to where the strategy will be applied and when it will be implemented is included in Appendix A. As required by the Permit, the effectiveness of the strategies will be analyzed, and modifications will be reported annually in the WQIP Annual report.

1.4.3 Environmentally Sensitive Areas

The RWQCB defines "Environmentally Sensitive Areas" in Attachment C.4 of the Municipal Permit. The term defined the areas to include, but not be limited to:

- All Clean Water Act 303(d) impaired water bodies;
- Areas designated as an "Area of Special Biological Significance" (ASBS) by the State Water Resources Control Board;

- Water bodies designated as having a RARE beneficial use by the State Water Resources Control Board; or
- Areas designated as preserves or their equivalent under the Multiple Species Conservation Program (MSCP) within the Cities and County of San Diego.

The San Diego Bay has been designated, in its entirety, as having a RARE beneficial use in the San Diego Basin Plan. Neither the 303(d) listings, nor the MSCP areas add any more area to those encompassed by the RARE designation.

1.5 Purpose and Objectives

This JRMP was designed to be a comprehensive stormwater management program for the Port. It has been developed to implement the strategies described in the WQIP and to assist the Port in identifying causes or contributions to water quality impacts, track urban runoff related activities, and to implement to the MEP best management practices to reduce or eliminate pollutants from reaching receiving waters within the Port's jurisdiction.

The Port JRMP objectives are:

- To improve water quality in the bay and adjacent receiving waters;
- To minimize the urban runoff discharges from Port tidelands; and
- To improve program management efforts related to urban runoff.

To comply with the requirements of the Municipal Permit and to meet the Port's objectives, the Port will engage a number of activities that will reduce or eliminate pollutants in the MS4. These activities may include the following, separately or in combination: employee training, tenant and public education/outreach, source identification, water quality monitoring, BMP development and implementation, inspections, code enforcement and coordination with adjacent cities. The measures and actions outlined in every chapter of the Port JRMP Document are intended to effectively protect and enhance the quality of the tideland's environmental resources, wherever possible.

Assessment and reporting of the JRMP program will occur in two ways; 1. Meeting the core permit requirements which will be reported annually on the Regional Board provided JRMP Annual Report Form, and 2. Review and analysis of the information and data collected through the implementation of the WQIP strategies. This information will be reported in the WQIP annual report. The JRMP will be updated as needed to include necessary modifications to the strategies.

1.6 JRMP Document Layout

The Port JRMP Document describes the actions the Port will take to reduce discharges of pollutants and urban runoff flow during each of three major phases of urban development, namely, the planning, the construction, and the existing development or existing use phases. This JRMP Document was prepared in accordance with the Permit requirements and describes all the activities that the Port has undertaken, is undertaking, or will undertake, to implement the requirements of each component outlined in Section E of the Permit.

The JRMP also incorporates the strategies of the WQIP. The applicable strategies are indicated at the beginning of each JRMP chapter. The chapter sub-section that the strategy is discussed and integrated in the program is also identified. As described in Section 1.4.2, greater detail of each strategy is provided in Appendix A. The Port JRMP document contains the executive summary, introduction, conclusions, recommendations, and signed certified statement required by the Permit. The document also discusses the Permit sections listed below:

E.1. Legal Authority and Enforcement

E.2. Illicit Discharge Detection and Elimination

E.3. Development Planning

E.4. Construction Management

E.5. Existing Development Management

E.6. Enforcement Response Plans

E.7. Public Participation and Education

E.8. Fiscal Analysis

The unique manner in which the Port was developed and conducts operations makes some of the Permit requirements difficult to achieve or not applicable to Port operations. For example, residential land uses and other Municipal Permit identified facilities and/or activities are not allowed on state tidelands as legislated by the Port Act. Where these discrepancies occur, the appropriate sections of this JRMP Document will make note of the limitations and not attempt to discuss them further during the five-year life of this Permit.

Chapter 2 Administrative and Legal

The Port is committed to ensuring compliance with the Permit and water quality protection for San Diego Bay. To this end, the Port has allocated staff positions, funding and external resources to effectively implement stormwater and pollution prevention practices across tidelands. The Port also adopted the “Stormwater Management and Discharge Control Ordinance,” Article 10 of the Port of San Diego Code (Appendix B), to regulate urban runoff within the Port’s jurisdiction. This ordinance will herein be referred to as “Article 10” throughout this document. The ordinance requires the prevention, control, treatment, or diversion of storm water discharges, through a program of education and enforcement of general and specific prohibitions and requirements. Article 10 applies to all dischargers and locations within the Port’s jurisdiction.

2.1 Departmental Roles and Responsibilities

Several Port departments play key roles in stormwater management and managing based on their day-to-day duties, their coordination with tenants, and their authority to approve development and/or lease agreements. This section discusses the roles and responsibilities related to stormwater management within various departments throughout the Port, and the ways in which they interact. The primary and secondary departmental responsibilities for the implementation of the JRMP are discussed below and are provided in Table 2-1. For reference, Figures 2-1 and 2-2 provide organizational charts for the Port and the Environmental Protection department (EP).

The EP department is the primary department responsible for developing and implementing the Port’s JRMP. Within EP, specific staff are dedicated to various elements of Municipal Permit compliance and are led by senior staff that oversee and manage the overall program elements. EP Environmental Specialists are assigned to implement each of the following JRMP elements: (1) public participation and education compliance; (2) land use planning and construction compliance; (3) industrial, commercial, and municipal compliance; (4) watershed management; (5) monitoring requirements; and (6) database and GIS management (7). Illicit discharges/illicit connection response, and other projects as needed. Responsibilities for enforcement are distributed throughout the entire staff. Table 2-1 indicates the elements covered by EP.

Table 2-1. Port Department Responsibilities for JRMP Implementation.

PROGRAM / ACTIVITY	Environmental Protection	PLANNING	DEVELOPMENT SERVICES	GENERAL SERVICES DEPARTMENT	HARBOR POLICE	REAL ESTATE DEPARTMENT	MARITIME DEPARTMENT	ENGINEERING DEPARTMENT
Public Participation	P							
Education	P			S	S	S	S	S
Enforcement	P		S		P	S		
Water Quality Monitoring	P							
Inventories	P					S		
Watershed Planning	P							
Program Assessment	P			S	S	S	S	S
Fiscal Analysis	P			S	S	S	S	S
Integrated Pest Management	S			P				
Household Hazardous Waste	P			S				
Municipal Facilities	S			P		S	S	S
Municipal Buildings	S			P		S	S	S
Landscape & Recreational Facilities	S			P				S
Parking Facilities	S			P		S		S
Stormwater Conveyance System	S			P				S
Streets	S			P				S
Vehicle Maintenance				P				
Industrial & Commercial Uses	S					P	P	
Land Use Planning	S	P	P					
Environmental Review	S	P	P					
Engineering-Construction	S					S		P
Construction	S			S		S		P
Non-emergency Fire Fighting					P			

P= PRIMARY
S=SECONDARY

2.1.1 Planning Department

The Planning Department is responsible for the Port's long range, integrated land and water use planning. The department leads and guides the Port's Master Planning efforts and conducts environmental review of projects planned on Port tidelands. Planning also is involved with JRMP implementation by integrating water quality protection concepts into the Port Master Plan and through the environmental review and mitigation measures integrated into their Coastal Development and California Environmental Quality Act (CEQA) project processing.

2.1.2 Development Services Department

The Development Services Department provides project review and processing services for Port tenant projects and Port sponsored projects. The department is the central hub for processing new development and redevelopment projects as well as minor maintenance and repair projects on tidelands. The department's suite of services includes CEQA and Coastal Development Permit reviews, conformance with Port standards including stormwater requirements, interdepartmental coordination on project reviews, and preparation of lease exhibits including plat maps and legal descriptions.

2.1.3 General Services Department

The General Services Department is responsible for many aspects of the Port's JRMP, including the Integrated Pest Management Program, municipal building maintenance, landscaping, park maintenance, maintaining the stormwater conveyance system and municipal structural BMPs, streets and parking lots, sweeping, and vehicle maintenance. Their secondary responsibilities include education, program assessment, fiscal analysis, and household hazardous waste.

2.1.4 Harbor Police Department

In addition to providing law enforcement on tidelands, the San Diego Harbor Police Department is in charge of non-emergency firefighting. They also are the primary department for issuing stormwater related judicial enforcement authorities. Harbor Police reports spills and other environmental incidents to EP. Secondary responsibilities of the Harbor Police include education, and program assessment.

2.1.5 Real Estate Department

The Real Estate Department primarily oversees municipal, industrial and commercial facilities and plays an integral role in coordinating tenant development projects. They are also responsible for referring various tenant environmental issues to EP. Their secondary responsibilities include education, enforcement, inventories, program assessment, fiscal analysis, buildings, and parking facilities.

2.1.6 Maritime Department

The Maritime Department is primarily responsible for maritime industrial and commercial uses at the marine terminals. They are also responsible for reporting spills and other environmental incidents to EP at the marine terminals. Additionally, Maritime staff is involved in implementing BMP Plans and the Rain Event Plans (REPs) for Port maintained areas at the Tenth Avenue Marine Terminal and Cruiseship Terminal, at B Street Pier. Their secondary responsibilities include education, program assessment, fiscal analysis, and buildings.

2.1.7 Engineering-Construction Department

The Engineering-Construction Department is primarily responsible for development/design of capital improvement projects and construction issues. They are also responsible for incorporating stormwater requirements within the design process and at construction sites. Their secondary responsibilities include education, program assessment, fiscal analysis, municipal facilities, landscaping, recreational facilities, buildings, parking facilities, streets, and the stormwater conveyance system.

Figure 2-1. District Division and Department Organizational Chart.

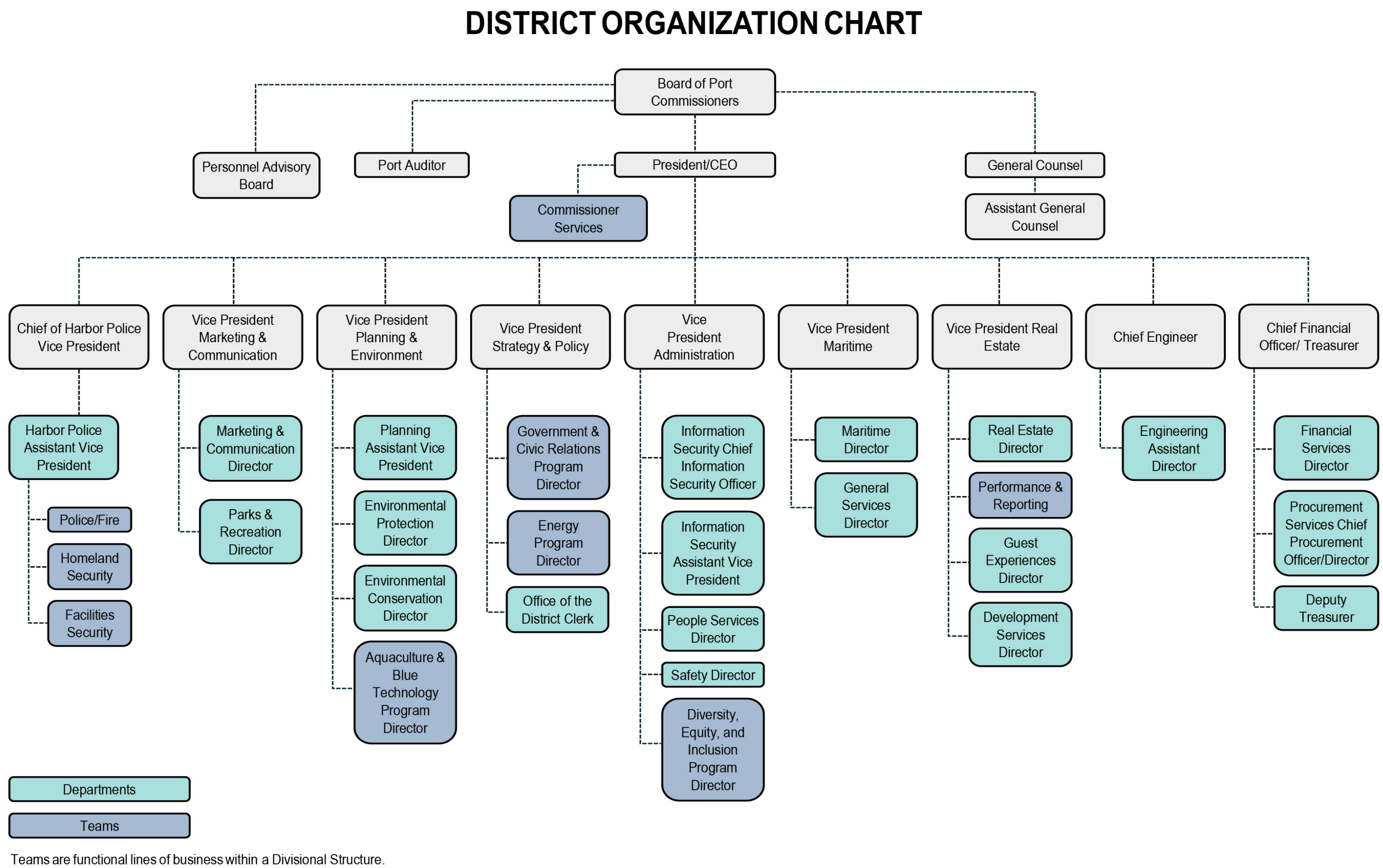


Figure 2-2. Planning and Environment Division Organization Chart.

2.2 Legal Authority

The Port has established and will maintain an enforceable legal authority to control pollutant discharges into and from its MS4 through ordinance, statute, permit, contract or similar means. This legal authority is provided in Article 10 and Article 0. Article 10 specifies criteria for the allowable types of discharges to the storm drain conveyance system, procedures for controlling pollutants, eliminating illicit connections and illegal discharges, reducing stormwater pollutants, and inspecting facilities and operations. In addition, Article 10 allows enforcement activities, providing for both administrative and judicial authorities, when necessary. Article 0 of the Port Code describes the process for issuing administrative citations and allows the Port to assess fines and corrective actions as needed to address a violation of Article 10.

Article 10 was originally enacted in 2000 in preparation for the upcoming 2001 Municipal Permit. Subsequently, Article 10 was updated in 2007 to comply with the 2007 Municipal Permit, and in May 2015 to comply with the current 2013 Municipal Permit. The update followed a lengthy process which involved comparing current Port enforcement operations with the new Permit requirements. Article 10 was updated once again in October 2018 to revise definitions to be consistent with the Permit and changes that Port staff identified as necessary to provide clarity on the provisions of Article 10. Language was also simplified in the Enforcement Section of Article 10 to clarify the Port's enforcement authorities. This section identifies and describes all relevant legal authorities available to the Port in implementing the requirements of the Permit.

2.2.1 BMP Requirements

Pursuant to the Article 10, the Port has required minimum BMPs to be implemented for specific activities and facilities, where applicable and feasible. These minimum BMPs are briefly described in Article 10 and are more fully defined in the applicable sections of this JRMP document. Updates to the BMP section of Article 10 include specific minimum BMP requirements for industrial and commercial activities, and construction activities. These minimum BMPs comply with the requirements of the Municipal Permit. BMP maintenance requirements and requirements for inspection and repair of treatment control BMPs were also updated.

2.2.2 Inspections

Article 10 authorizes the Port to inspect activities and facilities, whether or not occupied, at reasonable times, in a reasonable manner, and with reasonable notice to carry out the purposes of the Municipal Permit. Inspections may include all actions necessary to determine whether any illegal discharges or illicit connections exist, whether the BMPs installed and implemented are adequate to comply with Article 10, whether those BMPs are being properly maintained, investigating the source of any discharge, whether the facility or activity complies with other requirements of Article 10, and to abate or correct or prevent pollutants from entering the stormwater conveyance system or receiving waters. This may include but not limited to sampling, taking measurements, metering, and the placement of any devices necessary to sample or monitor or meter or record, visual inspections, and records review.

If an inspector identifies a violation, some level of enforcement may be required. (See Section 2.2.5 and the Port's Enforcement Response Plan). When samples are collected, the owner or operator may request and receive split samples. Records, reports, analyses, or other information required under Article 10 may be inspected and copied, and photographs taken to document a condition and/or violation.

2.2.3 Development and Redevelopment Projects

Article 10 also includes specific requirements for all development and redevelopment activities. Post-construction BMPs are addressed and required for all projects falling under the state's General Construction Permit. Article 10 also specifically requires structural treatment control BMPs for all priority development projects. Consistent with the Port BMP Design Manual, projects are required to implement low impact development (LID) BMPs as well as source control and site design BMPs for the project. Additionally, new development and redevelopment are required to submit a stormwater quality management plan (SWQMP) identifying post-construction BMPs for the project.

2.2.4 Prohibitions

The prohibitions in Article 10 were modified in the May 2015 amendment and again in October 2018 to better correlate with the Permit prohibition categories. All Permit required prohibitions are included in Article 10.

2.2.5 Enforcement

The Port employs several enforcement mechanisms and penalties to ensure the compliance with its ordinances. The levels of enforcement and associated penalties are typically issued at the discretion of the authorized enforcement staff with consideration of relevant circumstances regarding the violation. It should be stated that the Port is not required to utilize the court system to enforce stormwater violations. Specific administrative authorities, as listed below and fully detailed in Article

10, allow several options to be used that may have a more immediate resolution, including the ability to assess fines. There are limitations to the types and amounts of penalties that can occur within each option, however, the different types of enforcement actions that maybe used by the Port are summarized below.

It should be noted that other agencies, such as the Regional Water Quality Control Board, also exercise enforcement rights if violations fall within their jurisdiction. Often the penalties associated with the enforcement actions of these agencies may be coupled with those issued by the Port.

Administrative Authorities

(1) Administrative Citation. A written administrative citation may be issued and civil penalties and fines imposed whenever a violation of one or more of the provisions of Article 10 has occurred or continues to exist.

(2) *Stop Work Orders*. Whenever any work is being done contrary to the provisions of Article 10, or other laws implemented through enforcement of this Article, the Executive Director may order work stopped by notice in writing served on any person engaged in the doing or causing such work to be done, and any such person shall immediately stop such work until authorized to proceed.

(3) *Summary Abatement.* The Executive Director may abate any public nuisance created by or resulting from a violation of Article 10, including summary abatement. If the Executive Director determines that a public nuisance exists and immediate action is necessary, the Port may summarily abate the nuisance by any reasonable means without notice or hearing, however, challenges to the abatement will be resolved though the hearing procedures identified in Article 0.

(4) *Permit Suspension and Revocation*. Violations of Article 10 may be grounds for suspension or revocation of any permit or approval or other Port license. This includes violations of lease agreements. Suspensions and revocations shall occur in accordance with the hearing procedures identified in Article 0.

Judicial Authorities

(1) *Injunctive or Declaratory Relief.* Any violation of Article 10 may be enforced by a judicial action for injunctive or declaratory relief.

(2) *Civil Penalties and Remedies.* The Port Attorney (or City or District Attorney) is authorized to file actions in Superior Court to enforce Article 10, seeking civil penalties and/or other remedies as provided in Section 10.11 and in Section 10.12 (Penalties). There is no requirement that administrative enforcement procedures be pursued before such actions are filed.

(3) *Criminal Arrest.* The assistance of a peace officer may be enlisted to arrest violators as provided in California Penal Code, Ordinances 5, 5c, Title 3, Part 2 (or as amended) and/or a citation and notice to appear as prescribed in Ordinance 5c of Title 3, Part 2 of the Penal Code, including Section 853.6 (or as amended) may be issued. There is no requirement that administrative enforcement authorities be used before such actions are filed.

<u>Administrative Penalties</u>

Administrative penalties may be imposed pursuant to Section 0.11 (Penalties) of the District Code. The Executive Director may charge any violation of Article 10 as subject to an Administrative fine or penalty at his discretion.

<u>Criminal Penalties</u>

Criminal penalties may be imposed pursuant to Section 0.11 (Penalties) of the District Code.

(1) *Misdemeanor.* Non-compliance with any part of Article 10 constitutes a misdemeanor and may be enforced and punished as prescribed in District Code Section 0.11, and other applicable state laws, the California Penal Code and Government Code.

(2) *Infractions.* The Executive Director may charge any violation of Article 10 as an infraction at his discretion. Infractions may be abated as a nuisance or enforced and punished in District Code Section 0.11, the California Penal Code, and the Government Code.

<u>Civil Penalties</u>

The following may be awarded without monetary limitations in any civil action, except where a maximum monetary amount is specified.

- Injunctive Relief
- Costs to investigate, inspect, monitor, survey, or litigate
- Costs to place or remove soils or erosion control materials, costs to correct any violation, and costs to restore environmental damage or to end any other adverse effects of the violation
- Compensatory damages for losses to the District or any other plaintiff caused by violations; and/or restitution to third parties for losses caused by violations
- Civil penalties in accordance with Section 0.11(i) and
- Attorney fees and court costs.

Cost Recovery

The Executive Director may impose a monetary penalty without limitation to recover the costs, including staff time and materials, to investigate or monitor any violation of Article 10.

Attorney Fees

In any action, administrative proceeding or special proceeding to enforce Article 10 and abate a nuisance, the prevailing party may recover attorney fees.

Penalties and Remedies Not Exclusive

Penalties and remedies under the Article 10 may be cumulative and in addition to other administrative, civil or criminal remedies.

2.2.6 Certification of Legal Authority

The Port of San Diego has the legal authority to implement the requirements of the Municipal Permit. A certified statement confirming that the Port has taken the necessary steps to detail and maintain full legal authority within its jurisdiction to implement and enforce each of the requirements of the Municipal Permit was submitted with the first San Diego Bay Watershed Water Quality Improvement Plan Annual Report in January 2017. Enforcement, appeal, and administrative order/injunction processes are described in Section 2.2 “Legal Authority” and in Article 10 (Appendix B).

Chapter 3 Illicit Discharge Detection and Elimination

3.1 Introduction

Provision E.2 of the Municipal Permit requires that the Port establish an illicit discharge detection and elimination (IDDE) program in accordance with the strategies of the San Diego Bay Watershed WQIP in addition to core permit requirements. The purpose of the IDDE program is to actively seek and eliminate discharges of non-stormwater to the municipal separate storm sewer system (MS4).

This Chapter describes how the Port will meet the Permit conditions outlined in F.2.a and the IDDE requirements in E.2. Table 3-1 indicates the sections of this chapter where specific permit conditions are incorporated in to the Port's JRMP

Table 3-1. IDDE Program Permit Requirements and Corresponding JRMP Section.

Permit Requirement	Permit Reference	JRMP Section
Non-Storm Water Discharges	E.2.a	3.3
Prevention and Detection of Illicit Discharges and Connections – Maintain MS4 Map	E.2.b(1)	3.4.1
Prevention and Detection of Illicit Discharges and Connections – Personnel and contractor assistance with Illicit connections and discharges (ICIDs)	E.2.b(2)	3.4.3
Prevention and Detection of Illicit Discharges and Connections – promote, publicize, facilitate ICID reporting from the public	E.2.b(3)	3.4.2
Prevention and Detection of Illicit Discharges and Connections – prevention and response to ICIDs	E.2.b(4)	3.4.3
Prevention and Detection of Illicit Discharges and Connections – limiting infiltration of seepage from sanitary sewer to MS4	E.2.b(5)	3.4.4
Prevention and Detection of Illicit Discharges and Connections – ICID coordination with upstream Copermittees/entities	E.2.b(6)	3.4.5
MS4 Outfall Discharge Monitoring	E.2.b D.2.a.(2) D.2.b.(1)	3.5
Investigations and Elimination of Illicit Discharges and Connections	E.2.d.(1)-(2)	3.6.1-3.6.4
Tracking and Record Keeping	E.2.d.(2)(d)	3.6.5
Enforcement	E.2.d.(3)	3.7

The Port regulates non-stormwater discharges on tidelands through complaint response, monitoring, investigation, and enforcement procedures. This chapter explains the procedures the Port will undertake to implement its IDDE program and describes the strategies used to prioritize and eliminate non-stormwater discharges contributing to the high priority water quality conditions identified in the WQIP.

3.2 WQIP Strategies for IDDE

To assist in making the interim and final water quality goals identified in the WQIP, the Port identified two strategies that will be incorporated into the IDDE program. Table 3-2 below includes the strategy from the WQIP which is applicable to the Port's IDDE Program.

Table 3-2. WQIP IDDE Program Strategy.

SDB ID	Strategy Name	Implementation Year	JRMP Section
PO-14	Implement Core JRMP Program for IDDE program.	FY-15	3.3-3.7
PO-17	Implement Core JRMP Program for the Education and Outreach Program	FY-15	3.4.2, 3.4.4, and 3.6

The strategies aim to implement the core jurisdictional program that meets baseline permit requirements and addresses the highest and focused priority conditions identified in the WQIP, as applicable. These strategies will be implemented throughout the permit term. Strategy PO-14 is a core permit requirement and, as such it is incorporated into the entire IDDE Chapter. More detail on the strategies are included in Appendix A.

3.3 Non-stormwater Discharges

Provision E.2.a of the Permit requires the Port to address all non-stormwater discharges as "illicit" discharges unless a non-stormwater discharge is either identified as a discharge authorized by a separate NPDES permit or identified as a category of conditionally allowed non-stormwater discharges. In 2015, the Port updated its stormwater ordinance (Article 10) to reflect conditions of the Permit. Section 10.04 of the Port Code identifies conditionally allowed non-stormwater discharges and the requirements associated with each discharge type. Non-compliance with the NPDES or BMP requirements of the conditionally allowed discharges would render the discharge illegal and a violation of Port Code. Table 3-3 identifies specific non-stormwater discharges that are conditionally allowed and describes the conditions that must be satisfied for such discharge to occur.

Prohibited Discharges

As defined by Port Code, an illicit discharge as any discharge or release into stormwater, the MS4, receiving waters or land that is not composed entirely of stormwater except conditionally allowed discharges described in the Municipal Permit. Port Code Section 10.05 defines illicit discharges, illicit connections, waste and pollutants disposed on land and in water, flammable materials, excreta or sewage discharges, wash water, irrigation water runoff and repair, construction and demolition debris, specifically as prohibited discharges.

Table 3-3. Conditionally Allowed Non-Stormwater Discharges.

Non-Stormwater Discharge Type	Exceptions
Uncontaminated pumped ground water	Considered an illicit discharge unless the discharge has coverage under NPDES Permit No. CAG919001 or NPDES Permit No. CAG919002. Foundation and footing drains are exempted if the system is designed to be located at or below the groundwater table to actively or passively extract groundwater during any part of the year.
Discharges from fountain drains	
Water from crawl space pumps and footing drains	
Water line flushing	Considered an illicit discharge unless has coverage under NPDES Permit No. CAG679001. This category includes water line flushing and water main break discharges from water purveyors issued a water supply permit by the California Department of Public Health or federal military installations. Discharges from recycled or reclaimed water lines to the MS4 must be addressed as illicit discharges, unless the discharges have coverage under a separate NPDES permit.
Water main breaks	
Diverted Stream flows	Considered as illicit discharges only if the Copermittees or the RWQCB identifies the discharge as a source of pollutants to receiving waters. Foundation and footing drains are exempted if the system is designed to be located at or above the groundwater table at all times during the year and non-stormwater is discharges under unusual circumstances.
Rising ground waters	
Uncontaminated ground water infiltration to the MS4	
Springs	
Flows from riparian habitats and wetlands	
Potable water sources	
Foundation drains	
Footing drains	
Air conditioning condensation	Considered an illicit discharge unless controlled through statute, ordinance, permit, contract, order, or similar means.
Individual residential vehicle washing	
Dechlorinated swimming pool discharges	
Non-emergency firefighting	Considered an illicit discharge unless BMPs have been implemented to reduce or prevent pollutants from entering the MS4.
Emergency firefighting	Not considered an illicit discharge, however the Copermittees should develop and encourage the implementation of BMPs to reduce or eliminate pollutants.

3.4 Prevention and Detection of Illicit Discharges and Connections

The Permit requires that the Port institute measures to prevent and detect illicit discharges and connections to the MS4 and/or receiving water. To facilitate a proactive IDDE program, the Port coordinates discharge prevention, detection, containment, and response activities internally between various Port departments such as Environmental Protection, General Services and Engineering-Construction and works with outside agencies to ensure that water quality protection always occurs. The Port maintains a map of its MS4 infrastructure which is updated annually to reflect modifications. The MS4 map serves as a tool to identify potential pathways and sources of an illicit discharge.

The Permit also requires mechanisms to ensure that the Port is notified of spills, illicit connections or discharges such as over-irrigation. Through past permits, the Port has developed a strategy for preventing, reporting, and responding to illicit discharges including sewage-related incidents into the MS4 and receiving waters. The strategy ensures that routine inspections and maintenance occur as required and that a standard operating procedure (SOP) is in place to appropriately respond to all complaints. The Port has developed the SOP to prioritize incoming complaint reports and internally standardize the response and reporting. This strategy was reviewed and modified, where necessary to ensure that all new Permit requirements were met. In addition, the Port's website was significantly rebuilt in FY 2018. Information relating to the non-stormwater discharge prohibitions, such as over-irrigation, is now easier for the public to find. Public reporting tools on the website also make it easier for the public to report non-stormwater discharges such over-irrigation. The following section discusses the Port's prevention, reporting, and response procedures.

3.4.1 MS4 Mapping

The Port is required to maintain a map of the MS4 which exists on Port tidelands. The Port has an updated map of the MS4 in a GIS format which showcases the location and related attributes of each structure. The MS4 map and dataset serves as an important tool for prioritizing investigations based on the drainage areas which may correspond with the high priority water quality problems in WQIP, detecting the presence of illicit connections during monitoring, and preventing an illicit discharge from reaching the Bay. The MS4 map and dataset can be used to narrow the search for sources of an illicit discharge during investigations of a spill. Each MS4 structure has been assigned a unique identifier number that allows for easy reference during these investigations. Hardcopy maps are presented in Appendix F. As required, the Port's MS4 maps and dataset identify the following elements:

- All segments of the MS4 owned, operated, and maintained by the Port. Since there are also several MS4s that are not owned, operated, or maintained by the Port that occur within Port boundaries, those structures are also identified;

- All known locations of inlets that discharge and/or collect runoff into the Port's MS4;

- All known locations of connections with other MS4s not owned or operated by the Port;

- All known locations of MS4 outfalls and private outfalls that discharge runoff collected from areas within the Port's jurisdiction;

- All segments of receiving waters within the Port's jurisdiction that receive and convey runoff discharges from the Port's MS4 outfalls;

- Locations of the MS4 outfalls, identified pursuant to Provision D.2.a.(1) within the Port's jurisdiction;

- Locations of non-stormwater persistent flow MS4 outfall discharge monitoring stations, identified pursuant to Provision D.2.b.(2) within the Port's jurisdiction.

The Port has developed a process to update the MS4 map and dataset annually. The process is closely linked to development tracking presented in Chapter 4 of this JRMP. If development projects indicate that the MS4 will be modified, the changes to the MS4 are captured at the project close-out and verified by field personnel. There are also some cases where unknown MS4 structures may be identified during daily operations. These structures are researched, and, where possible, as-built drawings are located to confirm their connectivity to known MS4. If as-builts are unable to be located, CCTV is run through the structure to determine connectivity to known MS4. The location and related attributes of these structures are tracked and added to the Port's MS4 dataset. Updates to the MS4 will be included in JRMP updates submitted annually with the WQIP Annual Report.

3.4.2 Public Reporting of Illicit Discharges

The Municipal Permit requires the Port to promote, publicize, and facilitate public reporting of illicit discharges or water quality impacts associated with discharges into the MS4. The Port provides opportunities for the public to report illicit discharges through various mechanisms.

- Hotlines: The Port recognizes the effectiveness of using both a regional toll-free hotline as well as a local (jurisdictional) hotline and intends to use both mechanisms to facilitate public reporting of illegal discharges such as over-irrigation. The Regional Stormwater Hotline number is (888) 846-0800. The Regional Hotline is administered by the County of San Diego, Department of Public Works and answered by I Love A Clean San Diego, a local non-profit organization.

  The Port of San Diego also operates its own jurisdictional Stormwater Hotline to receive calls regarding complaints of pollution and non-stormwater discharges on Port tidelands. This hotline number is (619) 686-6254 and is administered by the Port's Environmental Protection (EP) department during regular business hours (Monday-Thursday and every other Friday).

  Additionally, the Port Harbor Police can receive and respond to complaints. The contact phone number for the Harbor Police is (619) 686-6272. This phone number is operated 24 hours per day, seven days per week. Complaints in Spanish or other languages will be referred to the Port's Call Center at (619) 686-6200 for interpretation.

- Email: The public can also email complaints directly to the Port at SWPollutionPrevention@portofsandiego.org. Email complaints will be routed to the Port's EP department to respond.

- Websites and On-line Applications: The Port website's homepage includes a link to a dedicated public reporting page that clearly states non-stormwater discharge prohibitions, including over-irrigation, and provides information on the different mechanisms available to the public to report non-stormwater discharges[1]. In FY 2020, the Port developed an online reporting application. The 311 Request app provides the public a mechanism for reporting non-emergency problems to the Port, similar to the City of San Diego's "Get It Done" app[2, 3]. App users can report problems like potholes, graffiti, trash, and illegal discharges such as over-irrigation occurring within the Port's jurisdiction. The goal of the new app is to provide a quick and user-friendly way for public to engage with the Port and modern tools for Port staff to process work. The public launch of the 311 Request app is anticipated to occur in FY 2021.

  The Port's web site also provides links to other on-line applications such as the City of San Diego's "Get It Done" app and a link to the Sweetwater Authority's (SWA) water waste reporting site[4]. In addition, the Port coordinates with the San Diego County Copermittees on the Project Clean Water (PCW)[5] website, which serves as a water quality resource for the region. The PCW website also offers a Report Pollution Interactive Mapping tool.[5] This pollution reporting tool is designed to pin-point by address, the area that needs attention so that the appropriate jurisdiction is notified.

Prevention of Pollution and Illicit Discharges

The Port believes that the most important step in preventing pollution and illicit discharges from entering the MS4 and receiving waters is through education and proper BMP implementation. Article 10 states that individuals involved in activities or use of an area who may have the potential to discharge pollutants to the MS4 or receiving waters must institute effective BMPs to prevent stormwater pollution and illicit discharges. Prevention of pollution and/or illicit discharges requires that Port staff, contractors, tenants, and the general public be aware of actions that may contribute to pollution. To that end, Port staff has implemented an educational strategy focusing on preventing pollution from entering the MS4 and receiving waters to ensure all individuals are aware of their spill prevention responsibilities. Further information regarding the Port's education program for the public can be found in JRMP Chapter 9.

Port field staff are trained annually in pollution prevention, stormwater issues, and spill response. This training focuses on BMP implementation so that field staff are aware of the necessary procedures to

1 https://www.portofsandiego.org/report-stormwater-pollution
2 https://portofsandiegoserviceportal.force.com
3 https://www.sandiego.gov/get-it-done
4 https://www.sweetwater.org/FormCenter/For-Customers-7/Report-Water-Waste-60
5 www.projectcleanwater.org

conduct operations with the least environmental impact. Topics include, but are not limited to, proper containment of wash water, covering storm drains during minor maintenance, routine maintenance of the irrigation systems to prevent over-irrigation discharge, and use of secondary containment for storing hazardous materials and wastes. Field staff are also aware of how to identify an illicit discharge and report any observations of non-stormwater runoff to the Port's EP department for investigation.

Discharges may also occur as the result of tenant operations which occur on Port tidelands. Port staff provide education regarding spill and discharge prevention during inspections or other various on-site visits to businesses which operate within the Port's jurisdiction. Educational material is distributed in various media formats including verbal instruction, signage, brochures, and the internet. Chapter 7 of this JRMP describes the Port's required BMPs for industrial and commercial operations.

3.4.3 Maintenance of the Sanitary Sewer System

The Permit requires the Port to implement practices and procedures to prevent and limit infiltration from sanitary sewers to the MS4. The Port does not have a municipal wastewater department nor does the Port maintain sanitary sewer lines other than laterals from its municipal properties. The Port does operate and maintain sewage lift stations and vessel sewage pump-out stations around the bay. Lift stations and vessel pump-out stations are maintained on a regular basis to ensure that the infrastructure is operating without problems or spills. The Port will continue to ensure that lift stations are inspected routinely and vessel pump-outs are inspected and maintained on an annual basis. Records of preventative maintenance will continue to be tracked within an electronic database.

Port tenants are required to maintain their own private sewage laterals. Port staff works to encourage tenants to routinely inspect and maintain their own private laterals to prevent leaks or spills. The Port may inspect tenants at any time and may require the repair of any leaking or faulty sewer lines.

3.4.4 Coordination with Other Jurisdictions

As required by the Permit, the Port will coordinate with surrounding jurisdictions, as necessary, to respond to and eliminate reports of illicit discharges. Coordination may come in the form of dual inspections, sharing MS4 maps, and communicating observations. Due to the nature of the drainage areas and MS4 which discharge to the Bay, there are a number of stormdrain lines which emanate upstream, run through the Port's jurisdiction, and finally empty into San Diego Bay. These MS4 are owned and the responsibility of outside jurisdictions. Although the Port is committed to responding to complaints of discharges to the Bay, if the source of the discharge is determined to have occurred outside of the Port's jurisdiction or from non-Port owned MS4, further investigation and enforcement of the incident will be forwarded to the appropriate jurisdiction for resolution. The Port may assist in such investigations, as necessary.

The Port's IDDE process also includes coordination with local water agencies. Complaints received by these agencies will be investigated as discussed above. Port staff will share all relevant information pertaining to the initial investigation with the agencies, as necessary. In addition, the Port's website provides links to the San Diego County Water Authority (SDCWA)[6] and Sweetwater Authority[7] webpages to allow reporting of over-irrigation directly to the water agencies.

3.5 MS4 Outfall Discharge Monitoring

In accordance with Provision D.2 of the Permit, the Port has developed a dry weather MS4 outfall discharge monitoring program as part of its JRMP. The program objectives are to 1) conduct visual observations of major MS4 outfalls within the Port's jurisdiction to classify the frequency of non-stormwater discharges as persistent, transient, or dry; 2) detect, prioritize, and eliminate illicit connections and illicit discharges to the MS4; and 3) identify sources of non-stormwater discharges.

According to Permit Provision D.2.a.(2), the Port's MS4 outfall discharge monitoring program is intended to be conducted during the transitional period prior to acceptance of the WQIP. Following the WQP acceptances, the MS4 outfall discharge monitoring program continued to occur, in compliance with Provision D.2.b.(1) of the Permit. The details of the monitoring are discussed in the subsections that follow.

3.5.1 MS4 Outfall Monitoring Station Inventory

Pursuant to Provision D.2.a(1) of the Permit, the Port must identify and create an inventory of major MS4 outfalls that discharge to receiving waters. Major MS4 outfall must meet one or both of the criteria below:

- A single pipe with an inside diameter of 36 inches or greater;
- A single pipe with an inside diameter of 12 inches or greater that receives runoff from lands zoned for industrial activity.

To develop the inventory based on the criteria above, Port staff reviewed its MS4 map and dataset to determine which outfalls meet the size standards to be considered a major MS4 outfall. Port staff also reviewed the Port Master Plan, which indicates land use types for the Port's planning areas, to identify those MS4 which drain industrial land uses.

As required by the Permit, the inventory of major MS4 outfalls includes the following information for each station:

- Latitude and Longitude;
- Watershed Management Area;

[6] www.sdcwa.org/water-shortage-and-drought-response
[7] https://www.sweetwater.org/353/Water-Waste-Prohibitions

- Hydrologic subarea;
- Outlet size;
- Accessibility;
- Approximate drainage area;
- Classification of frequency of dry weather flows: persistent flows, transient flows, no flow, or unknown flows.

The Port has been conducting field verifications of the MS4 since the beginning of the transitional monitoring period. The Port has developed a preliminary inventory of major MS4 outfalls that discharge to receiving waters. Major MS4 outfalls are identified on the MS4 maps presented in Appendix F. The inventory of major MS4 outfalls may be adjusted based on field observations and verification that the structures meet the requirements above.

3.5.2 MS4 Outfall Discharge Field Screening Monitoring

The Permit establishes a MS4 outfall monitoring frequency that is dependent upon the number of major MS4 outfalls present within a jurisdiction. Since the Port has less than 125 major MS4 outfalls, Provision D2.a.(2)(a)(i) of the Permit requires the Port to monitor 80% of the major MS4 outfalls twice during the monitoring year during dry weather conditions[8].

During each monitoring event, the Port will conduct visual observations of the MS4. The purpose of visual observations is to determine whether there is flowing, ponded, or dry conditions apparent within the MS4. Due to tidal fluctuations in San Diego Bay, the Port will conduct monitoring during low tidal cycles to minimize the effects of tidal inundation into the MS4. Nevertheless, due to their elevations and dimensions there are several MS4 outfalls which are continuously inundated with tidal flows. Other MS4 may not be accessible due to physical barriers or safety constraints. Where an outfall cannot be monitored due to tidal inundation, physical constraints, or safety concerns, the Port will monitor the first upstream manhole or inlet to verify the status of non-stormwater flows within the MS4. Depending on the extent of tidal conditions and the connectivity of the MS4 it may be necessary to monitor multiple manholes or inlets to verify conditions within the system. In those cases where upstream manholes or inlets are located outside of the Port's jurisdiction, the Port will record visual observations and will contact the appropriate jurisdiction for further action, as needed.

The Port establishes whether the conditions observed within the MS4 produce persistent flow, transient flow, or no dry weather flows. Persistent conditions become established based on three consecutive field screening events. If an MS4 outfall showcases less than three consecutive flowing conditions,

[8] Dry weather conditions occur when less than or equal to 0.1 inches of precipitation is recorded. If greater than 0.1 inches of rainfall is recorded, dry weather conditions cannot be established until after 72 hours following the storm. The monitoring year is defined as October 1 through September 30 of each year.

the flow is considered transient. For each monitoring event, the following information will be documented and recorded (pursuant to Table D-5 in Provision D.2.a.(b):

- Station identification, description, and location;
- Presence of flow, pooled, or ponded water;
- If non-stormwater is observed, the estimated flow (i.e., gallons per minute), characteristics of the flow (i.e., presence of floatables, etc.), and sources of flow;
- Sources of flow eliminated;
- Presence and assessment of trash in and around the station;
- Evidence of signs of illicit connections or illegal dumping.

Any illicit discharges or connections observed during MS4 outfall monitoring will be investigated by Port staff using the same procedures described in Section 3.5.3 below.

3.5.3 Persistent MS4 Outfall Discharge Monitoring

Following the approval of the WQIP by the Regional Board, the Port is required to continue with MS4 outfall discharge monitoring as described in Sections 3.5.a and 3.5.b. Those outfalls determined to have persistently flowing conditions must be prioritized according to the highest water quality conditions in the WQIP. According to Provision D.2.b.(2)(b), the Port must identify a minimum of five highest priority major MS4 outfalls with persistent flows. These five MS4 outfalls will be monitored twice (semi-annually) during each monitoring year. During each semi-annual monitoring event, the Port will sample the persistent flow and record the following parameters:

- pH
- Temperature
- Specific Conductivity
- Dissolved Oxygen
- Turbidity

In addition to the parameters above, the Port will collect samples for analysis where flow is present. Grab samples may be either measured in the field or transported under a chain of custody for analysis at a state certified laboratory. Samples will be collected and analyzed for the following constituents:

- Constituents contributing to the highest priority water quality conditions identified in the WQIP and/or those analytes determined to be a cause of impairments identified on the 303(d) List;
- Constituents included in implementation or load reduction plans developed for watersheds where the Port is listed as a responsible party under the TMDL;

- Applicable NAL constituents;
- Constituents listed in Provision D.2.b.(2)(e) identified in Table 3-4 unless there is existing data to justify their exclusion.

Table 3-4. Analytical Monitoring Constituents for Persistent Flow MS4 Outfall Discharges.

Conventionals, Nutrients	Metals (total and dissolved)	Indicator Bacteria	Pesticides
• Total dissolved solids • Total suspended solids • Total hardness • Total phosphorus • Orthophosphate • Nitrite[1] • Nitrate[1] • Total Nitrogen[3] • Total Kjedhal Nitrogen • Ammonia • MBAS[3]	• Cadmium • **Copper** • Chromium III[3] • Chromium VI[3] • Iron[3] • **Lead** • Manganese[3] • Nickel[3] • Selenium[3] • Silver[3] • **Zinc**	• **Total Coliform** • **Fecal Coliform[2]** • ***Enterococcus***	• Diazinon (OP)[3] • Chloropyrifos (OP)[3] • Malathion (OP)[3] • Bifenthrin (Pyrethroid)[3] • Cypermethrin (Pyrethroid)[3] • Chlordane[3] • PAHs[3] • PCBs[3]

[1] Nitrite and nitrate may be combined and reported as nitrite+nitrate
[2] E. Coli may be substituted for fecal coliform
[3] Analytes added to the San Diego Bay WMA MS4 Outfall monitoring analyte list in FY 2018 in response to 2014 Water Quality Assessment and 303(d) List Update, approved by State Board in October 2017.
Items in bold type are WQIP priority pollutants

Monitoring of persistent flowing drains will occur semi-annually until one of the conditions below is met:

- The discharge is eliminated for three consecutive monitoring events;
- The constituents in the persistent flow do not exceed NALs and can be reprioritized to a lower priority;
- The source of the persistent flow has been identified as a non-stormwater discharge authorized by a separate NPDES permit.

The Port will document those outfalls which are removed or reprioritized in the WQIP Annual Report. As an outfall is removed from the list of five highest priority outfalls, it will be replaced with the next highest prioritized outfall within its jurisdiction until there are no remaining prioritized outfalls.

3.6 Investigation and Elimination of Illicit Discharges and Connections

As part of its IDDE program strategy, the Port has developed procedures for notification, prioritization investigation, and follow-up criteria to adequately respond to and eliminate illicit discharges which occur within its jurisdiction. These mechanisms ensure consistency during potential discharge, spill, and investigation responses. Port staff have been trained in illicit discharge identification, BMP implementation, and water sampling protocols. The investigators are trained to understand which discharges are prohibited and the types of enforcement available to stop the discharges. During a complaint investigation, Port investigators will be prepared to search for sources, conduct field screening analyses, sample for laboratory analyses, and properly document the discharge for any future enforcement. The sections below identify the process and mechanisms available to Port staff for conducting investigations.

3.6.1 Notification and Prioritization of Discharges

The Permit requires the Port to respond to and prioritize notifications of non-stormwater discharges. Non-stormwater discharges may be observed by Port staff during daily operations, detected during monitoring, or received through citizen complaints through either the Regional or Port hotlines or from the local water agencies, as discussed in Section 3.4.2. Harbor Police may also receive calls or observe discharges while patrolling the Bay. Harbor Police work closely with EP and other agencies reporting stormwater problems. Officers have been trained in the identification of discharges and how to report discharges from the MS4. All suspected discharges are reported to EP using the appropriate Harbor Police reports. The reports often contain detailed information concerning the type of pollutant discharged, its source, and if known, the responsible party. All of these reporting mechanisms aim to accumulate information regarding the nature of the discharge, its location, and a potential source.

All incoming complaints are recorded into the Port's electronic stormwater database. The database includes an ICID section. In the ICID section, all incoming complaints are tracked by filling out an incoming compliant form where initial complaint information is logged. The information is used to initiate the appropriate complaint response and investigation. All incoming calls that are determined to require an investigation from the initial assessment are routed to investigative staff.

Responding to spills, discharges, and incoming complaints is an essential part of the Port's IDDE program. Port staff makes an effort to respond to all incoming complaints promptly. However, certain types of discharges warrant immediate response due to the threat it may pose to environmental and public health or the ability to eliminate or contain the discharge before it reaches the MS4 or receiving waters. Once an incident has been reported that warrants further analysis, the investigation process will begin. Discharges considered to be the highest priority include on-going discharges, discharges that are directly entering or have entered the Bay, sewage spills, and those discharges which may contribute to the highest or focused priority conditions identified in the WQIP.

Ongoing Discharges

Discharges or spills that are currently occurring have the best likelihood of an effective cleanup if immediate action is taken. Ongoing discharges require immediate action to quickly stop the spill, detect and eliminate the pollutant source, and potentially reduce the amount of the discharge which may reach the MS4 or receiving waters. As with other ongoing discharges, irrigation runoff will be eliminated promptly and the cause for the discharge (i.e., overspray, damaged irrigation systems, etc.) will be identified and addressed. Attempts will be made to immediately investigate and eliminate these discharges.

Spills Directly into the Bay

Spills that enter the bay can cause the most damage because they directly affect the receiving water. These spills require immediate action to stop the spill and may require additional protective measures (booms, absorbent materials, etc.) be put in place while the cleanup is ongoing. Attempts will be made to immediately investigate and eliminate these discharges.

Sewage Spills

If a reported spill is thought to be (or reported to be) sewage, investigation procedures will confirm that the reported spill is indeed sewage. All sewage spills are both an environmental and public health threat and require immediate investigations. If there is any sewage odor or any presence of solids in the discharge, Port investigators will immediately notify San Diego County Department of Environmental Health and the Regional Board.

High Priority Pollutants

The Port has identified metals, bacteria, and trash as its highest and focused water quality priorities in the WQIP. These conditions have been identified in specific locations within the hydrologic sub-areas of 908.22, 909.1, 910.1, and 910.2. In addition, there are a number of locations around the Bay which are identified on the 303(d) List for bacteria and metals. Complaints received by the Port which may involve these pollutants will be addressed immediately.

Other Discharges

Other reported discharges that have not entered the MS4 or receiving waters and do not pose an immediate threat to environmental or public health will be investigated as soon as possible to avoid environmental impacts.

3.6.2 Investigation Procedures

Reports of illicit discharges will be investigated and eliminated. This section identifies the process Port staff uses to investigate complaints. As described in Section 3.6.1, the Port has an SOP for determining when investigations are required. Once it is determined that an investigation is warranted, the Port attempts to investigate the incident(s) promptly using the following procedures.

Upon arrival at the site, the investigator will evaluate whether the report is valid (e.g., an illicit discharge actually occurred). There may be instances when the complaint assessment will result in an investigation, yet the investigator determines that there has been no illicit discharge or prohibited activity occurring. In these cases, the investigator will document that the complaint was unjustified. No further action by Port staff will be required once the investigation has been determined to be unjustified.

As discussed in Section 3.4.5, portions of the MS4 may emanate upstream and pass through the Port's jurisdiction before emptying into San Diego Bay. If an investigation determines that the probable source of an illicit discharge originates from a source outside of the Port's jurisdiction, the incident will be directed to another jurisdiction to investigate and enforce. Port staff will share all relevant information pertaining to the initial investigation with other jurisdictions, as necessary. These incidents will be documented as being referred to another jurisdiction for response.

If the investigation reveals that an illicit discharge does exist, the Port investigator will determine the nature and extent of the discharge. To aid in the investigation, there are a number of tools available for Port staff. The following tools may be used, as necessary.

<u>MS4 Map</u>

As previously discussed, the Permit requires each jurisdiction to develop or update a map of its entire MS4 and drainage areas. The Port has included updated MS4 maps within this document (Appendix F). The MS4 maps allow Port staff to identify all storm drain lines affected by a discharge and recognize potential sources of pollutants. The MS4 maps include the hydrologic unit and sub-area boundaries with information pertaining to the highest water quality priorities identified in the WQIP and impaired waterbodies identified on the 303(d) List. This data can be accessed by Port staff via laptop computers, tablets, or paper maps and is an integral aspect of prioritizing and responding to complaints.

<u>Stormwater database</u>

Investigators have access to the Port's stormwater database which can be retrieved remotely while in the field. The database provides investigators with location-specific information regarding Port or tenant contacts, pollutant generating activities, stormwater inspection results, investigations of non-stormwater discharges, and enforcement history. This detailed information may help an investigator understand the types of facilities and operations in the vicinity of a non-stormwater discharge. In addition, access to reports and photos of similar incidents may also help determine potential sources or repeat offenses. Further information pertaining to the Port's procedures for record keeping and reporting are described in Section 3.6.5 below.

Samples/Sampling

In the cases where the incoming complaint report cannot identify a source and/or there is no identifiable point source, field screening analyses and/or sample collection for laboratory analyses may help narrow the search for the source of the discharge. Field screening provides an onsite tool for quickly evaluating the discharge. The Port's Field Sampling Manual will accompany every investigator when they begin an investigation. Information such as field preparation and mobilization, sampling, data recording, and QA/QC procedures are all included in detail in this manual.

Depending on the field screening results, laboratory analyses may be needed. Analytes for laboratory sampling will be selected based on the initial field screening results, known sources within the drainage area, or past information and observations. Sampling will be conducted according to applicable evidence and sampling protocols. Sample collection will be documented on the investigation form and will include chain-of-custody transfer records. The Field Sampling Manual provides detailed descriptions of how to conduct field sampling, laboratory sample collection, and a list of analytes that may be sampled for during an investigation. Additional tests such as dye testing, smoke testing, or video inspections may be used if sampling still does not determine a source.

As noted in Section 3.6.1, the Harbor Police may also investigate complaint calls or observe discharges themselves. The Harbor Police will initiate the investigation process and will either 1) complete the investigation and close the case or 2) refer the case to EP staff. In cases where Harbor Police conducts and closes an investigation, the case information and any action taken, if necessary, are included in the detailed Harbor Police reports provided to EP staff. However, EP staff does not conduct additional investigation efforts as the cases are deemed closed.

3.6.3 Source Identification

Once the nature and extent of a non-stormwater discharge has been determined, the investigator will complete the proper documentation, attempt to identify the source and responsible party, and eliminate the discharge. In cases where the source of the discharge has been identified, such as cases involving irrigation runoff, the Port investigator will require the source of the illegal discharge to be eliminated immediately. In addition, if the source is identified, Port staff will assess the status of BMP implementation performed by the responsible party to prevent the discharge. If the investigation reveals the presence of a non-stormwater discharge that does not reach the MS4 or the receiving water and is properly contained and/or cleaned by the responsible party, Port staff may resolve the issue without the need for enforcement. Port staff will provide education regarding pollution prevention and spill response and document the incident in the Port's stormwater database.

If the discharge has reached the MS4 and/or receiving water, Port staff will determine the level of enforcement necessary to properly resolve the incident. The level of enforcement will be determined based on a number of factors including BMP implementation and the willingness of the responsible party to address the issue. The Port's enforcement procedures are outlined in Appendix C of this JRMP. The Port will educate the responsible party as to why the illicit connection or discharge, such as irrigation runoff, is illegal and will then inform them of their legal requirement to remove the connection, stop the discharge, or conduct appropriate clean-up within an allotted time period. Any directives and enforcement given to a responsible party will be documented on the inspection form and/or field citation if necessary and may require a follow-up inspection at a later time/date. Recommendations or requirements are expected to be fulfilled by the responsible party within a specified timeframe directed by the Port.

There will be times, however, when the investigator cannot determine the source or responsible party. If the responsible party cannot be determined, the incident will be documented as such. The incident will be evaluated to understand whether the discharge is persistent or transient[9]. For discharges found to be persistent, the Port will prioritize its elimination in accordance with the highest and focused priority water quality conditions in the WQIP as described in Section 3.6.1. For discharges determined to be transient, the Port investigator will coordinate cleanup efforts with other Port departments and/or initiate further source identification investigations, where applicable.

External Reporting

When a Port investigator determines that the situation poses an immediate and severe risk to public health or the environment, there may be a need to coordinate with other agencies or teams that are specially trained to assess and mitigate emergency situations (i.e. HazMat teams, United States Coast Guard, Fire Department, etc.). Investigators will contact these agencies as soon as they determine the severity of the situation. There may be times when a discharge is identified as occurring upstream and flowing through tidelands property. If it is determined that an illegal discharge has originated in another jurisdiction, the appropriate agencies will be notified as to their responsibility. Every investigator will take a list of emergency contacts and neighboring jurisdiction stormwater contact numbers into the field during each investigation. Table 3-5 identifies the reporting requirements for spills relating to sewage and other pollution. Port investigators will also follow the listed reporting procedures when reporting leaking private laterals as well as large sewage spills into the receiving water.

[9] Persistent flows are defined by the Permit as the presence of flowing, pooled, or ponded water more than 72 hours following a measureable rainfall event of 0.1 inch or greater during three consecutive monitoring and/or inspection events. All other flowing, pooled, or ponded water is considered transient.

Table 3-5. External Agency Reporting Requirements.

Agency Name	Contact Information	Reporting Requirement
San Diego Regional Water Quality Control Board	2375 Northside Drive, Ste. 100 San Diego, CA 92108-2700 (619)516-1990	Must be notified by telephone within 24 hours of an illicit discharge involving a discharge of sewage or other pollutants which endanger health or the environment. A written statement must be provided within 5 business days.
County of San Diego Department of Env. Health	1255 Imperial Ave. San Diego, CA 92101 (619) 338-2222 (800) 253-9933	Must be notified within 24 hours by telephone of a discharge involving a discharge of sewage or other pollutants which contain high levels of bacteria.
State Office of Emergency Services	3650 Schriever Ave. Mather, CA 95655 (800) 852-7550	Must be notified immediately by telephone of a discharge involving a discharge of over 1000 gallons of sewage.

3.6.4 Follow-up Investigations

Follow-up inspections may be required to verify that an illicit discharge has stopped and/or corrective actions required of a responsible party have eliminated the activity, such as over-irrigation, and potential to discharge. Follow-up inspections may require all or some of the investigation procedures discussed above. Follow-up measures may occur at either the end of the initial investigation or as a separate return visit depending on the intensity of requirements placed upon the responsible party. Documentation and photos will be included as part of the follow-up inspection to confirm the corrective action is effective. If the discharge continues, has not been cleaned properly, or the proper BMPs are not implemented, elevated enforcement measures may be necessary.

A follow-up inspection may also be initiated by the exceedance of Numeric Action Levels and/or Water Quality Objectives. In the case of an exceedance of these action levels, Port staff will conduct a follow-up inspection within two business days of receipt of the results. The purpose of such an inspection will be to identify a potential source and work toward eliminating the discharge. Table 3-6 presents criteria to determine whether an illicit discharge requires a follow-up inspection. One or more of the criteria may be met to indicate whether or not a follow-up inspection must occur.

Table 3-6. Port Investigation Follow-Up Actions.

Action	Criteria
No Follow-up Inspection Required	No traces of an illicit discharge upon inspection.
	Illicit discharge has stopped. Effective BMPs have been instituted to control and/or clean discharge.
	Water samples have been collected and results do not exceed Numeric Action Levels and/or Water Quality Objectives.
	Discharge originates from another jurisdiction's MS4
Follow-up Inspection Required	Discharge remains on-going
	Effective BMPs have not been instituted to control or clean discharge.
	Samples have been collected and results exceed Numeric Action Levels and/or Water Quality Objectives.

3.6.5 Record Keeping and Reporting

Information pertaining to complaints of illicit discharges and investigations, including follow-up investigations, will be documented and stored in the Port's stormwater database. The stormwater database is designed to establish a relationship between the initial complaint, the investigation, and any follow-up investigations so that an incident can be tracked from the time of notification through its resolution. In accordance with the Permit, the following information will be tracked and stored:

- Location of incident, including hydrologic subarea, portion of MS4 receiving the discharge, and the point of potential discharge with the receiving water;

- Date and source of information initiating the investigation;
- Dates of investigations and follow-up investigations, as necessary;
- Responsible party, if determined;
- Source of the illicit discharge, if determined;
- Known or suspected related incidents, if any;
- Results and enforcement used to resolve the incident;
- Date discharge was eliminated, if determined.

Related information used during the investigation including photos, correspondence, and sample results will be stored with each investigation, as necessary. A summary of illicit discharges investigated and eliminated within the Port's jurisdiction will be submitted with the JRMP and WQIP annual reports.

3.7 Enforcement

Permit Provision E.6 requires the Port to enforce its legal authority to eliminate illicit discharges as necessary to achieve the requirements of the Permit. Enforcement of non-stormwater discharges, such as from over-irrigation, is completed through the IDDE program. Although this is not an exhaustive list, the Port has identified several general scenarios in which enforcement would be required as part of the IDDE program. These include ICID investigations where the Port has determined that:

- Incident involves a spill, irrigation runoff, or release of pollutants from a known source originating on tidelands which has the ability to enter the MS4 and/or threaten receiving water quality;
- Incident involves an unpermitted non-stormwater discharge from a known source originating on tidelands;
- Incident involves a spill or release of pollutants from a known source originating off tidelands.

Where enforcement is required to maintain compliance, the Port will use its enforcement authority established by Article 10. Article 10 of the Port Code enables the Port, including Port inspectors, to prohibit discharges and require BMPs so that discharges on tidelands do not cause or contribute to water quality problems. Article 10, found in Appendix B, establishes enforcement procedures to ensure that responsible dischargers are held accountable for their contributions and/or flows. Enforcement mechanisms applicable to the IDDE Program include both administrative and judicial authorities and are reported annually.

The Port's Enforcement Response Plan ERP, (Appendix C) provides detail on the Port's enforcement authorities and process for the IDDE program. The ERP also identifies escalated enforcement actions and the procedure for reporting non-compliant sites to the Regional Board.

Chapter 4 Development Planning

4.1 Introduction

Provision E.3 of the Municipal Permit requires that the Port use its land use planning authorities as necessary to minimize the short and long-term impacts of development activities on receiving water quality. The Permit also requires the Port to implement a Development Planning program in accordance with strategies outlined in the San Diego Bay Watershed WQIP in addition to meeting core permit requirements. The core permit requirements for development planning include ensuring the implementation of minimum BMPs for all development projects[1] and ensuring structural treatment control BMPs as required for Priority Development Projects (PDPs). For PDPs, the Permit requires verification that those structural treatment control BMPs meet performance requirements. The core permit requirements also include the implementation of a Hydromodification Management Plan (HMP) and an updated Port BMP Design Manual that identifies BMP requirements for both "Standard Projects" and PDPs[2].

This Chapter describes how the Port will meet the Permit conditions outlined in Provision E.3 and Provision F.2 for the Development Planning and BMP Design Manual Updates, respectively. Table 4-1 indicates where specific permit conditions are incorporated into the Port's JRMP.

Table 4-1. Development Planning Permit Requirements and Corresponding JRMP section.

Permit Requirement	Permit Reference	JRMP Section
BMP Requirements for All Development Projects	E.3.a	4.5
Priority Development Projects	E.3.b	4.5.2
Priority Development Project Structural BMP Performance Requirements	E.3.c	4.6
BMP Design Manual Updates	E.3.d, F.2.b	4.4
Priority Development Project BMP Implementation and Oversight	E.3.e	4.7
Development Project Enforcement	E.3.f	4.8

4.2 WQIP Strategies for Development Planning

To assist in meeting water quality goals identified in the WQIP, the Port identified several strategies that will be incorporated into the development planning process. These strategies include core jurisdictional programs that meet baseline permit requirements and optional strategies that are program

[1] Development projects means construction, rehabilitation, redevelopment, or reconstruction of any public or private projects.
[2] As outlined in the manual, Standard Projects include requirements for source control and site design BMPs only, while PDPs include additional requirements for stormwater pollutant control and hydromodification management BMPs, as appropriate.

enhancements or focused efforts. Core program strategies will be implemented throughout the permit term while the optional strategies have varied schedules for implementation.

Table 4-2 below summarizes strategies from the WQIP that are included in the development planning process. The table identifies strategies that have been or are anticipated to be incorporated into the Port's JRMP program and references where in the JRMP the strategy is utilized. The table and the JRMP document will be updated as new strategies are incorporated in future years. A more detailed description of all the strategies is included in Appendix A.

Table 4-2. Development Planning Strategies.

SDB ID	Strategy Name	Implementation Year	JRMP Chapter Section
PO-1	Implement Core JRMP Program for all development projects that includes source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area, where applicable and feasible.	FY-16	Ch. 4
PO-2	For PDPs, administer a program requiring implementation of structural BMPs to control pollutants and manage hydromodification. Includes confirmation of design, construction, and maintenance of PDP structural BMPs.	FY-16	4.3.3, 4.6.2
PO-3	Train all applicable departments annually on storm-water requirements for all development projects.	FY-15	4.7.1
PO-4	Conduct project closeout inspection for all development projects to verify that Trash, Metals, and Bacteria BMPs are properly implemented.	FY-16	4.4
PO-5	Provide technical education and outreach to the development community on the design and implementation of the MS4 permit and WQIP requirements.	FY-16	4.7.1, Ch. 9
PO-19*	Require install shutoff irrigation sensors (e.g., Cal-Sense) for MM/CIP development projects. [CAP Water Conservation Measure (WC 1.3)][1]	FY-17	4.5.1
PO-42*	Develop an alternative compliance program framework that provides options for PDPs	FY16	4.6.3
PO-43*	Implement an alternative compliance program providing options for PDPs	FY21	4.6.3
PO-47*	Installation of inlet inserts in storm drains in high priority areas	FY-18	N/A

*These strategies were classified as optional strategies and require a trigger to be implemented.

4.3 Development Project Approval Process

The approval process for development on Port tidelands differs significantly from its member cities and the regional Copermittees. The Port reviews all development against the Port Master Plan and CEQA and Coastal Act regulations. Although the Port issues CEQA and Coastal Determinations, the Port defers the issuance of applicable building or grading permits to the member cities. Due to the absence of this permitting function, the Port has built other mechanisms into the review, approval, and verification process to ensure pertinent stormwater project components are reviewed in a consistent manner and appropriate conditions for approval are established.

A key function of the Port's development project approval process is determining whether a project is a standard project, Green Street, or a PDP[3]. Standard projects have source control and low impact development BMP requirements. PDPs and Green Street projects have additional structural control BMP requirements. As such, it is important that those requirements are identified early in the planning process.

4.3.1 Port Master Plan and Coastal Development Permits

Initially adopted by the Board of Port Commissioners in 1964, the Port Master Plan (PMP) was developed in response to the 1962 San Diego Unified Port District Act. This act provided for the creation of the Port and contained the provision that "the board (Board of Port Commissioners) draft a master plan for harbor and port improvement and for the use of all tidelands and submerged lands", which are conveyed to the Port. The PMP also serves a dual purpose acting concurrently as the local coastal program for the Port as directed by the Coastal Act of 1976, and as certified by the California Coastal Commission (CCC) in 1981.

The PMP provides the official planning policies for the physical development of the tidelands conveyed and granted in trust to the Port. The policies are expressed in written form and graphically on official maps. The PMP relates directly to its status as an official statement of the public policy adopted by the Board of Port Commissioners. Among other things, it serves as a guide for policy decisions, as the basis for protecting existing development, for capital improvement programming, and as a source of information.

The PMP is submitted to the CCC for review and certification in conformance with the Coastal Act. Upon PMP certification, either in whole or in part, coastal development permit authority for projects occurring within the Port's jurisdiction resides with the Board of Port Commissioners. Contained within the coastal development permits are conditions of project approval; including applicable water quality protection measures. For those portions of the PMP not certified, the uncertified areas remain under the permit authority of the CCC.

Section II of the PMP contains 14 Planning Goals which are used as the basis for the creation and implementation of Port's policies. Five of those goals are relevant to water quality and watershed protection policies and principles and are listed in Table 4-3.

[3] Refer to the Port BMP Design Manual for definitions. Green Street projects require structural treatment, similar to PDPs, but greater flexibility in BMP selection is provided since these projects generally occur in constrained settings. Some projects may also qualify for the Walkways Exemption, which does not require structural BMPs and is generally similar to the requirements for standard projects.

Table 4-3. Port Master Plan Goals with Relevance to Water Quality.

VI -	The Port will integrate the Tidelands into a functional regional transportation network. ▪ Improved automobile linkages, parking programs and facilities, so as to minimize the use of waterfront for parking purposes.
VIII -	The Port will enhance and maintain the Bay and Tidelands as an attractive physical and biological entity. ▪ Each activity, development*, and construction should be designed to best facilitate its particular function, which function should be integrated with and related to the site and surroundings of that activity. ▪ Establish guidelines and standards facilitating the retention and development of an aesthetically pleasing tideland environment free of noxious odors, excessive noise, and hazards to the health and welfare of the people of California.
X -	The quality of water in San Diego Bay will be maintained at such a level as will permit human water contact activities. ▪ Maintain a program of flotsam and debris cleanup. ▪ Insure through lease agreements that Port tenants do not contribute to water pollution. ▪ Cooperate with the Regional Board, the County Health Department, and other public agencies in a continual program of monitoring water quality and identifying source of any pollutant. ▪ Adopt ordinances and take other legal and remedial action to eliminate sources of pollution.
XI -	The Port will protect, preserve, and enhance natural resources, including natural plant and animal life in the Bay as a desirable amenity, an ecological necessity, and a valuable and usable resource. ▪ Promote and advance public knowledge of natural resources through environmental educational materials. ▪ Identify existing and potential assets. ▪ Keep appraised of the growing body of knowledge on ecological balance and interrelationships. ▪ Administer the natural resources so that impacts upon natural resource values remain compatible with the preservation requirements of the public trust.
XIII -	The Port will maintain its Master Plan current, relevant, and workable, in tune with circumstances, technology, and interest of the people of California. ▪ Curb the misuse of land so that it will not injuriously affect the people of the State of California through the prevention of substandard construction or unnecessarily add inappropriate developments. ▪ Prevent the abuse of land by curtailing abortive development and unfounded pollution contributors. ▪ Regulate the non-use or disuse of land by clearing unmarketable titles, withholding land from premature development, and restraining activities that would lead to discontinued use. ▪ Guide the reuse of land for more appropriate purposes by the clearance and redevelopment of the obsolete.

Source: 2012 Port Master Plan

**Under the California Coastal Act, "development" means: on land, in or under water, the placement or erection of any solid material or structure; discharge or disposal of any dredged material or of any gaseous, liquid, solid, or thermal waste; grading, removing, dredging, mining, or extraction of any materials; change in the density or intensity of use of land, change in the intensity of use of water, or of access thereto; construction, reconstruction, demolition, or alteration of the size of any structure, including any facility of any private, public, or municipal utility. As used in this section, "structure" includes, but is not limited to, any building, road, pipe, flume, conduit, siphon, aqueduct, telephone line, and electrical power transmission and distribution line (California Public Resources Code §30106).*

4.3.2 Environmental Review: California Environmental Quality Act (CEQA) and CEQA Determinations

Environmental review involves the evaluation of a project against CEQA regulations. CEQA applies to “discretionary” government action. This may involve activities directly undertaken by the Port, activities financed in whole or part by the Port, or private activities that require approval by the Port. A discretionary project requires the Port to use its judgment in deciding whether to approve or disapprove a project. If the project will be approved, the Port then must decide how it will be approved. Where the law requires a governmental agency to act on a project in a set way without allowing the agency to use its own judgment, the project is “ministerial” and CEQA does not apply.

The Port will comply with CEQA as set forth in the Port CEQA Guidelines whenever the Port proposes to carry out, or approve, an activity. CEQA review, preparation, and certification of appropriate documentation occur prior to granting an approval of private projects or authorization of public projects. Environmental Impact Reports and Negative Declarations are prepared as early as possible in the planning process to enable environmental considerations to influence project program and design, yet late enough to provide meaningful information for environmental assessment.

The Port’s Initial Study is a tool used in the preliminary project review to determine if a proposed project may result in significant effects on the environment. Using questions in the Initial Study (Table 4-4), the Port is able to identify potential impacts to the environment including impacts to water quality.

Table 4-4. Port Initial Study Questions with Relevance to Water Quality.

PORT INITIAL STUDY QUESTIONS
BIOLOGICAL RESOURCES -- Would the project:
a) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?
HYDROLOGY AND WATER QUALITY -- Would the project:
a) Violate any water quality standards or waste discharge requirements?
b) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river in a manner which would result in substantial erosion or siltation on- or off-site?
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?
d) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?
e) Otherwise substantially degrade water quality?
UTILITIES AND SERVICE SYSTEMS -- Would the project:
a) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?
MANDATORY FINDINGS OF SIGNIFICANCE -- Does the project:
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?
b) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

4.3.3 Project Approval Process

Integrated WQIP Strategy: PO-1, PO-2

Pursuant to the Municipal Permit, the Port is required to implement a Development Planning program in accordance with WQIP strategies including BMP requirements for all development projects, identifying applicable project type and requirements, evaluating structural BMP performance and oversight for PDPs. The Port meets this permit requirement by way of its development planning approval process both for capital development and tenant improvement projects. Development on Port tidelands happens either by tenants of the Port making improvements to leaseholds (hereafter referred to as “tenant projects”), or by the Port through its capital development and major maintenance projects (hereafter referred to as “capital projects”). In both cases, the project applicant must provide sufficient documentation to demonstrate that applicable requirements of the Port BMP Design Manual and the Municipal Permit will be met. Both tenant and capital projects that fall under the routine maintenance category will be tracked and reported by the Port.

Development planning projects on Port tidelands may be initiated by a Port tenant/developer making improvements or conducting maintenance on a leasehold or by the Port sponsoring major maintenance or capital improvement projects. Though the approval process may differ slightly between the two, the review of stormwater requirements is the same. Included in the application for a development project and pursuant to WQIP strategy PO-2, the Port requires that a Stormwater Requirements Applicability Checklist be completed by project applicants to determine what permanent and/or construction BMP requirements are necessary for the project. The checklist is available as one of two templates, differing slightly between tenant project and capital project. Port staff references the completed checklist to categorize the project and determine what stormwater quality requirements apply to the project. The project approval process for Tenant projects and Capital projects is described below.

Tenant Projects

Prior to any Port tenant or developer-improvement project, Port staff addresses pre-application questions and comments regarding the application process through a preliminary project review. Possible project requirements and considerations for the project are identified with the intent to generate a complete and comprehensive submittal. This pre-application step supports an efficient and effective approval process by addressing project scope and intent parallel with Port and permit requirements prior to a formal submittal.

The project review and approval process officially start with the tenant's submittal of a Tenant Project Application form to the Port. The application must be accompanied by plans and specifications indicating the nature and extent of the proposed work. The project application must clearly describe the scope of work for the proposed new construction, reconstruction, modification, or demolition project and include a completed tenant project Stormwater Requirements Applicability Checklist. This checklist summarizes the project's scope of work specific to stormwater management and identifies all required submittal components. Port staff reviews the application for completeness and determines the project's scope of work, level of environmental review required, project cost, and other parameters. If submittals are incomplete or do not clearly identify the scope of work, the application is returned to the applicant for additional information.

Once the Tenant Project Application is deemed complete, the project is forwarded to the appropriate departments for review. Referencing the information provided in the Stormwater Requirements Applicability checklist, Port staff verifies the project type and corresponding stormwater requirements. The project applicant is responsible for providing documentation that the project qualifies as routine maintenance and satisfies all criteria listed in Section 1.3.1 of the BMP Design Manual. In accordance with the project scope of work, the applicant must submit a Storm Water Quality Management Plan (SWQMP) accurately describing how the project will meet applicable stormwater requirements. Port staff facilitates a technical review of the SWQMP document and drainage design plans as applicable, to ensure that structural BMP requirements are met. The SWQMP is evaluated for compliance with the Municipal Permit and with design criteria outlined in the Port's BMP Design Manual.

Upon completion of the SWQMP review, Port staff will issue a review memo indicating if the plan has been approved or rejected. If the plan submittal is not approved, Port staff will issue a review memo identifying all outstanding issues that need to be addressed. The applicant is to revise and resubmit the non-approved SWQMP for review and approval.

Following successful review of the entire project submittal, the project is authorized to proceed in the form of a Project Review and Approval letter. The letter identifies project specific stormwater conditions in addition to standard conditions that apply to all proposed development projects. The approval of a Port tenant project becomes part of the lease or part of a use permit. For discretionary projects, any mitigation measures required by the environmental review process, such as implementation and maintenance of stormwater BMPs, also become part of the lease or use permit.

Once the approval process is complete, the project is able to commence and routine inspections will be conducted throughout the duration of the project construction. Upon completion of construction activities, Port staff conducts close-out inspections to verify all project conditions of approval have been met. Close-out inspections for PDPs and Green Street projects include an inspection of all project structural BMPs to ensure accurate installation and implementation per the approved SWQMP. The close-out process for projects with structural BMPs also includes completion of a "Closeout Verification Form" prior to granting occupancy or final approval. The form must be filled out by a Professional Engineer and typically, the engineer of record for the project. Construction phase requirements are identified in Chapter 5 – Construction.

Capital Projects

Capital projects (comparable to public works projects undertaken by a municipality) are evaluated, designed, and approved in accordance with the same environmental permitting standards that are applied to any development on Port tidelands. All capital projects begin with a pre-application "charter meeting" to discuss preliminary project design, likely submittal requirements, and considerations for the project. Staff representatives from multiple Port departments including EP, Engineering-Construction, and Procurement attend the charter meeting to provide input as needed.

Following the project charter meeting, the capital project review process is initiated when the Port's Engineering-Construction Department submits a Project Preliminary Environmental Review and Coastal Development Permit Application Memorandum to the Port's EP Department. The Memorandum outlines project scope of work and defines total development square footage and other relevant information. Included in the submittal is a capital project Stormwater Requirements Applicability Checklist that summarizes the scope of work specific to stormwater management and identifies any and all applicable stormwater submittals. The project manager is responsible for providing documentation that the project qualifies as routine maintenance and satisfies all criteria listed in Section 1.3.1 of the BMP Design Manual. The checklist is reviewed by Port staff for CEQA and Coastal Act processing and to assess stormwater requirements. Referencing the Stormwater Requirements Applicability Checklist, Port staff determines the project type and applicable stormwater requirements.

For PDPs and Green Street projects, Port EP staff complete a review process comparing the SWQMP document with the final design plans to ensure that structural BMP treatment control requirements are met and the project is in compliance with the Municipal Permit and conforms to the Port's BMP Design Manual. Following the review, the Port's EP Department issues an approval memo if the SWQMP is deemed thorough and complete. The Port's approval process for capital projects ensures that any and all structural BMP treatment control requirements are incorporated into the project design and shown on the plans prior to bidding for construction contracts or completion of construction work by Port staff.

Upon approval of a capital project submittal, construction activities may commence. Like tenant projects, capital projects include routine inspections conducted throughout the duration of the project's construction phase. Once the construction phase is complete, Port staff conducts close-out inspections to verify all project conditions of approval have been met. Close-out inspections for PDPs and Green Street projects include verification that structural BMPs described in the SWQMP have been installed and implemented correctly. The close-out process also includes completion of a "Closeout Verification Form" prior to granting occupancy. The form must be filled out by a Professional Engineer and typically, the engineer of record for the project. Construction phase requirements are identified in Chapter 5 – Construction Management.

4.3.4 SWQMP Review

The Port requires any development project applicant to submit a SWQMP with sufficient documentation to demonstrate that applicable requirements of the Port BMP Design Manual and the Municipal Permit will be met. SWQMP submittals for Standard Projects consist of a series of checklist templates verifying that source control and site design BMPs have been considered and have been implemented where feasible in the project. SWQMP submittals for PDPs and Green Street projects include additional information supporting the selection of permanent structural BMPs, as appropriate.

If the SWQMP is deemed thorough and complete, EP issues an approval memo. If the SWQMP is deemed incomplete or inadequate, the submittal is returned with a review memo identifying outstanding items that require addressing prior to approval and resubmittal. For PDPs and Green Street projects, if the drainage and/or structural BMP design is changed after the approval process, an amendment to the SWQMP is required and must be submitted to the Port for review and approval. EP will facilitate a secondary review of the amended SWQMP to ensure the project drainage and stormwater management design remains in compliance with the Municipal Permit. The process for review of an amended SWQMP is identical to that of the original submittal.

4.4 BMP Design Manual

Integrated WQIP Strategy: PO-1

The previous municipal permits (Order Nos. 2001-01 and 2007-0001) required the development and implementation of a Standard Urban Stormwater Management Program (SUSMP) to address urban runoff pollution issues in new development and redevelopment projects. As directed under the current Municipal Permit, the Port SUSMP has been replaced with a BMP Design Manual.

Pursuant to the Permit, the Port began implementing the BMP Design Manual February 16, 2016. The BMP Design Manual provides updated procedures for planning, selecting, and designing permanent structural stormwater BMPs based on specific performance standards outlined in the Permit. The Port's BMP Design Manual is consistent with the Model BMP Design Manual that was developed collectively with the other San Diego County jurisdictions. The Port BMP Design Manual identifies updated post-construction stormwater requirements for both tenant and Port-sponsored major maintenance or capital improvement projects as required by the Municipal Permit.

The BMP Design Manual identifies BMP requirements applicable to each project type as outlined in the Permit. All new development and redevelopment projects are required to implement standard source control and site design BMPs to eliminate or reduce stormwater runoff pollutants. Additionally, the BMP Design Manual includes enhancements to address the Port's priority pollutants for both types of development projects that are determined to have a high potential to generate trash, metals, and bacteria. For PDPs and Green Street projects, the BMP Design Manual also describes structural treatment controls that must be incorporated into the site design and, where applicable, address potential hydromodification impacts from changes in flow and sediment supply.

The BMP Design Manual provides guidance on implementing source control and site design requirements for all development projects. For PDPs, the manual outlines methods to implement pollutant control requirements and hydromodification management requirements, as applicable. Specific performance standards associated with each requirement are described in the manual and step-by-step guidance is outlined for the preparation of a project-specific stormwater management plan submittal.

The Municipal Permit also requires the Port to include hydromodification requirements in its BMP Design Manual. The Port is implementing an HMP in order to manage increases in runoff discharge rates and durations from all PDPs. The HMP manages runoff where increased rates and durations are likely to cause increased erosion of channel beds and banks, sediment pollutant generation, or other impacts to beneficial uses and stream habitat due to increased erosive force. The HMP requires post-project runoff discharge rates and durations to not exceed estimated pre-project discharge rates and durations. This is applicable when the increased discharge rates and durations will result in increased potential for erosion or other significant adverse impacts to beneficial uses that are attributable to changes in the discharge rates and durations.

In the fall of 2017, the Port completed a Tidal Influence Study to assess the use of modular wetlands in tidally influenced areas and identify sizing criteria for BMPs that are tidally impacted. The study included running a continuous simulation model to look at BMP elevation, rainfall, and tidal conditions to determine BMP sizing and effectiveness. The study is included in the BMP Design Manual found in Appendix D.

4.5 BMP Requirements for Development Projects

Integrated WQIP Strategy: PO-2, PO-19

For all proposed development projects, the Port will prescribe BMP requirements during the project planning process and prior to project approval. In addition to construction phase BMPs (as identified in Chapter 5), all minimum BMP requirements and any applicable post-construction structural BMPs must be identified for each project prior to construction. For both tenant project applications and capital project applications, BMPs applicable to each project are identified when completing the respective Stormwater Requirements Applicability Checklist and are outlined in the project's SWQMP.

4.5.1 Minimum Best Management Practices Requirements

The Municipal Permit directs the Port to require the implementation of BMPs during the planning process for all development projects. General requirements for these BMPs include the following:

1. Onsite BMPs must be located so as to remove pollutants from runoff prior to its discharge to any receiving waters, and as close to the source as possible;
2. Structural BMPs must not be constructed within waters of the U.S; and
3. Onsite BMPs must be designed and implemented with measures to avoid the creation of nuisance or pollution associated with vectors (e.g. mosquitos, rodents, or flies).

Source control BMPs must be implemented at all development projects where applicable and feasible. Source control BMP requirements include the following:

1. Prevention of illicit discharges into the MS4;
2. Storm drain system stenciling or signage;
3. Protect outdoor material storage areas from rainfall, run-on, runoff, and wind dispersal;
4. Protect trash storage areas from rainfall, run-on, runoff, and wind dispersal;

5. Minimize potential to generate trash, metals and/or bacteria pollutants in runoff pursuant to WQIP PO-4 and in conformance with the BMP Design Manual;

6. Installation of shutoff irrigation sensors in new landscape areas included in Port sponsored capital projects (WQIP optional strategy PO-19);

7. Any additional BMPs determined to be necessary by the Port to minimize pollutant generation at each project.

Low Impact Development (LID) BMPs must be implemented at all development projects where applicable and feasible. LID BMP requirements include the following:

1. Maintenance or restoration of natural storage reservoirs and drainage corridors (including topographic depressions, areas of permeable soils, natural swales, and ephemeral and intermittent streams);

2. Buffer zones for natural water bodies (where buffer zones are technically infeasible, project applicant is required to include other buffers such as trees, access restrictions, etc.);

3. Conservation of natural areas within the project footprint including existing trees, other vegetation, and soils;

4. Construction of streets, sidewalks, or parking lot aisles to the minimum widths necessary, provided public safety is not compromised;

5. Minimization of the impervious footprint of the project;

6. Minimization of soil compaction to landscaped areas;

7. Disconnection of impervious surfaces through distributed pervious areas;

8. Landscaped or other pervious areas designed and constructed to effectively receive and infiltrate, retain and/or treat runoff from impervious areas, prior to discharging to the stormdrain ;

9. Small collection strategies located at, or as close as possible to, the source (i.e. the point where stormwater initially meets the ground) to minimize the transport of runoff and pollutants to the Municipal and receiving waters;

10. Use of permeable materials for projects with low traffic areas and appropriate soil conditions;

11. Landscaping with native or drought tolerant species;

12. Collecting and using precipitation.

4.5.2 Priority Development Projects

As discussed in Section 4.4, development projects that exceed a specific size threshold and/or fit into a specific use category as identified in the BMP Design Manual are categorized as PDPs and require additional structural treatment control BMPs. Table 4-5 identifies the PDP categories as defined by the Permit and outlined in the Port BMP Design Manual.

Table 4-5. PDP Categories.[1]

Project Type	Size Threshold	Use Category
New development	Projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site).	Includes commercial, industrial, mixed-use, and capital development projects on Port tidelands.
Redevelopment	Projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces).	Includes commercial, industrial, mixed-use, and capital development projects on Port tidelands.
New and Redevelopment	Projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site)	Projects that support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.
New or Redevelopment	Projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site).	Projects that will be discharging directly to an Environmentally Sensitive Area (ESA). “Discharging directly to” includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA or conveyed in a pipe or open channel any distance as an isolated flow

Table 4-5. PDP Categories.[1]

Project Type	Size Threshold	Use Category
		from the project to the ESA (i.e. not commingled with flows from adjacent lands).
New or Redevelopment	Projects that create and/or replace 5,000 square feet or more of impervious surface	Projects that support one or more of the following uses: (a) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (b) Retail gasoline outlets. This category includes Retail gasoline outlets that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic of 100 or more vehicles per day.
New or Redevelopment	Projects that result in the disturbance of one or more acres of land	Projects that are expected to generate pollutants post construction.

[1] See BMP Design Manual for complete description of PDP categories and exemptions.

The Permit recognizes special considerations for redevelopment PDPs and identifies structural BMP performance requirements as follows:

1. Where redevelopment results in the creation or replacement of impervious surface in an amount of less than fifty percent of the surface area of the previously existing development, then the structural BMP performance requirements apply only to the creation or replacement of impervious surface, and not the entire development; or

2. Where redevelopment results in the creation or replacement of impervious surface in an amount of more than fifty percent of the surface area of the previously existing development, then the structural BMP performance requirements apply to the entire development.

The Permit allows for certain PDP exemptions at the discretion of each Copermittee. Pursuant to this allowance, the Port may allow exemptions for the following projects:

1. Walkways Exemption: New or retrofit paved sidewalks, bicycle lanes, or trails that meet the following criteria:
   a. Designed and constructed to direct stormwater runoff to adjacent vegetated areas, or other non-erodible permeable areas; or
   b. Designed and constructed to be hydraulically disconnected from paved streets or roads; or
   c. Designed and constructed with permeable pavements or surfaces in accordance with USEPA Green Streets guidance.

2. Green Street Exemption: Retrofitting or redevelopment of existing paved alleys, streets or roads that are designed and constructed in accordance with the USEPA Green Streets guidance.

More information about the requirements applicable to projects that qualify for the Walkways Exemption or the Green Street Exemption is provided in the BMP Design Manual.

4.6 PDP Structural BMP Performance Requirements

As identified in Section 4.5, the Port requires PDPs to implement permanent structural treatment control BMPs, as applicable. Compliant with the Municipal Permit, these BMPs must conform to performance requirements addressing stormwater pollutant control, hydromodification management, alternative compliance, BMP maintenance, and groundwater protection.

4.6.1 Stormwater Pollutant Control

Each PDP is required by the Port to implement LID BMPs designed to retain onsite the pollutants contained in the volume of stormwater runoff produced from a 24-hour 85th percentile storm event. If the implementation of BMPs to retain the full design capture volume onsite is determined to be technically infeasible, the Port may allow for the use of biofiltration BMPs to treat a design capture volume for runoff not reliably retained onsite as specified in the Permit.

If it is determined that biofiltration is not technically feasible for the project, the Port may allow the PDP to utilize flow-thru treatment BMPs to treat runoff leaving the site in combination with some level of off-site mitigation pursuant to the Port developed Alternative Compliance option addressed in 4.6.3. If Alternative Compliance is pursued, all accompanying flow-thru treatment BMPs must be sized and designed in accordance with the performance standards specified in the Municipal Permit.

4.6.2 Hydromodification Management

Pursuant to the Permit, the Port requires all applicable PDPs to implement onsite BMPs to manage hydromodification that may be caused by stormwater runoff discharging from the project. Although the majority of projects within the Port Tidelands do not influence hydromodification, any applicable PDP is required to implement onsite BMPs to address post-project runoff conditions and critical coarse sediment yield and include confirmation of BMP design, construction, and long-term maintenance.

4.6.3 Alternative Compliance Program

Integrated WQIP Strategy: PO-42, PO-43

Pursuant to WQIP optional strategies PO-42 and PO-43 and Provision E.3.c.(3) of the Municipal Permit, the Port has developed an Alternative Compliance program framework which is outlined in the Port's BMP Design Manual. This framework provides off-site mitigation options for PDPs in specific instances once an Alternative Compliance program is developed by the Port and approved by the Regional Board. Article 10 of the Port Code also enables the Port to authorize the use of off-site facilities and areas for stormwater management to supplement on-site BMPs at PDP as an alternative compliance measure to meet post-construction BMP performance requirements. The development of the Port's Alternative Compliance program framework was completed in FY 2016 and was incorporated into the Port BMP Design Manual.

The Port is continuing the development of an Alternative Compliance program through the Stormwater Compliance Credit Program (SWCCP). The MS4 Permit authorizes the Port to establish an Alternative Compliance Program, provided the following criteria are met:

1. Compliance credits are generated and used within the same watershed management area;
2. Compliance credit-generating projects are constructed within 4 years of the associated development project's completion;
3. At a minimum, "flow-through" treatment best management practices (BMPs) are installed on the development project site itself; and
4. Funding methods and legal agreements are in place to ensure the long-term maintenance and performance of the off-site stormwater credit project.

The Port's adoption of the SWCCP, and subsequent Regional Board's approval, would enable municipal or tenant project subject to stormwater permitting to comply with the MS4 Permit's pollution capture/treatment requirements through a combination of on-site stormwater treatment and the use of stormwater credits generated by off-site projects.

To date, the Port's SWCCP Development team, made up of staff and leadership from Real Estate, Development Services, Engineering, Legal, General Services, and EP, has completed the initial developmental steps for the draft SWCCP concept, including development of a technical memorandum, assessment of potential demand for off-site credits (given anticipated projects and conditions) and an assessment of the potential supply of credits that can be created on Port-owned properties and capital improvement projects. The upcoming key programmatic elements for SWCCP development include development of the administrative processes to set user guidelines, set pricing and entitlement protocols, and manage and track a credit-based program.

4.7 PDP BMP Implementation and Oversight

Pursuant to the Municipal Permit, Chapter 7 of the Port BMP Design Manual addresses long-term operation and maintenance for permanent structural BMPs. For all PDPs and Green Street projects on Port Tidelands, the tenant/project proponent is responsible to ensure inspection, operation and maintenance of permanent structural BMPs on a leasehold or Port maintained property. Stormwater structural BMP maintenance is provided by the individual tenant for tenant projects and by the Port for capital projects. In both cases, the Port will verify that appropriate mechanisms are in-place to ensure BMPs are implemented and maintained. The Port requires all project applicants submit a post-construction Operations and Maintenance (O&M) plan parallel with the SWQMP that identifies a responsible party to manage the structural BMPs in perpetuity and requires an annual inspection of structural BMPs to evaluate performance.

For all PDPs where applicable, the Port is directed by the Municipal Permit to implement a program requiring and confirming that the design, construction, and maintenance of structural BMPs is intended to remove pollutants in stormwater to the maximum extent practicable (MEP).

The structural BMP approval and verification process includes the following:

- The Port is to require and confirm that the requirements of the Municipal Permit are implemented for all PDP and Green Street project applications with the exception of those applications that have received Port-approved prior lawful approval by the time the Port BMP Design Manual is updated pursuant to the Municipal Permit;
- The Port is to identify the roles and responsibilities of its staff in implementing the structural BMP requirements, including each stage of a project from application review and approval through BMP maintenance and inspections;
- The Port is to properly record appropriate easements and ownerships in public records and the information is conveyed to all appropriate parties when there is a change in project or site ownership; and
- The Port is to inspect each structural BMP to verify that its construction and operation is in compliance with all of its specifications, plans, permits, ordinances, and the requirements set in the Municipal Permit.

As required by the Municipal Permit, the Port continues to develop, maintain, and update an inventory of all PDPs within the Port’s jurisdiction. The Port’s stormwater database is utilized, among other reasons, to track and inventory all PDPs and Green Street projects and their associated structural BMPs within the Tidelands. The database is regularly maintained and updated to include project information such as location, hydrologic area, and description of structural BMPs, construction dates, responsible party for structural BMP maintenance, BMP maintenance verifications, and any applicable corrective actions and/or resolutions.

All structural BMPs at projects that are designated as high priority are inspected by the Port annually prior to each rainy season. As described in the Port BMP Design Manual, the Port verifies that structural BMPs on each PDP and Green Street project are adequately maintained and continue to operate effectively to remove pollutants in stormwater to the MEP. This verification is completed through inspections, self-certifications, surveys, or other equally effective approaches. Where verifications are completed by non-Port means, adequate documentation must be provided to the Port to provide assurance that the required maintenance of structural BMPs at each project has been completed. As necessary, the Port conducts follow-up inspections, enforcement or similar measures to ensure that structural BMPs at each PDP continue to reduce pollutants in stormwater to the MEP.

This section identifies how the JRMP Development Planning will be implemented over the course of the Permit. Specific subsections focused on individual development planning programs or activities are presented to better describe how the Port will implement each program/activity.

4.7.1 Education

Integrated WQIP Strategy: PO-3, PO-5

The Port will conduct education efforts focusing on new development and redevelopment projects and their relationship to urban runoff impacts on water quality. Pursuant to WQIP Strategy PO-3, the Port will include annual internal stormwater training for all development projects. Additionally, and pursuant to WQIP PO-5, the Port will make available technical knowledge and direction to the development community on permit requirements. The objective of the education is to increase the knowledge of Port decision makers, Port staff, project proponents, consulting planners, architects, engineers and the general public regarding the potential water quality impacts associated with development and to the means to prevent or minimize those impacts. The Port's education plan for the Development Planning program is described in detail in the JRMP, Chapter 9 – Public Education and Participation.

4.7.2 Inspection

Integrated WQIP Strategy: PO-4

Pursuant to the Municipal Permit, post-construction inspections are required to ensure that all PDPs and Green Street projects incorporate the appropriate structural treatment control BMPs. In accordance with WQIP Strategy PO-4 and upon completion of the construction phase of a PDP or Green Street project, the Port inspectors will verify that any and all approved structural BMPs have been constructed in compliance with all specifications, plans, permits, and ordinances. Inspectors will verify that all required BMPs identified in the project SWQMP are in place as specified and that they were designed and constructed as required in the approved documents, and they are maintained to remove pollutants in stormwater to the MEP.

In addition to performance inspections, Port inspectors will also verify that an Operations and Maintenance (O&M) plan exists for all PDP or Green Street structural BMPs and that the responsible parties are aware of their requirements. Additionally, pursuant to strategy PO-9, the Port will require an inspection to verify that trash, metals, and bacteria BMPs are installed and functioning correctly where applicable.

Verification of effective operation and long-term maintenance will be accomplished through inspections and using the BMP tracking program described in the following section. As well, following the completion of structural BMP construction, the Port may request the project engineer provide a certification that the site improvements for the project have been constructed in conformance with the approved stormwater management documents and drawings.

4.7.3 BMP Tracking and Verification

The Port has developed and will continue to utilize its stormwater database to track and inventory approved treatment control BMPs and treatment control BMP maintenance within the tidelands. The database includes information on treatment control BMP type, location, watershed, date of construction, party responsible for maintenance, maintenance certifications or verifications, inspections, inspection findings, and corrective actions.

The Port will verify that approved treatment control BMPs are operating effectively and have been adequately maintained. The Port implements structural BMP tracking and verification in the following manner:

- An annual inventory of all approved treatment control BMPs within the Port's jurisdiction, including all treatment control BMPs approved during the previous permit cycle, will be maintained and updated.

- The Port will prioritize all projects with approved treatment control BMPs into high, medium, and low priority categories. At a minimum, projects with drainage insert treatment control BMPs will be designated as at least a medium priority. The prioritization of other projects with treatment control BMPs will consider treatment control BMP size, recommended maintenance frequency, likelihood of operational and maintenance issues, location, receiving water quality, and other pertinent factors during the prioritization process.

- The Port will inspect annually all of the structural treatment control BMPs that are designated as high priority. Inspection schedule is pursuant to the Municipal Permit and in conformance with those stated in the Port BMP Design Manual. The Port's inspections will verify effective operation and maintenance of the treatment control BMPs and compliance with all applicable ordinances and permits.

The Port requires an annual verification of effective operation and maintenance of each approved treatment control BMP by the party responsible for the treatment control BMP maintenance. The verification may include submittal of annual certifications of effective operation and maintenance or through verification during inspections.

4.8 Enforcement

Municipal Permit Provision E.3.f requires the Port to enforce its legal authority established for all development projects, as necessary, to achieve the requirements of the Permit. Article 10 of the Port Code establishes enforcement procedures to ensure accurate construction, installation and maintenance of structural BMPs for long-term performance. A finding of failure to comply with the conditions of the approved SWQMP will be followed by corrective actions and, as necessary, further enforcement. Enforcement mechanisms applicable to the Development Planning component include both administrative and judicial authorities.

During the development project review and approval process, there may be issues that arise which require enforcement to maintain JRMP and Permit compliance. Some of these issues may include:

- A development project commences without prior Port project approval;
- A development project begins site work before the Stormwater Quality Management Plan (SWQMP, formerly USMP) is approved by the Port;
- Post-construction BMPs proposed in the approved SWQMP or development plan are not installed or not installed as proposed;
- Changes were made in the project design after Port approval of the SWQMP is obtained that would alter the design calculations, assumptions and recommendation made in the SWQMP and amendments were not sent to the Port for review and approval;
- Approved alternative compliance project is not constructed, maintained or is not in conformance with Port approval; or
- Development project does not properly maintain and implement post-construction BMPs.

The Port's Enforcement Response Plan (ERP, Appendix C) provides detail on the Port's enforcement authorities and process. The ERP also identifies escalated enforcement actions and the procedure for reporting non-compliant sites to the Regional Board.

Chapter 5 Construction Management

5.1 Introduction

Provision E.4 of the Municipal Permit requires the Port to implement a Construction Management program in accordance with the strategies in the San Diego Bay Watershed WQIP in addition to core permit requirements. The core permit requirements include a project approval process that ensures appropriate BMPs are attached to conditions of approval for construction projects as well as ongoing construction site inventory updates, tracking and inspection. In addition, the Port is required to establish minimum BMPs to be implemented and maintained at construction sites and implement an enforcement process.

This Chapter describes how the Port will meet the Permit conditions outlined in Permit Provisions F.2.a and E.4 for Construction Management. Table 5-1 indicates the sections of this chapter where specific Permit conditions are incorporated into the Port's JRMP. The Construction Management program was also updated in 2015 in response to the Regional Board February 2014 audit of the Port's construction inspection program.

Table 5-1. Construction Management Permit Requirements and Corresponding JRMP Section.

Permit Requirement	Permit Reference	JRMP Section
Project Approval Process	E.4.a	5.3
Construction Site Inventory and Tracking	E.4.b	5.4, 5.5
Construction Site BMP Implementation	E.4.c	5.6
Construction Site Inspections Frequency	E.4.d.(1)	5.5, 5.7.1
Construction Site Inspection Content	E.4.d.(2)	5.7.2
Construction Site Tracking and Records	E.5.d.(3)	5.7.3
Enforcement	E.5.e	5.9 and Appendix C - Enforcement Response Plan

The Construction Management program applies to construction projects that involve ground disturbance or soil disturbing activities that can potentially generate pollutants in stormwater runoff. The goal of the Construction Management program is to minimize the impact of construction activities on water quality by minimizing pollution in urban runoff. There are a variety of activities at a construction site that can contribute to stormwater pollution. Typical pollutants from these activities include sediment, debris, hazardous materials, metals, trash, and bacteria. The Port ensures compliance is accomplished through project approvals, including stormwater requirements in project specifications, inspections, enforcement, reporting non-compliance, tracking, and training and outreach.

5.2 WQIP Strategies for Construction Management

To assist in meeting the interim and final water quality goals identified in the WQIP, the Port identified several strategies that will be incorporated into the Construction Management Program. The strategies include core jurisdictional programs that meet baseline permit requirements which will be implemented throughout the permit term and strategies that are program enhancements or focused efforts that have varied schedules for implementation.

Table 5-2 includes a list of the strategies from the WQIP that are identified for the Construction Management Program. The table indicates which strategies have been incorporated in the Port's JRMP program including a JRMP section reference where the strategy is incorporated. The table and the JRMP document will be updated as new strategies are incorporated. A more detailed description of all the strategies is included in Appendix A.

Table 5-2. WQIP Construction Management Strategies.

SDB ID	Strategy Name	Implementation Year	JRMP Section
PO-6	Implement Core JRMP Program to require and to oversee implementation of BMPs during the construction phase of land development.	FY-15	5.3.3, 5.5-5.7
PO-12	Implement Core JRMP Program requiring implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.	FY-15	5.6
PO-13	Develop and implement a strategy that identifies candidate areas of existing development for retrofit and rehabilitation opportunities to address trash, bacteria, and metals.	FY-15	5.6
PO-18*	Add BMP to construction BMPs that requires covering material stockpiles of treated wood during wet weather.	FY-15	5.6
PO-20*	Adopt Construction and Demolition Recycling Ordinance or include language into general requirements for all projects. [CAP Waste Reduction and Recycling Measure (SW2)][1]	FY-17	5.6.3

*These strategies were classified as optional strategies and require a trigger to be implemented.

5.3 Construction Project Approval Process

The Municipal Permit requires the Port to ensure that all construction projects[1] submit a construction BMP plan for the Port's review. The plan must include seasonally appropriate BMPs; comply with the local grading ordinance, other applicable ordinances, and the Municipal Permit. The Port must also verify that the project obtains coverage under the statewide General Construction Permit[2] (CGP) as applicable. The Port meets those permit requirements through the construction project approval process.

Construction activities on Port tidelands may be initiated by a Port tenant/developer making improvements or conducting maintenance on a leasehold or by the Port sponsoring major maintenance or capital improvement projects. As discussed in JRMP Chapter 4 – Development Planning, the Port's project review process varies slightly between tenant projects versus Port sponsored projects; however, the review for stormwater requirements is the same. All project approvals are conditioned with minimum BMP requirements and submittal of a Construction Site BMP plan or a Stormwater Pollution Prevention Plan (SWPPP) as appropriate. The construction site BMP plan and SWPPP will be discussed in Section 5.3.3 of this chapter. The stormwater

[1] Construction site or project means any project, including projects requiring coverage under the CGP, that involves soil disturbing activities including, but not limited to, clearing, grading, disturbances to ground such as stockpiling, and excavation.
[2] National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated With Construction and Land Disturbance Activities Order No. WQ 2022-0057-DWQ

requirements for the project plan approval process are also provided on the Port's website.[3]

As discussed in the JRMP Chapter 1, the Port has not adopted a grading ordinance. Grading ordinances are generally adopted by municipalities in order to regulate activities on private property. There is no private property in the Port's jurisdiction. The Port defers the issuance of applicable building and grading permits to the member cities. Due to the absence of this permitting function, the Port has built other mechanisms into the review, approval, and verification process to ensure the pertinent project components are reviewed in a consistent manner and appropriate conditions for approval are established. Such mechanisms are discussed below and in the following sections.

5.3.1 Port Tenant or Developer Project Review and Approval

Port tenants and developers seeking to conduct construction activities on Port tidelands must submit a project application to the Port's Real Estate Department for processing. The application includes a project description, an environmental review checklist and a stormwater requirements checklist. The stormwater requirements checklist assists the project applicant and Port staff identify whether the project triggers the CGP and requires a SWPPP or if a Construction BMP Plan is required.

The Port's project approval process is based on project cost, degree of proposed site modifications or change of site use. It is also dictated by the level of environmental review, i.e., CEQA and California Coastal Act (Coastal Act) processing, and whether a Port Master Plan Amendment is required[4]. Depending on the level of environmental review required for a project, approval may be issued by staff or require approval from the Board of Port Commissioners. Regardless of the project's review and approval path, all tenant and developer projects approved by the Port will be authorized to proceed in the form of a Project Review and Approval letter.

The Project Review and Approval letter contains a set of standard conditions that apply to all proposed projects on leased areas. The Project Review and Approval letter also contains project specific stormwater conditions. The Port's tenant project plan approval process is posted on the Port's website[5].

5.3.2 Port Sponsored Project Review and Approval

Port sponsored improvement projects include major maintenance and capital improvement projects. Port sponsored projects are designed and managed by the Port's Engineering-Construction Department. The review process for Port sponsored projects is generally initiated by a "Charter Meeting", whereby various Port departments such as Real Estate, General Services, Engineering-

[3] https://www.portofsandiego.org/stormwater-management
[4] See Chapter 3 – Development planning for more detailed discussion on the Port Master Plan.
[5] https://www.portofsandiego.org/development-services-department

Construction and EP, review the project at the conceptual stage and provides feedback on the possible project requirements and considerations. At the Charter Meeting, EP staff identifies whether the project will need to file for coverage under the CGP and whether a Construction BMP Plan or SWPPP would be required. This is confirmed by the completion of a Stormwater Requirements Checklist by the lead engineer.

Port sponsored projects also undergo CEQA and Coastal Act processing. Stormwater conditions will be included in the environmental documents. If the project is “Exempt” under CEQA or “Excluded” in the Coastal Act, stormwater requirements will be still be included in the project conditions. Although no formal Project Review and Approval letter is issued, as with tenant projects, the completed Stormwater Requirements Checklist, signed by the lead engineer, is the means adopted by the Port to conditionally approve a project with stormwater conditions.

The conditions of project approval for stormwater include the submittal of a Construction BMP Plan, or a SWPPP with a CGP WDID Number issued by the State Water Resources Control Board (State Board). Since the Port does not maintain the staff or equipment necessary to conduct construction projects, work carried out as a development project by the Port (“public works projects,” per se) is done under contract with a development/engineering/construction company. Through the contract, project specifications require that the construction and grading activities incorporate the minimum BMPs in the JRMP. A stormwater compliance section is included in all specifications for Port sponsored projects. Included in the stormwater compliance section are references to applicable stormwater regulations, BMP guidance, SWPPP requirements, and reference to the Port’s Construction BMP Plan or SWPPP template.

5.3.3 Construction BMP Plan and SWPPP Review

Integrated WQIP Strategy: PO-6

Prior to the approval of a construction project, the Port requires that all applicable minimum and seasonally appropriate BMPs have been identified and the proposed methods of implementation are appropriate to the project site. The review also confirms that minimum BMPs that address WQIP priorities are also included. If the project is subject to the CGP, then a SWPPP prepared in accordance with the CGP and a copy of the CGP registration approval from the State Board is required. If the project is not subject to the CGP, a Construction BMP Plan is required. The Construction BMP Plan includes many of the same elements as a standard SWPPP except for most post-construction BMPs and a monitoring plan. The Construction BMP Plan applies to construction projects less than one acre, but greater than 2,500 square feet of land disturbance, as well as construction projects that occur over water.

In order to ensure that the JRMP-required minimum BMPs are used at a project and to streamline the review process, the Port has created templates for the Construction BMP Plan and the SWPPP that incorporates the JRMP minimum BMPs. Use of these templates is required by both tenant and Port-sponsored projects. The implementation of a project's designated BMPs is verified during the review process. A copy of the Construction BMP Plan and SWPPP templates are available on the Port website[6].

Port approval on all SWPPPs and Construction BMP Plan is required prior to any work beginning on a project. All Construction BMP plans and SWPPPs are reviewed by the Port for completeness and consistency with the project design, the JRMP, the Port's Stormwater Ordinance (Article 10), the Municipal Permit, and other applicable permits. Based on the review results, the Port will either "not approve", "approve with conditions", or "approve" the submittal via a technical memorandum. Rejected documents will be sent back to the project applicant for required edits and/or additions. Submittals that are conditionally approved will be verified in the field upon initial stormwater inspection by Port staff to ensure all conditions are satisfied. Construction may commence only after the Port approves or conditionally approves the Construction BMP Plan or SWPPP.

5.4 Construction Site Inventory and Tracking

Integrated WQIP Strategy: PO-6

The Municipal Permit requires that the Port maintain and update an inventory of all the construction sites within the Port's jurisdiction. The inventory is to be categorized by hydrologic subarea and updated at least quarterly. The Port uses its stormwater database to manage construction site information and the inventory. As required by the Municipal Permit the database tracks the following construction project information:

- Relevant contact information for each site (e.g., name, address, phone, and email for the owner and contractor);
- Site location, address, WDID number (if applicable), size of site and approximate area of disturbance;
- Whether or not the site is considered a high threat to water quality. Threat to water quality assessment is discussed in Section 5.5;
- The project start and completion dates;
- The required inspection frequency;
- The approval date of the construction BMP plan or SWPPP;
- Applicable enforcement actions at the site.

[6] https://www.portofsandiego.org/stormwater-management

New projects are entered into the database by EP staff upon receipt of a Coastal Development permit copy or a project concept approval document from either the Port's Engineering-Construction or Real Estate Departments. Entering the project into the stormwater database triggers the project tracking process which continues onto SWPPP review and the inspection process.

Commencement of a construction project initiates routine stormwater compliance inspections. The content and frequency of those inspections are discussed in the proceeding subsections of this charter. Regularly scheduled inspections act as a mechanism for monthly, at a minimum, updates to the inventory database. The database is also updated when a close-out inspection and report is conducted at the completion of a project and again when a Notice of Termination (NOT) is submitted by the Port to the State Board.

5.5 Threat to Water Quality Assessment and Project Prioritization

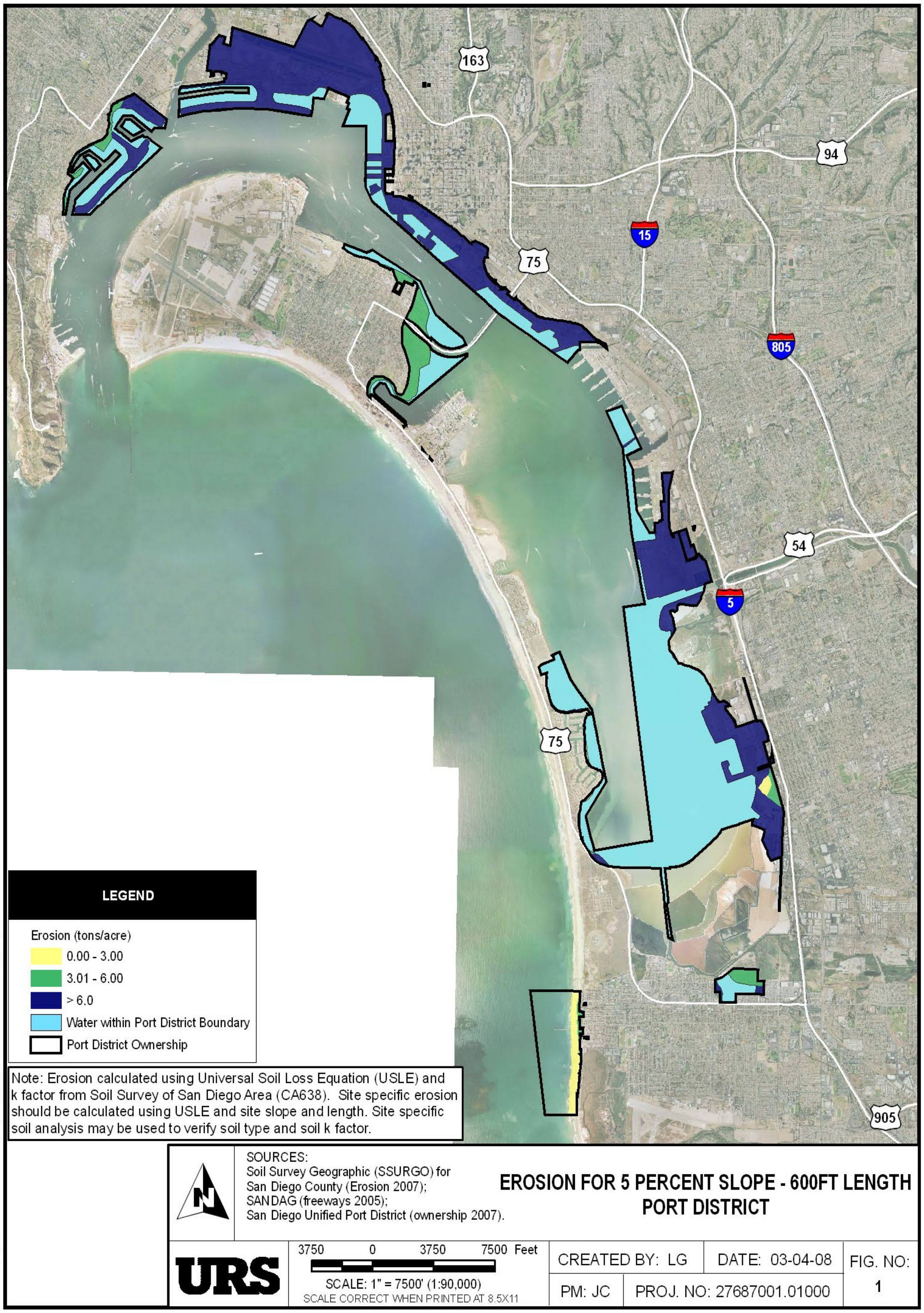
During the project review phase, the Port will assess each construction project's potential threat to water quality. This assessment will identify sites that represent a high threat to downstream surface water quality pursuant to Provision E.4.b.(2) of the Permit and will also be used to prioritize site stormwater compliance inspections frequencies which is in compliance with Permit Provision E.4.d.

The Permit states that the following factors should be considered in designating sites as high threats to water quality:

1. Sites located within a hydrologic subarea where sediment is known or suspected to contribute to the highest priority water quality conditions identified in the WQIP,
2. Sites located within the same hydrologic subarea and tributary to a water body segment listed as impaired for sediment on the CWA section 303(d) List;
3. Sites located within, directly adjacent to, or discharging directly to a receiving water within an Environmentally Sensitive Area (ESA);
4. Other sites determined by the Port or the Regional Board as a high threat to water quality.

The Port considered each of the above listed factors and analyzed the applicability of each in determining a threat to water quality on tidelands. The analysis revealed that Factors #1 and #2 listed above, are not applicable to construction sites on tidelands. Construction sites would not be located in a hydrologic subarea where sediment is identified as a contributor to the highest priority water quality conditions identified in the WQIP and no sites would not be located within a hydrologic subarea or tributary to a water body segment impaired for sediment on the CWA section 303(d) List.

Figure 5-1.
Erosion Potential for Port Tidelands.



Since San Diego Bay has been classified as an ESA and Port tidelands encircles the bay, sites located within, directly adjacent to, or discharging directly to receiving water within an ESA (i.e., Factor #3), will be a leading consideration when assessing a project's potential threat to water quality and whether the site poses a high threat. Other project details such as the project's size, type and whether the project will occur during the wet season (October 1 through April 30) will be considered in the assessment since the time of year, extent of grading, clearing, or soil disturbing activities increases the threat of sediment transport to the receiving waters.

The Permit's Factor #4, other sites determined by the Port or the Regional Board as a high threat to water quality, will also be included in the assessment as follows. No sites on tidelands have been identified to date by the Regional Board. The Port can reconsider and reassign a higher priority level of a construction site if a violation occurs during the course of the project or if the factors of the project change. The Port will also reassess the project prioritization, if there are repeat non-compliance issues with respect to BMP implementation that addresses WQIP priority pollutants (metals, bacteria, and trash).

Based on the factors assessed above, the Port has developed guidelines for prioritizing Port construction sites. The highest priority category under which a project falls will be the priority classification. Each construction project will be categorized into one of the following priority levels:

Low Priority – construction projects less than one acre in size that are not in or over receiving waters.

Medium Priority – construction projects that have one to five acres of soil disturbance that are not in or over a receiving water (may occur over one or multiple wet seasons), or construction projects with less than one acre of soil disturbance, that are not in or over a receiving water, where construction activities occur during more than one wet season.

High Priority/High Threat – construction projects between five and 50 acres of soil disturbance and occurring during the wet season or any construction project occurring in or over receiving waters.

Exceptional Priority/High Threat – construction projects greater than 50 acres where construction activities occur during the wet season and contain Hydrologic Soil Group D soils.

Every construction project on Port tidelands will be assessed and is prioritized based on the project's threat level during the project approval process. The priority level is noted in the stormwater database and will dictate the construction inspection frequency, temporary BMP requirements, and the need for active treatment systems discussed in Section 5.6.2.

5.6 BMP Requirements

Integrated WQIP Strategy: PO-6, PO-12, PO-13, PO-18

The Municipal Permit directs the Port to require minimum BMPs at all construction and grading projects. The minimum BMPs are required to ensure a reduction of potential pollutants from the project site to the MEP and to effectively prohibit non-stormwater discharges from construction sites to the municipal separate storm sewer system (MS4). These BMPs also ensure that all construction and grading activities are in compliance with applicable Port ordinances and other environmental laws and are supportive of the WQIP goals.

The required minimum BMPs fall into several major categories as outlined in the Municipal Permit including project planning, good site management, non-stormwater management, erosion control, sediment control, run-on and runoff controls, and where applicable, active/passive sediment treatment. The BMPs chosen to be implemented at a project must be site specific, seasonally appropriate, and construction phase appropriate. Notwithstanding seasonal variation, projects occurring during the dry season will be required to plan for and must be able to address rain events that may occur.

The Port also chose to include minimum BMPs that support the WQIP priorities and integrate WQIP strategies PO-12 and PO-13. Good Housekeeping BMPs prevent discharges of WQIP high priority pollutants including metals, bacteria, and trash to the MS4. Additionally, pursuant to WQIP Optional strategy PO-18, the Port requires project sites to cover all construction material stockpiles, including those that contain metals such as treated timber or galvanized materials, during wet weather.

Table 5.3 is a list of minimum BMPs that are required for all construction sites, depending on their applicability to the activity at hand. The list includes a general title for each BMP and an alphanumeric descriptor next to the BMPs that are referenced in the "California Stormwater Best Management Practice Handbook Portal - Construction, July 2012," produced and published by the California Stormwater Quality Association[7]. The Port may consider an alternate BMP to fulfil a BMP category on a case by case basis.

[7] http://www.casqa.org

Table 5-3. Minimum BMPs for Construction Sites.

BMP Category	BMP
Project Planning	• Minimization of areas that are cleared and graded to only the portion of the site that is necessary for construction • Develop and implement a SWPPP or Construction BMP Plan • Contractor Training (formal training or Port staff training
Non-stormwater management	• Water Conservation Practices (NS-1) • **Illicit Connection/Illegal Discharge Detection and Reporting (NS-6)** • Dewatering Operations (NS-2) • Paving and Grinding Operations (NS-3) • Potable Water/Irrigation (NS-7) • **Vehicle and Equipment Cleaning (NS-8)** • Vehicle and Equipment Fueling (NS-9) • Vehicle and Equipment Maintenance (NS-10)
Good Housekeeping/Waste Management	• **Cover construction material stockpiles such as treated lumber during wet weather. (WQIP Strategy PO-13)** • **Material delivery and storage (WM-1)** • **Material Use (WM-2)** • **Solid Waste Management (WM-5)** • Stockpile Management (WM-3, SE-1, SE-5, SE-6, SE-8, Caltrans WM-03)[8] • **Spill Prevention and Control (WM-4)** • **Hazardous Waste Management (WM-6)** • **Contaminated Soil Management (WM-7)** • Concrete Waste Management (WM-8) • **Sanitary/Septic Waste Management (WM-9)** • Construction Road Stabilization (TC-2) • Stabilized Construction Entrances (TC-1) • Entrance/Outlet Tire Wash (TC-3)
Erosion control[9] (choose at least one or a combination based on site conditions)	• Preservation of Existing Vegetation (EC-2) • Minimization of exposure time of disturbed soil areas • Scheduling (EC-1) [10] • Hydraulic Mulching (EC-3) • Soil Binders – (EC-5) • Straw Mulches (EC-6) • Wood Mulching – (EC-8) • Geotextiles and Mats (EC-7) • Wind Erosion Control (WE-1) • Soil Preparation/Roughening (EC-15) • Preservation of natural hydrologic features where feasible • Permanent revegetation or landscaping as early as feasible

BMPs in bold target WQIP priority pollutants including metals, trash and bacteria

[8] Soil, crushed materials, and base material stockpiles are required to be covered when not actively being used – see 5.6.2 below.
[9] Erosion controls must be implemented in all inactive disturbed soil areas (DSA). An inactive DSA is where construction activities such as grading, clearing, excavation or disturbances to ground are not occurring and those that have been active and are not scheduled to be re-disturbed for at least 14 days.
[10] Limitation of grading to a maximum disturbed area, determined by the Port to be 5 acres during the rainy season and 17 acres during the non-rainy season, before either temporary or permanent erosion controls are implemented to prevent stormwater pollution (See Section 5.6.1 for additional information.

BMP Category	BMP
Sediment Control (choose at least one or a combination based on site conditions)	• Silt Fence (SE-1) • Street Sweeping and Vacuuming (SE-7) • Sand Bag Barrier (SE-8) • Storm Drain Inlet Protection (SE-10) • Sediment Trap (SE-3) • Sediment Basin (SE-2) • Check Dams (SE-4) • Fiber Rolls (SE-5) • Gravel Bag Berms (SE-6) • Compost socks and berms (SE-13)
Run-on and Run-off Control	• Protect site perimeter to prevent run-on from entering the site and site run-off

BMPs in bold target WQIP priority pollutants including metals, trash and bacteria

5.6.1 Maximum Disturbed Area for Erosion Controls

The Port restricts the size of the project's total disturbed soil area (DSA) to 5 acres during the rainy season and 17 acres during the non-rainy season. These grading limits are recognized standards within the industry. The Port has the option to temporarily increase these limits if the individual site is in compliance with applicable stormwater regulations and the site has adequate control practices implemented to prevent stormwater pollution. The authority to temporarily increase the grading limits of a project site is with the Port construction inspector in cooperation with EP staff. If the amount of DSA is temporarily increased beyond the above limits, the contractor shall have the BMP material(s) required to implement the appropriate control practices available onsite and amend the project SWPPP to reflect this change. A mobilization plan including a description of the delivery and deployment of the appropriate BMP material to the jobsite prior to all predicted rain events shall also be submitted to the Port for approval and shall be included in the project SWPPP. Run-on controls shall be in place prior to opening any additional DSA.

5.6.2 Stockpile Management

To reduce or eliminate air and storm water pollution from stockpiles, the following stockpile management BMPs must be implemented year-round. Stockpiles include but are not limited to soil, sand, portland cement concrete or asphalt concrete rubble, cold mix asphalt, aggregate base or sub base, chemically treated wood, and landscaping materials.

1. Stockpiles must be protected to prevent discharge of sediment or other pollutants beyond the immediate area of the stockpile and offsite either by transport via wind or water.

2. All stockpiles must be stabilized at the end of each day. In addition, all stockpiles must be bermed (i.e. perimeter controls) at the end of each day.

3. Stockpiles in the right-of-way must be stabilized with an erosion control product and bermed (i.e. perimeter control) at the end of each day.

4. All stockpiles must be stabilized with an erosion control product and bermed (i.e. perimeter control) prior to rain.

   Examples of control products include, but not limited to, the following:

Erosion Control Products	Perimeter Controls
Hydromulch	Straw Wattles (Fiber Rolls)
Soil Binder / Tackifier	Gravel Bags
Plastic Cover*	Silt Fence

*Plastic must be appropriately selected, self-inspected, and maintained to prevent deterioration

5. For stockpiles where only a portion (or “face”) is actively being used, the remaining inactive portion (or faces) must be designated on the site map and stabilized with an erosion control product and bermed at all times. Active faces must be bermed and stabilized at the end of each day and prior to rain as described above in notes 3 and 4.

6. Stockpile perimeter controls must be inspected on a daily basis by the Contractor for sediment accumulation. Sediment accumulation must be removed when sediment reaches 1/3 of BMP height and prior to a rain event. For perimeter controls within the right-of-way, sediment accumulation must be removed daily and prior to rain event.

7. All stockpiles must be placed at least 18 inches from the curb face and are prohibited where they obstruct flow including storm drain inlets and drainage ditches.

5.6.2 Active/Passive Sediment Treatment Systems

In accordance with the Municipal Permit, the Port will require implementation of advanced treatment methods for sediment at construction sites determined to be exceptional threats to water quality. A site determined to be an exceptional priority or risk to water quality is described in Section 5.5. Active/passive sediment treatment may also be required for high priority sites based upon stormwater inspections and past record of non-compliance by the operators of the construction site.

5.6.3 Construction and Demolition Recycling Ordinance

Integrated WQIP Strategy: PO-20

The adoption of a construction and demolition (C&D) recycling ordinance or including recycling language into standard conditions for all projects is intended to address two of the Port’s highest priority water quality conditions; trash and metals. The Port is evaluating the established recycling ordinances of the member cities to determine whether a Port-specific ordinance is necessary.

In the interim, the Port continued to require Port-sponsored projects to comply with the ordinance of the member city in which the project is located. Additionally, CIP and major maintenance projects incorporate C&D recycling language into all bid packages and project specifications. For tenant projects, the Port includes C&D recycling requirements into project specifications on a case by case basis, with initial focus on projects that would generate a large amount of material to be disposed.

5.7 Construction Site Inspections

Integrated WQIP Strategy: PO-6

The Permit requires the Port to conduct site inspections to confirm compliance with its permits, ordinances and conditions of the Permit. The prioritization for site inspections must consider the site's threat to water quality as well as the nature of the construction activity, topography, and the characteristics of soils and receiving water quality.

EP staff or trained contractors working on behalf of EP conduct stormwater compliance inspections at all construction sites on tidelands. These inspections are focused on ensuring compliance with the JRMP and Municipal permit specifically. Observations and findings from these inspections are included in the JRMP annual report.

5.7.1 Inspection Frequency

The Municipal Permit specifies that construction site inspections be conducted at an appropriate frequency for each phase of construction to confirm the site reduces the discharge of pollutants to the MEP and effectively prohibits non-stormwater discharges from entering the municipal separate storm sewer system (MS4). The Port has established an inspection frequency based on the site's assessed threat to water quality.

The Port's inspection schedule is summarized in the table below.

Table 5-4. Port Inspection Frequencies According To Priority Level.

Project Priority Level	Inspection Frequency	
	Dry Season	Wet Season
Low	As needed or at least monthly	As needed or at least monthly
Medium	As needed or at least monthly	At Least Biweekly
High	As needed or at least monthly	At Least Biweekly
Exceptional	As needed or at least monthly	At Least Biweekly

The San Diego Bay is an ESA. In general, projects on Port tidelands are located directly adjacent to or are discharging directly to the bay. All construction Port sites, that have been prioritized as medium, high, or exceptional threats to water quality will be inspected biweekly (every two weeks) during the wet season and as needed or at least monthly during the dry season. Sites that have been characterized as low priority will be inspected as needed or at least monthly year-round. Inspection frequency may change based on inspection findings, enforcement measures, or other situations where the additional oversight is needed.

5.7.2 Inspection Content

Each inspection will include a review of the adequacy and effectiveness of each of the BMPs being implemented at the site, visual observations of actual non-stormwater discharges, visual observations of actual or potential discharge of sediment and/or construction related materials from the site, and actual or potential illicit connections. If the project is subject to the CGP, then the inspector will verify coverage under the CGP by review of the project WDID number upon initial inspection. The inspection will assess the compliance with the Port's ordinances and permits related to urban runoff, including implementation and maintenance of designated minimum BMPs. Previous inspection records and enforcement actions for the site will be reviewed prior to any inspection.

Inspections are documented and managed using the Port's stormwater database. Inspectors enter observations made in the field onto an electronic form. A copy of the completed inspection form with any corrective actions is provided to the site supervisor. The Port stormwater inspector also reviews the results of the inspection, noting any BMP violations and corrective actions with the site supervisor the day of the inspection. Corrective actions must be addressed within the Port specified timeframes or as soon as possible by the site supervisor (given safety considerations). Any education and outreach on stormwater pollution prevention needed for the site may be verbally provided at the time of the inspection by the Port. Following each facility inspection, a copy of the completed inspection form will be supplied to the facility's representative. The inspector will review the results of the inspection with the facility's representative and an evaluation letter based on the visual assessment of discharges and implementation and effectiveness of the BMPs on-site will be sent to the facility.

If violations discovered during an inspection are not resolved by the site supervisor within the defined timeframe or if an unauthorized discharge is observed, the Port will pursue appropriate enforcement actions as detailed in Article 10 and the Port's Enforcement Response Plan located in Appendix C of the JRMP.

5.7.3 Inspection Tracking and Records

As required by the Municipal Permit, the Port will track all inspections and follow-up inspections at all inventoried construction sites. Records of the inspections will be maintained in the Port stormwater database. Inspections records will include at a minimum:

1. Site name, location, hydrologic area and applicable WDID number
2. Inspection date;
3. Approximate amount of rainfall since last inspection;
4. Description of problems observed with BMPs and recommendations for repair, additions, replacement and scheduled follow-up inspection;
5. Descriptions of any other specific inspection comments and include rationale for longer compliance time;
6. Description of enforcement actions issued in accordance with the Enforcement Response Plan discussed in Section 5.7.4; and
7. Resolution of problems noted and date problems fixed.

Inspection records shall be made available to the Regional Board upon request.

5.8 Enforcement

The Municipal Permit Provision E.4 requires the Port to enforce its legal authority established for all its inventoried construction sites, as necessary to achieve the requirements of the Permit. During the project approval and construction phase of a project, there may be issues that arise that require enforcement to maintain JRMP and Permit compliance. Some of these issues may include the following:

- A construction project commences without prior Port review and/or approval of the project;
- A construction project begins site work before the pollution control plan or stormwater pollution prevention plan (SWPPP) is approved by the Port;
- A construction project does not properly maintain and implement construction BMPs or maintain required documentation;
- Required BMPs are missing;
- Conditions of approval for pollution control plan or SWPPP are not met;
- The project fails to obtain coverage under the statewide Construction General Permit; and/or
- Unauthorized discharge occurs as a result of missing or inadequate BMPs.

Where enforcement is required to maintain compliance, the Port will use its enforcement authority established by Article 10. Article 10 of the Port Code enables the Port, including Port inspectors, to prohibit discharges and require BMPs so that discharges on tidelands do not cause or contribute to water quality problems. Article 10 establishes enforcement procedures to ensure that construction-related activities and responsible dischargers are held accountable for their contributions and /or flows. Enforcement mechanisms applicable to the construction component include both administrative and judicial authorities.

The Port's Enforcement Response Plan (ERP, Appendix C) provides detail on the Port's enforcement authorities, the process for the Construction Management Program and identifies escalated enforcement actions. As described in Section 8.3 of the ERP, escalated enforcement of construction projects for violations relating to minimum BMPs targeting WQIP high priority pollutants are issued an Administrative Citation, which may include fines, unless the deficiencies are corrected the day of the inspection. Administrative Citations are also issued for deficiencies of BMPs addressing other pollutants, such as sediment, that are not corrected within the Port-specified timeframe. In addition, the ERP also identifies the procedure for reporting non-compliant sites to the Regional Board.

Chapter 6 Existing Development: Municipal

6.1 Introduction

Provision E.5 of the Permit requires that the Port implements an existing development management program in accordance with the strategies in the San Diego Bay Watershed WQIP in addition to core permit requirements. At a minimum, the Port is required to develop and track an inventory of municipal facilities and areas, establishing minimum BMPs, and carry out a verification and enforcement process to ensure the BMPs are implemented. Existing development includes facilities or areas operated for commercial, industrial, or municipal uses. This chapter of the Port's JRMP Document relates to municipal facilities and areas maintained by the Port.

This chapter describes how the Port will meet the Permit conditions outlined in F.2.a and E.5 for Existing Development Municipal requirements. Table 6-1 indicates the sections of this chapter where specific permit conditions are incorporated into the Port's JRMP.

Table 6-1 Existing Development Municipal Permit Requirements and Corresponding JRMP Section.

Permit Requirement	Permit Reference	JRMP Section
Inventory Development and Tracking	E.5.a	6.3
BMP Implementation and Maintenance	E.5.b	6.5
Inspections Frequency	E.5.c.(1)	6.6.2
Inspection Content	E.5.c.(2)	6.6.1, 6.6.3
Record Keeping and Tracking	E.5.c.(3)	6.6.4
Enforcement	E.5.d	6.7
Retrofitting & Rehabilitation	E.5.e	6.8, Appendix H

As described in this chapter, the Port will achieve its stormwater compliance and water quality goals through inventory management, pollutant source identification, BMP implementation, inspections, and enforcement. This chapter of the JRMP Document identifies the activities required by the Permit, and the strategies in the WQIP, which the Port has developed and will implement to address urban runoff from municipal facilities and areas.

6.2 WQIP Strategies for Existing Development - Municipal

To assist in achieving the interim and final water quality goals identified in the WQIP, the Port identified several strategies that will be incorporated into the Existing Development-Municipal Program. The strategies include core jurisdictional programs that meet baseline permit requirements which will be implemented throughout the permit term and strategies that are program enhancements or focused efforts that have varied schedules for implementation.

Table 6-2 includes a list of the strategies from the WQIP that are identified for the Existing Development-Municipal Program. The table indicates which strategies have been incorporated in the Port's JRMP program including a JRMP section reference where the strategy is incorporated. Some strategies in the table are expected to be implemented in future reporting years and will be incorporated into the JRMP per that schedule. The table and the JRMP document will be updated as new strategies are incorporated in future years.

Table 6-2. WQIP Strategies for Municipal Existing Development.

SDB ID	Strategy Name	Implementation Year	JRMP Section
PO-8	Implement Core JRMP Program for existing development (municipal facilities) to require implementation of minimum BMPs for municipal facilities that are specific to the facility, area types, and PGAs, as appropriate.	FY-15	6.5, 6.6, 6.7
PO-9	Provide List of BMPs for Special Events with requirements for trash, metals, and bacteria, and ensure compliance through inspections	FY-15	6.5, 6.8
PO-10	Implement Core JRMP Program for MS4 infrastructure	FY-15	6.6.4, 6.6.5, 6.6.6
PO-11	Implement Core JRMP Program for Street and Parking Lot Maintenance. Includes inspection and cleaning of public streets, paved roads, and parking lots.	FY-15	6.6.2, 6.5.11
PO-12	Implement Core JRMP Program requiring implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.	FY-15	6.5.14
PO-13	Develop and implement a strategy that identifies candidate areas of existing development for retrofit and rehabilitation opportunities to address trash, bacteria, and metals	FY-15	6.9
PO-17	Implement Core JRMP Education and Outreach program	FY-15	6.5.9
PO-21*	Perform annual inspection of commercial, industrial, and municipal facilities that are higher sources of trash, metals, and bacteria	FY-16	6.6.1
PO-22*	Continue pet waste bag dispensers in parks	FY-15	6.5.4
PO-23*	Implement Preventative Maintenance (PM) Plan to prevent backups in Municipal public restrooms	FY-15	6.5.6
PO-24*	Development of BMP guidance document for general services staff conducting minor maintenance operations	FY-16	6.5.10, 6.5.16
PO-25*	Train general services staff on proper BMP implementation during minor maintenance operations	FY-16	6.5.16
PO-26*	Conduct Trash Receptacle Assessment in municipal areas	FY-16	6.5.4
PO-27*	Develop a process to improve data management for tracking waste and materials diverted from waste stream and landfills [CAP Waste Reduction and Recycling Measure (SW)][1]	FY-17	6.5.4
PO-28*	Replace/upgrade current maintenance equipment, such as street sweeper or power washer, to new, more efficient and effective options	FY-16	6.5.11, 6.5.13
PO-29*	Replace all Port owned/leased vehicle brake pads with copper-free brake pads	FY-18	6.5.8

Table 6-2. WQIP Strategies for Municipal Existing Development (Continued).

SDB ID	Strategy Name	Implementation Year	JRMP Section
PO-30*	Evaluate MS4 inspection and cleaning locations and adjust as-needed for higher trash generating areas	FY-16	6.6.4
PO-31*	Update Power-washing Standard Operating Procedure Manual	FY-17	6.5.10, 6.5.17
PO-32*	Create Standard Operating Procedure for proper washout procedures in public restrooms	FY-20	6.5.6
PO-35	Sponsor, conduct, and host cleanup activities	FY-16	6.5.4
-46*	Retrofit trash enclosures, where applicable, in municipal areas	FY-18	N/A
PO-47*	Installation of inlet inserts in storm drains in high priority areas	FY-18	N/A
PO-52*	Enhanced public awareness and enforcement of prohibitions on feeding wildlife in municipal parks	FY-18	N/A
PO-56*	Marine Terminals Stormwater Program	FY-19	6.3.1, 6.5.18

*These strategies were classified as optional strategies and require a trigger to be implemented.

6.3 Municipal Facilities and Areas Inventory and Tracking

As required by the Permit, Provision E.5.a, the Port has developed an inventory of all existing development within its jurisdiction that may discharge a pollutant load to and from the MS4. The inventory includes the name, address or location, and Hydrologic Subarea (HSA) of each facility or area. In addition, the inventory includes all Permit-required information, including a description of the facility or area classifying it as commercial, industrial, or municipal and indicating whether it is active or inactive. Further, information pertaining to applicable SIC or NAICS codes, Industrial General Permit (IGP)[1] NOI and/or WDID numbers, pollutants, and location relative to environmentally sensitive areas (ESAs) and Clean Water Act Section 303(d) water quality segments are incorporated. The complete inventory of municipal existing developments within the Port's jurisdiction is presented in Appendix F for the MS4 and Appendix G for municipal facilities. The Port's stormwater database is used to maintain a current and accurate inventory. The Port conducted an internal audit of its stormwater program in June 2016. The audit recommended an additional quality check process to provide added verification regarding the completeness of the Port's facility inventory. The process, which involves routinely selecting and tracing existing and new facilities or activities observed in the field to the database, has been incorporated into the Port's SOP process.

For the purposes of this JRMP, the Port municipal inventory[2] is categorized as follows:

- Facilities and Operations Buildings

[1] Order No 2014-0057-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Industrial Activities CAS000001.
[2] The Port does not operate a municipal airfield, flood management facilities, municipal landfills, or municipal waste collection facilities, nor a wastewater treatment facility.

- Roads, Streets, and Highways
- Parking Facilities
- Parks and Recreation Areas
- MS4 and Related Structures
- Special Events
- Sewer collection systems

A summary and description of each municipal type will be described in the sections below.

6.3.1 Facilities and Operations Buildings

Port municipal facilities and operations buildings are located throughout Port tidelands. The types of facilities and operations buildings found within the Port's jurisdiction include:

- Administration Office
- General Services corporate service yard and hazardous waste collection and storage area
- Harbor Police Headquarters and substations
- Marine Terminals including the Tenth Avenue Marine Terminal (TAMT), Cruise Ship Terminal (B St. Pier)
- Broadway Pier Pavilion

The types of activities associated with these facilities depend on the operations they support. Administration facilities include office spaces or indoor storage with minimal outdoor activities or operations. In contrast, General Services and Harbor Police facilities and areas may include outdoor storage, fleet maintenance, fueling locations, etc. The Port also maintains the common areas of the Tenth Avenue Marine Terminal and B St. Pier. The types of activities associated with these areas include cargo laydown, or temporary holding areas, and main thoroughfares.

6.3.2 Roads, Streets, and Highways

The Port maintains an inventory of the roads and streets which are located within its jurisdictional boundary. Several arterial roadways have dedicated rights retained by surrounding cities for roadway and utility purposes. The Port tracks the location of these streets; however, the Port does not own nor maintain them. All roads and streets within the Port's jurisdictional boundary are included in Appendix G and shown on maps in Appendix F. The streets that are Port owned, operated, and maintained by surrounding jurisdictions are also identified in Appendix F.

6.3.3 Parking Facilities

There are several parking facilities operated and maintained by the Port throughout its jurisdiction. Often, parking facilities are associated with Port municipal buildings or parks and recreation areas. These parking facilities are not considered as separate or stand-alone facilities. As such only the stand-alone parking areas will be included in Appendix G.

6.3.4 Parks and Recreation Areas

The Port operates parks and recreation areas within tidelands. The parks primarily include active recreational areas consisting of ball fields, playgrounds, picnic areas, and walkways. Some of the parks include fishing piers, boat launch ramps, and parking areas. Parks and recreation areas which are leased to and operated by tenants are not included in the Port's municipal inventory. These parks are associated with industrial or commercial businesses presented in Chapter 7.

6.3.5 MS4 and Related Structures

Drainage from within the Port's jurisdiction enters the MS4 and empties into San Diego Bay. The MS4 is primarily composed of inlets, manholes, outfalls, and conveyance. There are several MS4 segments from surrounding cities which flow through the Port's jurisdiction and empty into the Bay. These portions of the MS4 are the responsibility of the jurisdiction which owns, operates, and maintains the storm drain lines and catch basins; therefore, they are not included in the Port's municipal MS4 inventory. However, the Port tracks the location of these segments of the MS4 within its MS4 map and dataset and notates them appropriately in Appendix F. The Port has developed a process to annually update the MS4 inventory as structures are modified through construction or as inspections identify physical constraints to access, feature type, and past cleaning and maintenance requirements.

6.3.6 Special Events

The Port maintains recreational and open space areas along San Diego Bay and welcomes special events in public areas. Major special events are those with an attendance of 500 or more people. Major special events are unique and may include, but are not limited to, a variety of event-related activities such as weddings, parties, or concerts. These events pose an assortment of potential pollutants to the MS4 and/or receiving water. Major special events require permits from the Port and will be tracked on an annual basis.

6.3.7 Sewer Collection System

The Port does not operate a municipal wastewater department nor maintain sanitary sewer lines other than private laterals from Port-managed areas. There are, however, 11 locations throughout the Port's jurisdiction where sewer lift-stations pump sewage from Port facilities or areas to the municipal wastewater system. In addition, there are three locations around the Bay where the Port operates and maintains sewage pump-out facilities for boats. Two of the pump-outs are associated with boat launch ramps located in Chula Vista and National City. The third pump-out location is on Shelter Island at the transient vessel dock next to the Harbor Police Dispatch Center and Boating Office. For the purpose of the municipal inventory, pump-out stations will be associated with the facility or the park in which they are located.

6.4 Municipal Facilities Inventory and Tracking

The Permit requires the Port to develop a watershed-based inventory of all municipal facilities having the potential to discharge a pollutant load to the MS4. The Port's existing stormwater database meets that permit requirement. The stormwater database is the primary component for storing facility-related stormwater information such as inventories, static facility data (address, PGAs, contact person, etc.), inspection records, watershed information, BMPs, construction/development activities, and compliance history. The database maintains ongoing records of all stormwater data collected at each facility since 2008. This database serves as the repository from which facility inventories are created, inspections are prioritized, and enforcement is tracked.

6.4.1 Source Characterization and Prioritization

The Port uses a standardized methodology to evaluate and assess the discharge potential of a given facility and its impact on WQIP priority pollutants. A facility's discharge potential is represented by an "Overall Threat to Water Quality" rating which is either "high" or "low". This rating characterizes facility priority ranking for the purposes of determining facility inspection frequency. Continued facility inspections will serve to either confirm or modify the rating as empirical data is gathered, such as verification of pollutant generating activities, BMP implementation, and compliance history.

The Port uses an internal standard operating procedure to ensure that the prioritization is conducted consistently during the annual inventory update; the process is summarized herein. Several factors are considered when making the threat to water quality determination. These factors include not only the facility's pollution generating activities and potential pollutants, but the weighted impact of those pollutants based on WQIP priorities for the watershed and the location in which a given facility location. A given pollutant may thus represent a greater threat to water quality in one area of the watershed compared to another, and this can ultimately affect the evaluation of discharge potential for a facility.

In FY 2017, the Port amended its source characterization and prioritization assessment process SOP to include facility inspection history. In addition, if a facility has one or more inspections during the permit cycle with no corrective actions or follow up inspections required, the Port may elect to forego the annual inspection in the following fiscal year. The inspection history of all facilities will be evaluated annually to determine inspection schedules.

6.4.2 Inventory Management & Annual Updates

The Port facilities inventory is actively managed and reviewed annually and updated as needed. The stormwater database includes all of the facility-specific information required by Permit Provisions E.5.a.(1-3). This includes information such as inventories, static facility data, whether a facility is active or inactive, inspection data, minimum BMP requirements, and compliance history.

The Port's stormwater database also tracks the Permit-required watershed information for all facilities, including the hydrologic area in which the facility is located, the WQIP priority pollutants associated with the facility and minimum BMP requirements. In this manner, the Port can track the numbers and types of facilities within each WQIP high or focused priority condition area and provide inspection and enforcement summaries based upon adherence to WQIP minimum BMPs. As the JRMP program progresses, additional queries may be built into the stormwater database to highlight watershed efforts.

As described in Chapter 4 of this JRMP, the Port has a process for tracking new development projects which may modify the municipal inventory. The inventory update will take into consideration new facilities or changes to existing facilities. The necessary tracking information pertaining to the requirements presented in Provision E.5.a of the Permit will be updated as applicable for each facility.

6.5 BMP Implementation and Maintenance

Integrated WQIP Strategy: PO-8, PO-9, PO-21, PO-31

Provision E.5.b of the Permit requires the Port designate a minimum set of BMPs and pollution prevention methods for existing development to address the priorities and strategies in the WQIP. In accordance with WQIP strategy PO-8, the Port has identified a core set of required BMPs for municipal facilities and areas. These minimum required BMPs build upon those which have been implemented during past permits and incorporate additional WQIP strategies. The implementation of the minimum required BMPs are intended to minimize or eliminate discharges to the MS4 and the receiving water and address the Port's highest priority water quality conditions.

6.5.1 Minimum Required BMPs

The Port's minimum required BMPs have been organized according to pollutant generating activities (PGAs) which are associated with specific municipal facilities and areas. The Port updated the minimum required BMPs to meet the 2013 Permit requirements. Table 6-3 identifies the PGAs and minimum required BMPs for all municipal operations. An explanation of the pollutant generating activities and their association with the WQIP Strategies will be described in the subsections below. In FY 2017, the Port updated the minimum BMP requirements to ensure WQIP priority pollutants are adequately addressed. Those minimum required BMPs which also serve as pollution prevention BMPs are shown in bold font in Table 6-3 and will be described further in Section 6.5.12. To prevent unauthorized discharges originating from special events (>500 people), the Port also requires the implementation and maintenance of minimum BMPs. The minimum BMPs for special events are shown in Table 6-4.

Table 6-3. Municipal Facilities Minimum BMPs.

	General Operations and Housekeeping				**Non-Stormwater Management**			**Waste Handling and Recycling**				**Outdoor Material Storage**		**Outdoor Drainage from Indoor Activity**	**Vehicles and Equipment**				**Education and Training**	**Over Water Activities**	**Marina Management**	**IPM**	**Outdoor Activity and Operation**		**Planning**
BMP	Conduct routine inspections and proper maintenance of BMPs and stormwater conveyance	**Properly dispose of debris from stormwater conveyance system**	**Conduct outdoor sweeping to adequately control dust and debris**	**Keep outdoor areas neat and clean**	Keep facility clear of illicit connections	**Keep facility clear of illegal discharges, including irrigation runoff**	Have spill response materials available at the facility	**Keep waste containers at acceptable levels (not overflowing)**	**Properly dispose of hazardous waste including used oil and toxic materials**	**Properly maintain specialized waste areas**	**Keep waste containers covered or lids closed**	**Minimize outside storage areas**	**Keep materials stored under overhead cover or within secondary containment**	Keep facility clear from indoor activity being tracked outdoors	**Keep facility clear of leaking fluids from vehicles and equipment**	**Regularly conduct preventive maintenance on all vehicles and equipment**	**Have absorbent booms or spill materials available when fueling vehicles and equipment on-site**	**Capture, contain, or treat all vehicle and equipment wash water**	Train employees in stormwater, spill response, and pollution prevention	**Implement BMPs to prevent discharges from maintenance activities**	**Regularly inspect and maintain pump-out facilities**	Limit use of chemical pesticides, herbicides and fertilizers	Keep outdoor activity and operation area clean from spills and debris	**Capture, contain, or treat all wash water**	**Develop a Stormwater Pollution Prevention Plan (SWPPP)/Facility BMP Plan including a Rain Event Plan (REP)**
Likely to Reduce WQIP Pollutant - Metals		x	x			x			x	x		x	x		x	x	x	x		x				x	x
Likely to Reduce WQIP Pollutant -Bacteria		x				x						x						x			x			x	x
Likely to Reduce WQIP Pollutant - Trash		x		x		x		x			x	x								x				x	x
Facility																									
Facilities and Operations Buildings or Yard	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Port District Administration Building and Annex	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	
General Services Department	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	
Port District Boat Maintenance and Dive Locker	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Harbor Police Headquarters	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Harbor Police Dispatch Center	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Harbor Police South Bay Substation				x	x	x	x	x			x				x	x	x	x	x			x			
Broadway Pier and Port Pavilion	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x	x		x	x	x	
TAMT/NCMT/B Street CST	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
G Street Mole	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x	x	x	
Parks	x	x	x	x	x	x		x	x	x	x			x	x	x			x			x	x	x	
Parking Lots	x	x	x	x	x	x		x	x	x	x				x				x			x			
Roads and Streets	x	x	x	x	x	x									x				x			x			
MS4	x	x	x	x	x	x													x						

***BMPs in bold represent Pollution Prevention BMPs**

Notes:
[1] Illicit discharges and non-stormwater discharges are discussed in Chapter 3 Illicit Discharge Detection Elimination Program.

Table 6-4. Minimum BMPs for Major Special Events.

BMP Category	BMP
Non-stormwater Management	• Keep event site clear of illicit connections • **Keep event site clear of illegal discharges, including ice** • Have spill response materials available on site • Protect all drainage points by utilizing storm drain protection devices • Prevent spills and leaks from entering stormwater conveyance system, including air conditioning condensation
General Operations and Housekeeping	• Conduct routine inspections and proper maintenance of BMPs and stormwater conveyance • **Properly dispose of trash and debris from stormwater conveyance system** • **Conduct outdoor sweeping to adequately control dust and debris** • **Keep outdoor areas neat and clean**
Outdoor Material Storage	• **Minimize outdoor storage areas** • **Keep pollutant generating materials stored under overhead cover or within secondary containment** • Place pollutant generating materials at least 10 feet away from storm drains and/or the bay • Remove all event-related materials upon condusion of event dismantle process
Waste Handling and Recycling	• Provide adequate trash and recycling receptacles throughout event site • **Keep waste containers at acceptable levels (not overflowing)** • Keep waste containers covered or lids closed • Conduct regular and frequent trash and debris removal throughout event site • Provide secondary containment when transporting waste • **Properly contain and dispose of hazardous waste, including cooking oil and grease**
Outdoor Activity & Operation	• Keep event site free of spills and debris • **Capture, contain, or treat all wash water**
Vehicles and Equipment	• **Keep event site clear of leaking fluids from vehicles and equipment** • **Regularly conduct preventive maintenance on all vehicles and equipment** • **Have absorbent booms or spill materials available when fueling vehicles and equipment on-site** • **Capture, contain, or treat all vehicle and equipment wash water**
Education and Training	• Train event staff and vendors in stormwater, spill response, and pollution prevention
Overwater Activities	• Implement additional BMPs to prevent discharges from activities performed directly over the water
Outdoor Drainage from Indoor Activity	• Keep event site clear from indoor activity being tracked outdoors

*** BMPs in bold target WQIP priority pollutants including metals, trash and bacteria**

6.5.2 General Operations Housekeeping

Good housekeeping practices are standard procedure for Port staff. Good housekeeping practices include keeping outdoor areas neat and clean and conducting outdoor sweeping to adequately control dust and debris in outdoor and parking areas. The Port performs preventive maintenance to uphold cleanliness and to prevent pollutants from entering the MS4. MS4 structures and associated structural BMPs such as storm drain inserts are inspected and assessed for cleaning. Maintaining and cleaning MS4 structures on a regular basis helps to remove potential pollutants such as trash and sediment, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly to avoid flooding. All materials removed from the MS4 are properly disposed of through a certified contractor.

6.5.3 Non-stormwater Management

Non-stormwater management BMPs are implemented to keep Port facilities and municipal areas clear of non-stormwater discharges. Inspections are conducted at municipal facilities and areas to ensure that there are no signs of overland runoff such as over-irrigation, illegal discharges, or illicit connections to the MS4. The Port has spill materials available at the General Services operations facility and on certain fleet vehicles. Spill materials include, but are not limited to, absorbent materials and berms to capture and contain discharged pollutants. The Port contracts with a third party to clean and properly dispose of hazardous waste and other pollutants as needed.

6.5.4 Waste Handling and Recycling

Integrated WQIP Strategies: PO-8, PO-9, PO-22, PO-26, PO-27

All municipal facilities maintain waste handling areas which may contain general trash collection, recycling, and/or specialized waste areas. Waste handling areas are inspected daily to ensure they are properly managed, neat and clean, and not posing a threat to water quality. Removal of waste occurs at a regular frequency to ensure containers are kept at an acceptable level (not overflowing). All waste containers are required to have lids and are kept closed when not in use. Recycling and hazardous waste are separated, tracked, and properly disposed by a certified contractor. In addition, the Port monitors the use of parks on Port tidelands by major special events. Prior to an event, the Port provides event organizers a list of designated BMPs, as discussed in Table 6-3, and conducts pre- and post-event inspections to verify compliance (WQIP strategy PO-9).

The Port has installed pet waste bag dispensers in Port parks (WQIP optional strategy PO-22) to reduce pet waste from entering the MS4 or receiving water. This strategy aims to encourage the proper disposal of pet waste and reduce a potential load from bacteria which may affect water quality.

In addition, the Port has conducted two trash receptacle assessment studies (in FY 2016 and FY 2019) in Port municipal areas (WQIP optional strategy PO-26) to assist the Port's Integrated Waste Management Program (IWMP, WQIP optional strategy PO-27). The IWMP is the Port's operational unit responsible for addressing existing and emerging regulatory and operational challenges associated with managing waste streams generated by Port (e.g., Port facilities) and non-Port (e.g., trash entering San Diego Bay from upstream) sources. The IWMP is not intended as a regulatory or policy document for tenant-operated facilities, but rather as an internal operative document that consolidates and standardizes the Port's waste management and reporting efforts. The goal of the studies is to develop and implement recommendations for better management of trash and other waste streams generated in Port municipal areas. The trash receptacle assessment studies evaluate the size, number, type, and location of waste receptacles throughout Port maintained parks, the amount and type of litter within and surrounding each waste receptacle, the proximity of each receptacle to storm drain structures and/or the bay, and the placement of waste receptacles in respect to the size and use of the park. The data from these assessments are analyzed to determine appropriateness of the current waste receptacle conditions and management practices to identify IWMP enhancement recommendations.

In addition, abandoned items may occur periodically within Port municipal areas due to illegal dumping or homeless individuals or encampments. Accordingly, the Port responds by either removing items left due to illegal dumping or posting a 24-hour public notice to remove the items, as required by law. Once the notification period expires, the Port's Harbor Police proceeds with measures to properly dispose of the remaining materials.

6.5.5 Outdoor Material Storage

Materials and supplies stored outdoors may be exposed to rain and runoff which can result in stormwater pollution. To the maximum extent possible, the Port minimizes outdoor storage and requires the implementation of BMPs such as the use of secondary containment or overhead cover. Stored materials are to be kept away from stormwater inlets. In addition, outdoor storage areas are kept clean and all stored materials are closed and secured in properly labeled containers.

6.5.6 Outdoor Drainage from Indoor Activity

Integrated WQIP Strategy: PO-23, PO-32

A variety of activities occur inside of Port facility buildings that have the potential to contribute pollutants to the MS4. Port staff make every effort to ensure all activities remain indoors. BMPs are implemented to prevent indoor activity from being tracked outside. Most of these BMPs include good housekeeping practices such as cleaning trash, debris, or spilt material immediately. Structural BMPs may also be installed at certain facilities. For example, restrooms located in Port parks contain sewer drains where wash water is directed when cleaning. Regular sweeping of access paths to outdoor areas also contributes to less material tracked outside.

Municipal restrooms may be a source of bacteria which could be tracked outdoors. As a result, the Port has developed a strategy to conduct preventative maintenance to prevent backups from municipal restrooms (WQIP optional strategy PO-23). The goal of the strategy is to avoid discharges of wastewater and bacteria from entering the MS4 or receiving water. The Scope of Services for janitorial services contract has an environmental requirements section (Section C – Article 10 requirements and environmentally preferred products) and includes measures to be implemented to prevent waste material generated from restroom facilities at the 18 public parks maintained by the Port of San Diego through a janitorial contract from entering the storm drains (WQIP optional strategy PO-32).

6.5.7 Outdoor Parking

Parking lots have the potential to contribute numerous pollutants, such as bacteria, gross pollutants, metals, oil & grease, sediments, and trash to the MS4. In order to reduce, prevent, and eliminate pollutants from reaching the MS4, storage of materials and waste are prohibited form outdoor parking areas without the use of BMPs to contain or cover the materials. In addition, outdoor parking areas are to be kept clean and free of trash and debris, and evidence of leaking fluids from vehicles are to be cleaned whenever observed. Along with Port maintained roads and streets, parking areas are required to be swept at a regular frequency using street sweeping vehicles and/or other equipment.

6.5.8 Vehicle and Equipment Maintenance, Cleaning, and Fueling

Integrated WQIP Strategy: PO-28, PO-29

Vehicle or equipment maintenance and repair is potentially a significant source of pollution due to the use of materials and wastes created during these activities. The Port implements BMPs designed to eliminate potential impacts from pollutants which can be generated during vehicle and equipment maintenance activities. All Port vehicles are maintained on a regular schedule. Vehicles are inspected by Port staff prior to use and checked for leaks daily. In addition, the Port will replace/upgrade current maintenance equipment, such as street sweepers or power washers, to new, more efficient and effective options (WQIP optional strategy PO-28).

The Port also makes every effort to conduct maintenance and repairs indoors or under overhead cover. Indoor maintenance areas are kept clean so that oils, greases, paints, or other materials do not build-up. Drip pans are used under leaking vehicles or when removing hoses, filters, or other parts that have the potential to create a spill. Small spills are cleaned immediately with rags; larger spills are cleaned with absorbent materials. All spill material is treated and disposed of as hazardous waste.

BMPs also prevent or reduce the discharge of pollutants during vehicle and equipment cleaning and fueling. Vehicles and equipment are washed only when necessary with a hose which contains a nozzle shut-off. Vehicle and equipment washing is conducted in designated, bermed areas located away from the storm drain conveyance system. As such, wash water is captured, contained, and discharged to the sanitary sewer. If there is a potential to generate large amounts of wastewater or if there is potential for high concentrations of stormwater pollutants, the Port will contract vehicle and equipment washing to an off-site vendor. A spill response plan has been developed for the on-site fueling of vehicles and equipment and all fueling trucks maintain an adequate amount of spill clean-up materials on-hand. Spill response materials are available in the event a spill occurs.

6.5.9 Education and Training

Integrated WQIP Strategies: PO-17, PO-25

The Port has implemented an employee-training program to inform the appropriate employees, maintenance staff, and maintenance contract managers of the goals and components of the Port's JRMP. The training considers the roles of the staff involved as well as the nature and complexity of the operations under review. Training will be conducted on an annual and/or as-needed basis and is intended to instill an overall sensitivity to stormwater pollution prevention. The effectiveness of the training program is evaluated routinely to verify that information is being adequately communicated to employees. The training program consists of both formal and informal training. Training tools include, as appropriate:

- Employee handbooks
- SOP review
- Multimedia presentations
- Routine employee meetings
- Bulletin boards
- Ride-alongs
- Facility audits

Further information on education and training for municipal staff is discussed in Chapter 9 of this JRMP Program Document.

6.5.10 Outdoor Activity and Operations

Integrated WQIP Strategies: PO-24, PO-25

The Port conducts multiple outdoor activities on Port tidelands, such as landscaping along with road, street, and infrastructure maintenance. All outdoor activities and operations are required to prevent and eliminate pollutants from entering the MS4 and receiving water. The minimum required BMPs which have been discussed throughout this subsection are aimed at reducing potential threats to water quality. Specific BMPs used during outdoor activities performed by the Port to prevent or eliminate pollutants from entering the MS4 or receiving water are described below.

6.5.11 Street and Parking Facilities Sweeping

Integrated WQIP Strategies: PO-11, PO-28

Provision E.5.b.(1)(c)(iii) of the Permit requires the Port to implement a schedule of operation and maintenance for roads, streets, and parking facilities. WQIP strategy PO-11 addresses the implementation of this Permit requirement. Sweeping is an effective method of reducing the amount of pollutants on paved surfaces that may impact stormwater. The sweeping of Port maintained roads, streets, and parking facilities is conducted on a regular basis. The Port has self-propelled sweepers available for street sweeping or may contract with private companies to conduct sweeping, as necessary. In order to increase cleaning efforts, sweeper operators are advised to make a sufficient number of passes to maximize the collection of trash and debris. Once collected, sweeping debris is either taken directly to a landfill or properly stockpiled (temporarily) at a Port facility until the debris can be transported for disposal or recycling. WQIP optional strategy PO-28 identifies replacing or updating one or more of the Port's street sweeper vehicles with a more efficient model.

6.5.12 Erosion Controls

Wherever possible, existing vegetation is preserved to prevent excessive sediment erosion during rain events. Mature vegetation typically has a more extensive root system that helps hold soil in place, and thus reduces erosion. Preservation of vegetation also promotes soil stabilization by intercepting rainfall impacts to the soil and by reducing runoff velocities from the landfill cover. Mulches may also be used as temporary cover to protect the soil surface from erosion or as temporary protection to aid in the establishment of seeded vegetation.

6.5.13 Irrigation and Water Conservation

Integrated WQIP Strategy: PO-8, PO-28

The Port recognizes that limiting water use during activities such as irrigation and surface washing decreases the chances of a non-stormwater discharge. As a result, the Port has been converting turf areas with water wise landscaping since 2009. Water conservation not only increases cost savings but reduces the amount of potential runoff which may enter the MS4. The Port will continue to convert non-usable grass areas and implement the use of water wise landscaping in the future.

Due to low rainfall throughout California during calendar years 2013 and 2014, the State Water Resources Control Board (SWRCB) issued emergency water conservation regulations to reduce wasteful use of water. The following prohibitions for outdoor watering became effective during 2015 throughout the state[3]:

- The application of potable water to driveways or sidewalks
- Using potable water to water outdoor landscapes in a manner that causes runoff to adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots or structures.
- Using a hose that dispenses potable water to wash a motor vehicle, unless the hose is fitted with a shut-off nozzle.
- Using potable water in a fountain or decorative water-feature, unless the water is recirculated. Recycled water is not mandated but encouraged for fountain use.
- The application of potable water to outdoor landscapes during and within 48 hours after measurable rainfall.
- Irrigating ornamental turf on public street medians with potable water.
- Irrigating with potable water of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development.

The Port's minimum required BMPs are in accordance with the State's emergency water conservation regulations. The Port prohibits non-stormwater discharges to the MS4 and receiving water from irrigation activities, vehicle cleaning, and surface washing. Irrigation is performed in a manner which limits the evaporation and overspray of landscaped areas. Many Port parks are equipped with "smart"

[3] Office of Emergency Law File No. 2015-0506-02 EE

irrigation sensors which can sense moisture levels to limit irrigation shortly after rain events and can detect problems remotely. The Port's General Services Department implements a preventative routine facility maintenance repair program and have designated personnel to ensure the Port's irrigation system is maintained regularly and any required repairs are fixed in a timely manner to ensure it is working properly. Maintenance is performed to correct broken sprinkler heads and to prevent runoff from landscaped areas. The Port also implements xeriscaping, or drought-tolerant landscaping, and drip irrigation watering systems at municipal facilities and parks whenever possible as both strategies cut down on water usage and minimize the likelihood and occurrences of over-irrigation. Vehicle and equipment washing is conducted using hoses with shut-off nozzles and all wash water is contained and directed to the sanitary sewer.

A WQIP optional strategy (PO-28) suggested by the Port is to replace or update existing surface washing equipment. Newer equipment may be able to conserve and recycle water.

6.5.14 Use of Pesticides, Herbicides, and Fertilizers

Integrated WQIP Strategy: PO-12

Permit Provision E.5.b.(1)(d) requires the Port to implement BMPs to reduce pollutants in stormwater discharges and prohibit discharges of non-stormwater to the maximum extent practicable associated with the application of pesticides, herbicides, and fertilizers. WQIP strategy PO-12 addresses the implementation of this requirement. The Port maintains a variety of landscaped municipal areas where the application of pesticides, herbicides, and fertilizers is routinely conducted. The Port has an Integrated Pest Management policy to limit and/or eliminate the use of toxic substances to the maximum extent practicable.

The Port instituted an Integrated Pest Management (IPM) Policy in 1997. The IPM policy provides the guiding principles to which the Port adheres concerning application and management of pesticides and herbicides. The Port has implemented several measures to address potential discharges associated with the application, storage, and disposal of pesticides, herbicides, and fertilizers.

- Minimum BMP Requirements: As previously described, the Port's minimum BMPs require that runoff generated from surface washing and irrigation be eliminated to reduce the transport of pesticides, herbicides, and fertilizers. Specifically, all municipal facilities are required to meet the minimum BMP requirements relating to outdoor material storage (Table 6-3). All materials, including pesticides, herbicides, and fertilizers, which are stored for use or disposal, will be located in areas with cover and secondary containment. In addition, stored materials containers must be kept closed and secure.

- Training/education/certifications: Only Port employees that are specifically trained and certified to apply pesticides, herbicides, or fertilizers can perform these activities on Port tidelands. As described in Section 9.3.1.5, Port landscaping staff complete annual training annually through public seminars and internal training on laws and regulations applicable to pesticide use and the connection between water quality impacts and pesticide use. The Port requires anyone considered to be an applicator or field worker maintain current applicable certifications and complete annual training, as discussed in Table 9-10. The Port also sponsors an annual regional IPM seminar in coordination with the University of California Cooperative Extension to provide information to municipal staff, local businesses, and the public about IPM topics.

- Contract Requirements: The Port requires all contractors comply with all rules and regulations of the Department of Food and Agriculture, the Department of Health, the Department of Industrial Relations and all other agencies such as the Department of Pesticide Regulation, which govern the use of pesticides and rodent control. Contractors must provide the Port a current registered copy of the County of San Diego certificate which permits application of pesticides and rodent control.

  The contracts also require the use of environmentally preferable products and include the following statement: "*Environmentally Preferable Products - In alignment with the District's Green Port Policy, the District will strive to minimize environmental impacts directly attributable to operations on San Diego Bay and the tidelands. In alignment with this Policy, the District has established criteria for the procurement of environmentally preferable products*."

6.5.15 Sanitary Sewer Lateral Inspections and Maintenance

Although the Port does not maintain sanitary sewer lines other than laterals from Port managed areas, routine inspections of sewer lift-stations and boat pump-out stations are conducted to ensure the system is functioning properly. Maintenance and inspections are performed on sewage lift stations and boat pump-out stations twice a week. Sewage lift stations are also maintained annually or as-needed. If discharges from sewage laterals are detected, the system is shut down until repairs can be made. If sewage is detected in the MS4 or in the receiving water emanating from outside agencies, the issue is referred to the appropriate jurisdiction and any assistance needed to resolve the incident is provided by Port.

6.5.16 Minor Maintenance Projects

Integrated WQIP Strategy: PO-24, PO-25

Minor maintenance projects may be conducted by Port staff on an as needed basis at municipal facilities or areas. BMPs are required to prevent the discharge of any maintenance related materials to the MS4 or receiving water. The Port's Minor Maintenance and Construction Activities

BMP Guidance document was developed in FY 2016 (WQIP optional strategy PO-24). The guidance document was designed to help General Services staff be aware of and to implement necessary BMP procedures to mitigate the discharge of trash, contaminated debris, and other pollutants when doing minor maintenance and construction activities at municipal facilities and parks on Port tidelands. Training events on the use of the guidance document to select, implement, and monitor the BMPs (WQIP optional strategy PO-25) are also completed on an annual and/or as-needed basis.

6.5.17 Over Water Activities

Integrated WQIP Strategy: PO-31

The Port maintains and operates a variety of structures such as docks or piers which exist over the water. During all activities, including general maintenance and cleaning, BMPs are required to be implemented to prevent discharges from reaching the receiving water. As with all surface washing activities, wash water is required to be contained or captured. Wooden piers are required to be dry swept or vacuumed to remove as much loose debris as possible. If any spills or hazardous materials are observed, they are cleaned with absorbent materials and properly disposed. Pressure washing may be conducted with Bay water only. In FY 2017, the Port completed a review of the power-washing standard operating procedure and found it to adequately address the new permit requirements (WQIP optional strategy PO-31).

6.5.18 Marine Terminals Facility BMP and Rain Event Plans

Integrated WQIP Strategy: PO-56

The Port's approach for stormwater management at the marine terminals was updated in FY 2019 to better align with facility operations and synchronize with terminal modernization. The updated approach is multifaceted, and includes additional staffing, wet weather monitoring to assess BMP effectiveness, a terminal specific inspection and audit process, permanent BMP installation, education/outreach and program assessment. Along with the required minimum BMPs applicable to facilities across the tidelands, individual Port tenant and Port common area facility BMP plans and Rain Event Plans [4] are also required (for marine terminal tenants see Section 7.5.2).

The Port maintains the common areas at the Tenth Avenue Marine Terminal and B Street Pier. The Port BMP Plans for the common areas identify the common area-related PGAs and describe the measures that will be implemented to prevent the discharge of pollutants in runoff. Additionally, the BMP Plans include an inspection schedule, a list of responsible parties, drainage

[4] Rain Event Plan (REP). The REP is a precipitation triggered plan that includes inspections prior to, during and after a rain event to identify and complete BMP-related corrective actions to maximize BMP effectiveness

maps and spill response procedures. The BMP Plans also have Rain Event Plans that are specifically focused action plans in that a facility will carry out in preparation for rain up to 72 hours beforehand. The goal of the Rain Event Plans is to ensure that potential pollutants are minimized. The Rain Event Plans identify required actions by the District and terminal tenants to ensure outdoor areas were cleaned and pollutant sources minimized just prior to and during rain. The efforts at the marine terminals are reflected in the new Port WQIP strategy PO-56.

6.5.19 Pollution Prevention BMPs and WQIP Priorities

The WQIP priority pollutants are taken into consideration when determining the impact a PGA may have on water quality and the minimum BMPs required for that PGA. A given PGA can be considered to have a higher discharge potential if it generates the WQIP pollutants or if it occurs in a hydrologic area in which the pollutants generated by that activity are priority pollutants. Therefore, WQIP priorities have been factored into the determination of minimum BMP requirements.

The Port has developed a list of pollution prevention BMPs applicable to municipal facilities on Port tidelands as required by the Permit. Pollution prevention practices are comprised of a variety of the minimum required BMPs as well as additional controls to reduce or eliminate pollution at the source. Pollution prevention minimizes the availability of pollutants exposed to stormwater and/or non-stormwater runoff. Because pollution prevention BMPs eliminates pollutants at their source, it is a preferred means of preventing discharge of priority pollutants into the receiving waters. The following minimum required BMPs identified in Table 6-3 serve as pollution prevention BMPs for all existing developments (municipal, industrial, and commercial). The list of pollution prevention methods includes the following:

- Keep facility clear of illegal discharges, including irrigation runoff (Trash, Metals, Bacteria)
- Keep waste containers covered or lids closed (Trash)
- Minimize outdoor storage areas (Trash, Metals)
- Capture, contain and/or treat wash water (Bacteria, Metals)
- Conduct employee training (Bacteria, Trash, Metals)

In addition, the Port will require the following pollution prevention practices at municipal facilities and areas:

- Safe Alternative Cleaning Products and Good Housekeeping Practices: The Port performs routine cleaning of a variety of facilities and areas throughout its jurisdiction. These facilities include but are not limited to buildings, restrooms, and outside areas. The Port utilizes safer alternative products where feasible to reduce the availability of toxic chemicals spilling and/or contacting runoff. The Port also employs good housekeeping practices such as proactive attention to spills or frequent trash disposal to limit the availability of substances or trash and debris from reaching the MS4 and receiving water.

- Stormwater Conveyance Signs: Stormwater pollutant loads reaching the MS4 can be greatly reduced when prohibitions against littering and illegal dumping are strictly enforced and the public is educated on improper disposal of pollutants into the MS4. The Port has been actively marking storm drain inlets with stencils or placards which indicate "No Dumping." This effort will continue and be prioritized in the high priority areas defined in the WQIP.

6.6 Municipal Facilities and Areas Inspections

Integrated WQIP Strategy: PO-8, PO-9, PO-21, PO-56

The Port is required to conduct inspections of municipal facilities to monitor and verify compliance with the Port's ordinances, permits, and the Permit. The Permit requires that each existing development facility in the Port's inventory be inspected at least once during the permit cycle. Inspection methods may include drive-by inspections or on-site inspections. This section discusses how the Port intends to inspect municipal facilities pursuant to the core permit requirements (PO-8) and enhanced inspections for those facilities that are determined to be higher sources of the WQIP pollutants bacteria, metals, and trash (WQIP Optional Strategy PO-21).

In addition to inspections, audits may also be used as an educational tool to promote communication and facilitate review of BMP Plans and BMP Plan implementation. In FY 2019, the Port began to conduct audits of the Facility BMP and Rain Event Plans for Port common areas on TAMT and B Street Pier. More information on the audits and other outreach efforts for Port staff at the terminals is provided in Chapter 9.3.1.7.

6.6.1 Inspection Methods

In accordance with Provision E.5.c(1)(a)(i) of the Permit and WQIP strategy PO-8, the Port will conduct inspections of its municipal inventory. Inspections will be conducted to verify that the minimum required BMPs presented in Table 6-3 are properly implemented and maintained. EP staff or contractors working on behalf of the Port will conduct municipal permit stormwater inspections. The Port may select drive-by or onsite inspections for the core program. Drive-by inspections will be used when internal access to a facility is not necessary to determine discharge status (e.g. when inspecting possible facility influence into MS4 structures in publicly accessible areas) or those instances where facility access is not essential to assess the facility's adherence to minimum BMP requirements. Drive-by inspections may occur in response to reports from members of the public of an illicit discharge into the MS4/receiving water. Onsite inspections will be used when a drive-by inspection does not provide enough access needed to assess minimum BMP implementation or during an illicit discharge or illegal connection into MS4/receiving water.

6.6.2 Municipal Facilities and Areas Inspection Frequency

Integrated WQIP Strategy: PO-8, PO-21, PO-56

The Permit requires the Port's inventoried facilities (commercial, industrial, and municipal) be inspected once every five years. The Permit also requires onsite inspections of an equivalent of at least 20% of all inventoried facilities be completed each year. Consistent with Provision E.5.c(1)(iv), if the Port deems a facility requires more than one onsite inspection in a given year, the additional onsite inspections completed at the facility will be counted toward the annual 20% requirement[5].

The frequency at which inspections will be conducted is dependent upon the priority assigned to the municipal facility or area. As discussed in Section 6.4.1, the Port has classified its municipal inventory as either high priority or low priority. The facilities or areas categorized as high priority are those that have activities which may generate pollutants identified as priorities in the WQIP. Low priority facilities or areas are those which have fewer pollutant generating activities and/or receive less use and therefore present less of a risk to water quality.

For any given year, review of past inspection results can be used to identify a subset of municipal facilities that may be inspected twice per year and reclassified as high priority (WQIP optional strategy PO-21). The strategy includes ensuring proper implementation of minimum BMPs that are specific to the facility, area types, and Pollutant Generating Areas (PGAs). In accordance with the revised stormwater management approach at the terminals, the Port common areas on the Tenth Avenue Marine Terminal and B Street Pier will also be inspected twice per year. In addition, facility audits of Facility BMP and Rain Event Plans are conducted for all tenants on the terminals twice per fiscal year. The audits occur in the first and fourth quarter of each fiscal year.

Table 6-5 identifies the frequency and method that will be employed within the Core Program (PO-8) and inspection enhancement (WQIP Optional Strategy PO-21). Note that inspection frequency will be evaluated annually throughout the permit term and may be modified as needed in response to inspection history and valid public complaints.

[5] Municipal Permit Provision E.5.c(1)(iv) footnote (p. 117): If any commercial, industrial, or municipal facilities or areas require multiple onsite inspections during any given year, those additional inspection will be counted toward the total annual inspection requirement.

Table 6-5. WQIP Strategy Inspection Frequency & Method.

WQIP Strategy #	Description	Inspection Frequency[1]	Inspection Methods	Use of Pollution Prevention Strategies
PO-8	Core Program	Once per permit term (equivalent of at least 20% of inventory/year)	• Drive by • On-site	Required
PO-21	Inspection Enhancements	Twice/year for subset of municipal facilities	• On-site	Required
PO-56	Marine Terminals Stormwater Program	Inspection – twice/year Audit – twice/year	• On-site	Required

1 Inspection frequency subject to change based on inspection history and valid public complaints

6.6.3 Municipal Facilities and Areas Inspection Content

Integrated WQIP Strategy: PO-8

Typically, the Port will conduct on-site inspections of its municipal inventory. The general inspection process of municipal facilities and areas will include the following elements:

A) A review of previous inspection records for each municipal facility or area;

B) An evaluation of the appropriate minimum required BMPs applicable to the municipal facility or area;

C) A visual assessment for the presence of potential or actual non-stormwater discharges and illicit connections to the MS4;

D) A verification of the implementation and maintenance of minimum required BMPs; and

E) An assessment of efforts to make appropriate corrective actions when ineffective BMPs have been identified.

The inspection of Port municipal operations buildings and yards, parks, roads and streets, and parking areas will include related infrastructure such as fishing piers, boat launch ramps, sewer lift- and pump-out stations, and the MS4. Roads and streets will receive drive-by inspections to quickly estimate lack of BMP implementation or the presence of non-stormwater discharges. Although roads and streets will receive an annual drive-by inspection, Port or contractor staff perform street sweeping on a weekly basis. The Port tracks the areas in which the street sweepers operate and tabulates the number of curb miles swept. These records will include the date, area, and the number of passes which occurred to properly clean a specific area. Records of street sweeping will be retained and reported annually.

The contents of the inspection will include, at a minimum, the requirements presented in Provision E.5.c(3) of the Permit:

- Name and location of the municipal facility or area
- Date of inspection and/or re-inspection
- Inspection method (Drive-by, Visual inspection, Onsite)
- General Observations
- Description of corrective actions or violations
- Description of enforcement actions issued to resolve corrective actions and violations and the date of resolution

Inspectors will fill out a form which includes a check list of minimum required BMPs applicable to the facility or area. Inspections will assess whether appropriate BMPs are present and if they are properly implemented. If BMPs are not properly implemented or if non-stormwater discharges are observed, corrective actions or violations will be noted on the inspection form and a follow-up inspection will be required to correct the problem. Those inspections which require follow-up procedures to properly implement BMPs or eliminate a non-stormwater discharge will be forwarded to the Port's enforcement process and will be responded to in a timely manner.

Inspections will include written documentation and photographic evidence of all violations, improper BMP implementation, or areas that require corrective actions. The inspection program will also include timely follow-up inspections whenever recommended corrective actions or BMP deficiencies have been identified. Photographic evidence to document all violations, improper BMP implementation, or areas that require corrective action shall be collected at the time of the inspection. The inspections will be retained in the Port's stormwater database.

For Port common areas located on TAMT and B Street Pier, facility audits will occur twice per year. The goal of the audit is to support effective BMP management by conducting facility walk-throughs and reviews of BMP and Rain Event Plans to identify any modifications as to how their pollution prevention strategies are implemented and to provide recommendations to improve BMP effectiveness.

6.6.2 Municipal Facilities and Areas Inspection Tracking and Recordkeeping

The Port has developed an electronic stormwater database to input municipal facility and area inspections. The database tracks inspections and any necessary follow-up inspections through completion. Records of inspections are permanently stored in the database and can be queried by date as needed. Specific reports regarding completion of inspections, BMP implementation, and enforcement required to resolve improperly implemented BMPs can also be generated.

6.6.3 MS4 and Structural BMP Inspection Frequency

Integrated WQIP Strategies: PO-10, PO-30

In accordance with WQIP strategy PO-10, MS4 structures owned, operated, and maintained by the Port including inlets, manholes, and outfalls and associated structural BMPs (i.e., inlets filters) will receive an assessment of cleaning and maintenance needs during the inspection of municipal facilities or areas. Proper cleaning and maintenance of the MS4 and BMPs is designed to ensure that the structures function properly and reduce potential pollutants from reaching the receiving water. In accordance with the frequency of inspections for municipal facilities and areas, the MS4 and BMP infrastructure located within high priority facilities or areas will be inspected annually whereas those associated with low priority facilities will be inspected at least once every 5 years. .

Per WQIP optional strategy PO-30, during FY 2016, the Port began to annually evaluate the inspection results from the past five years of MS4 monitoring data. The evaluation of the MS4 program data will enable the Port to identify whether modifications to inspection and/or cleaning activities are needed and to be implemented (i.e., change in frequency or location) to effectively address higher trash generating areas. Structures that were observed to have 50% debris accumulation during a routine inspection for at least two of the five years, or structures that required cleaning three or more times in five years, were determined to require increased inspection frequencies. Those MS4 structures determined to require more frequent MS4 cleaning will be conducted at least annually. Those structures determined to be in areas with less trash generation will be inspected at least once every five years.

6.6.4 MS4 and Structural BMP Inspection Content

Each MS4 and BMP structure will receive an individual inspection. Port or contractor staff will open manhole covers or inlet grates as necessary to make clear observations of the MS4 or BMP. At a minimum, the following information will be recorded for each MS4 or BMP structure:

- Date of inspection
- Type(s) of accumulated debris observed in the MS4
- Volume of accumulated debris
- Indication whether the structure needs to be cleaned

Additional notes may be collected regarding the condition of the structure, as needed. The contents of MS4 inspections will be entered into and stored in an electronic database.

6.6.5 MS4 Cleaning and Maintenance

During MS4 and BMP inspections, debris accumulation within these structures will be evaluated for cleaning. If the presence of debris is greater than 33% of the structure's capacity or the types of materials observed in the MS4 warrant immediate attention, the structure will be identified for cleaning. The location and details of each structure requiring cleaning will be identified and cleaning will take place in a timely manner. If a structure's integrity is noted to be in poor condition, a work request will be created to repair the problem.

6.7 Special Event Inspections

Integrated WQIP Strategies: PO-8, PO-9

Special events have been identified by the Port as a potential source of non-stormwater discharges to the storm drain system and San Diego Bay. The Port will conduct stormwater training and inspections of special events at municipal facilities on Port tidelands with an anticipated attendance of 500 people or greater. The special events inspection program includes stormwater training, pre-event and post-event inspections, and follow-up enforcement in Port-managed municipal areas in order to assist in maintaining compliance with the Municipal Permit. To prevent unauthorized discharges, the Port requires the implementation and maintenance of BMPs at all special events.

6.7.1 Inspection Frequency and Content

Special event inspections are completed a minimum of two times, with inspections completed before and after each event. The general inspection process of special events will consist of the following components:

1. An evaluation of the appropriate minimum required BMPs applicable to the special event;

2. A verification of the implementation and maintenance of minimum required BMPs following stormwater training;

3. Visual observations of the special event location for presence of actual non-storm water discharges, the presence of actual or potential discharge of pollutants, and the presence of actual or potential illicit connections; and

4. An assessment of efforts to make appropriate corrective actions when ineffective BMPs have been identified.

Inspectors will collect observational information and evaluate the special event area for proper BMP implementation during both pre- and post-event inspections. Minimum required BMPs (Table 6-4) specific to the activities planned for each special event are to be identified prior to the event. The pre-event inspection includes meeting with the event representative, reviewing the minimum required BMPs identified on the Pre-event Stormwater Inspection Report, evaluating and documenting the physical conditions of the event site, and training the event representative on how best to implement the applicable minimum required BMPs. The stormwater training will cover pollution prevention, spill response, and the Port's discharge prohibitions. The event representative will review and sign the Pre-event Stormwater Inspection Report, concluding the pre-event inspection. Additionally, all photographs documenting the pre-event site conditions will be uploaded to a Pre-event Photo Log and emailed with a scanned copy of the Pre-event Stormwater Inspection Report to the event representative for review.

During the Post-event inspection, inspectors will assess the special event representative's implementation of required minimum BMPs and its effectiveness in preventing any discharge into the MS4 and receiving water. Visual assessments and photographic evidence to document all violations, improper BMP implementation, or areas that require corrective action will be taken at the time of the inspection. Post-event inspection results will be summarized in the Post-event Stormwater Inspection Report and emailed to the event representative. The inspector will review the results of the inspection with the event representative and an evaluation letter and or email will be written based on the visual assessment of discharges and implementation and effectiveness of the BMPs on-site. If any problems or violations are found, Port inspectors will document appropriate actions in accordance with the Enforcement Response Plan (ERP, Appendix C) pursuant to Provision E.6. In addition, any BMP violations noted on the inspection form will be discussed with the event representative and corrective actions will be recommended in accordance with the Port's ERP.

6.7.2 Special Event Tracking and Recordkeeping

The results and observations made for all inspections are currently entered into an Excel database. However, the Port is planning to update the stormwater database to include special event inspections. All special event inspection information including inspection date, time, inspection method, observations and findings is included on the inspection field forms and is contained in the Excel database. For onsite inspections, the inspection records will also contain, as applicable a description of any problems or violations found during the inspection(s); a description of enforcement actions issued in accordance with the ERP; and the date problems or violations were resolved. The Excel database along with scanned copies of all inspection records will be stored within the Port's special event SharePoint site.

The Excel database is also used to track the number of facilities that meet the minimum BMPs, require a follow-up or corrective action, or receive a violation. Inspection results will be reported in the JRMP Annual Report.

6.8 Enforcement

Integrated WQIP Strategy: PO-15, PO-16

Pursuant to Provision E.4 of the Permit, the Port is required to use its legal authority for all its inventoried existing development facilities, as necessary to achieve compliance with the Permit. The enforcement process for the existing development program has been included in the Enforcement Response Plan (ERP). It describes the enforcement actions that may occur to ensure that designated minimum BMPs are implemented and maintained at the applicable facilities, facility documentation and training are updated, and industrial business have obtained proper industrial permit coverage (if applicable). During implementation of the Existing Development Municipal program, there may be items identified that require enforcement to ensure or maintain JRMP and Permit compliance. Some of these issues include the following:

- Facility or special event does not properly maintain and implement BMPs or maintain required documentation;
- Required BMPs are missing;
- The facility fails to obtain coverage under the statewide Industrial General Permit;
- Unauthorized discharge, such as irrigation runoff occurs as a result of missing or inadequate BMPs.

The enforcement response approach and options for the Existing Development program are fully discussed in the ERP found in Appendix C of this document.

6.9 Retrofit and Rehabilitating Areas of Existing Development

The Permit requires the Port to develop a program to retrofit areas of existing development to address identified sources of pollutants and/or stressors that contribute to the Port's WQIP highest priority water quality problems. The Port has identified candidate areas within existing development that would be feasible for retrofitting and has developed a strategy to facilitate the implementation of such projects. Such candidate areas focus on the WQIP pollutants, bacteria, metals, and trash, and include potential industrial and commercial areas. The Port's program for all existing development, including industrial and commercial facilities is found in Appendix H.

Chapter 7 Existing Development: Industrial and Commercial

7.1 Introduction

Provision E.5 of the Municipal Permit requires the Port to implement an existing development management program focused on industrial and commercial facilities in accordance with the strategies in the San Diego Bay Watershed WQIP in addition to core permit requirements. The core permit requirements include developing and maintaining an inventory of commercial and industrial facilities, establishing minimum BMPs and a verification and enforcement process to ensure the BMPs are implemented.

There are several industrial and commercial facilities that operate on Port managed property. These facilities occupy Port tidelands through long term leases, temporary occupancy permits, and other binding agreements with the Port. The Port also manages two marine terminals and a cruise ship terminal where industrial activities occur.

This chapter describes how the Port will meet the Permit conditions outlined in Permit Provisions F.2.a and E.5 for existing development. Table 7-1 identifies the specific subsections of this chapter that correlate to permit conditions.

Table 7-1. Existing Development Industrial/Commercial Permit Requirements and Corresponding JRMP Section.

Permit Requirement	Permit Reference	JRMP Section
Inventory Development and Tracking	E.5.a	7.4, Appendix F, and Appendix G
BMP Implementation and Maintenance	E.5.b	7.5
Inspection Frequency	E.5.c.(1)	7.6.1
Inspection Content	E.5.c.(2)	7.6.2
Inspection Tracking	E.5.c.(3)	7.6.3
Enforcement	E.5.d	7.7 and Appendix C
Retrofitting & Rehabilitation	E.5.e	7.8 and Appendix H

This chapter describes the Port's program to reduce and prevent industrial and commercial discharges of pollutants to the MS4. This program will be implemented through active management of an inventory of commercial and industrial facilities, pollutant source identification, BMP implementation, inspections, enforcement, and reporting of industrial non-filers. The Port will use these steps to regulate the urban runoff from industrial and commercial facilities throughout the tidelands and to reduce and/or eliminate the discharge of priority pollutants as outlined in the WQIP.

7.2 WQIP Strategies for Existing Development - Industrial and Commercial

The Permit requires that the Port implement an existing development management program in accordance with the strategies in the WQIP described pursuant to Provision B.3.b.(1). The Port has identified metals, bacteria, and trash as its focused watershed priorities, particularly within the hydrologic sub-areas of 908.22, 909.10, 910.10, and 910.20 (Table 1-1).

Commercial and industrial sources have the potential to generate the WQIP priority pollutants, and accordingly, the Port has developed strategies intended to prevent or minimize these discharges. The strategies range from the implementation of, or enhancements to the core Permit requirements. These strategies are either project specific or location specific actions targeted toward commercial and industrial sources. The specific WQIP strategies focused on commercial and industrial sources are identified in Table 7-2.

Within the subsections of this chapter (identified in Table 7-2), the Port will outline the manner in which each WQIP strategy will be implemented within its JRMP programmatic efforts. Refer to Appendix A for more detail on the strategies.

Table 7–2. WQIP Strategies for Commercial and Industrial Sources.

SDB ID	Strategy Name	Implementation Year (Trigger if Optional)	JRMP Section(s)
PO-7	Implement Core JRMP Program for existing development (commercial and industrial facilities) to require implementation of minimum BMPs that are specific to the facility, area types, and PGAs, as appropriate.	FY15	7.4.2 7.5 7.6.1, 7.7
PO-21*	Perform annual inspection of commercial, industrial, and municipal facilities that are higher sources of trash, metals, and bacteria	FY-16	7.6.2
PO-44*	Develop and implement a retrofit program to encourage installation of water conservation measures in existing businesses (e.g. xeriscaping, irrigation sensors, etc.) [CAP Water Conservation Measure (WC 1.3)][1]	FY-17	7.5.2
PO-45*	Installation of structural treatment control BMPs in storm drains in high priority areas to address trash, metals, and bacteria (facility-specific based on inspections and repeat violations)	FY16	7.5.2
PO-47*	Installation of inlet inserts in storm drains in high priority areas	FY-18	N/A
PO-48*	Installation of trash skimmers in marina basins	FY-18	N/A
PO-53*	Develop a Marine Terminal Structural BMP Action Plan for Tenth Avenue Marine Terminal (TAMT)	FY-18	7.5.2
PO-54*	Develop a Structural BMP Action Plan for Cruise ship Terminal at B Street Pier	FY-18	7.5.2
PO-55*	Develop a Structural BMP Action Plan for National City Marine Terminal	FY-18	7.5.2
PO-56*	Marine Terminals Stormwater Program	FY-19	7.5.2, 7.6.2

Notes:
SDB ID means San Diego Bay WQIP Strategy Identification Number. PDP means Priority Development Project

*These strategies were classified as optional strategies and require a trigger to be implemented.

7.3 Industrial and Commercial Facilities on Tidelands

In general, the stationary industrial and commercial facilities operating on tidelands are tenants of the Port. These facilities have established agreements with the Port either through a lease agreement, temporary occupancy permit or other binding agreements to occupy the Port leased property. The Port's inventory of industrial and commercial facilities is unique in that many of the businesses on tidelands are maritime or tourism related.

The Port's industrial facilities inventory consists of marine terminals, shipyards, boatyards, and other maritime-related businesses. Several of these businesses have been issued Waste Discharge Identification Numbers (WDID) numbers under the Industrial General Permit (IGP)[1], while several others (primarily shipyards and boatyards) hold individual NPDES Permits.

The Port's commercial facility inventory include hotels, restaurants, marinas and yacht clubs, retail shops, and other commercial and recreational waterfront-related business activities. The facility types included on the tidelands are limited to those listed in Table 7-3, below. A complete list of the commercial/industrial facilities currently in the inventory[2] as well as specific facility information required by Provisions E.5.a.(1) & (2) of the Permit is included in Appendix G. A map showing the location of existing inventoried development, watershed boundaries, and water bodies is included in Appendix F.

Table 7-3. Industrial & Commercial Facility Types Present on Port Tidelands.

Facility Types	
Industrial	**Commercial**
Boatyards	Auto repair, maintenance, fueling and/or cleaning
	Eating or drinking establishments
Chemical and allied product manufacturing	Hotels/Motels
	Marinas/Yacht clubs
Corporate yard, equipment, storage and repair	Marine services and supplies
	Museums
Industrial uses not elsewhere classified	Offices, administrative uses
	Parking lot/storage
Marine terminals and cruise ship terminal	Parks or other recreational areas/facilities
	Realty, including boat and automobile sales
Shipyards	Retail or wholesale fueling sites
	Specialty food and beverage shop
Wholesale distributors	Sportfishing
	Water transportation services, passengers

[1] Order 2014-0057-DWQ: National Pollutant Discharge Elimination System (NPDES) General Permit For Storm Water Discharges Associated With Industrial Activities NPDES No. Cas000001.
[2] The current inventory included in Appendix G displays only active facilities. However, the Port's stormwater database tracks all facilities both active and inactive.

7.4 Commercial/Industrial Facilities Inventory and Tracking

The Permit requires the Port to develop a watershed-based inventory of all commercial and industrial facilities having the potential to discharge a pollutant load to the MS4. The Port's existing stormwater database meets that permit requirement. The stormwater database is the primary component for storing facility-related stormwater information such as inventories, static facility data (address, PGAs, contact person, etc.), inspection records, watershed information, BMPs, construction/development activities, and compliance history. The database maintains ongoing records of all stormwater data collected at each facility since 2008. This database serves as the repository from which facility inventories are created, inspections are prioritized, and enforcement is tracked.

7.4.1 Source Characterization and Prioritization

The Port uses a standardized methodology to evaluate and assess the discharge potential of a given facility and its impact on WQIP priority pollutants. A facility's discharge potential is represented by an "Overall Threat to Water Quality" rating which is either "high" or "low". This rating ultimately determines facility priority ranking for the purposes of determining facility inspection frequency. Continued facility inspections will serve to either confirm or modify the rating, as empirical data is gathered, such as verification of pollutant generating activities, BMP implementation, and compliance history.

The Port uses an internal standard operating procedure to ensure that the prioritization is conducted accurately and consistently during the annual inventory update; the process is summarized herein. Several factors are considered when making the threat to water quality determination. These factors include not only the facility's pollution generating activities and potential pollutants, but the weighted impact of those pollutants based on WQIP priorities for the watershed and the location in which a given facility resides. A given pollutant may thus represent a greater threat to water quality in one area of the watershed compared with another, and this can ultimately affect the evaluation of discharge potential for a facility.

In FY 2017, the Port amended its source characterization and prioritization assessment process SOP to include facility inspection history. In addition, if a facility had two or more inspections during the permit cycle with no corrective action or follow up inspections required, the Port may elect to forego the annual inspection in the following fiscal year. The inspection history of all facilities will be evaluated annually to determine inspection schedules.

7.4.2 Inventory Management & Annual Updates

Integrated WQIP Strategy: PO-7

The Port facilities inventory is actively managed and reviewed annually. The Port's Real Estate department is primarily responsible for managing tenant inventory on Port tidelands. The EP department has developed a process for annually acquiring and reviewing tenant lists from the Real Estate department to update the Port's stormwater database.

The stormwater database includes all of the facility-specific information required by Permit Provisions E.5.a.(1-3). This includes information such as inventories, static facility data, whether a facility is active or inactive, inspection data, minimum BMP requirements, and compliance history.

The Port's stormwater database also tracks the Permit-required watershed information for all facilities, including the hydrologic area in which the facility is located, the WQIP priority pollutants associated with the facility and minimum BMP requirements. In this manner, the Port can track the numbers and types of facilities within each WQIP high or focused priority condition area and provide inspection and enforcement summaries based upon adherence to WQIP minimum BMPs. As the JRMP program progresses, additional queries may be built into the stormwater database to highlight watershed efforts.

Inspections serve as a further means of verifying the accuracy of the database information, as well as identifying sub-tenants which may not be contained in the master tenant list obtained from the Port's Real Estate department. Using the process described above ensures that the Port's inventory information is reviewed during facility inspections and updated at least annually. The Port also conducted an internal audit of its stormwater program in June 2016. The audit recommended an additional quality check process to provide additional verification on the completeness of the Port's facility inventory. The process, which involves routinely selecting and tracking existing and new facilities or activities observed in the field to the database, has been incorporated into the Port's SOP process.

7.5 BMP Implementation and Maintenance

Integrated WQIP Strategy: PO-7

Protecting and improving water quality requires the incorporation of pollution prevention practices and source control BMPs. In some instances, treatment control BMPs are also required to prevent discharges.

Pollution prevention occurs when materials and resources are utilized more efficiently, or when less harmful substances are substituted for hazardous ones. Pollution prevention practices and processes reduce or eliminate the generation of pollutants, in contrast to source control BMPs, treatment control BMPs, or disposal. Source control BMPs (both structural and non-structural) generally reduce contact between pollutants and runoff by keeping pollutants protected from exposure to the weather. Structural treatment control BMPs physically remove pollutants from runoff through a variety of processes. From a cost and aesthetic perspective, treatment control BMPs that use natural processes, such as grassy swales, are usually preferred over manufactured designs, where conditions allow, and can also potentially provide beneficial habitats. However, BMPs must be designed relative to local climate and geology, site constraints, urban runoff pollution challenges, and available space.

Much of the Port's tidelands, including industrial and commercial facilities and operations, have the potential to discharge directly to the receiving water. In addition, several stormdrains on tidelands are inundated daily with tidal water. As such, BMPs must be tailored to accommodate these conditions, yet remain effective.

The detailed organization of this section reflects the specific processes the Port will use to designate and require minimum BMPs, correlate BMPs with WQIP priorities, and verify BMP implementation and maintenance at industrial and commercial facilities.

7.5.1 Required Minimum BMPs

The Permit requires the Port to designate a set of minimum BMPs for industrial and commercial facilities and ensure BMP implementation. The BMPs must be specific to the facility/area and pollutant generating activities[3] (PGAs), as appropriate. Table 7-4 identifies the required minimum BMPs for all industrial and commercial facilities. The table includes a list of the facility types operating on tidelands and the corresponding PGA categories. Each PGA contains one or more BMPs that may be applicable to address pollutants from that activity. Required minimum BMPs for each facility type are denoted with an "X".

Mobile Sources at Industrial & Commercial Facilities

Mobile services may be utilized at industrial and commercial facilities. Such services may include vehicle washing, mobile fueling, swimming pool services, carpet, drape, or furniture cleaning, portable sanitary services, and landscaping and pest control services. The Port does not issue business licenses, nor does it use business licenses for authorizing operations on tidelands; instead, the Port establishes its land use/operating authority through leases, temporary use permits, and other means. Through the leases and agreements, the operators of a facility where a mobile service is used take responsibility for the discharges caused by that operation.

[3] The Port defines PGAs as "*activity categories common to general facility operations and having the potential to generate significant amounts of pollutants during routine operations*".

Notwithstanding, the Port has identified minimum BMPs for the mobile services known to operate on industrial and commercial facilities. Table 7-4 also identifies BMPs that are required for mobile sources. The list of mobile services is identified and PGA categories and corresponding BMPs are denoted with an "X". Tenants utilizing mobile services are expected to ensure those BMPs are a part of the minimum suite of BMPs implemented at their facility. On the occasion that industrial and commercial facilities use mobile services for certain activities, the facility operator is expected to ensure those persons operating mobile services on their facility have knowledge of, implement and maintain the required minimum BMPs while conducting their activities.

Marine Terminals Facility BMP and Rain Event Plans

Integrated WQIP Strategy: PO-56

The Port's approach for stormwater management at the Tenth Avenue Marine Terminal (TAMT), B Street Pier, B Street Pier, and National City Marine Terminals (NCMT) was updated in FY 2019 to better align with facility operations and synchronize with terminal modernization. The updated approach is multifaceted, and includes wet weather monitoring to assess BMP effectiveness, a terminal specific inspection and audit process, permanent BMP installation, education/outreach and program assessment. Along with the required minimum BMPs applicable to facilities across the tidelands, individual Port tenant facility BMP plans and Rain Event Plans are also required.

The facility BMP Plans identify the PGAs at each facility and describes the measures that will be implemented to prevent the discharge of pollutants in runoff. Additionally, the BMP Plans include an inspection schedule, a list of responsible parties, drainage maps and spill response procedures. The BMP Plans also have Rain Event Plans that are specifically focused action plans in that a facility will carry out in preparation for rain up to 72 hours beforehand. The goal of the Rain Event Plans is to ensure that potential pollutants are minimized. The Rain Event Plans identify required actions by the District and terminal tenants to ensure outdoor areas were cleaned and pollutant sources minimized just prior to and during rain. The efforts at the marine terminals are reflected in the new strategy PO-56 of the Port's WQIP strategies list.

Pollution Prevention BMPs & WQIP Priorities

The WQIP priority pollutants are taken into consideration when determining the impact a PGA may have on water quality and the minimum BMPs required for that PGA. A given PGA can be considered to have a higher discharge potential if it generates the WQIP pollutants or if it occurs in a hydrologic area in which the pollutants generated by that activity are priority pollutants. Therefore, WQIP priorities have been factored into the determination of minimum BMP requirements.

The Port has developed a list of pollution prevention BMPs applicable to industrial and commercial facilities on Port tidelands as required by the Permit. Because pollution prevention BMPs eliminate pollutants at their source, they are a preferred means of preventing discharge of priority pollutants into the receiving waters. The list of pollution prevention BMPs includes the following:

- Keep facility clear of illegal discharges, including irrigation runoff (Trash, Metals, Bacteria)
- Keep waste containers covered or lids closed (Trash)
- Minimize outdoor storage (Trash, Metals)
- Capture, contain and/or treat wash water (Bacteria, Metals)
- Conduct employee training (Bacteria, Trash, Metals)

Table 7-4 identifies the pollution prevention strategies that will be required to address WQIP priorities and the PGAs where they are applicable. Those BMPs will be required jurisdiction-wide and are presented in the table as bold font. The table also identifies the WQIP pollutants and denotes those BMPs that closely correlate to pollutant reduction/prevention.

Table 7-4. Industrial and Commercial Facilities Minimum BMPs.

	General Operations and Housekeeping				Non-Stormwater Management			Waste Handling and Recycling				Outdoor Material Storage		Outdoor Drainage from Indoor Activity	Vehicles and Equipment				Education and Training	Over Water Activities	Marina Management	IPM	Outdoor Activity and Operation		Planning
BMP	Conduct routine inspections and proper maintenance of BMPs and stormwater conveyance	**Properly dispose of debris from stormwater conveyance system**	**Conduct outdoor sweeping to adequately control dust and debris**	**Keep outdoor areas neat and clean**	Keep facility clear of illicit connections	**Keep facility clear of illegal discharges, including irrigation runoff**	Have spill response materials available at the facility	**Keep waste containers at acceptable levels (not overflowing)**	**Properly dispose of hazardous waste including used oil and toxic materials**	**Properly maintain specialized waste areas**	**Keep waste containers covered or lids closed**	**Minimize outside storage areas**	**Keep materials stored under overhead cover or within secondary containment**	Keep facility clear from indoor activity being tracked outdoors	**Keep facility clear of leaking fluids from vehicles and equipment**	**Regularly conduct preventive maintenance on all vehicles and equipment**	**Have absorbent booms or spill materials available when fueling vehicles and equipment on-site**	**Capture, contain, or treat all vehicle and equipment wash water**	Train employees in stormwater, spill response, and pollution prevention	**Implement BMPs to prevent discharges from maintenance activities**	**Regularly inspect and maintain pump-out facilities**	Limit use of chemical pesticides, herbicides and fertilizers	Keep outdoor activity and operation area clean from spills and debris	**Capture, contain, or treat all wash water**	**Develop a Stormwater Pollution Prevention Plan (SWPPP)/Facility BMP Plan including a Rain Event Plan (REP)**
Likely to Reduce WQIP Pollutant - Metals		x	x			x			x	x		x	x		x	x	x	x		x				x	x
Likely to Reduce WQIP Pollutant -Bacteria		x				x						x						x			x			x	x
Likely to Reduce WQIP Pollutant - Trash		x		x		x		x			x	x								x				x	x
Industrial and Commercial Facilities																									
Boatyards and Shipyards	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	
Auto Repair, Maintenance, Fueling, and Cleaning	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x			x	x	x	
Hotel/Motel	x	x	x	x	x	x	x	x	x		x	x	x	x				x	x			x	x	x	
Offices, Administrative Uses	x	x	x	x	x	x	x	x	x		x											x			
Realty, Including Boat and Automobile Sales	x	x	x	x	x	x	x	x	x		x								x	x		x		x	
Sportfishing	x	x	x	x	x	x	x	x	x		x								x	x		x	x	x	
Water Transportation Services, Passengers	x	x	x	x	x	x	x	x	x		x								x			x			
Specialty food or beverage shop	x	x	x	x	x	x	x	x	x		x	x	x	x					x			x		x	
Chemical and allied product manufacturing	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x			x			
Sandblasting and painting facility	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x			x	x	x	
Storage facilities	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x			x			
Food packaging and loading	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x	
Miscellaneous Manufacturing	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x			x	x	x	
Wholesale building materials suppliers and storage	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x			x	x	x	
Boat repair, maintenance, fueling and/or cleaning	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
Parking lots and storage facilities	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x			x	x	x	
Retail or wholesale fueling sites	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x			x	x	x	
Eating and drinking establishments	x	x	x	x	x	x	x	x	x		x	x	x	x					x	x		x	x	x	
Golf courses, parks, and other recreational areas/facilities	x	x	x	x	x	x	x	x	x		x	x	x			x			x	x		x	x	x	
Building material retailers and storage	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x			x	x	x	
Marinas	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	
Museums	x	x	x	x	x	x	x	x	x	x	x	x	x						x			x			
TAMT/NCMT/B Street CST	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
Mobile Services																									
Mobile automobile or other vehicle washing	x		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x				x	x	
Pest control services	x		x	x	x	x	x	x	x		x	x	x		x	x			x			x	x		
Mobile carpet, drape or furniture cleaning	x		x		x	x	x	x	x		x	x		x	x	x		x	x				x	x	
Landscaping	x		x	x	x	x	x	x	x		x	x			x	x	x		x			x	x	x	
Portable sanitary services	x		x	x	x	x	x	x	x		x	x		x	x	x		x	x				x	x	
Power washing services	x		x	x	x	x	x	x	x		x	x			x	x	x	x	x				x	x	

***BMPs in bold represent Pollution Prevention BMPs**

7.5.2 BMP Implementation

The Port will ensure BMP Implementation is upheld through the enforcement of its stormwater ordinance (Article 10, Appendix B) and verified through the means described in the inspection section (Section 7.6) of this JRMP. It is important to understand that the responsibility to implement the required BMPs falls upon the tenant on leased tidelands parcels and on the permit holder for Port-issued temporary use permits. However, the Port has an implementation role to (1) notify industrial and commercial facilities of BMP requirements, (2) inspect, (3) educate and (4) enforce as discussed in the relevant chapters of this JRMP document.

BMP Requirement Notifications

The Port will provide written notification to the owners and operators of industrial and commercial facilities about the minimum BMP requirements. All facilities will receive a written notification of required minimum BMPs in the initial year of Permit implementation following submittal of this JRMP program update. The written notification will also identify the additional BMP requirements that will be required if the tenant is using or may intend to use mobile services on their leasehold. In addition, facilities will be notified prior to annual routine facility inspections. All notifications will be tracked in the stormwater database.

SWPPP, Facility BMP Plan, and Rain Event Plans

Requiring a SWPPP, Facility BMP Plan, Rain Event Plan, or reviewing a facility's National Pollutant Discharge Elimination System (NPDES) required SWPPP during an inspection is another means of verifying BMP implementation. All industrial sites that are subject to coverage under the IGP or individual NPDES Permit, regardless of threat to water quality, must develop and implement a SWPPP pursuant to those permits. In addition, the Port has the authority to require a SWPPP, Facility BMP Plan, or Rain Event Plan for other industrial or commercial facilities at its discretion. This could occur if a facility is found to have multiple BMP implementation issues or repeat violations, or if the facility or area is identified as a focus area to address the Port's WQIP priority conditions. In the instances that a SWPPP or Facility BMP Plan is required, a copy of the document will be provided to the Port and included in the database for that facility.

Stormwater management at TAMT, B Street Pier, and NCMT was updated in FY 2019 to include Facility BMP and Rain Event Plan requirements for industrial facilities on the terminals (optional PO-56) to address metals, one of the Port's WQIP priority conditions, and other potential pollutants. (See Section 7.5.1). The facilities that are located at the terminals received written notification of the Facility BMP Plan and Rain Event Plan requirements as well as Port-developed templates to use in writing the plans. Verification of Facility BMP plan and Rain Event Plan implementation will be conducted through the Port's inspection process (Section 7.6.1). The Port will also reinforce good BMP implementation at the marine terminals through the audit process which began in FY 2019 (Chapter 9.3.1.7.).

Use of Structural Controls at Industrial and Commercial Facilities

Integrated WQIP Strategies:PO-45, PO-53, PO-54, PO-55, PO-56

The use of structural controls in industrial and commercial facilities is an optional strategy within the WQIP (PO-45). The trigger for this WQIP strategy is based upon the facility's inspection record or if an illicit connection or illegal discharge occurs. If a facility is found to have multiple BMP implementation issues or repeat violations, has ongoing corrective actions that are not fully remedied, has been determined to be a significant source of the WQIP pollutants, the Port can consider requiring the use of such structural controls at its discretion or may approve an alternative action that produces greater long term water quality benefits. In addition to the factors discussed above, the Port will consider whether the facility is located in the WQIP priority areas and whether the facility generates WQIP priority pollutants (trash, metals, or bacteria). Facilities required to implement this WQIP strategy will be documented in the database. The Port will provide information in annual reports on the number of facilities triggering this strategy and the effectiveness of such structural control following implementation.

In FY 2018, the Port began the development of Structural BMP Action plans to prevent the potential discharge of metals in stormwater discharges at TAMT, Cruise Ship Terminal, B Street Pier, and National City Marine Terminal. These optional strategies (PO-53, PO-54, PO-55, and PO-56) involve the design of structural BMPs to treat discharges from the terminals that considers the use and activities on each of the terminals, the challenges of the proximity to the bay and shallow depth to groundwater, and past water quality sampling records. A long-term structural BMP plan was completed for the three terminals in FY 2019. The plan identifies an escalated process the Port will follow to identify if/when a structural BMP is required, and the type needed at each terminal. The Port will provide information in annual reports on the installation of structural BMPs following implementation, as appropriate.

Irrigation Runoff Prohibition

Integrated WQIP Strategies: PO-44

As discussed in Section 6.5.13, the Port recognizes that limiting water use during activities such as irrigation decreases the chances of a non-stormwater discharge. The Port's minimum required BMPs are in accordance with the State's emergency water conservation regulations. The Port prohibits non-stormwater discharges to the MS4 and receiving water from irrigation activities, vehicle cleaning, and surface washing.

Since 2015, the Port has worked with businesses located on Port tidelands on several water conservation measures through the Green Business Network (GBN). The GBN is a voluntary sustainability program for commercial and industrial tenants, providing members with training opportunities and resources to improve operational efficiency and improve sustainable business practices. Through the GBN, the Port promotes indoor and outdoor water conservation efforts and has provided commercial and industrial tenants valuable resources to assist them in implementing measures to address water conservation and over-irrigation issues. Additional information on the GBN is provided in Section 9.3.1.8.

The WQIP optional strategy (PO-44) involves the development of the retrofit program to promote water conservation and source abatement in existing businesses (e.g. xeriscaping, irrigation sensors, trash full capture systems, etc.). The strategy will be triggered either by identification of grant funding or included as a corrective action. Port staff is also coordinating with industrial and commercial tenants to voluntarily install water conservation measures. It is anticipated that this activity could also be triggered as a corrective action for facilities with repeat violations related to irrigation runoff.

7.5.3 BMP Operation and Maintenance

As part of its core program, the Port will require the proper operation and maintenance of BMPs at industrial and commercial facilities. Proper implementation and maintenance of these BMPs are critical to their effectiveness for preventing or reducing stormwater pollution associated with industrial and commercial activities. The notification process described above, coupled with regularly scheduled inspections will ensure that industrial and commercial facilities properly operate and maintain BMPs.

7.6 Industrial and Commercial Facility Inspections

Integrated WQIP Strategy: PO-7, PO-21, PO-56

The Port is required to conduct inspections of industrial and commercial facilities to monitor and verify compliance with the Port's ordinances, permits, and the Permit. The Permit requires that each existing development facility in the Port's inventory be inspected at least once every five years. Inspection methods include drive-by inspections and on-site inspections by Port staff. This section discusses how the Port intends to inspect industrial and commercial facilities pursuant to the core permit requirements and WQIP strategy PO-7 and enhanced inspections for those facilities that are determined to be higher sources of the WQIP pollutants bacteria, metals, and trash (WQIP Optional Strategy PO-21). This process will effectively prohibit discharges and is reflective of the priorities set forth in the WQIP.

In addition to inspections, audits may also be used as an educational tool to promote communication and facilitate review of BMP Plans and BMP Plan implementation. In FY 2019, the Port began to conduct audits of the Facility BMP and Rain Event Plans for tenant facilities on TAMT, B Street Pier, and NCMT. More information on the audits and other outreach efforts for Port staff at the terminals is provided in Chapter 9.3.1.7.

7.6.1 Inspection Methods

The Port may select drive-by or onsite inspections for the core program. Drive-by inspections will be used when internal access to a facility is not necessary to determine discharge status (e.g. when inspecting possible facility influence into MS4 structures in publicly accessible areas) or those instances where facility access is not essential to assess the facility's adherence to minimum BMP requirements. Drive-by inspections may occur in response to reports from members of the public of an illicit discharge into the MS4/receiving water. Onsite inspections will be used when a drive-by inspection does not provide enough access needed to assess minimum BMP implementation or during an illicit discharge or illegal connection into MS4/receiving water.

7.6.2 Inspection Frequency

Integrated WQIP Strategy: PO-7, PO-21, PO-56

The Permit requires the Port's inventoried facilities (commercial, industrial, and municipal) be inspected once every five years. The Permit also requires onsite inspections of an equivalent of at least 20% of all inventoried facilities be completed each year. Consistent with Provision E.5.c(1)(iv), if the Port deems a facility requires more than one onsite inspection in a given year, the additional onsite inspections completed at the facility will be counted toward the annual 20% requirement[4].

Facilities that are higher sources of WQIP priority pollutants, bacteria, metals, and trash and all facilities within a WQIP high or focused priority area will be inspected annually. Annual inspections will continue until it is demonstrated that the facility does not have a significant potential to discharge the WQIP priority pollutants. The facilities that are higher sources of priority pollutants will be determined using the source characterization and prioritization methods discussed in Section 7.4.1. Only onsite inspections will be used for these facilities, using the process discussed in Section 7.6.1. For facilities that are not considered a higher priority based upon the WQIP pollutants, inspections will occur at least once every five years. Facilities in the Port's inventory not categorized as high priority in a given reporting year, will be required to submit a BMP Self-Certification documenting all required and applicable BMPs are being implemented at their facility and provide the date of the facility's

[4] Municipal Permit Provision E.5.c(1)(iv) footnote (p. 117): If any commercial, industrial, or municipal facilities or areas require multiple onsite inspections during any given year, those additional inspection will be counted toward the total annual inspection requirement.

annual stormwater training. This approach enables the Port to focus resources on facilities or areas requiring additional BMP over-sight.

An exception to the annual inspection schedule and prioritization approach for industrial and commercial facilities is with regard to the facilities on the terminals (TAMT, NCMT, and B Street Pier). The Port has developed an inspection schedule that includes more frequent inspections. Facilities located on TAMT, Cruise Ship Terminal, B Street Pier, and National City Marine Terminal will be inspected twice per year. In addition, facility audits of Facility BMP and Rain Event Plans are conducted for all tenants on the terminals twice per fiscal year. The audits occur in the first and fourth quarter of each fiscal year.

Table 7-5 identifies the frequency and method that will be employed within the Core Program (PO-7) and inspection enhancement (WQIP Optional Strategy PO-21). Note that inspection frequency will be evaluated annually throughout the permit term and may be modified as needed in response to valid public complaints.

Table 7-5. WQIP Strategy Inspection Frequency & Method.

WQIP Strategy #	Description	Inspection Frequency[1]	Inspection Methods	Use of Pollution Prevention Strategies
PO-7	Core Program	Once per permit term (equivalent of at least 20% of inventory/year)	• Drive by • On-site	Required
PO-21	Inspection Enhancements	Annual	• On-site	Required
PO-56	Marine Terminals Stormwater Program	Inspection – twice/year Audit – twice/year	• On-site	Required

[1] Inspection frequency subject to change based on valid public complaints

7.6.3 Industrial and Commercial Facilities Inspection Content

Facility inspections will verify that the facility information in the inventory is accurate, including SIC code, threat to water quality priority, facility monitoring data, and self-inspection records. The general inspection process will include the following elements:

A) Visual observations of the facility for presence of actual non-storm water discharges, the presence of actual or potential discharge of pollutants, and the presence of actual or potential illicit connections.

B) Verification that the description of the facility or area in the inventory[5] has not changed.

[5] Per the inventory provisions identified in the Permit (Provision E.5.a.(2))

C) Assessment of the implementation of the designated BMPs, and

D) Verification of coverage under the IGP, when applicable.

Prior to any inspection, Port staff will review permit applications, past inspections, compliance history and, for on-site inspections, will notify a facility representative to schedule an inspection. Additionally, an inspection form with the PGAs and minimum required BMPs for the facility to be inspected will be printed. The contents of the inspection will include, at a minimum, the requirements presented in Provision E.5.c(3) of the Permit:

- Name and location of the municipal facility or area
- Date of inspection and/or re-inspection
- Inspection method (Drive-by, Visual inspection, Onsite)
- General Observations
- Description of corrective actions or violations
- Description of enforcement actions issued to resolve corrective actions and violations and the date of resolution

Inspectors will fill out an inspection form which includes a check list of minimum required BMPs applicable to the facility or area. Inspections will assess whether appropriate BMPs are present and if they are properly implemented. If BMPs are not properly implemented or if non-stormwater discharges are observed, corrective actions or violations will be noted on the inspection form and a follow-up inspection will be required to correct the problem. Those inspections which require follow-up procedures to properly implement BMPs or eliminate a non-stormwater discharge will be forwarded to the Port's enforcement process and will be responded to in a timely manner.

Inspections will include written documentation and photographic evidence of all violations, improper BMP implementation, or areas that require corrective actions. The inspection program will also include timely follow-up inspections whenever there are recommended corrective actions or BMP deficiencies have been identified. Photographic evidence to document all violations, improper BMP implementation, or areas that require corrective action shall be collected at the time of the inspection. The inspections will be retained in the Port's stormwater database.

Visual assessments for BMP implementation, illicit discharges and connections will occur for all inspection methods (drive-by, on-site). In addition, for onsite inspections of high priority facilities, the Port will evaluate the facility's records to verify the facility's SIC code, training records, BMP maintenance records, SWPPP and, monitoring data (if applicable), and whether a Notice of Intent (NOI) has been filed (or if an individual NPDES permit has been obtained) during facility inspections.

During inspections, the Port will also determine if an industrial facility requires coverage under the IGP based on SIC code. It is the responsibility of the facility owner or operator to submit the NOI for their industrial facility as required by U.S. EPA regulations. If the facility is required to have an NOI and has not filed for such permit coverage, the Port will notify the owner/operator and the Regional Water Quality Control Board (Regional Board) of failure to comply following the facility inspection. Facilities that maintain an individual NPDES permit are not required to obtain coverage under the IGP, and as such, will not be reported to the Regional Board.

The facility representative will sign an acknowledgement form with the date of the inspection and name of the inspector. The inspector will review the results of the inspection with the facility representative and a facility evaluation letter will be written based on the visual assessment of discharges and implementation and effectiveness of the BMPs on-site will be sent to the facility. If any problems or violations are found, Port inspectors will document appropriate actions in accordance with the Enforcement Response Plan (ERP, Appendix C) pursuant to Provision E.6. In addition, any BMP violations noted on the inspection form will be discussed with the facility representative and corrective actions will be recommended in accordance with the Port's ERP.

For tenants located on TAMT, B Street Pier, and National City Marine Terminal, facility audits will occur twice per year. The goal of the audit is to support effective BMP management by conducting facility walk-throughs and reviews of BMP and Rain Event Plans to identify any modifications as to how their pollution prevention strategies are implemented and to provide recommendations to improve BMP effectiveness.

7.6.4 Inspection Tracking & Record-keeping

The results and observations made for all inspections including follow-up inspections will be entered into the stormwater database. All facility inspection information required by the Permit including inspection date, time, inspection method, observations and findings is included on the inspection field forms and is contained the database. For on-site inspections, the inspection records will also contain, as applicable a description of any problems or violations found during the inspection(s); a description of enforcement actions issued in accordance with the ERP; and the date problems or violations were resolved.

The stormwater database is also used to track the number of facilities that meet the minimum BMPs, require a follow-up or corrective action, or receive a violation. Inspection results will be reported in the JRMP Annual Report.

7.7 Enforcement

Integrated WQIP Strategies: PO-15, PO-16

Pursuant to Provisions E.4 and E.6 of the Permit, the Port developed an enforcement response plan (ERP) that consolidates the Port's existing enforcement process into one plan and outlines in greater detail, how the Port will proceed with enforcement (PO-15). The enforcement process for the existing development program has been included in the ERP. It describes the enforcement actions that may occur to ensure that designated minimum BMPs are implemented and maintained at the applicable facilities, facility documentation and training are updated, and industrial business have obtained proper permit coverage (if applicable). During implementation of the Industrial and Commercial program, there may be items identified that requires enforcement to ensure or maintain JRMP and Permit compliance. Some of these issues include the following:

- Facility does not properly maintain and implement BMPs or maintain required documentation;
- Required BMPs are missing;
- The facility fails to obtain coverage under the statewide Industrial General Permit;
- Unauthorized discharge, such as irrigation runoff, occurs as a result of missing or inadequate BMPs.

The enforcement response approach and options for the Existing Development program are fully discussed in the ERP found in Appendix C of this document.

7.8 Retrofit and Rehabilitating Areas of Existing Development

Integrated WQIP Strategies: PO-13

The Permit requires the Port to develop a program to retrofit areas of existing development to address identified sources of pollutants and/or stressors that contribute to the Port's WQIP highest priority water quality problems. The Port has identified candidate areas within existing development that may be feasible for retrofitting and has developed a strategy to facilitate the implementation of such projects. Such candidate areas focus on the WQIP pollutants, bacteria, metals, and trash, and include potential industrial and commercial areas. The Port's program for all existing development, including industrial and commercial facilities is found in Appendix H.

Chapter 8 Existing Development: Residential

8.1 No Residential Uses on Port Tidelands

Provision E.5 of the Municipal Stormwater Permit requires the Port to implement an existing development program for residential areas in accordance with the strategies in the San Diego Bay Watershed Water Quality Improvement Plan in addition to base permit requirements. The base permit requirements include maintenance of an updated inventory of existing residential areas and establishment of minimum BMPs and with a process for ensuring the BMPs are implemented and enforced.

As dictated by the Port Act and the Public Trust Doctrine, residential land uses are not permitted on Port tidelands.

During the course of a previous Permit (Order 2001-01), the Port clarified that residential uses do not exist on Port tidelands. This information was discussed with RWQCB staff during the Port's annual JURMP review meeting on June 20, 2005. At that time, it was agreed upon that the Port would not be required to address residential areas or activities. As such, this JRMP Document and all associated future JRMP Annual Reports will not address the residential requirements identified in Section E.5 of the Permit.

Chapter 9 Public Education and Participation

9.1 Introduction

Provision E.7 of the Municipal Permit requires the Port to implement a Public Education and Participation Program in accordance with the strategies in the San Diego Bay Watershed WQIP. A public education and participation program is the foundation of every effective JRMP and the basis of changing societal behaviors. The Port's program is intended to promote and develop management practices, other water quality related-programs, and behaviors that will reduce the discharge of pollutants in stormwater to the maximum extent practicable (MEP), minimize controllable non-stormwater discharges from entering the municipal separate storm sewer system (MS4), and protect water quality standards in receiving waters.

The Port's public education program has been in place for over a decade, and is based on the following mission:

To provide memorable experiences which promote environmental stewardship and sustainable behavior changes which support the health of the San Diego Bay.

The Port also encourages public participation and considers input from the public as a part of the decision-making process. This is accomplished by various means including public comments received during Board of Port Commissioners meetings, through solicitation of public comments on environmental and stormwater related documents, and through Port led environmental committees and programs.

This chapter outlines the Port's public education strategy, the topics covered, and audiences regarding; stormwater, urban runoff, and pollution prevention. It also describes how the Port will engage stakeholders and seek input and participation on those topics. The Port has updated its JRMP to meet the Municipal Permit conditions outlined in E.7 for public education and participation. Table 9-1 indicates the sections of this chapter that incorporate specific conditions into the Port's JRMP.

Table 9-1. Public Education and Participation Permit Requirements and Related JRMP Section.

Permit Requirement	Permit Reference	JRMP Section
Public education	E.7.a	9.3
Activities addressing pesticides, herbicides, and fertilizers	E.7.a.(1)	9.3.1, 9.4.1.5
Activities addressing proper management and disposal of used oil and toxic materials	E.7.a.(2)	9.3.1
Appropriate education and training measures for specific target audiences, as determined by the Port	E.7.a.(3)	9.3
Public participation	E.7.b	9.4
Process for the public to participate in determining WQIP priorities and strategies	E.7.b.(1)	9.4.3, 9.4.1.1
Opportunities for the public to provide recommendations to the Port regarding WQIP priorities and strategies.	E.7.b.(2)	9.4.3, 9.4.1.1
Opportunities for the public to participate in programs or activities that can prevent or eliminate non-stormwater discharges to the MS4, reduce pollutants, and protect the receiving water quality.	E.7.b.(3)	9.4.1

9.2 WQIP Strategies for Public Education and Participation

To assist in meeting the interim and final water quality goals in the WQIP, the Port has identified several strategies that it will incorporate into its Public Education and Participation Program. These WQIP strategies will promote public support of the Port's water quality protection efforts through outreach and education as they conduct Port employee-specific training and promote participation of the public. The strategies include core jurisdictional programs that meet baseline permit requirements which will be implemented throughout the permit term and strategies that are program enhancements or focused efforts that have varied schedules for implementation.

Table 9-2 lists the WQIP strategies for the Public Education and Participation Program and indicates which have been incorporated into the Port's JRMP, citing specific JRMP sections. The table and the JRMP document will be updated as new strategies are incorporated. A more detailed description of all the strategies is found in Appendix A.

Table 9-2. Public Education and Participation Strategies.

SDB ID	Strategy Name	Implementation Year	JRMP Section
PO-3	Train all applicable departments annually on stormwater requirements for all development projects	FY15	9.3.1.2
PO-5	Provide technical education and outreach to the development community on permit requirements.	FY16	9.3.2.1
PO-12	Implement Core JRMP Program requiring implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties	FY15	9.3.1.5, 9.3.2.4, 9.4.6
PO-17	Implement Core JRMP Program for Education and Outreach program to promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water prioritized by high-risk behaviors, pollutants of concern, and target audiences.	FY15	9.3
PO-25*	Train general services staff on proper BMP implementation during minor maintenance operations	FY16	9.3.1.5
PO-31*	Update Power-washing Standard Operating Procedure Manual	FY-17	9.3.1.3
PO-32	Create Standard Operating Procedure for proper washout procedures in public restrooms	FY-17	9.3.1.3
PO-33*	Improve consistency and content of websites to highlight permit requirements and facilitate public reporting	FY16	9.3.2.2, 9.3.2.3
PO-35*	Sponsor, conduct, and host cleanup activities (such as Operation Clean Sweep, Coastal Cleanup Day, Creek to Bay, etc.). Sponsor regional and watershed collection events for large items or items that may otherwise be illegally dumped. Some events could be considered multi-jurisdictional strategies	FY16	9.3.2.3, 9.3.1.9
PO-36*	Develop and conduct public perception survey on Physical Aesthetics and Swimmable Waters Conditions	FY17	9.3.2.3
PO-37*	Support organizations to address homelessness and to provide resources and educational materials to address trash and bacteria	FY16 and as funded	9.3.2.6
PO-52*	Enhanced public awareness and enforcement of prohibitions on feeding wildlife in municipal parks	FY-18	N/A
PO-56*	Marine Terminals Stormwater Program	FY-19	9.3.1.4, 9.3.1.7

BMP = best management practice; FY = fiscal year; SDB = San Diego Bay; TBD = to be determined
**These strategies were classified as optional strategies and require a trigger to be implemented.

9.3 Public Education Component

Integrated WQIP Strategy: PO-17

This section explains how the education program is tailored towards specific target audiences and reflects the training topics that meet core permit requirements as well as WQIP strategies. Educational activities throughout this chapter have been categorized into the following types as defined in Table 9-3.

Table 9-3. Education Activity Types.

Activity Type	Definition
Presentation	Training geared towards a target audience that focuses on a specific topic.
Public Seminar	Training offered to the general public that may consist of several topics. (This type of training may include field-based tours.) This may be in-person or virtual seminars.
Public Outreach	A coordinated event geared towards the general public in which Port staff educates and/or raises awareness on stormwater regulations and other environmental-related topics (typically with the use of promotional items).
Curriculum	Teaching materials designed for incorporation into local school districts.
Brochure	A visual printed training, teaching, or informational tool to provide guidance to the reader.
Website / Recorded Message	Information provided on the Port's website or on the Port's on-hold phone system.
Cleanup	A coordinated event in which volunteers remove trash from an environmentally sensitive area. This may be in-person or virtual.
Social Media Campaign /Public Service Announcement	Advertising or informational posts on billboards, radio, television, YouTube, Instagram, Twitter, or Facebook.
Inspection Training	On-site training by a Port Inspector during routine stormwater compliance inspections.
Internal Training	Training conducted internally that is attended by Port staff on a specific topic. This may be in-person or virtual.
External Training	Training conducted by outside agencies that is attended by Port staff or outside professionals in a specific industry. This may be in-person or virtual.
Facility Training	Training conducted by a Port tenant of its staff as part of its compliance with stormwater regulations.
Port Information Transfer	Training conducted by Port employees as part of Port compliance with stormwater regulations. This may include meetings, internal notifications/emails, or written standard operating procedures.

Table 9-3. Education Activity Types Continued.

Audit	Review of a facility's BMP Plan, BMP Plan implementation, and recordkeeping. Generally, an audit involves an one-on-one discussion and an on-site walk through with a facility representative regarding the facility BMP plan, expectations for BMP implementation, and potential recommendations for improvements to the pollution prevention measures at the facility.

Permit Provision E.7 describes the general topics to be covered by each activity, as applicable. The Port's education program integrates these topics into individual training programs for the target communities, as detailed in Table 9-4.

Pursuant to WQIP Strategy PO-17, the Port will promote educational programs to encourage desired management practices and behaviors. The benefits of educational outreach include an increase in public awareness, and improved behaviors. PO-17 strategies are also included in the education topics, listed in Table 9-4.

Table 9-4. Education Topics for Target Audiences.

		Target Audiences								
		Staff Training				Educational Outreach				
	Education Topics (Permit Provision E.7.a)	**Municipal Development Planning**	**Municipal Construction Activities**	**Municipal Industrial/Commercial Activities**	**Municipal Other Activities**	**Construction Site Owners & Developers**	**Industrial & Commercial Owners & Operators**	**Residential Community & General Public[a]**	**School Children**	**Underserved Audiences**
Laws, Regulations, Permits and Requirements	Federal, state and local water quality laws and regulations	X	X	X	X	X	X	X		X
	Statewide General NPDES Permit for Stormwater Discharges Associated with Industrial Activities			X			X			
	Statewide General NPDES Permit for Stormwater Discharges Associated with Construction Activities	X	X			X				
	WQIP Priorities and conditions, Port Stormwater Ordinance, JRMP, Port WQIP Strategies.	X	X	X	X	X	X	X		X
	Priority Development Project Requirements	X	X	X		X	X			
Best Management Practices (BMPs)	Develop Stormwater Pollution Prevention Plan (SWPPP)/Facility BMP Plan including a Rain Event Plan (REP)	X	X	X		X				
	Conduct routine inspections of BMPs and stormwater conveyance		X	X	X	X	X			
	Properly maintain stormwater conveyance system		X	X	X	X	X	X		
	Properly dispose of debris from stormwater conveyance system		X	X	X	X	X	X		
	Conduct outdoor sweeping to adequately control dust and debris		X	X	X	X	X	X	X	X
	Keep outdoor areas neat and clean		X	X	X	X	X	X	X	X
	Keep facility clear of illicit connections and illegal discharges, including irrigation runoff	X	X	X	X	X	X	X	X	X
	Have spill response materials available at the facility	X	X	X	X	X	X	X	X	
	Keep waste containers at acceptable levels (not overflowing)		X	X	X	X	X	X	X	X
	Properly dispose of hazardous waste including used oil and toxic materials		X	X	X	X	X	X		
	Keep waste containers covered or lids closed		X	X	X	X	X	X	X	X
	Keep materials stored under overhead cover or within secondary containment		X	X	X	X	X	X	X	
	Minimize outside storage areas		X	X	X	X	X	X	X	
	Keep facility clear from indoor activity being tracked outdoors		X	X	X	X	X	X	X	
	Keep facility clear of leaking fluids from vehicles and equipment		X	X	X	X	X	X		X
	Regularly conduct preventative maintenance on all vehicles and equipment		X	X	X	X	X	X		
	Have absorbent booms or spill materials available when fueling vehicles and equipment on-site		X	X	X	X	X	X		

	Capture, contain, or treat all vehicle and equipment wash water		X	X	X	X	X	X		X
	Train employees in stormwater, spill response, and pollution prevention		X	X	X	X	X	X		X
	Implement BMPs to prevent discharges from maintenance activities		X	X	X	X	X	X	X	X
	Illicit connection/illicit discharge (ICID) observations and follow-up and public reporting mechanism	X	X	X	X	X	X	X	X	X
	Reduce pollutants associated with the application of pesticides, herbicides, and fertilizers	X	X	X	X	X	X	X	X	
	Prohibit wildlife feeding in municipal parks							X	X	X

[a] There are no residential uses within the tidelands of the Port.

9.3.1 Municipal Staff Training

Integrated WQIP Strategy: PO-17

Training Port staff on how to manage stormwater and prevent pollution is a fundamental step in protecting and improving stormwater quality around the Port tidelands. Some Port employees will receive annual general training to increase their knowledge of stormwater issues. The general stormwater training will cover the Port's ICID program and updates on reporting non-stormwater discharge prohibitions including irrigation runoff and how to report potential ICIDs. Port staff training will also include proper management and disposal of used oil and toxic materials, and reducing pollutants associated with the application of pesticides, herbicides, and fertilizers. More intensive, job-specific training will be provided as needed to other employees. Port employees with responsibilities related to high-priority municipal areas, activities, and development (e.g., wharfingers, maintenance crews, and engineering) will be trained in greater depth and be given topic-specific training. Port staff will be notified of these educational events at staff meetings or via email or scheduled appointments.

9.3.1.1 Municipal: Development Planning

Integrated WQIP Strategy: PO-3

This target audience includes the Port's land use planners in the Planning Department and the Development Services Department, and the Real Estate Department. The Port will focus the education provided through WQIP strategy PO-3 on new developments and redevelopments, and how urban runoff can impact water quality both in the short term and long term. Education will also focus on incorporating post-construction BMPs early in the development planning phase of a project. The objective of this education is to increase the knowledge of the Port decision-makers and staff about the potential water quality impacts of development and redevelopment projects, and to inform them of tactics to prevent or minimize such impacts including the benefits of native vegetation. Land use planning staff works closely with stormwater staff on project reviews; as such, land use staff are constantly being updated on stormwater regulations related to development planning. The training will also include general stormwater pollution prevention concepts. Table 9-5 identifies applicable activity types that can best provide education to the Port's Planning, Development Services, and Real Estate Department staff.

Table 9-5. Proposed Education for the Port's Municipal Development Planning Staff.

Potential Activity	Activity Type	Frequency	Topics Covered
Real Estate, Planning, and Development Services Training	Presentation	Annually	• Required topics (Table 9-4) • Federal, state, and local regulations applicable to development projects • The connection between land use decisions and short- and long-term water quality impacts • BMP Design Manual related topics including post-construction BMP requirements for standard projects and Priority Development Projects (WQIP Strategy PO-1 and PO-2)
Educational Materials	Brochure	As Needed	• Required topics (Table 9-4) • LID requirements
Meetings and email correspondence with Real Estate, Planning, and Development Services	Port Information Transfer	As Needed	• Required topics (Table 9-4) • Coordination to identify projects and ensure compliance with stormwater regulations

9.3.1.2 Municipal: Construction Activities

Integrated WQIP Strategy: PO-3

The target audience for municipal construction education is inspectors and other responsible construction management staff in the Port's Engineering-Construction Department. The Port will use specific activities to create awareness of construction-related pollutants and solutions to minimize pollutants, as well as provide general education on stormwater pollution prevention concepts and strategies including how to identify, prevent, and report illegal discharges. Table 9-6 identifies applicable activity types for educating the Port's Municipal Engineering-Construction staff.

Table 9-6. Proposed Education for the Port's Municipal Construction Staff.

Potential Activity	Activity Type	Frequency	Topics Covered
Engineering-Construction Refresher Training	Presentation	Annually	• Required topics (Table 9-4) (PO-3) • Federal, state and local laws and regulations applicable to construction and grading activities • The connection between construction activities and water quality impacts • Proper implementation of erosion and sediment control and other BMPs to minimize the impacts on receiving water quality from construction activities • The Port's inspection, plan review, and enforcement policies and procedures to verify consistent application • BMP Design Manual related topics including post-construction BMP requirements for standard projects and Priority Development Projects (WQIP Strategy PO-6) and post-construction BMP design and site development
Meetings with Engineering Staff	Port Information Transfer	As Needed	• Required topics (Table 9-4) • Coordination to identify projects and ensure compliance with stormwater regulations
Implement Core JRMP Program (SWPPP review, inspections, BMP implementation)	Port Information Transfer/ Inspection Training	Ongoing	• Best management practices (WQIP Strategy PO-6) • Number of inspections used to track number of times this activity occurred,
Standard Operating Procedures /Refresher	Port Information Transfer	Annually	• Required topics (Table 9-4) • Inspection and enforcement procedures • Reviewing monitoring data • SWPPP/BMP Plan review

BMP = best management practice; LID = low-impact development.

9.3.1.3 Municipal: Industrial and Commercial Activities

Integrated WQIP Strategies: PO-31, PO-32

The target audience for municipal industrial and commercial education is the Port's EP employees and consultants who are responsible for conducting stormwater compliance inspections and enforcing regulations. These employees manage the Port's existing Industrial/Commercial Program and will attend regional Copermittee meetings focused on these topics, remain up to date with relevant current and upcoming regulations, and attend associated trainings. These employees and consultants will be trained annually on how to conduct a stormwater inspection, proper implementation of minimum required BMPs, how to investigate potential ICIDs, potable water discharges to the MS4, benefits of native vegetation, integrated pest management, how to review a SWPPP and Facility BMP Plan, and the importance of water conservation. Table 9-7 identifies the most applicable activity types for educating the Port's stormwater inspection staff.

Table 9-7. Proposed Education for Port Stormwater Inspection Staff.

Potential Activity	Activity Type	Frequency	Topics Covered
Building Industry Association of San Diego County Training Seminars	External Training	As Needed	• Required topics (Table 9-4) • SWPPP preparation, monitoring, implementation, and compliance • Sampling requirements
HAZWOPER Refresher Course	External Training	Annually	• Required topics (Table 9-4); • BMP selection and implementation for hazardous materials storage
Standard Operating Procedures /Refresher	Port Information Transfer	Annually	• Required topics (Table 9-4) • Inspection and enforcement procedures • Reviewing monitoring data • Reviewing SWPPP/Facility BMP Plans

BMP = best management practice; HAZWOPER = hazardous waste operations and emergency response;
SWPPP = stormwater pollution prevention plan

9.3.1.4 Municipal: Maritime Operations

Integrated WQIP Strategy: PO-17

The target audience for municipal marine operations is the staff of the Maritime Department, who work with the Port's maritime tenants at the Tenth Avenue Marine Terminal, National City Marine Terminal, and the Cruise Ship terminal. Maritime staff report environmental incidents and help ensure stormwater BMPs are implemented at the terminals. Maritime staff training will include general stormwater pollution prevention concepts, illegal discharge identification and reporting requirements, and training on terminal specific operational and structural BMPs. Table 9-8 identifies the most applicable activity types for educating the Port's Maritime staff. **Table 9-8.** Proposed Education for The Port's Marine Operators

Potential Activity	Activity Type	Frequency	Topics Covered
Stormwater Management for Marine Operators	Presentation	Annually	• Required topics (Table 9-4) • Non-stormwater discharge observations and procedures • BMP Plan training • Rain Event Plan training • Structural BMP inspection, cleaning
Meetings with Maritime Staff	Port Information Transfer	As Needed	• Required topics (Table 9-4) • Coordination to identify projects and ensure compliance with stormwater regulations
TAMT and B St. Pier Facility Audit	Audit	Twice per year	• Non-stormwater discharge observations and procedures • BMP Plan implementation • Rain Event Plan implementation • Structural BMP inspection, cleaning

9.3.1.5 Municipal: Other Activities

Integrated WQIP Strategies: PO-12, PO-24, PO-25

General Port Staff

The target audience for other municipal activities is all Port staff whose work is not directly related to environmental issues or outside pollutant generating activities. Training for general Port staff includes short and long-term water quality impacts associated with urbanization, the Port's ICID program and how they can report illegal discharges, potable water discharges to the MS4, integrated pest management, how to reduce pollutants associated with pesticides, herbicides and fertilizers, benefits of native vegetation, and water conservation. Table 9-9 identifies the activity types most applicable for educating them.

Table 9-9. Proposed Education for General Port Staff.

Potential Activity	Activity Type	Frequency	Topics Covered
Stormwater 101 Training	Training	As Needed	• Required topics (Table 9-4) • Activity-specific BMPs
Meetings with general Port staff	Port Information Transfer	As Needed	• Activity-specific BMPs • Coordination to identify projects and ensure compliance with stormwater regulations
Simon Says Series	Port Information Transfer	As Needed	• Environmental-related items
Green Team Meeting	Port Information Transfer	As Needed	• Environmental-related items
Board of Port Commissioners Memorandum	Port Information Transfer	As Needed	• Environmental-related items

BMP = best management practice

General Services Staff

This target audience includes Port staff responsible for maintaining the Port's parks, facilities, special events, and infrastructure. Table 9-10 identifies the activity types and training frequencies most applicable for educating the General Services staff. General Services staff will receive information on general stormwater pollution prevention as well as proper BMP implementation during minor maintenance operations, proper power-washing procedures, and other activity specific BMPs.

Table 9-10. Proposed Education for General Services Staff.

Potential Activity	Activity Type	Frequency	Topics Covered
Integrated Pest Management for Landscape Professionals	Public Seminar	Annually	• Required topics (Table 9-4); • Activity-specific BMPs • Reducing pollutants associated with the application of pesticides, herbicides, and fertilizers • Laws and regulations applicable to pesticide use • The connection between water quality impacts and pesticide use (WQIP Strategy PO-12)
Pesticide Handler's License Annual Trainings	External Training	Annually	• Required topics (Table 9-4) • Activity-specific BMPs
General Services BMP Training	Training	Annually	• Required topics (Table 9-4); • Activity-specific BMPs • Proper BMP implementation during minor maintenance operations (WQIP Strategies PO-24 and PO-25)
Hazardous Materials and Storage Training	Training	Annually	• Proper management and disposal of used oil and toxic materials
General Service Ride-Along	Port Information Transfer/ Training	As Needed	• Activity-specific BMPs • Coordination to identify projects and ensure compliance with stormwater regulations
Meetings with General Services Department	Port Information Transfer	As Needed	• Activity-specific BMPs • Coordination to identify projects and ensure compliance with stormwater regulations

BMP = best management practice

9.3.1.6 Stakeholder Outreach and Education Activities

The external component of the Port's education outreach efforts will reach construction site owners and developers, industrial and commercial owners and operators, the residential community and general public, school children, and underserved audiences. Outreach efforts will focus on sustainable resource use, ICID awareness and public reporting, potable water discharges to the MS4, short- and long-term water quality impacts associated with urbanization, reducing pollutants associated with pesticides, herbicides, and fertilizers, proper management and disposal of used oil and toxic materials, and pollution prevention in urban runoff. The program is designed to provide useful guidance in developing outreach and training programs to support the successful implementation of the Port's JRMP and to maximize consistency in information and evaluations.

Construction Site Owners and Developers

Integrated WQIP Strategies: PO-5, PO-17

One of the most important aspects of minimizing watershed pollution is proper environmental training and implementation of appropriate construction site BMPs. Construction and development activities can alter natural drainage patterns and contribute pollutants to stormwater. Improperly managed stormwater runoff from construction sites can be a significant source of pollution, potentially disturbing or destroying habitat, diminishing wildlife, and restricting water use and enjoyment.

The Port's construction education will address the need for training in urban runoff management for construction site owners and developers involved in land development and redevelopment projects in the Port tidelands. This includes Port tenants, project applicants, developers, contractors, property owners, community planning groups, and other responsible parties. Education outreach will take place throughout permitting and construction and will focus on activities during the construction phase and post-construction activities over the span of the project. Education will have specific emphasis on erosion control BMPs and will also include general stormwater pollution prevention concepts. Table 9-11 identifies the activity types most applicable for educating construction site owners and developers.

Table 9-11. Proposed Education for Construction Site Owners and Developers.

Potential Activity	Activity Type	Frequency	Topics Covered
Instruction During Inspections by Port Staff	Inspection Training	At least once per construction project	• The Copermittees' inspection, plan review, and enforcement policies and procedures to verify consistent application • The importance of educating all construction workers in the field about stormwater issues and BMPs • Methods of minimizing impacts on receiving water quality resulting from construction and development, including (1) stormwater management plan development and review, (2) methods to control downstream erosion impacts (3) proper implementation of erosion and sediment control, (4) identification of pollutants of concern and (5) good housekeeping practices
Building Industry Association of San Diego County Training Seminars	Public Seminar	As Needed	• Required topics (Table 9-4); • SWPPP preparation, monitoring, implementation and compliance • Permit requirements and sampling (WQIP Strategy PO-5)
Port's SWPPP and Construction BMP Template	Port Information Transfer	As Needed	• SWPPP preparation and compliance
Educational Materials and Outreach to Development Community	Training	As Needed	• Required topics (Table 9-4) • Industry-specific BMPs • Highlight permit requirements (WQIP Strategy PO-5)

BMP = best management practice; LID = low-impact development
SWPPP = stormwater pollution prevention plan

9.3.1.7 Industrial and Commercial Owners and Operators

Integrated WQIP Strategies: PO-7, PO-17

Industrial and commercial facilities cover a diverse arena of activities and practices, but educational approaches for both are similar. A key to successful industrial/commercial outreach is to disseminate information to a variety of groups about industry- or business-specific BMPs. Therefore, the Port's outreach will be geared toward small associations as well as individual facilities and mobile businesses. Education will cover general stormwater pollution prevention concepts, ICID awareness and public reporting, potable water discharges to the MS4, reducing pollutants associated with pesticides, herbicides, and fertilizers, proper management and disposal of used oil and toxic materials, and pollution prevention in urban runoff. Table 9-12 identifies the activity types most applicable for educating these owners and operators.

Table 9-12. Proposed Education for Industrial and Commercial Owners and Operators.

Potential Activity	Activity Type	Frequency	Topics Covered
Educational Materials and Instruction during Inspections by Port Staff	Inspection Training	Per facility inspection schedule	• Required topics (Table 9-4) (PO-7)
Marina Inspection Program	Inspection Training	Per facility inspection schedule	• Required topics (Table 9-4) • Safe boating practices
Hull Cleaning Inspection Program	Inspection Training	As Needed	• Required topics (Table 9-4) • Activity-specific BMPs
Educational Materials to All Commercial/ Industrial Tenants	Informational Video* (English and Spanish)	Annually/ Ongoing (available online)	• Minimum BMP requirements
Stormwater Required Best Management Practices for Industrial and Commercial Facilities	Flyer	As Needed	• Required topics (Table 9-4) • Industry-specific BMPs • Local contact information

Marine Terminals Facility Audits	Audit	Twice per year	• Non-stormwater discharge observations and procedures • BMP Plan implementation • Rain Event Plan implementation
Integrated Pest Management for Landscape Professionals	Public Seminar	Annually	• Required topics (Table 9-4) • Proper storage, handling, and use of pesticides • Laws and regulations applicable to pesticide use • The connection between water quality impacts and pesticide use • BMPs to minimize pesticides, herbicides, and fertilizer discharges (WQIP Strategy PO-12)
Stormwater Training (provided by Port staff)	Presentation	As Needed	• Required topics (Table 9-4) (PO-7) • Local natural resources • Wildlife
County of San Diego Online BMP Guide	Website/ Recorded Message	As Needed	• Highlight permit requirements
Green Business Network	Information Sharing/ Presentation	As Needed	• Industry-specific BMPs • Proper storage, handling, and use of pesticides • Water Conservation • Sustainability

* The Port's Stormwater Best Management Practices Training Video can be found in both English and Spanish on the Stormwater Management page of the Port's website[1].

[1] https://www.portofsandiego.org/environment/stormwater/302-stormwater-management-program.html

The Port provides commercial and industrial tenants materials relating to Stormwater Required BMPs for Industrial and Commercial Facilities. The below flyer is an example of these materials, these minimum required BMPs are to be inspected as part of the annual stormwater facility inspection.

PORT of SAN DIEGO

Required Pollution Prevention Best Management Practices for Industrial and Commercial Facilities

Routine business activities can generate pollutants that can flow into the San Diego Bay. Implement the following BMPs to minimize pollutants and prevent illegal discharges:

Keep outdoor activity and operation area clean from spills and debris
Properly maintain and conduct routine inspections of BMPs and stormwater conveyance
Keep facility clear of illicit connections
Implement BMPs to prevent discharges from maintenance activities
Have spill response materials available at the facility
Keep facility clear from indoor activity being tracked outdoors
Train employees in stormwater, spill response, and pollution prevention
Limit use of chemical pesticides, herbicides, and fertilizers
Properly dispose of debris from stormwater conveyance system *
Conduct outdoor sweeping to adequately control dust and debris
Keep outdoor areas neat and clean
Keep facility clear of illegal discharges, including irrigation runoff
Keep waste containers at acceptable levels (not overflowing)
Properly dispose of hazardous waste, including used oil and toxic materials
Properly maintain specialized waste areas
Keep waste containers covered or lids closed
Minimize outside storage areas
Keep materials stored under overhead cover or within secondary containment
Keep facility clear of leaking fluids from vehicles and equipment
Regularly conduct preventive maintenance on all vehicles and equipment
Have absorbent booms or spill materials available when fueling vehicles and equipment on-site
Capture, contain, or treat all vehicle and equipment wash water
Regularly inspect and maintain pump-out facilities
Capture, contain, or treat all wash water
Develop a Stormwater Pollution Prevention Plan (SWPPP) / Facility BMP Plan including a Rain Event Plan (REP)

** BMPs in bold address priority pollutants (trash, bacteria, and metals), and if found to be improperly implemented, enforcement is escalated to an Administrative Citation that may include a fine.*

Stormwater Questions:
(619) 686-6254
SWPollutionPrevention@portofsandiego.org
portofsandiegoserviceportal.force.com

Storm Drain Pollution Reports
On Port Tidelands:
Harbor Police (619) 686-6272

Off Port Tidelands:
projectcleanwater.org/report-pollution

Green Business Network

The Port's Green Business Network (GBN)[2] has been in place since 2012 and is a voluntary sustainability program for businesses located on Port tidelands, providing members with training opportunities and resources to improve operational efficiency and improve sustainable business practices. As of 2018, 88 members participate in the program including waterfront industries, hotels, marinas, restaurants, tourist attractions, and retail shops. The network provides education to members on ways businesses can save money and reduce their environmental impact by prioritizing energy efficiency, clean transportation, water conservation, and waste reduction. Members are recognized for their commitment to sustainable business practices through outreach campaigns, featured case studies, and an annual awards ceremony. Program offerings have also included energy and water audits, sustainability action planning, educational workshops, networking events, information on rebates and incentives, and one-on-one sustainability assistance.

Some of the work from the GBN include

- August 2015: The San Diego Water Authority provided presentations on ways businesses could reduce water during the drought.
- November 2016: The San Diego Convention Center hosted a sustainability tour for the GBN members including drought tolerant landscaping. 2015: 13 GBN members participated in a six-month long program where they created five-year sustainability action plans that included actionable measures to reduce water, waste, and energy. Some of the measures that were borne from the plans include: routine inspections to identify water leaks, boater education, maintenance and daily checks for leaking hose bibs, and educational opportunities to encourage vendors to conserve water when washing boats.
- May 2018: Water audits were conducted at five GBN facilities and identified viable water conservation measures.
- January 2019: Newsletter Green Tip: "Reducing water during the rainy season". The newsletter provided water conservation measures the GBN facilities could employ such as turning off irrigation if receiving adequate amounts of rain, inspecting and adjusting sprinklers, and maintaining a 3 inch layer of mulch.

[2] www.portofsandiego.org/greenbusiness

9.3.1.8 Residential Community and General Public

Integrated WQIP Strategies: PO-17, PO-36

The Port has no residential population so for the Port this target audience includes visitors to the San Diego Bay and extended to the general public throughout the San Diego Bay Watershed. This portion of the Port's education program is focused on spreading awareness of the many environmental issues that affect both the Port and San Diego Bay. The program has the following objectives:

- Stimulate an interest in San Diego Bay's environment throughout the local community by providing interactive venues with educational information on pollution, pollution prevention, and other related environmental issues;
- Increase understanding of urban runoff issues;
- Reduce pollutants associated with the application of pesticides, herbicides, fertilizer;
- Proper management and disposal of used oil and toxic materials; and
- Expose the vulnerability of the Bay's natural resources to reveal the impacts of pollution.

The Port also enhances public awareness of pollution prevention measures and over-irrigation issues by providing educational activities to various audiences. Table 9-13 identifies the activity types and frequencies most applicable for educating the residential community and general public.

Table 9-13. Proposed Education for the Residential Community and General Public.

Potential Activity	Activity Type	Frequency	Topics Covered
Cleanup Events (WQIP Strategy PO-35)	Cleanup	As Scheduled	• Required topics (Table 9-4)
Public Seminars	Public Seminar	As Scheduled	• Required topics (Table 9-4) • Wildlife • Watershed issues
Tours of San Diego Bay (including bus tours)	Public Seminar	As Scheduled	• Environmental history • Wildlife • Watershed issues
Preventing Stormwater Pollution: A Residential Guide	Brochure	As Needed	• Required topics (Table 9-4) • Watershed issues

Preventing Stormwater Pollution: A Guide to Integrated Pest Management (WQIP Strategy PO-12)	Brochure	As Needed	• Proper storage, handling, and use of pesticides • Nontoxic or less-toxic pesticide alternatives • Strategies to reduce the need for pesticides • The connection between water quality impacts and pesticide use
San Diego Bay Boater's Guide	Brochure	As Needed	• Required topics (Table 9-4) • Safe boating practices
Social Media	Social Media Campaign/ Public Service Announcement	As Needed	• Required topics (Table 9-4) • Watershed issues • Wildlife
On-Hold Phone Messages	Website/ Recorded Message	As Needed	• Watershed issues • Facilitate public reporting (WQIP Strategy PO-33)
Pollution Prevention Campaign (#ThatsMyBay)	Social Media/ Website/ Video/ Presentation	As Needed	• Required topics (Table 9-4) • Watershed issues • Facilitate public reporting • Wildlife
Project Clean Water Campaign	Social Media Campaign/Public Service Announcement	Ongoing	• Required topics (Table 9-4) • Watershed issues
Website Improvements	Website	Ongoing	• Continually improve the consistency and content of Port-sponsored websites to highlight permit requirements and facilitate public learning (WQIP Strategy PO-33)
Project Clean Water Workgroup	Information Exchange	Quarterly	• Watershed issues • Facilitate public reporting
Stormwater Special Events Training	Inspection Training	As Needed	• Required topics (Table 9-4) • Activity-specific BMPs • Stormwater pollution preventions • Spill prevention and response
Environmental Advisory Committee (EAC)	Presentation	As Needed	• Compliance with stormwater regulations • Upcoming projects
Wildlife Advisory Group (WAG)	Presentation	As Needed	• Compliance with stormwater regulations • Upcoming projects
San Diego Bay Watershed Meetings	Information Exchange	Monthly	• Required topics (Table 9-4) • Compliance with stormwater regulations • Upcoming projects
Regional Meetings	Information Exchange	Monthly	• Required topics (Table 9-4) • Compliance with stormwater regulations • Upcoming projects

Pollution Prevention Outreach Campaign

The Port's education and public outreach expanded significantly in FY 2018. During this timeframe, a new pollution prevention outreach campaign was developed and launched. The #ThatsMyBay campaign was developed to encourage a sense of ownership over protecting the environmental health of San Diego Bay. The focus of the campaign is reducing trash and other pollutants while promoting the general public to practice environmental stewardship through a series of videos and other media featuring specific behaviors individuals could practice helping keep trash out of the bay.

The messaging related to the #ThatsMyBay campaign is presented in a whimsical and humorous approach to engage the public in a fun and relatable manner. The campaign targets any visitors to San Diego Bay that want to enjoy the waterfront, but do not necessarily think of it as an environmental resource. The videos are distributed via the Port's multiple social media accounts (Twitter, YouTube, Facebook, LinkedIn, and Instagram), advertisements through social media, as well as television and radio advertisements. Additionally, the #ThatsMyBay campaign has dedicated webpage within the Port's website[3] with a dedicated webpage for each video. The campaign's name (#ThatsMyBay) doubles as a metadata tag to increase awareness and recognition of the campaign overtime and to link each video back to the overall message of environmental stewardship. More information on the #ThatsMyBay campaign and examples of tweets, posts and videos are provided in Appendix I. In addition, the Port collaborates with other agencies and stakeholders via social media to spread pollution prevention messages.

9.3.1.9 School Children

Integrated WQIP Strategy: PO-17

Schools are a key segment of the broad-based general public in the San Diego Bay Watershed. Although there are no schools within the Port's jurisdiction, the Port recognizes the unique opportunity that schools provide for educating children about local environmental issues and thus has maintained a school partnership program since the 1990s. The Port's Environmental Education Program (EEP) was developed to educate students, teachers, and the general public about pollution prevention, environmental stewardship, healthy ecosystems, and natural resources connected with the Bay. The Port's School Partnership Program was created as a

[3] https://www.portofsandiego.org/environment/thatsmybay

component of the EEP to focus on students within seven partner elementary schools representing the Port's five-member cities. The following seven schools are located within the five Port member cities and take part in this program: Bayside Elementary (Imperial Beach), Harborside Elementary (Chula Vista), Kimball Elementary (National City), Logan Elementary (San Diego), Perkins Elementary (San Diego), Silver Gate Elementary (San Diego), and Silver Strand Elementary (Coronado). The program consists of partnerships with local non-profit organizations that provide environmental education to specific grades within each school. Currently the Port is funding 10 environmental education programs:

- Chula Vista Elementary School District*;*

  Through its partnership with the Living Coast Discovery Center (LCDC), the Chula Vista Elementary School District (CVESD) Coastal Education Program provides standards-based lessons and hands-on curriculum focusing on environmental protection and conservation themes, including pollution prevention, stormwater management, watershed protection, habitat restoration, and endangered and sensitive species connected to the San Diego Bay.

- I Love A Clean San Diego*;*

  Through its *Connecting Kids and Communities to Conservation* program, I Love a Clean San Diego (ILACSD) provides environmental protection and pollution prevention education to students throughout the San Diego Bay watershed. Using interactive classroom presentations, hands-on post-presentation cleanup events, and community workshops and/or cleanups, the program covers the importance of water and watersheds, key pollutants and their effects, and how students can become environmental stewards to prevent pollution in local waterways.

- Living Coast Discovery Center;

  The Living Coast Discovery Center (LCDC) *Watershed Discovery: Connecting and Protecting San Diego Bay* program takes advantage of its unique location within the San Diego Bay National Wildlife Refuge to provide environmental conservation and environmental stewardship education to students and guests. The program consists of three components: a field trip that utilizes docent-led tours and educator-led lab activities to address conservation, watershed protection, pollution prevention, native plants and animals, and responsible outdoor recreation; public education utilizing instructor-led hands-on activities and interpretive signage designed to educate the general public on pollutant prevention and watershed protection related to the San Diego Bay; and habitat restoration and clean-up that engages volunteers as well as the general public.

- Maritime Museum of San Diego;

The Maritime Museum of San Diego *Ecology and Economy of the Bay* program addresses the role of the San Diego Bay in the regional economy, and the fragility of the San Diego Bay's ecology specifically related to human impacts. Students initially board the Museum's steam ferryboat *Berkeley*, and then take a trip around the Bay aboard the Museum's boat *Pilot.* Students participate in a series of marine science experiments to learn about the Bay's history, its flora and fauna, pollution prevention, sediment and water quality, and the way humans have impacted the San Diego Bay.

- Ocean Discovery Institute*;*

Through its *Student Initiative* program and the new Living Lab facility, Ocean Discovery Institute provides classroom, hands-on laboratory, and field-based programming connecting students to the San Diego Bay watershed. Lessons address coastal ecosystems, watershed management and protection, and conservation of natural resources while introducing students to a wide range of science professions.

- Resource Conservation District*;*

The Resource Conservation District (RCD) of Greater San Diego *Watershed Connection* program is an interactive classroom lesson connecting students to their local watershed. Lessons focus on water pollution issues including non-point source pollutants such as petroleum products, detergents, fertilizers, and pet waste, and introduces students and educators to appropriate best management practices. Using hands-on lessons to demonstrate watershed modeling, students learn where common pollutants are typically generated, how these pollutants travel from streets to waterways, and how to best manage and prevent further impacts to their watershed.

- San Diego Audubon Society;

The San Diego Audubon Society *Outdoor Explore!* program provides after-school outdoor environmental education to students through physical activity, exploration and exposure to natural spaces in their community. Focusing on the Otay River watershed, this program combines naturalist-led lessons with student-led self-exploration to provide students with an understanding of the function of floodplains and human impacts on habitat and water quality specific to the San Diego Bay.

- The Ocean Foundation;

The Ocean Foundation *Ocean Connectors* program provides hands-on environmental education through field trips, in-class lectures, and land and water-based eco-tours. The program provides instruction on the ecosystems of San Diego Bay and cultivates an understanding of coastal environments, the connection between terrestrial and aquatic ecosystems, and the health, cultural and economic value of San Diego Bay. As a component of the program, students use a “knowledge exchange” with student peers in Mexico to further their understanding of natural resources, recording and presenting information collected and learned from program participation.

- Zoological Society;

  The Zoological Society of San Diego *Guardians of the Bay* program provides intensive week-long project-based environmental education lessons for sixth through eighth grade students through a combination of in-classroom learning and outdoor investigations around San Diego Bay. The program creates an opportunity for students to generate change in local communities and watersheds, thereby supporting the overall health of the San Diego Bay. Each student grade level studies a different subject that fits into an overarching theme of environmental health specific to the San Diego Bay. The program introduces students to climate change and its impacts on local watersheds, pollution prevention, and natural resources through an all-school assembly. Specific grade level studies are then introduced, including data collection and scientific observation in the field, data analysis and interpretation of results in the classroom, and field application of the learned scientific skillset.

- Outdoor Outreach

  Outdoor Outreach’s *YES: Youth Environmental Stewardship Project* program utilizes recreational learning and hands-on environmental education and stewardship to educate, train and mobilize students from environmental justice communities within the San Diego Bay watershed. The program engages and connects students with San Diego Bay’s natural resources by incorporating environmental lessons on watershed dynamics, pollution prevention, and local ecology with recreational activities including hiking, biking, and kayaking, as well as participation in local trash clean ups and restoration events.

The Port also uses social media to promote these programs:

Port of San Diego Retweeted
Outdoor Outreach @OutdoorOutreach · 11 Dec 2018
Thanks to the @portofsandiego, Outdoor Outreach is able to provide educational and recreational learning programs in the San Diego Bay Watershed for teens that also reside in the watershed. Together, we're giving youth a chance to find & care for nature in their communities! 🌊🚣

Port of San Diego Retweeted
Project SWELL @projectswell · 3 Jul 2018
@SD_Coastkeeper Water Education for All-new climate science bilingual lessons are here! Thank you to the @portofsandiego Environmental Fund for your support to water & #climateliteracy and stewardship for our students in the #SanDiegoBay Watershed!

San Diego Coastkeeper, Port of San Diego Launche...
Bilingual water and climate science lessons available for use in schools is the result of a partnership of San Diego Coastkeeper and the Port of San Diego.
timesofsandiego.com

Table 9-14 identifies the activity types most applicable for educating school children.

Table 9-14. Proposed Education for School Children.

Potential Activity	Activity Type	Frequency	Topics Covered
Environmental Education Program	Curriculum	Ongoing	• Required topics (Table 9-4) • Wildlife • Watershed issues
Take Your Child to Work Day	Public seminar	Annually	• Required topics (Table 9-4) • Wildlife • Watershed issues

9.3.1.10 Underserved Audiences

Integrated WQIP Strategies: PO-17

The Permit requires the Port's education program to include underserved target audiences, which include various ethnic and socioeconomic groups. Because of the Port's unique structure and its lack of a residential population on the Port tidelands, there are no such underserved target audiences within the Port's jurisdiction. However, these audiences will be included in the Port's outreach efforts, specifically those towards the residential community, general public, school children. Many of the schools in the San Diego Bay Watershed are classified as Title 1 and receive special funding because of their high proportions of ethnic/racial groups, economically disadvantaged students, limited-English-proficiency students, and students with disabilities. Thus, many of the educational activities for school children also reach underserved audiences. Table 9-15 identifies activity types that the Port may use to reach underserved audiences.

Table 9-15. Training Opportunities for Underserved Audiences.

Opportunity to Reach Underserved Audiences	How the Opportunity Can Be Integrated into Port Outreach Programs
Title 1 Schools	Six of the seven schools in the Port's School Partnership Program are classified as Title I Schools. As such, they receive special funding because their student population comprises major ethnic/racial groups, economically disadvantaged students, limited English proficiency students, and students with disabilities. Additionally, the Port's partnership with the Maritime Museum of San Diego extends its environmental education program to Title I schools beyond those in the Port's School Partnership Program.
Spanish Language Outreach	The Port collaborates with the San Diego County's regional Outreach Workgroup, to develop and provide Spanish language outreach to San Diego County's Latino community. This strategy may include events, printed materials, and business and community partnerships.

9.3.1.11 Homeless Populations

Integrated WQIP Strategies: PO-17, PO-37

The Port has been active in addressing the homeless population around San Diego Bay in multiple ways. This segment of the population may also be considered underserved audiences. Per WQIP optional strategy PO-37, the Port is to address homelessness and provide resources and educational materials to address trash and bacteria levels in and around the Port's jurisdiction. Table 9-16 identifies activity types that the Port may use to address homeless population issues.

Table 9-16. Proposed Activities to Address Homeless Populations.

Potential Activity	Activity Type	Frequency	Topics Covered
Alpha Project[1]	Information Sharing/ Presentation	As Scheduled	• Required topics (Table 9-4)
Psychiatric Emergency Response Team (PERT) Program[2]	Information Sharing/ Presentation	As Scheduled	• Required topics (Table 9-4)

[1] The Port sponsors Alpha Project's efforts to provide outreach and intervention services to the homeless on Port tidelands. https://www.alphaproject.org/

[2] PERT is a program of Community Research Foundation (CRF) in partnership with San Diego County Health and Human Services (HHSA), San Diego County law enforcement, emergency medical services (EMS), and consumer advocacy organizations. Pairs licensed mental health clinicians or nurses with uniformed law enforcement officers/deputies to provide proactive preventative connection to services.

9.3.1.12 Public Reporting

The Port realizes the importance of public reporting. Empowering the public to report potential pollution to the Port will help the Port address ICIDs more effectively and efficiently. The Port has a delectated webpage for reporting stormwater pollution[4], with a link on every page of the Port's website for quick and easy access. The Port also has a dedicated email[5]. The Port promotes public reporting in all training events as well as over social media.

9.4 Public Participation Component

Public participation involves evaluating input from the public as part of the decision-making process. It includes all aspects of identifying problems and opportunities, developing alternatives, and making decisions. An effective stakeholder participation process enhances the effectiveness of the Port's decisions in many ways:

- This participation process provides an early warning system for public concerns and needs, enabling changing policies and procedures to head off problems before they develop;
- It contributes to sustainable decision making;
- It presents an opportunity for the public to communicate with the decision makers;
- It promotes the public's understanding and acceptance of potentially controversial issues; and
- It furthers public knowledge and support of the Port's WQIP goals.

The following subsections describe the Port's public participation program and opportunities as they relate to urban runoff and water quality protection and improvement.

[4] https://www.portofsandiego.org/report-stormwater-pollution
[5] Dedicated reporting email - SWPollutionPrevention@PortofSanDiego.org

9.4.1 Public Participation Program Implementation

Integrated WQIP Strategies: PO-17, PO-36

Effective public participation is supported by engaging stakeholders at an appropriate level of decision making. Public input into any decision-making process can be as simple as providing public notification of a forthcoming initiative or as complex as requiring the stakeholders to be intrinsically involved and responsible for the final outcome or can be at any level in between. Properly identifying the role of stakeholders at the onset is crucial to ensuring success when public input is sought.

Each project initiative should be analyzed before designing a public participation plan. The benefits of proactively engaging the public versus the risks of having no involvement and/or inappropriate participation must be considered. Table 9-17 describes the full spectrum of levels of public participation. Additionally, the following components are analyzed to help determine the appropriate public participation level:

- Identification of stakeholders
- Identification of values represented by the stakeholders
- Selection of the public's role in the decision-making
- Identification of techniques that support the public participation objectives

Table 9-17. Levels of Public Participation.

Levels of Public Participation Objectives				
Inform	Consult	Involve	Collaborate	Empower
To provide balanced and objective information to help understand the problem, its alternatives, and opportunities and/or solutions	To obtain public feedback on alternatives, analysis, and/or decisions	To work directly with the public throughout the process so that public concerns and aspirations are consistently understood and considered	To partner with the public in each aspect of the decision making, including developing alternatives and the identifying the preferred solution	To place final decision-making in the hands of the public

In FY 2018, the Port collaborated with other Copermittees to complete a public perception survey on Physical Aesthetics and Swimmable Waters focused priority conditions (PO-36). This WQIP strategy was implemented to understand public opinions about the current status of the focused priority conditions and to help the RPs identify how they may adapt their programs to improve both water quality and public perception.

9.4.1.1 JRMP and WQIP Development

The Port encouraged the public's involvement in the development of the WQIP and updates to the JRMP and provided multiple opportunities for the public to provide input. With respect to WQIP development, public participation included multiple public workshops, as well as an open comment period following a deliverable to the Regional Board.

Regarding the updates to the JRMP, the Port encouraged the public's input on agenda items such as the amendment to Article 10 (Stormwater Ordinance). Outreach items included notices of a review and comment period, which were mailed out and posted on the Port's website. Additionally, the Copermittee Draft Model BMP Design Manual and the Port's BMP Design Manual were made available to the public for review and comment.

Table 9-18. Public Involvement in WQIP Development.

Component	Outcome
Identification of stakeholders	Many stakeholders including environmental non-profit organizations, regulatory agencies, and Port tenants, are concerned about the environmental quality of the San Diego Bay and development of the WQIP,
Identification of values represented by stakeholders	The primary value of the stakeholders is environmental protection.
Selection of the public's role in decision making	**Involvement and Consult** was selected as the appropriate public participation method because the Port will take in the public's consideration during the open review process of the WQIP and JRMP updates.
Identification of techniques	Public comment at public meetings was determined to be the appropriate method of public participation for WQIP priorities development, because it provides an opportunity for any member of the public to provide feedback Creating opportunities for public review and comment on the proposed BMP Design Manual and Article 10 was determined to be an appropriate method for garnering public involvement in JRMP updates.

9.4.1.2 Port Environmental Advisory Committee

Integrated WQIP Strategies: PO-17

The Environmental Committee offers several opportunities for collaborative public participation. The goal is to inform the public on the Port's environmental programs and recommend funding projects that are beyond mitigation and compliance. The Committee is advisory and comprises a balance of resource and regulatory representatives from academia, environmental advocacy groups, governmental agencies, and Port tenants.

Table 9-19. Environmental Policy and Committee Public Participation Evaluation.

Component	Outcome
Identification of stakeholders	Many stakeholders including environmental non-profit organizations, regulatory agencies, and Port tenants, are concerned about the environmental quality of the San Diego Bay.
Identification of values represented by stakeholders	The primary value of the stakeholders is environmental protection.
Selection of the public's role in decision making	**Collaboration** was selected as the public participation objective for this committee because its decisions affect a large, important, and sensitive area of the San Diego region and affect many stakeholders. Although final decisions must be made by the BPC, the BPC is invested in incorporating opinions of the stakeholders into the process.
Identification of techniques	Regular committee meetings were determined to be the appropriate method of public participation, because they give all parties an opportunity to give direct feedback to the BPC.

BPC = Board of Port Commissioners

9.4.1.3 Board of Port Commissioner Meetings

Integrated WQIP Strategy: PO-17

The Board of Port Commissioners (BPC) holds monthly board meetings, which are advertised and open to the public. BPC meetings have open comment periods during which stakeholders can share their opinions and concerns about any aspect of the Port's business. Table 9-20 identifies the outcomes of the public participation analysis that was conducted during the establishment of the BPC meetings.

Table 9-20. Public Participation Evaluation of BPC Meetings.

Component	Outcome
Identification of stakeholders	Key stakeholders include residents, Port tenants, nonprofit organizations, advocacy groups, and businesses wishing to conduct business with the Port.
Identification of values represented by stakeholders	Many different values are represented by stakeholders, including environmental protection, economic vitality, urban development, aesthetic quality, and public health and safety.
Selection of the public's role in decision making	The public participation objective for BPC meetings is **consultation**, because regulatory constraints prevent the public from being involved in a higher capacity.
Identification of techniques	Public comment at public meetings was determined to be the appropriate method of public participation, because it provides an opportunity for any member of the public to provide feedback. However, all decision-making authority is retained by the BPC.

9.4.1.4 Copper Reduction Program

Integrated WQIP Strategy: PO-17

The Port's Copper Reduction Program was created in response to the regulatory total maximum daily load (TMDL) imposed on copper in the Shelter Island Yacht Basin (SIYB). The program has five components: alternative hull paint testing and research, policy development and legislation, hull paint conversion, monitoring and data assessment, and education and outreach. Through this program, the Port has many projects that provide an ongoing forum for stakeholder involvement and incorporate stakeholder input. Such input during the reporting period has included researching and testing recreational boat hull paints; policy considerations, both local and statewide; and grant initiatives. This input can be obtained during workshops, public forums, focus group meetings, and open comment periods at BPC meetings. Interested stakeholders are nonprofit groups, the environmental community, marina owners, boat hull cleaners, and hull paint manufacturers. In most cases, the Port considered the public's role as involvement.

The Port promotes the Copper Reduction Program through their social media accounts.

Port of San Diego @portofsandiego · 25 Sep 2018

Copper paints are commonly used when painting the hulls of ships; this can harm marine wildlife. The Port's Copper Reduction Program will reduce copper in the bay dramatically by 2022, improving water quality & balancing economic interests. Learn more: bit.ly/2nZJ9jb

Table 9-21. Copper TMDL Stakeholder Workgroups Public Participation Evaluation.

Component	Outcome
Identification of stakeholders	Key stakeholders are Port employees, marinas, boatyards, environmental groups, and local and state regulatory agencies with concerns about copper loading in the San Diego Bay.
Identification of values represented by stakeholders	The primary values of copper reduction are environmental protection and restoration of water quality beneficial uses.
Selection of the public's role in decision making	**Involvement** was selected as the appropriate public participation method because the Port will work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.
Identification of techniques	Regular workgroup meetings were determined to one method of public participation, because they give all parties the chance to regularly provide feedback. Informational presentations at BPC meetings and during other public forums will also be used to update Workgroup decisions. However, the Port also holds and sets-up information booths at events to encourage public participation.

9.4.1.5 Integrated Pest Management Program

Integrated WQIP Strategies: PO-12, PO-17

The Port has had an Integrated Pest Management (IPM) Program in place since 1997 to support the goals of the Integrated Pest Management Policy (BPC No. 737). The policy's purpose is to reduce the use of pesticides, herbicides, and fertilizers that can adversely impact human health or environmental quality. The Program comprises Port representatives from the Port's EP and General Services departments, as well as representatives of the University of California Cooperative Extension. All Program members provide input and advice on the Port's use of IPM techniques and help plan outreach activities and events. The Port JRMP Document defines the public's role in this process as collaboration.

Table 9-22. IPM Committee.

Component	Outcome
Identification of Stakeholders	Key stakeholders are Port employees, and existing professionals.
Identification of Values Represented by Stakeholders	The primary values of the IPM Program are environmental protection and restoration of water quality beneficial uses.
Selection of the Public's Role in Decision Making	**Collaboration** was selected as the appropriate public participation method because the Port will work with others in the industry to come up with alternative, more environmentally desirable pest management strategies.
Identification of Techniques	An annual workshop was determined to be the appropriate method of public participation, because all parties will have an open opportunity to participate and provide input on IPM Strategies. Informational presentations at BPC meetings and during other public forums will also be used to provide updates of Workgroup decisions.

Chapter 10 Fiscal Analysis

10.1 Introduction

Provision E.8 of the Municipal Permit requires the Port to secure resources necessary to meet the requirements of the Permit. The Port is also required to outline the proposed strategy for conducting a fiscal analysis of the JRMP in its entirety. The Port has established a stormwater program that provides environmental benefits and is cost-effective for the Port, Port tenants, and users of tidelands. In order to demonstrate sufficient financial resources to implement the Program, the Port will conduct an annual fiscal analysis as part of its JRMP Annual Report.

This Chapter describes how the Port will meet the fiscal analysis conditions outlined in F.2.a and E.8 in the Permit. Table 10-1 indicates the sections of this chapter where specific permit conditions are incorporated in to the Port's JRMP.

Table 10-1. Fiscal Analysis Requirements and Corresponding JRMP Section.

Permit Requirement	Permit Reference	JRMP Section
Confirmation that resources are secured to meet Permit requirements	E.8.a	10.2.1 and 10.2.3
Annual Fiscal Analysis of JRMP program	E.8.b	10.2
Annual Fiscal Analysis – Expenditure Categories	E.8.b(1)	10.2.2, Table 10-2, 10-3, 10-4
Annual Fiscal Analysis – Required staff resources	E.8.b(2)	10.2.2, Table 10-3, Chapter 2 – Administrative and Legal, Section 2.1
Annual Fiscal Analysis – Estimated Expenditures for current fiscal year	E.8.b(3)	10.2.3, Table 10-2, 10-3, 10-4
Annual Fiscal Analysis – Funding sources	E.8.b(4)	10.2.1
Annual Fiscal Analysis Reporting	E.8.c	10.3
Maintenance of Records	E.8.d	10.3

10.2 Fiscal Analysis Methods

The Port's approach to conducting a fiscal assessment was developed as part of a coordinated effort with the San Diego County Copermittees during the previous municipal permit cycle. The fiscal approach evaluates the requirements for implementing the Port's JRMP and assesses the costs associated with the program elements. The approach prioritizes the program by assessing environmental, hydrological, infrastructure, and tenant management improvement needs, as well as their associated fiscal requirements. Once priorities are recognized, the various components and their financial implications become clear, and budgets and funding can be appropriately allocated.

The details of the Port's current fiscal assessment approach, including funding sources, expenditures, and budget information are described within this chapter.

10.2.1 Funding Sources

The Port is accounted for as an enterprise fund and generates revenue from four major revenue sources: 1) charges received by Maritime Operations; 2) charges received by Real Estate Operations; 3) The Port's Cost Recovery Program, and 4) Reimbursement for Services charged to the San Diego County Regional Airport Authority. The revenues currently generated by the Port are sufficient to implement the Port's JRMP. Each of these revenue sources are more fully discussed below, including and legal restrictions on the uses of these funds.

Maritime Operations - Revenue generated through maritime operations includes charges for wharfage, dockage, storage, passenger fees, and other marine services subject to Port tariffs filed with the Federal Maritime Commission. Wharfage revenue is the charge assessed to both inbound and outbound cargo when crossing over Port property. Dockage fees are the charges assessed against a vessel for the right to berth at a wharf or pier of the Port.

Real Estate Operations - A substantial portion of the Port's land and some of its facilities including marine terminal facilities, and office and commercial space are leased to tenants. All leases prohibit transfer of land ownership to the lessee at the expiration of the agreement and are accounted for as operating leases. The majority of these lease agreements are not cancelable and permit the Port to periodically adjust rents. In addition, these leases are secured by letters of credit. Percentage rentals are received under certain leases on the basis of percentages of sales in excess of stipulated minimums. Other leases are based on flat rates. Revenue generated through Real Estate operations is generally derived from flat-fee ground rentals and rental fees based on a fixed percentage of tenant revenues subject to certain minimum monthly fees for industrial, commercial, and recreational facilities.

Port Cost Recovery Program - On June 11, 2013, the Port adopted a Cost Recovery User Fee Policy (BPC Policy No.106) and Cost Recovery User Fee Schedule (Ordinance 2720) establishing a fee schedule and general guidelines to recoup all costs associated with services provided by the Port. The policy became effective as of July 11, 2013. Services that are cost recoverable include for example, project review and approvals, environmental review (for CEQA and Coastal Development Permits), SWPPP and SWQMP reviews, construction stormwater inspections and initial inspections of treatment control BMPs.

Reimbursement for Services at San Diego County Regional Airport Authority (SDCRAA). The Port also generates revenue from the SDCRAA. Income from the SDCRAA has been generated since the agencies were separated in 2003. The Port's Harbor Police Department is the primary law enforcement agency for the airport. As such, the SDCRAA reimburses the Port for those services. Additionally, the SDCRAA also leases land from the Port per typical real estate lease agreements, as described above. This income stream is anticipated to continue as long as the SDCRAA wishes to retain Harbor Police services.

The Port will provide updates in its JRMP funding sources in the WQIP annual report as new sources are identified.

10.2.2 JRMP Related Expenditures

The Port has generally committed funds to the following issues: 1) the Capital Improvement Program (CIP) for major capital improvements within the tidelands: 2) operating expenses, including most of the Port JRMP activities; 3) municipal service contracts with the five member cities; and 4) various required collaborative efforts pertaining to urban runoff issues. Urban runoff related expenditures are included within each of these funding commitments as follows.

Capital Improvement Program – In Fiscal Year 2013, the Board of Port Commissioners approved a CIP for the development of certain capital outlay projects located either on the San Diego Bay and Imperial Beach tidelands or on the uplands adjacent to these tidelands for fiscal years 2019-2023. Each project in the plan must be reviewed, analyzed, and authorized by the Board of Port Commissioners on a project-by-project basis. The CIP is to be updated as conditions and circumstances warrant. BMPs that are required as part of CIP projects are addressed and accounted for within this program.

Municipal Service Contracts – The Port enters into contracts with its five member cities for annual municipal services being provided by the cities for the benefit of the Port. These include park maintenance at various tideland locations, waste collection, MS4 cleaning and other various as-needed services relating to clean-up and maintenance.

Stormwater Program Implementation Operating Expenses – The implementation of an adequate urban runoff program requires appropriate staffing relative to the managerial, administrative, and technical aspects of the program including field technicians for IC/ID, monitoring, and enforcement. Use of outside services, such as consultants for monitoring, inspections, development-review deliverables, BMP design, and other urban runoff tasks must also be accounted for. Staffing needs are prioritized and the number of staff is contingent on the ultimate scope, complexity, and affordability of the final program as dictated by the results of the monitoring program and other discovery-related phases of the JRMP. Chapter 2 of the JRMP describes the Port staff dedicated to implementing the JRMP program.

Regional and Watershed-Based Collaboration Efforts – The Port is contributing to ongoing programs such as the Regional Harbor Monitoring Program, THINK BLUE San Diego Region, Project Clean Water, grants focused on the San Diego Bay Watershed, and other regionally or watershed focused water quality improvement programs to address regional education and outreach efforts and to support the goals of the San Diego bay Watershed WQIP. Additionally, the Port is an active stakeholder in the various TMDLs that are in place throughout the bay. As such, funding for TMDL required monitoring and implementation activities overlap and become a part of the overall funding needed to address urban runoff related costs.

10.2.3 Budget

On or before the 15th day of June of each year, the Board of Port Commissioners adopts a preliminary budget divided into the following main classes: ordinary annual expenses, capital outlay, and debt service. Public hearings are then conducted to obtain citizen comments on the proposed budget. After the budget hearings, but no later than the first day of August of each year, the Board of Port Commissioners files the final budget with the San Diego County Board of Supervisors.

As stated above, a budget has been established to adequately fund the implementation of the Port JRMP, including monitoring, investigation, outreach, education, inspection, and enforcement programs. Funding is also available for the maintenance of stormwater infrastructure and the additional structural BMPs that may potentially come on-line as a result of new development/redevelopment requirements and/or the results of the monitoring program.

Reviewing the JRMP fiscal assessment annually allows the Port to appropriately budget resources for upcoming years.

10.3 Annual Fiscal Analysis Reporting and Record Keeping

Pursuant to the Permit, the Port will conduct an annual fiscal analysis of its urban runoff management program in its entirety and submit a summary of that analysis annually with the San Diego Bay Watershed WQIP Annual Report. Information that will be provided in that report includes:

- Identification of the various categories of expenditures necessary to implement the requirements of the Permit, including a description of the specific capital, operation and maintenance, and other expenditure items to be accounted for in each category.
- Staff resources required and allocated to meet the requirements of the Permit, including any development, implementation, and enforcement activities required;
- The estimated expenditures for the current fiscal year;

- The source of funds including applicable legal restrictions that are proposed to meet the expenditures

The Port will provide documentation used to develop the summary of the annual fiscal analysis upon request of the Regional Water Quality Control Board.

The attached tables 10-2 and 10-3 provide templates for the types of expenditure categories.

Table 10-2. San Diego County Copermittees Fiscal Analysis Report for Urban Runoff Management Programs.

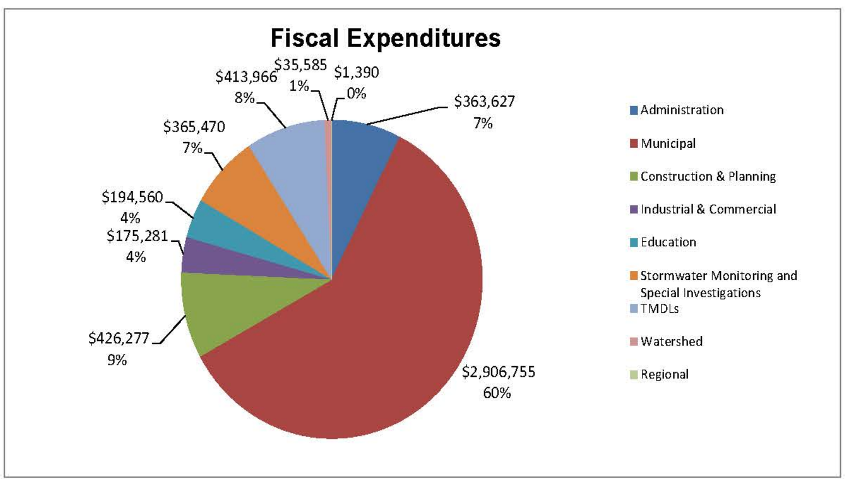
Copermittee Name:	Port of San Diego
Date:	
Reporting Year:	

EXPENDITURE SUMMARY

JURISDICTIONAL COMPONENT	
ADMINISTRATION	$
DEVELOPMENT PLANNING	$
CONSTRUCTION	$
MUNICIPAL/IDDE	$
INDUSTRIAL AND COMMERCIAL	$
RESIDENTIAL	$
EDUCATION AND PUBLIC PARTICIPATION	$
STORMWATER MONITORING AND SPECIAL INVESTIGATIONS	$
TOTAL MAXIMUM DAILY LOADS	$
NON-EMERGENCY FIREFIGHTING	$
TOTAL	**$**

WATERSHED AND REGIONAL COMPONENTS	
SAN DIEGO BAY WATERSHED COST SHARE	$
WATERSHED PLANNING/ACTIVITIES	$
REGIONAL COPERMITTEE COST SHARE	$
TOTAL	**$**

Total Costs	**$**



Funding Sources: The Port's implementation of its Municipal Permit requirements is budgeted and approved annually by the Board of Port Commissioners. The Port is accounted for as an enterprise fund and generates revenue from four major revenue sources; 1) charges received from Marine Operations, 2) charges received by Real Estate Operations, 3) the Port's Cost Recovery Program, and 4) reimbursement for services charged to the San Diego Regional Airport Authority. Legal restrictions related to the use of these funds are generally centered on the standard public contracting and fiscal reporting requirements. See the Port JRMP Chapter 10 for additional description of each funding source.

Table 10-3. FY X All Expenditures by Program Component & Activity.

Category	Category Description	Expenditures		Total Expenditures
ADMINISTRATION		Staff Expenditures	External Expenditures	
Administration	Staff expenditures include general administrative activities, meetings, and general reporting for the implementation of the Municipal Stormwater Permit. External costs include fees for municipal and construction permits.			
Stormwater Data Management	Staff expenditures include stormwater database management and GIS/Mapping/data utilization. External expenditures include contracted services for development and implementation of the stormwater database.			
DEVELOPMENT PLANNING				
Project Planning & Engineering	Staff and external expenditures include environmental project and proposal review, SQWMP applicability and the review of SWPPP and SQWMP documents.			
CONSTRUCTION				
Compliance Inspections & Enforcement	Staff expenditures include meetings with contractors, engineers and construction staff, site inspections, follow-ups, and written correspondence. External expenditures include contracted support for inspections and documentation, inspection follow-ups, as well as BMP design, deployment, and maintenance.			
MUNICIPAL				
Municipal Inspections	Staff expenditures include storm drain inspections, site inspections (parks, Port facilities, etc.), special event inspections, departmental meetings, storm drain markers/GPS efforts, and BMP studies. External expenditures include contractor related costs for MS4 inspections, maintenance or repair/replacement and cleaning of Port owned MS4 and structural BMPs.			
Waste Management, Trash Collection, and Recycling	Staff expenditures include implementing Waste Management Program and trash collection. External expenditures include costs for contracted services for waste pick-up, removal, disposal, and recycling from Port facilities.			
Cleanup Events	External expenditures for baywide debris removal and clean-up programs (e.g,, Creek to Bay event)			
Illegal Dumping	Staff expenditures to clean up and remove trash and debris from illegal dumping and homeless encampments			
Street Sweeping	Staff expenditures for street sweeping activities			
Other expenditures	Staff expenditures include hazardous waste disposal and Rain Event response. External expenditures includes stormwater training, equipment and supplies.			
INDUSTRIAL / COMMERCIAL				
Marine Terminals Stormwater Strategy	Staff expenditures include the implementation of the Marine Terminals Stormwater Strategy for the TAMT, NCMT, and Cruise Ship Terminal[1]. External expenditures include consultant support for implementation and updates to the Marine Terminals Stormwater Strategy.			
Compliance Inspections & Enforcement	Staff expenditures include industrial and commercial inspections (including all follow-ups, written correspondence, meetings, consultant oversight, etc.) and tenant-related ICID cases. External costs include consultant support for inspections, related follow-ups, and reporting.			

1

EDUCATION AND PUBLIC PARTICIPATION				
Education & Outreach	Staff expenditures includes staff training and development/oversight of public outreach, children (school) education, regional education meetings, regional outreach efforts, Environmental Champions Campaign, and website development. External expenditures includes consultant support for Environmental Champions campaign and funding of Environmental Education Program activities.			
STORMWATER MONITORING				
Outfall Monitoring	Staff expenditures include dry weather major MS4 outfall and Physical Aesthetics related monitoring. Monitoring includes field work for dry weather monitoring, report preparation. External expenditures include consultant costs for monitoring and as-needed water quality sample laboratory analysis if a non-stormwater discharge is observed.			
Marine Terminals Stormwater Strategy	External expenditures for wet weather monitoring at the three Port Terminal Facilities			
SPECIAL INVESTIGATIONS				
Regional Harbor Monitoring Program	Staff expenditures to comply with RWQCB directive issued in July 2003 include time for meetings report preparation and review, coordination and planning. External cost include the Port's portion of cost-share related to consultant services for sampling and reporting.			
Other Studies/Programs	Staff and external expenditures include costs for various efforts within San Diego Bay watershed, including participation in the RWQCB's San Diego Bay Strategy.			
TOTAL MAXIMUM DAILY LOADS				
SIYB Dissolved Copper TMDL	Staff and external expenditures include costs to comply with TMDL and implementation of bay-wide Copper Reduction Program.			
SISP Bacteria TMDL	Staff and external expenditures include costs to comply with TMDL - Sampling, meetings, reporting.			
Chollas Creek Metals and Bacteria TMDLs	Staff and external expenditures include costs to comply with TMDL - Monitoring and Reporting (Port portion of cost-share only).			
WATERSHED				
Watershed Management	Staff expenditures include for meetings and report preparation, GIS/Mapping, and external consultant expenditures on WQIP strategies, watershed education, etc.			
Watershed Cost Share Agreement	External expenditures related to watershed consultant support for coordination of implementation efforts and reporting of the San Diego Bay WQIP (Port portion of cost-share only).			
Regional				
San Diego Regional Copermittee MOU	External cost related to Regional Municipal Permit MOU cost share (Port portion only).			
	FY X Total Expenditures			

[1] Additional staff expenditures to fully implement the Terminals Stormwater Strategy are included in the following categries: Municipal and Industrial Compliance Inspections and Enforcement; Education and Outreach; Stormwater Monitoring.

2

Chapter 11 Modifications to the JRMP

11.1 Modifications to the JRMP

The Port JRMP Document is designed to be a living document. It is anticipated that the program objectives, activities, BMPs, and management actions may need to be revised as the JRMP evolves and matures and as strategies associated with the San Diego Bay WQIP are incorporated.

The Port will evaluate all activities, programs, and components of the JRMP program in accordance with the assessment approaches outlined in the WQIP. Additionally, a thorough review of the program will occur annually to ensure that all urban runoff related efforts identified are up to date and consistent with current operating practices. In the instance(s) where an activity and/or JRMP components require modifications, the updates will be incorporated into a JRMP update which will be submitted with the WQIP Annual Report and posted to the Port's website.

January 2025 JRMP Update

In FY 2025, the Port reviewed activities, programs, and components of the JRMP program and document to identify modifications needed to be consistent with current Port processes and operating practices. Table 12-13 in Appendix 3, Section 12-5 of the FY 2024 San Diego Bay WQIP Annual Report (Table 11-1) describes the changes and the rationale for making each revision. JRMP updates were indicated and certified by the Port in the San Diego Bay WQIP Annual Report (Figure 11-1) that was submitted to the Regional Board on January 31, 2025. A link to the JRMP Update on the Port's website[1] is also provided on the Project Clean Water[2] website.

[1] Port of San Diego's JRMP web page: https://www.portofsandiego.org/environment/environmental-protection/stormwater
[2] Project Clean Water: http://www.projectcleanwater.org/

Table 11-1. Port of San Diego JRMP Updates in the FY2024 San Diego Bay WQIP Annual Report

Section	JRMP Section	Update
Executive Summary		No Updates
Section 1	Introduction	No Updates
Section 2	Administrative and Legal	Section 2.1: Update Figure 2-1
Section 3	Illicit Discharge Detection and Elimination	No Updates
Section 4	Development Planning	No Updates
Section 5	Construction Management	No Updates
Section 6	Existing Development: Municipal	No Updates
Section 7	Existing Development: Industrial and Commercial	No Updates
Section 8	Existing Development: Residential	N/A[1]
Section 9	Public Education and Participation	No Updates
Section 10	Fiscal Analysis	No Updates
Appendices		
Appendix A	WQIP Strategies	No Updates
Appendix B	Article 10	No Updates
Appendix C	Enforcement Response Plan	No Updates
Appendix D	BMP Design Manual	No Updates
Appendix E	SWPPP Templates	No Updates
Appendix F	MS4 and facilities inventory maps	Updates to the maps to reflect changes made over the previous year.
Appendix G	Facilities inventory list	Updates made to inventory list to reflect changes made over the previous year.
Appendix H	Retrofit and Rehabilitation Program	No Updates

Notes:
1. The Port does not have residential land uses.

Figure 11-1. Statement of Certification from FY 2024 WQIP Annual Report

PORT of SAN DIEGO

Statement of Certification
San Diego Bay Watershed Management Area Water Quality Improvement Plan
Fiscal Year 2023-2024 Annual Report

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted.

Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations [40 CFR 122.22(d)].

1/10/2025

Karen Holman
Director, Environmental Protection
San Diego Unified Port District

Date

Chapter 12 Conclusions and Recommendations

The Port JRMP Document describes the activities that the Port has undertaken, is undertaking, or will undertake, to reduce discharges of pollutants and urban runoff flow to the stormwater conveyance system to the maximum extent practicable. The document also describes how the Port has integrated the strategies identified in the San Diego Bay Watershed WQIP to address the highest priority water quality conditions. The program addresses three phases of urban development: namely, the development planning, the construction, and existing development. The JRMP Document provides an overall account of the program to be conducted by the Port during the five-year life of the Municipal Permit.

This JRMP Document signifies the continuation of a long-term effort to protect and enhance the water quality of the Bay. Many of the JRMP efforts are a continuation of the efforts initiated and refined during the last five years as part of the previous Permit (Order 2007-001). Over the past year, Port staff in several departments committed significant time and resources toward evaluating and reviewing existing stormwater programs/practices. Where needed, implementation efforts were refined, information tracking was improved, and programs and related documents were updated to reflect the changes in Permit requirements. This JRMP Document represents the culmination of those efforts and describes all of the actions and activities the Port will undertake minimize pollution and improve water quality within the tidelands.

The Port JRMP Document discusses the program components required by the Municipal Permit: namely, existing development, new development and redevelopment, construction activities, illicit discharge detection and elimination activities, education activities, public participation activities, and enforcement activities. It also outlines the methods to be used in analyzing the effectiveness and the budget and funding JRMP requirements. Article 10, facility inventories, MS4 maps, are also included as appendices to the JRMP Document.

The Port will coordinate its jurisdictional efforts with the watershed's high priority and focused priority water quality goals and use the information gathered through the jurisdictional program to inform programmatic changes to reach water quality goals in the WQIP. To accomplish those tasks, linkages between programs/activities, pollutants, and watershed hydrologic areas will be established whenever possible. Additionally, the Port will continue to expand efforts to develop information tracking systems that store, retrieve and report information within and across program components. It is anticipated that both of these efforts will significantly improve the Port's ability to document Permit compliance and, more importantly, relate urban runoff management actions to water quality improvements.

The Port approach to managing runoff is a dynamic program that will evolve with time. It is recommended that as characteristics, policies, and procedures continue to change in the Port's tidelands jurisdiction, so must the program and this JRMP Document. Thus, this document is considered a living document that will be periodically modified to ensure that it adequately describes the Port's program. Where regional or watershed level efforts have been initiated or will be initiated to standardize JRMP programs, the Port will work collectively with the regional and watershed copermittees to ensure that Port JRMP efforts and actions remain consistent with the final standards. Any proposed revisions to the Port JRMP Document will be made part of the WQIP Annual Report required by Permit Provision F.3.b.(3).

Implementation of the Port JRMP should help to meet the Port's overall objectives to reduce and/or eliminate the impacts of polluted urban runoff on San Diego Bay, improve receiving water quality, and improve stormwater program management efforts.

Appendix A
Updated WQIP Strategies

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
JRMP (E.2-E.7) Strategies (E.3.b.(1)(a))											
Development Projects (including Priority Development Projects)											
PO-1	Implement Core JRMP Program for all development projects that includes source control BMPs to minimize pollutant generation at each project and implement LID BMPs to maintain or restore hydrology of the area, where applicable and feasible.	For development projects, source control and LID BMP requirements will be required as applicable and feasible for new development projects. Requirements are assigned during the project planning process and prior to project approval consistent with the Port BMP Design Manual. Source control and LID BMP requirements are incorporated into project approvals. Verification of BMP installation performed by the Port as part of the project close-out process. Refer to JRMP Section 4 and JRMP Appendix D Port BMP Design Manual. Program funding is contingent upon approval by the Port's Board of Commissioners (BPC) each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-1 is a Permit-required strategy to be implemented jurisdiction-wide and continuously throughout permit term.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Parks, Land Development Swimmable Waters (Bacteria): Sewage (Sanitary/Septic waste management), Over-irrigation/runoff	FY 2015	Continuous	EP FY Budget	$$	EP, Engineering, REO
PO-2	For PDPs, administer a program requiring implementation of structural BMPs to control pollutants and manage hydromodification. Includes confirmation of design, construction, and maintenance of PDP structural BMPs.	For all PDPs, consistent with the Port BMP Design Manual, treatment control BMP requirements are assigned as applicable during the project planning process and incorporated as a condition of project approvals. Proposed SWQMPs and BMPs are reviewed by the Port prior to construction. Verification of BMP installation, maintenance is conducted by the Port and by project owner. Refer to JRMP Section 4 and JRMP Appendix D Port BMP Design Manual. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-2 is a Permit-required strategy to be implemented jurisdiction-wide and continuously throughout permit term.		X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Parks, Land Development	FY 2015	Continuous	EP FY Budget	$$	EP, Engineering, REO

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-3	Train all applicable departments annually on stormwater requirements for all development projects	Conduct education efforts focusing on new development and redevelopment projects and their relationship to urban runoff impacts on water quality. See JRMP Sections 4.7.1 and 9.3.1. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. Funding for future fiscal years is contingent on annual budget approval by BPC. PO-3 is a Permit-required strategy to be implemented jurisdiction-wide and on an annual basis throughout the permit term.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Parks, Land Development	FY 2015	Annually	EP FY Budget	$	EP
PO-4	Conduct project closeout inspection for all development projects to verify that Trash, Metals, and Bacteria BMPs are properly implemented	Post construction inspections will be conducted at PDP sites to verify that any and all approved structural BMPs have been installed as approved by the Port. The close-out inspection will also verify that trash, metals, and bacteria BMPs are installed as required. Funding for future fiscal years is contingent on annual budget approval by BPC. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-4 is a Permit-required strategy to be implemented jurisdiction-wide and will be conducted on a continuous basis as part of the PDP project closeout inspection.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Parks, Land Development	FY 2015	Continuous	EP FY Budget	$	EP
PO-5	Provide technical education and outreach to the development community on the design and implementation of the MS4 permit and WQIP requirements	Conduct education/outreach to the development community on MS4 permit, WQIP and BMP design standards, Port BMP Design Manual, and WMAA. See JRMP sections 4.7.1, 9.3.11 and 9.3.2.1. Funding for future fiscal years is contingent on annual budget approval by BPC. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-5 is a Permit-required strategy to be implemented jurisdiction-wide at least annually.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Parks, Land Development	FY 2015	Continuous	EP FY Budget	$	EP, San Diego region Copermittees

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Construction Program											
PO-6	Implement Core JRMP Program to require and to oversee implementation of BMPs during the construction phase of land development. Includes inspections at an appropriate frequency and enforcement of requirements. [SWPPP Review, inspections, BMP Implementation]	Prior to the approval of a construction project, the Port will require that all applicable minimum and seasonally appropriate BMPs have been identified and the proposed methods of implementation are appropriate to the project site. The review also confirms that minimum BMPs that address WQIP priorities are included. Construction inspections are conducted at a minimum of monthly basis based on assessed threat to water quality. Inspection frequency may increase based on issues of non-compliance with respect to trash, metals, bacteria BMPs. See JRMP Section 5.5 and 5.6, and JRMP Appendix C- Enforcement Response Plan. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-6 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.		X	X	Physical Aesthetics (Trash): General retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Illegal Dumping, Construction Swimmable Waters (Bacteria): Over-irrigation/runoff, Sewage (Sanitary/septic waste management), Construction, Roads and Parking Lots	FY 2015	Continuous	EP FY Budget	$$	EP, Engineering, REO

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Existing Development											
Commercial / Industrial Facilities											
PO-7	Implement Core JRMP Program for existing development (commercial and industrial facilities) to require implementation of minimum BMPs that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of existing development at appropriate frequencies and using appropriate methods, maintenance of an existing development inventory, and enforcement.	Identify the minimum BMPs and pollution prevention practices that the Port requires for existing commercial and industrial facilities. Verify through inspections that the BMPs are implemented. For facilities that are not considered a higher priority based upon the WQIP pollutants, inspections will occur at least once during the Permit cycle and at least 20% of the inventoried facilities inspected each year. See JRMP Section 7.5.1 and 7.6.1. See PO-21 for additional information. Program funding is contingent on approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-7 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.	X	X	X	Chollas Creek (Metals/Bacteria): General Industrial Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Roads and Parking Lots Swimmable Waters (Bacteria): Over-irrigation/runoff, Commercial, Pet waste, Eating and drinking establishments	FY 2015	Continuous	EP FY Budget	$$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Municipal Areas & Facilities											
PO-8	Implement Core JRMP Program for existing development (municipal facilities) to require implementation of minimum BMPs for municipal facilities that are specific to the facility, area types, and PGAs, as appropriate. Includes inspection of the municipal facilities at appropriate frequencies and using appropriate methods, maintenance of a facility inventory and enforcement.	Identify the minimum BMPs and pollution prevention practices that the Port requires for existing municipal facilities. Verify through inspections that the BMPs are implemented. For facilities that are not considered a higher priority based upon the WQIP pollutants, inspections will occur at least once during the Permit cycle and at least 20% of the inventoried facilities inspected each year. See JRMP Section 6.5 and 6.6. Annual inspections will be performed at facilities that are determined to be higher sources of trash, metals, and bacteria. Those facilities are designated as "high priority" in the facility inventory. See PO-21 for additional information. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-8 is a Permit-required strategy is to be implemented jurisdiction-wide and will be on a continuous basis.	X	X	X	Physical Aesthetics (Trash): Homeless, Roads and Parking Lots, Parks, Municipal Facilities Swimmable Waters (Bacteria): Pet waste, Sewage (Sanitary/septic waste management at parks and special events), Eating and drinking establishments (special events), Parks, Over-irrigation/runoff, Homeless, Roads and Parking Lots	FY 2015	Continuous	EP FY Budget	$$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-9	Provide List of BMPs for Special Events with requirements for trash, metals, and bacteria, and ensure compliance thru inspections	Reduce and/or prevent the discharge of high priority pollutants from special events of 500 or more people on Port Tidelands. Establish a set of designated BMPs and conduct inspections to verify compliance. See JRMP Section 6.3.6 and 6.5.1. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-9 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, Roads and Parking Lots, Parks Swimmable Waters (Bacteria): Pet waste, Sewage (Sanitary/septic waste management at special events), Eating and drinking establishments (special events), Roads and Parking Lots	FY 2015	Continuous	EP FY Budget	$	EP, GS
MS4 Infrastructure											
PO-10	Implement Core JRMP Program for MS4 infrastructure (inspection and cleaning) for water quality improvement.	Inspect and clean the MS4 and associated BMPs that the Port owns and operates. Maintain a record and track inspection and cleaning activities. See JRMP Section 6.3.5, 6.5.1, and 6.6.4. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-10 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General Industrial Areas, Municipal, Roads and Parking Lots. Swimmable Waters (Bacteria): Sewage infrastructure and activities, Over-irrigation/runoff, Roads and Parking lots, Municipal facilities and parks	FY 2015	Continuous	EP FY Budget	$$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Roads, Streets, and Parking Lots											
PO-11	Implement Core JRMP Program for Street and Parking Lot Maintenance. Includes inspection and cleaning of public streets, paved roads, and parking lots.	Identify minimum BMPs for streets and parking lot maintenance and conduct an inspection process to verify compliance. Port staff or contractors perform street sweeping on a weekly basis. Track the areas in which the street sweepers operate and tabulate the number of curb miles swept. See JRMP Sections 6.5.1, 6.6.2, and 6.5.11. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-11 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.		X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Roads and Parking Lots, Municipal facilities, Parks Swimmable Waters (Bacteria): Roads and Parking Lots, Parks	FY 2015	Continuous	EP FY Budget	$	EP
Pesticide, Herbicides, and Fertilizers BMP Program											
PO-12	Implement Core JRMP Program requiring implementation of BMPs to address application, storage, and disposal of pesticides, herbicides, and fertilizers on commercial, industrial, and municipal properties. Includes education, permits, and certifications.	Implement the Port Integrated Pest Management policy to limit and/or eliminate the use of toxic substances. Train applicable employees and the public on appropriate IPM methods and minimum BMPs to implement to address potential discharges of pesticides, herbicides, and fertilizers. See JRMP Sections 6.5.1 and 6.5.14. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-12 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.	X	X		Commercial, Industrial, and Municipal, Over-irrigation/runoff, Landscaping	FY 2015	Continuous	EP FY Budget	$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Retrofit and Rehabilitation in Areas of Existing Development											
PO-13	Develop and implement a strategy that identifies candidate areas of existing development for retrofit and rehabilitation opportunities to address trash, bacteria, and metals	The retrofit and rehabilitation strategy includes methods for identifying and assessing potential retrofit projects in existing development areas. Retrofit project selection will be based upon a variety of factors including proximity to highest or focused priority conditions, potential pollutant load removal effectiveness, and feasibility of implementation. See JRMP Section 6.8, 7.8, and JRMP Appendix H. Funding and resources were secured for FY 2025 and allocated for FY 2026. Funding for future fiscal years is contingent on annual budget approval by BPC. Permit required administrative update to be implemented jurisdiction-wide and on a continuous basis.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Development, Municipal facilities, Parks Swimmable Waters (Bacteria): Eating and drinking establishments; Over-irrigation	FY 2015	Continuous	EP FY Budget	$	EP, GS

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Illicit Discharge, Detection, and Elimination (IDDE) Program											
PO-14	Implement Core JRMP Program for IDDE program. Requirements include: maintain MS4 map, identify and report illicit discharges, maintain a hotline for public reporting of illicit discharges, monitor MS4 outfalls, and investigate and address any illicit discharges. When sewage is detected, identify source and implement measures to eliminate sources.	Investigate and eliminate dry weather discharges and illegal connections to the MS4 as reported to the Port or identified by Port staff. Utilize appropriate enforcement actions to achieve compliance such as Administrative Citations and corrective actions. See JRMP Chapter 3 and JRMP Appendix C. IDDE related BMPs are also included in the Construction, Development, and Existing Development components of the JRMP. This strategy also relates to PO-15 and PO-16. See Supplemental Attachment 1 for IDDE related BMPs that will address sources causing or contributing to the Highest or Focused Priority Conditions. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-14 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.	X	X	X	Chollas Creek (Metals/Bacteria): General Industrial, Illegal discharges and connections Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Development, Illegal Discharges and Connections, Illegal Dumping Swimmable Waters (Bacteria): Pet waste, Over-irrigation/runoff, Illegal Discharges and Connections, Illegal Dumping	FY 2015	Continuous	EP FY Budget	$-$$	EP
Enforcement Response Plan											
PO-15	Develop and implement the Enforcement Response Plan [escalating enforcement responses; statutes, ordinances, permits, contracts, orders, and other requirements].	The Plan includes escalated enforcement process for violations from sources related to bacteria, metals, and trash. See JRMP Appendix G. Funding and resources was secured for FY 2015. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026.Permit required administrative update to be implemented jurisdiction-wide and implemented on a continuous basis.	X	X	X	Chollas Creek (Metals/Bacteria): General Industrial, Illegal discharges and connections Physical Aesthetics (Trash): Variable, Illegal discharges and connections Swimmable Waters (Bacteria): Over-irrigation/runoff, Illegal Discharges and Connections	FY 2015	Continuous	EP FY Budget	$-$$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-16	Update Port's Stormwater Ordinance	Update the Port's stormwater ordinance to provide Port legal authority to enforce the JRMP and the requirements of the Permit. See JRMP Section 2.2 and JRMP Appendix B. Funding and resources were secured for FY 2023. Permit required administrative update to be implemented jurisdiction-wide and completed prior to JRMP submittal.	X	X	X	Chollas Creek (Metals/Bacteria): General Industrial, Illegal discharges and connections Physical Aesthetics (Trash): Variable, Illegal discharges and connections Swimmable Waters (Bacteria): Over-irrigation/runoff, Illegal Discharges and Connections	FY 2015	One-time	EP FY Budget	$	EP, Legal

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Public Education and Participation											
PO-17	Implement Core JRMP Program for Education and Outreach program	Promote public support and participation of the Port's water quality protection efforts through outreach and education to various audiences. Topics include a discussion on WQIP priority conditions (trash, metals, and bacteria). The strategy includes core jurisdictional programs that meet baseline permit requirements which will be implemented throughout the permit term and strategies that enhance the program or focused efforts. The strategy will promote and encourage development of programs, management practices, and behaviors that reduce the discharge of pollutants in storm water and non-stormwater discharges, such as over-irrigation, prioritized by high-risk behaviors, pollutants of concern, and target audiences. Municipal Staff Training; Educational Outreach: Industrial & Commercial Owners & Operators; Residential Community & General Public; School Children; Underserved Audiences See JRMP Chapter 9. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and has been allocated for FY 2026. PO-17 is a Permit-required strategy to be implemented jurisdiction-wide and on a continuous basis.	X	X	X	Chollas Creek (Metals/Bacteria): General Industrial, Residential Community & General Public; School Children; Underserved Audiences Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Development, Construction, Municipal facilities, Parks, Residential Community & General Public; School Children; Underserved Audiences Swimmable Waters (Bacteria): Pet Waste, Sewage (Sanitary/septic waste management at parks and special events), Over-irrigation, Illegal discharges and connections, General Public; School Children; Underserved Audiences	FY 2015	Continuous	EP FY Budget	$-$$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Non-JRMP Strategies (Optional Strategies, B.3.b(1)(b))											
Non-structural											
PO-18	Add BMP to construction BMPs that requires covering material stockpiles of treated wood during wet weather	Where material stockpiles include treated wood, the concentrated discharge of metals that may be leached from the wood will be minimized by covering the stockpile. See JRMP Section 5.6. This strategy has been implemented, so no trigger is needed. Funding and resources were secured for FY 2015. PO-18 is optional, jurisdictional program enhancement to be implemented jurisdiction-wide and on a continuous basis.		X		Physical Aesthetics (Trash): General retail/commercial Areas, General Industrial Areas, Roads and Parking Lots, Illegal Dumping Swimmable Waters (Bacteria): Over-irrigation/runoff, Sewage (Sanitary/septic waste management), Construction, Roads and Parking Lots	FY 2015	One-time	EP FY Budget	$	EP, Engineering
PO-19	Require install shutoff irrigation sensors (e.g., Cal-Sense) for MM/CIP development projects. [CAP Water Conservation Measure (WC 1.3)][2]	This strategy will assist in eliminating non-stormwater discharge by requiring the irrigation sensors, where applicable, to development plans. This strategy will be triggered upon identification of new landscape area in Port sponsored major maintenance or capital improvement projects. Funding and resources required include cost for equipment, design, installation, and routine maintenance. Optional, jurisdictional program enhancement to be implemented jurisdiction-wide and as-needed.	X	X	X	Physical Aesthetics (Trash): Municipal facilities, Parks, Development, Construction Swimmable Waters (Bacteria): Over-irrigation, Municipal facilities, Parks, Construction	FY 2017	As-needed	Port Major Maintenance or Capital Improvement Budgets	$$	REO, Engineering, EP, GS

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-20	Adopt Construction and Demolition Recycling Ordinance or include language into general requirements for all projects [CAP Waste Reduction and Recycling Measure (SW2)][2]	Provide direction to construction projects regarding waste and recyclable materials management. This strategy will be triggered following an evaluation of potential conflicts with member cities. If member cities have existing ordinances, the Port may elect to follow the corresponding city's ordinance. Funding and resources have been secured for FY 2023. PO-20 is optional, jurisdictional program enhancement to be implemented jurisdiction-wide and one-time.		X	X	Physical Aesthetics (Trash): Development, Construction	FY 2017	One-time	EP / Eng FY Budget	$	EP, Engineering
PO-21	Perform annual inspection of commercial, industrial, and municipal facilities that are higher sources of trash, metals, and bacteria	The frequency of inspections will be expanded from the baseline frequency (at least once during the permit cycle) to annually for higher sources of trash, metals, and bacteria. Commercial, industrial and municipal facilities that may have higher sources of trash, metals, and/or bacteria were identified through standard operating procedures developed by Port staff. A subset of municipal facilities will also be inspected twice per year based on past inspection results and classification as a high priority facility. The strategy includes ensuring proper implementation of minimum BMPs that are specific to the facility, area types, and Pollutant Generating Areas (PGAs), and, as appropriate; enforcement of violations; and providing education as-needed. This strategy is planned for implementation, so no trigger is needed. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-21 is optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Municipal facilities, Parks Swimmable Waters (Bacteria): Eating and drinking establishments, Sewage (Sanitary/septic waste management at parks and special events), Over-irrigation/runoff, Parks	FY 2016	Annually	EP FY Budget	$$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-22	Continue pet waste bag dispensers in parks	Reduce pet waste in municipal areas by encouraging clean up by pet owners. Provide pet waste bags in municipal areas. Ensure proper installation, maintenance, and restocking of dispensers. Port staff periodically reevaluates the locations of dispensers and where new dispensers may be needed in the future. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-22 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide. This strategy has been planned for implementation, so no trigger is needed.	X			Swimmable Waters (Bacteria): Pet waste, Municipal/Parks	FY 2015	Annually	GS FY Budget	$	GS, EP
PO-23	Implement Preventative Maintenance (PM) Plan to prevent backups in Municipal public restrooms	Implement a janitorial and preventative maintenance services plan for public restrooms on Port Tidelands to prevent waste material generated from public restroom facilities from entering into storm water conveyance system. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and has been allocated for FY 2026. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-23 is an optional, jurisdictional Non-Permit Required JRMP Strategy to be implemented jurisdiction-wide. This strategy has been implemented, so no trigger is needed	X			Swimmable Waters (Bacteria): Sewage infrastructure and activities, Municipal/Parks	FY 2015	Continuous	GS FY Budget	$	GS, EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-24	Development of BMP guidance document for general services staff conducting minor maintenance operations	Development of a guidance document to assist General Services staff in implementing the necessary BMPs to mitigate the discharge of contaminated debris, trash, and potential chemicals during minor maintenance and construction activities. The document to provide guidance on selecting the appropriate BMPs, as well as proper BMP implementation, operation, and maintenance. This strategy has been implemented. Optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): Roads and Parking Lots, Municipal facilities, Parks Swimmable Waters (Bacteria): Sewage infrastructure and activities, Over-irrigation/runoff, Municipal facilities, Parks	FY 2016	One-time, Completed as planned	EP FY Budget	$	EP, GS
PO-25	Train general services staff on proper BMP implementation during minor maintenance operations	Train General Services staff on the implementation of a BMP guidance document to use as a guide for selecting, implementing, and monitoring BMPs. Funding and resources were secured for FY 2025. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-25 is optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): Roads and Parking Lots, Municipal facilities, Parks Swimmable Waters (Bacteria): Sewage infrastructure and activities, Over-irrigation/runoff, Municipal facilities, Parks	FY 2016	As-needed	EP FY Budget	$	EP
PO-26	Conduct Trash Receptacle Assessment in municipal areas	Identify the current waste management practices in municipal facilities and areas (i.e., parks) and determine whether the size, number, and location of the receptacles provided are adequate. Where improvements are required, identify potential options to address deficiencies. This strategy was implemented, so no trigger is needed. PO-26 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X		X	Physical Aesthetics (Trash): Municipal Facilities, Homeless, Parks Swimmable Waters (Bacteria): Pet waste, Homeless, Municipal Facilities, Parks	FY 2016	One-time, Completed as planned. Completed follow-up study in FY 2019	EP FY Budget	$	GS, EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-27	Develop and implement a process to improve data management for tracking waste and materials diverted from waste stream and landfills [CAP Waste Reduction and Recycling Measure (SW)][2]	Identify effective and efficient use of trash receptacles that are specific to the area types, pollutant generating activities (PGAs), and/or event, as appropriate. The goal of this strategy is to provide recommendations to be implemented to address the WQIP Focused Priority Conditions (Physical Aesthetics and Swimmable Waters (bacteria)) and the State-led Trash Amendments. This strategy was implemented, so no trigger is needed. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-27 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.			X	Physical Aesthetics (Trash): Municipal Facilities, Parks	FY 2017	One-time, Completed as planned	EP FY Budget	$	EP, GS
PO-28	Replace/upgrade current maintenance equipment, such as street sweeper or power washer, to new, more efficient and effective options	This strategy involves the acquisition of maintenance equipment that is more efficient and effective than the equipment currently in use by Port's General Services Department (GSD). Equipment acquisition will be based on the GSD's equipment replacement schedule and the BPC approval of funds. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-28 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Roads and Parking Lots, Municipal Facilities Swimmable Waters (Bacteria): Streets and Parking Lots	FY 2016	Continuous	GS FY Budget	$$-$$$	GS

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-29	Replace all Port owned/leased vehicle brake pads with low-copper and copper-free brake pads	As copper-free brake pads become commercially available, implement installation of copper-free brake pads on Port owned or leased vehicles to reduce pollution deposition. This strategy will be triggered based on availability of effective copper-free and low-copper brake pads and equipment replacement schedule. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-29 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.		X		Chollas Creek (Metals/Bacteria): Brake Pad Wear	FY 2018	As-needed	GS FY Budget	$$	GS, EP
PO-30	Evaluate MS4 inspection and cleaning locations and adjust as-needed for higher trash generating areas	Enhance the core MS4 inspection program through an annual jurisdiction-wide evaluation of the inspection and maintenance activities for catch basins, stormwater inlets, and other stormwater conveyance structures the Port owns and operates. The annual evaluation of the MS4 program data will enable the Port to identify whether modifications to inspection and/or cleaning activities are needed and to be implemented (i.e., change in frequency or location) to effectively address higher trash generating areas. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025 and have been allocated for FY 2026. PO-30 is an optional, jurisdictional program enhancement to be implemented in a phased approach, targeted areas then jurisdiction-wide. This strategy is planned for implementation, so no trigger is needed.	X	X	X	Physical Aesthetics (Trash): General retail/commercial areas, General industrial areas, Roads and Parking Lots, Municipal Facilities, Parks Swimmable Waters (Bacteria): Sewage infrastructure and activities, Over-irrigation/runoff, Streets and Parking lots	FY 2016	Annually	EP FY Budget	$	EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-31	Update Power-washing Standard Operating Procedure Manual	This strategy will provide updates to the Port's General Services Department on new requirements and restrictions on power-washing operations. This strategy is planned for implementation, so no trigger is needed. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-31 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X		Municipal	FY 2017	One-time, Completed as planned	EP FY Budget	$	GS, EP
PO-32	Create Standard Operating Procedure for proper washout procedures in public restrooms	This strategy will create and update as-needed, a standard operating procedure or a standard set of requirements in the contract's Scope of Services for General Services staff and contractors to follow when maintaining public restrooms. This strategy is planned for implementation, so no trigger is needed. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-32 is an optional, additional Non-Permit Required Jurisdictional Strategy to be implemented jurisdiction-wide.	X			Swimmable Waters (Bacteria): Sewage infrastructure and activities, Municipal/Parks	FY 2021	One-time	GS FY Budget	$	GS, EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-33	Improve consistency and content of websites to highlight permit requirements and facilitate public reporting	Port staff regularly evaluates the website content and provide updates to ensure that the information on the website remains current and easy to find. In addition, staff collaborates with other Copermittees to improve the consistency in messaging and content on agency websites on a watershed and regional level as part of this ongoing activity. Funding and resources were secured for FY 2025. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-33 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X	X	Chollas Creek (Metals/Bacteria): General Industrial, Residential Community & General Public; School Children; Underserved Audiences Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas, Development, Construction, Municipal facilities, Parks, Residential Community & General Public; School Children; Underserved Audiences Swimmable Waters (Bacteria): Pet Waste, Over-irrigation, Illegal discharges and connections, General Public; School Children; Underserved Audiences	FY 2016	Continuous	MarCom FY Budget	$	MarCom, EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-34	Site/Area prioritization study to identify high volume trash areas	Conduct a study to assist the Port in identifying areas under its jurisdictional authority that are high volume trash areas to help focus resources and potentially install structural controls, where feasible. Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2016 and was approved for FY 2017. Funding and resources were secured for FY 2017. PO-34 is an optional, jurisdictional program enhancement to be implemented in a phased, targeted approach then jurisdiction-wide. This strategy is planned for implementation, so no trigger was needed.			X	Physical Aesthetics (Trash): Variable	FY 2016	One-time, Completed as planned	EP FY Budget	$-$$	EP
PO-35	Sponsor, conduct, and host cleanup activities (Operation Clean Sweep, Coastal Cleanup Day, Creek to Bay, etc.). Sponsor regional/watershed collection events for large items or items that may otherwise be illegally dumped.	Sponsor various cleanup and collection events and/or participate by soliciting volunteers, working as site captains, and hosting cleanup and collection sites. Collection events collect large, unwanted household items (e.g., refrigerators, mattresses, etc.), vegetation, and other debris with the intent of preventing illegal dumping of these items in the San Diego Bay WMA. This strategy may be implemented if the following triggers are met: 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, and 3) partners have been identified and formal MOUs have been developed, as-needed. Funding and resources were secured for FY 2025. Funding for future fiscal years is contingent on annual budget approval by Port BPC. WMA (Multi-jurisdictional) PO-35 is an Optional Program Enhancement to be implemented jurisdiction-wide.	X	X	X	Chollas Creek (Metals/Bacteria): Variable; Homeless encampments; Eating and drinking establishments; Illegal dumping Physical Aesthetics (Trash): Variable, General retail/commercial areas, Homeless, Parks, Waste disposal, Illegal Dumping Swimmable Waters (Bacteria): Eating and drinking establishments, Homeless, Waste disposal, Parks	FY 2016	Continuous	EP FY Budget / Port Environmental Fund/Grant	$-$$	EP, GCR, GS, San Diego Bay RPs, San Diego Port Tenants Association, SD Coastkeeper, ILACSD

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-36	Develop and conduct public perception survey on Physical Aesthetics and Swimmable Waters Conditions	Conduct a public perception survey to gain an understanding of the public opinion regarding the current status of the physical aesthetics and swimmable waters conditions at the Coronado Bayfront beaches and the lower Sweetwater and Otay HUs. This strategy will be triggered upon final approval on a MOU by all RPs involved, the consultant selection and contract(s), and scope of work. Funds/resources needed for this strategy include staff time and/or consultant expenses to develop and implement the survey. PO-36 is a WMA (Multi-jurisdictional) optional Strategy to be implemented in targeted drainage areas.	X		X	Physical Aesthetics (Trash): General retail/commercial areas, General industrial areas, Municipal Facilities, Parks, Illegal Dumping Swimmable Waters (Bacteria): Pet Waste, Parks, Sewage infrastructure and activities, Over-irrigation/runoff	FY 2019	Once per Permit Cycle	MarCom and EP FY Budget (could be cost shared with other RPs)	$$	MarCom, EP, San Diego Bay RPs (Chula Vista, Coronado, Imperial Beach)

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-37	Support organizations to address homelessness and to provide resources and educational materials to address trash and bacteria	Research and implement outreach and intervention services through near, medium, and long-term strategies to assist the homeless population along the Tidelands, while coordinating efforts at a regional level. In addition to the humanitarian aspects of providing these services, MS4 and receiving water quality may be improved due to reduced trash or waste as a result of these efforts. This strategy may be implemented if the following triggers are met: 1) funding to address MS4 discharges is identified and secured, 2) staff resources are identified and secured, 3) partners have been identified and formal MOUs have been developed, and 4) consensus and community support has been achieved. Resources necessary to implement this strategy include Port staff to coordinate with the regional effort and consultant or third-party assistance to implement projects. Projected funding needs may be met through grant funding, support from community groups or other institutions, or the Port's annual budget. Funding is secured on an annual basis and is contingent on annual budget approval by Port BPC. WMA (Regional) Optional, Additional Non-Permit Required Strategy to be implemented jurisdiction-wide.	X		X	Chollas Creek (Metals/Bacteria): Homeless encampments Physical Aesthetics (Trash): Homeless Encampments, Waste disposal, Illegal Dumping Swimmable Waters (Bacteria): Homeless, Waste disposal	FY 2016	Annually	HPD/GCR FY Budget	$$	HPD, GCR, EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-38	Participation in the San Diego Regional Reference Stream Study [The study will develop numeric targets for minimally disturbed or "reference" condition]	WMA (Regional) Optional, project that focuses on collecting data necessary to derive reasonable and accurate numeric targets for bacteria, nutrients, and heavy metals by referencing natural, local conditions. This study will provide a scientific basis for evaluating bacteria compliance levels in the Bacteria TMDL. The results of this study are used to support the forthcoming reopener of the recently adopted Bacteria TMDL and to support numeric targets in future TMDLs for bacteria, nutrients, and metals. This strategy has been planned for implementation, so no trigger is needed. Funding and resources were secured for FY2016.	X			Variable	FY 2015/2016	One-time, Completed as planned	EP FY Budget [Regional Cost Share]	$	EP; Regional MS4 Copermittees (20 other jurisdictions)
PO-39	Participation in the Southern California Coastal Water Research Project's (SCCWRP) San Diego Bay Trash Study. SCCWRP will initially assess targeted geographic areas and may include (1) assessment of current conditions to provide a baseline to demonstrate progress in the future, (2) identification of high-priority areas for targeted strategy implementation, and (3) identification of commonalities among jurisdictions for potential collaborative outreach opportunities.	The Trash Study is a comprehensive bay-wide study to help managers understand the current extent and magnitude of plastic-based debris accumulation and takes into account seasonal changes to better understand the plastic debris conditions throughout San Diego Bay and its upland contributing areas. SCCWRP will initially assess targeted geographic areas and may include (1) assessment of current conditions to provide a baseline to demonstrate progress in the future, (2) identification of high-priority areas for targeted strategy implementation, and (3) identification of commonalities among jurisdictions for potential collaborative outreach opportunities. This strategy was implemented. Resources were secured for FY 2017. PO-39 is a WMA (Multi-jurisdictional) Optional program enhancement to be implemented jurisdiction-wide.			X	Variable	FY 2015	One-time, Completed as planned	EP FY Budget [Cost Shared among participants]	$	EP; San Diego Bay RPs (City of Chula Vista and Imperial Beach); SCCWRP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-40	Delisting feasibility study for Tidelands Park, Coronado	WMA (Multi-jurisdictional) Optional, Non-Permit Required Strategy to be implemented in targeted drainage areas (Tidelands Park, Coronado). The study will assess available historical AB411 monitoring data from the County of San Diego's Department of Environmental Health to determine the number of exceedances of *Enterococcus* standards that have occurred at EH-070 and to identify whether the results warrant consideration of removal of the water body from the SWRCB 303(d) List (i.e., de-listing). This strategy has been planned for implementation, so no trigger is needed. Resources necessary to implement this strategy include Port staff or consulting team. Funding and resources were secured for FY 2025.	X			Swimmable Waters (Bacteria): Pet waste, Sewage (Sanitary/septic waste management at parks and special events), Eating and drinking establishments (special events), Parks, Over-irrigation/runoff, Homeless, Roads and Parking Lots	FY 2016	One-time	EP FY Budget	$-$$	EP, San Diego Bay RP (City of Coronado)
PO-52	Enhanced public awareness and enforcement of prohibitions on feeding wildlife.	This strategy will address potential sources of bacteria from wildlife (i.e., birds) fecal matter on Port tidelands that may enter into storm water conveyance system or directly into the San Diego Bay. The strategy involves public outreach, installation of signs within park facilities urging the public to refrain from feeding birds in accordance with federal and state law prohibitions, and enforcement, as-needed. This strategy is planned for implementation, so no trigger is needed. Funding and resources were secured for FY 2025. This optional, jurisdictional program enhancement will be implemented in a targeted approach.	X			Swimmable Waters (Bacteria): Municipal/Parks, Wildlife	FY 2018	On-going, Completed as planned	HP FY Budget	$	HP, EP, MarCom

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-57	San Diego Rivers Watershed Consortium	Senate Bill 1367 authorizes the San Diego River Conservancy to initiate the San Diego Rivers Watershed Consortium to assist in protecting, enhancing, and restoring the natural, historical, cultural, educational, and recreational resources located in the Otay River, Sweetwater River, and the California portion of the Tijuana River watersheds. The program creates an Advisory Panel for each watershed, and identifies stakeholders appointed from specific jurisdictions and agencies to sit on these Advisory Panels. The Port was identified as a stakeholder for all three Advisory Panels. The Advisory Panels are tasked with developing strategic plans using existing adopted plans within each watershed and identifying funding opportunities for projects that are consistent with those plans. This strategy is planned for implementation, so no trigger is needed. Port funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-57 is an optional, non-permit required strategy involving multiple agencies and third parties.	X	X	X	Variable	FY 2019	On-going	EP, NR FY Budgets	$	EP, NR

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-58	Bacteria Source Investigations	Jurisdictional Optional, Non-Permit Required Strategy to be implemented in targeted drainage areas (i.e., Tidelands Park, Coronado) to determine potential sources of bacteria FIB and/or other WQIP pollutants. Funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2025. This strategy has been planned for implementation, so no trigger is needed. Resources necessary to implement this strategy include Port staff or consulting team.	X			Swimmable Waters (Bacteria):	FY 2020	On-going	EP Budget	$-$$	EP
Structural											
PO-41	Install fence along southern parameter of Pond 20 to capture trash and debris	The Port installed a custom fence to improve the South San Diego site known as Pond 20. This strategy has been implemented, so no trigger is needed. Funding and resources were secured for FY 2015. Optional, jurisdictional program, to be implemented in a Specific drainage area (Otay Sub-watershed).	X		X	Physical Aesthetics (Trash): Waste Disposal, Illegal Dumping, Homeless, Roads and Parking Lots	FY 2015	One-time, Completed as planned	ENG FY Budget	$$$	ENG, GS, EP

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-42	Develop an alternative compliance program framework that provides options for PDPs	The WMAA provides alternative compliance methods in lieu of meeting structural BMP design standards and/or hydromodification management criteria on the project site. The San Diego County Copermittees have collectively funded and provided guidance for development of a regional WMAA. This strategy is planned for implementation, so no trigger is needed. Funding and resources were secured for FY 2016. PO-42 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide.	X	X	X	Variable	FY 2016	One time, Completed as planned	EP FY Budget	$	EP, Engineering, REO, Legal
PO-43	Implement an alternative compliance program providing options for PDPs	Administer an alternative compliance program for on-site structural BMP implementation (includes identifying WMAA candidate projects). Program funding is contingent upon approval by the BPC each fiscal year. Funding and resources were approved for FY 2019, FY 2020, FY 2021, FY 2022, and was approved for FY 2023. However, the Port has paused the development of the alternative compliance program. PO-43 is an optional, jurisdictional program enhancement to be implemented jurisdiction-wide. This strategy is planned for implementation, so no trigger is needed.	X	X	X	Variable	FY 2023	As-needed	EP FY Budget	$$	EP, Engineering, REO, Legal

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-44	Develop and implement a retrofit program to encourage installation of water conservation measures in existing businesses (e.g. xeriscaping, irrigation sensors, etc.) [CAP Water Conservation Measure (WC 1.3)][2]	Develop and implement a retrofit program to promote water conservation and source abatement. Once the program is developed, Port staff will coordinate with industrial and commercial tenants to voluntarily installing water conservation measures. This strategy will be triggered either by identification of grant funding or may be included as a corrective action for facilities that have repeat violations related to irrigation runoff BMPs. Projected funding needs may be met through grant funding, support from community groups or other institutions, or PE's annual budget. All Port funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-44 is an optional, jurisdictional program enhancement to be implemented in phased, targeted areas then jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): General Retail/commercial Areas, General industrial areas Swimmable Waters (Bacteria): General Retail/commercial Areas; Over-irrigation	FY 2017	As-needed	Env Fund / Grant	$	EP, GS, REO
PO-45	Installation of structural treatment control BMPs in storm drains in high priority areas to address trash, metals, and bacteria	The strategy will address industrial and commercial facilities that have repeat violations for discharges, specifically metals, and bacteria. The facility may be required to install structural treatment control BMPs to reduce or eliminate discharges of pollutants to the MS4 causing or contributing to an impairment of water quality standards. This strategy will be triggered based on facility inspections history, repeat violations and site location and conditions. The industrial or commercial facility tenant will be responsible for providing the necessary funding to implement required systems. PO-45 is an optional, jurisdictional program to be implemented in phased, targeted areas then jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): General retail/commercial areas, General industrial areas, Homeless, Land Development, Municipal Facilities, Parks Swimmable Waters (Bacteria): Eating and drinking establishments, Over-irrigation	FY 2016	As-needed	Tenant	$	EP, REO

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-46	Retrofit trash enclosures, where applicable, in municipal areas	This strategy will be triggered according to results of PO-26 and PO-34 and identification of the appropriate action to be taken as result of retrofit program. Projected funding needs may be met through grant funding, or PE or GS annual budget. Resource needs to implement the project include equipment (i.e., trash receptacles) and staff or contract resources to install and maintain. All Port funding for future fiscal years is contingent on annual budget approval by the BPC. PO-46 is an optional, jurisdictional program enhancement to be implemented in phased, targeted areas then jurisdiction-wide.	X		X	Physical Aesthetics (Trash): Homeless, Municipal Facilities, Parks Swimmable Waters (Bacteria): Pet waste, Parks, Homeless	FY 2018	As-needed	GS or EP FY Budget	$ -$$	EP, GS
PO-47	Installation of inlet inserts in storm drains in high priority areas	Trigger is based on results of PO-34 and availability of funding. Projected funding needs may be met through grant funding, or PE or GS annual budget. Resource needs to implement the project include equipment (i.e., inlet inserts) and staff or contract resources to install and maintain. All Port funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-47 is an optional, additional non-permit required to be implemented in phased, targeted areas then jurisdiction-wide.	X	X	X	Physical Aesthetics (Trash): General retail/commercial areas, General industrial areas, Homeless, Land Development, Municipal Facilities, Parks Swimmable Waters (Bacteria): Over-irrigation/runoff, Municipal Facilities, Parks	FY 2018	As-needed	ENG or EP FY Budget	$-$$	EP, GS

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-48	Installation of trash skimmers in marina basins	Optional, non-permit required to be implemented in a phased approach, implemented first in marinas in areas of the Port specified under the Physical Aesthetics Focused Priority Condition, then will assess application jurisdiction-wide. The trash skimmers will help to collect trash and debris found within marina basins. This strategy will be triggered if marinas are identified as high trash generating area in assessment Projected funding needs may be met through grant funding, or PE or GS annual budget. All Port funding for future fiscal years is contingent on annual budget approval by Port BPC.			X	Physical Aesthetics (Trash): General retail/commercial areas, Waste disposal	FY 2018	As-needed	GS or EP FY budget/ Tenants/ E. Fund	$$	EP, GS
PO-53 PO-54 PO-55	Develop a Marine Terminal Structural BMP Action Plan for Tenth Avenue Marine Terminal (TAMT); Cruise ship Terminal at B Street Pier; National City Marine Terminal	This strategy will help prevent the discharge of metals from the Tenth Avenue Marine Terminal. A TAMT Structural BMP Action plan will be developed to prevent the potential discharge of metals in stormwater discharges. The strategy involves the design of structural BMPs to treat discharges from the terminal that considers the use and activities on the facility, the challenges of the proximity to the bay and shallow depth to groundwater, and past water quality sampling records. These strategies were consolidated into PO-56.		X	X	Vehicle and truck traffic, vehicle maintenance, maritime and ship operations	FY 2018	On-going; Starting in FY 2020, activities occurring at the marine terminals are included in strategy PO-56.	EP FY Budget	$$	EP, Maritime

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-56	Marine Terminals Stormwater Program	This strategy focuses on the Port Stormwater Program's approach at the three marine terminals (Tenth Avenue Marine Terminal, National City Marine Terminal, and B Street Pier). To improve pollution prevention efforts, minimize environmental impacts and better align with the activities at each facility, the stormwater programmatic approach is a mix of administrative improvements, education and outreach, monitoring, and assessment approaches and structural pollutant controls. This strategy is planned for implementation, so no trigger is needed. Funding and resources were secured for FY 2025 and allocated for FY 2026. This optional, jurisdictional program enhancement will be implemented in a targeted approach at the marine terminals.	X	X	X	Vehicle and truck traffic, vehicle maintenance, maritime and ship operations	FY 2019	On-going	EP FY Budget	$$	EP, Maritime, GS

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
Restoration											
PO-49	Otay District Habitat Improvement (Former South Bay Power Plant)	Restoration Project: Decommission the South Bay Power Plant (completed) in a manner that allows habitat improvements to be performed at the site. Buffer area (25 acres) for habitat enhancements and/or mitigation purposes and will create additional upland transition, intertidal and subtidal habitat. The project leads are the Port and the City of Chula Vista. This strategy will be triggered upon completion of the following: 1) Multi-jurisdictional approval of development plans; 2) CEQA review process has been completed; and 3) Approval by California Coastal Commission. Projected funding needs may be met through grant funding, support from community groups or other institutions, or as a potential alternative compliance program candidate project. All Port funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-49 is an optional, non-permit required strategy involving multiple agencies and third parties.	X	X	X	Variable	FY 2028	One time	External	$$$$	Tenants; Developers; City of Chula Vista; Coastal Commission; RWQCB; Army Corp; USFWS; CA Dept. Fish and Wildlife; NR

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-50	Enhance wetland and connections to F and G St marsh and J Street marsh.	Restoration Project: Habitat enhancement of marsh, and associated mudflats and low-lying salt marsh and upland transition areas. Enhance through cutting back the existing incised channel slope, reducing the slope and then creating additional salt marsh habitat on the created floodplain. Enhancement potential: An additional channel, improvements to existing culvert to increase flushing, refuge islands, secondary tidal channels, and bay-ward expansion of the marsh. A portion of the habitat enhancement will be completed through the California Natural Resources Agency Urban Green Grant-funded Chula Vista Bike Path and Promenade, including layback of the channel slopes adjacent to the F & G Street inlet channel and native species restoration. The project leads are the Port and the City of Chula Vista. This strategy will be triggered upon completion of the following: 1) Multi-jurisdictional approval of development plans; 2) CEQA review process has been completed; and 3) Approval by California Coastal Commission. Projected funding needs may be met through grant funding, support from community groups or other institutions, or as potential alternative compliance program candidate projects. All Port funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-50 is an optional, non-permit required strategy involving multiple agencies and third parties.	X	X	X	Variable	FY 2025	One-time	Grant funding	$$$$	REO; NR; EP; San Diego Natural Wildlife Refuge; Tenants; Developers; City of Chula Vista; Coastal Commission; RWQCB; Army Corp; USFWS; CA Dept. Fish and Wildlife

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-51	Pond 20 – Site Development Mitigation Banking	Restoration Project: The strategy will include the establishment of a mitigation bank while assigning certain parcels a commercial land use or conservation/wetlands designation. This includes a Port Master Plan Amendment to bring the site into the Port's Coastal Permitting jurisdiction. The strategy involves two different objectives for site development-mitigation banking that focus on habitat conservation and developing the site for commercial purposes. The Port is the project lead. This strategy will be triggered upon completion of the following: 1) the necessary entitlement process is completed; 2) CEQA review process has been completed; and 3) Approval by California Coastal Commission. Any proposed method for moving forward with a mitigation bank would require future approvals from the BPC. Funding for future fiscal years is contingent on annual budget approval by Port BPC. PO-51 is an optional WMA -Multi-jurisdictional, non-permit required strategy.	X	X	X	Variable	FY 2026	One-time	REO FY Budget	$$$$	REO; NR; EP; City of San Diego; City of Imperial Beach

Appendix A – Table 1 Updated Jurisdictional WQIP Strategies.

SDB ID	Strategy	Implementation Approach (Frequency of Inspections, B.3.b.(1)(a)(iv)) (Inventory BMPs, B.3.b.(1)(a)(ii)) (Funds/Resources, B.3.b.(1)(b)(iv), B.3.b.(3)(a)(iii)) (Triggers, B.3.b.(1)(b)(v))	Priority Conditions Addressed by Strategy			Suspected Areas or Sources Causing or May Be Contributing to Highest and/or Focused Priority Conditions (B.3.b(1)(a)(i))	Implementation Year	Frequency of Implementation	Funding Strategy	Cost (Estimated Annual Cost)[1]	Responsible Port Department and Other Collaborating Departments or Agencies
			Bacteria	Metals	Trash						
PO-59	Port of San Diego's Living Shorelines – Sweetwater Channel Project	Restoration Project: This strategy is a pilot project that replaces approximately 1,000 linear feet of existing riprap along the Sweetwater Flood Channel with biologically enhanced habitat-friendly shoreline units. Benefits of the project include: an increase of local biodiversity, productivity, and ecosystem services, improving water quality by filtering pollutants from the receiving water and stormwater runoff, and maintaining shoreline erosion protection. The project also serves the surrounding DACs with habitat enhancement, coastal resiliency, and creation of recreational and environmental education opportunities. The project leads are the Port and the City of San Diego. This strategy will be triggered upon completion of the following: 1) the SDRWQCB R9-2023-0017 final settlement and release of funds; 2) finalizing MOU between the Port and City of San Diego; 3) Obtaining USACE pre-certified Nationwide Permit and RWQCB Clean Water Act Section 401 Certification, and 4) CEQA review process has been completed; and 5) Approval by California Coastal Commission. Program funding is contingent upon approval by the Port's Board of Commissioners (BPC) each fiscal year. Funding and resources were approved for FY 2025. PO-59 is an optional WMA -Multi-jurisdictional, non-permit required strategy.	X	X	X	Variable	FY 2025	One Time	SDRWQCB R9-2023-0017 required City of San Diego to fund this project as a Supplemental Environmental Project (SEP)	$$$$	EC, EP, REO; RWQCB; City of San Diego Public Utilities Department

[1] Estimated Cost Range: $ = $1,000-25,000; $$ = $26,000 – 200,000; $$$ = $201,000 – 500,000; $$$$ = >501,000
[2] CAP - Port of San Diego's Climate Action Plan (2013) (https://www.portofsandiego.org/environment/energy-sustainability/climate-action-plan)
PE – Planning and Environmental; EP – Environmental Protection; REO – Real Estate Department; GS – General Services Department; Eng – Engineering Department; MarCom – Marketing and Communications Department; GCR – Government and Community Relations Department; HPD – Harbor Police Department; USFWS – United States Fish and Wildlife Service; NR – Natural Resources.

Appendix B
Article 10

ARTICLE 10

STORMWATER MANAGEMENT AND DISCHARGE CONTROL

SECTION NO. 10.01 – TITLE, PURPOSE AND INTENT

(a) “Title”. This Article shall be known as "San Diego Unified Port District Stormwater Management and Discharge Control" and may be so cited.

(b) “Purpose”. The purpose of this Article is to establish a defined set of requirements, protocols and procedures by which the District and users of District tideland resources may operate in compliance with State stormwater regulations. Further, it is the intent of this Article to protect the health, safety and general welfare of the public, tenants, and visitors within District jurisdiction; to protect water resources and to improve water quality; to cause the use of management practices by the District and its tenants and/or subtenants, and users of District tidelands to reduce the adverse effects of polluted runoff discharges on waters of the State to ensure compliance with the Municipal Separate Storm Sewer System (MS4) Permit Order No. R9-2013-0001 (NPDES No. CAS0109266) including any amendments, and any applicable State and Federal law. This Article seeks to promote these goals by:

1. Effectively prohibiting no-stormwater discharges to the MS4;

2. Prohibiting and eliminating all illicit discharges and illicit connections to the MS4, and reducing pollutants in discharges into

and from the MS4 to receiving waters, consistent with the prohibitions and limitations of the MS4 Permit;

3. Establishing minimum requirements for stormwater management, including source control requirements to prevent and reduce pollution;

4. Establishing site design requirements for development projects, to reduce stormwater pollution to the maximum extent practicable (MEP) and enhance existing water-dependent habitats;

5. Establishing standards for the use of off-site facilities and areas for stormwater management to supplement on-site practices at Priority Development Projects to meet post-construction BMP performance requirements;

6. Establishing notice procedures and standards for adjusting stormwater and non-stormwater management requirements where necessary;

7. Conforming with the Clean Water Act, the Porter-Cologne Water Quality Control Act, all applicable provisions of statewide Water Quality Control Plans and Policies adopted by the State Water Resources Control Board, the Water Quality Control Plan for the San Diego Basin adopted by the Regional Water Quality Control Board, and all other applicable State and Federal regulations; and

8. Establishing and identifying enforcement procedures.

(c) "Intent". The San Diego Unified Port District intends that this Article shall be the primary enforcement document for the management and discharge control of stormwater and urban runoff within District jurisdiction

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

(Amended October 9, 2018 – Ordinance No. 2931)

SECTION NO. 10.02 – DEFINITIONS

(a) For purposes of this Article:

1. "Beneficial Uses" – means the uses of water necessary for the survival or well-being of humans, plants, and wildlife. These uses of water serve to promote tangible and intangible economic, social, and environmental goals. "Beneficial Uses" of the waters of the State that may be protected include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. Existing beneficial uses are uses that were attained in the surface or ground water on or after November 28, 1975; and potential beneficial uses are uses that would probably develop in future years through the implementation of various control measures. "Beneficial Uses" are equivalent to "Designated Uses" under federal law.

2. "Best Management Practices" – means schedules of activities, pollution treatment practices or devices, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices or devices to prevent or reduce the

discharge of pollutants directly or indirectly to stormwater, receiving waters, or the stormwater conveyance system. Plans that describe the BMPs to be implemented and other steps to be taken by a Person using property held in trust by the District, as required by the Executive Director to meet all applicable stormwater requirements, including, but not limited to, the prohibitions and limitations of the MS4 Permit, may also be considered a BMP. Such plans may include, but are not limited to, Stormwater Pollution Prevention Plans, Construction BMP Plans, BMP Plans and Rain Event Plans. BMPs also include, but are not limited to, treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage. BMPs may include any type of pollution prevention and pollution control measure that can help to achieve compliance with this Article.

3. “BMPs” – means Best Management Practices.

4. “BMP Design Manual for Permanent Site Design, Stormwater Treatment and Hydro modification Management” (BMP Design Manual) – means a programmatic level guidance document developed to eliminate, reduce, or mitigate the impacts of runoff from development projects, including Priority Development

Projects. The BMP Design Manual provides procedures for planning, selecting, and designing permanent stormwater BMPs based on the performance standards presented in the MS4 Permit Order No. R9-2013-0001. The BMP Design Manual replaces the Standard Urban Stormwater Mitigation Plan which was developed pursuant to the 2008 Municipal Stormwater Permit for San Diego County.

5. “Commercial Activity” – means any public or private activity involved in the production, storage, transportation,(including transport of person) distribution, exchange or sale of goods and/or commodities, or providing professional and/or non-professional services. These commercial activities do not include industrial activities, nor do they include any Federal, State, Municipal, or other government agency activities.

6. “Construction Activity” – means any activity involving the clearing, grading, and disturbances to the ground such as stockpiling, or excavation that results in land disturbance.

7. “Construction BMP Plan” – means a document which describes the BMPs to be implemented and other steps to be taken during the course of construction by the Discharger for projects that do not require coverage under the General Construction Stormwater Permit.

8. “CWA” – means the Federal Water Pollution Control Act, commonly known as the Clean Water Act.

9. “Development Projects” – means new development or redevelopment with land disturbing activities, structural development, including construction or installation of a building or structure, the creation of impervious surfaces, public agency projects.

10. “Discharge” – means any release, spill, leak, pump, flow, escape, dumping, or disposal of any liquid, semi-solid or solid substance.

11. “Discharger” – means any person or entity engaged in activities or operations which have resulted or have the potential to result in a discharge to the MS4, or receiving waters; or any person or entity leasing or owning property on which such activities, operations or facilities are located.

12. “Dry Season” – means the time period from May 1 through September 30.

13. “Environmentally Sensitive Areas” – means areas that include, but are not limited to, all CWA 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance; water bodies designated with the RARE beneficial use by the State Water Resources Control Board; areas designated as preserves or their

equivalent under the Multiple Species Conservation Program within the Cities and County of San Diego.

14. "Erosion" – means when land is diminished or worn away due to wind, water, or glacial ice. Often the eroded debris (silt or sediment) becomes a pollutant via stormwater runoff. Erosion occurs naturally but can be intensified by land clearing activities such as farming, development, road building, and timber harvesting.

15. "ESA" – means Environmentally Sensitive Areas.

16. "Facility" – means a building, structure, installation or contiguous land , including but not limited to, terminals or parts of terminals, from which or to which a discharge could occur.

17. "General Construction Stormwater Permit" – means NPDES Permit No. CAS000002, Waste Discharge Requirements for Discharges of Storm Water Associated with Construction Activities, and any modifications or amendments thereto, or as re-issued.

18. "General Industrial Stormwater Permit" – means NPDES Permit No. CASOOOOOl, Waste Discharge Requirements for Discharges of Storm Water Associated with Industrial Activities Excluding Construction Activities, and any modifications or amendments thereto, or as re-issued.

19. “Grading” – means the cutting and/or filling of the land surface to a desired slope or elevation.
20. “Illicit Connection” – Means any man-made conveyance or drainage system through which a non-storm water discharge to the MS4 occurs or may occur or any connection to the MS4 which has not been reviewed and authorized by the District that conveys an illicit discharge.
21. “Illicit Discharge” – means any discharge or release into stormwater, the MS4, receiving waters, or land that is not composed entirely of stormwater except conditionally allowed discharges described in the MS4 Permit Order No. R9-2013-0001.
22. “Impervious Surface” – means any man-made, constructed or modified surface(s) that prevents or significantly reduces infiltration of water or precipitation into the underlying soil, resulting in runoff from the surface in greater volumes and/or at an increased rate, when compared to natural conditions prior to development. The term includes, but is not limited to, parking lots, driveways, streets, roadways, storage areas, rooftops, pavement, sidewalks, compacted gravel, compacted earth and oiled earth.
23. “Industrial Activity” – means any public or private activity which is associated with any of the eleven (11) categories of activities

defined in 40 CFR 122.26(b)(14) and required to obtain an NPDES permit, or other activities required to obtain an NPDES permit or Waste Discharge Permit for stormwater runoff control, and any facility used for conducting industrial activities.

24. "Industrial Discharger" – means a Discharger who conducts and Industrial Activities.

25. "Infiltration" – means the process of percolating stormwater or non-stormwater into the subsoil.

26. "Jurisdictional Runoff Management Plan" – means a written description of the specific jurisdictional runoff management measures and programs that each Copermittee will implement to comply with MS4 Permit Order No. R9-2013-0001 and ensures that pollutant discharges in urban runoff are reduced to the MEP and do not cause or contribute to a violation of water quality objectives.

27. "JRMP" – means Jurisdictional Runoff Management Plan.

28. "LID" – means Low Impact Development.

29. "Low Impact Development" – means a storm management and land development strategy that emphasizes conservation and the use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions.

30. Low Impact Development Best Management Practices (LID BMPs) – include schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States through stormwater management and land development strategies that emphasize conservation and the use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions. LID BMPs include retention practices that do not allow runoff, such as infiltration, rain water harvesting and reuse, and evapotranspiration. LID BMPs also include flow-through practices such as bio filtration that may have some discharge of stormwater following pollutant reduction.

31. “Maintenance of a BMP” – means regularly scheduled activities taken to uphold the as-designed performance of a BMP, and includes, but is not limited to, repairing and cleaning of the BMP as necessary, and replacement of the BMP by an equally effective or more effective BMP at the end of its useful life.

32. “Maximum Extent Practicable” – means the technology-based standard established by Congress in CWA Section 402(p)(3)(B)(iii)

that operators of MS4s must meet. MEP is further defined in Attachment C of the MS4 Permit Order No. R9-2013-0001.

33. “MEP” – means Maximum Extent Practicable.

34. “MS4” – means Municipal Separate Storm Sewer System.

35. “Municipal Separate Storm Sewer System” – means a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, natural drainage features or channels, modified natural channels, man-made channels, or storm drains, by which urban runoff and stormwater may be conveyed to the receiving waters. The terms “MS4” and “Stormwater Conveyance System may be used interchangeably.

36. “2008 Municipal Stormwater Permit” – means the San Diego County Municipal Storm Water Permit Order No. R9-2007-0001, Waste Discharge Requirements for Discharges of Urban Runoff From the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority that was in effect from 2007 through 2013.

37. “MS4 Permit” – means Regional Municipal Stormwater Permit Order No. R9-2013-0001 Waste Discharge Requirements for Discharges from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds within the San Diego Region as modified, amended or re-issued.

38. “Non-Stormwater” – means all discharges to and from a MS4 or to the receiving water that do not originate from precipitation events (i.e., all discharges from a MS4 other than stormwater). Non-stormwater includes illicit discharges, non-prohibited discharges, and National Pollutant Discharge Elimination System permitted discharges.

39. “National Pollutant Discharge Elimination System” – means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of the CWA.

40. “NPDES” – means National Pollutant Discharge Elimination System.

41. “Person” – means in this Article, an individual, association, partnership, corporation, limited liability company, trustee,

municipality, State or Federal agency, or any other legal entity, or agent or employee thereof.

42. "Point Source" – means any discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

43. "Pollutant" – means any substance introduced to the MS4 that may cause or contribute to the degradation of water quality such that public health, the environment, or beneficial uses of receiving waters may be affected.

44. "Pollution" – means the alteration of the quality of the receiving water or MS4 by waste, to a degree that unreasonably affects either the waters for beneficial use or facilities that serve these beneficial uses.

45. "Pollution Prevention BMP" – means practices and processes that reduce or eliminate the generation of pollutants, in contrast to source control BMPs, treatment control BMPs, or disposal. Stormwater pollution prevention practices that are generally

recognized in the applicable industry or business as being effective and economically sound.

46. “Post-Construction BMPs” – means a subset of BMPs including structural and non-structural controls which detail, retain, filter, or educate to prevent the release of pollutants to surface waters during the functional life of developments.

47. “Priority Development Projects” – means new development and redevelopment projects defined in Provision E.3.b of the MS4 Permit:

48. “Receiving Waters” – means Waters of the United States.

49. “Redevelopment” – means the creation, addition, and/or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, the addition to or replacement of a structure, and creation or addition of impervious surfaces. Replacement of impervious surfaces includes any activity that is not part of the routine maintenance activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include trenching and resurfacing associated with utility work; resurfacing and reconfiguring surface parking lots and existing roadways; new sidewalk construction, pedestrian ramps, or bike

lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair.

50. “RWQCB” – means the California Regional Water Quality Control Board for the San Diego Region.

51. “Sediment” – means soil, sand, and minerals washed from land into water from anthropogenic sources.

52. “Source Control BMP” – means land use or site planning practices, or structural or nonstructural measures that aim to prevent runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimizes the contact between pollutants and runoff.

53. “Standard Urban Stormwater Mitigation Plan” – means a programmatic level guidance document developed to eliminate, reduce, or mitigate the impacts of runoff from development projects, including Priority Development Projects. The SUSMP was developed pursuant to the 2008 Municipal Stormwater Permit for San Diego County.

54. “Stormwater” – means stormwater runoff, snow melt runoff, and surface runoff and drainage.

55. “Stormwater Conveyance System” – this term is used interchangeably with MS4.

56. “Stormwater Pollution Prevention Plan” – means a document which meets the requirements set out in the General Construction Stormwater Permit, General Industrial Stormwater Permit, MS4 Permit, JRMP, or this Article. A SWPPP describes the BMPs to be implemented and other steps to be taken by the Discharger to meet the applicable stormwater requirements for a construction site, facility or for the use of property or resources held in trust by the District, as required by the Executive Director.
57. “SUSMP” – means Standard Urban Stormwater Mitigation Plan.
58. “SWPPP” – means Stormwater Pollution Prevention Plan.
59. “Stormwater Quality Management Plan” – means a plan developed to mitigate the impacts of urban runoff from Priority Development Projects that is in accordance with the MS4 Permit and District JRMP.
60. SWQMP – means Stormwater Quality Management Plan.
61. “Tenant” – means any person who enters into a lease agreement or a use permit agreement (including Tideland Use and Occupancy Permits, rental agreements, easements, licenses, and other similar types of agreements) with the District directly or indirectly as a subtenant to the primary leaseholder.

62. “Treatment Control BMP” – means any engineered system including BMPs that rely on either a physical condition (other than an entirely natural and undisturbed condition) or a constructed or installed device designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media absorption or any other physical, biological, or chemical process.
63. “Urban Runoff” – means all flows in a stormwater conveyance system and consists of the following components: stormwater (wet weather flows) and non-stormwater illegal discharge (dry weather flows).
64. “Urban Stormwater Mitigation Plan (USMP)” – means a plan developed to mitigate the impacts of urban runoff from Priority Development Projects that is in accordance with the 2008 Municipal Stormwater Permit.
65. “Waste” – includes sewage and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation, including waste placed within the containers of whatever nature prior to, and for purposes of, disposal.
66. “Water Quality Control Plans” – means a document adopted by the State Water Resources Control Board that sets forth water quality

standards for surface water and groundwater, as well as actions to control nonpoint and point sources of pollution to achieve and maintain these standards.

67. “Water Quality Objective” – means numerical or narrative limits on constituents or characteristics of water to protect designated beneficial uses of the water. California's water quality objectives are established by the State and Regional Water Boards in the Water Quality Control Plans.

68. “Water(s) of the State” – means any water, surface or underground, including fresh and saline waters within the boundaries of the State (California Water Code Section 13050(e)). The definition of the waters of the State is broader than that for the Waters of the United States in that all water in the State is considered to be a water of the State regardless of circumstances or condition.

69. “Water(s) of the United States” – means water subject to the regulatory jurisdiction of the United States under the CWA and applicable case law.

70. “Watershed” – means that geographical area which drains to a specified point on a water course, usually a confluence of streams or rivers (also known as drainage area, catchment, or river basin).

71. “Wet Season” – means the time period from October 1 through April 30, also known as the rainy season.

(*Enacted July 25, 2000 – Ordinance No. 2105)*

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

(Amended October 9, 2018 – Ordinance No. 2931)

SECTION NO. 10.03 – GENERAL PROVISIONS

(a) “Construction and Application”. This Article is not intended to interfere with, abrogate or annul any other Article, rule or regulation, statute, or other provision of law. The requirements of this Article should be considered minimum requirements, and where any provision of this Article imposes restrictions different from those imposed by any other Article, rule or regulation, statute or other provision of law, whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall take precedence.

(b) “Compliance Disclaimer”. Full compliance by any person with the provisions of this Article shall not preclude the need to comply with other local, State or Federal statutory or regulatory requirements, which may be required for the control of the discharge of pollutants into stormwater and/or the protection of stormwater quality.

(c) “Recycled Water”. This Article is not intended to prohibit or prevent the use of recycled water provided such use complies with this Article.

(d) “Executive Director Authority”. The Executive Director is empowered to enforce the requirements of this Article, including, but not limited to, requiring Persons using property or resources held in trust by the District to prepare and implement BMPs to comply with this Article and to take other actions necessary to comply with this Article.

(e) “District Permits and Approvals”.

1. An application and approval is required for development projects, tenant improvements and construction activity on tidelands. Applications and permits are also required for special events and temporary commercial or industrial activities.

2. An application for any permits or approvals shall be accompanied by plans or documentation demonstrating how the applicable requirements of this Article will be met. No permit or approval shall be granted unless the decision maker determines that the application will comply with this Article.

3. An application for any special event permit or approval shall be accompanied by a deposit to cover any costs or expenses to abate an Illicit Discharge or to repair any obstruction, damage or other impairment to the stormwater conveyance system

(f) “Procedures, Forms and Documents”. The Executive Director may prepare, disseminate and maintain procedures, forms and other documents addressing the use of pollution prevention practices and BMPs and require their use for specific activities or Facilities. The District JRMP, BMP Design Manual, and templates, are available at the District and on the District's website, www.portofsandiego.org.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

(Amended October 9, 2019 – Ordinance No. 2931)

SECTION NO. 10.04 – CONDITIONALLY ALLOWED NON-STORMWATER DISCHARGES

(a) "Conditionally Allowed Non-stormwater Discharges". The following are conditionally allowed non-stormwater discharges as defined in the MS4 Permit.

1. Any discharge or connection to the MS4 regulated under an NPDES permit issued to a Discharger and administered by the State of California pursuant to Division 7 of the California Water Code is allowed, provided that the Discharger is in compliance with all requirements of the NPDES permit and other applicable laws and regulations.

2. Non-stormwater discharges to the MS4 from the following categories are allowed if the discharge has coverage under NPDES Permit No. CAG919001 (Order No. R9-2007-0034, or subsequent order) for discharges to San Diego Bay, or NPDES Permit No. CAG919002 (Order No. R9-2008-0002 or subsequent order) for discharges to surface waters other than San Diego Bay.

   a) Uncontaminated pumped ground water;

   b) Discharges from foundation drains;

   c) Water from crawl space pumps; and

d) Water from footing drains. When the system is designed to be located at or below the groundwater table to actively or passively extract groundwater during any part of the year.

3. Non-storm water discharges to the MS4 from water line flushing and Water main breaks are allowed if the discharges have coverage under NPDES Permit No. CAG679001 (RWQCB Order No. R9-2010-0003 or subsequent order), and the Discharger is in compliance with all requirements of that NPDES permit and other applicable laws and regulations. This category includes water line flushing and water main break discharges from water purveyors issued a water supply permit by the California Department of Public Health or federal military installations.

4. Discharges from recycled or reclaimed water lines to the MS4 are conditionally allowed if the discharges have coverage under an NPDES permit, and the Discharger is in compliance with the applicable NPDES permit and other applicable laws and regulations. Otherwise, discharges from water lines are illicit discharges.

5. Non-storm water discharges to the MS4 from the following categories are conditionally allowed, unless the District or the RWQCB identifies the discharge as a source of pollutants to

receiving waters, in which case the discharge is considered an illicit discharge;

a) Discharges from diverted stream flows;

b) Discharges from rising groundwater;

c) Discharges from uncontaminated groundwater infiltration to the MS4;

d) Discharges from springs

e) Discharges from riparian habitats and wetlands;

f) Discharges from potable water sources, except as set forth in Section 10.04(a) 3.

g) Discharges from foundation drains when the system is designed to be located above the groundwater table at all times of the year, and the system is only expected to produce non-storm water discharges under unusual circumstances; and

h) Discharges from footing drains when the system is designed to be located above the groundwater table at all times of the year, and the system is only expected to produce non-storm water discharges under unusual circumstances

6. Non-storm water discharges from the following categories are conditionally allowed if they are addressed with BMPs. Otherwise, non-storm water discharges from the following categories are illicit discharges.

    a) Air conditioning condensation;

    b) Individual residential vehicle washing;

    c) Water from swimming pools.

7. Non-storm water discharges to the MS4 from firefighting activities are conditionally allowed if they are addressed as follows:

    a) Non-emergency firefighting discharges. Non-emergency firefighting discharges, including building fire suppression system maintenance discharges (e.g. sprinkler line flushing), controlled or practice blazes, training, and maintenance activities shall be addressed by BMPs to prevent the discharge of pollutants to the MS4;

    b) Emergency firefighting discharges. BMPs are encouraged to prevent pollutants from entering the MS4. During emergencies, priority of efforts should be directed toward life, property, and the environment (in descending order). BMPs shall not interfere with emergency response operations or impact public health and safety.

(b) Notwithstanding the categories of non-storm water discharges conditionally allowed in this section, if the RWQCB or the District determines that any of these categories of conditionally allowed non-storm water discharges are a source of pollutants to receiving waters, are a danger to public health or safety, or are causing a public nuisance, such discharges are prohibited from entering the MS4 and will be considered an illicit discharge.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

SECTION NO. 10.05 – PROHIBITIONS

(a) The following prohibitions apply to all persons and activities on land or waters within District jurisdiction.

1. "Illegal Discharges". Except as provided in Section 10.04, it is unlawful for any Person to discharge non-stormwater to the MS4. It is unlawful to cause or contribute to any illicit discharge directly or indirectly into the MS4, receiving waters, or land except as conditionally allowed in this Article. It is unlawful for any Person to cause, either individually or jointly, any discharge into or from the MS4 that results in or contributes to a violation of the MS4 Permit.
2. "Illicit Connection". It is unlawful to establish, use or maintain an illicit connection to the stormwater conveyance system. This prohibition applies retroactively to connections made in the past, even if the connection was established pursuant to a valid permit and was legal at the time of the connection.
3. "Waste and Pollutants Disposed on Land and in Water". It is unlawful to release, discharge, place or deposit any substances, pollutants, or waste, on land or in the MS4 or elsewhere in the receiving waters except in such receptacles as may be provided by the District. It is unlawful to dispose of, or attempt to dispose of, waste by burying it in or under the earth or water.

4. “Flammable Materials”. It is unlawful to throw, deposit, leave, abandon, pump, or discharge oil, spirits, or any flammable liquid or material on District lands, in the MS4, or in receiving waters.

5. “Discharge of Excreta and Sewage”. It is unlawful to discharge, or cause or permit the discharge of excreta or sewage, except in designated pump-out stations or restroom facilities. It is unlawful to fail to properly connect any inhabited improvements to a sewage disposal system or sanitary sewer or to permit sewage seepage.

6. “Washing of Impervious Surfaces”. It is unlawful to discharge, cause or permit the discharge of untreated wash water from the washing of impervious surfaces.

7. “Wash Waters”. It is unlawful to discharge, cause or permit the discharge of untreated wash water or the washing of any floor coverings such as grates, mats or rugs from any commercial or industrial sites or activities, including but not limited to, restaurants, commercial fishing landings, gas stations, auto repair garages, or from other types of automotive or repair facilities, into the stormwater conveyance system or receiving waters.

8. “Irrigation Water Runoff”. It is unlawful to discharge, or cause or permit the discharge of irrigation water, including recycled water

used for irrigation, landscape irrigation, and lawn watering to the MS4 or receiving waters

9. “Repair, Construction and Demolition Debris”. It is unlawful to deposit or abandon waste or building material of any description that has been generated during the repair, construction, or demolition of any structure or vessel. Upon the completion of any repair, construction or demolition, all Dischargers shall gather up and haul away all waste of every nature, and return the land to a condition equal to or better than its original condition, at their sole cost and expense.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

SECTION NO. 10.06 – BEST MANAGEMENT PRACTICE REQUIREMENTS

(a) "Applicability". Every Person undertaking any activity or use of a premise or facility which may cause or contribute to stormwater pollution, illicit discharges, or non-stormwater discharges, shall comply with the BMP guidelines or pollution control requirements as established by this Article and the JRMP.

1. "Minimum BMPs for All Persons". All Persons must install, implement and maintain the following minimum BMPs.

   a) Pollution Prevention BMPs. Stormwater pollution prevention practices that are generally recognized in the applicable industry or business as being effective and economically sound or as described in the JRMP must be implemented.

   b) Proper Use of Materials. All materials with the potential to pollute urban runoff (including but not limited to cleaning and maintenance products used outdoors, fertilizers, pesticides and herbicides) shall be used in accordance with label directions or material safety data sheets.

   c) Storage of Materials and Waste. All materials and wastes with the potential to discharge to the MS4 or receiving waters shall be stored in a manner that either prevents contact with stormwater or contains contaminated runoff for treatment and disposal.

2. “Minimum BMPs for All Facilities and Activities”. All facilities and/or activities identified in this Subsection must implement and maintain the BMPs applicable to that facility or activity as identified in the JRMP, as required by the Executive Director, as required by applicable NPDES Permits, as required by other state or federal law or, for Priority Development Projects, the BMP Design Manual.

   a) Commercial Facilities and Activities. Commercial facilities and activities must meet the applicable requirements of this Article and the JRMP. This includes, but is not limited to, compliance with all prohibition requirements and minimum BMPs specified in the JRMP for commercial activities.

   b) Industrial Facilities and Activities. Facilities and activities subject to the General Industrial Stormwater Permit must install, implement and maintain any additional BMPs required by that Permit in addition to the BMPs required in the JRMP.

   c) Construction Activities. Construction activities must meet the applicable requirements of this Article and the JRMP. This includes, but is not limited to, compliance with all prohibition requirements and minimum BMPs specified in the JRMP for construction activities. Those facilities and activities also subject to the General Construction Stormwater Permit must install, implement and maintain any additional BMPs required by that permit and meet documentation, permit registration and permit close-out requirements of that permit.

(b) "Maintenance of BMPs". Every person undertaking any municipal, construction, commercial or industrial activity, development, or any activity or use of a facility shall maintain the BMPs necessary to achieve and maintain compliance with this Article. The tenant(s) and operators of lands on which treatment control BMPs, including but not limited to temporary and post-construction BMPs, have been installed to meet the requirements of this Article or the JRMP shall ensure the maintenance of those BMPs at all times. Maintenance of a BMP may be transferred with the following conditions.

1. The District or another public entity may accept responsibility for maintenance of any BMP, under such conditions as the District or other public entity determines are appropriate. Where a maintenance obligation is proposed by a public entity other than the District, the District shall be involved in the negotiations with that agency, and in negotiations with the other agencies responsible for issuing permits for the construction and/or maintenance of the BMP. In these instances, the District must be identified as a third

party beneficiary empowered to enforce any such maintenance agreement.

2. Any Discharger who transfers ownership of a BMP or responsibility for the maintenance of a BMP to another Discharger shall provide written notice of the maintenance obligations associated with that BMP to the District and any new or Additional responsible party prior to that transfer. No transfer of ownership of a BMP or transfer of maintenance responsibilities to a new responsible party may occur without District approval and signed acknowledgements from all parties involved with the transaction.

3. “Inspection, Repair and Upgrading of Treatment Control BMPs”. The Discharger must regularly inspect any treatment control BMPs at manned and unmanned facilities to verify that they are functioning as designed. Inspections must be performed at least once a year. The Discharger must repair any treatment control BMPs that fail as soon as it is safe to do so. If the failure of such a BMP indicates that the BMPs in use are inappropriate or inadequate to the circumstances, the Discharger must modify or upgrade the BMPs to prevent any further failure in the same or similar circumstances.

4. “Documentation of BMP Maintenance and Inspection of Treatment Control BMPs”. The Discharger must maintain inspection records and documentation of routine maintenance and report of the treatment control BMPs at their facility. Inspection records and documentation of maintenance must be made available to the District upon request.

(c) “Stormwater Plan Compliance”. Whenever a SWPPP, Construction BMP Plan, or other plan is required, the Executive Director may require consideration of District documents when determining which BMPs to include in the proposed plan(s) to prevent or reduce pollution. Any person required to prepare a SWPPP or Construction BMP Plan or other plan shall install, implement and maintain the BMPs identified in the plan for the life of the project or the duration of the pollutant generating activities. Such plans may be required for:

1. “NPDES Permits”. Any Discharger that owns or operates industrial facilities or activities subject to the General Industrial Stormwater Permit shall prepare and maintain on site an up-to-date SWPPP as required by the applicable NPDES Permit. Any Discharger that owns or operates construction activities subject to the General Construction Stormwater Permit shall prepare and maintain on site

an up-to-date SWPPP as required by the applicable NPDES Permit.

2. "District Requirements". In addition to any other authority provided in this Article 10, the Executive Director may require any person to prepare, submit and implement a SWPPP, Construction BMP Plan or other plan if:

   a) A person proposes to undertake any construction activities, whether or not such activity is subject to the General Construction Stormwater Permit;

   b) A person does not come into compliance with this Article after one or more warnings or other enforcement actions in response to inadequate implementation or maintenance of BMPs;

   c) The facility or activity at issue is a source of pollutants to receiving waters despite compliance with this Article; or

   d) To ensure compliance with the MS4 Permit.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

(Amended October 9, 2018 – Ordinance No. 2931)

SECTION NO. 10.07 – INSPECTION AND MAINTENANCE OF STORMWATER CONVEYANCE LATERALS, SEWER LATERALS AND ON-SITE WASTE WATER SYSTEMS

(a) “Inspection and Maintenance of Stormwater Conveyance Laterals, Sewer Laterals and On-site Wastewater Systems”. Stormwater conveyance laterals shall be cleaned, maintained and replaced when necessary to prevent seepage and spills. Sewer laterals shall be cleaned, maintained and replaced when necessary to prevent seepage and spills. On-site wastewater systems shall be pumped, maintained, and modified or replaced when necessary to prevent spills.

1. “Spills”. Any spill or release from the failure of a stormwater conveyance lateral, sewer lateral or on-site wastewater system shall be contained and cleaned-up in a manner that minimizes any release of pollutants.

2. “Damaged or Failed Systems”. Damaged or failed stormwater conveyance laterals, sewer laterals or on-site wastewater systems shall be repaired or replaced, after obtaining all required permits and approvals;

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

SECTION NO. 10.08 – MONITORING AND REPORTING REQUIREMENTS

(a) “Applicability”. All Dischargers shall comply with this Section.

(b) “Reporting of Spills, Releases and Illicit Discharges”. The Discharger shall report spills, releases, and illicit discharges to the stormwater conveyance system or to receiving waters to the District upon discovery and as otherwise required by applicable State and Federal laws, rules or regulations. The Discharger shall provide copies to the District of any and all communications between the Discharger and any other government agency upon request. If safe to do so, the Discharger shall take immediate action to contain and minimize the spill, release or illicit discharge.

(c) “Monitoring”. Any Discharger required to sample, test, monitor, and report shall make the results of such activities available to the District upon request at the Discharger’s sole expense. Sampling, testing, monitoring, and reporting may be required for:

1. “NPDES Permits”. Discharges subject to the General Industrial Stormwater Permit and the General Construction Stormwater Permit shall perform the sampling, testing, monitoring and reporting required by the applicable NPDES Permit.

2. District Requirements. Whenever a SWPPP, Construction BMP or other plan is required, the Executive Director may require the Discharger to perform sampling, testing, monitoring and reporting.

3. “District Orders”. The Executive Director may order a Discharger to conduct testing or monitoring and to report the results to the District at the Discharger’s sole expense if:

    a) The Executive Director determines that testing or monitoring is needed to determine whether BMPs are effectively preventing or reducing pollution in stormwater as required by this Article, or to determine whether the facility is a significant source of pollutants to receiving waters;

    b) The Executive Director determines that testing or monitoring is needed to assess the impacts of a spill or illicit discharge;

    c) A spill or illicit discharge has not been eliminated after written notice by the Executive Director;

    d) Repeated violations have been documented by written notices from the Executive Director; or

    e) The RWQCB requires the District to provide any information related to the Discharger's activities

(d) “Testing”. The Executive Director may determine the manner in which any testing and monitoring must occur, and may determine when required sampling, testing or monitoring may be discontinued. Testing and monitoring ordered may include the following:

1. Visual monitoring of dry weather flows, wet weather erosion, and/or BMPs;
2. Visual monitoring of premises for spills or discharges;
3. Laboratory analyses performed by a California State Certified Laboratory of stormwater or non-stormwater discharges for pollutants;
4. Background or baseline monitoring or analysis; and
5. Monitoring of receiving waters or sediments that may be affected by pollutant discharges by the Discharger (or by a group of Dischargers including the Discharger).

(e) "Reporting of Testing Results". The Executive Director may determine the manner in which the results of any testing and monitoring are reported.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

(Amended October 9, 2018 – Ordinance No. 2931)

SECTION NO. 10.09 – DEVELOPMENT AND REDEVELOPMENT PROJECTS

(a) "Applicability". The following requirements are applicable to all development and redevelopment activities.

(b) "Post-Construction BMP Requirements for all development projects". Development and redevelopment projects as defined in the BMP Design Manual shall be designed to include and shall implement post-construction BMPs consistent with the BMP Design Manual. Post-construction BMPs must ensure that pollutants and runoff from the development will be reduced to the MEP, will not significantly degrade receiving water quality, and will not cause or contribute to an exceedance of receiving water quality objectives.

(c) "BMP Operation and Maintenance Verification". Annual written verification of effective operation and maintenance of each approved treatment control BMP by the Discharger is required to be submitted to the District at the Discharger's sole expense prior to each wet season.

(d) Any proposed alteration or construction activity to a development project where post-construction BMPs had been previously installed must evaluate whether the proposed alteration or construction activity will impact the original design, intent, or pollutant removal effectiveness of the post-construction BMP at the site. Any proposed impacts to post-construction BMPs must be addressed either by replacement or upgrade as required to meet the conditions of the development project approval, the JRMP, or this Article.

(e) "Priority Development Projects". Priority Development Projects are subject to structural BMP requirements as defined in the BMP Design Manual. All Priority Development Projects (including ministerial projects) shall be designed using the methods described in the BMP Design Manual and shall include all applicable studies and reviews required by the BMP Design Manual.

1. "Priority Development Project BMP Requirements". All priority development projects shall implement the post-construction BMPs unless they have provided a written determination, to the satisfaction of the District that said BMPs are not applicable or feasible.

2. "Stormwater Quality Management Plan". All Priority Development Projects shall develop a SWQMP and submit the plan for the District's review and approval. The SWQMP must reflect the actual constructed condition of the Priority Development Project.

3. "Priority Development Project BMP Requirements". All Priority Development Projects shall implement post-construction BMPs consistent with the BMP Design Manual unless they have provided

a written determination, to the satisfaction of the District that said BMPs are not applicable or feasible.

(f) “Post-Construction BMP Operations and Management Plan”. All applications for a permit or approval associated with a development or redevelopment project subject to structural treatment control must be accompanied by a post-construction operations and management plan specified by the District. The plan shall specify the manner in which the applicant will implement the post-construction BMPs required by this Article.

(g) “Stormwater Management Plan Review Deposit”. The District may require a monetary deposit to pay the estimated reasonable costs for the review of any development or redevelopment project proposal for compliance with this Section. Such a monetary deposit must be approved by the Board of Port Commissioners prior to implementation.

(h) “Alternative Compliance for Priority Development Projects”. Pursuant to Provision E.3.c.(3) of the MS4 Permit, the District may authorize the use of off-site facilities and areas for stormwater management to supplement on-site BMPs at Priority Development Projects as an alternative compliance measure to meet post-construction BMP performance requirements. The applicant must meet all the terms and conditions of the District alternative compliance approval within the required timeframe.

(i) Waivers. Principal permits or approvals sought for a project otherwise subject to this Section may be waived if the Executive Director determines that compliance would be infeasible

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

SECTION NO. 10.10 – OTHER ACTS AND OMISSIONS THAT ARE VIOLATIONS

The following acts and omissions are violations of this Article:

(a) "Causing, Permitting, Aiding or Abetting Non-Compliance". It is unlawful to cause, permit, aid or abet non-compliance with any part of this Article.

(b) "False Statements, Misrepresentation and Concealment". It is unlawful to make any false statement or misrepresentation to the District or its agents concerning compliance with this Article. False statements or misrepresentations may include, but are not limited to, any misrepresentation in a voluntary disclosure, any submission of a report that omits required material facts without disclosing such omission, and any withholding of information required to be submitted by or pursuant to this Article. It is unlawful to conceal a violation of this Article.

(c) "Failure to Promptly Correct Non-Compliance". Violations of this Article must be corrected as soon as practical or within the time period specified by the Executive Director. Each day or part thereof that action necessary to correct a violation is not initiated and diligently pursued is a separate violation.

(d) "Continued Non-Compliance". A separate violation may be considered to have taken place for each day of non-compliance with this Article exists.

(e) "Permits, Approvals and SWPPPs". It is unlawful to fail to conform with an applicable SWPPP, Construction BMP Plan or another plan required pursuant to this Article or fail to comply with urban runoff-related provisions in any other District permit or approval.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

(Amended October 9, 2018 – Ordinance No. 2931)

SECTION NO. 10.11 – INSPECTIONS

(a) "Authority to Inspect". The Executive Director is authorized to inspect activities and facilities, whether or not occupied, at reasonable times, in a reasonable manner, and with reasonable notice to carry out the purposes of this Article or any applicable statute, rule, code or regulation enforceable by the District.

(b) "Scope of Inspections". Inspections may include any and all actions necessary to determine compliance with this Article. Inspections may include, but may not be limited to sampling, taking measurements, metering, and placing devices necessary to sample, monitor, meter, record, visually inspect and review records. When samples are collected, the owner or operator may request and receive split samples. Records, reports, analyses, or other information required under this Article may be inspected and copied, and photographs taken to document a condition and/or a violation of this Article.

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

SECTION NO. 10.12 – ENFORCEMENT

Violations of this Article may be deemed a threat to public health, safety and welfare, and the environment and are identified as public nuisances. The Executive Director may enforce this Article and abate public nuisances in his or her discretion as follows:

(a) "Administrative Authorities". Written and/or verbal orders may be issued to stop any action in violation of this Article or any applicable statute, rule, code or regulation enforceable by the District, including but not limited to the elimination of illicit discharges or the removal of illicit connections.

1. "Administrative Citation". An Administrative Citation may be issued and civil penalties may be imposed pursuant to Section O.ll (i). Administrative citations may be issued to discipline a Discharger for violations of this article, to require abatement, corrective, remedial, and/ or mitigation activities, including but not limited to any of those listed in Section 10.06 or any applicable statute, rule, code or regulation enforceable by the District. All required actions must be performed within a reasonable period of time as determined by the Executive Director. An Administrative Citation may also be issued to abate any public nuisance created by or resulting from a violation of this Article, including summary abatement. All costs to detect and

abate any such public nuisance shall be borne by the violator and/ or the tenant of the premises on which the public nuisance exists.

2. “Stop Work Orders”. Whenever any work is being done contrary to the provisions of this Article, or any applicable statute, rule, code or regulation enforceable by the District, the Executive Director may order the work stopped by notice in writing, served on any person performing the work or causing such work to be done, and any such person shall immediately stop such work until authorized by the Executive Director to proceed. Any challenge to the abatement costs or the necessity of manner of abatement shall be resolved through the hearing procedures in Section 0.11(i).

3. “Summary Abatement”. If the Executive Director determines that a public nuisance exists and immediate action is necessary to preserve or protect the public health or safety, the District may summarily abate the nuisance by any reasonable means without notice or hearing. Any challenge to the abatement costs or the necessity or manner of abatement shall be resolved through the hearing procedures in Section 0.11(i).

4. “Permit Suspension and Renovation”. Violations of this Article or any applicable statute, rule, code or regulation enforceable by the District may be grounds for suspension, revocation or modification

of any permit, license or approval. Suspensions and revocations shall occur in accordance with the hearing procedures in Section 0.11(i).

b. “Judicial Authorities”.

1. “Injunctive or Declaratory Relief”. Any violation of this Article or any applicable statute, rule, code or regulation enforceable by the District may be enforced by a judicial action for injunctive or declaratory relief.

2. “Civil Penalties and Remedies”. The District may file actions in Superior Court to enforce this Article or any applicable statute, rule, code or regulation enforceable by the District, seeking civil penalties and/or other remedies as provided in this Section and in Section 10.12. There is no requirement that administrative enforcement authorities be used before such actions are filed.

3. “Criminal Arrest”. The assistance of a peace officer may be enlisted to arrest violators as provided in California Penal Code, Ordinances 5, 5c, 5d of Title 3, Part 2 (or as amended) and/or a citation and notice to appear as prescribed in Ordinance 5c of Title 3, Part 2 of the Penal Code, including Section 853.6 (or as amended) may be issued. There is no requirement that administrative enforcement authorities be used before such actions are filed. The immunities

prescribed in Section 836.5 of the Penal Code are applicable to the Executive Director and his or her designees acting in the course and scope of their employment pursuant to this Article.

a) “Administrative Penalties”. Administrative penalties may be imposed pursuant to District Code Section 0.11(i). Any later-enacted administrative penalty provision in the District Code shall also be applicable to this Article, unless otherwise provided therein.

b) “Criminal Penalties”. Criminal penalties may be imposed pursuant to District Code Section 0.11.

1. Misdemeanor. Non-compliance with any part of this Article constitutes a misdemeanor and may be enforced and punished as prescribed in Section 0.11 and any other applicable statute, rule or regulation.

2. Infraction. The Executive Director may charge any violation of this Article as an infraction at his or her discretion. Infractions may be abated as a nuisance or enforced and punished as prescribed in Section 0.11 and any other applicable statute, rule or regulation.

c) "Civil Penalties". The following may be awarded without monetary limitation in any civil action, except where a maximum monetary amount is specified.

1. Injunctive relief;
2. Costs to investigate, inspect, monitor, survey or litigate;
3. Costs to place or remove soils or erosion control materials, to correct any violation, and to repair environmental damage or to end any other adverse effects of a violation;
4. Compensatory damages for losses to the District or any other plaintiff caused by violations; and/or restitution to third parties for losses caused by violations;
5. Civil penalties in accordance with District Code Section 0.11(i); and
6. Attorney fees and court costs as permitted by law

d). <u>Cost Recovery</u>. The Executive Director may impose a monetary penalty without limitation to recover the costs, including staff time and materials, to investigate or monitor any violation of this Article.

e) Attorney Fees. In any action, administrative proceeding or special proceeding to enforce this Article and abate a nuisance, the prevailing party may recover attorney fees if, at the initiation of the action or proceeding, the District elects to seek recovery of its own attorneys' fees. In no event shall the award of attorney fees to the prevailing party exceed the amount of reasonable attorney fees incurred by the District in the action or proceeding.

f) Penalties and Remedies Not Exclusive. Penalties and remedies under this Article may be cumulative and in addition to other administrative, civil, or criminal remedies

(Enacted July 25, 2000 – Ordinance No. 2105)

(Amended December 11, 2007 – Ordinance No. 2475)

(Amended May 12, 2015 – Ordinance No. 2815)

Appendix C
Enforcement Response Plan

Appendix C **Enforcement Response Plan**

1.0 Introduction

The Port of San Diego (Port) is committed to improving and protecting the quality of water in San Diego Bay. Through the Port's Jurisdictional Runoff Management Program (JRMP) and the Port's stormwater ordinance Article 10, the Port reinforces this commitment by preventing and prohibiting unauthorized non-stormwater discharges from its municipal separate storm sewer system (MS4) to the receiving water to the maximum extent practicable (MEP).

The Port JRMP document describes best management practices (BMPs) for major activity types (Illicit Discharge Detection and Elimination (IDDE), Construction, Development, and Existing Development) and explains the steps the Port will take to ensure that the BMPs are implemented, maintained, and assessed. One of the means by which the Port ensures compliance with the JRMP is through the Port's enforcement process.

The JRMP document also provides a description of how the Port will comply with directives of the San Diego Regional Water Quality Control Board, Order No. R9-2013-001, Municipal Stormwater Permit (Municipal Permit). The Municipal Permit requires that the Port establish and utilize its legal enforcement authority to compel compliance with the JRMP. The Permit also requires the Port to develop and implement an enforcement response plan that describes the applicable approaches and options to enforce the requirements of the JRMP.

This Enforcement Response Plan (ERP) consolidates the Port's existing enforcement process into one plan and outlines in greater detail, how the Port will proceed with enforcement. It also defines and incorporates the permit required enforcement provisions including "Escalated Enforcement" triggers and procedures applicable to the Construction Management, IDDE Development Planning and Existing Development JRMP components.

2.0 Background

Since 2000, the Port has established and continues to maintain enforceable legal authority to control pollutant discharges into and from its MS4 through its stormwater ordinance, Article 10. Article 10 provides Port staff the legal backing to ensure compliance with the JRMP; providing the Port both administrative and judicial authorities for enforcement. Article 10 was updated in 2007 to comply with the previous 2007 municipal permit and was updated in May 2015 and October 2018 to bring it into compliance with the current permit.

From the Port's perspective, education and outreach is the preferred way to prevent non-stormwater discharges because it can lead to long lasting behavior change. Issuing enforcement orders, citations and assigning penalties are less desirable paths to achieve compliance. However, both education and enforcement must be used in balance to ensure issues are properly and promptly resolved.

Since 2000, the Port has had an enforcement response process in place. The process was written into the JRMP and implemented through standard operating procedures for internal staff. Over the past 19 years, the Port has had the authority to issue a variety of administrative and judicial actions and it is notable that a majority of compliance issues have been resolved through verbal and written warnings. It is recognized however, that some incidents require a more elevated response from the Port to achieve results (in a timely manner) and the Port responds accordingly.

3.0 Purpose and Objectives

The Purpose of the Enforcement Response Plan is to comply with the Permit and provide stakeholders a clear description of the enforcement actions the Port will take to achieve compliance with the JRMP. This plan addresses enforcement of the following JRMP components:

- IDDE – JRMP Chapter 3
- Development Planning – JRMP Chapter 4
- Construction Management – JRMP Chapter 5
- Existing Development – JRMP Chapters 6 and 7

The objectives of the Plan include:

1. Establish standard enforcement response procedures to ensure JRMP and Permit compliance.
2. Improve water quality in the bay and adjacent receiving waters;
3. Minimize the urban runoff discharges from Port tidelands; and
4. Improve program management efforts related to urban runoff

4.0 Enforcement Authorities: Article 10

Article 10 enables the Port to prohibit discharges and require BMPs so that discharges on tidelands do not cause or contribute to water quality problems (see Appendix B of Port JRMP). Article 10 establishes enforcement procedures and pathways to ensure that activities and responsible dischargers are held accountable for their contributions and /or flows. Enforcement mechanisms established in Article 10 include the following administrative and judicial authorities.

Administrative Authorities: including administrative citations and field citations, stop work orders, summary abatement, permit suspension and revocation.

Judicial Authorities: including injunctive or declaratory relief, civil penalties and remedies, or criminal arrest.

Written warnings or administrative citations may be initially administered while on site either verbally or by written document, such as the corrective action portion of an inspection form or a field citation. For most incidents, the written warnings and administrative citations are adequate to achieve compliance. However, in instances where a discharge is determined to be a significant threat to human health or the environment, Port staff can use stop work orders or permit suspension to require immediate cessation of the activity or the discharge. Finally, in severe cases or in instances where responsible parties refuse to comply or appear to act in a threatening manner, Port staff can enlist Harbor Police services and use the judicial authorities identified above.

5.0 Escalated Enforcement

As defined Section E.6.d of the Permit, escalated enforcement is any enforcement scenario where a violation or other non-compliance is determined to cause or contribute to the highest priority water quality conditions identified in the San Diego Bay Watershed Water Quality Improvement Plan (WQIP). Table 1.1 lists the highest water quality conditions. The items highlighted in blue are Port focused priorities:

Table 1-1 San Diego Bay WMA Summary of Highest and Focused Priority Conditions.

HU	Condition	Pollutant/ Stressor	Geographic Extent (HU/HA)	Responsible Parties
Pueblo (908)	**Water Quality[1]**	**Bacteria;** **Dissolved copper, lead, and zinc**	**Chollas Creek** **(908.22)**	**City of La Mesa** **City of Lemon Grove** **City of San Diego** **County of San Diego** **Port of San Diego** **Caltrans**
	Water Quality	Copper and zinc (Wet Weather)	Airport Authority jurisdiction within 908.21	Airport Authority
Sweetwater (909)	Riparian Area Quality	Various	Paradise Creek—lower Sweetwater, HA 909.1[2]	City of National City
	Physical Aesthetics	Trash	The western portion of the City of Chula Vista within HA 909.1	City of Chula Vista Port of San Diego
Otay (910)	Swimmable Waters (Beaches)	Bacteria	Applicable RP jurisdiction within HA 910.1	City of Coronado City of Imperial Beach Port of San Diego
	Physical Aesthetics	Trash	Applicable RP jurisdiction in HA 910.2	City of Chula Vista City of Imperial Beach Port of San Diego

Notes:
[1] **The conditions in bold are the Highest Priority Conditions for the San Diego Bay WMA**. Pollutants in regular font are the Focused Priority Conditions.
[2.] For the purposes of the Water Quality Improvement Plan, Paradise Creek is considered to be part of the lower Sweetwater area, for which the San Diego Bay priority condition analysis has identified potential impacts to beneficial uses such as habitat and non-contact recreation

As defined in the Permit, escalated enforcement may be defined differently for development planning, construction sites, commercial facilities or areas, industrial facilities, municipal facilities, and residential areas. Generally, this type of enforcement will be triggered based on BMP maintenance and implementation. Escalated enforcement actions will continue to increase in severity as necessary to compel compliance as soon as possible. Escalated enforcement is described further in the sections below.

6.0 Enforcement - IDDE

Chapter 3 of the Port JRMP describes the Port's IDDE program. The IDDE program is designed to actively detect and eliminate illegal discharges and unauthorized connections to the MS4. It is also designed to identify discharges that may be required to be covered under a separate NPDES permit.

The Port will respond to reports or complaints of unpermitted non-stormwater discharges, illicit connections and illegal discharges (ICID) that may be received from other Port staff or the public. As indicated in the JRMP, all incoming ICID reports are logged in the Port's database and assessed for appropriate follow-up based on established criteria. Through the Port's ICID assessment process, the incident may be characterized as "no further action required" or requiring some level of enforcement. General ICID scenarios that require further action are listed below:

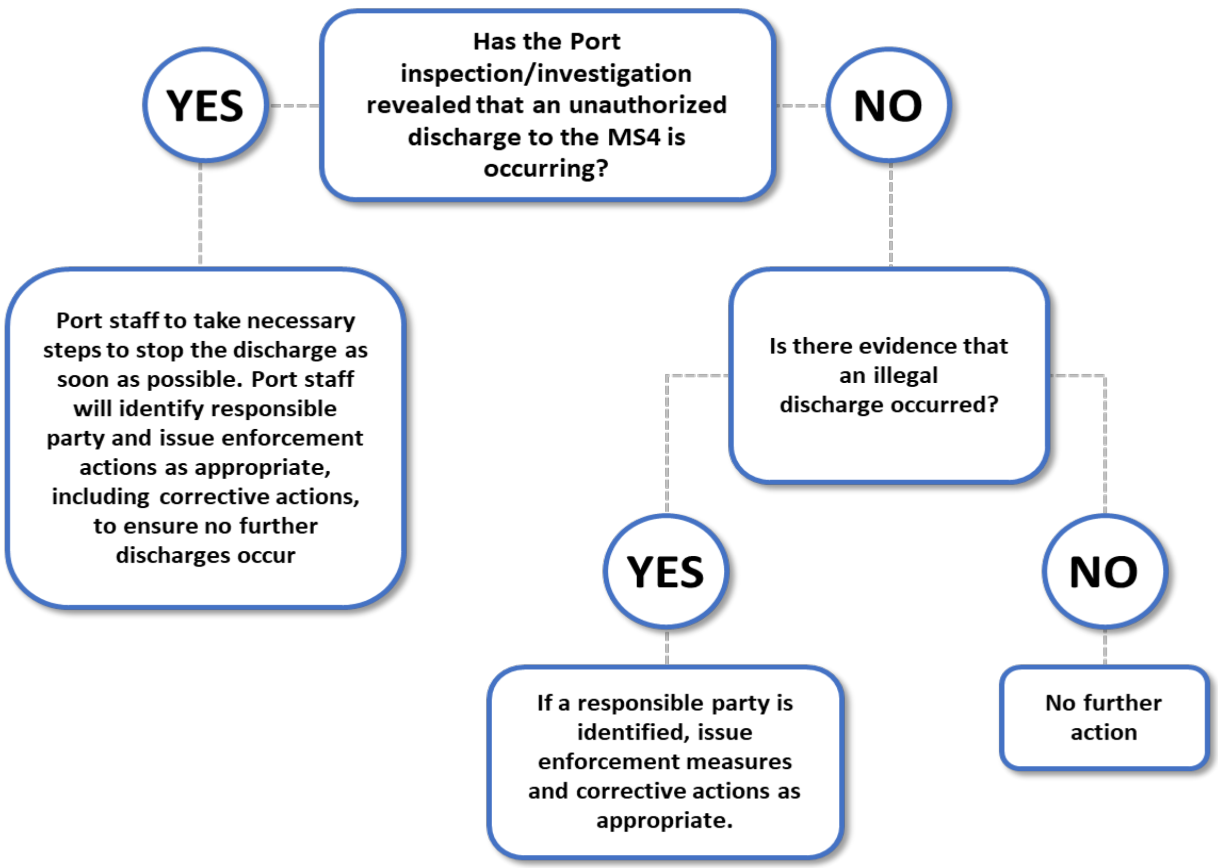
- Incident involves a spill or release of pollutants from a known source originating on tidelands which has the ability to enter the MS4 and/or threaten receiving water quality.
- Incident involves an unpermitted non-stormwater discharge from a known source originating on tidelands.
- Incident involves a spill or release of pollutants from a known source originating off tidelands.

The enforcement response approach and options for ICIDs are described in the section below.

6.1 Enforcement Response Approach and Options-IDDE

Pursuant to Section E.3.(b) of the Permit, if the Port identifies the source of an ICID as a controllable source of non-storm water or illicit discharge or connection that has originated on tidelands, the Port will initiate its enforcement response process as outlined in this plan. The Port will also enforce its legal authority to prohibit and eliminate illicit discharges and connections to its MS4. Figure 1 provides an outline of the Port's enforcement response approach to validated (through Port investigation) non-stormwater discharges and ICIDs. Note that where discharges are observed at Port maintained facilities, Port stormwater staff will submit a compliance work request to the Port's General Services Department to make corrective actions immediately or as soon as feasible given access and safety constraints.

Figure 1 IDDE Enforcement Flowchart



*where discharges are observed at Port maintained facilities, Port stormwater staff will submit a compliance work request to the Port's General Services Department to make corrective actions immediately or as soon as feasible.

6.2 Correction of Violations-IDDE

The goal of the Port's enforcement response to non-stormwater discharges or ICIDs is to stop and/or prevent the discharges and reoccurrence. The Port will require the responsible party to carry-out identified corrective actions as soon as possible and feasible. The Port will conduct follow-up actions, in the form of requiring and reviewing response documentation, site visits, and/or inspections as well as any discharge sample collection.

Per Sections E.6.c.1and 2 of the Permit, violations will be corrected in a timely manner with the goal of stopping a discharge immediately and correcting the violations within a Port-specified timeframe but not greater than 30 calendar days after the violations are discovered, or prior to the next predicted rain event, whichever is sooner. If more than 30 calendar days are required to achieve compliance, then a rationale will be required to be submitted to the Port. All ICID investigations will be recorded and tracked in the Port's stormwater database.

6.3 Escalated Enforcement-IDDE

Identification of escalated enforcement procedures for the IDDE program is not required by the Permit. However, the Port defines escalated enforcement for the IDDE program as unauthorized discharges to the MS4 or receiving water resulting in an immediate administrative citation with fine and/or corrective actions depending on the severity and duration of the incident.

6.4 Reporting IDDE Investigations

Pursuant to Permit Section E.2.d(4) and F.3.b(1)(a), the Port will submit a summary of the non-stormwater discharges and ICIDs investigated and eliminated within its jurisdiction with each WQIP Annual Report and the JRMP Annual Report.

7.0 Enforcement - Development Planning

Chapter 4 of the JRMP describes the Port's Development Planning program. Pursuant to Section B.3.b.(1) of the Permit, the program uses the Port's land use planning and permitting authorities to implement a development planning program in accordance with the strategies in the WQIP and to meet core Permit requirements. This includes ensuring BMPs are applied as applicable and feasible to all development projects and ensuring that BMPs on all Priority Development Projects (PDP) are designed, constructed and maintained to remove pollutants in stormwater in compliance with the Port BMP Design Manual.

During the development review and approval process, there may be issues that arise which require enforcement to maintain JRMP and Permit compliance. Some of these issues may include:

- A development project commences without prior Port project approval;
- A development project begins site work before the Stormwater Quality Management Plan (SWQMP, formerly USMP) is approved by the Port;
- Post-construction BMPs proposed in the approved SWQMP or development plan are not installed or not installed as proposed;
- Changes were made in the project design after Port approval of the SWQMP is obtained that would alter the design calculations, assumptions and recommendation made in the SWQMP and amendments were not sent to the Port for review and approval;
- Approved alternative compliance project is not constructed, maintained or is not in conformance with Port approval;
- Development project does not properly maintain and implement post-construction BMPs.

The enforcement response approach and options for the Development Planning program are described in the section below.

7.1 Enforcement Response Approach and Options—Development Planning

Section E.3 of the Permit requires the Port to enforce its legal authority established pursuant to Provision E.1 for all development projects, as necessary, to achieve compliance with the Permit. All PDP inspections are entered into the stormwater database and results of inspections and follow-up actions are relayed to the facility via inspection evaluation letters. Where follow-up actions are identified, the letter serves as a written warning to the facility to address those items within specified timeframes.

Figure 2 presents the enforcement process for development projects. During an inspection, the Port may identify "recommended corrective actions", "required corrective actions", and/or "BMP Violations".

- "Recommended corrective actions" include items that require minor maintenance or improvements in implementation or instances where maintenance may not be required at this time but a potential problem exists that will most likely need to be addressed in the future. Recommended corrective actions will be revisited by the Port inspector at the next routine inspection. A recommended corrective action will be elevated to a "Required Corrective Action" if not addressed within the next routine inspection. Recommended corrective actions will be addressed via written warning.
- "Required corrective actions indicate that immediate action is expected but only minor maintenance is required. Required corrective actions will be addressed via written

warning. A required corrective action will be elevated to a “BMP Violation” if the item is not addressed within the Port-specified timeframe.

- “BMP Violations” may be noted where required PDP BMPs are missing, in need of replacement or a required corrective action is not addressed within the specified timeframe. An Administrative Citation will be issued for BMP violations that may also include fines. Repeat violations or failure to comply with the directives of the administrative citation will initiate further enforcement that may include (additional) fines, a stop work order or other additional enforcement as deemed necessary by the Port.

Where corrective actions or discharges are observed at Port maintained PDP BMPs, Port stormwater staff will submit a compliance work request to the Port’s General Services Department to make corrective actions immediately or as soon as feasible.

Figure 2 Development Planning Enforcement Flowchart

*SWQMP Stormwater Quality Management Plan

7.2 Correction of Violations-Development Planning

The goal of the Port's enforcement response in the Development Planning program is to ensure that impacts from development activities on receiving water quality by reducing pollutants and runoff flows from new development and redevelopment to the MEP. Throughout the development process there are several stormwater related compliance points for a project to meet. For instance, there are documents, such as the SWQMP, that are required to be submitted to the Port for review and Port approvals that are also required. There are also BMP inspections and installation verifications that must occur. A project's failure to meet those compliance points is considered a violation of Article 10 and thus will trigger enforcement actions. The Port will require the responsible party to complete (carry-out) identified corrective actions as soon as possible and feasible. The Port will conduct follow-up actions, in the form of requiring and reviewing response documentation, site visits, and/or inspections.

Per Sections E.6.c.(1)-(2) of the Permit, violations will be corrected according to a Port-specified timeframe not greater than 30 calendar days after the violations are discovered. Where missing or improperly maintained post-construction BMPs are discovered, corrective actions will be required to be completed within a shortened timeframe or prior to the next predicted rain event, whichever is sooner. If more than 30 calendar days are required to achieve compliance, a rationale explaining the need for additional time will be required to be submitted to the Port by the responsible party. Failure to respond to required corrective actions will result in increased enforcement action. The Port's stormwater database will be used to track violations.

7.3 Escalated Enforcement-Development Planning

Escalated enforcement in the Development Planning program includes violations or other non-compliance determined to cause or contributes to the highest priority water quality condition in the WQIP. Escalated enforcement will be applied to development planning issues when the following conditions apply:

- Inspection of approved post-construction BMPs designed to prevent discharges of trash, metals or bacteria to the MS4 indicates BMPs are 1) missing, or 2) are not adequately maintained and in a condition that renders them ineffective and in need of a replacement

Escalated enforcement will begin with an Administrative Citation which may include fines. This enforcement action is beyond a verbal or written warning, which is the standard starting point of Port enforcement. Escalated enforcement actions will continue to increase in severity as necessary to compel compliance as soon as possible. Repeat violations of failure to implement or maintain BMPs that treat WQIP priority conditions will be escalated to enforcement with fines.

7.4 Reporting of Non-Compliant Sites-Development Planning

Pursuant to Permit Section F.3b(1)(a), the Port will submit the number of development planning related enforcement actions issued and escalated enforcement carried out within its jurisdiction with each JRMP Annual Report.

8.0 Construction Management

Chapter 5 of the JRMP describes the Port's Construction Management program. Pursuant to Section E.4 of the Permit, the Port uses its land use and project approval authorities to implement a Construction Management program in accordance with the strategies in the WQIP and to meet core Permit requirements. These include ensuring temporary BMPs are implemented and maintained and proper documentation is maintained as required throughout the projects duration.

During the project approval and construction phase of a project, there may be issues that arise that require enforcement to maintain JRMP and Permit compliance. Some of these issues may include the following:

- A construction project commences without prior Port review and/or approval of the project;
- A construction project begins site work before the pollution control plan or stormwater pollution prevention plan (SWPPP) is approved by the Port;
- A construction project does not properly maintain and implement construction BMPs or maintain required documentation;
- Required BMPs are missing;
- Conditions of approval for pollution control plan or SWPPP are not met;
- The project fails to obtain coverage under the statewide Construction General Permit;
- Unauthorized discharge occurs as a result of missing or inadequate BMPs

The enforcement response approach and options for the Construction Management program are described in the section below.

8.1 Enforcement Response Approach and Options-Construction Management

Section E.4 of the Permit requires the Port to enforce its legal authority for all its inventoried construction sites as necessary, to achieve compliance with the Permit. The Port's legal authority is exercised during the SWPPP and Construction BMP plan reviews, and when conducting site inspections. Construction inspections are entered into the stormwater database. A copy of the completed inspection form with any corrective actions is provided to the site supervisor and facility's representative. The Port stormwater inspector also reviews the results of the inspection, noting any BMP violations and corrective actions with the site supervisor the day of the inspection. Results of the inspections and follow-up actions are relayed to the responsible parties via an inspection evaluation letter.

Figure 3 presents the enforcement process for construction inspections. To ensure or maintain JRMP and Permit compliance, the Port may identify issues as "recommended corrective actions", "required corrective actions", and/or "BMP or SWPPP Violations" during inspections.

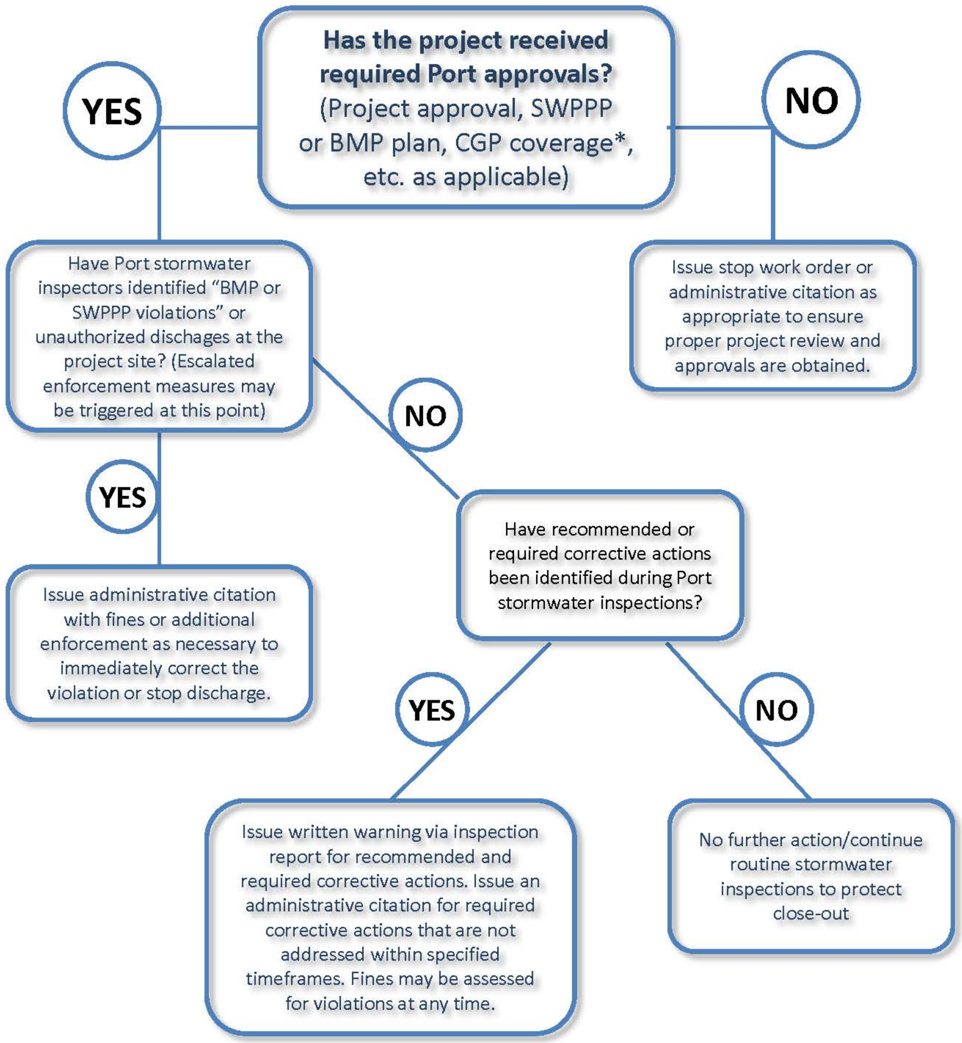
- "Recommended corrective actions" include items that require minor maintenance or improvements in implementation or instances where maintenance may not be required at this time but a potential problem exists that will most likely need to be addressed in the future. Recommended corrective actions will be revisited by the Port inspector at the next biweekly or monthly inspection. Recommended corrective actions will be addressed via written warnings. A recommended corrective action will be elevated to a "required corrective action" if not addressed within the next routine inspection.

- "Required corrective actions" indicate that immediate action is expected. Required corrective actions will be assigned when BMPs are not implemented properly or in disrepair. Required corrective actions are also assigned when administrative updates and SWPPP maintenance is required. Required corrective actions will be addressed via written warning. A "required corrective action" will be elevated to a "BMP or SWPPP Violation" if the item is not addressed within the Port-specified timeframe and is non-compliant.

- "BMP or SWPPP Violations" are where required BMPs are missing or may be identified where a "required corrective action" is not addressed within the required timeframe and is non-compliant. Other "BMP or SWPPP violations" include:
    - instances where a construction project commences without prior Port review and/or approval;
    - a construction project begins site work before the Construction BMP Plan or SWPPP is approved by the Port;
    - conditions of approval for pollution control plan or SWPPP are not met;
    - failure to obtain coverage under the statewide Construction General Permit; or
    - where an unauthorized discharge occurs as a result of missing or inadequate BMPs.

In these instances, the Port will issue Administrative Citations that may include fines for BMP or SWPPP violations.

FIGURE 3 Construction Management Enforcement Flowchart



*CGP – State Water Board Construction General Permit

8.2 Correction of Violations-Construction Management

The goal of the Port's enforcement response in construction is to ensure impacts from construction activities on receiving water quality are minimized by reducing pollutants and runoff flows from project sites. The Port will require the responsible party to carry-out identified corrective actions as soon as possible and feasible. The Port will conduct follow-up actions, in the form of requiring and reviewing response documentation, site visits, and/or inspections.

All unauthorized non-stormwater discharges will be required to be addressed the day of the discharge or as soon as possible given safety and access constraints. Other stormwater plan or BMP related violations and corrective actions will be required to be addressed in a timely manner or within 14 calendar days after the violations or corrective actions are discovered. Where missing or improperly maintained BMPs are discovered, corrective actions will be required to be completed within 14 days or prior to the next predicted rain event, whichever is sooner. If more than 14 calendar days are required to achieve compliance, then the responsible party will be required to submit a rationale explaining the need for additional time to come into full compliance.

Repeat violations or failure to comply with the directives of an administrative citation will initiate further enforcement that may include (additional) fines, a stop work order or other additional enforcement as deemed necessary by the Port. The Port's stormwater database will be used to track violations and corrective actions.

8.3 Escalated Enforcement-Construction Management

Escalated enforcement in construction includes violations or other non-compliance determined to cause or contributes to the highest priority water quality condition in the WQIP. Escalated enforcement will be applied to construction sites that have been identified as high priority when the following conditions apply:

- Inspection of approved temporary construction BMPs designed to prevent discharges of trash, metals or bacteria to the MS4 indicates BMPs are missing or are not adequately maintained and in a condition that renders them ineffective. These BMPs are indicated in body type in Table 5-3 in JRMP Chapter 5.

Escalated enforcement of construction projects for violations relating to BMPs targeting WQIP high priority pollutants (i.e., metals, bacteria, and/or trash) are issued an Administrative Citation, which may include fines, unless the deficiencies are corrected the day of the inspection. This enforcement action is beyond a verbal or written warning which is the standard starting point of Port enforcement. Escalated enforcement actions will continue to increase in severity as necessary to compel compliance as soon as possible. Repeat violations of failure to implement or maintain BMPs that treat WQIP priority conditions will be escalated to enforcement with fines and/or stop work order.

8.4 Reporting of Non-Compliant Sites-Construction Management

Pursuant to Permit Section E.6.e(1), the Port will notify the San Diego Regional Water Quality Control Board in writing, either by email or letter, within 5 calendar days of issuing escalated enforcement to a construction site that poses a significant threat to water quality as a result of violations or other non-compliance with its permits and applicable ordinances, and the Permit.

In addition, pursuant to Permit Section F.3.b.(1)(a), the Port will submit the number of the enforcement actions issued and escalated enforcement carried out at construction sites within its jurisdiction with each JRMP Annual Report.

9.0 Enforcement-Existing Development

Pursuant to Section E.5 of the Permit, the Port must implement an existing development program in accordance with the strategies in the WQIP and to meet core Permit requirements including; ensuring that designated minimum BMPs are implemented and maintained at the applicable facilities and at special events. Chapter 6 (Existing Development – Municipal) and Chapter 7 (Existing Development – Industrial/Commercial) of the Port JRMP describes the Port's Existing Development Program. Inspections of municipal, industrial and commercial facilities will be conducted in accordance with the schedule outlined in the Port JRMP. During the course of inspection there may be items identified that requires enforcement to ensure or maintain JRMP and Permit compliance. Some of these issues may include:

- Facility or special event does not properly maintain and implement BMPs or maintain required documentation;
- Required BMPs are missing;
- The facility fails to obtain coverage under the statewide Industrial General Permit;
- Unauthorized discharge occurs as a result of missing or inadequate BMPs

The enforcement response approach and options for the Existing Development program are described in the section below.

9.1 Enforcement Response Approach and Options-Existing Development

Section E.4 of the Permit requires the Port to enforce its legal authority for all its inventoried existing development facilities and areas as necessary, to achieve compliance with the Permit. Existing development inspections are entered into the stormwater database and results of inspections and follow-up actions are relayed to each facility via a facility evaluation letter. Where follow-up actions are identified, the letter serves as a written warning to the facility to address those actions within specified timeframes. Where corrective actions or discharges are observed at Port maintained facilities, Port stormwater staff will submit a compliance municipal work order to the Port’s General Services Department to make corrective actions immediately or as soon as feasible.

Figure 4 presents the enforcement process at existing development facilities. To ensure or maintain JRMP and Permit compliance, the Port may identify “recommended corrective actions”, “required corrective actions”, and/or “BMP or SWPPP Violations” during inspections.

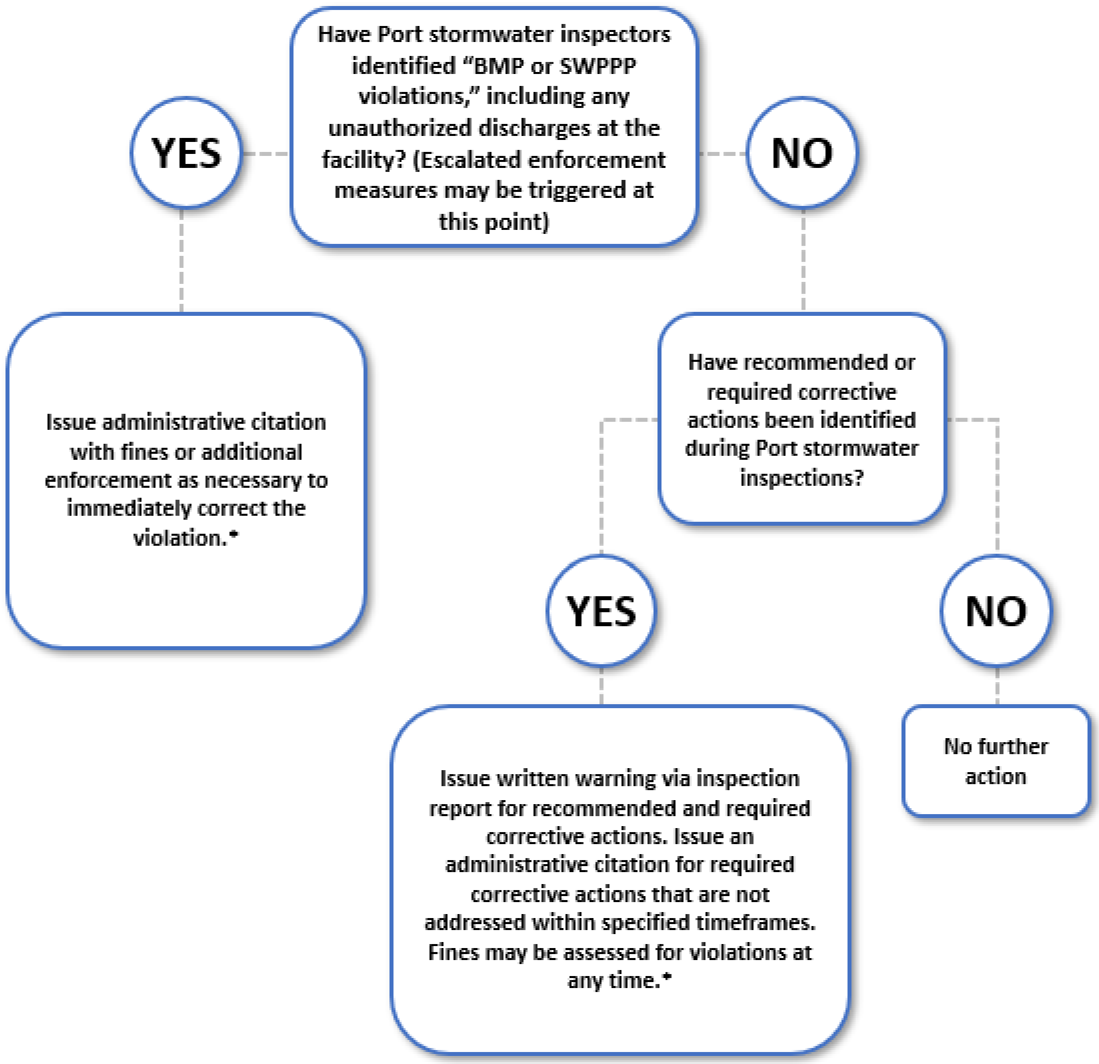
- “Recommended corrective actions” include items that require minor maintenance or improvements in implementation or instances where maintenance may not be required at this time but a potential problem exists that will most likely need to be addressed in the future. Recommended corrective actions will be revisited by the Port inspector at the next routine inspection. A recommended corrective action will be elevated to a “Required Corrective Action” if not addressed within the next routine inspection. Recommended corrective actions will be addressed via written warning.

- "Required corrective actions indicate immediate action is expected to improve stormwater compliance at a facility. Required corrective actions will be assigned when required BMPs are not implemented properly or in disrepair. Required corrective actions will be addressed via written warning. A required corrective action will be elevated to a “BMP or SWPPP Violation” for non-compliance if the item is not addressed within the Port-specified timeframe.

- “BMP or SWPPP Violations” may be noted where required BMPs are missing or a required corrective action is not addressed within the specified timeframe and is non-compliant. Violations will also be noted in instances where a project fails to obtain coverage under the statewide Industrial General Permit or where an unauthorized discharge occurs as a result of missing or inadequate BMPs. An Administrative Citation will be issued for “BMP or SWPPP” violations that may also include fines. Repeat violations or failure to comply with the directives of the administrative citation will initiate further enforcement that may include (additional) fines, a stop work order or other additional enforcement as deemed necessary by the Port.

Follow-up actions are conducted to ensure corrective actions identified during the initial inspection are adequately addressed. Follow-up actions are then entered into the database and a follow-up evaluation letter will be sent to the facility once all corrective actions have been completed.

Figure 4 Existing Development Enforcement Flowchart



*where "BMP or SWPPP violations" are observed at Port maintained facilities, Port stormwater staff will submit a compliance work request to the Port's General Services Department to make corrective actions immediately or as soon as feasible.

EP

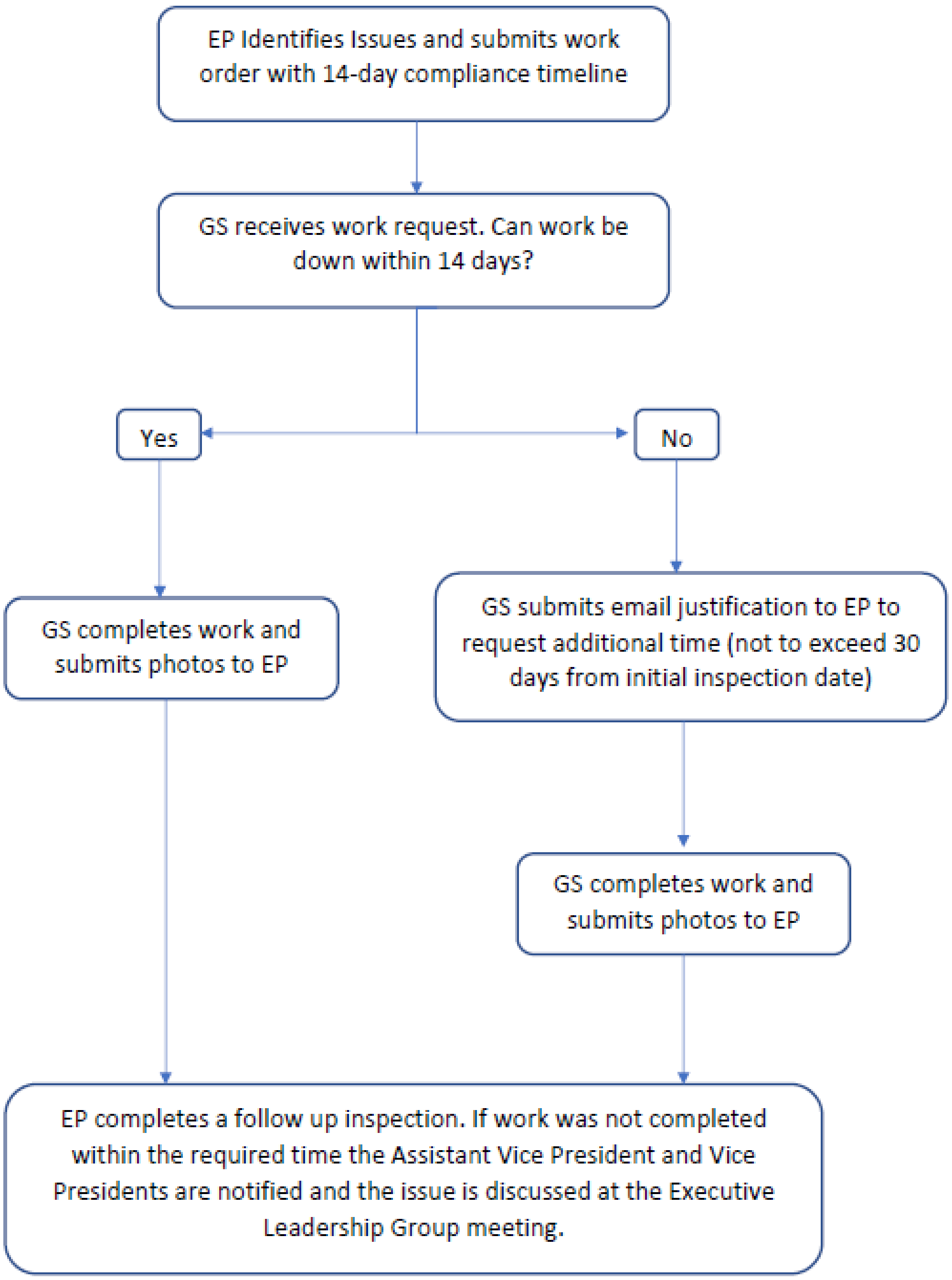
9.2 Correction of Violations-Existing Development

The Port will require the responsible party to carry-out identified corrective actions as soon as possible and feasible. The Port will conduct follow-up actions, in the form of requiring and reviewing response documentation, site visits, and/or inspections. Per Sections E.6.c.1and 2 of the Permit, violations will be corrected in a timely manner with the goal of correcting the violations within 30 calendar days after the violations are discovered.

To ensure corrective actions are completed within 30 calendar days the Port will submit either a work order for municipal facilities or an inspection evaluation report for tenant facilities requiring those items be completed within 14 days of receiving the required corrective actions or prior to the next predicted rain event, whichever is sooner and feasible. If more than 30 calendar days are required to achieve compliance, then a rationale will be recorded in the Port's stormwater database used to track violations.

In FY 2018, the Port conducted an internal audit to assess municipal facility compliance with stormwater regulations and determine the delineation of roles and procedures to ensure efficient and effective facility environmental compliance with response requirements. As a result, General Services (GS) and Environmental Protection (EP) staff collaborated in the development of a Compliance Response Process to ensure stormwater related work orders receive proper prioritization for completion. Figure 5 describes the municipal work order process that tracks stormwater-related work orders to completion and identifies escalated enforcement that will be taken if the issue(s) have not been resolved within the specified timeframe.

Figure 5. Municipal Facility Corrective Action Work Order Process



9.3 Escalated Enforcement-Existing Development

Escalated enforcement in existing development includes violations or other non-compliance determined to cause or contributes to the highest priority water quality condition in the WQIP. Escalated enforcement will be applied to existing development sites when the following conditions apply:

- Required BMPs that have been identified as likely to reduce WQIP pollutants (Table 7-4, JRMP Chapter 7) are either missing or not adequately maintained and in a condition that renders them ineffective.

Escalated enforcement will begin with an Administrative Citation which may include fines. This enforcement action is beyond a verbal or written warning which is the standard starting point of Port enforcement. Escalated enforcement actions will continue to increase in severity as necessary to compel compliance as soon as possible. Repeat violations of failure to implement or maintain BMPs that treat WQIP priority conditions will be escalated to enforcement with fines and/or stop work order.

9.4 Reporting of Non-Compliant Sites-Existing Development

Pursuant to Permit Section E.6.e.(2), the Port will notify the San Diego Regional Water Quality Control Board in writing, either by email or letter, within 5 calendar days of any persons required to obtain coverage under the statewide General Industrial Permit.

In addition, pursuant to Permit Section F.3.b.(1).(a), the Port will submit the number of the enforcement actions issued and escalated enforcement carried out each JRMP Annual Report.

10.0 Amendments to the Enforcement Response Plan

Amendments to the Enforcement Response Plan may be included as needed and necessary to continue compliance with the JRMP and the Permit. Amendments will be incorporated into the plan and summarized on the attached sheet.

Enforcement Response Plan Amendment Form

DATE	**AMENDMENT**
January 2019	1
January 2020	2

Appendix D
BMP Design Manual

PORT of SAN DIEGO
Environment

January 2024

Port of San Diego's BMP Design Manual

Proposed updates to the BMP Design Manual noted in Chapter 11 are pending approval by the San Diego RWQCB. Once approved, the document will be updated.

Page intentionally left blank.

Table of Contents

Appendix

A

BMP DESIGN MANUAL

Submittal Templates

February 2016, January 2018 update

Appendix A Submittal Templates

Port-specific SWQMP templates can be found at
https://www.portofsandiego.org/environment/stormwater/stormwater-development.html

Appendix

B

Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Appendix B Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Table of Contents:

B.1 DCV

DCV is defined as the volume of storm water runoff resulting from the 85th percentile, 24-hr storm event. The following hydrologic method shall be used to calculate the DCV:

$$DCV = C \times d \times A \times 43{,}560\ sf/ac \times 1/12\ in/ft$$

$$DCV = 3{,}630 \times C \times d \times A$$

Where:

DCV = Design Capture Volume in cubic feet

C = Runoff factor (unitless); refer to section B.1.1

d = 85th percentile, 24-hr storm event rainfall depth (inches), refer to section B.1.3

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingles with project runoff and drains to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects consult section 1.4.3.

B.1.1 Runoff Factor

Estimate the area weighted runoff factor for the tributary area to the BMP using runoff factor (from Table B.1-1) and area of each surface type in the tributary area and the following equation:

$$C = \frac{\sum C_x A_x}{\sum A_x}$$

Where:

C_x = Runoff factor for area X

A_x = Tributary area X (acres)

These runoff factors apply to areas receiving direct rainfall only. For conditions in which runoff is routed onto a surface from an adjacent surface, see Section B.2 for determining composite runoff factors for these areas.

Table B.1-1: Runoff factors for surfaces draining to BMPs – Pollutant Control BMPs

Surface	Runoff Factor
Roofs[1]	0.90
Concrete or Asphalt[1]	0.90
Unit Pavers (grouted)[1]	0.90
Decomposed Granite	0.30
Cobbles or Crushed Aggregate	0.30
Amended, Mulched Soils or Landscape	0.10
Compacted Soil (e.g., unpaved parking)	0.30
Natural (A Soil)	0.10
Natural (B Soil)	0.14
Natural (C Soil)	0.23
Natural (D Soil)	0.30

1. Surface is considered impervious and could benefit from use of Site Design BMPs and adjustment of the runoff factor per Section B.2.1.

B.1.2 Offline BMPs

Diversion flow rates for offline BMPs shall be sized to convey the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The following hydrologic method shall be used to calculate the diversion flow rate for off-line BMPs:

$$Q = C \times i \times A$$

Where:

Q = Diversion flow rate in cubic feet per second

C = Runoff factor, area weighted estimate using Table B.1

i = Rainfall intensity of 0.2 in/hr

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects also consult Section 1.4.3.

B.1.3 85th Percentile, 24-Hour Storm Event

The 85th percentile, 24-hour isopluvial map is provided as Figure B.1-1. The rainfall depth to estimate the DCV shall be determined using Figure B.1-1. The methodology used to develop this map is presented below:

B.1.3.1 Gage data and calculation of 85th percentile

The method of calculating the 85th percentile is to produce a list of values, order them from smallest to largest, and then pick the value that is 85 percent of the way through the list. Only values that are capable of producing run off are of interest for this purpose. Lacking a legislative definition of rainfall values capable of producing runoff, Flood Control staff in San Diego County have observed that the point at which significant runoff begins is rather subjective, and is affected by land use type and soil moisture. In highly-urbanized areas, the soil has a high impermeability and runoff can begin with as little as 0.02" of rainfall. In rural areas, soil impermeability is significantly lower and even 0.30" of rain on dry soil will frequently not produce significant runoff. For this reason, San Diego County has chosen to use the more objective method of including all non-zero 24-hour rainfall totals when calculating the 85th percentile. To produce a statistically significant number, only stations with 30 years or greater of daily rainfall records are used.

B.1.3.2 Mapping the gage data

A collection of 56 precipitation gage points was developed with 85th percentile precipitation values based on multiple years of gage data. A raster surface (grid of cells with values) was interpolated from that set of points. The surface initially did not cover the County's entire jurisdiction. A total of 13 dummy points were added. Most of those were just outside the County boundary to enable the software to generate a surface that covered the entire County. A handful of points were added to enforce a plausible surface. In particular, one point was added in the desert east of Julian, to enforce a gradient from high precipitation in the mountains to low precipitation in the desert. Three points were added near the northern boundary of the County to adjust the surface to reflect the effect of elevation in areas lacking sufficient operating gages.

Several methods of interpolation were considered. The method chosen is named by Environmental Systems Research Institute as the Natural Neighbor technique. This method produces a surface that is highly empirical, with the value of the surface being a product of the values of the data points nearest each cell. It does not produce peaks or valleys of surface based on larger area trends, and is free of artifacts that appeared with other methods.

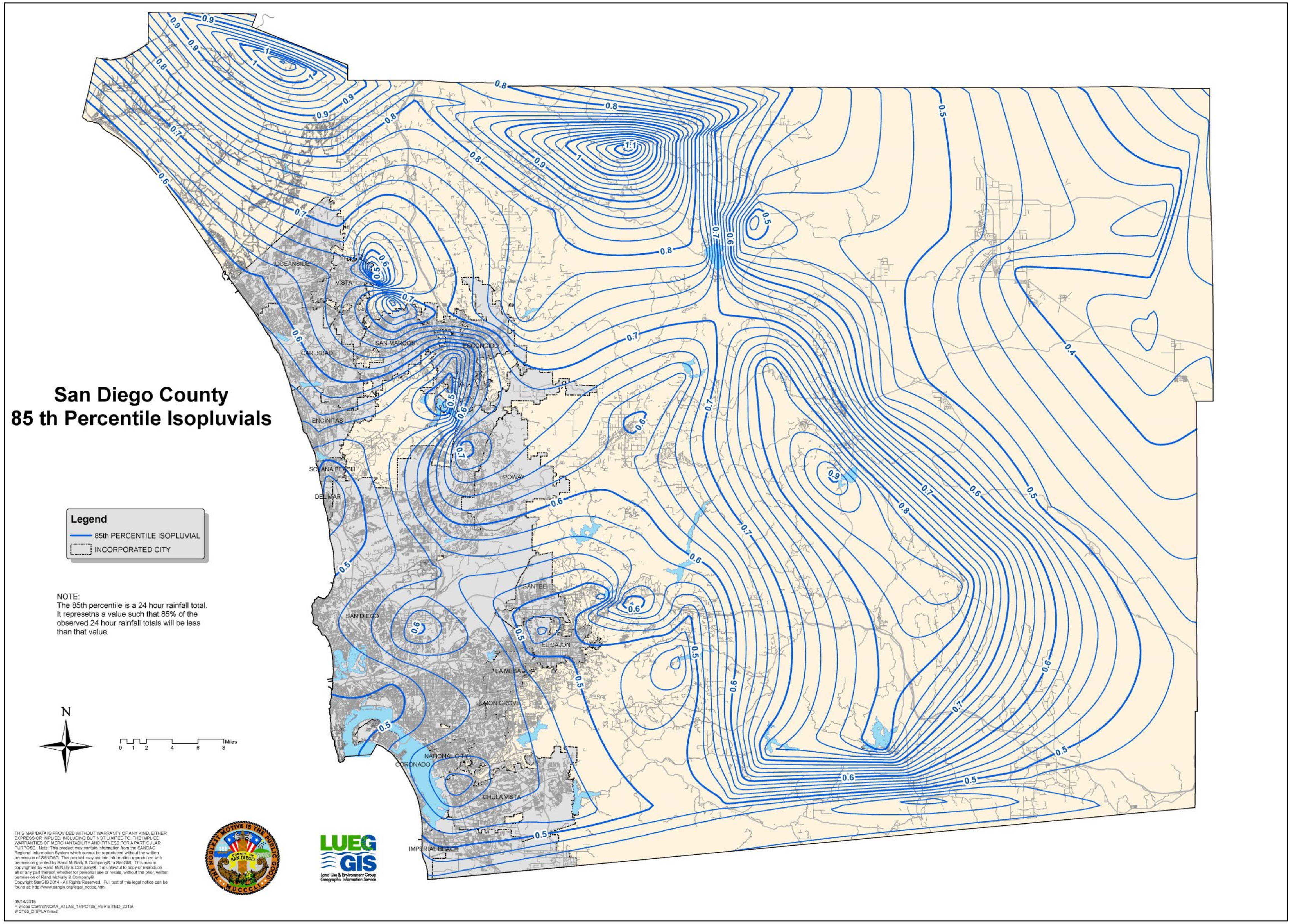


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

B.2 Adjustments to Account for Site Design BMPs

This section provides methods to adjust the DCV (for sizing pollutant control BMPs) as a result of implementing site design BMPs. The adjustments are provided by one of the following two methods:

- Adjustment to impervious runoff factor
- Adjustment to DCV

B.2.1 Adjustment to Impervious Runoff Factor

When one of the following site design BMPs is implemented the runoff factor of 0.9 for impervious surfaces identified in Table B.1-1 should be adjusted using the factors listed below and an adjusted area weighted runoff factor shall be estimated following guidance from Section B.1.1 and used to calculate the DCV.

- SD-5 Impervious area dispersion
- SD-6A Green roofs
- SD-6B Permeable pavement

B.2.1.1 Impervious area dispersion (SD-5)

Dispersion of impervious areas through pervious areas: The following adjustments are allowed to impervious runoff factors when dispersion is implemented in accordance with the SD-5 fact sheet (Appendix E). Adjustments are only credited up to a 4:1 maximum ratio of impervious to pervious areas. In order to adjust the runoff factor, the pervious area shall have a minimum width of 10 feet and a maximum slope of 5%. Based on the ratio of **impervious area to pervious area** and the hydrologic soil group of the pervious area, the adjustment factor from Table B.2-1 shall be multiplied with the unadjusted runoff factor (Table B.1-1) of the impervious area to estimate the adjusted runoff factor for sizing pollutant control BMPs. The adjustment factors in Table B.2-1 are **only** valid for impervious surfaces that have an unadjusted runoff factor of 0.9.

Table B.2-1: Impervious area adjustment factors that accounts for dispersion

Pervious area hydrologic soil group	Ratio = Impervious area/Pervious area			
	<=1	2	3	4
A	0.00	0.00	0.23	0.36
B	0.00	0.27	0.42	0.53
C	0.34	0.56	0.67	0.74
D	0.86	0.93	0.97	1.00

Continuous simulation modeling in accordance with Appendix G is required to develop adjustment factors for surfaces that have an unadjusted runoff factor less than 0.9. Approval of adjustment factors for surfaces that have an unadjusted runoff factor less than 0.9 is at the discretion of the Port.

The adjustment factors in Table B.2-1 were developed by performing continuous simulations in SWMM with default parameters from Appendix G and impervious to pervious area ratios of 1, 2, 3, and 4. When using adjustment factors from Table B.2-1:

- **Linear interpolation** shall be performed if the impervious to pervious area ratio of the site is in between one of ratios for which an adjustment factor was developed;
- Use adjustment factor for a ratio of 1 when the impervious to pervious area ratio is less than 1; and
- Adjustment factor is not allowed when the impervious to pervious area ratio is greater than 4, when the pervious area is designed as a site design BMP.

Example B.2-1: DMA is comprised of one acre of impervious area that drains to a 0.4 acre hydrologic soil group B pervious area and then the pervious area drains to a BMP. Impervious area dispersion is implemented in the DMA in accordance with SD-5 factsheet. Estimate the adjusted runoff factor for the DMA.

- Baseline Runoff Factor per Table B.1-1 = [(1*0.9+0.4*0.14)/1.4] = 0.68.
- Impervious to Pervious Ratio = 1 acre impervious area/ 0.4 acre pervious area = 2.5; since the ratio is 2.5 adjustment can be claimed.
- From Table B.2-1 the adjustment factor for hydrologic soil group B and a ratio of 2 = 0.27; ratio of 3 = 0.42.
- Linear interpolated adjustment factor for a ratio of 2.5 = 0.27 + {[(0.42 -0.27)/(3-2)]*(2.5-2)} = 0.345.
- Adjusted runoff factor for the DMA = [(1*0.9*0.345+0.4*0.14)/1.4] = 0.26.
- Note only the runoff factor for impervious area is adjusted, there is no change made to the pervious area.

B.2.1.2 Green Roofs

When green roofs are implemented in accordance with the SD-6A factsheet the green roof footprint shall be assigned a runoff factor of 0.10 for adjusted runoff factor calculations.

B.2.1.3 Permeable Pavement

When a permeable pavement is implemented in accordance with the SD-6B factsheet and it does not have an impermeable liner and has storage greater than the 85th percentile depth below the underdrain, if an underdrain is present, then the footprint of the permeable pavement shall be assigned a runoff factor of 0.10 for adjusted runoff factor calculations.

Permeable Pavement can also be designed as a structural BMP to treat run on from adjacent areas. Refer to INF-3 factsheet and Appendix B.4 for additional guidance.

B.2.2 Adjustment to DCV

When the following site design BMPs are implemented the anticipated volume reduction from these BMPs shall be deducted from the DCV to estimate the volume for which the downstream structural BMP should be sized for:

- SD-1: Street trees
- SD-8 Rain barrels

B.2.2.1 Street Trees

Street tree credit volume from tree trenches or boxes (tree BMPs) is a sum of three runoff reduction volumes provided by trees that decrease the required DCV for a tributary area. The following reduction in DCV is allowed per tree based on the mature diameter of the tree canopy, when trees are implemented in accordance with SD-1 factsheet and meet the following criteria:

- Total tree credit volume is less than 0.25DCV of the project footprint and
- Single tree credit volume is less than 400 ft^3

Credit for trees that do not meet the above criteria shall be based on the criteria for sizing the tree as a storm water pollutant control BMP in SD-1 fact sheet.

Mature Tree Canopy Diameter (ft)	Tree Credit Volume (ft^3/tree)
5	10
10	40
15	100
20	180
25	290
30	420

Basis for the reduction in DCV:

Tree credit volume was estimated based on typical characteristics of street trees as follows:

It is assumed that each tree and associated trench or box is considered a single BMP, with calculations based on the media storage volume and/or the individual tree within the tree BMP as appropriate. Tree credit volume is calculated as:

$$\boldsymbol{TCV = TIV + TCIV + TETV}$$

Where:

- *TCV* = Tree credit volume (ft^3)
- *TIV* = Total infiltration volume of all storage layers within tree BMPs (ft^3)
- *TCIV* = Total canopy interception volume of all individual trees within tree BMPs (ft^3)
- *TETV* = Total evapotranspiration volume, sums the media evapotranspiration storage within each tree BMP (ft^3)

Total infiltration volume was calculated as the total volume infiltrated within the BMP storage layers. Infiltration volume was assumed to be 20% of the total BMP storage layer volume, the available pore space in the soil volume (porosity – field capacity). Total canopy interception volume was calculated for all street trees within the tributary area as the average interception capacity for the entire mature tree total canopy projection area. Interception capacity was determined to be 0.04 inches for all street tree sizes, an average from the findings published by Breuer et al (2003) for coniferous and deciduous trees. Total evapotranspiration volume is the available evapotranspiration storage volume (field capacity – wilting point) within the BMP storage layer media. TEVT is assumed to be 10% of the minimum soil volume. The minimum soil volume as required by SD-1 fact sheet of 2 cubic feet per unit canopy projection area was assumed for estimating reduction in DCV.

B.2.2.2 Rain Barrels

Rain barrels are containers that can capture rooftop runoff and store it for future use. Credit can be taken for the full rain barrel volume when each barrel volume is smaller than 100 gallons, implemented per SD-8 fact sheet and meet the following criteria:

- Total rain barrel volume is less than 0.25 DCV and
- Landscape areas are greater than 30 percent of the project footprint.

Credit for harvest and use systems that do not meet the above criteria shall be based on the criteria in Appendix B.3 and HU-1 fact sheet.

Worksheet B.2-1. DCV

Design Capture Volume		Worksheet B-2.1		
1	85^{th} percentile 24-hr storm depth from Figure B.1-1	d=		inches
2	Area tributary to BMP (s)	A=		acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=		unitless
4	Street trees volume reduction	TCV=		cubic-feet
5	Rain barrels volume reduction	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=		cubic-feet

B.3 Harvest and Use BMPs

The purpose of this section is to provide guidance for evaluating feasibility of harvest and use BMPs, calculating harvested water demand and sizing harvest and use BMPs.

B.3.1 Planning Level Harvest and Use Feasibility

Harvest and use feasibility should be evaluated at the scale of the entire project, and not limited to a single DMA. For the purpose of initial feasibility screening, it is assumed that harvested water collected from one DMA could be used within another. Types of non-potable water demand that may apply within a project include:

- Toilet and urinal flushing
- Irrigation
- Vehicle washing
- Evaporative cooling
- Dilution water for recycled water systems
- Industrial processes
- Other non-potable uses

Worksheet B.3-1 provides a screening process for determining the preliminary feasibility for harvest and use BMPs. This worksheet should be completed for the overall project.

Worksheet B.3-1. Harvest and Use Feasibility Screening

<table>
<tr><th colspan="2">Harvest and Use Feasibility Screening</th><th>Worksksheet B.3-1</th></tr>
<tr><td colspan="3">1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?
☐ Toilet and urinal flushing
☐ Landscape irrigation
☐ Other:______________</td></tr>
<tr><td colspan="3">2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

[Provide a summary of calculations here]</td></tr>
<tr><td colspan="3">3. Calculate the DCV using worksheet B-2.1.

[Provide a results here]</td></tr>
<tr><td>3a. Is the 36-hour demand greater than or equal to the DCV?
Yes / No ⇨
⇩</td><td>3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV?
Yes / No ⇨
⇩</td><td>3c. Is the 36-hour demand less than 0.25DCV?
Yes
⇩</td></tr>
<tr><td>Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.</td><td>Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.</td><td>Harvest and use is considered to be infeasible.</td></tr>
</table>

B.3.2 Harvested Water Demand Calculation

The following sections provide technical references and guidance for estimating the harvested water demand of a project. These references are intended to be used for the planning phase of a project for feasibility screening purposes.

B.3.2.1 Toilet and Urinal Flushing Demand Calculations

The following guidelines should be followed for computing harvested water demand from toilet and urinal flushing:

- If reclaimed water is planned for use for toilet and urinal flushing, then the demand for harvested storm water is equivalent to the total demand minus the reclaimed water supplied, and should be reduced by the amount of reclaimed water that is available during the wet season.
- Demand calculations for toilet and urinal flushing should be based on the average rate of use during the wet season for a typical year.
- Demand calculations should include changes in occupancy over weekends and around holidays and changes in attendance/enrollment over school vacation periods.
- For facilities with generally high demand, but periodic shut downs (e.g., for vacations, maintenance, or other reasons), a project specific analysis should be conducted to determine whether the long term storm water capture performance of the system can be maintained despite shut downs.
- Such an analysis should consider the statistical distributions of precipitation and demand, most importantly the relationship of demand to the wet seasons of the year.

Table B.3-1 provides planning level demand estimates for toilet and urinal flushing per resident, or employee, for a variety of project types. The per capita use per day is based on daily employee or resident usage. For non-residential types of development, the "visitor factor" and "student factor" (for schools) should be multiplied by the employee use to account for toilet and urinal usage for non-employees using facilities.

Table B.3-1. Toilet and Urinal Water Usage per Resident or Employee

Land Use Type	Toilet User Unit of Normalization	Per Capita Use per Day		Visitor Factor[4]	Water Efficiency Factor	Total Use per Resident or Employee
		Toilet Flushing[1, 2]	Urinals[3]			
Residential	Resident	18.5	NA	NA	0.5	9.3
Office	Employee (non-visitor)	9.0	2.27	1.1	0.5	7 (avg)
Retail	Employee (non-visitor)	9.0	2.11	1.4	0.5	
Schools	Employee (non-student)	6.7	3.5	6.4	0.5	33
Various Industrial Uses (excludes process water)	Employee (non-visitor)	9.0	2	1	0.5	5.5

1- Based on American Waterworks Association Research Foundation,1999. Residential End Uses of Water. Denver, CO: AWWARF
2 - Based on use of 3.45 gallons per flush and average number of per employee flushes per subsector, Table D-1 for MWD (Pacific Institute, 2003)
3 - Based on use of 1.6 gallons per flush, Table D-4 and average number of per employee flushes per subsector, Appendix D (Pacific Institute, 2003)
4 - Multiplied by the demand for toilet and urinal flushing for the project to account for visitors. Based on proportion of annual use allocated to visitors and others (includes students for schools; about 5 students per employee) for each subsector in Table D-1 and D-4 (Pacific Institute, 2003)
5 – Accounts for requirements to use ultra low flush toilets in new development projects; assumed that requirements will reduce toilet and urinal flushing demand by half on average compared to literature estimates. Ultra low flush toilets are required in all new construction in California as of January 1, 1992. Ultra low flush toilets must use no more than 1.6 gallons per flush and Ultra low flush urinals must use no more than 1 gallon per flush. Note: If zero flush urinals are being used, adjust accordingly.

B.3.2.2 General Requirements for Irrigation Demand Calculations

The following guidelines should be followed for computing harvested water demand from landscape irrigation:

- If reclaimed water is planned for use for landscape irrigation, then the demand for harvested storm water should be reduced by the amount of reclaimed water that is available during the wet season.
- Irrigation rates should be based on the irrigation demand exerted by the types of landscaping that are proposed for the project, with consideration for water conservation requirements.
- Irrigation rates should be estimated to reflect the average wet season rates (defined as October through April) accounting for the effect of storm events in offsetting harvested water demand. In the absence of a detailed demand study, it should be assumed that irrigation demand is not present during days with greater than 0.1 inches of rain and the subsequent 3-day period. This irrigation shutdown period is consistent with standard practice in land application of wastewater and is applicable to storm water to prevent irrigation from resulting in dry weather

runoff. Based on a statistical analysis of San Diego County rainfall patterns, approximately 30 percent of wet season days would not have a demand for irrigation.

- If land application of storm water is proposed (irrigation in excess of agronomic demand), then this BMP must be considered to be an infiltration BMP and feasibility screening for infiltration must be conducted. In addition, it must be demonstrated that land application would not result in greater quantities of runoff as a result of saturated soils at the beginning of storm events. Agronomic demand refers to the rate at which plants use water.

The following sections describe methods that should be used to calculate harvested water irrigation demand. While these methods are simplified, they provide a reasonable estimate of potential harvested water demand that is appropriate for feasibility analysis and project planning. These methods may be replaced by a more rigorous project-specific analysis that meets the intent of the criteria above.

B.3.2.2.1 Demand Calculation Method

This method is based on the San Diego Municipal Code Land Development Code Landscape Standards Appendix E which includes a formula for estimating a project's annual estimated total water use based on reference evaporation, plant factor, and irrigation efficiency.

For the purpose of calculating harvested water irrigation demand applicable to the sizing of harvest and use systems, the estimated total water use has been modified to reflect typical wet-season irrigation demand. This method assumes that the wet season is defined as October through April. This method further assumes that no irrigation water will be applied during days with precipitation totals greater than 0.1 inches or within the 3 days following such an event. Based on these assumptions and an analysis of Lake Wohlford, Lindbergh and Oceanside precipitation patterns, irrigation would not be applied during approximately 30 percent of days from October through April.

The following equation is used to calculate the Modified Estimated Total Water Usage:

$$\text{Modified ETWU} = ETo_{Wet} \times [[\Sigma(PF \text{ x } HA)/IE] + SLA] \text{ x } 0.015$$

Where:

Modified ETWU = Estimated daily average water usage during wet season
ETo_{Wet} = Average reference evapotranspiration from October through April (use 2.8 inches per month, using CIMS Zone 4 from Table G.1-1)
PF = Plant Factor

Table B.3-2. Planning Level Plant Factor Recommendations

Plant Water Use	Plant Factor	Also Includes
Low	< 0.1 – 0.2	Artificial Turf
Moderate	0.3 – 0.7	
High	0.8 and greater	Water features
Special Landscape Area	1.0	

HA = Hydrozone Area (sq-ft); A section or zone of the landscaped area having plants with similar water needs.
Σ(PF x HA) = The sum of PF x HA for each individual Hydrozone (accounts for different landscaping zones).
IE = Irrigation Efficiency (assume 90 percent for demand calculations)
SLA = Special Landscape Area (sq-ft); Areas used for active and passive recreation areas, areas solely dedicated to the production of fruits and vegetables, and areas irrigated with reclaimed water.

In this equation, the coefficient (0.015) accounts for unit conversions and shut down of irrigation during and for the three days following a significant precipitation event:

0.015 = (1 mo/30 days)×(1 ft/12 in)×(7.48 gal/cu-ft)×(approximately 7 out of 10 days with irrigation demand from October through April)

B.3.2.2.2 Planning Level Irrigation Demands

To simplify the planning process, the method described above has been used to develop daily average wet season demands for a one-acre irrigated area based on the plant/landscape type. These demand estimates can be used to calculate the drawdown of harvest and use systems for the purpose of LID BMP sizing calculations.

Table B.3-3. Planning Level Irrigation Demand by Plant Factor and Landscape Type

General Landscape Type	36-Hour Planning Level Irrigation Demand (gallons per irrigated acre per 36 hour period)
Hydrozone – Low Plant Water Use	390
Hydrozone – Moderate Plant Water Use	1,470
Hydrozone – High Plant Water Use	2,640
Special Landscape Area	2,640

B.3.2.3 Calculating Other Harvested Water Demands

Calculations of other harvested water demands should be based on the knowledge of land uses, industrial processes, and other factors that are project-specific. Demand should be calculated based on the following guidelines:

- Demand calculations should represent actual demand that is anticipated during the wet season (October through April).
- Sources of demand should only be included if they are reliably and consistently present during the wet season.
- Where demands are substantial but irregular, a more detailed analysis should be conducted based on a statistical analysis of anticipated demand and precipitation patterns.

B.3.3 Sizing Harvest and Use BMPs

Sizing calculations shall demonstrate that one of two equivalent performance standards is met:

1. Harvest and use BMPs are sized to drain the tank in 36 hours following the end of rainfall. The size of the BMP is dependent on the demand (Section B.3.2) at the site.
2. Harvest and use BMP is designed to capture at least 80 percent of average annual (long term) runoff volume.

It is rare cisterns can be sized to capture the full DCV and use this volume in 36 hours. So when using Worksheet B.3-1 if it is determined that harvest and use BMP is feasible then the BMP should be sized to the estimated 36-hour demand.

B.4 Infiltration BMPs

Sizing calculations shall demonstrate that one of two equivalent performance standards is met:

1. The BMP or series of BMPs captures the DCV and infiltrates this volume fully within 36 hours following the end of precipitation. This can be demonstrated through the Simple Method (Section B.4.1).

2. The BMP or series of BMPs infiltrates at least 80 percent of average annual (long term) runoff volume. This can be demonstrated using the percent capture method (Section B.4.2), through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in Appendix G, as acceptable to the Port. This method is **not** applicable for sizing biofiltration BMPs.

The methods to show compliance with these standards are provided in the following sections.

B.4.1 Simple Method

Stepwise Instructions:

1. Compute DCV using Worksheet B.4-1
2. Estimate design infiltration rate using Worksheet D.5-1
3. Design BMP(s) to ensure that the DCV is fully retained (i.e., no surface discharge during the design event) and the stored effective depth draws down in no longer than 36 hours.

Worksheet B.4-1: Simple Sizing Method for Infiltration BMPs

	Simple Sizing Method for Infiltration BMPs	Worksheet B.4-1		
1	DCV (Worksheet B-2.1)	DCV=		cubic-feet
2	Estimated design infiltration rate (Worksheet D.5-1)	K_{design}=		in/hr
3	Available BMP surface area	A_{BMP}=		sq-ft
4	Average effective depth in the BMP footprint (DCV/A_{BMP})	D_{avg}=		feet
5	Drawdown time, T (D_{avg} *12/K_{design})	T=		hours
6	Provide alternative calculation of drawdown time, if needed.			

Notes:

- Drawdown time must be less than 36 hours. This criterion was set to achieve average annual capture of 80% to account for back to back storms (See rationale in Section B.4.3). In order to use a different drawdown time, BMPs should be sized using the percent capture method (Section B.4.2).
- The average effective depth calculation should account for any aggregate/media in the BMP. For example, 4 feet of stone at a porosity of 0.4 would equate to 1.6 feet of effective depth.
- This method may overestimate drawdown time for BMPs that drain through both the bottom and walls of the system. BMP specific calculations of drawdown time may be provided that account for BMP-specific geometry.

B.4.2 Percent Capture Method

This section describes the recommended method of sizing volume-based BMPs to achieve the 80 percent capture performance criterion. This method has a number of potential applications for sizing BMPs, including:

- Use this method when a BMP can draw down in less than 36 hours and it is desired to demonstrate that 80 percent capture can be achieved using a BMP volume smaller than the DCV.
- Use this method to determine how much volume (greater than the DCV) must be provided to achieve 80 percent capture when the drawdown time of the BMP exceeds 36 hours.
- Use this method to determine how much volume should be provided to achieve 80 percent capture when upstream BMP(s) have achieved some capture, but have not achieved 80 percent capture.

By nature, the percent capture method is an iterative process that requires some initial assumptions about BMP design parameters and subsequent confirmation that these assumptions are valid. For example, sizing calculations depend on the assumed drawdown time, which depends on BMP depth, which may in turn need to be adjusted to provide the required volume within the allowable footprint. In general, the selection of reasonable BMP design parameters in the first iteration will result in minimal required additional iterations. Figure B.4-1 presents the nomograph for use in sizing retention BMPs in San Diego County.

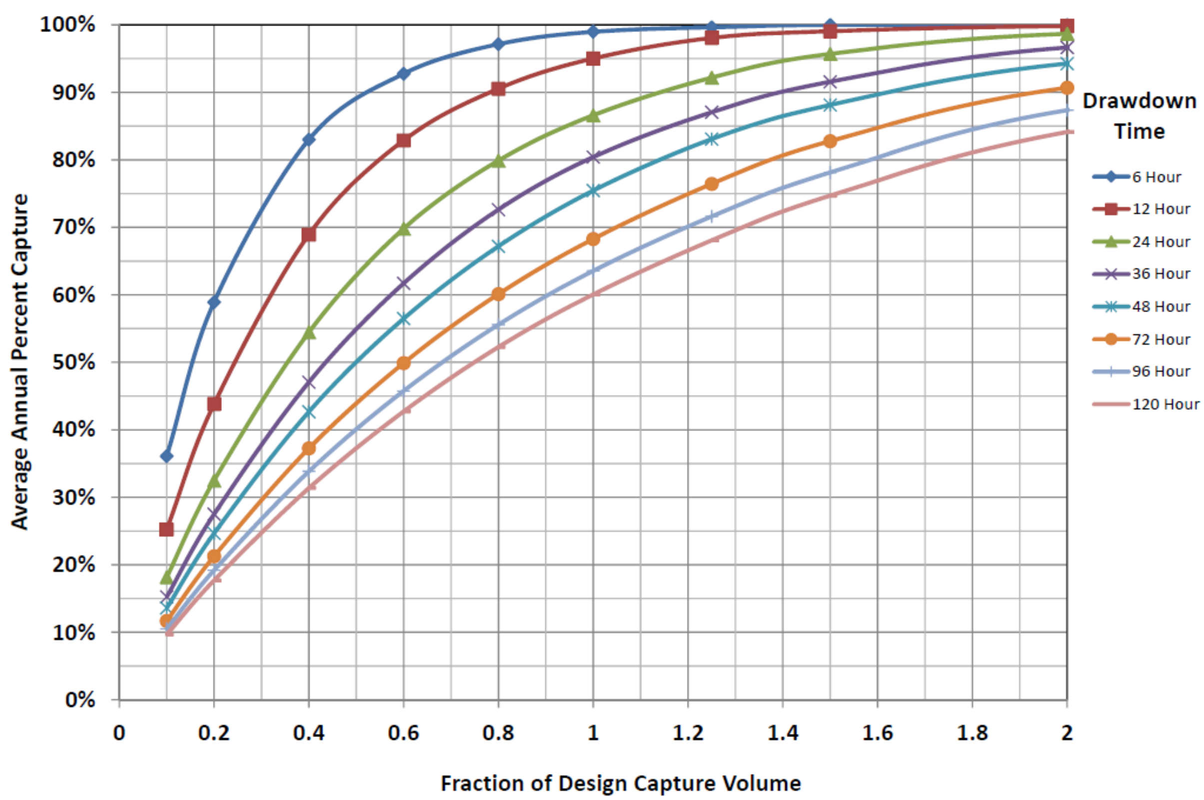


Figure B.4-1: Percent Capture Nomograph

B.4.2.1 Stepwise Instructions for sizing a single BMP:

1. Estimate the drawdown time of the proposed BMP by estimating the design infiltration rate (Worksheet D.5-1) and accounting for BMP dimensions/geometry. See the applicable BMP Fact Sheet for specific guidance on how to convert BMP geometry to estimated drawdown time.
2. Using the estimated drawdown time and the nomograph from Figure B.4-1 locate where the line corresponding to the estimated drawdown time intersects with 80 percent capture. Pivot to the X axis and read the fraction of the DCV that needs to be provided in the BMP to achieve this level of capture.
3. Calculate the DCV using Worksheet B.2-1.
4. Multiply the result of Step 2 by the DCV (Step 3). This is the required BMP design volume.
5. Design the BMP to retain the required volume, and confirm that the drawdown time is no more than 25 percent greater than estimated in Step 1. If the computed drawdown time is greater than 125 percent of the estimated drawdown, then return to Step 1 and revise the initial drawdown time assumption.

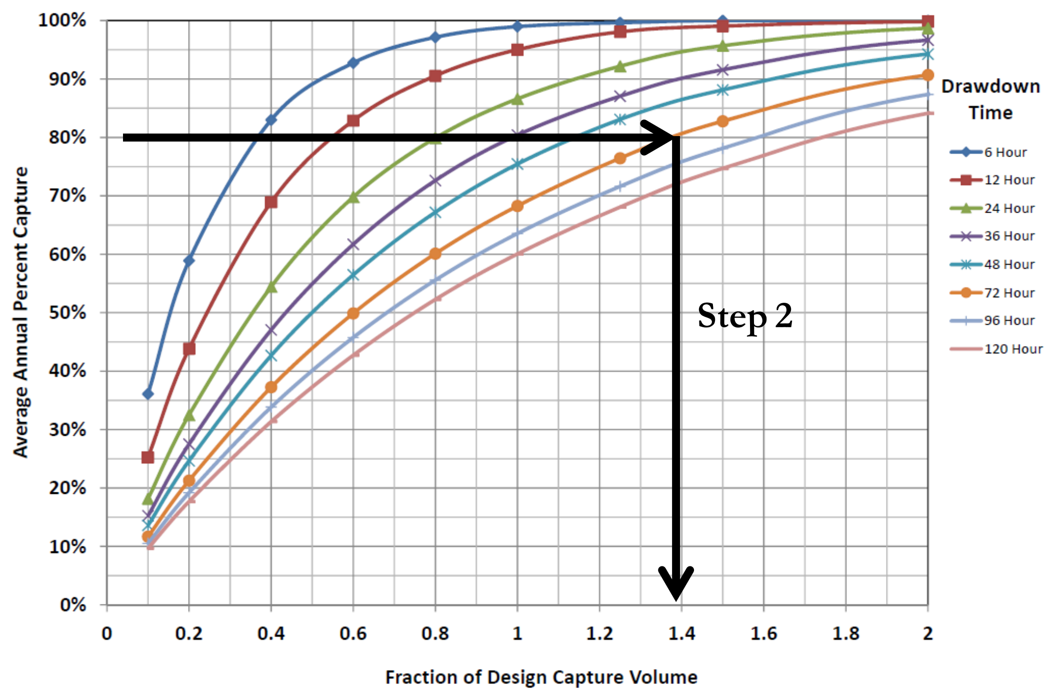
See the respective BMP facts sheets for BMP-specific instructions for the calculation of volume and drawdown time. The above method can also be used to size and/or evaluate the performance of other retention BMPs (evapotranspiration, harvest and use) that have a drawdown rate that can be approximated as constant throughout the year or over the wet season. In order to use this method for other retention BMPs, drawdown time in Step 1 will need to be evaluated using an applicable method for the type of BMP selected. After completing Step 1 continue to Step 2 listed above.

Example B.4.2.1 Percent Capture Method for Sizing a Single BMP:

Given:
• Estimated drawdown time: 72 Hours • DCV: 3000 ft^3
Required:
• Determine the volume required to achieve 80 percent capture.
Solution:
1. Estimated drawdown time = 72 Hours 2. Fraction of DCV required = 1.35 3. DCV = 3000 ft^3 (Given for this example; To be estimated using Worksheet B.2-1) 4. Required BMP volume = 1.35 x 3000 = 4050 ft^3 5. Design BMP and confirm drawdown Time is $\leq$ 90 Hours (72 Hours +25%)

Example B.4.2.1 Continued:

Graphical Operations Supporting Solution:



Percent Capture Nomograph

B.4.2.2 Stepwise Instructions for sizing BMPs in series:

For projects where BMPs in series have to be implemented to meet the performance standard the following stepwise procedure shall be used to size the downstream BMP to achieve the 80 percent capture performance criterion:

1. Using the upstream BMP parameters (volume and drawdown time) estimate the average annual capture efficiency achieved by the upstream BMP using the nomograph.
2. Estimate the drawdown time of the proposed downstream BMP by estimating the design infiltration rate (Worksheet D.5-1) and accounting for BMP dimensions/geometry. See the applicable BMP Fact Sheet for specific guidance on how to convert BMP geometry to estimated drawdown time. Use the nomograph and locate where the line corresponding to the estimated drawdown time intersects with 80 percent capture. Pivot to the horizontal axis and read the fraction of the DCV that needs to be provided in the BMP. This is referred to as X_1.
3. Trace a horizontal line on the nomograph using the capture efficiency of the upstream BMP estimated in Step 1. Find where the line traced intersects with the drawdown time of the downstream BMP (Step 2). Pivot and read down to the horizontal axis to yield the fraction of the DCV already provided by the upstream BMP. This is referred to as X_2.

4. Subtract X_2 (Step 3) from X_1 (Step 2) to determine the fraction of the design volume that must be provided in the downstream BMP to achieve 80 percent capture to meet the performance standard.
5. Multiply the result of Step 4 by the DCV. This is the required downstream BMP design volume.
6. Design the BMP to retain the required volume, and confirm that the drawdown time is no more than 25 percent greater than estimated in Step 2. If the computed drawdown time is greater than 125 percent of the estimated drawdown, then return to Step 2 and revise the initial drawdown time assumption.

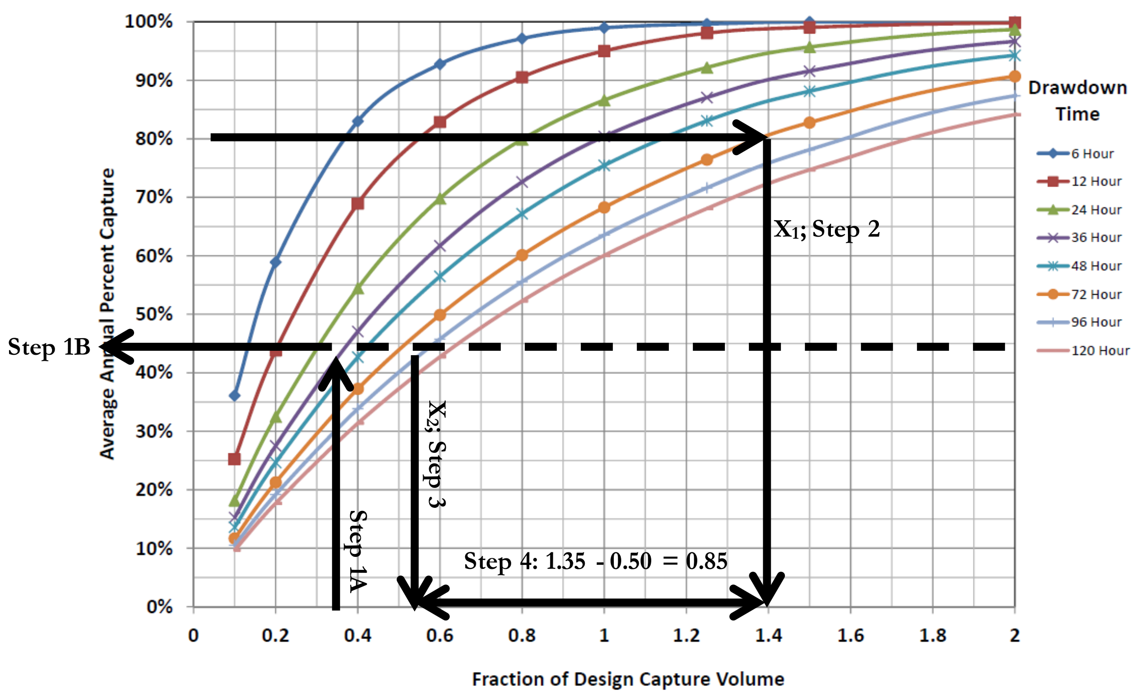
See the respective BMP facts sheets for BMP-specific instructions for the calculation of volume and drawdown time.

Example B.4.2.2 Percent Capture Method for Sizing BMPs in Series:

Given:
• Estimated drawdown time for downstream BMP: 72 Hours • DCV for the area draining to the BMP: 3000 ft^3 • Upstream BMP volume: 900 ft^3 • Upstream BMP drawdown time: 24 Hours
Required:
• Determine the volume required in the downstream BMP to achieve 80 percent capture.
Solution:
1. Step 1A: Upstream BMP Capture Ratio = 900/3000 = 0.3; Step 1B: Average annual capture efficiency achieved by upstream BMP = 44% 2. Downstream BMP drawdown = 72 hours; Fraction of DCV required to achieve 80% capture = 1.35 3. Locate intersection of design capture efficiency and drawdown time for upstream BMP (See Graph); Fraction of DCV already provided (X_2) = 0.50 (See Graph) 4. Fraction of DCV Required by downstream BMP = 1.35-0.50 = 0.85 5. DCV (given) = 3000 ft^3 ; Required downstream BMP volume = 3000 ft^3 x 0.85 = 2,550 ft^3 6. Design BMP and confirm drawdown Time is $\leq$ 90 Hours (72 Hours +25%)

Example B.4.2.2 Continued:

Graphical Operations Supporting Solution:



Percent Capture Nomograph

B.4.3 Technical Basis for Equivalent Sizing Methods

Storm water BMPs can be conceptualized as having a storage volume and a treatment rate, in various proportions. Both are important in the long-term performance of the BMP under a range of actual storm patterns, depths, and inter-event times. Long-term performance is measured by the operation of a BMP over the course of multiple years, and provides a more complete metric than the performance of a BMP during a single event, which does not take into account antecedent conditions, including multiple storms arriving in short timeframes. A BMP that draws down more quickly would be expected to capture a greater fraction of overall runoff (i.e., long-term runoff) than an identically sized BMP that draws down more slowly. This is because storage is made available more quickly, so subsequent storms are more likely to be captured by the BMP. In contrast a BMP with a long drawdown time would stay mostly full, after initial filling, during periods of sequential storms. The volume in the BMP that draws down more quickly is more "valuable" in terms of long term performance than the volume in the one that draws down more slowly. The MS4 permit definition of the DCV does not specify a drawdown time, therefore the definition is not a complete indicator of a

BMP's level of performance. An accompanying performance-based expression of the BMP sizing standard is essential to ensure uniformity of performance across a broad range of BMPs and helps prevents BMP designs from being used that would not be effective.

An evaluation of the relationships between BMP design parameters and expected long term capture efficiency has been conducted to address the needs identified above. Relationships have been developed through a simplified continuous simulation analysis of precipitation, runoff, and routing, that relate BMP design volume and storage recovery rate (i.e., drawdown time) to an estimated long term level of performance using United States Environmental Protection Agency (USEPA) SWMM and parameters listed in Appendix G for Lake Wohlford, Lindbergh, and Oceanside rain gages. Comparison of the relationships developed using the three gages indicated that the differences in relative capture estimates are within the uncertainties in factors used to develop the relationships. For example, the estimated average annual capture for the BMP sized for the DCV and 36 hour drawdown using Lake Wohlford, Lindbergh, and Oceanside are 80%, 76% and 83% respectively. In an effort to reduce the number of curves that are made available, relationships developed using Lake Wohlford are included in this manual for use in the whole San Diego County region.

Figure B.4-1 demonstrated that a BMP sized for the runoff volume from the 85th percentile, 24-hour storm event (i.e., the DCV), which draws down in 36 hours is capable of managing approximately 80 percent of the average annual. There is long precedent for 80 percent capture of average annual runoff as approximately the point at which larger BMPs provide decreasing capture efficiency benefit (also known as the "knee of the curve") for BMP sizing. The characteristic shape of the plot of capture efficiency versus storage volume in Figure B.4-1 illustrates this concept.

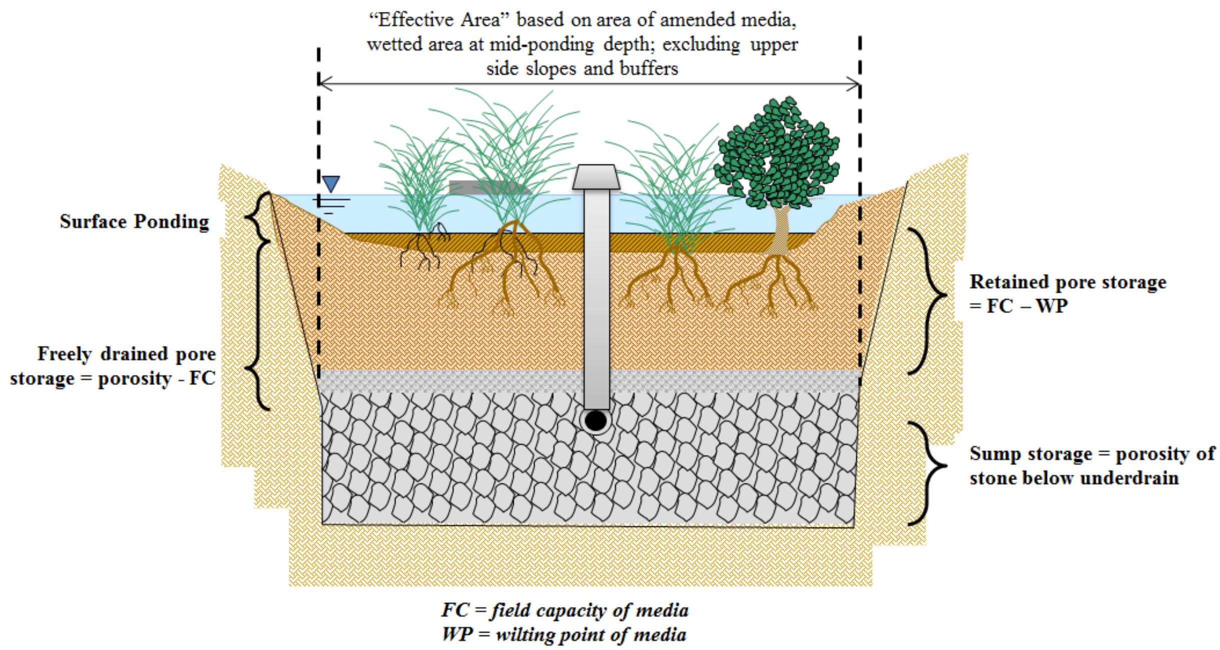
As such, this equivalency (between DCV draw down in 36-hours and 80 percent capture) has been utilized to provide a common currency between volume-based BMPs with a wide range of drawdown rates. This approach allows flexibility in the design of BMPs while ensuring consistent performance.

B.5 Biofiltration BMPs

Biofiltration BMPs shall be sized by one of the following sizing methods:

Option 1: Treat 1.5 times the portion of the DCV not reliably retained onsite, OR

Option 2: Treat 1.0 times the portion of the DCV not reliably retained onsite; and additionally check that the system has a total static (i.e., non-routed) storage volume, including pore spaces and pre-filter detention volume, equal to at least 0.75 times the portion of the DCV not reliably retained onsite.



Explanation of Biofiltration Volume Compartments for Sizing Purposes

Worksheet B.5-1 provides a simple sizing method for sizing biofiltration BMP with partial retention and biofiltration BMP.

When using sizing option 1 a routing period of 6 hours is allowed. The routing period was estimated based on 50th percentile storm duration for storms similar to 85th percentile rainfall depth. It was estimated based on inspection of continuous rainfall data from Lake Wohlford, Lindbergh and Oceanside rain gages.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs		cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible		in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]		inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]		inches
7	Assumed surface area of the biofiltration BMP		sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7		cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]		cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]		inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations		inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area		inches
14	Media available pore space	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]		inches
19	Total Depth Treated [Line 17 + Line 18]		inches

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]		cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12		sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]		cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12		sq-ft
Footprint of the BMP			
24	Area draining to the BMP		sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)		
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)		unitless
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]		sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)		sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of the DCV retained by the BMP [Line 9/ Line 1]		unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV > 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the Port, if it meets the requirements in Appendix F.

B.5.1 Basis for Minimum Sizing Factor for Biofiltration BMPs

B.5.1.1 Introduction

MS4 Permit Provision E.3.c.(1)(a)(i)

The MS4 Permit describes conceptual performance goals for biofiltration BMPs and specifies numeric criteria for sizing biofiltration BMPs (See Section 2.2.1 of this Manual).

However, the MS4 Permit does not define a specific footprint sizing factor or design profile that must be provided for the BMP to be considered "biofiltration." Rather, the MS4 Permit specifies (Footnote 25):

> **As part of the Copermittee's update to its BMP Design Manual, pursuant to Provision E.3.d, the Copermittee must provide guidance for hydraulic loading rates and other biofiltration design criteria necessary to maximize storm water retention and pollutant removal.**

To meet this provision, this manual includes specific criteria for design of biofiltration BMPs. Among other criteria, a minimum footprint sizing factor of 3 percent (BMP footprint area as percent of contributing area times adjusted runoff factor) is specified. The purpose of this section is to provide the technical rationale for this 3 percent minimum sizing factor.

B.5.1.2 Conceptual Need for Minimum Sizing Factor

Under the 2011 Model SUSMP, a sizing factor of 4 percent was used for sizing biofiltration BMPs. This value was derived based on the goal of treating the runoff from a 0.2 inch per hour uniform precipitation intensity at a constant media flow rate of 5 inches per hour. While this method was simple, it was considered to be conservative as it did not account for significant transient storage present in biofiltration BMPs (i.e., volume in surface storage and subsurface storage that would need to fill before overflow occurred). Under this manual, biofiltration BMPs will typically provide subsurface storage to promote infiltration losses; therefore typical BMP profiles will tend to be somewhat deeper than those provided under the 2011 Model SUSMP. A deeper profile will tend to provide more transient storage and allow smaller footprint sizing factors while still providing similar or better treatment capacity and pollutant removal. Therefore a reduction in the minimum sizing factor from the factor used in the 2011 Model SUSMP is supportable. However, as footprint decreases, issues related to potential performance, operations, and/or maintenance can increase for a number of reasons:

1) As the surface area of the media bed decreases, the sediment loading per unit area increases, increasing the risk of clogging. While vigorous plant growth can help maintain permeability

of soil, there is a conceptual limit above which plants may not be able to mitigate for the sediment loading. Scientific knowledge is not conclusive in this area.

2) With smaller surface areas and greater potential for clogging, water may be more likely to bypass the system via overflow before filling up the profile of the BMP.
3) As the footprint of the system decreases, the amount of water that can be infiltrated from subsurface storage layers and evapotranspire from plants and soils tends to decrease.
4) With smaller sizing factors, the hydraulic loading per unit area increases, potentially reducing the average contact time of water in the soil media and diminishing treatment performance.

The MS4 Permit requires that volume and pollutant retention be maximized. Therefore, a minimum sizing factor was determined to be needed. This minimum sizing factor does not replace the need to conduct sizing calculations as described in this manual; rather it establishes a lower limit on required size of biofiltration BMPs as the last step in these calculations. Additionally, it does not apply to alternative biofiltration designs that utilize the checklist in Appendix F (Biofiltration Standard and Checklist). Acceptable alternative designs (such as proprietary systems meeting Appendix F criteria) typically include design features intended to allow acceptable performance with a smaller footprint and have undergone field scale testing to evaluate performance and required O&M frequency.

B.5.1.3 Lines of Evidence to Select Minimum Sizing Factor

Three primary lines of evidence were used to select the minimum sizing factor of 3 percent (BMP footprint area as percent of contributing area times adjusted runoff factor) in this manual:

1. Typical design calculations.
2. Volume reduction performance.
3. Sediment clogging calculations.

These lines of evidence and associated findings are explained below.

Typical Design Calculations

A range of BMP profiles were evaluated for different design rainfall depths and soil conditions. Worksheet B.5-1 was used for each case to compute the required footprint sizing factor. For these calculations, the amount of water filtered during the storm event was determined based on a media filtration rate of 5 inches per hour and a routing time of 6 hours. These input assumptions are considered to be well-supported and consistent with the intent of the MS4 Permit. These calculations generally yielded footprint factors between 1.5 and 4.9 percent. In the interest of establishing a uniform County-wide minimum sizing factor, a 3 percent sizing factor was selected from this range, consistent with other lines of evidence.

Volume Reduction Performance

Consistent with guidance in Fact Sheet PR-1, the amount of retention storage (in gravel sump below underdrain) that would drain in 36 hours was calculated for a range of soil types. This was used to estimate the volume reduction that would be expected to be achieved. For a sizing factor of 3 percent and a soil filtration rate of 0.20 inches per hour, the average annual volume reduction was estimated to be approximately 40 percent (via percent capture method; see Appendix B.4.2).

In describing the basis for equivalency between retention and biofiltration (1.5 multiplier), the MS4 Permit Fact Sheet referred to analysis prepared in the Ventura County Technical Guidance Manual. The Ventura County analysis considered the pollutant treatment as well as the volume reduction provided by biofiltration in considering equivalency to retention. This analysis assumed an average long term volume reduction of 40 percent based on analysis of data from the International Stormwater BMP Database. The calculations of estimated volume reduction at a 3 percent sizing factor is (previous paragraph) consistent with this value. While estimated volume reduction is sensitive to site-specific factors, this analysis suggests that a sizing factor of approximately 3 percent provides levels of volume reduction that are reasonably consistent with the intent of the MS4 Permit.

Sediment Clogging Calculations

As sediment accumulates in a filter, the permeability of the filter tends to decline. The lifespan of the filter bed can be estimated by determining the rate of sediment loading per unit area of the filter bed. To determine the media bed surface area sizing factor needed to provide a target lifespan, simple sediment loading calculations were conducted based on typical urban conditions. The inputs and results of this calculation are summarized in Table B.5-1.

Table B.5-1: Inputs and Results of Clogging Calculation

Parameter	Value	Source
Representative TSS Event Mean Concentration, mg/L	100	Approximate average of San Diego Land Use Event Mean Concentrations from San Diego River and San Luis Rey River WQIP
Runoff Coefficient of Impervious Surface	0.90	Table B.1-1
Runoff Coefficient of Pervious Surface	0.10	Table B.1-1 for landscape areas
Imperviousness	40% to 90%	Planning level assumption, covers typical range of single family to commercial land uses
Average Annual Precipitation, inches	11 to 13	Typical range for much of urbanized San Diego County
Load to Initial Maintenance, kg/m^2	10	Pitt, R. and S. Clark, 2010. Evaluation of Biofiltration Media for Engineered Natural Treatment Systems.
Allowable period to initial clogging, yr	10	Planning-level assumption
Estimated BMP Footprint Needed for 10-Year Design Life	2.8 to 3.3%	Calculated

This analysis suggests that a 3 percent sizing factor, coupled with sediment source controls and careful system design, should provide reasonable protection against premature clogging. However, there is substantial uncertainty in sediment loading and the actual load to clog that will be observed under field conditions in the San Diego climate. Additionally this analysis did not account for the effect of plants on maintaining soil permeability. Therefore this line of evidence should be considered provisional, subject to refinement based on field scale experience. As field scale experience is gained about the lifespan of biofiltration BMPs in San Diego and the mitigating effects of plants on long term clogging, it may be possible to justify lower factors of safety and therefore smaller design sizes in some cases. If a longer lifespan is desired and/or greater sediment load is expected, then a larger sizing factor may be justified.

B.5.1.4 Discussion

Generally, the purpose of a minimum sizing factor is to help improve the performance and reliability of standard biofiltration systems and limit the use of sizing methods and assumptions that may lead to designs that are less consistent with the intent of the MS4 Permit.

Ultimately, this factor is a surrogate for a variety of design considerations, including clogging and associated hydraulic capacity, volume reduction potential, and treatment contact time. A prudent design approach should consider each of these factors on a project-specific basis and identify whether site conditions warrant a larger or smaller factor. For example a system treating only rooftop runoff in an area without any allowable infiltration may have negligible clogging risk and negligible volume reduction potential – a smaller sizing factor may not substantially reduce performance in either of these areas. Alternatively, for a site with high sediment load and limited pre-treatment potential, a larger sizing factor may be warranted to help mitigate potential clogging risks. The Port has discretion to accept alternative sizing factor(s) based on project-specific or jurisdiction-specific considerations. Additionally, the recommended minimum sizing factor may change over time as more experience with biofiltration is obtained.

The worksheet B.5-2 below shall be used to support a request for an alternative minimum footprint sizing factor. Based on a review of the submitted worksheet and supporting documentation, the use of a smaller footprint sizing factor may be approved at the discretion of the Port. If approved, the estimated footprint from the worksheet below can be used in line 26 of worksheet B.5-1 in lieu of the 3 percent minimum footprint value.

This worksheet includes the following general steps to calculate the minimum footprint sizing factor:

- Select a "load to clog" that is representative of the type of BMP proposed
- Select a target life span (i.e., frequency of major maintenance) that is acceptable to the Port. A default value of 10 years is recommended.
- Compile information about the DMA from other parts of the SWQMP development process.
- Determine the event mean concentration (EMC) of TSS that is appropriate for the DMA
- Perform calculations to determine the minimum footprint to provide the target lifespan.

Worksheet B.5-2: Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor		Worksheet B.5-2 (Page 1 of 2)	
1	Area draining to the BMP		sq-ft
2	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)		
3	Load to Clog[1] (See Table B.5-2 for guidance; L_c)	2.0	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)	10	years

Volume Weighted EMC Calculation

Land Use	Fraction of Total DCV	TSS EMC (mg/L)	Product
Single Family Residential		123	
Commercial		128	
Industrial		125	
Education (Municipal)		132	
Transportation		78	
Multi-family Residential		40	
Roof Runoff		14	
Low Traffic Areas		50	
Open Space		216	
Other, specify:			
Other, specify:			
Other, specify:			

5	Volume Weighted EMC (sum of all products)		mg/L

BMP Parameters

6	If pretreatment measures are included in the design, apply an adjustment of 25%[2] [Line 5 x (1-0.25)]		mg/L
7	Average Annual Precipitation		inches
8	Calculate the Average Annual Runoff (Line 7 x 43,560/12) x Line2	1	cu-ft/yr
9	Calculate the Average Annual TSS Load (Line 8 x 62.4 x Line 6)/10^6		lb/yr
10	Calculate the BMP Footprint Needed (Line 9 x Line 4)/Line 3		sq-ft
11	Calculate the Alternative Minimum Footprint Sizing Factor [Line 10/ (Line 1 x Line 2)]		

[1] Load to clog value should be in the range of 2 – 5 lb/sq-ft per Pitt and Clark (2010). If selecting a value other than 2, a justification for the value selected is required. See guidance in Table B.5-2.

[2] A value of 25 percent is supported by Maniquiz-Redillas et al. (2014) study, which found a pretreatment sediment capture range of 15% - 35%. If using a value outside of this range, documentation of the selected value is required. A value of 50 percent can be claimed for a system with an active Washington State TAPE approval rating for "pre-treatment."

Table B.5-1: Typical land use total suspended solids (TSS) event mean concentration (EMC) values.

Land Use	TSS EMC[3], mg/L
Single Family Residential	123
Commercial	128
Industrial	125
Education (Municipal)	132
Transportation[4]	78
Multi-family Residential	40
Roof Runoff[5]	14
Low Traffic Areas[6]	50
Open Space	216

Table B.5-2: Guidance for Selecting Load to Clog (LC)

BMP Configuration	Load to Clog, L_c, lb/sq-ft
Baseline: Approximately 50 percent vegetative cover; typical fine sand and compost blend	2
Baseline + increase vegetative cover to at least 75 percent	3
Baseline + include coarser sand to increase initial permeability to 20 to 30 in/hr; control flowrate with outlet control	3
Baseline + increase vegetative cover and include more permeable media with outlet control, per above	4

References

Charters, F.J., Cochrane, T.A., and O'Sullivan, A.D., (2015). Particle Size Distribution Variance in Untreated Urban Runoff and its implication on treatment selection. Water Research, 85 (2015), pg. 337-345.

Davis, A.P. and McCuen, R.H., (2005). Stormwater Management for Smart Growth. Springer Science & Business Media, pg. 155.

Maniquiz-Redillas, M.C., Geronimo, F.K.F, and Kim, L-H. Investigation on the Effectiveness of Pretreatment in Stormwater Management Technologies. Journal of Environmental Sciences, 26 (2014), pg. 1824-1830.

Pitt, R. and Clark, S.E., (2010). Evaluation of Biofiltration Media for Engineered Natural Treatment Systems. Geosyntec Consultants and The Boeing Company.

[3] EMCs are from SBPAT datasets for SLR and SDR Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics for San Diego, unless otherwise noted.

[4] EMCs are based on Los Angeles region default SBPAT datasets due to lack of available San Diego data.

[5] Value represents the average first flush concentration for roof runoff (Charters et al., 2015).

[6] Davis and McCuen (2005)

B.5.2 Sizing Biofiltration BMPs Downstream of a Storage Unit

B.5.2.1 Introduction

In scenarios, where the BMP footprint is governed based on Option 1 (Line 21 of Worksheet B.5-1) or the required volume reduction of 40% average annual (long term) runoff capture for partial infiltration conditions (Line 31 of Worksheet B.5.1) the footprint of the biofiltration BMP can be optimized using the sizing calculations in this Appendix B.5.2 when there is an upstream storage unit (e.g. cistern) that can be used to regulate the flows through the biofiltration BMP.

This methodology is **not** applicable when the minimum footprint factor is governed based on the alternative minimum footprint sizing factor calculated using Worksheet B.5-2 (Line 11). Biofiltration BMP smaller than the alternative minimum footprint sizing factor is considered compact biofiltration BMP and may be allowed at the discretion of the Port if the BMP meets the requirements in Appendix F **and** Option 1 or Option 2 sizing in Worksheet B.5-1.

B.5.2.2 Sizing Calculations

Sizing calculations for the biofiltration footprint shall demonstrate that one of two equivalent performance standards is met:

1. Use continuous simulation and demonstrate one of the following is met based on the infiltration condition identified in Chapter 5.4.2:
    a. **No infiltration condition**: The BMP or series of BMPs biofilters at least 92 percent of average annual (long term) runoff volume. This can be demonstrated through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in Appendix G, as acceptable to the Port. The 92 percent of average annual runoff treatment corresponds to the average capture achieved by implementing a BMP with 1.5 times the DCV and a drawdown time of 36 hours (Appendix B.4.2).
    b. **Partial infiltration condition**: The BMP or series of BMPs biofilters at least 92 percent of average annual (long term) runoff volume and achieves a volume reduction of at least 40 percent of average annual (long term) runoff volume. This can be demonstrated through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in Appendix G, as acceptable to the Port.
2. Use the simple sizing method in Worksheet B.5-3. The applicant is also required to complete Worksheet B.5-1 and B.5-2 when the applicant elects to use Worksheet B.5-3 to optimize the biofiltration BMP footprint. Worksheet B.5-3 was developed to satisfy the following two criteria as applicable:
    a. Greater than 92 percent of the average annual runoff volume from the storage unit is routed to the biofiltration BMP through the low flow orifice and the peak flow from the low flow orifice can instantaneously be filtered through the biofiltration media. If the outlet design includes orifices at different elevations and an overflow structure,

only flows from the overflow structure should be excluded from the calculation (both for 92 percent capture and for peak flow to the biofiltration BMP that needs to be instantaneously filtered), unless the flows from other orifices also bypass the biofiltration BMP, in which case flows from the orifices that bypass should also be excluded.

b. The retention losses from the optimized biofiltration BMP is equal to or greater than the retention losses from the conventional biofiltration BMP. This second criterion is only applicable for partial infiltration condition.

Table B.5-3 Storage required for different drawdown times

Drawdown Time (hours)	Storage requirement (below the overflow elevation, or below outlet elevation that bypass the biofiltration BMP)
12	0.85 DCV
24	1.25 DCV
36	1.50 DCV
48	1.80 DCV
72	2.20 DCV
96	2.60 DCV
120	2.80 DCV

For drawdown times that are outside the range of values presented in Table B.5-4 above the storage unit should be designed to discharge greater than 92% average annual capture to the downstream Biofiltration BMP.

Worksheet B.5-3: Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit

Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit		Worksheet B.5-3	
1	Area draining to the storage unit and biofiltration BMP		sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)		
3	Effective impervious area draining to the storage unit and biofiltration BMP [Line 1 x Line 2]		sq-ft
4	Remaining DCV after implementing retention BMPs		cubic-feet
5	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible		ft/hr.
6	Media Thickness [1.5 feet minimum], also add mulch layer thickness to this line for sizing calculations		ft
7	Media filtration rate to be used for sizing (0.42 ft/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate)		ft/hr
8	Media retained pore storage	0.1	ft/ft
Storage Unit Requirement			
9	Drawdown time of the storage unit, minimum(from the elevation that bypasses the biofiltration BMP, overflow elevation)		hours
10	Storage required to achieve greater than 92 percent capture (see Table B.5-4)		fraction
11	Storage required in cubic feet (Line 4 x Line 10)		cubic-feet
12	Storage provided in the design, minimum(from the elevation that bypasses the biofiltration BMP, overflow elevation)		cubic-feet
13	Is Line 12 ≥ Line 11. If no increase storage provided until this criteria is met	☐ Yes	☐ No
Criteria 1: BMP Footprint Biofiltration Capacity			
14	Peak flow from the storage unit to the biofiltration BMP (using the elevation used to evaluate the percent capture)		cfs
15	Required biofiltration footprint [(3,600 x Line 14)/Line 7]		sq-ft
Criteria 2: Alternative Minimum Sizing Factor (Clogging)			
16	Alternative Minimum Footprint Sizing Factor [Line 11 of Worksheet B.5-2]		Fraction
17	Required biofiltration footprint [Line 3 x Line 16]		sq-ft
Criteria 3: Retention requirement [Not applicable for No Infiltration Condition]			
18	Conventional biofiltration footprint Line 28 of Worksheet B.5-1		sq-ft
19	Retention Losses from the conventional footprint (36 x Line 5 + Line 6 x Line 8) x Line 18		cubic-feet
20	Average discharge rate from the storage unit to the biofiltration BMP		cfs
21	Depth retained in the optimized biofiltration BMP {Line 6 x Line 8} + {[(Line 4)/(2400 x Line 20)] x Line 5}		ft
22	Required optimized biofiltration footprint (Line 19/Line 21)		sq-ft
Optimized Biofiltration Footprint			
23	Optimized biofiltration footprint, maximum(Line 15, Line 17, Line 22)		sq-ft

Note: Biofiltration BMP smaller than the alternative minimum footprint sizing (Line 17) is considered compact biofiltration BMP and may be allowed at the discretion of the Port if the BMP meets the requirements in Appendix F and Option 1 or Option 2 sizing in Worksheet B.5-1.

B.6 Flow-Thru Treatment Control BMPs (for use with Alternative Compliance)

The following methodology shall be used for selecting and sizing onsite flow-thru treatment control BMPs. These BMPs are to be used only when the project is participating in an alternative compliance program. This methodology consists of three steps:

1) Determine the PDP most significant pollutants of concern (Appendix B.6.1).
2) Select a flow-thru treatment control BMP that treats the PDP most significant pollutants of concern and meets the pollutant control BMP treatment performance standard (Appendix B.6.2).
3) Size the selected flow-thru treatment control BMP (Appendix B.6.3).

B.6.1 PDP Most Significant Pollutants of Concern

The following steps shall be followed to identify the PDP most significant pollutants of concern:

1) Compile the following information for the PDP and receiving water:
    a. Receiving water quality (including pollutants for which receiving waters are listed as impaired under the Clean Water Act section 303(d) List; refer to Section 1.9);
    b. Pollutants, stressors, and/or receiving water conditions that cause or contribute to the highest priority water quality conditions identified in the WQIP (refer to Section 1.9);
    c. Land use type(s) proposed by the PDP and the storm water pollutants associated with the PDP land use(s) (see Table B.6–1).
2) From the list of pollutants identified in Step 1 identify the most significant PDP pollutants of concern. A PDP could have multiple most significant pollutants of concerns and shall include the highest priority water quality condition identified in the watershed WQIP and pollutants anticipated to be present onsite/generated from land use.

TABLE B.6–1: Anticipated and Potential Pollutants Generated by Land Use Type

Priority Project Categories	General Pollutant Categories								
	Sediment	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development >one acre	P(1)	P(1)	X	P(2)	X	P(5)	X	P(3)	P(5)
Heavy Industry	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	P(1)
Hillside Development >5,000 ft2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X	X	P(1)

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists onsite.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

B.6.2 Selection of Flow-Thru Treatment Control BMPs

The following steps shall be followed to select the appropriate flow-thru treatment control BMPs for the PDP:

1) For each PDP most significant pollutant of concern identify the grouping using Table B.6-2. Table B.6-2 is adopted from the Model SUSMP.
2) Select the flow-thru treatment control BMP based on the grouping of pollutants of concern that are identified to be most significant in Step 1. This section establishes the pollutant control BMP treatment performance standard to be met for each grouping of pollutants in order to meet the standards required by the MS4 permit and how an applicant can select a non-proprietary or a proprietary BMP that meets the established performance standard. The grouping of pollutants of concern are:
    a. Coarse Sediment and Trash (Appendix B.6.2.1)
    b. Pollutants that tend to associate with fine particles during treatment (Appendix B.6.2.2)
    c. Pollutants that tend to be dissolved following treatment (Appendix B.6.2.3)

TABLE B.6–2: Grouping of Potential Pollutants of Concern

Pollutant	Coarse Sediment and Trash	Suspended Sediment and Particulate-bound Pollutants[1]	Soluble-form Dominated Pollutants[2]
Sediment	X	X	
Nutrients			X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

[1] Pollutants in this category can be addressed to Medium or High effectiveness by effectively removing suspended sediments and associated particulate-bound pollutants. Some soluble forms of these pollutants will exist, however treatment mechanisms to address soluble pollutants are not necessary to remove these pollutants to a Medium or High effectiveness.

[2] Pollutants in this category are not typically addressed to a Medium or High level of effectiveness with particle and particulate-bound pollutant removal alone.

One flow-thru BMP can be used to satisfy the required pollutant control BMP treatment performance standard for the PDP most significant pollutants of concern. In some situations it might be necessary to implement multiple flow-thru BMPs to satisfy the pollutant control BMP treatment performance standards. For example, a PDP has trash, nutrients and bacteria as the most significant pollutants of concern. If a vegetated filter strip is selected as a flow-thru BMP then it is anticipated to meet the performance standard in Appendix B.6.2.2 and B.6.2.3 but would need a trash removal BMP to meet the pollutant control BMP treatment performance standard in Appendix B.6.2.1 upstream of the vegetated filter strip. This could be achieved by fitting the inlets and/or outlets with racks or screens on to address trash.

B.6.2.1 Coarse Sediment and Trash

If coarse sediment and/or trash and debris are identified as a pollutant of concern for the PDP, then BMPs must be selected to capture and remove these pollutants from runoff. The BMPs described below can be effective in removing coarse sediment and/or trash. These devices must be sized to treat the flow rate estimated using Worksheet B.6-1. Applicant can only select BMPs that have High or Medium effectiveness.

Trash Racks and Screens [Coarse Sediment: Low effectiveness; Trash: Medium to High effectiveness] are simple devices that can prevent large debris and trash from entering storm drain infrastructure and/or ensure that trash and debris are retained with downstream BMPs. Trash racks and screens can be installed at inlets to the storm drain system, at the inflow line to a BMP, and/or on the outflow structure from the BMP. Trash racks and screens are commercially available in many sizes and configurations or can be designed and fabricated to meet specific project needs.

Hydrodynamic Separation Devices [Coarse Sediment: Medium to High effectiveness; Trash: Medium to High effectiveness] are devices that remove coarse sediment, trash, and other debris from incoming flows through a combination of screening, settlement, and centrifugal forces. The design of hydrodynamic devises varies widely, more specific information can be found by contacting individual vendors. A list of hydrodynamic separator products approved by the Washington State Technology Acceptance Protocol-Ecology protocol can be found at:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html.

Systems should be rated for "pretreatment" with a General Use Level Designation or provide results of field-scale testing indicating an equivalent level of performance.

Catch Basin Insert Baskets [Coarse Sediment: Low effectiveness; Trash: Medium effectiveness, if appropriately maintained] are manufactured filters, fabrics, or screens that are placed in inlets to remove trash and debris. The shape and configuration of catch basin inserts varies based on inlet type and configuration. Inserts are prone to clogging and bypass if large trash items are accumulated, and therefore require frequent observation and maintenance to remain effective. Systems with screen size small enough to retain coarse sediment will tend to clog rapidly and should be avoided.

Other Manufactured Particle Filtration Devices [Coarse Sediment: Medium to High effectiveness; Trash: Medium to High effectiveness] include a range of products such as cartridge filters, bag filters, and other configurations that address medium to coarse particles. Systems should be rated for "pretreatment" with a General Use Level Designation under the Technology Acceptance Protocol-Ecology program or provide results of field-scale testing indicating an equivalent level of performance.

Note, any BMP that achieves Medium or High performance for suspended solids (See Section B.6.2.2) is also considered to address coarse sediments. However, some BMPs that address suspended solids do not retain trash (for example, swales and detention basins). These types of BMPs could be fitted with racks or screens on inlets or outlets to address trash.

BMP Selection for Pretreatment:

Devices that address both coarse sediment and trash can be used as pretreatment devices for other BMPs, such as infiltration BMPs. However, it is recommended that BMPs that meet the performance standard in Appendix B.6.2.2 be used. A device with a "pretreatment" rating and General Use Level Designation under Technology Acceptance Protocol-Ecology is required for pretreatment upstream of infiltration basins and underground galleries. Pretreatment may also be provided as presettling basins or forebays as part of a pollutant control BMP instead of implementing a specific pretreatment device for systems where maintenance access to the facility surface is possible (to address clogging), expected sediment load is not high, and appropriate factors of safety are included in design.

B.6.2.2 Suspended Sediment and Particulate-Bound Pollutants

Performance Standard

The pollutant treatment performance standard is shown in Table B.6-3. This performance standard is consistent with the Washington State Technology Acceptance Protocol-Ecology Basic Treatment Level, and is also met by technologies receiving Phosphorus Treatment or Enhanced Treatment certification. This standard is based on pollutant removal performance for total suspended solids. Systems that provide effective TSS treatment also typically address trash, debris, and particulate bound pollutants and can serve as pre-treatment for offsite mitigation projects or for onsite infiltration BMPs.

Table B.6-3: Performance Standard for Flow-Thru Treatment Control

Influent Range	Criteria
20 – 100 mg/L TSS	Effluent goal ≤ 20 mg/L TSS
100 – 200 mg/L TSS	≥ 80% TSS removal
>200 mg/L TSS	> 80% TSS removal

Selecting Non-Proprietary BMPs

Table B.6-4 identifies the categories of non-proprietary BMPs that are considered to meet the pollutant treatment performance standard if designed to contemporary design standards[7]. BMP types with a "High" ranking should be considered before those with a "Medium" ranking. Statistical analysis by category from the International Stormwater BMP Database (also presented in Table B.6-4) indicates each of these BMP types (as a categorical group) meets or nearly meets the performance standard. The International Stormwater BMP Database includes historic as well as contemporary BMP studies; contemporary BMP designs in these categories are anticipated to meet or exceed this standard on average.

[7] Contemporary design standards refers to design standards that are reasonably consistent with the current state of practice and are based on desired outcomes that are reasonably consistent with the context of the MS4 Permit and this manual. For example, a detention basin that is designed solely to mitigate peak flow rates would not be considered a contemporary water quality BMP design because it is not consistent with the goal of water quality improvement. Current state of the practice recognizes that a drawdown time of 24 to 72 hours is typically needed to promote settling. For practical purposes, design standards can be considered "contemporary" if they have been published within the last 10 years, preferably in California or Washington State, and are specifically intended for storm water quality management.

Table B.6-4: Flow-Thru Treatment Control BMPs Meeting Performance Standard

List of Acceptable Flow-Thru Treatment Control BMPs	Statistical Analysis of International Stormwater BMP Database				Evaluation of Conformance to Performance Standard		
	Count In/Out	TSS Mean Influent, mg/L	TSS Mean Effluent[1], mg/L	Average Category Volume Reduct.	Volume-Adjusted Effluent Conc[2], mg/L	Volume-Adjusted Removal Efficiency[2]	Level of Attainment of Performance Standard (with rationale)
Vegetated Filter Strip	361/ 282	69	31	38%	19	72%	Medium, effluent < 20 mg/L after volume adjustment
Vegetated Swale	399/ 346	45	33	48%	17	61%	Medium, effluent < 20 mg/L after volume adjustment
Detention Basin	321/ 346	125	42	33%	28	77%	Medium, percent removal near 80% after volume adjustment
Sand Filter/ Media Bed Filter	381/ 358	95	19	NA[3]	19	80%	High, effluent and % removal meet criteria without adjustment
Lined Porous Pavement[4]	356/ 220	229	46	NA[3,4]	46	80%	High, % removal meets criteria without adjustment
Wet Pond	923/ 933	119	31	NA[3]	31	74%	Medium, percent removal near 80%

Source: 2014 BMP Performance Summaries and Statistical Appendices; 2010 Volume Performance Summary; available at: www.bmpdatabase.org

1 - A statistically significant difference between influent and effluent was detected at a p value of 0.05 for all categories.

2 - Estimates were adjusted to account for category-average volume reduction.

3 - Not Applicable as these BMPs are not designed for volume reduction and are anticipated to have very small incidental volume reduction.

4 - The category presented in this table represents a lined system for flow-thru treatment purposes. Porous pavement for retention purposes is an infiltration BMP, not a flow-thru BMP. This table should not be consulted for porous pavement for infiltration.

Selecting Proprietary BMPs

Proprietary BMPs can be used if the BMP meets each of the following conditions:

(1) **The proposed BMP meets the performance standard in Appendix B.6.2.2 as certified through third-party, field scale evaluation.** An active General Use Level Designation for Basic Treatment, Phosphorus Treatment or Enhanced Treatment under the Washington State Technology Acceptance Protocol-Ecology program is the preferred method of demonstrating that the performance standard is met. The list of certified technologies is updated as new technologies are approved (link below). Technologies with Pilot Use Level Designation and Conditional Use Level Designations are not acceptable. Refer to:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html. Alternatively, other field scale verification of 80 percent TSS capture, such as through Technology Acceptance Reciprocity Partnership or New Jersey Corporation for Advance Testing may be acceptable. A list of field-scale verified technologies under Technology Acceptance Reciprocity Partnership Tier II and New Jersey Corporation for Advance Testing can be accessed at: http://www.njcat.org/verification-process/technology-verification-database.html (refer to field verified technologies only).

(2) The proposed BMP is designed and maintained in a manner consistent with its performance certifications (see explanation below). The applicant must demonstrate conclusively that the proposed application of the BMP is consistent with the basis of its certification/verification. Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the Technology Acceptance Reciprocity Partnership or New Jersey Corporation for Advance Testing programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification. It is common for these approvals to specify the specific model of BMP, design capacity for given unit sizes, type of media that is the basis for approval, and/or other parameters.

(3) The proposed BMP is acceptable at the discretion of the Port. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met. In determining the acceptability of a proprietary flow-thru treatment control BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant

B.6.2.3 Soluble-form dominated Pollutants (Nutrients)

If nutrients are identified as a most significant pollutant of concern for the PDP, then BMPs must be selected to meet the performance standard described in Appendix B.6.2.2 **and** must be selected to provide medium or high level of effectiveness for nutrient treatment as described in this section. The most common nutrient of concern in the San Diego region is nitrogen, therefore total nitrogen (TN) was used as the primary indicator of nutrient performance in storm water BMPs.

Selection of BMPs to address nutrients consists of two steps:

1) Determine if nutrients can be addressed via source control BMPs as described in Appendix E and Chapter 4. After applying source controls, if there are no remaining source areas for soluble nutrients, then this pollutant can be removed from the list of pollutants of concerns for the purpose of selecting flow-thru treatment control BMPs. Particulate nutrients will be addressed by the performance standard in Appendix B.6.2.2.

2) If soluble nutrients cannot be fully addressed with source controls, then select a flow-thru treatment control BMPs that meets the performance criteria in Table B.6-5 or select from the nutrient-specific menu of treatment control BMPs in Table B.6-6.

    a. The performance standard for nitrogen removal (Table B.6-5) has been developed based on evaluation of the relative performance of available categories of non-proprietary BMPs.

    b. For proprietary BMPs, submit third party performance data indicating that the criteria in Table B.6-5 are met. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met. In determining the acceptability of a proprietary flow-thru treatment control BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant

Table B.6-5: Performance Standard for Flow-Thru Treatment Control BMPs for Nutrient Treatment

Basis	Criteria
Treatment Basis	Comparison of mean influent and effluent indicates significant concentration reduction of TN approximately 40 percent or higher based on studies with representative influent concentrations
Combined Treatment and Volume Reduction Basis	Combination of concentration reduction and volume reduction yields TN mass removal of approximately 40 percent or higher based on studies with representative influent concentrations

Table B.6-6: Flow-Thru Treatment Control BMPs Meeting Nutrient Treatment Performance Standard

List of Acceptable Flow-Thru Treatment Control BMPs for Nutrients	Statistical Analysis of International Stormwater BMP Database				Evaluation of Conformance to Performance Standard		
	Count In/Out	TN Mean Influent, mg/L	TN Mean Effluent[1], mg/L	Average Category Volume Reduct.	Volume-Adjusted Effluent Conc[2], mg/L	Volume-Adjusted Removal Efficiency[2]	Level of Attainment of Performance Standard (with rationale)
Vegetated Filter Strip	138/ 122	1.53	1.37	38%	0.85	44%	Medium, if designed to include volume reduction processes
Detention Basin	90/ 89	2.34	2.01	33%	1.35	42%	Medium, if designed to include volume reduction processes
Wet Pond	397/ 425	2.12	1.33	NA	1.33	37%	Medium, best concentration reduction among BMP categories, but limited volume reduction

Source: 2014 BMP Performance Summaries and Statistical Appendices; 2010 Volume Performance Summary; available at: www.bmpdatabase.org

1 - A statistically significant difference between influent and effluent was detected at a p value of 0.05 for all categories included.

2 - Estimates were adjusted to account for category-average volume reduction.

B.6.3 Sizing Flow-Thru Treatment Control BMPs:

Flow-thru treatment control BMPs shall be sized to filter or treat the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The required flow-thru treatment rate should be adjusted for the portion of the DCV already retained or biofiltered onsite as described in Worksheet B.6-1. The following hydrologic method shall be used to calculate the flow rate to be filtered or treated:

$$Q = C \times i \times A$$

Where:

Q = Design flow rate in cubic feet per second

C = Runoff factor, area-weighted estimate using Table B.1-1.

i = Rainfall intensity of 0.2 in/hr.

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Section 3.3.3 for additional guidance. Street projects consult Section 1.4.3.

Worksheet B.6-1: Flow-Thru Design Flows

Flow-thru Design Flows		Worksheet B.6-1		
1	DCV	DCV		cubic-feet
2	DCV retained	$DCV_{retained}$		cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$		cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow\text{-}thru}$		cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=		unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=		acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=		unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=		cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located upstream of flow-thru BMPs. That is, if the flow-thru BMP is upstream of the project's retention and biofiltration BMPs then the flow-thru BMP shall be sized using an adjustment factor of 1.
2) Volume based (e.g., dry extended detention basin) flow-thru treatment control BMPs shall be sized to the volume in Line 4 and flow based (e.g., vegetated swales) shall be sized to flow rate in Line 9. Sand filter and media filter can be designed either by volume in Line 4 or flow rate in Line 9.
3) Proprietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the calculated flow rate in Line 9; certified treatment capacity per unit shall be consistent with third party certifications.

Appendix

C

BMP DESIGN MANUAL

Geotechnical and Groundwater Investigation Requirements

Appendix C Geotechnical and Groundwater Investigation Requirements

C.1 Purpose and Phasing

Feasibility of storm water infiltration is dependent on the geotechnical and groundwater conditions at the project site.

This appendix provides guidelines for performing and reporting feasibility analysis for infiltration with respect to geotechnical and groundwater conditions. It provides framework for feasibility analysis at two phases of project development:

- *Planning Phase*: Simpler methods for conducting preliminary screening for feasibility/infeasibility, and
- *Design Phase*: When infiltration is considered potentially feasible, more rigorous analysis is needed to confirm feasibility and to develop design considerations and mitigation measures if required

Planning Phase At this stage of the project, information about the site may be limited, the proposed design features may be conceptual, and there may be an opportunity to adjust project plans to incorporate infiltration into the project layout as it is developed. At this phase, project geotechnical engineers are typically responsible for conducting explorations of geologic conditions, performing preliminary analyses, and identifying particular aspects of design that require more detailed investigation at later phases. As part of this process, the role of a planning- level infiltration feasibility assessment is to help planners reach early tentative conclusions regarding where infiltration is likely feasible, possibly feasible if done carefully, or clearly infeasible. This determination can help guide the design process by influencing project layout, selection of infiltration BMPs, and identifying if more detailed studies are necessary. The goal of the planning and feasibility phase is to identify potential geotechnical and groundwater impacts and to determine which impacts may be considered fatal flaws and which impacts may be possible to mitigate with design features. Determination of acceptable risks and/or mitigation measures may involve discussions with adjacent land owners and/or utility operators, as well as coordination with other projects under planning or design in the project vicinity. Early involvement of potentially impacted parties is critical to avoid late-stage design changes and schedule delays and to reduce potential future liabilities.

Design Phase During this phase, potential geotechnical and groundwater impacts must be fully considered and evaluated and mitigation measures should be incorporated in the BMP design, as appropriate. Mitigation measures refer to design features or assumptions intended to reduce risks associated with storm water infiltration. While rules of thumb may be useful, if applied carefully, for the planning level phase, the analyses conducted in the detailed design phase require the involvement of a geotechnical professional familiar with the local conditions. One of the first steps in the design phase should be determination if additional field and/or laboratory investigations are required (e.g., borings, test pits, laboratory or field testing) to further assess the geotechnical impacts of storm water infiltration. As the design of infiltration systems are highly dependent on the subsurface conditions, coordination with the storm water design team may be beneficial to limit duplicative efforts and costs.

Worksheet C.4-1 is provided to document infiltration feasibility screening. This worksheet is divided into two parts. Part 1 "Full Infiltration Feasibility Screening Criteria" is used to determine if the full design volume can be infiltrated onsite, whereas Part 2 "Partial Infiltration versus No Infiltration Screening Criteria" is used to determine if any amount of volume can be infiltrated.

Note that it is not necessary to investigate each and every criterion in the worksheet, a single "no" answer in Part 1 and Part 2 controls the feasibility and desirability. If all the answers in Part 1 are "yes" then it is not required to complete Part 2. The same worksheet could be used to document both planning-level categorization and design-level categorization. Note that planning-level categorization, are typically based on initial site assessment results; therefore it is not necessarily conclusive. Categorizations should be confirmed or revised, as necessary, based on more detailed design-level investigation and analysis during BMP design.

C.2 Geotechnical Feasibility Criteria

This section is divided into seven factors that should be considered, as applicable, while assessing the feasibility and desirability of infiltration related to geotechnical conditions. Note that during the planning phase, if one or more of these factors precludes infiltration as an approach, it is not necessary to assess every other factor. However, if proposing infiltration BMPs, then every applicable factor in this section must be addressed.

C.2.1 Soil and Geologic Conditions

Site soils and geologic conditions influence the rate at which water can physically enter the soils. Site assessment approaches for soil and geologic conditions may consist of:

- Review of soil survey maps
- Review of available reports on local geology to identify relevant features, such as depth to bedrock, rock type, lithology, faults, and hydrostratigraphic or confining units
- Review of previous geotechnical investigations of the area
- Site-specific geotechnical and/or geologic investigations (e.g., borings, infiltration tests)

Geologic investigations should also seek to provide an assessment of whether soil infiltration properties are likely to be uniform or variable across the project site. Appendix D provides guidance on determining infiltration rates for planning and design phase.

C.2.2 Settlement and Volume Change

Settlement and volume change limits the amount of infiltration that can be allowed without resulting in adverse impacts that cannot be mitigated. Upon considering the impacts of an infiltration design, the designer must identify areas where soil settlement or heave is likely and whether these conditions would be unfavorable to existing or proposed features. Settlement refers to the condition when soils decrease in volume, and heave refers to expansion of soils or increase in volume.

There are several different mechanisms that can induce volume change due to infiltration that the professional must be aware of and consider while completing the feasibility screening including:

- Hydro collapse and calcareous soils;
- Expansive soils;
- Frost heave;
- Consolidation; and
- Liquefaction.

C.2.3 Slope Stability

Infiltration of water has the potential to result in an increased risk of slope failure of nearby slopes. This should be assessed as part of both the feasibility and design stages of a project. There are many factors that impact the stability of slopes, including, but not limited to, slope inclination, soil and unit weight and seepage forces. Increases in moisture content or rising of the water table in the vicinity of a slope, which may result from storm water infiltration, have the potential to change the soil strength and unit weight and to add seepage forces to the slope, which in turn, may reduce the factor of safety of the stability of the slope. When evaluating the effect of infiltration on the design of a slope, the designer must consider all types of potential slope failures.

C.2.4 Utility Considerations

Utilities are either public or private infrastructure components that include underground pipelines and vaults (e.g., potable water, sewer, storm water, gas pipelines), underground wires/conduit (e.g., telephone, cable, electrical) and above ground wiring and associated structures (e.g., electrical distribution and transmission lines). Utility considerations are typically within the purview of a geotechnical site assessment and should be considered in assessing the feasibility of storm water infiltration. Infiltration has the potential to damage subsurface utilities and/or underground utilities may pose geotechnical hazards in themselves when infiltrated water is introduced. Impacts related to storm water infiltration in the vicinity of underground utilities are not likely to cause a fatal flaw in the design, but the designer must be aware of the potential cost impacts to the design during the planning stage.

C.2.5 Groundwater Mounding

Storm water infiltration and recharge to the underlying groundwater table may create a groundwater mound beneath the infiltration facility. The height and shape of the mound depends on the infiltration system design, the recharge rate, and the hydrogeologic conditions at the site, especially the horizontal hydraulic conductivity and the saturated thickness. Elevated groundwater levels can lead to a number of problems, including flooding and damage to structures and utilities through buoyancy and moisture intrusion, increase in inflow and infiltration into municipal sanitary sewer systems, and flow of water through existing utility trenches, including sewers, potentially leading to formation of sinkholes (Gobel et al. 2004). Mounding shall be considered by the geotechnical professional while performing the infiltration feasibility screening.

C.2.6 Retaining Walls and Foundations

Development projects may include retaining walls or foundations in close proximity to proposed infiltration BMPs. These structures are designed to withstand the forces of the earth they are retaining and other surface loading conditions such as nearby structures. Foundations include shallow foundations (spread and strip footings, mats) and deep foundations (piles, piers) and are designed to support overburden and design loads. All types of retaining walls and foundations can be impacted by increased water infiltration into the subsurface as a result of potential increases in lateral pressures and potential reductions in soil strength. The geotechnical professional should consider these factors while performing the infiltration feasibility screening.

C.2.7 Other Factors

While completing the feasibility screening, other factors determined by the geotechnical professional to influence the feasibility and desirability of infiltration related to geotechnical conditions shall also be considered.

C.3 Groundwater Quality and Water Balance Feasibility Criteria

This section is divided into eight factors that should be considered, to the extent applicable, while assessing the feasibility and desirability of infiltration related to groundwater quality and water balance. Note that during the planning phase, if one or more of these factors precludes infiltration as an approach, it is not necessary to assess every other factor. However, if proposing infiltration BMPs, then every applicable factor in this section must be addressed.

C.3.1 Soil and Groundwater Contamination

Infiltration shall be avoided in areas with:

- Physical and chemical characteristics (e.g., appropriate cation exchange capacity, organic content, clay content and infiltration rate) which are not adequate for proper infiltration durations and treatment of runoff for the protection of groundwater beneficial uses.

- Groundwater contamination and/or soil pollution, if infiltration could contribute to the movement or dispersion of soil or groundwater contamination or adversely affect ongoing clean-up efforts, either onsite or down-gradient of the project.

If infiltration is under consideration for one of the above conditions, a site-specific analysis should be conducted to determine where infiltration-based BMPs can be used without adverse impacts.

C.3.2 Separation to Seasonal High Groundwater

The depth to seasonally high groundwater tables (normal high depth during the wet season) beneath the base of any infiltration BMP must be greater than 10 feet for infiltration BMPs to be allowed. The depth to groundwater requirement can be reduced from 10 feet at the discretion of the approval agency if the underlying groundwater basin does not support beneficial uses and the groundwater quality is maintained at the proposed depth. Depth to seasonally high groundwater levels can be estimated based on well level measurements or redoximorphic methods. For sites with complex groundwater tables, long term studies may be needed to understand how groundwater levels change in wet and dry years.

C.3.3 Wellhead Protection

Wellheads natural and man-made are water resources that may potentially be adversely impacted by storm water infiltration through the introduction of contaminants or alteration in water supply and levels. It is recommended that the locations of wells and springs be identified early in the design process and site design be developed to avoid infiltration in the vicinity of these resources. Infiltration BMPs must be located a minimum of 100 feet horizontally from any water supply well.

C.3.4 Contamination Risks from Land Use Activities

Concentration of storm water pollutants in runoff is highly dependent on the land uses and activities present in the area tributary to an infiltration BMP. Likewise, the potential for groundwater contamination due to the infiltration BMP is a function of pollutant abundance, concentration of pollutants in soluble forms, and the mobility of the pollutant in the subsurface soils. Hence infiltration

BMPs must not be used for areas of industrial or light industrial activity unless source control BMPs to prevent exposure of high threat activities are implemented, or runoff from such activities is first treated or filtered to remove pollutants prior to infiltration.

C.3.5 Consultation with Applicable Groundwater Agencies

Infiltration activities should be coordinated with the applicable groundwater management agency, such as groundwater providers and/or resource protection agencies, to ensure groundwater quality is protected. It is recommended that coordination be initiated as early as possible during the planning process to determine whether specific site assessment activities apply or whether these agencies have data available that may support the planning and design process.

C.3.6 Water Balance Impacts on Stream Flow

Use of infiltration systems to reduce surface water discharge volumes may result in additional volume of deeper infiltration compared to natural conditions, which may result in impacts to receiving channels associated with change in dry weather flow regimes. A relatively simple survey of hydrogeologic data (piezometer measurements, boring logs, regional groundwater maps) and downstream receiving water characteristics is generally adequate to determine whether there is potential for impacts and whether a more rigorous assessment is needed.

Where water balance conditions appear to be sensitive to development impacts and there is an elevated risk of impacts, a computational analysis may be warranted to evaluate the feasibility/desirability of infiltration. Such an analysis should account for precipitation, runoff, irrigation inputs, soil moisture retention, evapotranspiration, baseflow, and change in groundwater recharge on a long term basis. Because water balance calculations are sensitive to the timing of precipitation versus evapotranspiration, it is most appropriate to utilize a continuous model simulation rather than basing calculations on average annual or monthly normal conditions.

C.3.7 Downstream Water Rights

While water rights cases are not believed to be common, there may be cases in which infiltration of water from area that was previously allowed to drain freely to downstream water bodies would not be legal from a water rights perspective. Site-specific evaluation of water rights laws should be conducted if this is believed to be a potential issue in the project location.

C.3.8 Other Factors

While completing the feasibility screening, other factors determined by the geotechnical professional to influence the feasibility and desirability of infiltration related to groundwater quality and water balance shall also be considered.

C.4 Geotechnical and Groundwater Investigation Report Requirements

The geotechnical and groundwater investigation report(s) addressing onsite storm water infiltration shall include the following elements, as applicable. These reports may need to be completed by multiple professional disciplines, depending on the issues that need be addressed for a given site. It may also be necessary to prepare separate report(s) at the planning phase and design phase of a project if the methods and timing of analyses differ.

C.4.1 Site Evaluation

Site evaluation shall identify the following:

- Areas of contaminated soil or contaminated groundwater within the site;
- "Brown fields" adjacent to the site;
- Mapped soil type(s);
- Historic high groundwater level;
- Slopes steeper than 25 percent; and
- Location of water supply wells, septic systems (and expansion area), or underground storage tanks, or permitted gray water systems within 100 feet of a proposed infiltration/ percolation BMP.

C.4.2 Field Investigation

Where the site evaluation indicates potential feasibility for onsite storm water infiltration BMPs, the following field investigations will be necessary to demonstrate suitability and to provide design recommendations.

C.4.2.1 Subsurface Exploration

Subsurface exploration and testing for storm water infiltration BMPs shall include:

- A minimum of two exploratory excavations shall be conducted within 50-feet of each proposed storm water infiltration BMP. The excavations shall extend at least 10 feet below the lowest elevation of the base of the proposed infiltration BMP.
- Soils shall be logged in detail with emphasis on describing the soil profile.
- Identify low permeability or impermeable materials.

- Indicate any evidence of soil contamination.

C.4.2.2 Material Testing and Infiltration/Percolation Testing

Various material testing and in situ infiltration/percolation testing methods and guidance for appropriate factor of safety are discussed in detail in Appendix D. Infiltration testing methods described in Appendix D include surface and shallow excavation methods and deeper subsurface tests.

C.4.2.3 Evaluation of Depth to Groundwater

An evaluation of the depth to groundwater is required to confirm the feasibility of infiltration. Infiltration BMPs may not be feasible in high groundwater conditions (within 10 feet of the base of infiltration/ percolation BMP) unless an exemption is granted by the approval agency.

C.4.3 Reporting Requirements by Geotechnical Engineer

The geotechnical and groundwater investigation report shall address the following key elements, and where appropriate, mitigation recommendations shall be provided.

- Identify areas of the project site where infiltration is likely to be feasible and provide justifications for selection of those areas based on soil types, slopes, proximity to existing features, etc. Include completed and signed Worksheet C.4-1.
- Investigate, evaluate and estimate the vertical infiltration rates and capacities in accordance with the guidance provided in Appendix D which describes infiltration testing and appropriate factor of safety to be applied for infiltration testing results. The site may be broken into sub-basins, each of which has different infiltration rates or capacities.
- Describe the infiltration/ percolation test results and correlation with published infiltration/ percolation rates based on soil parameters or classification. Recommend providing design infiltration/percolation rate(s) at the sub-basins. Use Worksheet D.5-1.
- Investigate the subsurface geological conditions and geotechnical conditions that would affect infiltration or migration of water toward structures, slopes, utilities, or other features. Describe the anticipated flow path of infiltrated water. Indicate if the water will flow into pavement sections, utility trench bedding, wall drains, foundation drains, or other permeable improvements.
- Investigate depth to groundwater and the nature of the groundwater. Include an estimate of the high seasonal groundwater elevations.
- Evaluate proposed use of the site (industrial use, commercial use, etc.), soil and groundwater data and provide a concluding opinion whether proposed storm water infiltration could cause adverse impacts to groundwater quality and if it does cause impacts whether the impacts could be reasonably mitigated or not.

- Estimate the maximum allowable infiltration rates and volumes that could occur at the site that would avoid damage to existing and proposed structures, utilities, slopes, or other features. In addition the report must indicate if the recommended infiltration rate is appropriate based on the conditions exposed during construction.
- Provide a concluding opinion regarding whether or not the proposed onsite storm water infiltration/percolation BMP will result in soil piping, daylight water seepage, slope instability, or ground settlement.
- Recommend measures to substantially mitigate or avoid any potentially detrimental effects of the storm water infiltration BMPs or associated soil response on existing or proposed improvements or structures, utilities, slopes or other features within and adjacent to the site. For example, minimize soil compaction.
- Provide guidance for the selection and location of infiltration BMPs, including the minimum separations between such infiltration BMPs and structures, streets, utilities, manufactured and existing slopes, engineered fills, utilities or other features. Include guidance for measures that could be used to reduce the minimum separations or to mitigate the potential impacts of infiltration BMPs.
- Provide a concluding opinion whether or not proposed infiltration BMPs are in conformance with the following design criteria:
    - Runoff will undergo pretreatment such as sedimentation or filtration prior to infiltration;
    - Pollution prevention and source control BMPs are implemented at a level appropriate to protect groundwater quality for areas draining to infiltration BMPs;
    - The vertical distance from the base of the infiltration BMPs to the seasonal high groundwater mark is greater than 10 feet. This vertical distance may be reduced when the groundwater basin does not support beneficial uses and the groundwater quality is maintained;
    - The soil through which infiltration is to occur has physical and chemical characteristics (e.g., appropriate cation exchange capacity, organic content, clay content, and infiltration rate) which are adequate for proper infiltration durations and treatment of runoff for the protection of groundwater beneficial uses;
    - Infiltration BMPs are not used for areas of industrial or light industrial activity unless source control BMPs to prevent exposure of high threat activities are implemented, or runoff from such activities is first treated or filtered to remove pollutants prior to infiltration; and
    - Infiltration BMPs are located a minimum of 100 feet horizontally from any water supply wells.

C.4.4 Reporting Requirements by the Project Design Engineer

Project design engineer has the following responsibilities:

- Complete criteria 4 and 8 in Worksheet C.4-1; and
- In the SWQMP provide a concluding opinion whether or not proposed infiltration BMPs will affect seasonality of ephemeral streams.

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition			Worksheet C.4-1
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteri	Screening Question	**Yes**	**No**
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		

Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		

Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.		
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the Port to substantiate findings.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 3 of 4</th></tr>
<tr><td colspan="4"><u>Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria</u>

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>6</td><td>Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
</table>

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the Port to substantiate findings

C.5 Feasibility Screening Exhibits

Table C.5-1 lists the feasibility screening exhibits that were generated using readily available GIS data sets to assist the project applicant to screen the project site for feasibility.

Table C.5-1: Feasibility Screening Exhibits

Figures	Layer	Intent/Rationale	Data Sources
C.1 Soils[1]	Hydrologic Soil Group – A, B, C, D	Hydrologic Soil Group will aid in determining areas of potential infiltration	SanGIS http://www.sangis.org/
	Hydric Soils	Hydric soils will indicate layers of intermittent saturation that may function like a D soil and should be avoided for infiltration	USDA Web Soil Survey. Hydric soils, (ratings of 100) were classified as hydric. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
C.2: Slopes and Geologic Hazards	Slopes >25%	BMPs are hard to construct on slopes >25% and can potentially cause slope instability	SanGIS http://www.sangis.org/
	Liquefaction Potential	BMPs (particularly infiltration BMPs) must not be sited in areas with high potential for liquefaction or landslides to minimize earthquake/landslide risks	SanGIS http://www.sangis.org/
	Landslide Potential		SanGIS Geologic Hazards layer. Subset of polygons with hazard codes related to landslides was selected. This data is limited to the City of San Diego Boundary. http://www.sangis.org/
C.3: Groundwater Table Elevations	Groundwater Depths	Infiltration BMPs will need to be sited in areas with adequate distance (>10 ft) from the groundwater table	GeoTracker. Data downloaded for San Diego county from 2014 and 2013. In cases where there were multiple measurements made at the same well, the average was taken over that year. http://geotracker.waterboards.ca.gov/data_download_by_county.asp
C.4: Contaminated Sites	Contaminated soils and/or groundwater sites	Infiltration must limited in areas of contaminated soil/groundwater	GeoTracker. Data downloaded for San Diego county and limited to active cleanup sites http://geotracker.waterboards.ca.gov/

[1]In undefined areas it is the responsibility of the project proponent to verify soils conditions and provide geotechnical findings.

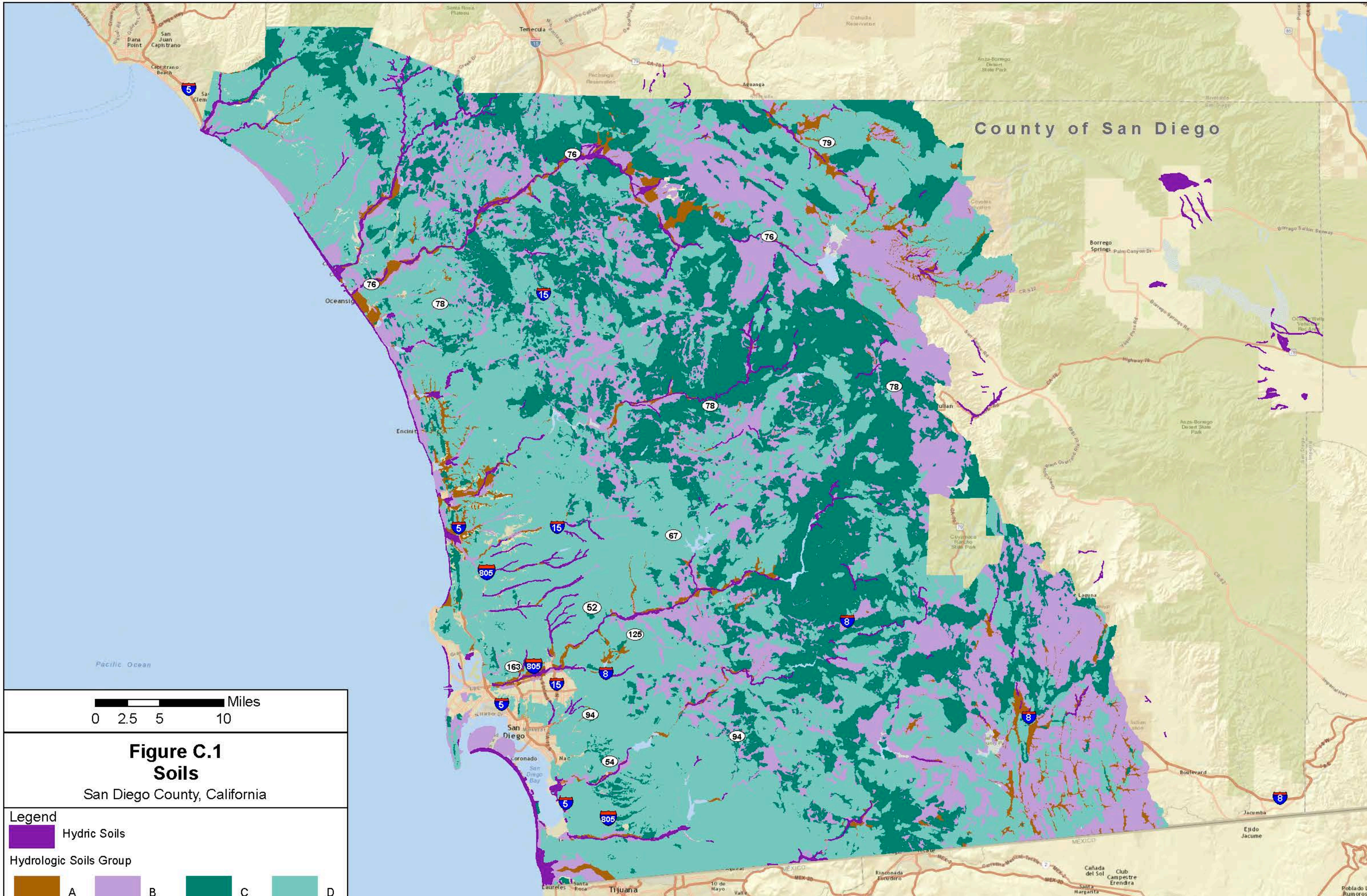


Figure C.1
Soils
San Diego County, California

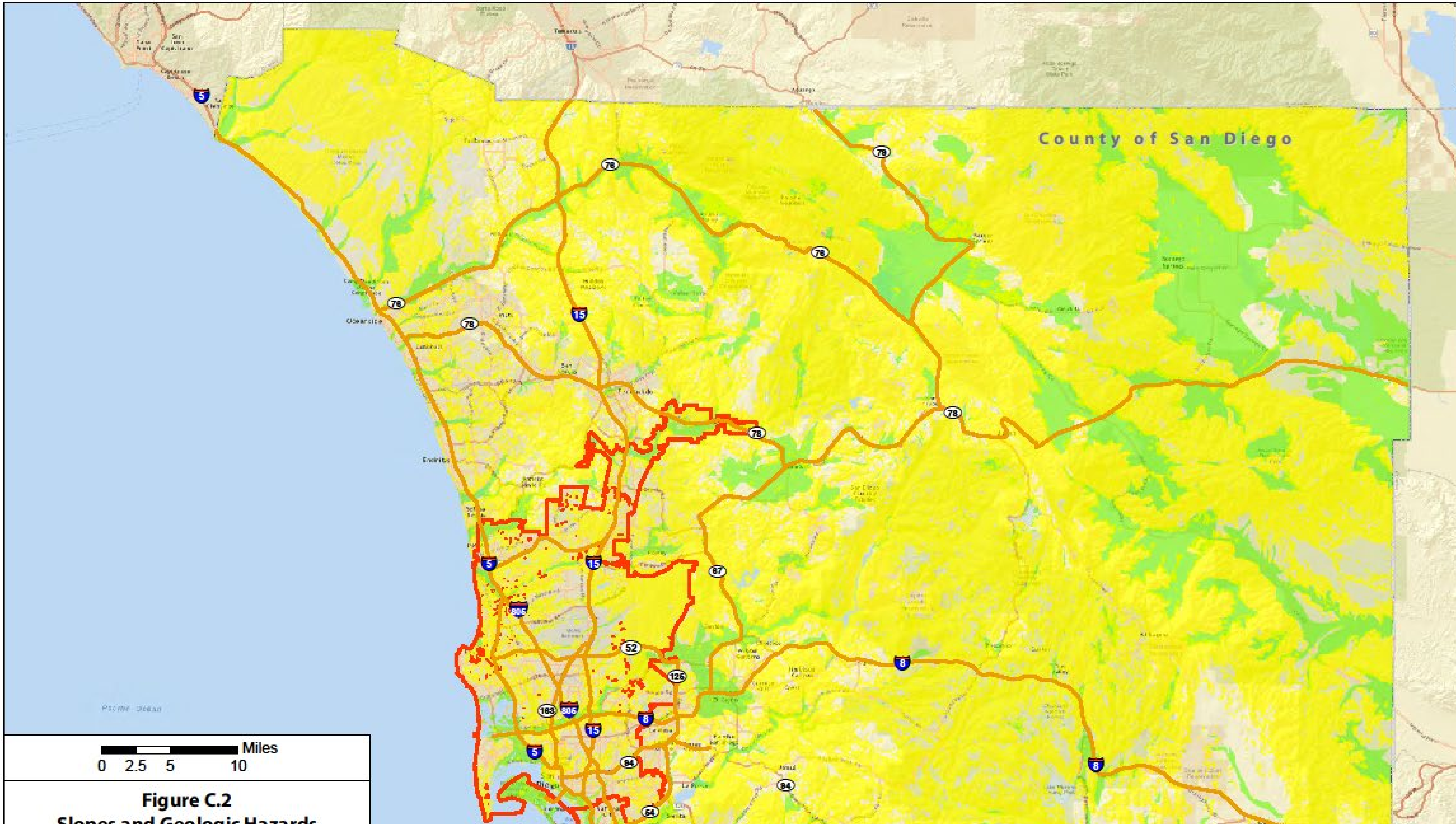


Figure C.2
Slopes and Geologic Hazards

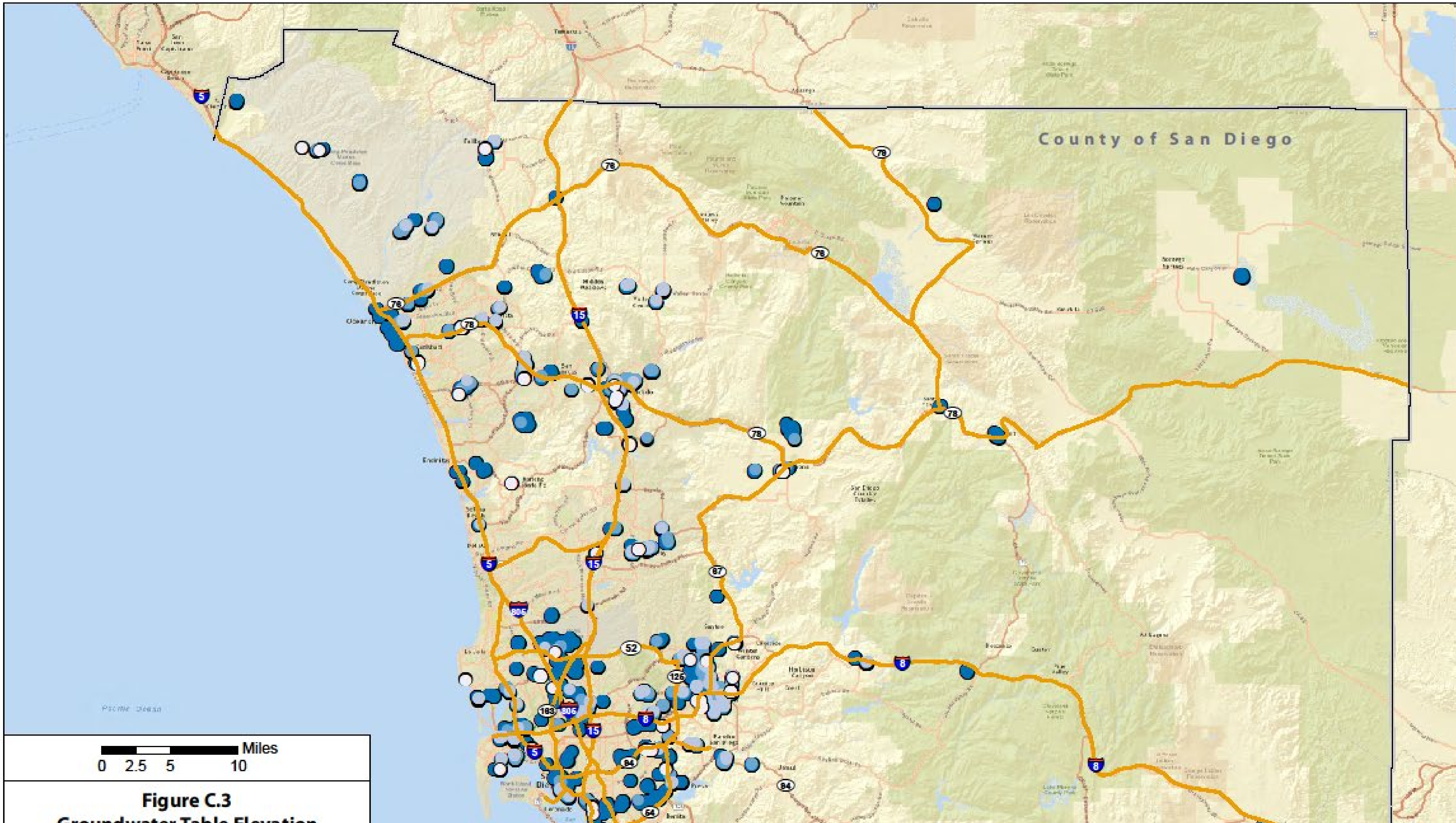


Figure C.3
Groundwater Table Elevation

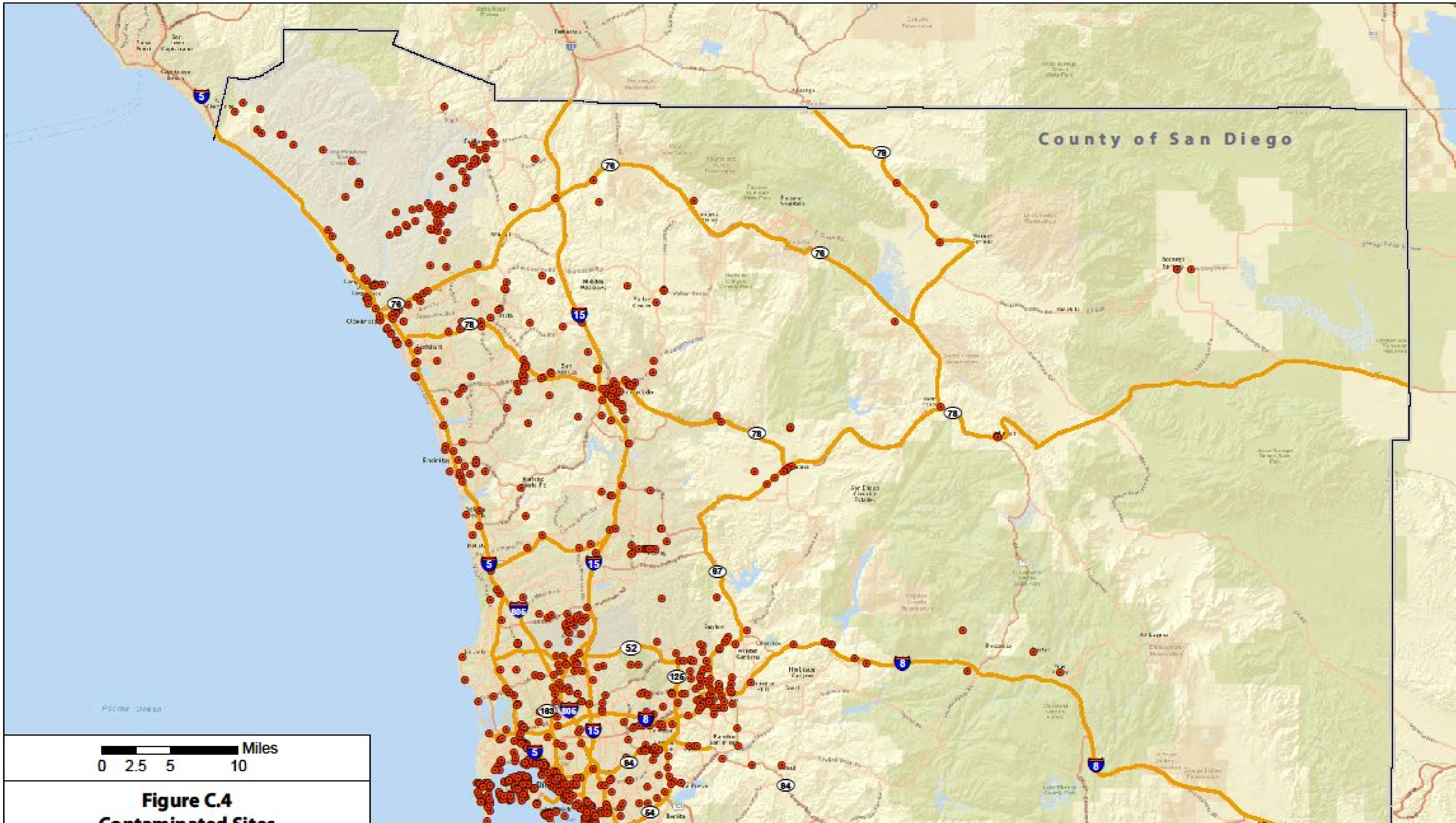


Figure C.4
Contaminated Sites

Appendix

D

BMP DESIGN MANUAL

Approved Infiltration Rate Assessment Methods for Selection of Storm Water BMPs

Appendix D Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs

D.1 Introduction

Characterization of potential infiltration rates is a critical step in evaluating the degree to which infiltration can be used to reduce storm water runoff volume. This appendix is intended to provide guidance to help answer the following questions:

1. *How and where does infiltration testing fit into the project development process?*

   Section D.2 discusses the role of infiltration testing in different stage of project development and how to plan a phased investigation approach.

2. *What infiltration rate assessment methods are acceptable?*

   Section D.3 describes the infiltration rate assessment methods that are acceptable.

3. *What factors should be considered in selecting the most appropriate testing method for a project?*

   Section D.4 provides guidance on site-specific considerations that influence which assessment methods are most appropriate.

4. *How should factors of safety be selected and applied to, for BMP selection and design?*

   Section D.5 provides guidance for selecting a safety factor.

Note, that this appendix does not consider other feasibility criteria that may make infiltration infeasible, such as groundwater contamination and geotechnical considerations (these are covered in Appendix C). In general, infiltration testing should only be conducted after other feasibility criteria specified in this manual have been evaluated and cleared.

D.2 Role of Infiltration Testing in Different Stages of Project Development

In the process of planning and designing infiltration facilities, there are a number of ways that infiltration testing or estimation factors into project development, as summarized in Table D.2-1. As part of selecting infiltration testing methods, the geotechnical engineer shall select methods that are applicable to the phase of the project and the associated burden of proof.

Table D.2-1: Role of Infiltration Testing

Project Phase	Key Questions/Burden of Proof	General Assessment Strategies
Site Planning Phase	• Where within the project area is infiltration potentially feasible? • What volume reduction approaches are potentially suitable for my project?	• Use existing data and maps to the extent possible • Use less expensive methods to allow a broader area to be investigated more rapidly • Reach tentative conclusions that are subject to confirmation/refinement at the design phase
BMP Design Phase	• What infiltration rates should be used to design infiltration and biofiltration facilities? • What factor of safety should be applied?	• Use more rigorous testing methods at specific BMP locations • Support or modify preliminary feasibility findings • Estimate design infiltration rates with appropriate factors of safety

D.3 Guidance for Selecting Infiltration Testing Methods

The geotechnical engineer shall select appropriate testing methods for the site conditions, subject to the engineer's discretion and approval of the Port, that are adequate to meet the burden of proof that is applicable at each phase of the project design (See Table D.3-1):

- At the planning phase, testing/evaluation method must be selected to provide a reliable estimate of the locations where infiltration is feasible and allow a reasonably confident determination of infiltration feasibilility to support the selection between full infiltration, partial infiltration, and no infiltration BMPs.

- At the design phase, the testing method must be selected to provide a reliable infiltration rate to be used in design. The degree of certainty provided by the selected test should be considered

Table D.3-1 provides a matrix comparison of these methods. Sections D.3.1 to D.3.3 provide a summary of each method. This appendix is not intended to be an exhaustive reference on infiltration testing at this time. It does not attempt to discuss every method for testing, nor is it intended to provide step-by-step procedures for each method. The user is directed to supplemental resources (referenced in this appendix) or other appropriate references for more specific information.

Alternative testing methods are allowed with appropriate rationales, subject to the discretion of the Port.

In order to select an infiltration testing method, it is important to understand how each test is applied and what specific physical properties the test is designed to measure. Infiltration testing methods vary considerably in these regards. For example, a borehole percolation test is conducted by drilling a borehole, filling a portion of the hole with water, and monitoring the rate of fall of the water. This test directly measures the three dimensional flux of water into the walls and bottom of the borehole. An approximate correction is applied to indirectly estimate the vertical hydraulic conductivity from the results of the borehole test. In contrast, a double-ring infiltrometer test is conducted from the ground surface and is intended to provide a direct estimate of vertical (one-dimensional) infiltration rate at this point. Both of these methods are applicable under different conditions.

Table D.3-1: Comparision of Infiltration Rate Estimation and Testing Methods

Test	Suitability at Planning Level Screening Phase	Suitability at BMP Design Phase
NRCS Soil Survey Maps	Yes, but mapped soil types must be confirmed with site observations. Regional soil maps are known to contain inaccuracies at the scale of typical development sites.	No, unless a strong correlation is developed between soil types and infiltration rates in the direct vicinity of the site and an elevated factor of safety is used.
Grain Size Analysis	Not preferred. Should only be used if a strong correlation has been developed between grain size analysis and measured infiltration rates testing results of site soils.	No
Cone Penetrometer Testing	Not preferred. Should only be used if a strong correlation has been developed between CPT results and measured infiltration rates testing results of site soils.	No
Simple Open Pit Test	Yes	Yes, with appropriate correction for infiltration into side walls and elevated factor of safety.
Open Pit Falling Head Test	Yes	Yes, with appropriate correction for infiltration into side walls and elevated factor of safety.
Double Ring Infiltrometer Test (ASTM 3385)	Yes	Yes
Single Ring Infiltrometer Test	Yes	Yes

Test	Suitability at Planning Level Screening Phase	Suitability at BMP Design Phase
Large-scale Pilot Infiltration Test	Yes, but generally cost prohibitive and too water-intensive for preliminary screening of a large area.	Yes, but should consider relatively large water demand associated with this test.
Smaller-scale Pilot Infiltration Test	Yes	Yes
Well Permeameter Method (USBR 7300-89)	Yes; reliability of this test can be improved by obtaining a continuous core where tests are conducted.	Yes in areas of proposed cut where other tests are not possible; a continuous boring log should be recorded and used to interpret test; should be confirmed with a more direct measurement following excavation.
Borehole Percolation Tests (various methods)	Yes; reliability of this test can be improved by obtaining a continuous core where tests are conducted.	Yes in areas of proposed cut where other tests are not possible; a continuous boring log should be recorded and used to interpret test; should be confirmed with a more direct measurement following excavation.
Laboratory Permeability Tests (e.g., ASTM D2434)	Yes, only suitable for evaluating potential infiltration rates in proposed fill areas. For sites with proposed cut, it is preferred to do a borehole percolation test at the proposed grade instead of analyzing samples in the lab. A combination of both tests may improve reliability.	No. However, may be part of a line of evidence for estimating the design infiltration of partial infiltration BMPs constructed in future compacted fill.

D.3.1 Desktop Approaches and Data Correlation Methods

This section reviews common methods used to evaluate infiltration characteristics based on desktop-available information, such as GIS data. This section also introduces methods for estimating infiltration properties via correlations with other measurements.

D.3.1.1 NRCS Soil Survey Maps

NRCS Soil Survey maps (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) can be used to estimate preliminary feasibility conditions, specifically by mapping hydrologic soil groups, soil texture classes, and presence of hydric soils relative to the site layout. For feasibility determinations, mapped conditions must be supplemented with available data from the site (e.g., soil borings, observed soil textures, biological indicators). The presence of D soils, if confirmed by available data, provides a reasonable basis to determine that full infiltration is not feasible for a given DMA.

D.3.1.2 Grain Size Analysis Testing and Correlations to Infiltration Rate

Hydraulic conductivity can be estimated indirectly from correlations with soil grain-size distributions. While this method is approximate, correlations have been relatively well established for some soil conditions. One of the most commonly used correlations between grain size parameters and hydraulic conductivity is the Hazen (1892, 1911) empirical formula (Philips and Kitch, 2011), but a variety of others have been developed. Correlations must be developed based on testing of site-specific soils.

D.3.1.3 Cone Penetrometer Testing and Correlations to Infiltration Rate

Hydraulic conductivity can also be estimated indirectly from cone penetrometer testing (CPT). A cone penetrometer test involves advancing a small probe into the soil and measuring the relative resistance encountered by the probe as it is advanced. The signal returned from this test can be interpreted to yield estimated soil types and the location of key transitions between soil layers. If this method is used, correlations must be developed based on testing of site-specific soils.

D.3.2 Surface and Shallow Excavation Methods

This section describes tests that are conducted at the ground surface or within shallow excavations close to the ground surface. These tests are generally applicable for cases where the bottom of the infiltration system will be near the existing ground surface. They can also be conducted to confirm the results of borehole methods after excavation/site grading has been completed.

D.3.2.1 Simple Open Pit Test

The Simple Open Pit Test is most appropriate for planning level screening of infiltration feasibility. Although it is similar to Open Pit Falling Head tests used for establishing a design infiltration rate (see below), the Simple Open Pit Test is less rigorous and is generally conducted to a lower standard of care. This test can be conducted by a nonprofessional as part of planning level screening phase.

The Simple Open Pit Test is a falling head test in which a hole at least two feet in diameter is filled with water to a level of 6" above the bottom. Water level is checked and recorded regularly until either an hour has passed or the entire volume has infiltrated. The test is repeated two more times in succession and the rate at which the water level falls in the third test is used as the infiltration rate.

This test has the advantage of being inexpensive to conduct. Yet it is believed to be fairly reliable for screening as the dimensions of the test are similar, proportionally, to the dimensions of a typical BMP. The key limitations of this test are that it measures a relatively small area, does not necessarily result in a precise measurement, and may not be uniformly implemented.

Source: City of Portland, 2008. Storm Water Management Manual

D.3.2.2 Open Pit Falling Head Test

This test is similar to the Simple Open Pit Test, but covers a larger footprint, includes more specific instructions, returns more precise measurements, and generally should be overseen by a geotechnical professional. Nonetheless, it remains a relatively simple test.

To perform this test, a hole is excavated at least 2 feet wide by 4 feet long (larger is preferred) and to a depth of at least 12 inches. The bottom of the hole should be approximately at the depth of the proposed infiltrating surface of the BMP. The hole is pre-soaked by filling it with water at least a foot above the soil to be tested and leaving it at least 4 hours (or overnight if clays are present). After pre-soaking, the hole is refilled to a depth of 12 inches and allow it to drain for one hour (2 hours for slower soils), measuring the rate at which the water level drops. The test is then repeated until successive trials yield a result with less than 10 percent change.

In comparison to a double-ring infiltrometer, this test has the advantage of measuring infiltration over a larger area and better resembles the dimensionality of a typical small scale BMP. Because it includes both vertical and lateral infiltration, it should be adjusted to estimate design rates for larger scale BMPs.

D.3.2.3 Double Ring Infiltrometer Test (ASTM 3385)

The Double Ring Infiltrometer was originally developed to estimate the saturated hydraulic conductivity of low permeability materials, such as clay liners for ponds, but has seen significant use in storm water applications. The most recent revision of this method from 2009 is known as ASTM 3385-09. The testing apparatus is designed with concentric rings that form an inner ring and an annulus between the inner and outer rings. Infiltration from the annulus between the two rings is intended to saturate the soil outside of the inner ring such that infiltration from the inner ring is restricted primarily to the vertical direction.

To conduct this test, both the center ring and annulus between the rings are filled with water. There is no pre-wetting of the soil in this test. However, a constant head of 1 to 6 inches is maintained for 6 hours, or until a constant flow rate is established. Both the inner flow rate and annular flow rate are recorded, but if they are different, the inner flow rate should be used. There are a variety of approaches that are used to maintain a constant head on the system, including use of a Mariotte tube, constant level float valves, or manual observation and filling. This test must be conducted at the elevation of the proposed infiltrating surface; therefore application of this test is limited in cases where the infiltration surface is a significant distance below existing grade at the time of testing.

This test is generally considered to provide a direct estimate of vertical infiltration rate for the specific point tested and is highly replicable. However, given the small diameter of the inner ring (standard diameter is 12 inches, but it can be larger), this test only measures infiltration rate in a small area. Additionally, given the small quantity of water used in this test compared to larger scale tests, this test may be biased high in cases where the long term infiltration rate is governed by groundwater mounding and the rate at which mounding dissipates (i.e., the capacity of the infiltration receptor). Finally, the added effort and cost of isolating vertical infiltration rate may not necessarily be warranted considering that BMPs typically have a lateral component of infiltration as well. Therefore, while this method has the advantages of being technical rigorous and well standardized, it should not necessarily be assumed to be the most representative test for estimating full-scale infiltration rates. Source: American Society for Testing and Materials (ASTM) International (2009)

D.3.2.4 Single Ring Infiltrometer Test

The single ring infiltrometer test is not a standardized ASTM test, however it is a relatively well-controlled test and shares many similarities with the ASTM standard double ring infiltrometer test (ASTM 3385-09). This test is a constant head test using a large ring (preferably greater than 40 inches in diameter) usually driven 12 inches into the soil. Water is ponded above the surface. The rate of water addition is recorded and infiltration rate is determined after the flow rate has stabilized. Water can be added either manually or automatically.

The single ring used in this test tends to be larger than the inner ring used in the double ring test. Driving the ring into the ground limits lateral infiltration; however some lateral infiltration is generally considered to occur. Experience in Riverside County (CA) has shown that this test gives results that are close to full-scale infiltration facilities. The primary advantages of this test are that it is relatively simple to conduct and has a larger footprint (compared to the double-ring method) and restricts horizontal infiltration and is more standardized (compared to open pit methods). However, it is still a relatively small scale test and can only be reasonably conducted near the existing ground surface.

D.3.2.5 Large-scale Pilot Infiltration Test

As its name implies, this test is closer in scale to a full-scale infiltration facility. This test was developed by Washington State Department of Ecology specifically for storm water applications.

To perform this test, a test pit is excavated with a horizontal surface area of roughly 100 square feet to a depth that allows 3 to 4 feet of ponding above the expected bottom of the infiltration facility. Water is continually pumped into the system to maintain a constant water level (between 3 and 4 feet about the bottom of the pit, but not more than the estimated water depth in the proposed facility) and the flow rate is recorded. The test is continued until the flow rate stabilizes. Infiltration rate is calculated by dividing the flow rate by the surface area of the pit. Similar to other open pit test, this test is known to result in a slight bias high because infiltration also moves laterally through the walls of the pit during the test. Washington State Department of Ecology requires a correction factor of 0.75 (factor of safety of 1.33) be applied to results.

This test has the advantage of being more resistant to bias from localized soil variability and being more similar to the dimensionality and scale of full scale BMPs. It is also more likely to detect long term decline in infiltration rates associated with groundwater mounding. As such, it remains the preferred test for establishing design infiltration rates in Western Washington (Washington State Department of Ecology, 2012). In a comparative evaluation of test methods, this method was found to provide a more reliable estimate of full-scale infiltration rate than double ring infiltrometer and borehole percolation tests (Philips and Kitch 2011).

The difficulty encountered in this method is that it requires a larger area be excavated than the other methods, and this in turn requires larger equipment for excavation and a greater supply of water. However, this method should be strongly considered when less information is known about spatial variability of soils and/or a higher degree of certainty in estimated infiltration rates is desired.

Source: Washington State Department of Ecology, 2012.

D.3.2.6 Smaller-scale Pilot Infiltration Test

The smaller-scale PIT is conducted similarly to the large-scale PIT but involves a smaller excavation, ranging from 20 to 32 square feet instead of 100 square feet for the large-scale PIT, with similar depths. The primary advantage of this test compared to the full-scale PIT is that it requires less excavation volume and less water. It may be more suitable for small-scale distributed infiltration controls where the need to conduct a greater number of tests outweighs the accuracy that must be obtained in each test, and where groundwater mounding is not as likely to be an issue. Washington State Department of Ecology establishes a correction factor of 0.5 (factor of safety of 2.0) for this test in comparison to 0.75 (factor of safety of 1.33) for the large-scale PIT to account for a greater fraction of water infiltrating through the walls of the excavation and lower degree of certainty related to spatial variability of soils.

D.3.3 Deeper Subsurface Tests

D.3.3.1 Well Permeameter Method (USBR 7300-89)

Well permeameter methods were originally developed for purposes of assessing aquifer permeability and associated yield of drinking water wells. This family of tests is most applicable in situations in which infiltration facilities will be placed substantially below existing grade, which limits the use of surface testing methods.

In general, this test involves drilling a 6 inch to 8 inch test well to the depth of interest and maintaining a constant head until a constant flow rate has been achieved. Water level is maintained with down-hole floats. The Porchet method or the nomographs provided in the USBR Drainage Manual (United States Department of the Interior, Bureau of Reclamation, 1993) are used to convert the measured rate of percolation to an estimate of vertical hydraulic conductivity. A smaller diameter boring may be adequate, however this then requires a different correction factor to account for the increased variability expected.

While these tests have applicability in screening level analysis, considerable uncertainty is introduced in the step of converting direct percolation measurements to estimates of vertical infiltration. Additionally, this testing method is prone to yielding erroneous results cases where the vertical horizon of the test intersects with minor lenses of sandy soils that allow water to dissipate laterally at a much greater rate than would be expected in a full-scale facility. To improve the interpretation of this test method, a continuous bore log should be inspected to determine whether thin lenses of material may be biasing results at the strata where testing is conducted. Consult USBR procedure 7300-89 for more details.

Source: (United States Department of the Interior, Bureau of Reclamation, 1990, 1993)

D.3.3.2 Borehole Percolation Tests (various methods)

Borehole percolation tests were originally developed as empirical tests to estimate the capacity of onsite sewage disposal systems (septic system leach fields), but have more recently been adopted into use for evaluating storm water infiltration. Similar to the well permeameter method, borehole percolation methods primarily measure lateral infiltration into the walls of the boring and are designed for situations in which infiltration facilities will be placed well below current grade. The percolation rate obtained in this test should be converted to an infiltration rate using a technique such as the Porchet method.

This test is generally implemented similarly to the USBR Well Permeameter Method. Per the Riverside County Borehole Percolation method, a hole is bored to a depth at least 5 times the borehole radius. The hole is presoaked for 24 hours (or at least 2 hours if sandy soils with no clay). The hole is filled to approximately the anticipated top of the proposed infiltration basin. Rates of fall are measured for six hours, refilling each half hour (or 10 minutes for sand). Tests are generally repeated until consistent results are obtained.

The same limitations described for the well permeameter method apply to borehole percolation tests, and their applicability is generally limited to initial screening. To improve the interpretation of this test method, a continuous soil core can be extracted from the hole and below the test depth, following testing, to determine whether thin lenses of material may be biasing results at the strata where testing is conducted.

Sources: Riverside County Percolation Test (2011), California Test 750 (Caltrans, 1986), San Bernardino County Percolation Test (1992); USEPA Falling Head Test (USEPA, 1980).

D.4 Specific Considerations for Infiltration Testing

The following subsections are intended to address specific topics that commonly arise in characterizing infiltration rates.

D.4.1 Hydraulic Conductivity versus Infiltration Rate versus Percolation Rate

A common misunderstanding is that the "percolation rate" obtained from a percolation test is equivalent to the "infiltration rate" obtained from tests such as a single or double ring infiltrometer test which is equivalent to the "saturated hydraulic conductivity". In fact, these terms have different meanings. Saturated hydraulic conductivity is an intrinsic property of a specific soil sample under a given degree of compaction. It is a coefficient in Darcy's equation (Darcy 1856) that characterizes the flux of water that will occur under a given gradient. The measurement of saturated hydraulic conductivity in a laboratory test is typically referred to as "permeability", which is a function of the density, structure, stratification, fines, and discontinuities of a given sample under given controlled conditions. In contrast, infiltration rate is an empirical observation of the rate of flux of water into a given soil structure under long term ponding conditions. Similarly to permeability, infiltration rate can be limited by a number of factors including the layering of soil, density, discontinuities, and initial moisture content. These factors control how quickly water can move through a soil. However, infiltration rate can also be influenced by mounding of groundwater, and the rate at which water dissipates horizontally below a BMP – both of which describe the "capacity" of the "infiltration receptor" to accept this water over an extended period. For this reason, an infiltration test should ideally be conducted for a relatively long duration resembling a series of storm events so that the capacity of the infiltration receptor is evaluated as well as the rate at which water can enter the system. Infiltration rates are generally tested with larger diameter holes, pits, or apparatuses intended to enforce a primarily vertical direction of flux.

In contrast, percolation is tested with small diameter holes, and it is mostly a lateral phenomenon. The direct measurement yielded by a percolation test tends to overestimate the infiltration rate, except perhaps in cases in which a BMP has similar dimensionality to the borehole, such as a dry well. Adjustment of percolation rates may be made to an infiltration rate using a technique such as the Porchet Method.

D.4.2 Cut and Fill Conditions

Cut Conditions: Where the proposed infiltration BMP is to be located in a cut condition, the infiltration surface level at the bottom of the BMP might be far below the existing grade. For example, if the infiltration surface of a proposed BMP is to be located at an elevation that is currently beneath 15 feet of planned cut, *how can the proposed infiltration surface be tested to establish a design infiltration rate prior to beginning excavation?* The question can be addressed in two ways: First, one of the deeper subsurface tests described above can be used to provide a planning level screening of potential rates at the elevation of the proposed infiltrating surface. These tests can be conducted at depths exceeding 100 feet, therefore are applicable in most cut conditions. Second, the project can commit to further testing using more reliable methods following bulk excavation to refine or adjust infiltration rates, and/or apply higher factors of safety to borehole methods to account for the inherent uncertainty in these measurements and conversions.

Fill Conditions: There are two types of fills – those that are engineered or documented, and those that are undocumented. Undocumented fills are fills placed without engineering controls or construction quality assurance and are subject to great uncertainty. Engineered fills are generally placed using construction quality assurance procedures and may have criteria for grain-size and fines content, and the properties can be very well understood. However, for engineered fills, infiltration rates may still be quite uncertain due to layering and heterogeneities introduced as part of construction that cannot be precisely controlled.

If the bottom of a BMP (infiltration surface) is proposed to be located in a fill location, the infiltration surface may not exist prior to grading. How then can the infiltration rate be determined? For example, if a proposed infiltration BMP is to be located with its bottom elevation in 10 feet of fill, <u>how could one reasonably establish an infiltration rate prior to the fill being placed?</u>

Where possible, infiltration BMPs on fill material should be designed such that their infiltrating surface extends into native soils. Additionally, for shallow fill depths, fill material can be selectively graded (i.e., high permeability granular material placed below proposed BMPs) to provide reliable infiltration properties until the infiltrating water reaches native soils. In some cases, due to considerable fill depth, the extension of the BMP down to natural soil and/or selective grading of fill material may prove infeasible. In additional, fill material will result in some compaction of now buried native soils potentially reducing their ability to infiltrate. In these cases, because of the uncertainty of fill parameters as described above as well as potential compaction of the native soils, an infiltration BMP may not be feasible.

If the source of fill material is defined and this material is known to be of a granular nature and that the native soils below is permeable and will not be highly compacted, infiltration through compacted fill materials may still be feasible. In this case, a project phasing approach could be used including the following general steps, (1) collect samples from areas expected to be used as borrow sites for fill activities, (2) remold samples to approximately the proposed degree of compaction and measure the saturated hydraulic conductivity of remolded samples using laboratory methods, (3) if infiltration rates appear adequate for infiltration, then apply an appropriate factor of safety and use the initial rates for preliminary design, (4) following placement of fill, conduct in-situ testing to refine design infiltration rates and adjust the design as needed; the infiltration rate of native soil below the fill should also be tested at this time to determine if compaction as a result of fill placement has significantly reduced its infiltration rate. The project geotechnical engineer should be involved in decision making whenever infiltration is proposed in the vicinity of engineered fill structures so that potential impacts of infiltration on the strength and stability of fills and pavement structures can be evaluated.

D.4.3 Effects of Direct and Incidental Compaction

It is widely recognized that compaction of soil has a major influence on infiltration rates (Pitt et al. 2008). However, direct (intentional) compaction is an essential aspect of project construction and indirect compaction (such as by movement of machinery, placement of fill, stockpiling of materials, and foot traffic) can be difficult to avoid in some parts of the project site. Infiltration testing strategies should attempt to measure soils at a degree of compaction that resembles anticipated post-construction conditions.

Ideally, infiltration systems should be located outside of areas where direct compaction will be required and should be staked off to minimize incidental compaction from vehicles and stockpiling. For these conditions, no adjustment of test results is needed.

However, in some cases, infiltration BMPs will be constructed in areas to be compacted. For these areas, it may be appropriate to include field compaction tests or prepare laboratory samples and conducting infiltration testing to approximate the degree of compaction that will occur in post-construction conditions. Alternatively, testing could be conducted on undisturbed soil, and an additional factor of safety could be applied to account for anticipated infiltration after compaction. To develop a factor of safety associated with incidental compaction, samples could compacted to various degrees of compaction, their hydraulic conductivity measured, and a "response curve" developed to relate the degree of compaction to the hydraulic conductivity of the material.

D.4.4 Temperature Effects on Infiltration Rate

The rate of infiltration through soil is affected by the viscosity of water, which in turn is affected by the temperature of water. As such, infiltration rate is strongly dependent on the temperature of the infiltrating water (Cedergren, 1997). For example, Emerson (2008) found that wintertime infiltration rates below a BMP in Pennsylvania were approximately half their peak summertime rates. As such, it is important to consider the effects of temperature when planning tests and interpreting results.

If possible, testing should be conducted at a temperature that approximates the typical runoff temperatures for the site during the times when rainfall occurs. If this is not possible, then the results of infiltration tests should be adjusted to account for the difference between the temperature at the time of testing and the typical temperature of runoff when rainfall occurs. The measured infiltration can be adjusted by the ratio of the viscosity at the test temperature versus the typical temperature when rainfall occurs (Cedergren, 1997), per the following formula:

$$K_{Typical} = K_{Test} \times \left(\frac{\mu_{Test}}{\mu_{Typical}} \right)$$

Where:

$K_{Typical}$ = the typical infiltration rate expected at typical temperatures when rainfall occurs

K_{Test} = the infiltration rate measured or estimated under the conditions of the test
$\mu_{Typical}$ = the viscosity of water at the typical temperature expected when rainfall occurs
μ_{Test} = the viscosity of water at the temperature at which the test was conducted

D.4.5 Number of Infiltration Tests Needed

The heterogeneity inherent in soils implies that all but the smallest proposed infiltration facilities would benefit from infiltration tests in multiple locations. The following requirements apply for in situ infiltration/percolation testing:

- In situ infiltration/ percolation testing shall be conducted at a minimum of two locations within 50-feet of each proposed storm water infiltration/ percolation BMP.
- In situ infiltration/percolation testing shall be conducted using an approved method listed in Table D.3-1
- Testing shall be conducted at approximately the same depth and in the same material as the base of the proposed storm water BMP.

D.5 Selecting a Safety Factor

Monitoring of actual facility performance has shown that the full-scale infiltration rate can be much lower than the rate measured by small-scale testing (King County Department of Natural Resources and Parks, 2009). Factors such as soil variability and groundwater mounding may be responsible for much of this difference. Additionally, the infiltration rate of BMPs naturally declines between maintenance cycles as the BMP surface becomes occluded and particulates accumulate in the infiltrative layer.

<u>In the past, infiltration structures have been shown to have a relatively short lifespan. Over 50 percent of infiltration systems either partially or completely failed within the first 5 years of operation (United States EPA. 1999). In a Maryland study on infiltration trenches (Lindsey et al. 1991), 53 percent were not operating as designed, 36 percent were clogged, and 22 percent showed reduced filtration. In a study of 12 infiltration basins (Galli 1992), none of which had built-in pretreatment systems, all had failed within the first two years of operation.</u>

Given the known potential for infiltration BMPs to degrade or fail over time, an appropriate factor of safety applied to infiltration testing results is strongly recommended. This section presents a recommended thought process for selecting a safety factor. This method considers factor of safety to be a function of:

- Site suitability considerations, and
- Design-related considerations.

These factors and the method for using them to compute a safety factor are discussed below.

Importantly, this method encourages rigorous site investigation, good pretreatment, and commitments to routine maintenance to provide technically-sound justification for using a lower factor of safety.

D.5.1 Determining Factor of Safety

Worksheet D.5-1, at the end of this section can be used in conjunction with Tables D.5-1 and D.5-2 to determine an appropriate safety factor. Tables D.5-1 and D.5-2 assign point values to design considerations; the values are entered into Worksheet D.5-1, which assign a weighting factor for each design consideration.

The following procedure can be used to estimate an appropriate factor of safety to be applied to the infiltration testing results. When assigning a factor of safety, care should be taken to understand what other factors of safety are implicit in other aspects of the design to avoid incorporating compounding factors of safety that may result in significant over-design.

1. For each consideration shown above, determine whether the consideration is a high, medium, or low concern.
2. For all high concerns in Table D.5-1, assign a factor value of 3, for medium concerns, assign a factor value of 2, and for low concerns assign a factor value of 1.
3. Multiply each of the factors in Table D.5-1 by 0.25 and then add them together. This should yield a number between 1 and 3.
4. For all high concerns in Table D.5-2, assign a factor value of 3, for medium concerns, assign a factor value of 2, and for low concerns assign a factor value of 1.
5. Multiply each of the factors in Table D.5-2 by 0.5 and then add them together. This should yield a number between 1 and 3.
6. Multiply the two safety factors together to get the final combined safety factor. If the combined safety factor is less than 2, then 2 should be used as the safety factor.
7. Divide the tested infiltration rate by the combined safety factor to obtain the adjusted design infiltration rate for use in sizing the infiltration facility.

Note: The minimum combined adjustment factor should not be less than 2.0 and the maximum combined adjustment factor should not exceed 9.0.

D.5.2 Site Suitability Considerations for Selection of an Infiltration Factor of Safety

Considerations related to site suitability include:

- Soil assessment methods – the site assessment extent (e.g., number of borings, test pits, etc.) and the measurement method used to estimate the short-term infiltration rate.
- Predominant soil texture/percent fines – soil texture and the percent of fines can influence the potential for clogging. Finer grained soils may be more susceptible to clogging.
- Site soil variability – site with spatially heterogeneous soils (vertically or horizontally) as determined from site investigations are more difficult to estimate average properties for resulting in a higher level of uncertainty associated with initial estimates.
- Depth to seasonal high groundwater/impervious layer – groundwater mounding may become an issue during excessively wet conditions where shallow aquifers or shallow clay lenses are present.

These considerations are summarized in Table D.5-1 below, in addition to presenting classification of concern.

Table D.5-1: Suitability Assessment Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern – 3 points	Medium Concern – 2 points	Low Concern – 1 point
Assessment methods (see explanation below)	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates Use of well permeameter or borehole methods without accompanying continuous boring log Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log Direct measurement of infiltration area with localized infiltration measurement methods (e.g., infiltrometer) Moderate spatial resolution	Direct measurement with localized (i.e., small-scale) infiltration testing methods at relatively high resolution[1] or Use of extensive test pit infiltration measurement methods[2]
Texture Class	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site soil variability	Highly variable soils indicated from site assessment, or Unknown variability	Soil borings/test pits indicate moderately homogeneous soils	Soil borings/test pits indicate relatively homogeneous soils
Depth to groundwater/ impervious layer	<5 ft below facility bottom	5-15 ft below facility bottom	>15 below facility bottom

1 - Localized (i.e., small scale) testing refers to methods such as the double-ring infiltrometer and borehole tests)

2 - Extensive infiltration testing refers to methods that include excavating a significant portion of the proposed infiltration area, filling the excavation with water, and monitoring drawdown. The excavation should be to the depth of the proposed infiltration surface and ideally be at least 30 to 100 square feet.

D.5.3 Design Related Considerations for Selection of an Infiltration Factor of Safety

Design related considerations include:

- Level of pretreatment and expected influent sediment loads – credit should be given for good pretreatment to account for the reduced probability of clogging from high sediment loading. Appendix B.6 describes performance criteria for "flow-thru treatment" based 80 percent capture of total suspended solids, which provides excellent levels of pretreatment. Additionally, the Washington State Technology Acceptance Protocol-Ecology provides a certification for "pre-treatment" based on 50 percent removal of TSS, which provides moderate levels of treatment. Current approved technologies are listed at: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html. Use of certified technologies can allow a lower factor of safety. Also, facilities designed to capture runoff from relatively clean surfaces such as rooftops are likely to see low sediment loads and therefore may be designed with lower safety factors. Finally, the amount of landscaped area and its vegetation coverage characteristics should be considered. For example in arid areas with more soils exposed, open areas draining to infiltration systems may contribute excessive sediments.
- Compaction during construction – proper construction oversight is needed during construction to ensure that the bottoms of infiltration facility are not impacted by significant incidental compaction. Facilities that use proper construction practices and oversight need less restrictive safety factors.

Table D.5-2: Design Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern – 3 points	Medium Concern – 2 points	Low Concern – 1 point
Level of pretreatment/ expected influent sediment loads	Limited pretreatment using gross solids removal devices only, such as hydrodynamic separators, racks and screens AND tributary area includes landscaped areas, steep slopes, high traffic areas, road sanding, or any other areas expected to produce high sediment, trash, or debris loads.	Good pretreatment with BMPs that mitigate coarse sediments such as vegetated swales AND influent sediment loads from the tributary area are expected to be moderate (e.g., low traffic, mild slopes, stabilized pervious areas, etc.). Performance of pretreatment consistent with "pretreatment BMP performance criteria" (50% TSS removal) in Appendix B.6	Excellent pretreatment with BMPs that mitigate fine sediments such as bioretention or media filtration OR sedimentation or facility only treats runoff from relatively clean surfaces, such as rooftops/non-sanded road surfaces. Performance of pretreatment consistent with "flow-thru treatment control BMP performance criteria" (i.e., 80% TSS removal) in Appendix B.6

Consideration	High Concern – 3 points	Medium Concern – 2 points	Low Concern – 1 point
Redundancy/ resiliency	No "backup" system is provided; the system design does not allow infiltration rates to be restored relatively easily with maintenance	The system has a backup pathway for treated water to discharge if clogging occurs <u>or</u> infiltration rates can be restored via maintenance.	The system has a backup pathway for treated water to discharge if clogging occurs <u>and</u> infiltration rates can be relatively easily restored via maintenance.
Compaction during construction	Construction of facility on a compacted site or increased probability of unintended/ indirect compaction.	Medium probability of unintended/ indirect compaction.	Equipment traffic is effectively restricted from infiltration areas during construction and there is low probability of unintended/ indirect compaction.

D.5.4 Implications of a Factor of Safety in BMP Feasibility and Design

The above method will provide safety factors in the range of 2 to 9. From a simplified practical perspective, this means that the size of the facility will need to increase in area from 2 to 9 times relative to that which might be used without a safety factor. Clearly, numbers toward the upper end of this range will make all but the best locations prohibitive in land area and cost.

In order to make BMPs more feasible and cost effective, steps should be taken to plan and execute the implementation of infiltration BMPs in a way that will reduce the safety factors needed for those projects. A commitment to effective site design and source control thorough site investigation, use of effective pretreatment controls, good construction practices, and restoration of the infiltration rates of soils that are damaged by prior compaction should lower the safety factor that should be applied, to help improve the long term reliability of the system and reduce BMP construction cost. While these practices decrease the recommended safety factor, they do not totally mitigate the need to apply a factor of safety. The minimum recommended safety factor of 2.0 is intended to account for the remaining uncertainty and long-term deterioration that cannot be technically mitigated.

Because there is potential for an applicant to "exaggerate" factor of safety to artificially prove infeasibility, an upper cap on the factor of safety is proposed for feasibility screening. A maximum factor of safety of 2.0 is recommended for infiltration <u>feasibility screening</u> such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified. If the site passes the feasibility analysis at a factor of safety of 2.0, then infiltration must investigated, but a higher factor of safety may be selected at the discretion of the design engineer.

Worksheet D.5-1: Factor of Safety and Design Infiltration Rate Worksheet

<table>
<tr><th colspan="3">Factor of Safety and Design Infiltration Rate Worksheet</th><th colspan="3">Worksheet D.5-1</th></tr>
<tr><td colspan="2">Factor Category</td><td>Factor Description</td><td>Assigned Weight (w)</td><td>Factor Value (v)</td><td>Product (p)
p = w x v</td></tr>
<tr><td rowspan="5">A</td><td rowspan="5">Suitability Assessment</td><td>Soil assessment methods</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Predominant soil texture</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Site soil variability</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Depth to groundwater / impervious layer</td><td>0.25</td><td></td><td></td></tr>
<tr><td colspan="3">Suitability Assessment Safety Factor, $S_A = \Sigma p$</td><td></td></tr>
<tr><td rowspan="4">B</td><td rowspan="4">Design</td><td>Level of pretreatment/ expected sediment loads</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Redundancy/resiliency</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Compaction during construction</td><td>0.25</td><td></td><td></td></tr>
<tr><td colspan="3">Design Safety Factor, $S_B = \Sigma p$</td><td></td></tr>
<tr><td colspan="5">Combined Safety Factor, $S_{total} = S_A \times S_B$</td><td></td></tr>
<tr><td colspan="5">Observed Infiltration Rate, inch/hr, $K_{observed}$
(corrected for test-specific bias)</td><td></td></tr>
<tr><td colspan="5">Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$</td><td></td></tr>
<tr><td colspan="6">Supporting Data</td></tr>
<tr><td colspan="6">Briefly describe infiltration test and provide reference to test forms:</td></tr>
</table>

Appendix

E

BMP DESIGN MANUAL

BMP Design Fact Sheets

Appendix E BMP Design Fact Sheets

This appendix presents BMPs for consideration for development and redevelopment projects. All projects must include Site Design and Source Control BMPs to reduce pollutants in runoff to San Diego Bay. The following priority pollutants have been identified in the Water Quality Improvement Plan for San Diego Bay (2015): trash, bacteria, and metals. Therefore, BMPs will be required on a project-specific basis that specifically address controlling those pollutants either through source control or site design features. It is the responsibility of the project applicant to propose BMPs to control these pollutants in addition to any project specific pollutants identified in accordance with the methods required by this design manual. During Port review of the SWQMP, the adequacy of BMPs proposed that target trash, bacteria, and metals will be considered and additional BMPs may be required by the Port if adequate BMPs are not selected by the project.

The following fact sheets were developed to assist the project applicants with designing BMPs to meet the storm water obligations:

MS4 Category	Manual Category	Design Fact Sheet
Source Control	Source Control	SC: Source Control BMP Requirements
Site Design	Site Design	SD-1: Street Trees SD-5: Impervious Area Dispersion SD-6A: Green Roofs SD-6B: Permeable Pavement (Site Design BMP) SD-8: Rain Barrels
Retention	Harvest and Use	HU-1: Cistern
	Infiltration	INF-1: Infiltration Basins INF-2: Bioretention INF-3: Permeable Pavement (Pollutant Control)
	Partial Retention	PR-1: Biofiltration with Partial Retention
Biofiltration	Biofiltration	BF-1: Biofiltration BF-2: Nutrient Sensitive Media Design BF-3: Proprietary Biofiltration
Flow-thru Treatment Control	Flow-thru Treatment Control with Alternative Compliance	FT-1: Vegetated Swales FT-2: Media Filters FT-3: Sand Filters FT-4: Dry Extended Detention Basin FT-5: Proprietary Flow-thru Treatment Control
		PL: Plant List

E.1 Source Control BMP Requirements

Worksheet E.1-1: Source Control BMP Requirements

How to comply: Projects shall comply with this requirement by implementing all source control BMPs listed in this section that are applicable to their project. Applicability shall be determined through consideration of the development project's features and anticipated pollutant sources. Appendix E.1 provides guidance for identifying source control BMPs applicable to a project. Checklist I.4 in Appendix I shall be used to document compliance with source control BMP requirements.

How to use this worksheet:

1. Review Column 1 and identify which of these potential sources of storm water pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your project site plan.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in a table in your project-specific storm water management report. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternatives.

If These Sources Will Be on the Project Site …	… Then Your SWQMP Shall Consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **A.** Onsite storm drain inlets ❑ Not Applicable	❑ Locations of inlets.	❑ Mark all inlets with placards provided by the Port,	❑ Maintain and periodically repaint or replace inlet markings. ❑ Provide storm water pollution prevention information to new site tenants or operators. ❑ See applicable operational BMPs in Fact Sheet SC-44, “Drainage System Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **B.** Interior floor drains and elevator shaft sump pumps ❑ Not Applicable		❑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **C.** Interior parking garages ❑ Not Applicable		❑ State that parking garage floor drains will be plumbed to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **D1.** Need for future indoor & structural pest control ❑ Not Applicable		❑ Note building design features that discourage entry of pests.	❑ Provide Integrated Pest Management information to tenants and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **D2.** Landscape/ Outdoor Pesticide Use ❑ Not Applicable	❑ Show locations of existing trees or areas of shrubs and ground cover to be undisturbed and retained. ❑ Show self-retaining landscape areas, if any. ❑ Show storm water treatment facilities.	State that final landscape plans will accomplish all of the following. ❑ Preserve existing drought tolerant trees, shrubs, and ground cover to the maximum extent possible. ❑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. ❑ Where landscaped areas are used to retain or detain storm water, specify plants that are tolerant of periodic saturated soil conditions. ❑ Consider using pest-resistant plants, especially adjacent to hardscape. ❑ To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	❑ Maintain landscaping using minimum or no pesticides. ❑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ❑ Provide IPM information to new tenants and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on Drawings**	3 **Permanent Controls—List in Table and Narrative**	4 **Operational BMPs—Include in Table and Narrative**
❑ **E.** Pools, spas, ponds, decorative fountains, and other water features. ❑ Not Applicable	❑ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	❑ If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **F.** Food service ❑ Not Applicable	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to ensure that the largest items can be accommodated.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **G.** Refuse areas ❑ Not Applicable	❑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ❑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run- on and show locations of berms to prevent runoff from the area. Also show how the designated area will be protected from wind dispersal. ❑ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	❑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ❑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	❑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on- site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative Table and Narrative**
❑ **H.** Industrial processes. ❑ Not Applicable	❑ Show process area.	❑ If industrial processes are to be located onsite, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	❑ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.) ❑ Not Applicable	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or runoff from area and protected from wind dispersal. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release Prevention Program ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank	❑ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **J.** Vehicle and Equipment Cleaning ❑ Not Applicable	❑ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle /equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited onsite and hoses are provided with an automatic shut- off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	❑ If a car wash area is not provided, describe measures taken to discourage onsite car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ❑ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ Car dealerships and similar may rinse cars with water only. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **K.** Vehicle/Equipment Repair and Maintenance ❑ Not Applicable	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to protect from rainfall, run-on runoff, and wind dispersal. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on Drawings**	3 **Permanent Controls—List in Table and Narrative**	4 **Operational BMPs—Include in Table and Narrative**
❑ **L.** Fuel Dispensing Areas ❑ Not Applicable	❑ Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are (1) graded at the minimum slope necessary to prevent ponding; and (2) separated from the rest of the site by a grade break that prevents run-on of storm water to the MEP. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area1.] The canopy [or cover] shall not drain onto the fueling area.		❑ The tenant or property manager shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

1. The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
M. Loading Docks ❑ Not Applicable	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **N.** Fire Sprinkler Test Water ❑ Not Applicable		❑ Provide a means to drain fire sprinkler test water to the sanitary sewer.	❑ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
O. Miscellaneous Drain or Wash Water ❑ Boiler drain lines ❑ Condensate drain lines ❑ Rooftop equipment ❑ Drainage sumps ❑ Roofing, gutters, and trim ❑ Not Applicable		❑ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ❑ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ❑ Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ❑ Any drainage sumps onsite shall feature a sediment sump to reduce the quantity of sediment in pumped water. ❑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **P.** Plazas, sidewalks, and parking lots. ❑ Not Applicable			❑ Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Washwater containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

E.2 SD-1 Street Trees

MS4 Permit Category
Site Design

Manual Category
Site Design

Applicable Performance Standard
Site Design

Primary Benefits
Volume Reduction

Street Trees (Source: County of San Diego LID Manual – EOA, Inc.)

Description

Trees planted to intercept rainfall and runoff can be used as storm water management measures that provide additional benefits beyond those typically associated with trees, including energy conservation, air quality improvement, and aesthetic enhancement. Typical storm water management benefits associated with trees include:

- **Interception of rainfall** – tree surfaces (roots, foliage, bark, and branches) intercept, evaporate, store, or convey precipitation to the soil before it reaches surrounding impervious surfaces
- **Reduced erosion** – trees protect denuded area by intercepting or reducing the velocity of rain drops as they fall through the tree canopy
- **Increased infiltration** – soil conditions created by roots and fallen leaves promote infiltration
- **Treatment of storm water** – trees provide treatment through uptake of nutrients and other storm water pollutants (phytoremediation) and support of other biological processes that break down pollutants

Typical street tree system components include:

- Trees of the appropriate species for site conditions and constraints
- Available growing space based on tree species, soil type, water availability, surrounding land uses, and project goals
- Optional suspended pavement design to provide structural support for adjacent pavement

without requiring compaction of underlying layers

- Optional root barrier devices as needed; a root barrier is a device installed in the ground, between a tree and the sidewalk, intended to guide roots down and away from the sidewalk in order to prevent sidewalk lifting from tree roots.
- Optional tree grates; to be considered to maximize available space for pedestrian circulation and to protect tree roots from compaction related to pedestrian circulation; tree grates are typically made up of porous material that will allow the runoff to soak through.
- Optional shallow surface depression for ponding of excess runoff
- Optional planter box drain

Design Adaptations for Project Goals

Site design BMP to provide incidental treatment. Street trees primarily functions as site design BMPs for incidental treatment. Benefits from street trees are accounted for by adjustment factors presented in Appendix B.2. This credit can apply to non-street trees as well (that meet the same criteria). Trees as a site design BMP are only credited up to 0.25 times the DCV from the project footprint (with a maximum single tree credit volume of 400 ft^3).

Storm water pollutant control BMP to provide treatment. Applicants are allowed to design trees as a pollutant control BMP and obtain credit greater than 0.25 times the DCV from the project footprint (or a credit greater than 400 ft^3 from a single tree). For this option to be approved by the Port, applicant is required to do infiltration feasibility screening (Appendix C and D) and provide calculations supporting the amount of credit claimed from implementing trees within the project footprint. The Port has the discretion to request additional analysis before approving credits greater than 0.25 times the DCV from the project footprint (or a credit greater than 400 ft^3 from a single tree).

Design Criteria and Considerations

Street Trees must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	**Tree species** is appropriately chosen for the development (tenant or capital). For public rights-of-ways, local planning guidelines and zoning provisions for the permissible species and placement of trees are consulted. A list of trees appropriate for site design that can be	Proper tree placement and species selection minimizes problems such as pavement damage by surface roots and poor growth.

	Siting and Design	*Intent/Rationale*
	used by all county municipalities are provided in Appendix E.20	
☐	**Location of trees** planted along public streets follows local requirements and guidelines. Vehicle and pedestrian line of sight are considered in tree selection and placement. Unless exemption is granted by the Port the following minimum tree separation distance is followed	Roadway safety for both vehicular and pedestrian traffic is a key consideration for placement along public streets.
☐	**Underground utilities and overhead wires** are considered in the design and avoided or circumvented. Underground utilities are routed around or through the planter in suspended pavement applications. All underground utilities are protected from water and root penetration.	Tree growth can damage utilities and overhead wires resulting in service interruptions. Protecting utilities routed through the planter prevents damage and service interruptions.

Improvement	Minimum distance to Street Tree
Traffic Signal, Stop sign	20 feet
Underground Utility lines (except sewer)	5 feet
Sewer Lines	10 feet
Above ground utility structures (Transformers, Hydrants, Utility poles, etc.)	10 feet
Driveways	10 feet
Intersections (intersecting curb lines of two streets)	25 feet

	Siting and Design	*Intent/Rationale*
☐	**Suspended pavement** design was developed where appropriate to minimize soil compaction and improve infiltration and filtration capabilities. Suspended pavement was constructed with an approved structural cell.	Suspended pavement designs provide structural support without compaction of the underlying layers, thereby promoting tree growth. Recommended structural cells include poured in place concrete columns, Silva Cells manufactured by Deeproot Green Infrastructures and Stratacell and Stratavault systems manufactured by Citygreen Systems.
☐	A minimum soil volume of 2 cubic feet per square foot of canopy projection volume is provided for each tree. Canopy projection area is the ground area beneath the tree, measured at the drip line.	The minimum soil volume ensures that there is adequate storage volume to allow for unrestricted evapotranspiration. A lower amount of soil volume may be allowed at the discretion of the Port if certified by a landscape architect or agronomist. The retention credit from the tree is directly proportional to the soil volume provided for the tree.
☐	DCV from the tributary area draining to the tree is equal to or greater than the tree credit volume	The minimum tributary area ensures that the tree receives enough runoff to fully utilize the infiltration and evapotranspiration potential provided. In cases where the minimum tributary area is not provided, the tree credit volume must be reduced proportionately to the actual tributary area.
☐	Inlet opening to the tree that is at least 18 inches wide. A minimum 2 inch drop in grade from the inlet to the finish grade of the tree. Grated inlets are allowed for pedestrian circulation. Grates need to be ADA compliant and have sufficient slip resistance.	Design requirement to ensure that the runoff from the tributary area is not bypassed. Different inlet openings and drops in grade may be allowed at the discretion of the Port if calculations are shown that the diversion flow rate (Appendix B.1.2) from the tributary area can be conveyed to the tree. In cases where the inlet capacity is limiting the amount of runoff draining to the tree, the tree credit

Siting and Design	*Intent/Rationale*
	volume must be reduced proportionately.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where street trees can be used in the site design to achieve incidental treatment. Street trees reduce runoff volumes from the site. Refer to Appendix B. Document the proposed tree locations in the SWQMP.
2. When trees are proposed as a storm water pollutant control BMP, applicant must complete feasibility analysis in Appendix C and D and submit detailed calculations for the DCV treated by trees. Document the proposed tree locations, feasibility analysis and sizing calculations in the SWQMP. The following calculations should be performed and the smallest of the three should be used as the volume treated by trees:
    a. Delineate the DMA (tributary area) to the tree and calculate the associated DCV.
    b. Calculate the required diversion flow rate using Appendix B.1.2 and size the inlet required to covey this flow rate to the tree. If the proposed inlet cannot convey the diversion flow rate for the entire tributary area, then the DCV that enters the tree should be proportionally reduced.
        i. For example, 0.5 acre drains to the tree and the associated DCV is 820 ft^3. The required diversion flow rate is 0.10 ft^3/s, but only an inlet that can divert 0.05 ft^3/s could be installed.
        ii. Then the effective DCV draining to the tree = 820 ft^3 * (0.05/0.10) = 420 ft^3
    c. Estimate the amount of storm water treated by the tree by summing the following:
        i. Evapotranspiration credit of 0.1 * amount of soil volume installed; and
        ii. Infiltration credit calculated using sizing procedures in Appendix B.4.

E.3 SD-5 Impervious Area Dispersion

MS4 Permit Category
Site Design

Manual Category
Site Design

Applicable Performance Criteria
Site Design

Primary Benefits
Volume Reduction
Peak Flow Attenuation

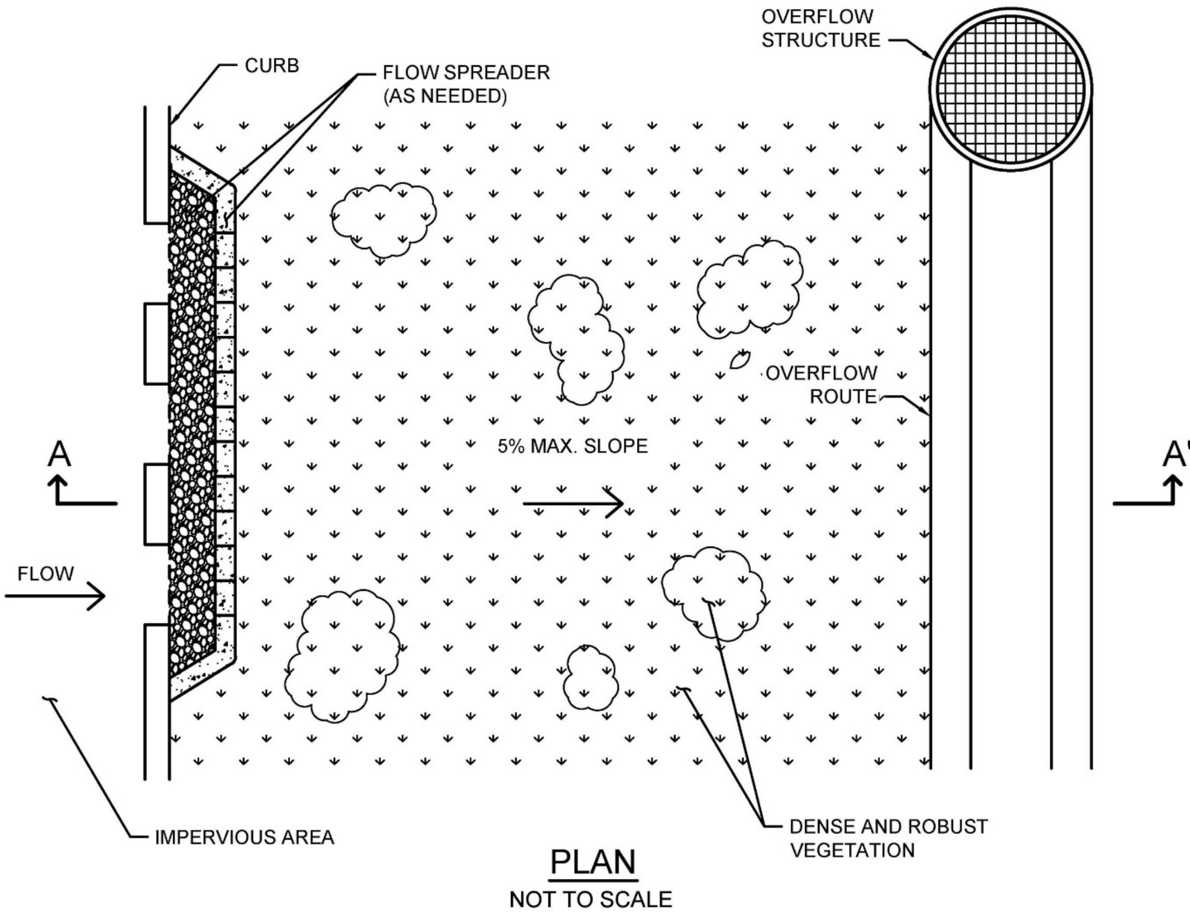
Photo Credit: Orange County Technical Guidance Document

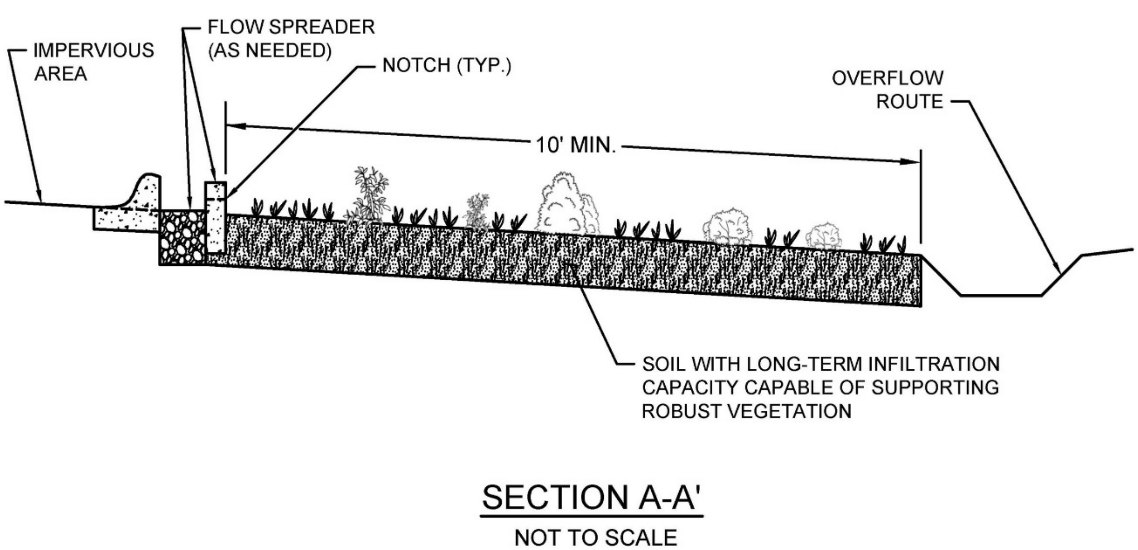
Description

Impervious area dispersion (dispersion) refers to the practice of effectively disconnecting impervious areas from directly draining to the storm drain system by routing runoff from impervious areas such as rooftops (through downspout disconnection), walkways, and driveways onto the surface of adjacent pervious areas. The intent is to slow runoff discharges, and reduce volumes. Dispersion with partial or full infiltration results in significant volume reduction by means of infiltration and evapotranspiration.

Typical dispersion components include:

- An impervious surface from which runoff flows will be routed with minimal piping to limit concentrated inflows
- Splash blocks, flow spreaders, or other means of dispersing concentrated flows and providing energy dissipation as needed
- Dedicated pervious area, typically vegetated, with in-situ soil infiltration capacity for partial or full infiltration
- Optional soil amendments to improve vegetation support, maintain infiltration rates and enhance treatment of routed flows
- Overflow route for excess flows to be conveyed from dispersion area to the storm drain system or discharge point





Typical plan and section view of an Impervious Area Dispersion BMP

Design Adaptations for Project Goals

Site design BMP to reduce impervious area and DCV. Impervious area dispersion primarily functions as a site design BMP for reducing the effective imperviousness of a site by providing partial or full infiltration of the flows that are routed to pervious dispersion areas and otherwise slowing down excess flows that eventually reach the storm drain system. This can significantly reduce the DCV for the site.

Design Criteria and Considerations

Dispersion must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Dispersion is over areas with soil types capable of supporting or being amended (e.g., with sand or compost) to support vegetation. Media amendments must be tested to verify that they are not a source of pollutants.	Soil must have long-term infiltration capacity for partial or full infiltration and be able to support vegetation to provide runoff treatment. Amendments to improve plant growth must not have negative impact on water quality.
☐	Dispersion has vegetated sheet flow over a relatively large distance (minimum 10 feet) from inflow to overflow route.	Full or partial infiltration requires relatively large areas to be effective depending on the permeability of the underlying soils.
☐	Pervious areas should be flat (with less than 5% slopes) and vegetated.	Flat slopes facilitate sheet flows and minimize velocities, thereby improving treatment and reducing the likelihood of erosion.
Inflow velocities		
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
Dedication		
☐	Dispersion areas must be dedicated for the purposes of dispersion to the exclusion of other future uses that might reduce the effectiveness of the dispersion area.	Dedicated dispersion areas prevent future conversion to alternate uses and facilitate continued full and partial infiltration benefits.

Siting and Design		Intent/Rationale
Vegetation		
☐	Dispersion typically requires dense and robust vegetation for proper function. Drought tolerant species should be selected to minimize irrigation needs. A plant list to aid in selection can be found in Appendix E.20.	Vegetation improves resistance to erosion and aids in runoff treatment.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where dispersion can be used in the site design to reduce the DCV for pollutant control sizing.
2. Calculate the DCV for storm water pollutant control per Appendix B.2, taking into account reduced runoff from dispersion.
3. Determine if a DMA is considered "Self-retaining" if the impervious to pervious ratio is:
    a. 2:1 when the pervious area is composed of Hydrologic Soil Group A
    b. 1:1 when the pervious area is composed of Hydrologic Soil Group B

E.4 SD-6A: Green Roofs

MS4 Permit Category

Site Design

Manual Category

Site Design

Applicable Performance Standard

Site Design

Primary Benefits

Volume Reduction

Peak Flow Attenuation

Location: County of San Diego Operations Center, San Diego, California

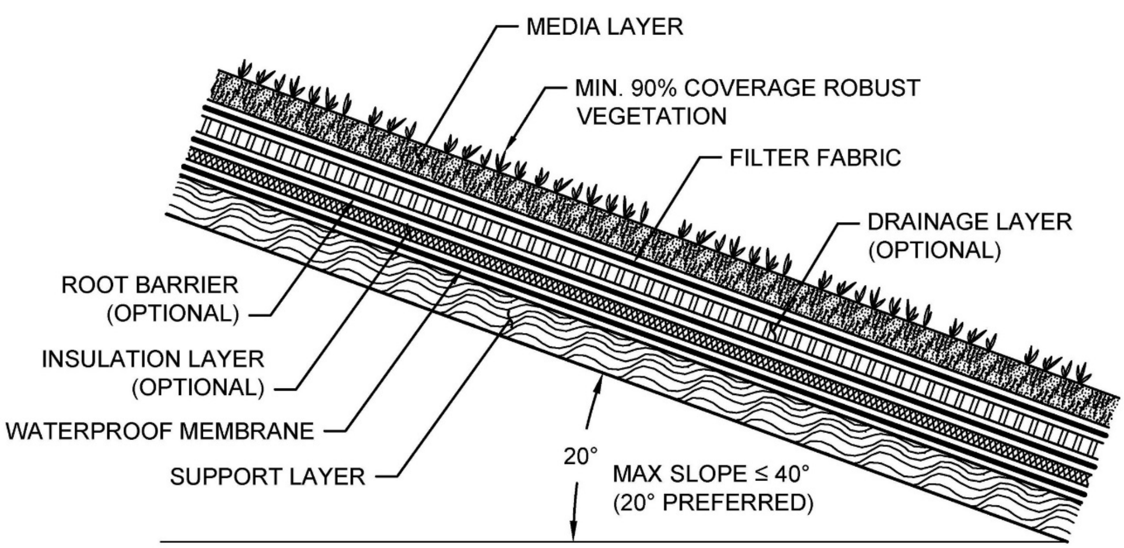
Description

Green roofs are vegetated rooftop systems that reduce runoff volumes and rates, treat storm water pollutants through filtration and plant uptake, provide additional landscape amenity, and create wildlife habitat. Additionally, green roofs reduce the heat island effect and provide acoustical control, air filtration and oxygen production. In terms of building design, they can protect against ultraviolet rays and extend the roof lifetime, as well as increase the building insulation, thereby decreasing heating and cooling costs. There are two primary types of green roofs:

- **Extensive** – lightweight, low maintenance system with low-profile, drought tolerant type groundcover in shallow growing medium (6 inches or less)
- **Intensive** – heavyweight, high maintenance system with a more garden-like configuration and diverse plantings that may include shrubs or trees in a thicker growing medium (greater than 6 inches)

Typical green roof components include, from top to bottom:

- Vegetation that is appropriate to the type of green roof system, climate, and watering conditions
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter fabric to prevent migration of fines (soils) into the drainage layer
- Optional drainage layer to convey excess runoff
- Optional root barrier
- Optional insulation layer
- Waterproof membrane
- Structural roof support capable of withstanding the additional weight of a green roof



PROFILE
NOT TO SCALE

Typical profile of a Green Roof BMP

Design Adaptations for Project Goals

Site design BMP to provide incidental treatment. Green roofs can be used as a site design feature to reduce the impervious area of the site through replacing conventional roofing. This can reduce the DCV and flow control requirements for the site.

Design Criteria and Considerations

Green roofs must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Roof slope is ≤ 40% (Roofs that are ≤ 20% are preferred).	Steep roof slopes increases project complexity and requires supplemental anchoring.
☐	Structural roof capacity design supports the calculated additional load (lbs/sq. ft) of the vegetation growing medium and additional drainage and barrier layers.	Inadequate structural capacity increases the risk for roof failure and harm to the building and occupants.
☐	Design and construction is planned to be completed by an experienced green roof specialist.	A green roof specialist will minimize complications in implementation and potential structural issues that are critical to green roof success.
☐	Green roof location and extent must meet fire safety provisions.	Green roof design must not negatively impact fire safety.
☐	Maintenance access is included in the green roof design.	Maintenance will facilitate proper functioning of drainage and irrigation components and allow for removal of undesirable vegetation and soil testing, as needed.
Vegetation		
☐	Vegetation is suitable for the green roof type, climate and expected watering conditions. Perennial, self-sowing plants that are drought-tolerant (e.g., sedums, succulents) and require little to no fertilizer, pesticides or herbicides are recommended. Vegetation pre-grown at grade may allow plants to establish prior to facing harsh roof conditions.	Plants suited to the design and expected growing environment are more likely to survive.

	Siting and Design	*Intent/Rationale*
☐	Vegetation is capable of covering ≥ 90% the roof surface.	Benefits of green roofs are greater with more surface vegetation.
☐	Vegetation is robust and erosion-resistant in order to withstand the anticipated rooftop environment (e.g., heat, cold, high winds).	Weak plants will not survive in extreme rooftop environments.
☐	Vegetation is fire resistant.	Vegetation that will not burn easily decreases the chance for fire and harm to the building and occupants.
☐	Vegetation considers roof sun exposure and shaded areas based on roof slope and location.	The amount of sunlight the vegetation receives can inhibit growth therefore the beneficial effects of a vegetated roof.
☐	An irrigation system (e.g., drip irrigation system) is included as necessary to maintain vegetation.	Proper watering will increase plant survival, especially for new plantings.
☐	Media is well-drained and is the appropriate depth required for the green roof type and vegetation supported.	Unnecessary water retention increases structural loading. An adequate media depth increases plant survival.
☐	A filter fabric is used to prevent migration of media fines through the system.	Migration of media can cause clogging of the drainage layer.
☐	A drainage layer is provided if needed to convey runoff safely from the roof. The drainage layer can be comprised of gravel, perforated sheeting, or other drainage materials.	Inadequate drainage increases structural loading and the risk of harm to the building and occupants.
☐	A root barrier comprised of dense material to inhibit root penetration is used if the waterproof membrane will not provide root penetration protection.	Root penetration can decrease the integrity of the underlying structural roof components and increase the risk of harm to the building and occupants.
☐	An insulation layer is included as needed to protect against the water in the drainage layer from extracting building heat in the winter and cool air in the summer.	Regulating thermal impacts of green roofs will aid in controlling building heating and cooling costs.
☐	A waterproof membrane is used to prevent the roof runoff from vertically	Water-damaged roof materials increase the risk of harm to the building and occupants.

Siting and Design	*Intent/Rationale*
migrating and damaging the roofing material. A root barrier may be required to prevent roots from compromising the integrity of the membrane.	

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where green roofs can be used in the site design to replace conventional roofing to reduce the DCV. These green roof areas can be credited toward reducing runoff generated through representation in storm water calculations as pervious, not impervious, areas but are not credited for storm water pollutant control.
2. Calculate the DCV per Appendix B.2.

E.5 SD-6B Permeable Pavement (Site Design BMP)

Photo Credit: San Diego Low Impact Development Design Manual

Description

Permeable pavement is pavement that allows for percolation through void spaces in the pavement surface into subsurface layers. Permeable pavements reduce runoff volumes and rates and can provide pollutant control via infiltration, filtration, sorption, sedimentation, and biodegradation processes. When used as a site design BMP, the subsurface layers are designed to provide storage of storm water runoff so that outflow rates can be controlled via infiltration into subgrade soils. Varying levels of storm water treatment and flow control can be provided depending on the size of the permeable pavement system relative to its drainage area and the underlying infiltration rates. As a site design BMP permeable pavement areas are designed to be self-retaining and are designed primarily for direct rainfall. Self-retaining permeable pavement areas have a ratio of total drainage area (including permeable pavement) to area of permeable pavement of 1.5:1 or less. Permeable pavement surfaces can be constructed from modular paver units or paver blocks, pervious concrete, porous asphalt, and turf pavers. Sites designed with permeable pavements can significantly reduce the impervious area of the project. Reduction in impervious surfaces decreases the DCV and can reduce the footprint of treatment control and flow control BMPs.

Design Adaptations for Project Goals

Site design BMP to reduce impervious area and DCV. Permeable pavement without an underdrain can be used as a site design feature to reduce the impervious area of the site by replacing traditional pavements, including roadways, parking lots, emergency access lanes, sidewalks, trails and driveways.

Typical Permeable Pavement Components (Top to Bottom)
Permeable surface layer
Bedding layer for permeable surface
Aggregate storage layer with optional underdrain(s)
Optional final filter course layer over uncompacted existing subgrade

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where permeable pavements can be used in the site design to replace conventional pavements to reduce the DCV. These areas can be credited toward reducing runoff generated through representation in storm water calculations as pervious, not impervious, areas but are not credited for storm water pollutant control.
2. Calculate the DCV per Appendix B.2, taking into account reduced runoff from permeable pavement areas.

E.6 SD-8 Rain Barrels

Photo Credit: San Diego Low Impact Development Design Manual

Description

Rain barrels are containers that can capture rooftop runoff and store it for future use. With controlled timing and volume release, the captured rainwater can be used for irrigation or alternative grey water between storm events, thereby reducing runoff volumes and associated pollutants to downstream waterbodies. Rain barrels tend to be smaller systems, less than 100 gallons. Treatment can be achieved when rain barrels are used as part of a treatment train along with other BMPs that use captured flows in applications that do not result in discharges into the storm drain system. Rooftops are the ideal tributary areas for rain barrels.

Design Adaptations for Project Goals

Site design BMP to reduce effective impervious area and DCV. Barrels can be used as a site design feature to reduce the effective impervious area of the site by removing roof runoff from the site discharge. This can reduce the DCV and flow control requirements for the site.

Typical Rain Barrel Components
Storage container, barrel or tank for holding captured flows
Inlet and associated valves and piping
Outlet and associated valves and piping
Overflow outlet
Optional pump
Optional first flush diverters
Optional roof, supports, foundation, level indicator, and other accessories

Important Considerations

Maintenance: Rain barrels require regular monitoring and cleaning to ensure that they do not become clogged with leaves or other debris.
Economics: Rain barrels have low installation costs.
Limitations: Due to San Diego's arid climate, some rain barrels may fill only a few times each year.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where rain barrels can be used in the site design to capture roof runoff to reduce the DCV. Rain barrels reduce the effective impervious area of the site by removing roof runoff from the site discharge.
2. Calculate the DCV per Appendix B.2, taking into account reduced runoff from permeable pavement areas.

E.7 HU-1 Cistern

MS4 Permit Category

Retention

Manual Category

Harvest and Use

Applicable Performance Standards

Pollutant Control
Flow Control

Primary Benefits

Volume Reduction
Peak Flow Attenuation

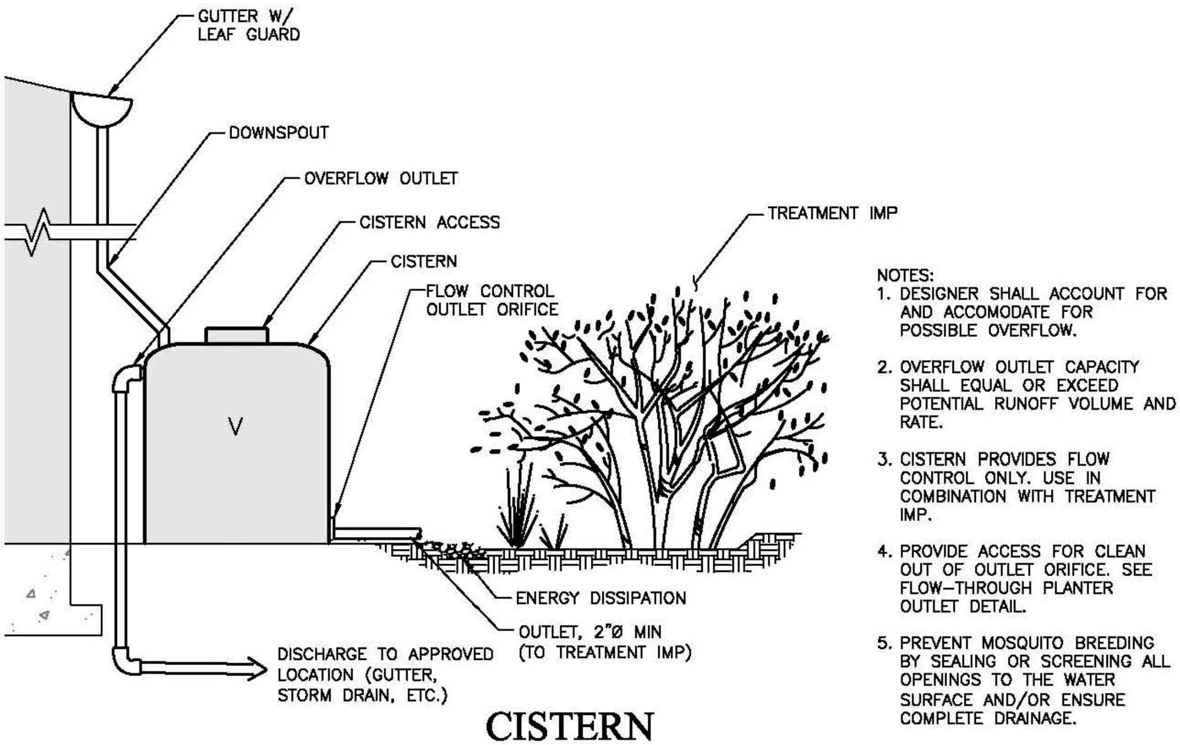
Photo Credit: Water Environment Research Foundation: WERF.org

Description

Cisterns are containers that can capture rooftop runoff and store it for future use. With controlled timing and volume release, the captured rainwater can be used for irrigation or alternative grey water between storm events, thereby reducing runoff volumes and associated pollutants to downstream water bodies. Cisterns are larger systems (generally>100 gallons) that can be self-contained aboveground or below ground systems. Treatment can be achieved when cisterns are used as part of a treatment train along with other BMPs that use captured flows in applications that do not result in discharges into the storm drain system. Rooftops are the ideal tributary areas for cisterns.

Typical cistern components include:

- Storage container, barrel or tank for holding captured flows
- Inlet and associated valves and piping
- Outlet and associated valves and piping
- Overflow outlet
- Optional pump
- Optional first flush diverters
- Optional roof, supports, foundation, level indicator, and other accessories



Source: City of San Diego Storm Water Standards

Design Adaptations for Project Goals

Site design BMP to reduce effective impervious area and DCV. Cisterns can be used as a site design feature to reduce the effective impervious area of the site by removing roof runoff from the site discharge. This can reduce the DCV and flow control requirements for the site.

Harvest and use for storm water pollutant control. Typical uses for captured flows include irrigation, toilet flushing, cooling system makeup, and vehicle and equipment washing.

Integrated storm water flow control and pollutant control configuration. Cisterns provide flow control in the form of volume reduction and/or peak flow attenuation and storm water treatment through elimination of discharges of pollutants. Additional flow control can be achieved by sizing the cistern to include additional detention storage and/or real-time automated flow release controls.

Design Criteria and Considerations

Cisterns must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Cisterns are sized to detain the full DCV of contributing area and empty within 36 hours.	Draining the cistern makes the storage volume available to capture the next storm. The applicant has an option to use a different drawdown time up to 96 hours if the volume of the facility is adjusted using the percent capture method in Appendix B.4.2.
☐	Cisterns are fitted with a flow control device such as an orifice or a valve to limit outflow in accordance with drawdown time requirements.	Flow control provides flow attenuation benefits and limits cistern discharge to downstream facilities during storm events.
☐	Cisterns are designed to drain completely, leaving no standing water, and all entry points are fitted with traps or screens, or sealed.	Complete drainage and restricted entry prevents mosquito habitat.
☐	Leaf guards and/or screens are provided to prevent debris from accumulating in the cistern.	Leaves and organic debris can clog the outlet of the cistern.
☐	Access is provided for maintenance and the cistern outlets are accessible and designed to allow easy cleaning.	Properly functioning outlets are needed to maintain proper flow control in accordance with drawdown time requirements.
☐	Cisterns must be designed and sited such that overflow will be conveyed safely overland to the storm drain system or discharge point.	Safe overflow conveyance prevents flooding and damage of property.

Conceptual Design and Sizing Approach for Site Design and Storm Water Pollutant Control

1. Calculate the DCV for site design per Appendix B.
2. Determine the locations on the site where cisterns can be located to capture and detain the DCV from roof areas without subsequent discharge to the storm drain system. Cisterns are best located in close proximity to building and other roofed structures to minimize piping. Cisterns can also be used as part of a treatment train upstream by increasing pollutant control through delayed runoff to infiltration BMPs such as bioretention without underdrain facilities.
3. Use the sizing worksheet in Appendix B.3 to determine if full or partial capture of the DCV is achievable.

4. The remaining DCV to be treated should be calculated for use in sizing downstream BMP(s).

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or duration will typically require significant cistern volumes, and therefore the following steps should be taken prior to determination of site design and storm water pollutant control. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that cistern siting and design criteria have been met. Design for flow control can be achieved using various design configurations, shapes, and quantities of cisterns.
2. Iteratively determine the cistern storage volume required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control valve operation.
3. Verify that the cistern is drawdown within 36 hours. The drawdown time can be estimated by dividing the storage volume by the rate of use of harvested water.
4. If the cistern cannot fully provide the flow rate and duration control required by this manual, a downstream structure with additional storage volume or infiltration capacity such as a biofiltration can be used to provide remaining flow control.

E.8 INF-1 Infiltration Basin

MS4 Permit Category
Retention

Manual Category
Infiltration

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Volume Reduction
Peak Flow Attenuation

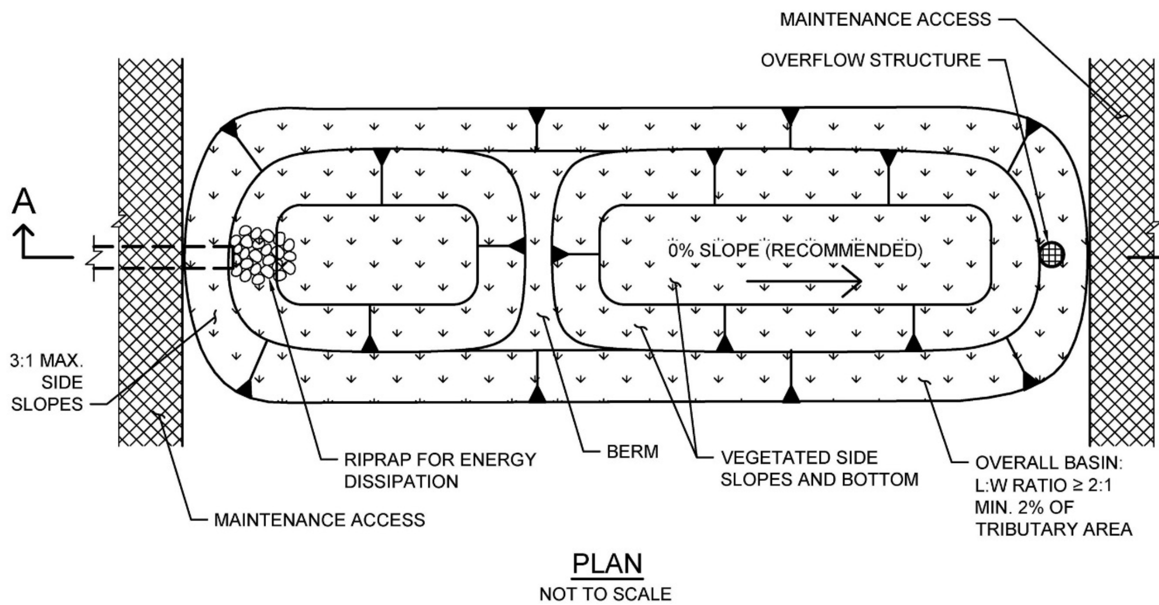
Photo Credit: http://www.stormwaterpartners.com/facilities/basin.html

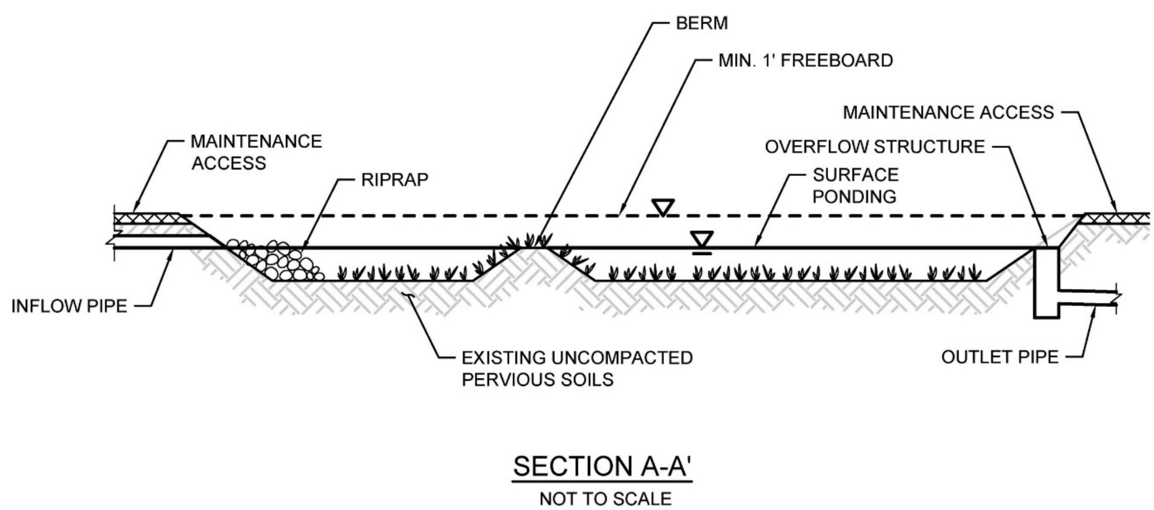
Description

An infiltration basin typically consists of an earthen basin with a flat bottom constructed in naturally pervious soils. An infiltration basin retains storm water and allows it to evaporate and/or percolate into the underlying soils. The bottom of an infiltration basin is typically vegetated with native grasses or turf grass; however other types of vegetation can be used if they can survive periodic inundation and long inter-event dry periods. Treatment is achieved primarily through infiltration, filtration, sedimentation, biochemical processes and plant uptake. Infiltration basins can be constructed as linear **trenches** or as **underground infiltration galleries**.

Typical infiltration basin components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Forebay to provide pretreatment surface ponding for captured flows
- Vegetation selected based on basin use, climate, and ponding depth
- Uncompacted native soils at the bottom of the facility
- Overflow structure





Typical plan and section view of an Infiltration BMP

Design Adaptations for Project Goals

Full infiltration BMP for storm water pollutant control. Infiltration basins can be used as a pollutant control BMP, designed to infiltrate runoff from direct rainfall as well as runoff from adjacent areas that are tributary to the BMP. Infiltration basins must be designed with an infiltration storage volume (a function of the surface ponding volume) equal to the full DCV and able to meet drawdown time limitations.

Integrated storm water flow control and pollutant control configuration. Infiltration basins can also be designed for flow rate and duration control by providing additional infiltration storage through increasing the surface ponding volume.

Design Criteria and Considerations

Infiltration basins must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a full infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
☐	Finish grade of the facility is ≤ 2% (0% recommended).	Flatter surfaces reduce erosion and channelization with the facility.
☐	Settling forebay has a volume ≥ 25% of facility volume below the forebay overflow.	A forebay to trap sediment can decrease frequency of required maintenance.
☐	Infiltration of surface ponding is limited to a 36-hour drawdown time.	Prolonged surface ponding reduce volume available to capture subsequent storms. The applicant has an option to use a different drawdown time up to 96 hours if the volume of the facility is adjusted using the percent capture method in Appendix B.4.2.
☐	Minimum freeboard provided is ≥1 foot.	Freeboard minimizes risk of uncontrolled surface discharge.
☐	Side slopes are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.

	Siting and Design	*Intent/Rationale*
Inflow and Overflow Structures		
☐	Inflow and outflow structures are accessible by required equipment (e.g., vactor truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control

To design infiltration basins for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement and basin area requirements, forebay volume, and maximum slopes for basin sides and bottom.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet (Appendix B.4) to determine if full infiltration of the DCV is achievable based on the infiltration storage volume calculated from the surface ponding area and depth for a maximum 36-hour drawdown time. The drawdown time can be estimated by dividing the average depth of the basin by the design infiltration rate. Appendix D provides guidance on evaluating a site's infiltration rate.

Conceptual Design and Sizing Approach for Storm Water Pollutant Treatment and Flow Control

Control of flow rates and/or durations will typically require significant surface ponding volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement and basin area

requirements, forebay volume, and maximum slopes for basin sides and bottom.

2. Iteratively determine the surface ponding required to provide infiltration storage to reduce flow rates and durations to allowable limits while adhering to the maximum 36-hour drawdown time. Flow rates and durations can be controlled using flow splitters that route the appropriate inflow amounts to the infiltration basin and bypass excess flows to the downstream storm drain system or discharge point.
3. If an infiltration basin cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide additional control.
4. After the infiltration basin has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.9 INF-2 Bioretention

MS4 Permit Category
Retention

Manual Category
Infiltration

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Volume Reduction
Treatment
Peak Flow Attenuation

Photo Credit: Ventura County Technical Guidance Document

Description

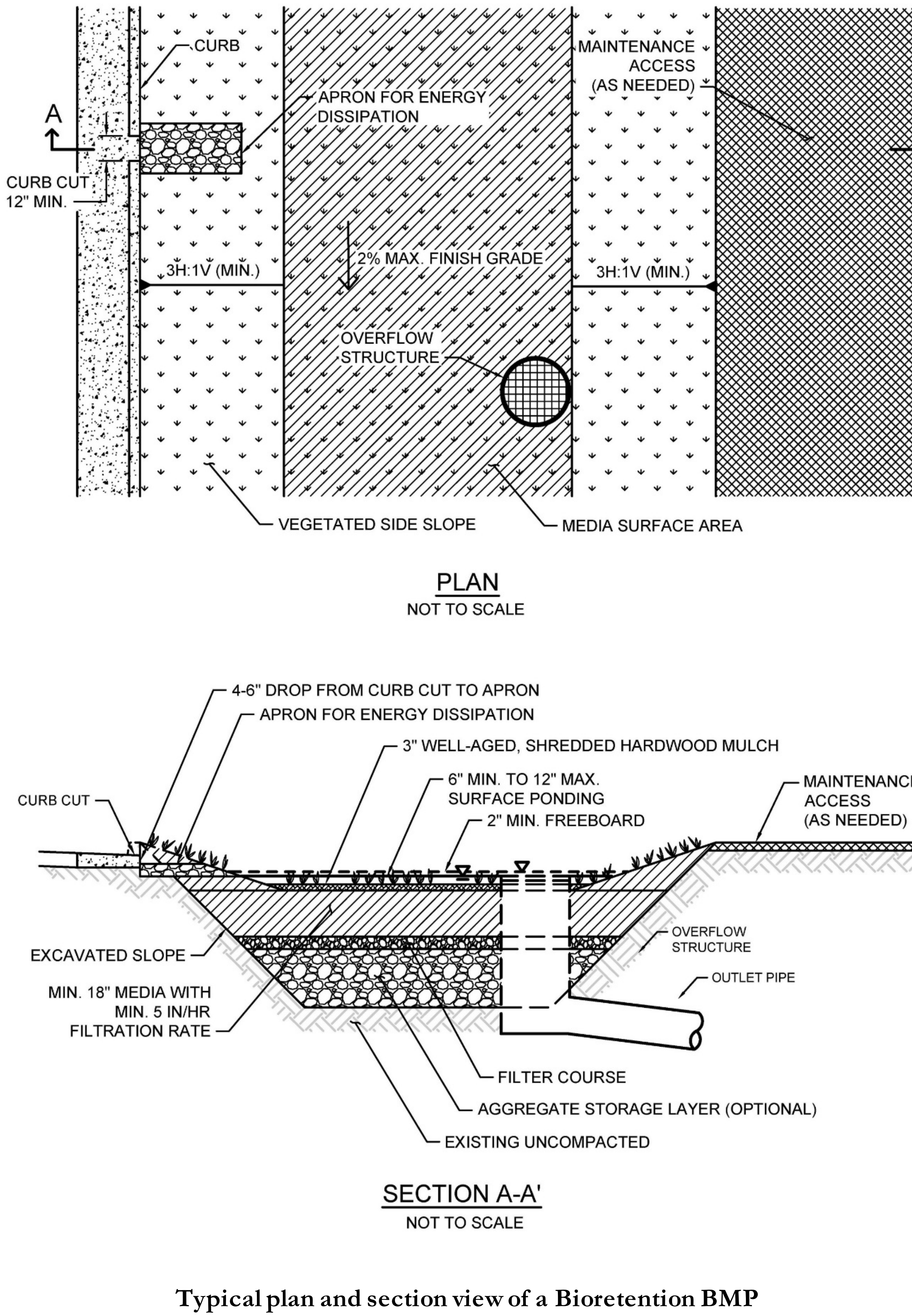
Bioretention (bioretention without underdrain) facilities are vegetated surface water systems that filter water through vegetation and soil, or engineered media prior to infiltrating into native soils. These facilities are designed to infiltrate the full DCV. Bioretention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed inground or partially aboveground, such as planter boxes with open bottoms (no impermeable liner at the bottom) to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

Typical bioretention without underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Optional aggregate storage layer for additional infiltration storage
- Uncompacted native soils at the bottom of the facility
- Overflow structure

Design Adaptations for Project Goals

- **Full infiltration BMP for storm water pollutant control.** Bioretention can be used as a pollutant control BMP designed to infiltrate runoff from direct rainfall as well as runoff from adjacent tributary areas. Bioretention facilities must be designed with an infiltration storage volume (a function of the ponding, media and aggregate storage volumes) equal to the full DCV and able to meet drawdown time limitations.
- **Integrated storm water flow control and pollutant control configuration.** Bioretention facilities can be designed to provide flow rate and duration control. This may be accomplished by providing greater infiltration storage with increased surface ponding and/or aggregate storage volume for storm water flow control.



Typical plan and section view of a Bioretention BMP

Design Criteria and Considerations

Bioretention must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of BMP is based on infiltration feasibility criteria and appropriate design infiltration rate presented in Appendix C and D.	Must operate as a full infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
☐	Contributing tributary area is ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of the facility is ≤ 2%. In long bioretention facilities where the potential for internal erosion and channelization exists, the use of check dams is required.	Flatter surfaces reduce erosion and channelization within the facility. Internal check dams reduce velocity and dissipate energy.
	Surface Ponding	
☐	Surface ponding is limited to a 24-hour drawdown time.	24-hour drawdown time is recommended for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the Port if certified by a landscape architect or agronomist.

	Siting and Design	*Intent/Rationale*
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the Port if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are ≥ 3H: 1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply is provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows beneficial microbes to multiply.

	Siting and Design	*Intent/Rationale*
Media Layer		
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. A minimum initial filtration rate of 10 in/hr is recommended.	A high filtration rate through the soil mix minimizes clogging potential and allows flows to quickly enter the aggregate storage layer, thereby minimizing bypass.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards, Appendix F (February 2016, unless superseded by more recent edition) **<u>or</u>** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition).	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed.
☐	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	For non-standard or proprietary designs, compliance with F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
Filter Course Layer (Optional)		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.

	Siting and Design	*Intent/Rationale*
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
	Aggregate Storage Layer (Optional)	
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	Maximum aggregate storage layer depth is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time to facilitate provision of adequate storm water storage for the next storm event.
	Inflow and Overflow Structures	
☐	Inflow and overflow structures are accessible for inspection and maintenance. Overflow structures must be connected to downstream storm drain system or appropriate discharge point.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement and basin area requirements, maximum side and finish grade slope, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine if full infiltration of the DCV is achievable based on the available infiltration storage volume calculated from the bioretention without underdrain footprint area, effective depths for surface ponding, media and aggregate storage layers, and in-situ soil design infiltration rate for a maximum 36-hour drawdown time for the aggregate storage layer, with surface ponding no greater than a maximum 24-hour drawdown. The drawdown time can be estimated by dividing the average depth of the basin by the design infiltration rate of the underlying soil. Appendix D provides guidance on evaluating a site's infiltration rate. A generic sizing worksheet is provided in Appendix B.4.
4. Where the DCV cannot be fully infiltrated based on the site or bioretention constraints, an underdrain can be added to the design (use biofiltration with partial retention factsheet).

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations shall be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, maximum side and finish grade slopes, and the recommended media surface area tributary area ratio. Design for flow control can be achieved using various design configurations.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide infiltration storage to reduce flow rates and durations to allowable limits while adhering to the maximum drawdown times for surface ponding and aggregate storage. Flow rates and durations can be controlled using flow splitters that route the appropriate inflow amounts to the bioretention facility and bypass excess flows to the downstream storm drain system or discharge point.
3. If bioretention without underdrain facility cannot fully provide the flow rate and duration control required by the MS4 permit, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide additional control.
4. After bioretention without underdrain BMPs have been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.10 INF-3 Permeable Pavement (Pollutant Control)

MS4 Permit Category

Retention
Flow-thru Treatment Control

Manual Category

Infiltration
Flow-thru Treatment Control

Applicable Performance Standard

Pollutant Control

Flow Control

Primary Benefits

Volume Reduction
Peak Flow Attenuation

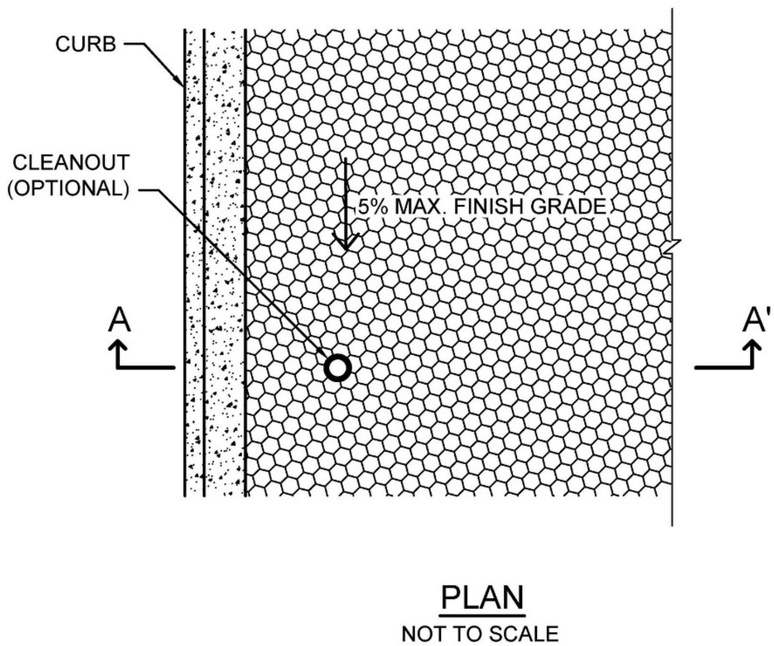
Location: Kellogg Park, San Diego, California

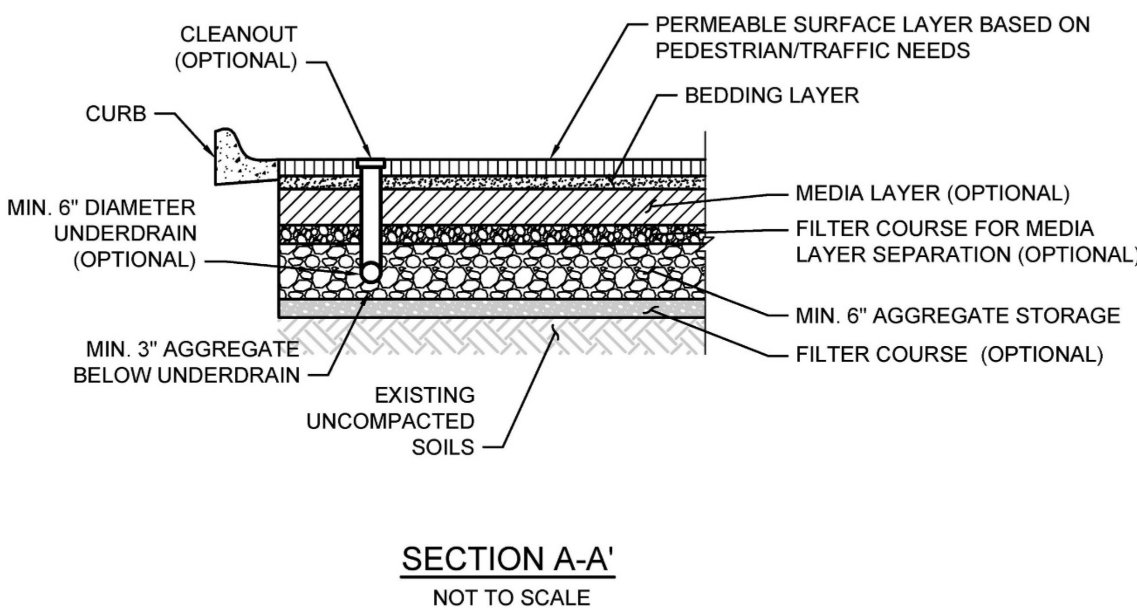
Description

Permeable pavement is pavement that allows for percolation through void spaces in the pavement surface into subsurface layers. The subsurface layers are designed to provide storage of storm water runoff so that outflows, primarily via infiltration into subgrade soils or release to the downstream conveyance system, can be at controlled rates. Varying levels of storm water treatment and flow control can be provided depending on the size of the permeable pavement system relative to its drainage area, the underlying infiltration rates, and the configuration of outflow controls. Pollutant control permeable pavement is designed to receive runoff from a larger tributary area than site design permeable pavement (see SD-6B). Pollutant control is provided via infiltration, filtration, sorption, sedimentation, and biodegradation processes.

Typical permeable pavement components include, from top to bottom:

- Permeable surface layer
- Bedding layer for permeable surface
- Aggregate storage layer with optional underdrain(s)
- Optional final filter course layer over uncompacted existing subgrade





Typical plan and Section view of a Permeable Pavement BMP

Subcategories of permeable pavement include modular paver units or paver blocks, pervious concrete, porous asphalt, and turf pavers. These subcategory variations differ in the material used for the permeable surface layer but have similar functions and characteristics below this layer.

Design Adaptations for Project Goals

Site design BMP to reduce impervious area and DCV. See site design option SD-6B.

Full infiltration BMP for storm water pollutant control. Permeable pavement without an underdrain and without impermeable liners can be used as a pollutant control BMP, designed to infiltrate runoff from direct rainfall as well as runoff from adjacent areas that are tributary to the pavement. The system must be designed with an infiltration storage volume (a function of the aggregate storage volume) equal to the full DCV and able to meet drawdown time limitations.

Partial infiltration BMP with flow-thru treatment for storm water pollutant control. Permeable pavement can be designed so that a portion of the DCV is infiltrated by providing an underdrain with infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered flow-thru treatment and is not considered biofiltration treatment. Storage provided above the underdrain invert is included in the flow-thru treatment volume.

Flow-thru treatment BMP for storm water pollutant control. The system may be lined and/or installed over impermeable native soils with an underdrain provided at the bottom to carry away filtered runoff. Water quality treatment is provided via unit treatment processes other than infiltration. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Significant aggregate storage provided above the underdrain invert can provide detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain. **PDPs have the option to add saturated storage to the flow-thru configuration in order to reduce the DCV that the BMP is required to treat.** Saturated storage can be added to this design by including an upturned elbow installed at the downstream end of the underdrain or via an internal weir structure designed to maintain a specific water level elevation. The DCV can be reduced by the amount of saturated storage provided.

Integrated storm water flow control and pollutant control configuration. With any of the above configurations, the system can be designed to provide flow rate and duration control. This may include having a deeper aggregate storage layer that allows for significant detention storage above the underdrain, which can be further controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Permeable pavements must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection must be based on infiltration feasibility criteria.	Full or partial infiltration designs must be supported by drainage area feasibility findings.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Permeable pavement is not placed in an area with significant overhanging trees or other vegetation.	Leaves and organic debris can clog the pavement surface.
☐	For pollutant control permeable pavement, the ratio of the total drainage area (including the permeable pavement) to the permeable pavement should not exceed 4:1.	Higher ratios increase the potential for clogging but may be acceptable for relatively clean tributary areas.
☐	Finish grade of the permeable pavement has a slope ≤ 5%.	Flatter surfaces facilitate increased runoff capture.
☐	Minimum depth to groundwater and bedrock ≥ 10 ft.	A minimum separation facilitates infiltration and lessens the risk of negative groundwater impacts.
☐	Contributing tributary area includes effective sediment source control and/or pretreatment measures such as raised curbed or grass filter strips.	Sediment can clog the pavement surface.

	Siting and Design	*Intent/Rationale*
☐	Direct discharges to permeable pavement are only from downspouts carrying "clean" roof runoff that are equipped with filters to remove gross solids.	Roof runoff typically carries less sediment than runoff from other impervious surfaces and is less likely to clog the pavement surface.
	Permeable Surface Layer	
☐	Permeable surface layer type is appropriately chosen based on pavement use and expected vehicular loading.	Pavement may wear more quickly if not durable for expected loads or frequencies.
☐	Permeable surface layer type is appropriate for expected pedestrian traffic.	Expected demographic and accessibility needs (e.g., adults, children, seniors, runners, high-heeled shoes, wheelchairs, strollers, bikes) requires selection of appropriate surface layer type that will not impede pedestrian needs.
	Bedding Layer for Permeable Surface	
☐	Bedding thickness and material is appropriate for the chosen permeable surface layer type.	Porous asphalt requires a 2- to 4-inch layer of asphalt and a 1- to 2-inch layer of choker course (single-sized crushed aggregate, one-half inch) to stabilize the surface. Pervious concrete also requires an aggregate course of clean gravel or crushed stone with a minimum amount of fines. Permeable Interlocking Concrete Paver requires 1 or 2 inches of sand or No. 8 aggregate to allow for leveling of the paver blocks. Similar to Permeable Interlocking Concrete Paver, plastic grid systems also require a 1- to 2-inch bedding course of either gravel or sand. For Permeable Interlocking Concrete Paver and plastic grid systems, if sand is used, a geotextile should be used between the sand course and the reservoir media to prevent the sand from migrating into the stone media.

	Siting and Design	*Intent/Rationale*
☐	Aggregate used for bedding layer is washed prior to placement.	Washing aggregate will help eliminate fines that could clog the permeable pavement system aggregate storage layer void spaces or underdrain.
	Media Layer (Optional) –used between bedding layer and aggregate storage layer to provide pollutant treatment control	
☐	The pollutant removal performance of the media layer is documented by the applicant.	Media used for BMP design should be shown via research or testing to be appropriate for expected pollutants of concern and flow rates.
☐	A filter course is provided to separate the media layer from the aggregate storage layer.	Migration of media can cause clogging of the aggregate storage layer void spaces or underdrain.
☐	If a filter course is used, calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
☐	Consult permeable pavement manufacturer to verify that media layer provides required structural support.	Media must not compromise the structural integrity or intended uses of the permeable pavement surface.
	Aggregate Storage Layer	
☐	Aggregate used for the aggregate storage layer is washed and free of fines.	Washing aggregate will help eliminate fines that could clog aggregate storage layer void spaces or underdrain.
☐	Minimum layer depth is 6 inches and for infiltration designs, the maximum depth is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A minimum depth of aggregate provides structural stability for expected pavement loads.
	Underdrain and Outflow Structures	
☐	Underdrains and outflow structures, if used, are accessible for inspection and maintenance.	Maintenance will improve the performance and extend the life of the permeable pavement system.

	Siting and Design	*Intent/Rationale*
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
	Filter Course (Optional)	
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog subgrade and impede infiltration.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where permeable pavement can be used in the site design to replace traditional pavement to reduce the impervious area and DCV. These permeable pavement areas can be credited toward reducing runoff generated through representation in storm water calculations as pervious, not impervious, areas but are not credited for storm water pollutant control. These permeable pavement areas should be designed as self-retaining with the appropriate tributary area ratio identified in the design criteria.
2. Calculate the DCV per Appendix B, taking into account reduced runoff from self-retaining permeable pavement areas.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design permeable pavement for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, maximum finish grade slope, and the recommended tributary area ratio for non-self-retaining permeable pavement. If infiltration is infeasible, the permeable pavement can be designed as flow-thru treatment per the sizing worksheet. If infiltration is feasible, calculations should follow the remaining design steps.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.

3. Use the sizing worksheet to determine if full or partial infiltration of the DCV is achievable based on the available infiltration storage volume calculated from the permeable pavement footprint, aggregate storage layer depth, and in-situ soil design infiltration rate for a maximum 36-hour drawdown time. The applicant has an option to use a different drawdown time up to 96 hours if the volume of the facility is adjusted using the percent capture method in Appendix B.4.2.
4. Where the DCV cannot be fully infiltrated based on the site or permeable pavement constraints, an underdrain must be incorporated above the infiltration storage to carry away runoff that exceeds the infiltration storage capacity.
5. The remaining DCV to be treated should be calculated for use in sizing downstream BMP(s).

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, maximum finish grade slope, and the recommended tributary area ratio for non-self-retaining permeable pavement. Design for flow control can be achieving using various design configurations, but a flow-thru treatment design will typically require a greater aggregate storage layer volume than designs which allow for full or partial infiltration of the DCV.
2. Iteratively determine the area and aggregate storage layer depth required to provide infiltration and/or detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If the permeable pavement system cannot fully provide the flow rate and duration control required by this manual, a downstream structure with sufficient storage volume such as an underground vault can be used to provide remaining controls.
4. After permeable pavement has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.11 PR-1 Biofiltration with Partial Retention

Location: 805 and Bonita Road, Chula vista, CA.

MS4 Permit Category
NA

Manual Category
Partial Retention

Applicable Performance Standard
Pollutant Control
Flow Control

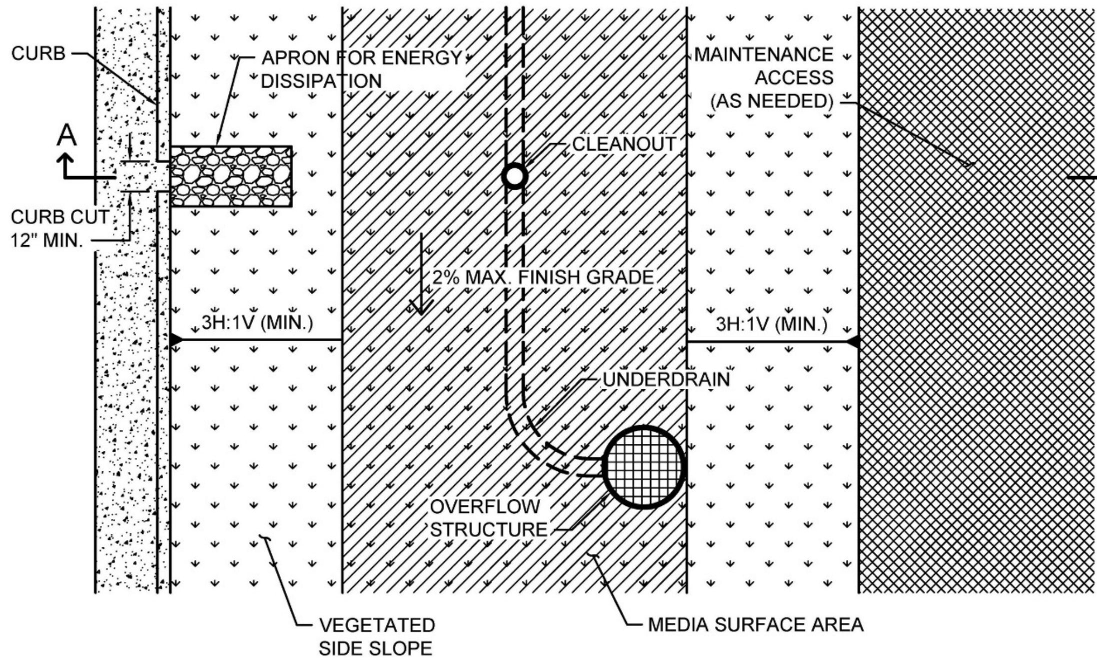
Primary Benefits
Volume Reduction
Treatment
Peak Flow Attenuation

Description

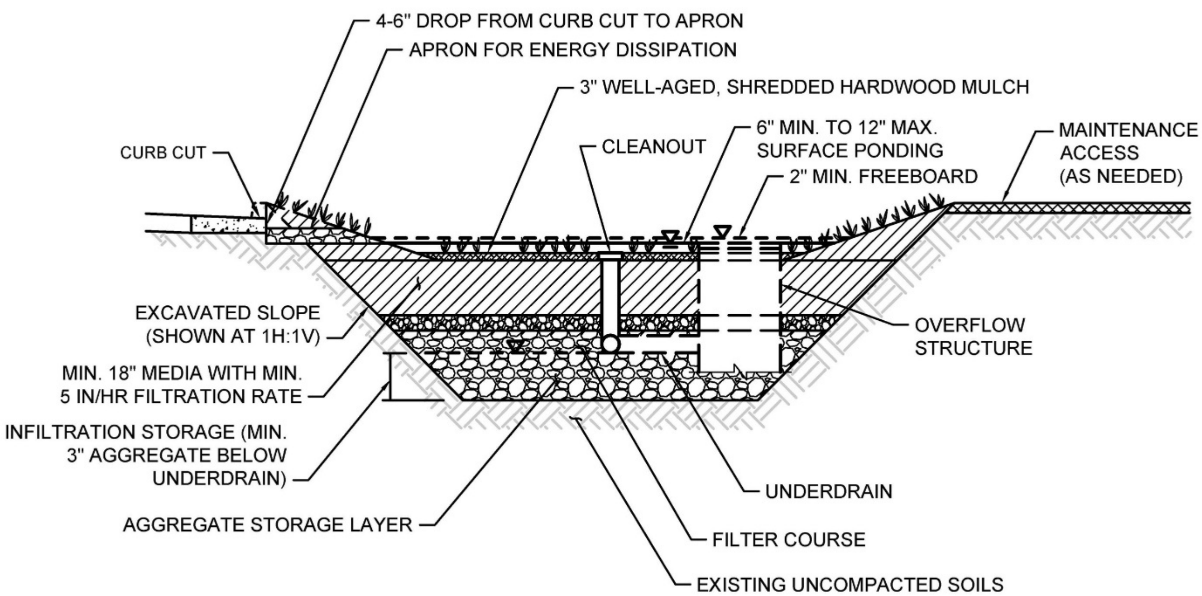
Biofiltration with partial retention (partial infiltration and biofiltration) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to infiltrating into native soils, discharge via underdrain, or overflow to the downstream conveyance system. Where feasible, these BMPs have an elevated underdrain discharge point that creates storage capacity in the aggregate storage layer. Biofiltration with partial retention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed in ground or partially aboveground, such as planter boxes with open bottoms to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

Typical biofiltration with partial retention components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side Slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Uncompacted native soils at the bottom of the facility
- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Biofiltration with Partial Retention BMP

Design Adaptations for Project Goals

Partial infiltration BMP with biofiltration treatment for storm water pollutant control. Biofiltration with partial retention can be designed so that a portion of the DCV is infiltrated by providing infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered biofiltration treatment. Storage provided above the underdrain within surface ponding, media, and aggregate storage is included in the biofiltration treatment volume.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer. This will allow for significant detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Biofiltration with partial retention must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a partial infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.

	Siting and Design	Intent/Rationale
	Siting and Design	*Intent/Rationale*
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
	Surface Ponding	
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the Port if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the Port if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18” will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.

	Siting and Design	*Intent/Rationale*
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
	Vegetation	
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
	Mulch	
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
	Media Layer	
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events, and allows flows to relatively quickly enter the aggregate storage layer, thereby minimizing bypass. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.

	Siting and Design	*Intent/Rationale*
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards Appendix F (February 2016, unless superseded by more recent edition) **<u>or</u>** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.

	Siting and Design	*Intent/Rationale*
	Filter Course Layer	
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
	Aggregate Storage Layer	
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	Maximum aggregate storage layer depth below the underdrain invert is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time is needed for vector control and to facilitate providing storm water storage for the next storm event.
	Inflow, Underdrain, and Outflow Structures	
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it

	Siting and Design	*Intent/Rationale*
		grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Nutrient Sensitive Media Design

To design biofiltration with partial retention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design biofiltration with partial retention and an underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Generalized sizing procedure is presented in Appendix B.5. The surface ponding should be verified to have a maximum 24-hour drawdown time.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention and/or infiltration storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If biofiltration with partial retention cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After biofiltration with partial retention has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.12 BF-1 Biofiltration

MS4 Permit Category
Biofiltration

Manual Category
Biofiltration

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

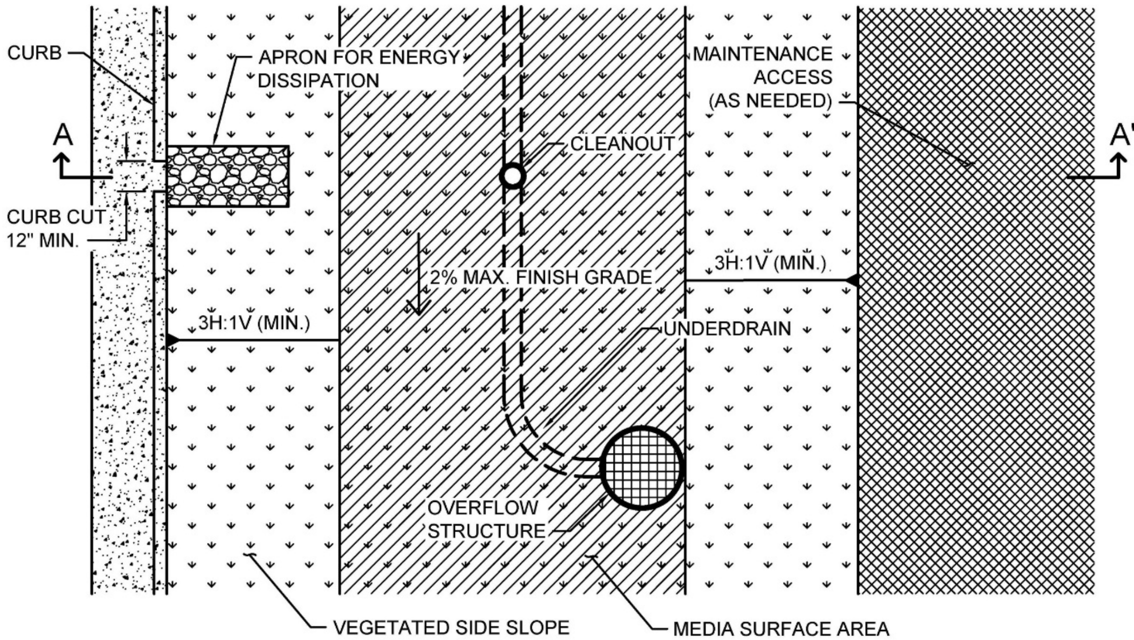
Location: 43rd Street and Logan Avenue, San Diego, California

Description

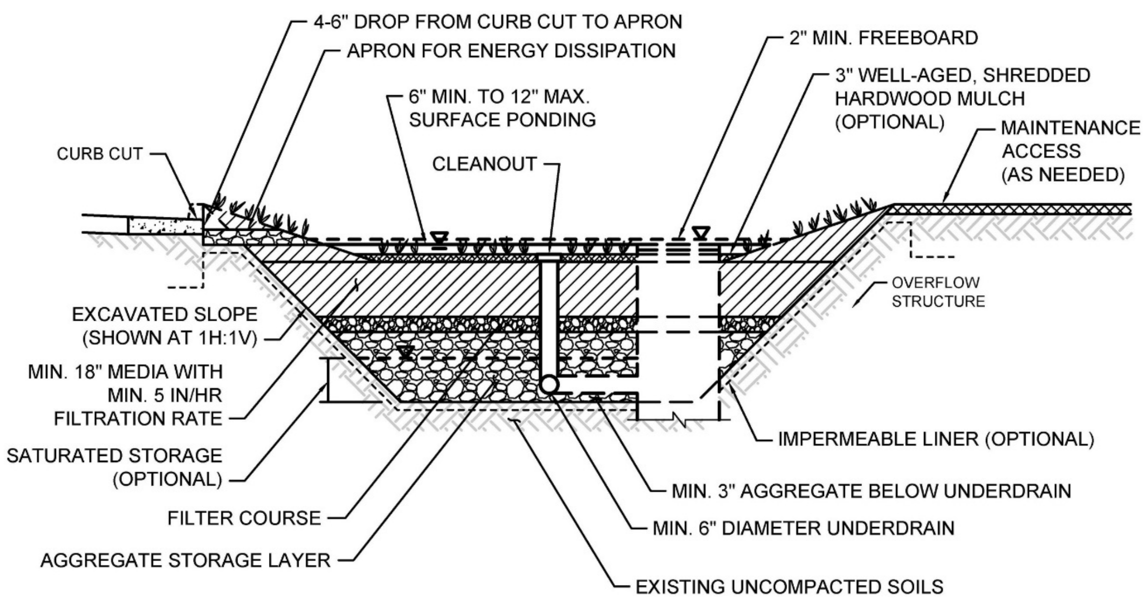
Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.

	Siting and Design	*Intent/Rationale*
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
	Surface Ponding	
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the Port if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the Port if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.

	Siting and Design	*Intent/Rationale*
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
	Vegetation	
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
	Mulch	
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
	Media Layer	
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards Appendix F (February 2016, unless superseded by more recent edition) **<u>or</u>** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed.

	Siting and Design	*Intent/Rationale*
	(June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	For non-standard or proprietary designs, compliance with F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.

	Siting and Design	*Intent/Rationale*
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.

	Aggregate Storage Layer	
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
	Inflow, Underdrain, and Outflow Structures	
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve

Siting and Design		Intent/Rationale
		hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended

media surface area tributary ratio.

2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.13 BF-2 Nutrient Sensitive Media Design

Some studies of bioretention with underdrains have observed export of nutrients, particularly inorganic nitrogen (nitrate and nitrite) and dissolved phosphorus. This has been observed to be a short-lived phenomenon in some studies or a long term issue in some studies. The composition of the soil media, including the chemistry of individual elements is believed to be an important factor in the potential for nutrient export. Organic amendments, often compost, have been identified as the most likely source of nutrient export. The quality and stability of organic amendments can vary widely.

The biofiltration media specifications contained in the County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition) and the City of San Diego Low Impact Development Design Manual (page B-18) (July 2011, unless superseded by more recent edition) were developed with consideration of the potential for nutrient export. These specifications include criteria for individual component characteristics and quality in order to control the overall quality of the blended mixes. As of the publication of this manual, the June 2014 County of San Diego specifications provide more detail regarding mix design and quality control.

The City and County specifications noted above were developed for general purposes to meet permeability and treatment goals. In cases where the BMP discharges to receiving waters with nutrient impairments or nutrient TMDLs, the biofiltration media should be designed with the specific goal of minimizing the potential for export of nutrients from the media. Therefore, in addition to adhering to the City or County media specifications, the following guidelines should be followed:

1. Select plant palette to minimize plant nutrient needs

A landscape architect or agronomist should be consulted to select a plant palette that minimizes nutrient needs. Utilizing plants with low nutrient needs results in less need to enrich the biofiltration soil mix. If nutrient quantity is then tailored to plants with lower nutrient needs, these plants will generally have less competition from weeds, which typically need higher nutrient content. The following practices are recommended to minimize nutrient needs of the plant palette:

- **Utilize native, drought-tolerant plants and grasses where possible.** Native plants generally have a broader tolerance for nutrient content, and can be longer lived in leaner/lower nutrient soils.

- **Start plants from smaller starts or seed.** Younger plants are generally more tolerant of lower nutrient levels and tend to help develop soil structure as they grow. Given the lower cost of smaller plants, the project should be able to accept a plant mortality rate that is somewhat higher than starting from larger plants and providing high organic content.

2. Minimize excess nutrients in media mix

Once the low-nutrient plant palette is established (item 1), the landscape architect and/or agronomist should be consulted to assist in the design of a biofiltration media to balance the interests of plant establishment, water retention capacity (irrigation demand), and the potential for nutrient export. The following guidelines should be followed:

- **The mix should not exceed the nutrient needs of plants.** In conventional landscape design, the nutrient needs of plants are often exceeded intentionally in order to provide a factor of safety for plant survival. This practice must be avoided in biofiltration media as excess nutrients will increase the chance of export. The mix designer should keep in mind that nutrients can be added later (through mulching, tilling of amendments into the surface), but it is not possible to remove nutrients, once added.

- **The actual nutrient content and organic content of the selected organic amendment source should be determined when specifying mix proportions.** Nutrient content (i.e., C:N ratio; plant extractable nutrients) and organic content (i.e, % organic material) are relatively inexpensive to measure via standard agronomic methods and can provide important information about mix design. If mix design relies on approximate assumption about nutrient/organic content and this is not confirmed with testing (or the results of prior representative testing), it is possible that the mix could contain much more nutrient than intended.

- **Nutrients are better retained in soils with higher cation exchange capacity.** Cation exchange capacity can be increased through selection of organic material with naturally high cation exchange capacity, such as peat or coconut coir pith, and/or selection of inorganic material with high cation exchange capacity such as some sands or engineered minerals (e.g., low P-index sands, zeolites, rhyolites, etc). Including higher cation exchange capacity materials would tend to reduce the net export of nutrients. Natural silty materials also provide cation exchange capacity; however potential impacts to permeability need to be considered.

- **Focus on soil structure as well as nutrient content.** Soil structure is loosely defined as the ability of the soil to conduct and store water and nutrients as well as the degree of aeration of the soil. Soil structure can be more important than nutrient content in plant survival and biologic health of the system. If a good soil structure can be created with very low amounts of organic amendment, plants survivability should still be provided. While soil structure generally develops with time, biofiltration media can be designed to promote earlier development of soil structure. Soil structure is enhanced by the use of amendments with high humus content (as found in well-aged organic material). In addition, soil structure can be enhanced through the use of organic material with a distribution of particle sizes (i.e., a more heterogeneous mix).

- **Consider alternatives to compost.** Compost, by nature, is a material that is continually evolving and decaying. It can be challenging to determine whether tests previously done on a given compost stock are still representative. It can also be challenging to determine how the properties of the compost will change once placed in the media bed. More stable materials such as aged coco coir pith, peat, biochar, shredded bark, and/or other amendments should be considered.

With these considerations, it is anticipated that less than 10 percent organic amendment by volume could be used, while still balancing plant survivability and water retention. If compost is used, designers should strongly consider utilizing less than 10 percent by volume.

3. Design with partial retention and/or internal water storage

An internal water storage zone, as described in Fact Sheet PR-1 is believed to improve retention of nutrients. For lined systems, an internal water storage zone worked by providing a zone that fluctuates between aerobic and anaerobic conditions, resulting in nitrification/denitrification. In soils that will allow infiltration, a partial retention design (PR-1) allows significant volume reduction and can also promote nitrification/denitrification.

Acknowledgment: This fact sheet has been adapted from the Orange County Technical Guidance Document (May 2011). It was originally developed based on input from: Deborah Deets, City of Los Angeles Bureau of Sanitation, Drew Ready, Center for Watershed Health, Rick Fisher, ASLA, City of Los Angeles Bureau of Engineering, Dr. Garn Wallace, Wallace Laboratories, Glen Dake, GDML, and Jason Schmidt, Tree People. The guidance provided herein does not reflect the individual opinions of any individual listed above and should not be cited or otherwise attributed to those listed.

E.14 BF-3 Proprietary Biofiltration Systems

The purpose of this fact sheet is to help explain the potential role of proprietary BMPs in meeting biofiltration requirements, when full retention of the DCV is not feasible. The fact sheet does not describe design criteria like the other fact sheets in this appendix because this information varies by BMP product model.

Criteria for Use of a Proprietary BMP as a Biofiltration BMP

A proprietary BMP may be acceptable as a "biofiltration BMP" under the following conditions:

(1) The BMP meets the minimum design criteria listed in Appendix F, including the pollutant treatment performance standard in Appendix F.1;

(2) The BMP is designed and maintained in a manner consistent with its performance certifications (See explanation in Appendix F.2); and

(3) The BMP is acceptable at the discretion of the Port. In determining the acceptability of a BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant..

Guidance for Sizing a Proprietary BMP as a Biofiltration BMP

Proprietary biofiltration BMPs must meet the same sizing guidance as non-proprietary BMPs. Sizing is typically based on capturing and treating 1.50 times the DCV not reliably retained. Guidance for sizing biofiltration BMPs to comply with requirements of this manual is provided in Appendix F.2.

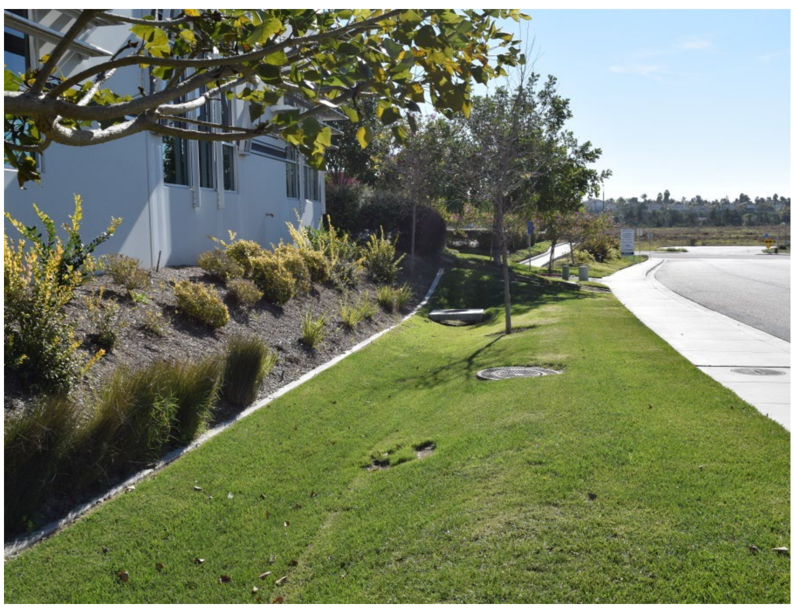
E.15 FT-1 Vegetated Swales

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control

Primary Benefits
Treatment Volume Reduction (Incidental) Peak Flow Attenuation



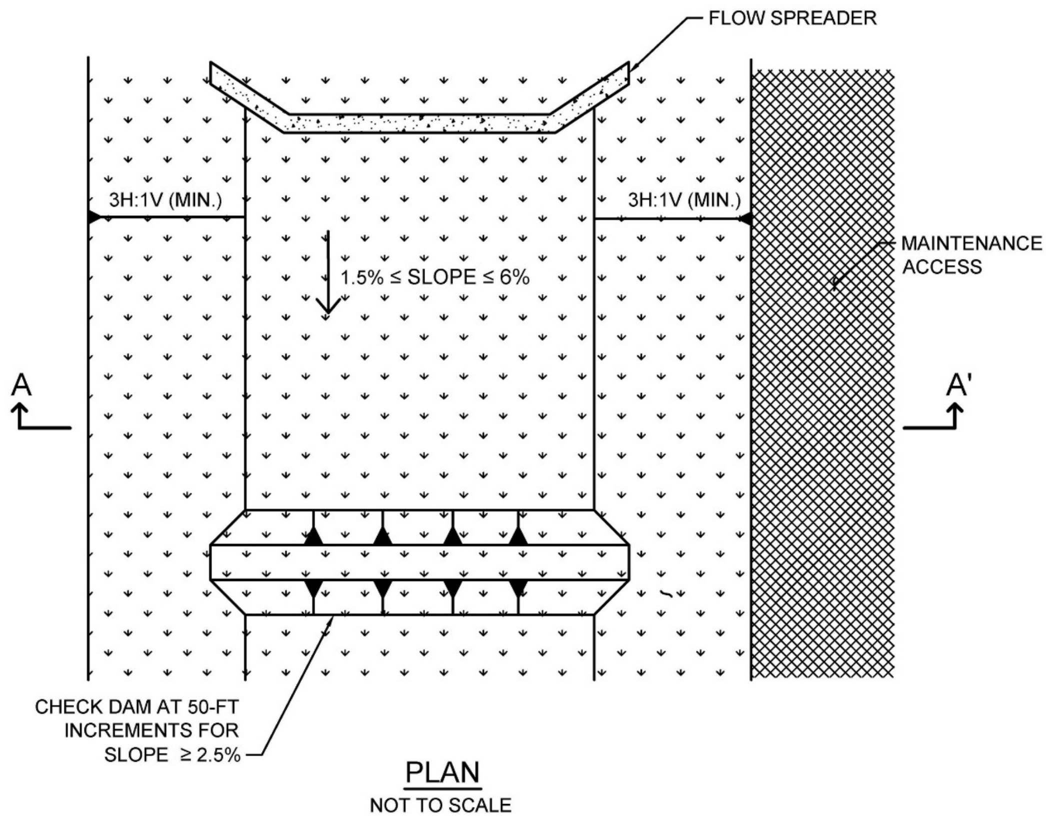
Location: Eastlake Business Center, Chula Vista, California; Photo Credit: Eric Mosolgo

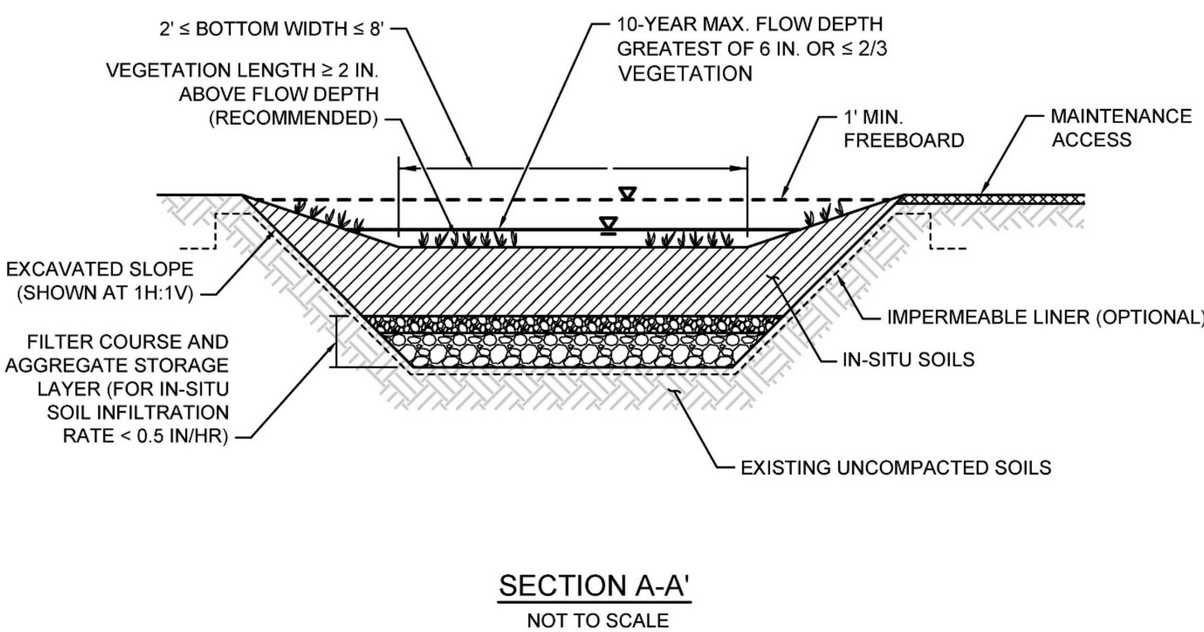
Description

Vegetated swales are shallow, open channels that are designed to remove storm water pollutants by physically straining/filtering runoff through vegetation in the channel. Swales can be used in place of traditional curbs and gutters and are well-suited for use in linear transportation corridors to provide both conveyance and treatment via filtration. An effectively designed vegetated swale achieves uniform sheet flow through densely vegetated areas. When soil conditions allow, infiltration and volume reduction are enhanced by adding a gravel drainage layer underneath the swale. Vegetated swales with a subsurface media layer can provide enhanced infiltration, water retention, and pollutant-removal capabilities. Pollutant removal effectiveness can also be maximized by increasing the hydraulic residence time of water in swale using weirs or check dams.

Typical vegetated swale components include:

- Inflow distribution mechanisms (e.g., flow spreader)
- Surface flow
- Vegetated surface layer
- Check dams (if required)
- Optional aggregate storage layer with underdrain(s)





Typical plan and Section view of a Vegetated Swale BMP

Design Adaptations for Project Goals

Site design BMP to reduce runoff volumes and storm peaks. Swales without underdrains are an alternative to lined channels and pipes and can provide volume reduction through infiltration. Swales can also reduce the peak runoff discharge rate by increasing the time of concentration of the site and decreasing runoff volumes and velocities.

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration with an underdrain and designed to provide pollutant removal through settling and filtration in the channel vegetation (usually grasses). This configuration is considered to provide flow-thru treatment via horizontal surface flow through the swale. Sizing for flow-thru treatment control is based on the surface flow rate through the swale that meets water quality treatment performance objectives.

Design Criteria and Considerations

Vegetated swales must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		Intent/Rationale
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Contributing tributary area ≤ 2 acres.	Higher ratios increase the potential for clogging but may be acceptable for relatively clean tributary areas.
☐	Longitudinal slope is ≥ 1.5% and ≤ 6%.	Flatter swales facilitate increased water quality treatment while minimum slopes prevent ponding.
☐	For site design goal, in-situ soil infiltration rate ≥ 0.5 in/hr (if < 0.5 in/hr, an underdrain is required and design goal is for pollutant control only).	Well-drained soils provide volume reduction and treatment. An underdrain should only be provided when soil infiltration rates are low or per geotechnical or groundwater concerns.

	Siting and Design	*Intent/Rationale*
Surface Flow		
☐	Maximum flow depth is ≤ 6 inches or ≤ $^2/_3$ the vegetation length, whichever is greater. Ideally, flow depth will be ≥ 2 inches below shortest plant species.	Flow depth must fall within the height range of the vegetation for effective water quality treatment via filtering.
	A minimum of 1 foot of freeboard is provided.	Freeboard minimizes risk of uncontrolled surface discharge.
☐	Cross sectional shape is trapezoidal or parabolic with side slopes ≥ 3H:1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
☐	Bottom width is ≥ 2 feet and ≤ 8 feet.	A minimum of 2 feet minimizes erosion. A maximum of 8 feet prevents channel braiding.
☐	Minimum hydraulic residence time ≥ 10 minutes.	Longer hydraulic residence time increases pollutant removal.
☐	Swale is designed to safely convey the 10-yr storm event unless a flow splitter is included to allow only the water quality event.	Planning for larger storm events lessens the risk of property damage due to flooding.
☐	Flow velocity is ≤ 1 ft/s for water quality event. Flow velocity for 10-yr storm event is ≤ 3 ft/s.	Lower flow velocities provide increased pollutant removal via filtration and minimize erosion.
Vegetated Surface Layer (amendment with media is Optional)		
☐	Soil is amended with 2 inches of media mixed into the top 6 inches of in-situ soils, as needed, to promote plant growth (optional). For enhanced pollutant control, 2 feet of media can be used in place of in-situ soils. Media meets either of these two media specifications: City of San Diego Storm Water Standards Appendix F, February 2016); Or County of San Diego Low Impact Development Handbook, June 2014: Appendix G -Bioretention Soil Specification.	Amended soils aid in plant establishment and growth. Media replacement for in-situ soils can improve water quality treatment and site design volume reduction.

	Siting and Design	*Intent/Rationale*
☐	Vegetation is appropriately selected low-growing, erosion-resistant plant species that effectively bind the soil, thrive under site-specific climatic conditions and require little or no irrigation.	Plants suited to the climate and expected flow conditions are more likely to survive.
Check Dams		
☐	Check dams are provided at 50-foot increments for slopes ≥ 2.5%.	Check dams prevent erosion and increase the hydraulic residence time by lowering flow velocities and providing ponding opportunities.
Filter Course Layer (For Underdrain Design)		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
Aggregate Storage Layer (For Underdrain Design)		
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
☐	Aggregate used for the aggregate storage layer is washed and free of fines.	Washing aggregate will help eliminate fines that could clog aggregate storage layer void spaces or underdrain.
Inflow and Underdrain Structures		
☐	Inflow and underdrains are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.

	Siting and Design	*Intent/Rationale*
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where vegetated swales can be used in the site design to replace traditional curb and gutter facilities and provide volume reduction through infiltration.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design vegetated swales for storm water pollutant control only, the following steps should be taken:

1. Verify that siting and design criteria have been met, including bottom width and longitudinal and side slope requirements.
2. Calculate the design flow rate per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine flow-thru treatment sizing of the vegetated swale and if flow velocity, flow depth, and hydraulic residence time meet required criteria. Swale configuration should be adjusted as necessary to meet design requirements.

E.16 FT-2 Media Filters

MS4 Permit Category

Flow-thru Treatment Control

Manual Category

Flow-thru Treatment Control

Applicable Performance Standard

Pollutant Control

Flow Control

Primary Benefits

Treatment

Peak Flow Attenuation (Optional)

Photo Credit: Contech Stormwater Solutions

Description

Media filters are manufactured devices that consist of a series of modular filters packed with engineered media that can be contained in a catch basin, manhole, or vault that provide treatment through filtration and sedimentation. The manhole or vault may be divided into multiple chambers where the first chamber acts as a presettling basin for removal of coarse sediment while the next chamber acts as the filter bay and houses the filter cartridges. A variety of media types are available from various manufacturers that can target pollutants of concern via primarily filtration, sorption, ion exchange, and precipitation. **Specific products must be selected to meet the flow-thru BMP selection requirements described in Appendix B.6**. Treatment effectiveness is contingent upon proper maintenance of filter units.

Typical media filter components include:

- Vault for flow storage and media housing
- Inlet and outlet
- Media filters

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. Water quality treatment is provided through filtration. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Storage provided within the vault restricted by an outlet is considered detention storage and is included in calculations for the flow-thru treatment volume.

Integrated storm water flow control and pollutant control configuration. Media filters can also be designed for flow rate and duration control via additional detention storage. The vault storage can be designed to accommodate higher volumes than the storm water pollutant control volume and can utilize multi-stage outlets to mitigate both the duration and rate of flows within a prescribed range.

Design Criteria and Considerations

Media filters must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Recommended for tributary areas with limited available surface area or where surface BMPs would restrict uses.	Maintenance needs may be more labor intensive for media filters than surface BMPs. Lack of surface visibility creates additional risk that maintenance needs may not be completed in a timely manner.
☐	Vault storage drawdown time ≤96 hours.	Provides vector control.
☐	Vault storage drawdown time ≤36 hours if the vault is used for equalization of flows for pollutant treatment.	Provides required capacity to treat back to back storms. Exception to the 36 hour drawdown criteria is allowed if additional vault storage is provided using the curves in Appendix B.4.2.
Inflow and Outflow Structures		
☐	Inflow and outflow structures are accessible by required equipment (e.g., vactor truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design a media filter for storm water pollutant control only (no flow control required), the following steps should be taken

1. Verify that the selected BMP complies with BMP selection requirements in Appendix B.6.
2. Verify that placement and tributary area requirements have been met.
3. Calculate the required DCV and/or flow rate per Appendix B.6.3 based on expected site design runoff for tributary areas.
4. Media filter can be designed either for DCV or flow rate. To estimate the drawdown time, divide the vault storage by the treatment rate of media filters.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant vault storage volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that placement and tributary area requirements have been met.
2. Iteratively determine the vault storage volume required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows to MS4.
3. If a media filter cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide remaining controls.
4. After the media filter has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.
5. Verify that the vault drawdown time is 96 hours or less. To estimate the drawdown time:
    a. Divide the vault volume by the filter surface area.
    b. Divide the result (a) by the design filter rate.

E.17 FT-3 Sand Filters

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

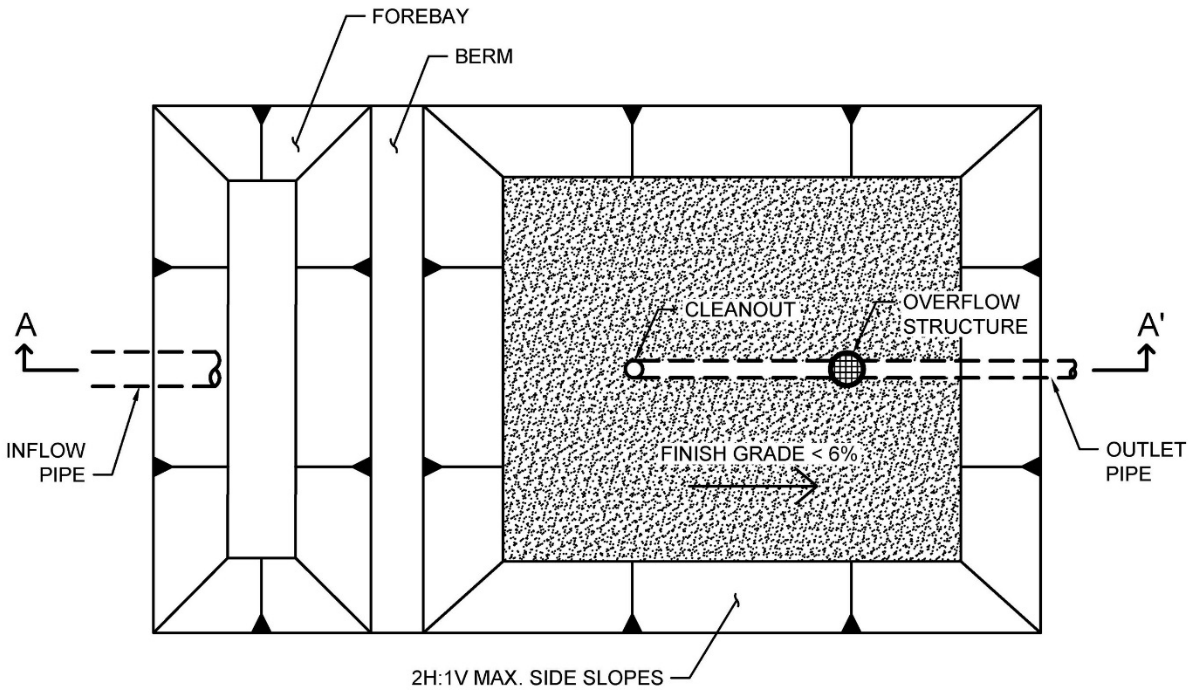
Photo Credit: City of San Diego LID Manual

Description

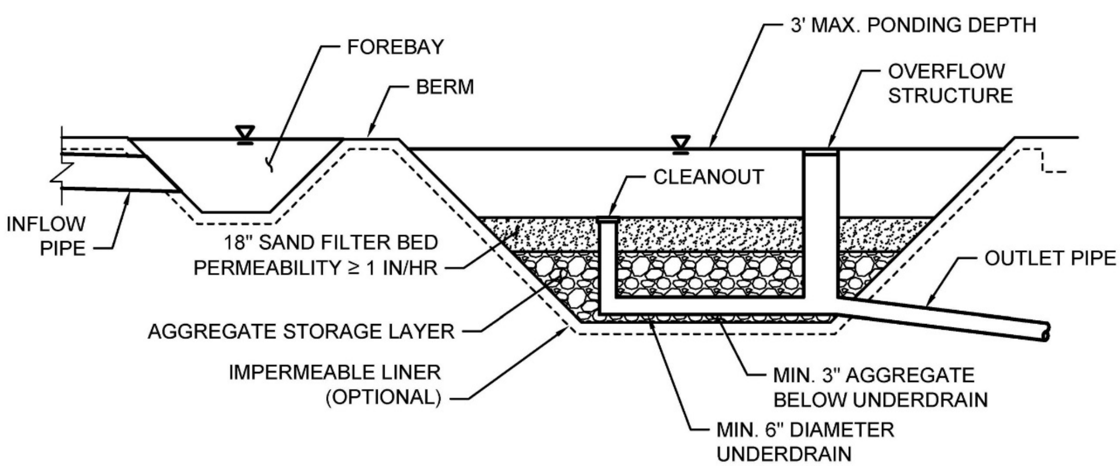
Sand filters operate by filtering storm water through a constructed sand bed with an underdrain system. Runoff enters the filter and spreads over the surface. Sand filter beds can be enclosed within concrete structures or within earthen containment. As flows increase, water backs up on the surface of the filter where it is held until it can percolate through the sand. The treatment pathway is downward (vertical) through the media to an underdrain system that is connected to the downstream storm drain system. As storm water passes through the sand, pollutants are trapped on the surface of the filter, in the small pore spaces between sand grains or are adsorbed to the sand surface. The high filtration rates of sand filters, which allow a large runoff volume to pass through the media in a short amount of time, can provide efficient treatment for storm water runoff.

Typical sand filter components include:

- Forebay for pretreatment/energy dissipation
- Surface ponding for captured flows
- Sand filter bed
- Aggregate storage layer with underdrain(s)
- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Sand Filter BMP

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide flow-thru treatment via vertical flow through the sand filter bed. Storage provided above the underdrain within surface ponding, the sand filter bed, and aggregate storage is considered included in the flow-thru treatment volume. Saturated storage within the aggregate storage layer can be added to this design by including an upturned elbow installed at the downstream end of the underdrain or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Sand filters must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.

	Siting and Design	*Intent/Rationale*
☐	Contributing tributary area (≤ 5 acres).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of facility is < 6%.	Flatter surfaces reduce erosion and channelization within the facility.
☐	Earthen side slopes are ≥ 3H:1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
☐	Surface ponding is limited to a 36-hour drawdown time.	Provides required capacity to treat back to back storms. Exception to the 36 hour drawdown criteria is allowed if additional surface storage is provided using the curves in Appendix B.4.2.
☐	Surface ponding is limited to a 96-hour drawdown time.	Prolonged surface ponding can create a vector hazard.
☐	Maximum ponding depth does not exceed 3 feet.	Surface ponding capacity lowers subsurface storage requirements and results in lower cost facilities. Deep surface ponding raises safety concerns.
☐	Sand filter bed consists of clean washed concrete or masonry sand (passing ¼ inch sieve) or sand similar to the ASTM C33 gradation.	Washing sand will help eliminate fines that could clog the void spaces of the aggregate storage layer.
☐	Sand filter bed permeability is at least 1 in/hr.	A high filtration rate through the media allows flows to quickly enter the aggregate storage layer, thereby minimizing bypass.

Siting and Design		*Intent/Rationale*
☐	Sand filter bed depth is at least 18 inches deep.	Different pollutants are removed in various zones of the media using several mechanisms. Some pollutants bound to sediment, such as metals, are typically removed within 18 inches of the media.
☐	Aggregate storage should be washed, bank-run gravel.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow must be non-erosive sheet flow (≤ 3 ft/s) unless an energy-dissipation device, flow diversion/splitter or forebay is installed.	Concentrated flow and/or excessive volumes can cause erosion in a sand filter and can be detrimental to the treatment capacity of the system.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains should be made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design a sand filter for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, and maximum finish grade slope.
2. Calculate the required DCV and/or flow rate per Appendix B.6.3 based on expected site design runoff for tributary areas.
3. Sand filter can be designed either for DCV or flow rate. To estimate the drawdown time, divide the average ponding depth by the permeability of the filter sand.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the Manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, and maximum finish grade slope.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If a sand filter cannot fully provide the flow rate and duration control required by the MS4 permit, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide remaining controls.
4. After the sand filter has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.18 FT-4 Dry Extended Detention Basin

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation

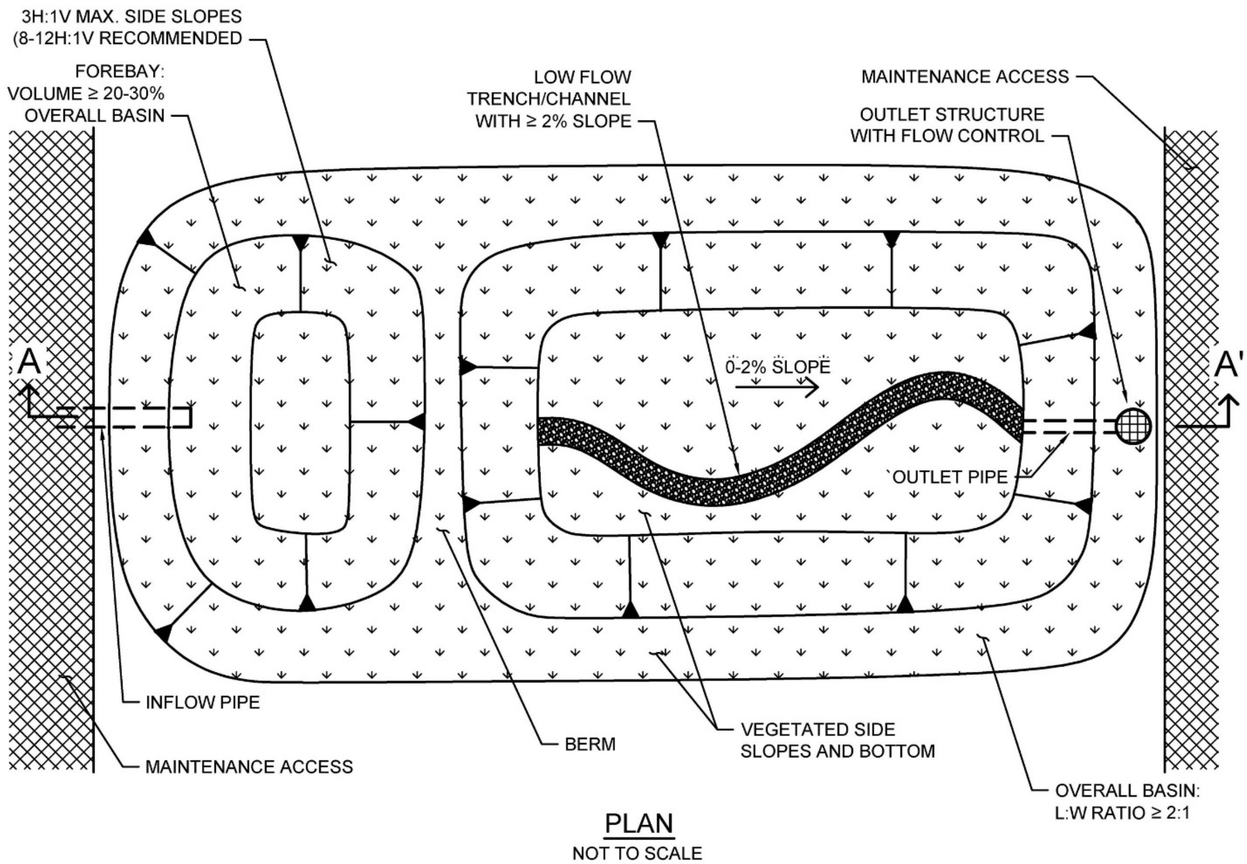
Location: Rolling Hills Ranch, Chula Vista, California; Photo Credit: Eric Mosolgo

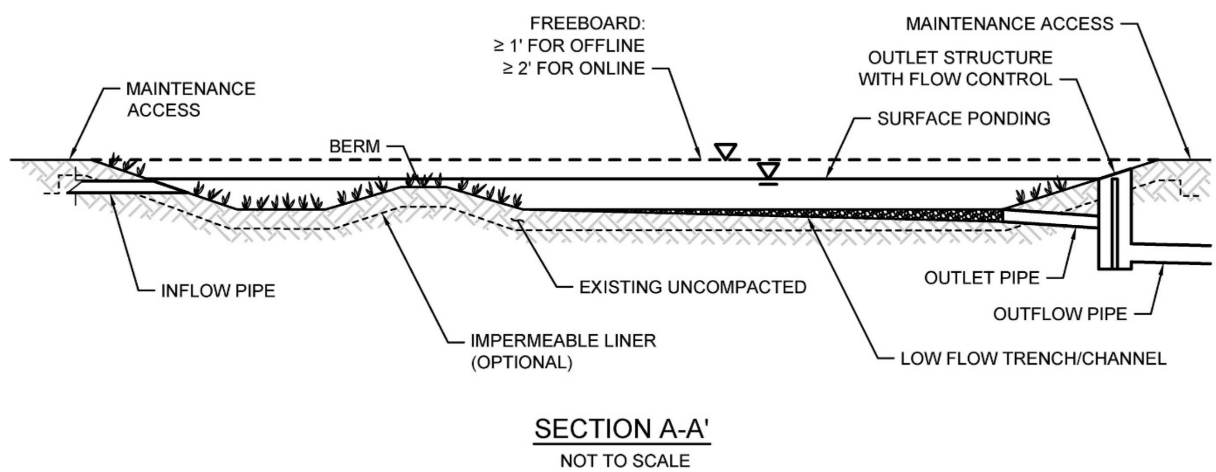
Description

Dry extended detention basins are basins that have been designed to detain storm water for an extended period to allow sedimentation and typically drain completely between storm events. A portion of the dissolved pollutant load may also be removed by filtration, uptake by vegetation, and/or through infiltration. The slopes, bottom, and forebay of dry extended detention basins are typically vegetated. Considerable storm water volume reduction can occur in dry extended detention basins when they are located in permeable soils and are not lined with an impermeable barrier. dry extended detention basins are generally appropriate for developments of ten acres or larger, and have the potential for multiple uses including parks, playing fields, tennis courts, open space, and overflow parking lots. They can also be used to provide flow control by modifying the outlet control structure and providing additional detention storage.

Typical dry extended detention basins components include:

- Forebay for pretreatment
- Surface ponding for captured flows
- Vegetation selected based on basin use, climate, and ponding depth
- Low flow channel, outlet, and overflow device
- Impermeable liner or uncompacted native soils at the bottom of the facility





Typical plan and Section view of a Dry Extended Detention Basin BMP

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration and designed to detain storm water to allow particulates and associated pollutants to settle out. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Storage provided as surface ponding above a restricted outlet invert is considered detention storage and is included in calculations for the flow-thru treatment volume.

Integrated storm water flow control and pollutant control configuration. Dry extended detention basins can also be designed for flow control. The surface ponding can be designed to accommodate higher volumes than the storm water pollutant control volume and can utilize multi-stage outlets to mitigate both the duration and rate of flows within a prescribed range.

Design Criteria and Considerations

Dry extended detention basins must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Contributing tributary area is large (typically ≥ 10 acres).	Dry extended detention basins require significant space and are more cost-effective for treating larger drainage areas.
☐	Longitudinal basin bottom slope is 0 - 2%.	Flatter slopes promote ponding and settling of particles.
☐	Basin length to width ratio is ≥ 2:1 (L:W).	A larger length to width ratio provides a longer flow path to promote settling.
☐	Forebay is included that encompasses 20 - 30% of the basin volume.	A forebay to trap sediment can decrease frequency of required maintenance.

	Siting and Design	*Intent/Rationale*
☐	Side slopes are ≥ 3H:1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
☐	Surface ponding drawdown time is between 24 and 96 hours.	Minimum drawdown time of 24 hours allows for adequate settling time and maximizes pollutant removal. Maximum drawdown time of 96 hours provides vector control.
☐	Minimum freeboard provided is ≥1 foot for offline facilities and ≥2 feet for online facilities.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Inflow and outflow structures are accessible by required equipment (e.g., vactor truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	A low flow channel or trench with a ≥ 2% slope is provided. A gravel infiltration trench is provided where infiltration is allowable.	Aids in draining or infiltrating dry weather flows.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow.	Planning for overflow lessens the risk of property damage due to flooding.
☐	The maximum rate at which runoff is discharged is set below the erosive threshold for the site.	Extended low flows can have erosive effects.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design dry extended detention basins for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and criteria have been met, including placement requirements, contributing tributary area, forebay volume, and maximum slopes for basin sides and bottom.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine flow-thru treatment sizing of the surface ponding of the dry extended detention basin, which includes calculations for a maximum 96-hour drawdown time.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and criteria have been met, including placement requirements, tributary area, and maximum slopes for basin sides and bottom.
2. Iteratively determine the surface ponding required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If a dry extended detention basin cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an additional basin or underground vault can be used to provide remaining controls.
4. After the dry extended detention basin has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.19 FT-5 Proprietary Flow-Thru Treatment Control BMPs

The purpose of this fact sheet is to help explain the potential role of proprietary BMPs in meeting flow thru treatment control BMP requirements. The fact sheet does not describe design criteria like the other fact sheets in this appendix because this information varies by BMP product model.

Criteria for Use of a Proprietary BMP as a Flow-Thru Treatment Control BMP

A proprietary BMP may be acceptable as a "flow-thru treatment control BMP" under the following conditions:

(1) The BMP is selected and sized consistent with the method and criteria described in Appendix B.6;

(2) The BMP is designed and maintained in a manner consistent with its performance certifications (See explanation in Appendix B.6); and

(3) The BMP is acceptable at the discretion of the Port. In determining the acceptability of a BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant..

Guidance for Sizing Proprietary BMPs

Proprietary flow-thru BMPs must meet the same sizing guidance as other flow-thru treatment control BMPs. Guidance for sizing flow-thru BMPs to comply with requirements of this manual is provided in Appendix B.6.

E.20 PL Plant List

Plant Name		Irrigation Requirements		Preferred Location in Basin		Applicable Bioretention Sections (Un-Lined Facilities)				Applicability to Flow-Through Planter? (Lined Facility)	
Latin Name	Common Name	Temporary Irrigation during Plant Establishment Period	Permanent Irrigation (Drip / Spray)[1]	Basin Bottom	Basin Side Slopes	Section A Treatment-Only Bioretention in Hydrologic Soil Group A or B Soils	Section B Treatment-Only Bioretention in Hydrologic Soil Group C or D soils	Section C Treatment Plus Flow Control Bioretention in Hydrologic Soil Group A or B Soils	Section D Treatment Plus Flow Control Bioretention in Hydrologic Soil Group C or D Soils	**NO** Applicable to Un-lined Facilities Only (Bioretention Only)	**YES** Can Use in Lined or Un-Lined Facility (Flow-Through Planter OR Bioretention)
TREES[2]											
Alnus rhombifolia	White Alder	X		X	X	X	X	X	X	X	
Platanus racemosa	California Sycamore	X		X	X	X	X	X	X	X	
Salix lasiolepis	Arroyo Willow	X			X	X	X	X	X	X	
Salix lucida	Lance-Leaf Willow	X			X	X	X	X	X	X	
Sambucus mexicana	Blue Elderberry	X			X	X	X	X	X	X	
SHRUBS / GROUNDCOVER											
Achillea millefolium	Yarrow	X			X	X	X				X
Agrostis palens	Thingrass	X			X	X	X	X	X		X
Anemopsis californica	Yerba Manza	X			X	X	X	X	X		X
Baccharis douglasii	Marsh Baccahris	X	X	X		X	X	X	X		X
Carex praegracillis	California Field Sedge	X	X	X		X	X	X	X		X
Carex spissa	San Diego Sedge	X	X	X		X	X	X	X		X
Carex subfusca	Rusty Sedge	X	X	X	X	X	X	X	X		X
Distichlis spicata	Salt Grass	X	X	X		X	X	X	X		X
Eleocharis macrostachya	Pale Spike Rush	X	X	X		X	X	X	X		X
Festuca rubra	Red Fescue	X	X	X	X	X	X				X
Festuca californica	California Fescue	X	X		X	X	X				X
Iva hayesiana	Hayes Iva	X			X	X	X				X
Juncus Mexicana	Mexican Rush	X	X	X	X	X	X	X	X		X
Jucus patens	California Gray Rush	X	X	X	X	X	X	X	X		X
Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	X	X	X	X	X	X	X	X		X
Mahonia nevinii	Nevin's Barberry	X			X	X	X	X	X		X
Muhlenburgia rigens	Deergrass	X	X	X	X	X	X	X	X		X
Mimulus cardinalis	Scarlet Monkeyflower	X		X	X	X	X				X
Ribes speciosum	Fushia Flowering Goose.	X			X	X	X				X
Rosa californica	California Wild Rose	X	X		X	X	X				X
Scirpus cenuus	Low Bullrush	X	X	X		X	X	X	X		X
Sisyrinchium bellum	Blue-eyed Grass	X			X	X	X				X

1. All plants will benefit from some supplemental irrigation during hot dry summer months, particularly those on basin side slopes and further inland.
2. All trees should be planted a min. of 10' away from any drain pipes or structures.

Appendix

F

BMP DESIGN MANUAL

Biofiltration Standard and Checklist

Appendix F Biofiltration Standard and Checklist

Introduction

The MS4 Permit and this manual define a specific category of storm water pollutant treatment BMPs called "biofiltration BMPs." The MS4 Permit (Section E.3.c.1) states:

Biofiltration BMPs must be designed to have an appropriate hydraulic loading rate to maximize storm water retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP, and must be sized to:

a) **Treat 1.5 times the DCV not reliably retained onsite, OR**

b) **Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite.**

A project applicant must be able to affirmatively demonstrate that a given BMP is designed and sized in a manner consistent with this definition to be considered as a "biofiltration BMP" as part of a compliant storm water management plan. Retention is defined in the MS4 Permit as evapotranspiration, infiltration, and harvest and use of storm water vs. discharge to a surface water system.

Contents and Intended Uses

This appendix contains a checklist of the key underlying criteria that must be met for a BMP to be considered a biofiltration BMP. The purpose of this checklist is to facilitate consistent review and approval of biofiltration BMPs that meet the "biofiltration standard" defined by the MS4 Permit.

This checklist includes specific design criteria that are essential to defining a system as a biofiltration BMP; however it does not present a complete design basis. This checklist was used to develop BMP Fact Sheets for PR-1 biofiltration with partial retention and BF-1 biofiltration, which do present a complete design basis. Therefore, biofiltration BMPs that substantially meet all aspects of the Fact sheets PR-1 or BF-1 should be able to complete this checklist without additional documentation beyond what would already be required for a project submittal.

Other biofiltration BMP designs[8] (including both non-proprietary and proprietary designs) may also meet the underlying MS4 Permit requirements to be considered biofiltration BMPs. These BMPs may be classified as biofiltration BMPs if they (1) meet the minimum design criteria listed in this appendix, including the pollutant treatment performance standard in Appendix F.1, (2) are designed and maintained in a manner consistent with their performance certifications (See explanation in Appendix F.2), if applicable, and (3) are acceptable at the discretion of the Port. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met.

Organization

The checklist in this appendix is organized into the seven (7) main objectives associated with biofiltration BMP design. It describes the associated minimum criteria that must be met in order to qualify a biofiltration BMP as meeting the biofiltration standard. The seven main objectives are listed below. Specific design criteria and associated manual references associated with each of these objectives is provided in the checklist in the following section.

1. Biofiltration BMPs shall be allowed only as described in the BMP selection process in this manual (i.e., retention feasibility hierarchy).

2. Biofiltration BMPs must be sized using acceptable sizing methods described in this manual.

3. Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration.

4. Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control/sequestration processes, and minimize potential for pollutant washout.

5. Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.

6. Biofiltration BMPs must be designed to prevent erosion, scour, and channeling within the BMP.

7. Biofiltration BMP must include operations and maintenance design features and planning

[8] Defined as biofiltration designs that do not conform to the specific design criteria described in Fact Sheets PR-1 or BF-1. This category includes proprietary BMPs that are sold by a vendor as well as non-proprietary BMPs that are designed and constructed of primarily of more elementary construction materials.

considerations to provide for continued effectiveness of pollutant and flow control functions.

Biofiltration Criteria Checklist

The applicant shall provide documentation of compliance with each criterion in this checklist as part of the project submittal. The right column of this checklist identifies the submittal information that is recommended to document compliance with each criterion. Biofiltration BMPs that substantially meet all aspects of Fact Sheets PR-1 or BF-1 should still use this checklist; however additional documentation (beyond what is already required for project submittal) should not be required.

1. Biofiltration BMPs shall be allowed to be used only as described in the BMP selection process based on a documented feasibility analysis.

Intent: This manual defines a specific prioritization of pollutant treatment BMPs, where BMPs that retain water (retained includes evapotranspired, infiltrated, and/or harvested and used) must be used before considering BMPs that have a biofiltered discharge to the MS4 or surface waters. Use of a biofiltration BMP in a manner in conflict with this prioritization (i.e., without a feasibility analysis justifying its use) is not permitted, regardless of the adequacy of the sizing and design of the system.

☐	The project applicant has demonstrated that it is not technically feasible to retain the full DCV onsite.	Document feasibility analysis and findings in SWQMP per Appendix C.

2. Biofiltration BMPs must be sized using acceptable sizing methods.

Intent: The MS4 Permit and this manual defines specific sizing methods that must be used to size biofiltration BMPs. Sizing of biofiltration BMPs is a fundamental factor in the amount of storm water that can be treated and also influences volume and pollutant retention processes.

☐	The project applicant has demonstrated that biofiltration BMPs are sized to meet one of the biofiltration sizing options available (Appendix B.5).	Submit sizing worksheets (Appendix B.5) or other equivalent documentation with the SWQMP.

3. Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration.

Intent: Various decisions about BMP placement and design influence how much water is retained via infiltration and evapotranspiration. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention (evapotranspiration and infiltration) of storm water volume.

☐	The biofiltration BMP is sited to allow for maximum infiltration of runoff volume based on the feasibility factors considered in site planning efforts. It is also designed to maximize evapotranspiration through the use of amended media and plants (biofiltration designs without amended media and plants may be permissible; see Item 5).	Document site planning and feasibility analyses in SWQMP per Section 5.4.
☐	For biofiltration BMPs categorized as "Partial Infiltration Condition" the infiltration storage depth in the biofiltration design has been selected to drain in 36 hours (+/-25%) or an alternative value shown to maximize infiltration on the site.	Included documentation of estimated infiltration rate per Appendix D; provide calculations using Appendix B.4 and B.5 to show that the infiltration storage depth meets this criterion. Note, depths that are too shallow or too deep may not be acceptable.
☐	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the infiltration storage is over the entire bottom of the biofiltration BMP footprint.	Document on plans that the infiltration storage covers the entire bottom of the BMP (i.e., not just underdrain trenches); or an equivalent footprint elsewhere on the site.
☐	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the sizing factor used for the infiltration storage area is not less than the minimum biofiltration BMP sizing factors calculated using Worksheet B.5.1 to achieve 40% average annual percent capture within the BMP or downstream of the BMP. .	Provide a table that compares the minimum sizing factor per Appendix B.5 to the provided sizing factor. Note: The infiltration storage area could be a separate storage feature located downstream of the biofiltration BMP, not necessarily within the same footprint.
☐	An impermeable liner or other hydraulic restriction layer is only used when needed to avoid geotechnical and/or subsurface contamination issues in locations identified as "No Infiltration Condition."	If using an impermeable liner or hydraulic restriction layer, provide documentation of feasibility findings per Appendix C that recommend the use of this feature.

☐	The use of "compact" biofiltration BMP design[9] is permitted only in conditions identified as "No Infiltration Condition" and where site-specific documentation demonstrates that the use of larger footprint biofiltration BMPs would be infeasible.	Provide documentation of feasibility findings that recommend no infiltration is feasible. Provide site-specific information to demonstrate that a larger footprint biofiltration BMP would not be feasible.

4. **Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control processes, and minimize potential for pollutant washout.**

Intent: Various decisions about biofiltration BMP design influence the degree to which pollutants are retained. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention of storm water pollutants.

☐	Media selected for the biofiltration BMP meets minimum quality and material specifications per 2016 City Storm Water Standards or County LID Manual, including the maximum allowable design filtration rate and minimum thickness of media.	Provide documentation that media meets the specifications in 2016 City Storm Water Standards or County LID Manual.
	OR	
☐	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, field scale testing data are provided to demonstrate that proposed media meets the pollutant treatment performance criteria in Section F.1 below.	Provide documentation of performance information as described in Section F.1.

[9] Compact biofiltration BMPs are defined as features with infiltration storage footprint less than the minimum sizing factors required to achieve 40% volume retention. Note that if a biofiltration BMP is accompanied by an infiltrating area downstream that has a footprint equal to at least the minimum sizing factors calculated using Worksheet B.5.1 assuming a partial infiltration condition, then it is not considered to be a compact biofiltration BMP for the purpose of Item 4 of the checklist. For potential configurations with a higher rate biofiltration BMP upstream of an larger footprint infiltration area, the BMP would still need to comply with Item 5 of this checklist for pollutant treatment effectiveness.

☐	To the extent practicable, filtration rates are outlet controlled (e.g., via an underdrain and orifice/weir) instead of controlled by the infiltration rate of the media.	Include outlet control in designs or provide documentation of why outlet control is not practicable.
☐	The water surface drains to at least 12 inches below the media surface within 24 hours from the end of storm event flow to preserve plant health and promote healthy soil structure.	Include calculations to demonstrate that drawdown rate is adequate. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the [City Engineer] if certified by a landscape architect or agronomist.
☐	If nutrients are a pollutant of concern, design of the biofiltration BMP follows nutrient-sensitive design criteria.	Follow specifications for nutrient sensitive design in Fact Sheet BF-2. Or provide alternative documentation that nutrient treatment is addressed and potential for nutrient release is minimized.
☐	Media gradation calculations or geotextile selection calculations demonstrate that migration of media between layers will be prevented and permeability will be preserved.	Follow specification for choking layer or geotextile in Fact Sheet PR-1 or BF-1. Or include calculations to demonstrate that choking layer is appropriately specified.

5. Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.

Intent: Biological processes are an important element of biofiltration performance and longevity.

☐	Plants have been selected to be tolerant of project climate, design ponding depths and the treatment media composition.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.
☐	Plants have been selected to minimize irrigation requirements.	Provide documentation describing irrigation requirements for establishment and long term operation.
☐	Plant location and growth will not impede expected long-term media filtration rates and will enhance long term infiltration rates to the extent possible.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.
☐	If plants are not part of the biofiltration design, other biological processes are supported as needed to sustain treatment processes (e.g., biofilm in a subsurface flow wetland).	For biofiltration designs without plants, describe the biological processes that will support effective treatment and how they will be sustained.

6. Biofiltration BMPs must be designed with a hydraulic loading rate to prevent erosion, scour, and channeling within the BMP.

Intent: Erosion, scour, and/or channeling can disrupt treatment processes and reduce biofiltration effectiveness.

☐	Scour protection has been provided for both sheet flow and pipe inflows to the BMP, where needed.	Provide documentation of scour protection as described in Fact Sheets PR-1 or BF-1 or approved equivalent.
☐	Where scour protection has not been provided, flows into and within the BMP are kept to non-erosive velocities.	Provide documentation of design checks for erosive velocities as described in Fact Sheets PR-1 or BF-1 or approved equivalent.
☐	For proprietary BMPs, the BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification[10] (i.e., maximum tributary area, maximum inflow velocities, etc., as applicable).	Provide copy of manufacturer recommendations and conditions of third-party certification.

7. Biofiltration BMP must include operations and maintenance design features and planning considerations for continued effectiveness of pollutant and flow control functions.

Intent: Biofiltration BMPs require regular maintenance in order provide ongoing function as intended. Additionally, it is not possible to foresee and avoid potential issues as part of design; therefore plans must be in place to correct issues if they arise.

☐	The biofiltration BMP O&M plan describes specific inspection activities, regular/periodic maintenance activities and specific corrective actions relating to scour, erosion, channeling, media clogging, vegetation health, and inflow and outflow structures.	Include O&M plan with project submittal as described in Chapter 7.
☐	Adequate site area and features have been provided for BMP inspection and maintenance access.	Illustrate maintenance access routes, setbacks, maintenance features as needed on project water quality plans.

[10] Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the New Jersey Corporation for Advanced Technology programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification

☐	For proprietary biofiltration BMPs, the BMP maintenance plan is consistent with manufacturer guidelines and conditions of its third-party certification (i.e., maintenance activities, frequencies).	Provide copy of manufacturer recommendations and conditions of third-party certification.

F.1 Pollutant Treatment Performance Standard

Standard biofiltration BMPs that are designed following the criteria in Fact Sheets PR-1 and BF-1 are presumed to the meet the pollutant treatment performance standard associated with biofiltration BMPs. This presumption is based on the MS4 Permit Fact Sheet which cites analyses of standard biofiltration BMPs conducted in the Ventura County Technical Guidance Manual (July 2011).

For BMPs that do not meet the biofiltration media specification and/or the range of acceptable media filtration rates described in Fact Sheet, PR-1 and BF-1, additional documentation must be provided to demonstrate that adequate pollutant treatment performance is provided to be considered a biofiltration BMP. Project applicants have three options for documenting compliance:

1) Project applicants may provide documentation to substantiate that the minor modifications to the design is expected to provide equal or better pollutant removal performance for the project pollutants of concern than would be provided by a biofiltration design that complies with the criteria in Fact Sheets PR-1 and BF-1. Minor modifications are design elements that deviate only slightly from standard design criteria and are expected to either not impact performance or to improve performance compared to standard biofiltration designs. The reviewing agency has the discretion to accept or reject this documentation and/or request additional documentation to substantiate equivalent or better performance to BF-1 or PR-1, as applicable. Examples of minor deviations include:

    - Different particle size distribution of aggregate, with documentation that system filtration rate will meet specifications.

    - Alternative source of organic components, with documentation of material suitability and stability from appropriate testing agency.

    - Specialized amendments to provide additional treatment mechanisms, and which have negligible potential to upset other treatment mechanisms or otherwise deteriorate performances.

2) For proprietary BMPs, project applicants may provide evidence that the BMP has been certified for use as part of the Washington State Technology Assessment Protocol-Ecology certification program and meets each of the following requirements:

    a. The applicant must demonstrate (using the checklist in this Appendix) that the BMP meets all other conditions to be considered as a biofiltration BMP. For example, a cartridge media filter or hydrodynamic separator would not meet biofiltration BMP design criteria regardless of Technology Acceptance Protocol-Ecology certification because they do not support effective biological processes.

b. The applicant must select BMPs that have an active Technology Acceptance Protocol-Ecology certification, with General Use Level Designation for the appropriate project pollutants of concern as identified in Table F.1-1. The list of certified technologies is updated as new technologies are approved (link below). Technologies with Pilot Use Level Designation and Conditional Use Level Designations are not acceptable. Refer to:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html.

c. The applicant must demonstrate that BMP is being used in a manner consistent with all conditions of the Technology Acceptance Protocol-Ecology certification while meeting the flow rate or volume design criteria that is required for biofiltration BMPs under this manual. Conditions of Technology Acceptance Protocol-Ecology certification are available by clicking on the technology name at the website listed in bullet b. Additional discussion about sizing of proprietary biofiltration BMPs to comply with applicable sizing standards is provided below in Section F.2.

d. For projects within the public right of way and/or public projects: the product must be acceptable to the [City Engineer] with respect to maintainability and long term operation of the product. In determining the acceptability of a product the [City Engineer] should consider, as applicable, maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business, and other relevant factors. If a proposed BMP is not accepted by the [City Engineer], a written explanation/reason will be provided to the applicant.

3) For BMPs that do not fall into options 1 or 2 above, the [City Engineer] may allow the applicant to submit alternative third-party documentation that the pollutant treatment performance of the system is consistent with the performance levels associated with the necessary Technology Acceptance Protocol-Ecology certifications. Table F.1-1 describes the required levels of certification and Table F.1-2 describes the pollutant treatment performance levels associated with each level of certification. Acceptance of this approach is at the sole discretion of the [City Engineer]. If a proposed BMP is not accepted by the [City Engineer], a written explanation/reason will be provided to the applicant. If Technology Acceptance Protocol-Ecology certifications are not available, preference shall be given to:

   a. Verified third-party, field-scale testing performance under the Technology Acceptance Reciprocity Partnership Tier II Protocol. This protocol is no longer operated, however this is considered to be a valid protocol and historic verifications are considered to be representative provided that product models being proposed are consistent with those that were tested. Technology Acceptance Reciprocity Partnership verifications were conducted under New Jersey Corporation for Advance Testing and are archived at the website linked below. Note that Technology Acceptance Reciprocity Partnership verifications must be matched to pollutant treatment standards in Table F.1-2 then matched to an equivalent Technology Acceptance Protocol-Ecology certification in Table F.1-1.

b. Verified third-party, field-scale testing performance under the New Jersey Corporation for Advance Testing protocol. Note that New Jersey Corporation for Advance Testing verifications must be matched to pollutant treatment standards in Table F.1-2 then matched to an equivalent Technology Acceptance Protocol-Ecology certification in Table F.1-1.

A list of field-scale verified technologies under Technology Acceptance Reciprocity Partnership Tier II and New Jersey Corporation for Advance Testing can be accessed at: http://www.njcat.org/verification-process/technology-verification-database.html (refer to field verified technologies only).

Table F.1-1: Required Technology Acceptance Protocol-Ecology Certifications for Polltuants of Concern for Biofiltration Performance Standard

Project Pollutant of Concern	Required Technology Acceptance Protocol-Ecology Certification for Biofiltration Performance Standard
Trash	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Sediments	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Oil and Grease	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Nutrients	Phosphorus Treatment[1]
Metals	Enhanced Treatment
Pesticides	Basic Treatment (including filtration)[2] OR Phosphorus Treatment OR Enhanced Treatment
Organics	Basic Treatment (including filtration)[2] OR Phosphorus Treatment OR Enhanced Treatment
Bacteria and Viruses	Basic Treatment (including bacteria removal processes)[3] OR Phosphorus Treatment OR Enhanced Treatment

1 – There is no Technology Acceptance Protocol-Ecology equivalent for nitrogen compounds; however systems that are designed to retain phosphorus (as well as meet basic treatment designation), generally also provide treatment of nitrogen compounds. Where nitrogen is a pollutant of concern, relative performance of available certified systems for nitrogen removal should be considered in BMP selection.
2 – Pesticides, organics, and oxygen demanding substances are typically addressed by particle filtration consistent with the level of treatment required to achieve Basic treatment certification; if a system with Basic treatment certification does not provide filtration, it is not acceptable for pesticides, organics or oxygen demanding substances.
3 – There is no Technology Acceptance Protocol-Ecology equivalent for pathogens (viruses and bacteria), and testing data are limited because of typical sample hold times. Systems with Technology Acceptance Protocol-Ecology Basic Treatment must be include one or more significant bacteria removal process such as media filtration, physical sorption, predation, reduced redox conditions, and/or solar inactivation. Where design options are available to enhance pathogen removal (i.e., pathogen-specific media mix offered by vendor), this design variation should be used.

Table F.1-2: Performance Standards for Technology Acceptance Protocol-Ecology Certification

Performance Goal	Influent Range	Criteria
Basic Treatment	20 – 100 mg/L TSS	Effluent goal ≤ 20 mg/L TSS
	100 – 200 mg/L TSS	≥ 80% TSS removal
	>200 mg/L TSS	> 80% TSS removal
Enhanced (Dissolved Metals) Treatment	Dissolved copper 0.005 – 0.02 mg/L	Must meet basic treatment goal and better than basic treatment currently defined as >30% dissolved copper removal
	Dissolved zinc 0.02 – 0.3 mg/L	Must meet basic treatment goal and better than basic treatment currently defined as >60% dissolved zinc removal
Phosphorous Treatment	Total phosphorous 0.1 – 0.5 mg/L	Must meet basic treatment goal and exhibit ≥50% total phosphorous removal
Oil Treatment	Total petroleum hydrocarbon > 10 mg/L	No ongoing or recurring visible sheen in effluent Daily average effluent Total petroleum hydrocarbon concentration < 10 mg/L Maximum effluent Total petroleum hydrocarbon for a 15 mg/L for a discrete (grab) sample
Pretreatment	50 – 100 mg/L TSS	≤ 50 mg/L TSS
	≥ 200 mg/L TSS	≥ 50% TSS removal

F.2 Guidance on Sizing and Design of Non-Standard Biofiltration BMPs

This section explains the general process for design and sizing of non-standard biofiltration BMPs. This section assumes that the BMPs have been selected based on the criteria in Section F.1.

F.2.1 Guidance on Design per Conditions of Certification/Verification

The biofiltration standard and checklist in this appendix requires that "the BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification." Practically, what this means is that the BMP is used in the same way in which it was tested and certified. For example, it is not acceptable for a BMP of a given size to be certified/verified with a 100 gallon per minute treatment rate and be applied at a 150 gallon per minute treatment rate in a design.
Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the Technology Acceptance Reciprocity Partnership or New Jersey Corporation for Advance Testing programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification. It is common for these approvals to specify the specific model of BMP, design capacity for given unit sizes, type of media that is the basis for approval, and/or other parameter. The applicant must demonstrate conclusively that the proposed application of the BMP is consistent with these criteria.

For alternate non-proprietary systems that do not have a Technology Acceptance Protocol-Ecology / Technology Acceptance Reciprocity Partnership / New Jersey Corporation for Advance Testing certification (but which still must provide quantitative data per Appendix F.1), it must be demonstrate that the configuration and design proposed for the project is reasonably consistent with the configuration and design under which the BMP was tested to demonstrate compliance with Appendix F.1.

F.2.2 Sizing of Flow-Based Biofiltration BMP

This sizing method is <u>only</u> available when the BMP meets the pollutant treatment performance standard in Appendix F.1.

Proprietary biofiltration BMPs are typically designed as a flow-based BMPs (i.e., a constant treatment capacity with negligible storage volume). Additionally, proprietary biofiltration is only acceptable if no infiltration is feasible and where site-specific documentation demonstrates that the use of larger footprint biofiltration BMPs would be infeasible or if the proprietary biofiltration BMP is supplemented with a downstream retention BMP that achieves volume reduction equivalent to a non-proprietary BMP sized in accordance with Worksheet B.5-1. The applicable sizing method for biofiltration is therefore reduced to: <u>Treat 1.5 times the DCV</u>.

The following steps should be followed to demonstrate that the system is sized to treat 1.5 times the

DCV.

1. Calculate the flow rate required to meet the pollutant treatment performance standard without scaling for the 1.5 factor. Options include either:
   - o Calculate the runoff flow rate from a 0.2 inch per hour uniform intensity precipitation event (See methodology Appendix B.6.3), or
   - o Conduct a continuous simulation analysis to compute the size required to capture and treat 80 percent of average annual runoff; for small catchments, 5-minute precipitation data should be used to account for short time of concentration. Nearest rain gage with 5-minute precipitation data is allowed for this analysis.
2. Multiply the flow rate from Step 1 by 1.5 to compute the design flow rate for the biofiltration system.
3. Based on the conditions of certification/verification (discussed above), establish the design capacity, as a flow rate, of a given sized unit.
4. Demonstrates that an appropriate unit size and number of units is provided to provide a flow rate that meets the required flow rate from Step 2.
5. Provide a downstream retention BMP that achieves volume reduction equivalent to a non-proprietary BMP sized in accordance with Worksheet B.5-1.

Appendix

G

BMP DESIGN MANUAL

Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

Appendix G Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

G.1 Guidance for Continuous Simulation Hydrologic Modeling for Hydromodification Management Studies in San Diego County Region 9

G.1.1 Introduction

Continuous simulation hydrologic modeling is used to demonstrate compliance with the performance standards for hydromodification management in San Diego. There are several available hydrologic models that can perform continuous simulation analyses. Each has different methods and parameters for determining the amount of rainfall that becomes runoff, and for representing the hydraulic operations of certain structural BMPs such as biofiltration with partial retention or biofiltration. This Appendix is intended to:

- Identify acceptable models for continuous simulation hydrologic analyses for hydromodification management;
- Provide guidance for selecting climatology input to the models;
- Provide standards for rainfall loss parameters to be used in the models;
- Provide standards for defining physical characteristics of LID components; and
- Provide guidance for demonstrating compliance with performance standards for hydromodification management.

This Appendix is not a user's manual for any of the acceptable models, nor a comprehensive manual for preparing a hydrologic model. This Appendix provides guidance for selecting model input parameters for the specific purpose of hydromodification management studies. The model preparer must be familiar with the user's manual for the selected software to determine how the parameters are entered to the model.

G.1.2 Software for Continuous Simulation Hydrologic Modeling

The following software models may be used for hydromodification management studies in San Diego:

- HSPF – Hydrologic Simulation Program-FORTRAN, distributed by USEPA, public domain.
- SDHM – San Diego Hydrology Model, distributed by Clear Creek Solutions, Inc. This is an HSPF-based model with a proprietary interface that has been customized for use in San Diego for hydromodification management studies.
- SWMM – Storm Water Management Model, distributed by USEPA, public domain.

Third-party and proprietary software, such as XPSWMM or PCSWMM, may be used for hydromodification management studies in San Diego, provided that:

- Input and output data from the software can interface with public domain software such as SWMM. In other words, input files from the third party software should have sufficient functionality to allow export to public domain software for independent validation.
- The software's hydromodification control processes are substantiated.

G.1.3 Climatology Parameters

G.1.3.1 Rainfall

In all software applications for preparation of hydromodification management studies in San Diego, rainfall data must be selected from approved data sets that have been prepared for this purpose. As part of the development of the March 2011 Final HMP, long-term hourly rainfall records were prepared for public use. The rainfall record files are provided on the Project Clean Water website. The rainfall station map is provided in the March 2011 Final HMP and is included in this Appendix as Figure G.1-1.

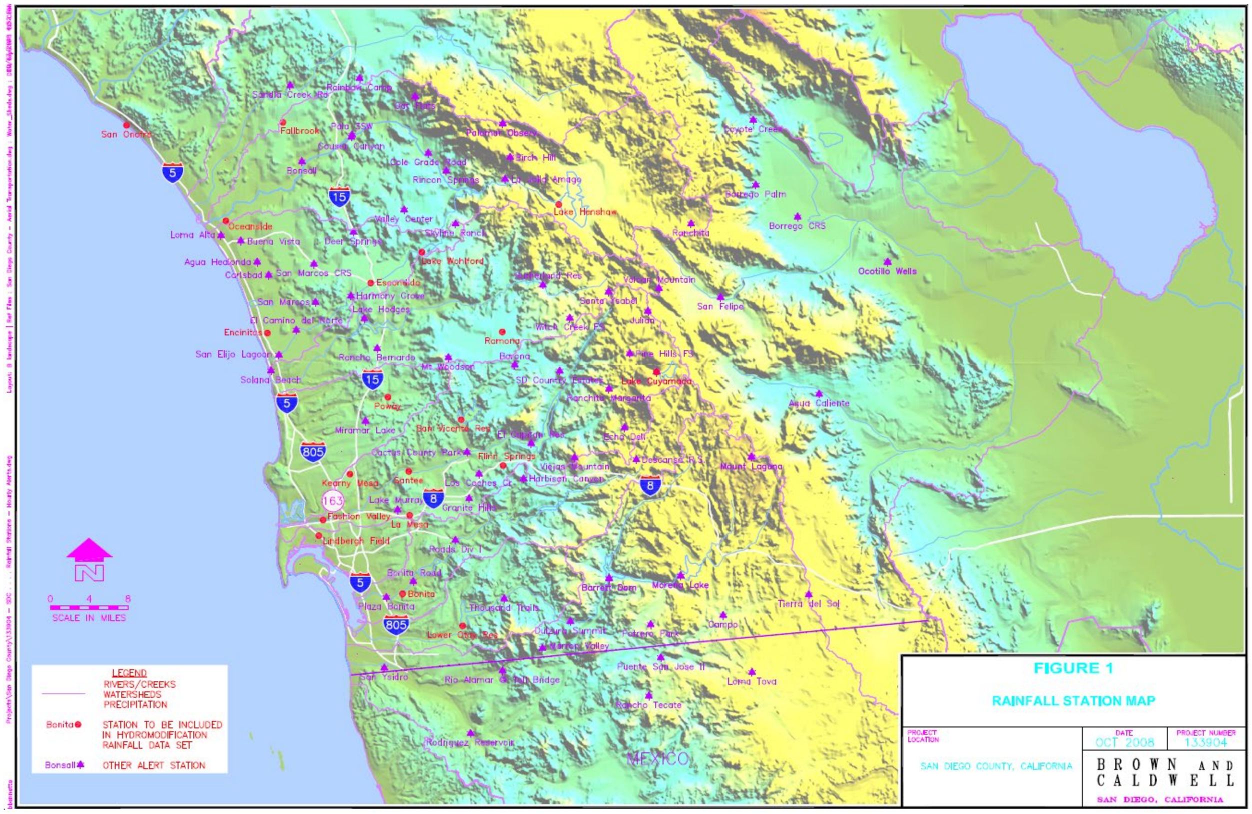


Figure G.1-1: Rainfall Station Map

Project applicants preparing continuous simulation models shall select the most appropriate rainfall data set from the rainfall record files provided on the Project Clean Water website. For a given project location, the following factors should be considered in the selection of the appropriate rainfall data set:

- In most cases, the rainfall data set in closest proximity to the project site will be the appropriate choice (refer to the rainfall station map).
- In some cases, the rainfall data set in closest proximity to the project site may not be the most applicable data set. Such a scenario could involve a data set with an elevation significantly different from the project site. In addition to a simple elevation comparison, the project proponent may also consult with the San Diego County's average annual precipitation isopluvial map, which is provided in the San Diego County Hydrology Manual (2003). Review of this map could provide an initial estimate as to whether the project site is in a similar rainfall zone as compared to the rainfall stations. Generally, precipitation totals in San Diego County increase with increasing elevation.
- Where possible, rainfall data sets should be chosen so that the data set and the project location are both located in the same topographic zone (coastal, foothill, mountain) and major

watershed unit (Upper San Luis Rey, Lower San Luis Rey, Upper San Diego River, Lower San Diego River, etc.).

For SDHM users, the approved rainfall data sets are pre-loaded into the software package. SDHM users may select the appropriate rainfall gage within the SDHM program. HSPF or SWMM users shall download the appropriate rainfall record from the Project Clean Water website and load it into the software program.

Both the pre-development and post-project model simulation period shall encompass the entire rainfall record provided in the approved rainfall data set. Scaling the rainfall data is not permitted.

G.1.3.2 Potential Evapotranspiration

Project applicants preparing continuous simulation models shall select a data set from the sources described below to represent potential evapotranspiration.

For HSPF users, this parameter may be entered as an hourly time series. The hourly time series that was used to develop the BMP Sizing Calculator parameters is provided on the project clean water website and may be used for hydromodification management studies in San Diego. For SDHM users, the hourly evaporation data set is pre-loaded into the program. HSPF users may download the evaporation record from the Project Clean Water website and load it into the software program.

For HSPF or SWMM users, this parameter may be entered as monthly values in inches per month or inches per day. Monthly values may be obtained from the California Irrigation Management Information System "Reference Evapotranspiration Zones" brochure and map (herein "CIMIS ETo Zone Map"), prepared by California Department of Water Resources, dated January 2012. The CIMIS ETo Zone Map is available from www.cimis.gov, and is provided in this Appendix as Figure G.1-2. Determine the appropriate reference evapotranspiration zone for the project from the CIMIS ETo Zone Map. The monthly average reference evapotranspiration values are provided below in Table G.1-1.

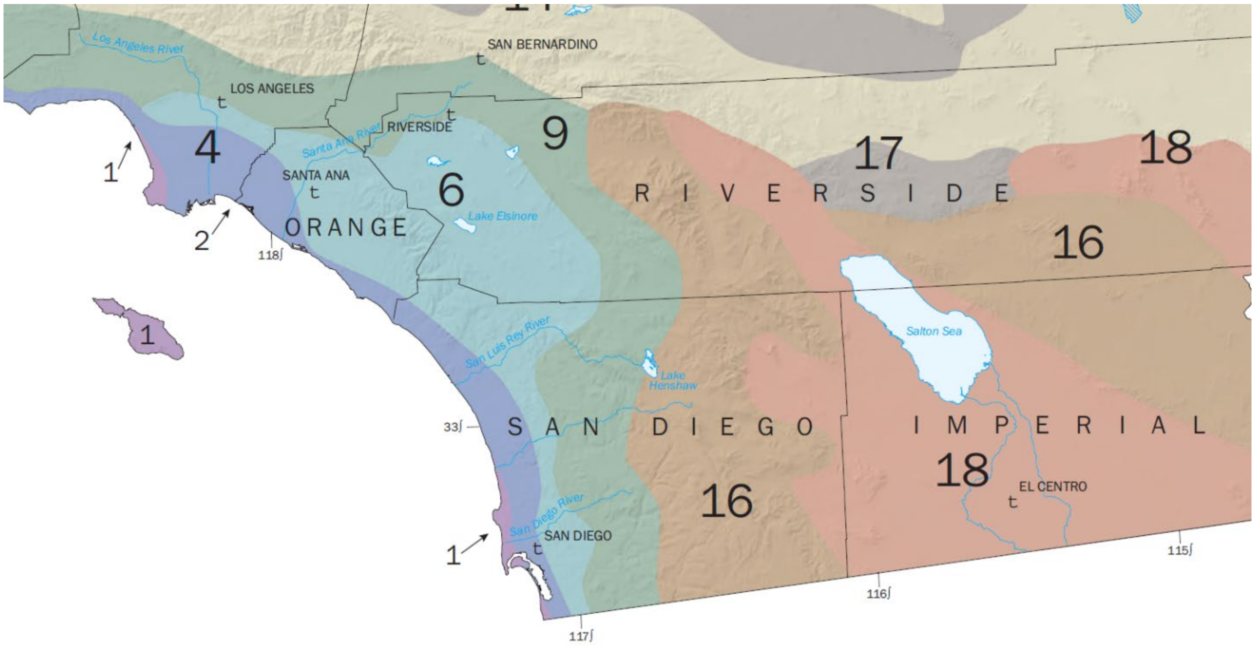


Figure G.1-2: California Irrigation Management Information System "Reference Evapotranspiration Zones"

Table G.1-1: Monthly Average Reference Evapotranspiration by ETo Zone (inches/month and inches/day) for use in SWMM Models for Hydromodification Management Studies in San Diego County CIMIS Zones 1, 4, 6, 9, and 16 (See CIMIS ETo Zone Map)

	January	February	March	April	May	June	July	August	September	October	November	December
Zone	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month
1	0.93	1.4	2.48	3.3	4.03	4.5	4.65	4.03	3.3	2.48	1.2	0.62
4	1.86	2.24	3.41	4.5	5.27	5.7	5.89	5.58	4.5	3.41	2.4	1.86
6	1.86	2.24	3.41	4.8	5.58	6.3	6.51	6.2	4.8	3.72	2.4	1.86
9	2.17	2.8	4.03	5.1	5.89	6.6	7.44	6.82	5.7	4.03	2.7	1.86
16	1.55	2.52	4.03	5.7	7.75	8.7	9.3	8.37	6.3	4.34	2.4	1.55
	January	February	March	April	May	June	July	August	September	October	November	December
Days	31	28	31	30	31	30	31	31	30	31	30	31
Zone	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day
1	0.030	0.050	0.080	0.110	0.130	0.150	0.150	0.130	0.110	0.080	0.040	0.020
4	0.060	0.080	0.110	0.150	0.170	0.190	0.190	0.180	0.150	0.110	0.080	0.060
6	0.060	0.080	0.110	0.160	0.180	0.210	0.210	0.200	0.160	0.120	0.080	0.060
9	0.070	0.100	0.130	0.170	0.190	0.220	0.240	0.220	0.190	0.130	0.090	0.060
16	0.050	0.090	0.130	0.190	0.250	0.290	0.300	0.270	0.210	0.140	0.080	0.050

G.1.4 Land Characteristics and Loss

In all software applications for preparation of hydromodification management studies in San Diego, rainfall loss parameters must be consistent with this Appendix unless the preparer can provide documentation to substantiate use of other parameters, subject to local jurisdiction approval. HSPF and SWMM use different processes and different sets of parameters. SDHM is based on HSPF, therefore parameters for SDHM and HSPF are presented together in Section G.1.4.1. Parameters that have been pre-loaded into SDHM may be used for other HSPF hydromodification management studies outside of SDHM. Parameters for SWMM are presented separately in Section G.1.4.2.

G.1.4.1 Rainfall Loss Parameters for HSPF and SDHM

Rainfall losses in HSPF are characterized by PERLND/PWATER parameters and IMPLND parameters, which describe processes occurring when rainfall lands on pervious lands and impervious lands, respectively. "BASINS Technical Notice 6, Estimating Hydrology and Hydraulic Parameters for HSPF," prepared by the USEPA, dated July 2000, provides details regarding these parameters and summary tables of possible ranges of these parameters. Table G.1-2, excerpted from the above-mentioned document, presents the ranges of these parameters.

For HSPF studies for hydromodification management in San Diego, PERLND/PWATER parameters and IMPLND parameters shall fall within the "possible" range provided in EPA Technical Note 6. To select specific parameters, HSPF users may use the parameters established for development of the San Diego BMP Sizing Calculator, and/or the parameters that have been established for SDHM. Parameters for the San Diego BMP Sizing Calculator and SDHM are based on research conducted specifically for HSPF modeling in San Diego.

Documentation of parameters selected for the San Diego BMP Sizing Calculator is presented in the document titled, San Diego BMP Sizing Calculator Methodology, prepared by Brown and Caldwell, dated January 2012 (herein "BMP Sizing Calculator Methodology"). The PERLND/PWATER parameters selected for development of the San Diego BMP Sizing Calculator represent a single composite pervious land cover that is representative of most pre-development conditions for sites that would commonly be managed by the BMP Sizing Calculator. The parameters shown below in Table G.1-3 are excerpted from the BMP Sizing Calculator Methodology.

Table G.1-2: HSPF PERLND/PWATER and IMPLND Parameters from EPA Technical Note 6

Name	Definition	Units	Range of Values: Typical Min	Typical Max	Possible Min	Possible Max	Function of …	Comment
PWAT – PARM2								
FOREST	Fraction forest cover	none	0.0	0.50	0.0	0.95	Forest cover	Only impact when SNOW is active
LZSN	Lower Zone Nominal Soil Moisture Storage	inches	3.0	8.0	2.0	15.0	Soils, climate	**Calibration**
INFILT	Index to Infiltration Capacity	in/hr	0.01	0.25	0.001	0.50	Soils, land use	**Calibration**, divides surface and subsurface flow
LSUR	Length of overland flow	feet	200	500	100	700	Topography	Estimate from high resolution topo maps or GIS
SLSUR	Slope of overland flow plane	ft/ft	0.01	0.15	0.001	0.30	Topography	Estimate from high resolution topo maps or GIS
KVARY	Variable groundwater recession	1/inches	0.0	3.0	0.0	5.0	Baseflow recession variation	Used when recession rate varies with GW levels
AGWRC	Base groundwater recession	none	0.92	0.99	0.85	0.999	Baseflow recession	**Calibration**
PWAT – PARM3								
PETMAX	Temp below which ET is reduced	deg. F	35.0	45.0	32.0	48.0	Climate, vegetation	Reduces ET near freezing, when SNOW is active
PETMIN	Temp below which ET is set to zero	deg. F	30.0	35.0	30.0	40.0	Climate, vegetation	Reduces ET near freezing, when SNOW is active
INFEXP	Exponent in infiltration equation	none	2.0	2.0	1.0	3.0	Soils variability	Usually default to 2.0
INFILD	Ratio of max/mean infiltration capacities	none	2.0	2.0	1.0	3.0	Soils variability	Usually default to 2.0
DEEPFR	Fraction of GW inflow to deep recharge	none	0.0	0.20	0.0	0.50	Geology, GW recharge	Accounts for subsurface losses
BASETP	Fraction of remaining ET from baseflow	none	0.0	0.05	0.0	0.20	Riparian vegetation	Direct ET from riparian vegetation
AGWETP	Fraction of remaining ET from active GW	none	0.0	0.05	0.0	0.20	Marsh/wetlands extent	Direct ET from shallow GW
PWAT – PARM4								
CEPSC	Interception storage capacity	inches	0.03	0.20	0.01	0.40	Vegetation type/density, land use	Monthly values usually used
UZSN	Upper zone nominal soil moisture storage	inches	0.10	1.0	0.05	2.0	Surface soil conditions, land use	Accounts for near surface retention
NSUR	Manning's n (roughness) for overland flow	none	0.15	0.35	0.05	0.50	Surface conditions, residue, etc.	Monthly values often used for croplands
INTFW	Interflow inflow parameter	none	1.0	3.0	1.0	10.0	Soils, topography, land use	**Calibration**, based on hydrograph separation
IRC	Interflow recession parameter	none	0.5	0.70	0.30	0.85	Soils, topography, land use	Often start with a value of 0.7, and then adjust
LZETP	Lower zone ET parameter	none	0.2	0.70	0.1	0.9	Vegetation type/density, root depth	**Calibration**
IWAT – PARM2								
LSUR	Length of overland flow	feet	50	150	50	250	Topography, drainage system	Estimate from maps, GIS, or field survey
SLSUR	Slope of overland flow plane	ft/ft	0.01	0.05	0.001	0.15	Topography, drainage	Estimate from maps, GIS, or field survey
NSUR	Manning's n (roughness) for overland flow	none	0.03	0.10	0.01	0.15	Impervious surface conditions	Typical range is 0.05 to 0.10 for roads/parking lots
RETSC	Retention storage capacity	inches	0.03	0.10	0.01	0.30	Impervious surface conditions	Typical range is 0.03 to 0.10 for roads/parking lots
IWAT – PARM3 (PETMAX and PETMIN, same values as shown for PWAT – PARM3)								

Table G.1-3: HSPF PERLND/PWATER Parameters from BMP Sizing Calculator Methodology

		Hydrologic Soil Group A			Hydrologic Soil Group B			Hydrologic Soil Group C			Hydrologic Soil Group D		
	Slope	5%	10%	15%	5%	10%	15%	5%	10%	15%	5%	10%	15%
PWAT_PARM2	Units												
FOREST	None	0	0	0	0	0	0	0	0	0	0	0	0
LZSN	inches	5.2	4.8	4.5	5.0	4.7	4.4	4.8	4.5	4.2	4.8	4.5	4.2
INFILT	in/hr	0.090	0.070	0.045	0.070	0.055	0.040	0.050	0.040	0.032	0.040	0.030	0.020
LSUR	Feet	200	200	200	200	200	200	200	200	200	200	200	200
SLSUR	ft/ft	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15
KVARY	1/inches	3	3	3	3	3	3	3	3	3	3	3	3
AGWRC	None	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
PWAT_PARM3													
PETMAX (F)	F	35	35	35	35	35	35	35	35	35	35	35	35
PETMIN (F)	F	30	30	30	30	30	30	30	30	30	30	30	30
INFEXP	None	2	2	2	2	2	2	2	2	2	2	2	2
INFILD	None	2	2	2	2	2	2	2	2	2	2	2	2
DEEPFR	None	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
BASETP	None	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
AGEWTP	None	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PWAT_PARM4													
CEPSC	inches	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
UZSN	inches	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
NSUR	None	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
INTFW	None	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
IRC	None	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
LZETP	None	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Parameters within SDHM are documented in "San Diego Hydrology Model User Manual," prepared by Clear Creek Solutions, Inc. (as of the development of the Manual, the current version of the SDHM User Manual is dated January 2012). Parameters established for SDHM represent "grass" (non-turf grasslands), "dirt," "gravel," and "urban" cover. The documented PERLND and IMPLND parameters for the various land covers and soil types have been pre-loaded into SDHM. SDHM users shall use the parameters that have been pre-loaded into the program without modification unless the preparer can provide documentation to substantiate use of other parameters.

G.1.4.2 Rainfall Loss Parameters for SWMM

In SWMM, rainfall loss parameters (parameters that describe processes occurring when rainfall lands on pervious lands and impervious lands) are entered in the "subcatchment" module. In addition to specifying parameters, the SWMM user must also select an infiltration model.

The SWMM Manual provides details regarding the subcatchment parameters and summary tables of possible ranges of these parameters. For SWMM studies for hydromodification management in San Diego, subcatchment parameters shall fall within the range provided in the SWMM Manual. Some of the parameters depend on the selection of the infiltration model. For consistency across the San Diego region, SWMM users shall use the Green-Ampt infiltration model for hydromodification management studies. Table G.1-4 presents SWMM subcatchment parameters for use in hydromodification management studies in the San Diego region.

Table G.1-4: Subcatchment Parameters for SWMM Studies for Hydromodification Management in San Diego

SWMM Parameter Name	Unit	Range	Use in San Diego
Name X-Coordinate Y-Coordinate Description Tag Rain Gage Outlet	N/A	N/A – project-specific	Project-specific
Area	acres (ac)	Project-specific	Project-specific
Width	feet (ft)	Project-specific	Project-specific
% Slope	percent (%)	Project-specific	Project-specific
% Imperv	percent (%)	Project-specific	Project-specific
N-imperv	--	0.011 – 0.024 presented in Table A.6 of SWMM Manual	default use 0.012 for smooth concrete, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
N-Perv	--	0.05 – 0.80 presented in Table A.6 of SWMM Manual	default use 0.15 for short prairie grass, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
Dstore-Imperv	inches	0.05 – 0.10 inches presented in Table A.5 of SWMM Manual	0.05
Dstore-Perv	inches	0.10 – 0.30 inches presented in Table A.5 of SWMM Manual	0.10
%ZeroImperv	percent (%)	0% – 100%	25%
Subarea routing	--	OUTLET IMPERVIOUS PERVIOUS	Project-specific, typically OUTLET
Percent Routed	%	0% – 100%	Project-specific, typically 100%
Infiltration	Method	HORTON GREEN_AMPT CURVE_NUMBER	GREEN_AMPT

SWMM Parameter Name	Unit	Range	Use in San Diego
Suction Head (Green-Ampt)	Inches	1.93 – 12.60 presented in Table A.2 of SWMM Manual	Hydrologic Soil Group A: 1.5 Hydrologic Soil Group B: 3.0 Hydrologic Soil Group C: 6.0 Hydrologic Soil Group D: 9.0
Conductivity (Green-Ampt)	Inches per hour	0.01 – 4.74 presented in Table A.2 of SWMM Manual by soil texture class 0.00 – ≥0.45 presented in Table A.3 of SWMM Manual by hydrologic soil group	Hydrologic Soil Group A: 0.3 Hydrologic Soil Group B: 0.2 Hydrologic Soil Group C: 0.1 Hydrologic Soil Group D: 0.025 Note: reduce conductivity by 25% in the post-project condition when native soils will be compacted. Conductivity may also be reduced by 25% in the pre-development condition model for redevelopment areas that are currently concrete or asphalt but must be modeled according to their underlying soil characteristics. For fill soils in post-project condition, see Section G.1.4.3.
Initial Deficit (Green-Ampt)		The difference between soil porosity and initial moisture content. Based on the values provided in Table A.2 of SWMM Manual, the range for completely dry soil would be 0.097 to 0.375	Hydrologic Soil Group A: 0.30 Hydrologic Soil Group B: 0.31 Hydrologic Soil Group C: 0.32 Hydrologic Soil Group D: 0.33 Note: in long-term continuous simulation, this value is not important as the soil will reach equilibrium after a few storm events regardless of the initial moisture content specified.
Groundwater	yes/no	yes/no	NO
LID Controls			Project Specific

SWMM Parameter Name	Unit	Range	Use in San Diego
Snow Pack Land Uses Initial Buildup Curb Length			Not applicable to hydromodification management studies

G.1.4.3 Pervious Area Rainfall Loss Parameters in Post-Project Condition (HSPF, SDHM, and SWMM)

The following guidance applies to HSPF, SDHM, and SWMM. When modeling pervious areas in the post-project condition, fill soils shall be modeled as hydrologic soil group Type D soils, or the project applicant may provide an actual expected infiltration rate for the fill soil based on testing (must be approved by the Port for use in the model). Where landscaped areas on fill soils will be re-tilled and/or amended in the post-project condition, the landscaped areas may be modeled as Type C soils. Areas to be re-tilled and/or amended in the post-project condition must be shown on the project plans. For undisturbed pervious areas (i.e., native soils, no fill), use the actual hydrologic soil group, the same as in the pre-development condition.

G.1.5 Modeling Structural BMPS (Ponds AND LID Features)

There are many ways to model structural BMPs. There are standard modules for several pond or LID elements included in SDHM and SWMM. Users may also set up project-specific stage-storage-discharge relationships representing structural BMPs. Regardless of the modeling method, certain characteristics of the structural BMP, including infiltration of water from the bottom of the structural BMP into native soils, porosity of bioretention soils and/or gravel sublayers, and other program-specific parameters must be consistent with those presented below, unless the preparer can provide documentation to substantiate use of other parameters, subject to local jurisdiction approval. The geometry of structural BMPs is project-specific and shall match the project plans.

G.1.5.1 Infiltration into Native Soils Below Structural BMPs

Infiltration into native soils below structural BMPs may be modeled as a constant outflow rate equal to the project site-specific design infiltration rate (Worksheet D.5-1) multiplied by the area of the infiltrating surface (and converted to cubic feet per second). This infiltration rate is not the same as an infiltration parameter used in the calculation of rainfall losses, such as the HSPF INFILT parameter or the Green-Ampt conductivity parameter in the SWMM subcatchment module. It must be site-specific and must be determined based on the methods presented in Appendix D of this manual.

For preliminary analysis when site-specific geotechnical investigation has not been completed, project applicants proposing infiltration into native soils as part of the structural BMP design shall prepare a sensitivity analysis to determine a potential range for the structural BMP size based on a range of potential infiltration rates. As shown in Appendices C and D of this manual, many factors influence the ability to infiltrate storm water. Therefore even when soils types A and B are present, which are generally expected to infiltrate storm water, the possibility that a very low infiltration rate could be determined at design level must be considered. The range of potential infiltration rates for preliminary analysis is shown below in Table G.1-5.

Table G.1-5: Range of Potential Infiltration Rates to be Studied for Sensitivity Analysis when Native Infiltration is Proposed but Site-Specific Geotechnical Investigation has not been Completed

Hydrologic Soil Group at Location of Proposed Structural BMP	Low Infiltration Rate for Preliminary Study (inches/hour)	High Infiltration Rate for Preliminary Study (inches/hour)
A	0.02	2.4
B	0.02	0.52
C	0	0.08
D	0	0.02

The infiltration rates shown above are for preliminary investigation only. Final design of a structural BMP must be based on the project site-specific design infiltration rate (Worksheet D.5-1).

G.1.5.2 Structural BMPs That Do Not Include Sub-Layers (Ponds)

To model a pond, basin, or other depressed area that does not include processing runoff through sublayers of amended soil and/or gravel, create a stage storage discharge relationship for the pond, and supply the information to the model according to the program requirements. For HSPF users, the stage-storage-discharge relationship is provided in FTABLES. SDHM users may use the TRAPEZOIDAL POND element for a trapezoidal pond or IRREGULAR POND element to request the program to create the stage-storage-discharge relationship, use the SSD TABLE element to supply a user-created stage-storage-discharge relationship, or use other available modules such as TANK or VAULT. For SWMM users, the stage-storage relationship is supplied in the storage unit module, and the stage-discharge relationship may be represented by various other modules such as the orifice, weir, or outlet modules. Stage-storage and stage-discharge curves for structural BMPs must be fully documented in the project-specific HMP report and must be consistent with the structural BMP(s) shown on project plans.

For user-created stage-discharge relationships, refer to local drainage manual criteria for equations representing hydraulic behavior of outlet structures. Users relying on the software to develop the stage-discharge relationship may use the equations built into the program. This manual does not recommend that all program modules calculating stage-discharge relationships must be uniform because the flows to be controlled for hydromodification management are low flows, calculated differently from the single-storm event peak flows studied for flood control purposes, and hydromodification management performance standards do not represent any performance standard for flood control drainage design. Note that for design of emergency outlet structures, and any calculations related to single-storm event routing for flood control drainage design, stage-discharge calculations must be consistent with the local drainage design requirements. This may require separate calculations for stage-discharge relationship pursuant to local manuals. The HMP flow rates shall not be used for flood control calculations.

G.1.5.3 Structural BMPs That Include Sub-Layers (Bioretention and Other LID)

G.1.5.3.1 Characteristics of Engineered Soil Media

The engineered soil media used in bioretention, biofiltration with partial retention, and biofiltration structural BMPs is a sandy loam. The following parameters presented in Table G.1-6 are characteristics of a sandy loam for use in continuous simulation models.

Table G.1-6: Characteristics of Sandy Loam to Represent Engineered Soil Media in Continuous Simulation for Hydromodification Management Studies in San Diego

Soil Texture	Porosity	Field Capacity	Wilting Point	Conductivity	Suction Head
Sandy Loam	0.4	0.2	0.1	5 inches/hour	1.5 inches

- Porosity is the volume of pore space (voids) relative to the total volume of soil (as a fraction).
- Field Capacity is the volume of pore water relative to total volume after the soil has been allowed to drain fully (as a fraction). Below this level, vertical drainage of water through the soil layer does not occur.
- Wilting point is the volume of pore water relative to total volume for a well dried soil where only bound water remains (as a fraction). The moisture content of the soil cannot fall below this limit.
- Conductivity is the hydraulic conductivity for the fully saturated soil (in/hr or mm/hr).
- Suction head is the average value of soil capillary suction along the wetting front (inches or mm).

Figures G.1-3 and G.1-4, from http://www.stevenswater.com/articles/irrigationscheduling.aspx, illustrate unsaturated soil and soil saturation, field capacity, and wilting point.

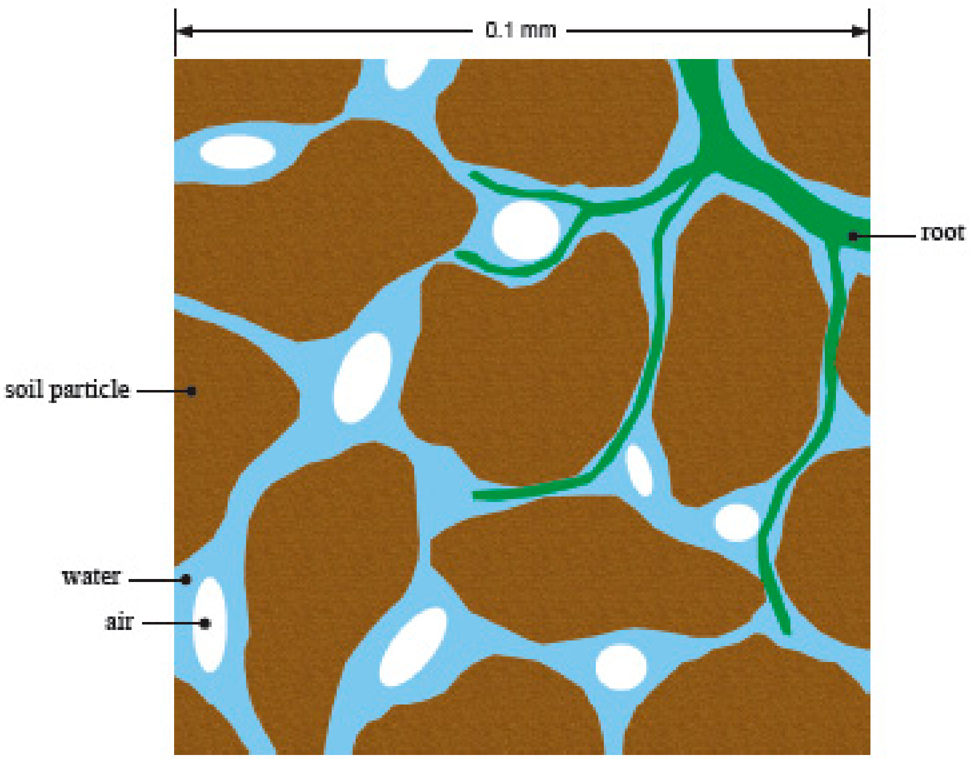


Figure G.1-3: Unsaturated Soil Composition

Unsaturated soil is composed of solid particles, organic material and pores. The pore space will contain air and water.

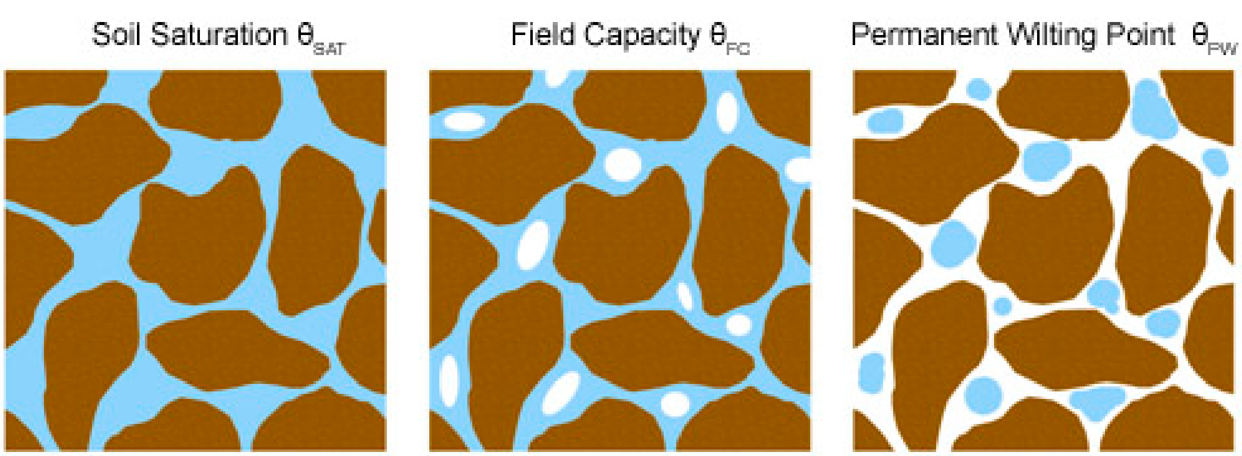


Figure G.1-4: Soil saturation, field capacity, and wilting point

G.1.5.3.2 Characteristics of Gravel

For the purpose of hydromodification management studies, it may be assumed that water moves freely through gravel, not limited by hydraulic properties of the gravel. For the purpose of calculating available volume, use porosity of 0.4, or void ratio of 0.67. Porosity is equal to void ratio divided by (1 + void ratio).

G.1.5.3.3 Additional Guidance for SDHM Users

The module titled "bioretention/rain garden element" may be used to represent bioretention or biofiltration BMPs. SDHM users using the available "bioretention/rain garden element" shall customize the soil media characteristics to use the parameters from Table G.1-6 above, and select "gravel" for gravel sublayers. All other input variables are project-specific. "Native infiltration" refers to infiltration from the bottom of the structural BMP into the native soil. This variable is project-specific, see Section G.1.5.1.

G.1.5.3.4 Additional Guidance for SWMM Users

The "bio-retention cell" LID control may be used to represent bioretention or biofiltration BMPs. Table G.1-7 provides parameters required for the standard "bio-retention cell" available in SWMM. The parameters are entered in the LID Control Editor.

Table G.1-7: Parameters for SWMM "Bio-Retention Cell" Module for Hydromodification Management Studies in San Diego

SWMM Parameter Name	Unit	Use in San Diego
Surface		
Berm Height also known as Storage Depth	inches	Project-specific
Vegetative Volume Fraction also known as Vegetative Cover Fraction	---	0
Surface Roughness	---	0 (this parameter is not applicable to bio-retention cell)
Surface Slope	---	0 (this parameter is not applicable to bio-retention cell)
Soil		
Thickness	inches	project-specific
Porosity	---	0.40
Field Capacity	---	0.2

SWMM Parameter Name	Unit	Use in San Diego
Wilting Point	---	0.1
Conductivity	Inches/hour	5
Conductivity Slope	---	5
Suction Head	inches	1.5
Storage		
Thickness also known as Height	inches	Project-specific
Void Ratio	---	0.67
Seepage Rate also known as Conductivity	Inches/hour	Conductivity from the storage layer refers to infiltration from the bottom of the structural BMP into the native soil. This variable is project-specific, see Section G.5.1. Use 0 if the bio-retention cell includes an impermeable liner
Clogging Factor	---	0
Underdrain		
Flow Coefficient Also known as Drain Coefficient	---	Project-specific
Flow Exponent Also known as Drain Exponent	---	Project-specific, typically 0.5
Offset Height Also known as Drain Offset Height	Inches	Project-specific

G.1.6 Flow Frequency and Duration

The continuous simulation model will generate a flow record corresponding to the frequency of the rainfall data input as its output. This flow record must then be processed to determine pre-development and post-project flow rates and durations. Compliance with hydromodification management requirements of this manual is achieved when results for flow duration meet the performance standards. The performance standard is as follows (also presented in Chapter 6 of this manual):

1. For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-development 2-year runoff event ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-development 10-year runoff event (Q_{10}), the post-project discharge rates and durations must not exceed the pre-development rates and

durations by more than 10 percent. The specific lower flow threshold will depend on the erosion susceptibility of the receiving stream for the project site (see Section 6.3.4).

To demonstrate that a flow control facility meets the hydromodification management performance standard, a flow duration summary must be generated and compared for pre-development and post-project conditions. The following guidelines shall be used for determining flow rates and durations.

G.1.6.1 Determining Flow Rates from Continuous Hourly Flow Output

Flow rates for hydromodification management studies in San Diego must be based on partial duration series analysis of the continuous hourly flow output. Partial duration series frequency calculations consider multiple storm events in a given year. To construct the partial duration series:

1. Parse the continuous hourly flow data into discrete runoff events. The following separation criteria may be used for separation of flow events: a new discrete event is designated when the flow falls below an artificially low flow value based on a fraction of the contributing watershed area (e.g., 0.002 to 0.005 cfs/acre) for a time period of 24 hours. Project applicants may consider other separation criteria provided the separation interval is not more than 24 hours and the criteria is clearly described in the submittal document.
2. Rank the peak flows from each discrete flow event, and compute the return interval or plotting position for each event.

Readers who are unfamiliar with how to compute the partial-duration series should consult reference books or online resources for additional information. For example, Hydrology for Engineers, by Linsley et all, 1982, discusses partial-duration series on pages 373-374 and computing recurrence intervals or plotting positions on page 359. Handbook of Applied Hydrology, by Chow, 1964, contains a detailed discussion of flow frequency analysis, including Annual Exceedance, Partial-Duration and Extreme Value series methods, in Chapter 8. The US Geological Survey (USGS) has several hydrologic study reports available online that use partial duration series statistics (see http://water.usgs.gov/ and http://water.usgs.gov/osw/bulletin17b/AGU_Langbein_1949.pdf).

Pre-development Q_2 and Q_{10} shall be determined from the partial duration analysis for the pre-development hourly flow record. Pre-development Q_{10} is the upper threshold of flow rates to be controlled in the post-project condition. The lower flow threshold is a fraction of the pre-development Q_2 determined based on the erosion susceptibility of the receiving stream. Simply multiply the pre-development Q_2 by the appropriate fraction (e.g., $0.1Q_2$) to determine the lower flow threshold.

G.1.6.2 Determining Flow Durations from Continuous Hourly Flow Output

Flow durations must be summarized within the range of flows to control. Flow duration statistics provide a simple summary of how often a particular flow rate is exceeded. To prepare this summary:

1. Rank the entire hourly runoff time series output.

2. Extract the portion of the ranked hourly time series output from the lower flow threshold to the upper flow threshold – this is the portion of the record to be summarized.
3. Divide the applicable portion of the record into 100 equal flow bins (compute the difference between the upper flow threshold (cfs) and lower flow threshold (cfs) and divide this value by 99 to establish the flow bin size).
4. Count the number of hours of flow that fall into each flow bin.

Both pre-development and post-project flow duration summary must be based on the entire length of the flow record. Compare the post-project flow duration summary to the pre-development flow duration summary to determine if it meets performance criteria for post-project flow rates and durations (criteria presented under Section G.1.6).

G.2 Sizing Factors for Hydromodification Management BMPs

This section presents sizing factors for design of flow control structural BMPs based on the sizing factor method identified in Chapter 6.3.5.1. The sizing factors are re-printed from the "San Diego BMP Sizing Calculator Methodology," dated January 2012, prepared by Brown and Caldwell (herein "BMP Sizing Calculator Methodology"). The sizing factors are linked to the specific details and descriptions that were presented in the BMP Sizing Calculator Methodology, with limited options for modifications. The sizing factors were developed based on the 2007 MS4 Permit. Although the sizing factors were developed under the 2007 MS4 Permit, the unit runoff ratios and some sizing factors developed for flow control facility sizing may still be applied at the discretion of the [City Engineer]. Some of the original sizing factors developed based on the 2007 MS4 Permit and presented in the BMP Sizing Calculator Methodology are not compatible with new requirements of the 2013 MS4 Permit, and therefore are not included in this manual. The sizing factor method is intended for simple studies that do not include diversion, do not include significant offsite area draining through the project from upstream, and do not include offsite area downstream of the project area. Use of the sizing factors is limited to the specific structural BMPs described in this Appendix. Sizing factors are available for the following specific structural BMPs:

- Full infiltration condition:
    - **Infiltration**: sizing factors available for A and B soils represent a below-ground structure (dry well)
    - **Bioretention**: sizing factors available for A and B soils represent a bioretention area with engineered soil media and gravel storage layer, with no underdrain and no impermeable liner
- Partial infiltration condition:
    - **Biofiltration with partial retention**: sizing factors available for C and D soils represent a bioretention area with engineered soil media and gravel storage layer, with an underdrain, with gravel storage below the underdrain, with no impermeable liner
- No infiltration condition:
    - **Biofiltration**: sizing factors available for C and D soils represent a bioretention area with engineered soil media and gravel storage layer, with an underdrain, without gravel storage below the underdrain, with no impermeable liner
    - **Biofiltration (formerly known as "flow-through planter") with impermeable liner**: sizing factors available for C and D soils represent a biofiltration system with engineered soil media and gravel storage layer, with an underdrain, with or without

gravel storage below the underdrain, with an impermeable liner

- Other:
  - **Cistern**: sizing factors available for A, B, C, or D soils represent a vessel with a low flow orifice outlet to meet the hydromodification management performance standard.

Sizing factors were created based on three rainfall basins: Lindbergh Field, Oceanside, and Lake Wohlford.

The following information is needed to use the sizing factors:

- Determine the appropriate rainfall basin for the project site from Figure G.2-1, Rainfall Basin Map
- Hydrologic soil group at the project site (use available information pertaining to existing underlying soil type such as soil maps published by the Natural Resources Conservation Service)
- Pre-development and post-project slope categories (low = 0% – 5%, moderate = 5% – 15%, steep = >15%)
- Area tributary to the structural BMP
- Area weighted runoff factor (C) for the area draining to the BMP from Table G.2-1. Note: runoff coefficients and adjustments presented in Appendices B.1 and B.2 are for pollutant control only and are not applicable for hydromodification management studies
- Fraction of Q2 to control (see Chapter 6.3.4)

When using the sizing factor method, Worksheet G.2-1 may be used to present the calculations of the required minimum areas and/or volumes of BMPs as applicable.

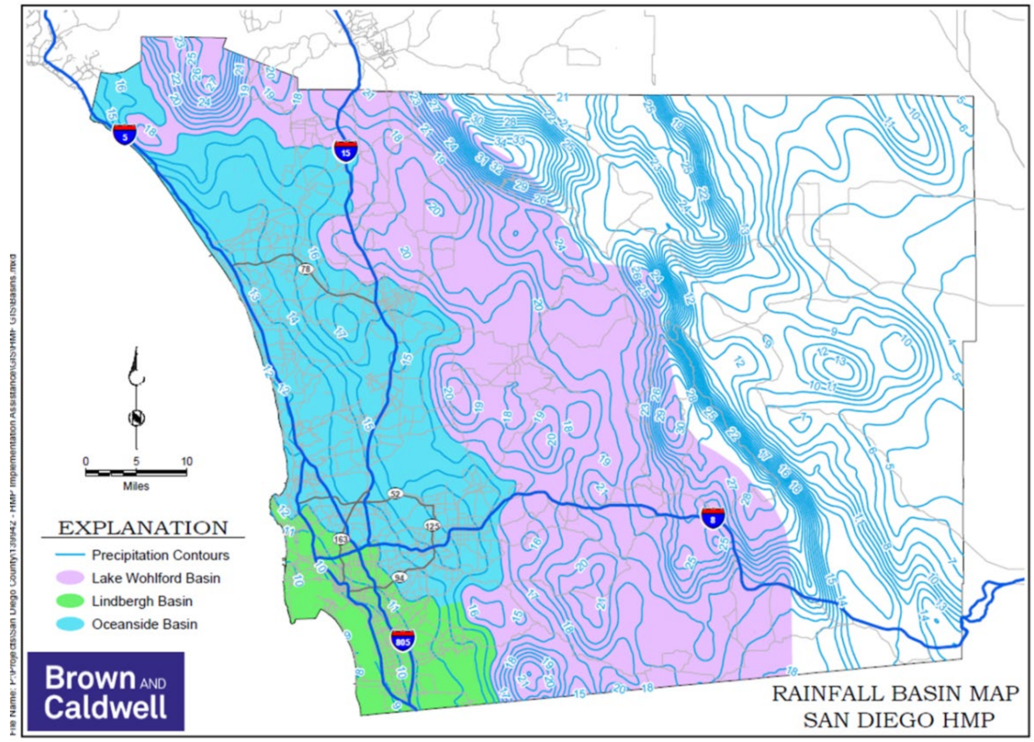


Figure G.2-1: Appropriate Rain Gauge for Project Sites

Table G.2-1: Runoff factors for surfaces draining to BMPs for Hydromodification Sizing Factor Method

Surface	Runoff Factor
Roofs	1.0
Concrete	1.0
Pervious Concrete	0.10
Porous Asphalt	0.10
Grouted Unit Pavers	1.0
Solid Unit Pavers on granular base, min. 3/16 inch joint space	0.20
Crushed Aggregate	0.10
Turf block	0.10
Amended, mulched soils	0.10
Landscape	0.10

Worksheet G.2-1: Sizing Factor Worksheet

Site Information			
Project Name:		Hydrologic Unit	
Project Applicant:		Rain: Gauge:	
Jurisdiction:		Total Project Area:	
Assessor's Parcel Number :		Low Flow Threshold:	
BMP Name:		BMP Type:	

Areas Draining to BMP						Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Pre-Project Slope	Post Project Surface Type	Runoff Factor (From Table G.2-1)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
Total DMA Area								Minimum BMP Size*			
								Proposed BMP Size*			

*Minimum BMP Size = Total of rows above.

*Proposed BMP Size ≥ Minimum BMP size.

G.2.1 Unit Runoff Ratios

Table G.2-2 presents unit runoff ratios for calculating pre-development Q_2, to be used when applicable to determine the lower flow threshold for low flow orifice sizing for biofiltration with partial retention, biofiltration, biofiltration with impermeable liner, or cistern BMPs. There is no low flow orifice in the infiltration BMP or bioretention BMP. The unit runoff ratios are re-printed from the BMP Sizing Calculator methodology. Unit runoff ratios for "urban" and "impervious" cover categories were not transferred to this manual due to the requirement to control runoff to pre-development condition (see Chapter 6.3.3).

How to use the unit runoff ratios:

Obtain unit runoff ratio from Table G.2-2 based on the project's rainfall basin, hydrologic soil group, and pre-development slope (for redevelopment projects, pre-development slope may be considered if historic topographic information is available, otherwise use pre-project slope). Multiply the area tributary to the structural BMP (A, acres) by the unit runoff ratio (Q2, cfs/acre) to determine the pre-development Q2 to determine the lower flow threshold, to use for low flow orifice sizing.

Table G.2-2: Unit Runoff Ratios for Sizing Factor Method

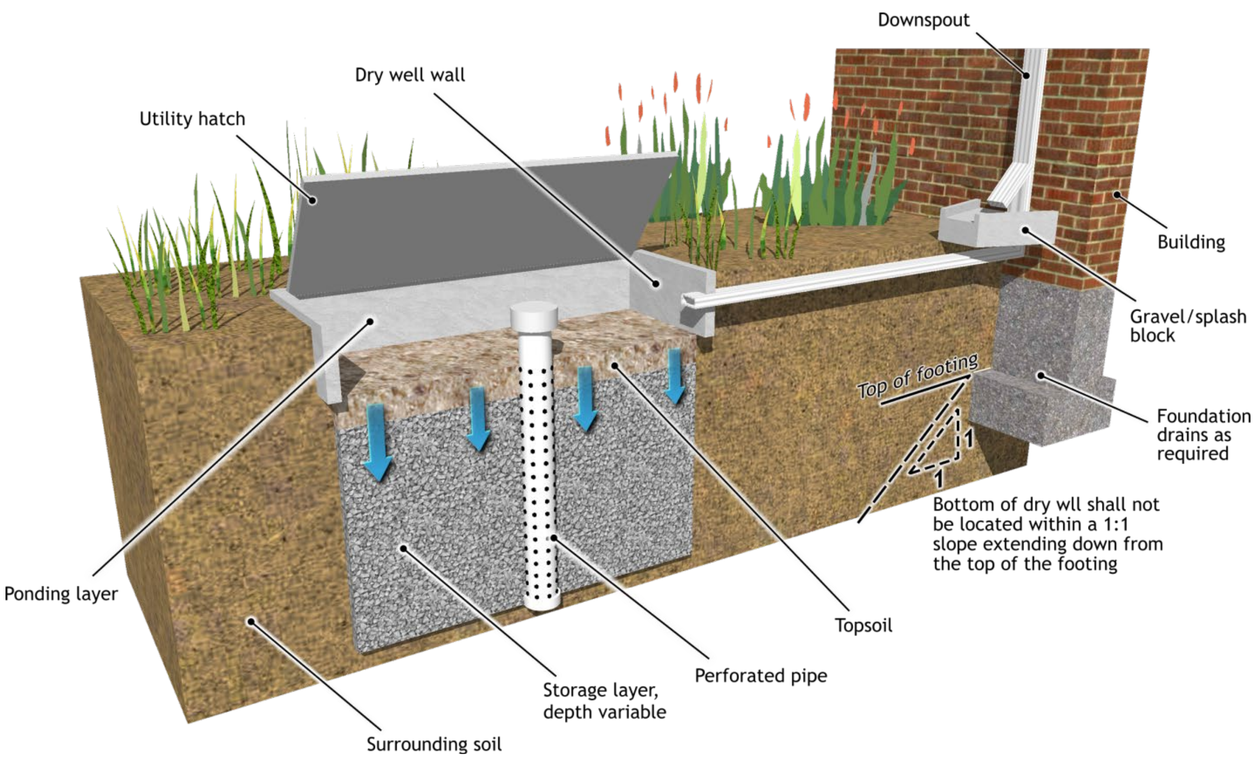
Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	A	Scrub	Low	0.136	0.369
Lake Wohlford	A	Scrub	Moderate	0.207	0.416
Lake Wohlford	A	Scrub	Steep	0.244	0.47
Lake Wohlford	B	Scrub	Low	0.208	0.414
Lake Wohlford	B	Scrub	Moderate	0.227	0.448
Lake Wohlford	B	Scrub	Steep	0.253	0.482
Lake Wohlford	C	Scrub	Low	0.245	0.458
Lake Wohlford	C	Scrub	Moderate	0.253	0.481
Lake Wohlford	C	Scrub	Steep	0.302	0.517
Lake Wohlford	D	Scrub	Low	0.253	0.48
Lake Wohlford	D	Scrub	Moderate	0.292	0.516
Lake Wohlford	D	Scrub	Steep	0.351	0.538

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Oceanside	A	Scrub	Low	0.035	0.32
Oceanside	A	Scrub	Moderate	0.093	0.367
Oceanside	A	Scrub	Steep	0.163	0.42
Oceanside	B	Scrub	Low	0.08	0.365
Oceanside	B	Scrub	Moderate	0.134	0.4
Oceanside	B	Scrub	Steep	0.181	0.433
Oceanside	C	Scrub	Low	0.146	0.411
Oceanside	C	Scrub	Moderate	0.185	0.433
Oceanside	C	Scrub	Steep	0.217	0.458
Oceanside	D	Scrub	Low	0.175	0.434
Oceanside	D	Scrub	Moderate	0.212	0.455
Oceanside	D	Scrub	Steep	0.244	0.571
Lindbergh	A	Scrub	Low	0.003	0.081
Lindbergh	A	Scrub	Moderate	0.018	0.137
Lindbergh	A	Scrub	Steep	0.061	0.211
Lindbergh	B	Scrub	Low	0.011	0.134
Lindbergh	B	Scrub	Moderate	0.033	0.174
Lindbergh	B	Scrub	Steep	0.077	0.23
Lindbergh	C	Scrub	Low	0.028	0.19
Lindbergh	C	Scrub	Moderate	0.075	0.232
Lindbergh	C	Scrub	Steep	0.108	0.274
Lindbergh	D	Scrub	Low	0.05	0.228
Lindbergh	D	Scrub	Moderate	0.104	0.266
Lindbergh	D	Scrub	Steep	0.143	0.319

G.2.2 Sizing Factors for "Infiltration" BMP

Table G.2-3 presents sizing factors for calculating the required surface area (A) and volume (V1) for an infiltration BMP. There is no underdrain and therefore no low flow orifice in the infiltration BMP. Sizing factors were developed for hydrologic soil groups A and B only. This BMP is not applicable in hydrologic soil groups C and D. The infiltration BMP is a below-ground structure (dry well) that consists of three layers:

- Ponding layer: a nominal 6-inch ponding layer should be included below the access hatch to allow for water spreading and infiltration during intense storms.
- Soil layer [topsoil layer]: 12 inches of soil should be included to remove pollutants.
- Free draining layer [storage layer]: The drywell is sized assuming a 6-foot deep free draining layer. However, designers could use shallower facility depths [provided the minimum volume and surface area are met].



Infiltration Facility BMP Example Illustration

Reference: "San Diego BMP Sizing Calculator Methodology," prepared by Brown and Caldwell, dated January 2012

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-3 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet) and volume (V1, cubic feet) for the infiltration BMP. The civil engineer shall provide the necessary volume and surface area of the BMP on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size of the BMP using the sizing factors, then refer to Appendix B.4 to check whether the BMP meets performance standards for infiltration for pollutant control. If necessary, increase the surface area to meet the drawdown requirement for pollutant control.

Table G.2-3: Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	0.040	0.1040	N/A
$0.5Q_2$	A	Moderate	Lindbergh	0.040	0.1040	N/A
$0.5Q_2$	A	Steep	Lindbergh	0.035	0.0910	N/A
$0.5Q_2$	B	Flat	Lindbergh	0.058	0.1495	N/A
$0.5Q_2$	B	Moderate	Lindbergh	0.055	0.1430	N/A
$0.5Q_2$	B	Steep	Lindbergh	0.050	0.1300	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Flat	Oceanside	0.045	0.1170	N/A
$0.5Q_2$	A	Moderate	Oceanside	0.045	0.1170	N/A
$0.5Q_2$	A	Steep	Oceanside	0.040	0.1040	N/A
$0.5Q_2$	B	Flat	Oceanside	0.065	0.1690	N/A
$0.5Q_2$	B	Moderate	Oceanside	0.065	0.1690	N/A
$0.5Q_2$	B	Steep	Oceanside	0.060	0.1560	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Flat	L Wohlford	0.050	0.1300	N/A
$0.5Q_2$	A	Moderate	L Wohlford	0.050	0.1300	N/A
$0.5Q_2$	A	Steep	L Wohlford	0.040	0.1040	N/A
$0.5Q_2$	B	Flat	L Wohlford	0.078	0.2015	N/A
$0.5Q_2$	B	Moderate	L Wohlford	0.075	0.1950	N/A
$0.5Q_2$	B	Steep	L Wohlford	0.065	0.1690	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Flat	Lindbergh	0.040	0.1040	N/A
$0.3Q_2$	A	Moderate	Lindbergh	0.040	0.1040	N/A
$0.3Q_2$	A	Steep	Lindbergh	0.035	0.0910	N/A
$0.3Q_2$	B	Flat	Lindbergh	0.058	0.1495	N/A
$0.3Q_2$	B	Moderate	Lindbergh	0.055	0.1430	N/A
$0.3Q_2$	B	Steep	Lindbergh	0.050	0.1300	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Flat	Oceanside	0.045	0.1170	N/A
$0.3Q_2$	A	Moderate	Oceanside	0.045	0.1170	N/A
$0.3Q_2$	A	Steep	Oceanside	0.040	0.1040	N/A
$0.3Q_2$	B	Flat	Oceanside	0.065	0.1690	N/A
$0.3Q_2$	B	Moderate	Oceanside	0.065	0.1690	N/A
$0.3Q_2$	B	Steep	Oceanside	0.060	0.1560	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Flat	L Wohlford	0.050	0.1300	N/A
$0.3Q_2$	A	Moderate	L Wohlford	0.050	0.1300	N/A
$0.3Q_2$	A	Steep	L Wohlford	0.040	0.1040	N/A
$0.3Q_2$	B	Flat	L Wohlford	0.078	0.2015	N/A
$0.3Q_2$	B	Moderate	L Wohlford	0.075	0.1950	N/A
$0.3Q_2$	B	Steep	L Wohlford	0.065	0.1690	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Lindbergh	0.040	0.1040	N/A
$0.1Q_2$	A	Moderate	Lindbergh	0.040	0.1040	N/A
$0.1Q_2$	A	Steep	Lindbergh	0.035	0.0910	N/A
$0.1Q_2$	B	Flat	Lindbergh	0.058	0.1495	N/A
$0.1Q_2$	B	Moderate	Lindbergh	0.055	0.1430	N/A
$0.1Q_2$	B	Steep	Lindbergh	0.050	0.1300	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Oceanside	0.045	0.1170	N/A
$0.1Q_2$	A	Moderate	Oceanside	0.045	0.1170	N/A
$0.1Q_2$	A	Steep	Oceanside	0.040	0.1040	N/A
$0.1Q_2$	B	Flat	Oceanside	0.065	0.1690	N/A
$0.1Q_2$	B	Moderate	Oceanside	0.065	0.1690	N/A
$0.1Q_2$	B	Steep	Oceanside	0.060	0.1560	N/A

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Flat	L Wohlford	0.050	0.1300	N/A
$0.1Q_2$	A	Moderate	L Wohlford	0.050	0.1300	N/A
$0.1Q_2$	A	Steep	L Wohlford	0.040	0.1040	N/A
$0.1Q_2$	B	Flat	L Wohlford	0.078	0.2015	N/A
$0.1Q_2$	B	Moderate	L Wohlford	0.075	0.1950	N/A
$0.1Q_2$	B	Steep	L Wohlford	0.065	0.1690	N/A
$0.1Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Infiltration volume sizing factor for flow control

<u>Definitions for "N/A"</u>

- Soil groups A and B: N/A in column V2 means there is no V2 element in this infiltration BMP for soil groups A and B
- Soil groups C and D: N/A across all elements (A, V1, V2) means sizing factors were not developed for an infiltration BMP for soil groups C and D

G.2.3 Sizing Factors for Bioretention

Table G.2-4 presents sizing factors for calculating the required surface area (A) and surface volume (V1) for the bioretention BMP. The bioretention BMP consists of two layers:

- Ponding layer: 10-inches active storage, [minimum] 2-inches of freeboard above overflow relief
- Growing medium: 18-inches of soil [bioretention soil media]

This BMP is applicable in soil groups A and B. This BMP does not include an underdrain or a low flow orifice. This BMP does not include an impermeable layer at the bottom of the facility to prevent infiltration into underlying soils, regardless of hydrologic soil group. If a facility is to be lined, the designer must use the sizing factors for biofiltration with impermeable layer (formerly known as "flow-through planter").

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-4 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet) and surface volume (V1, cubic feet). Note the surface volume is the ponding layer. The BMP must also include 18 inches of bioretention soil media which does not contribute to V1. The civil engineer shall provide the necessary volume and surface area of the BMP on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size of the BMP using the sizing factors, then refer to Appendix B.4 to check whether the BMP meets performance standards for infiltration for pollutant control. If necessary, adjust the surface area, depth of storage layer, or depth of growing medium as needed to meet pollutant control standards.

Table G.2-4: Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	0.060	0.0500	N/A
$0.5Q_2$	A	Moderate	Lindbergh	0.055	0.0458	N/A
$0.5Q_2$	A	Steep	Lindbergh	0.045	0.0375	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Flat	Lindbergh	0.093	0.0771	N/A
$0.5Q_2$	B	Moderate	Lindbergh	0.085	0.0708	N/A
$0.5Q_2$	B	Steep	Lindbergh	0.065	0.0542	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Flat	Oceanside	0.070	0.0583	N/A
$0.5Q_2$	A	Moderate	Oceanside	0.065	0.0542	N/A
$0.5Q_2$	A	Steep	Oceanside	0.060	0.0500	N/A
$0.5Q_2$	B	Flat	Oceanside	0.098	0.0813	N/A
$0.5Q_2$	B	Moderate	Oceanside	0.090	0.0750	N/A
$0.5Q_2$	B	Steep	Oceanside	0.075	0.0625	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Flat	L Wohlford	0.050	0.0417	N/A
$0.5Q_2$	A	Moderate	L Wohlford	0.045	0.0375	N/A
$0.5Q_2$	A	Steep	L Wohlford	0.040	0.0333	N/A
$0.5Q_2$	B	Flat	L Wohlford	0.048	0.0396	N/A
$0.5Q_2$	B	Moderate	L Wohlford	0.045	0.0375	N/A
$0.5Q_2$	B	Steep	L Wohlford	0.040	0.0333	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	A	Flat	Lindbergh	0.060	0.0500	N/A
$0.3Q_2$	A	Moderate	Lindbergh	0.055	0.0458	N/A
$0.3Q_2$	A	Steep	Lindbergh	0.045	0.0375	N/A
$0.3Q_2$	B	Flat	Lindbergh	0.098	0.0813	N/A
$0.3Q_2$	B	Moderate	Lindbergh	0.090	0.0750	N/A
$0.3Q_2$	B	Steep	Lindbergh	0.070	0.0583	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Flat	Oceanside	0.070	0.0583	N/A
$0.3Q_2$	A	Moderate	Oceanside	0.065	0.0542	N/A
$0.3Q_2$	A	Steep	Oceanside	0.060	0.0500	N/A
$0.3Q_2$	B	Flat	Oceanside	0.098	0.0813	N/A
$0.3Q_2$	B	Moderate	Oceanside	0.090	0.0750	N/A
$0.3Q_2$	B	Steep	Oceanside	0.075	0.0625	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Flat	L Wohlford	0.050	0.0417	N/A
$0.3Q_2$	A	Moderate	L Wohlford	0.045	0.0375	N/A
$0.3Q_2$	A	Steep	L Wohlford	0.040	0.0333	N/A
$0.3Q_2$	B	Flat	L Wohlford	0.060	0.0500	N/A
$0.3Q_2$	B	Moderate	L Wohlford	0.055	0.0458	N/A
$0.3Q_2$	B	Steep	L Wohlford	0.045	0.0375	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Lindbergh	0.060	0.0500	N/A
$0.1Q_2$	A	Moderate	Lindbergh	0.055	0.0458	N/A
$0.1Q_2$	A	Steep	Lindbergh	0.045	0.0375	N/A
$0.1Q_2$	B	Flat	Lindbergh	0.100	0.0833	N/A
$0.1Q_2$	B	Moderate	Lindbergh	0.095	0.0792	N/A
$0.1Q_2$	B	Steep	Lindbergh	0.080	0.0667	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Oceanside	0.070	0.0583	N/A
$0.1Q_2$	A	Moderate	Oceanside	0.065	0.0542	N/A
$0.1Q_2$	A	Steep	Oceanside	0.060	0.0500	N/A
$0.1Q_2$	B	Flat	Oceanside	0.103	0.0854	N/A
$0.1Q_2$	B	Moderate	Oceanside	0.090	0.0750	N/A
$0.1Q_2$	B	Steep	Oceanside	0.075	0.0625	N/A
$0.1Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Flat	L Wohlford	0.050	0.0417	N/A
$0.1Q_2$	A	Moderate	L Wohlford	0.045	0.0375	N/A
$0.1Q_2$	A	Steep	L Wohlford	0.040	0.0333	N/A
$0.1Q_2$	B	Flat	L Wohlford	0.090	0.0750	N/A
$0.1Q_2$	B	Moderate	L Wohlford	0.085	0.0708	N/A
$0.1Q_2$	B	Steep	L Wohlford	0.065	0.0542	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	**Soil Group**	**Slope**	**Rain Gauge**	**A**	**V_1**	**V_2**
$0.1Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Surface volume sizing factor for flow control

Definitions for "N/A"

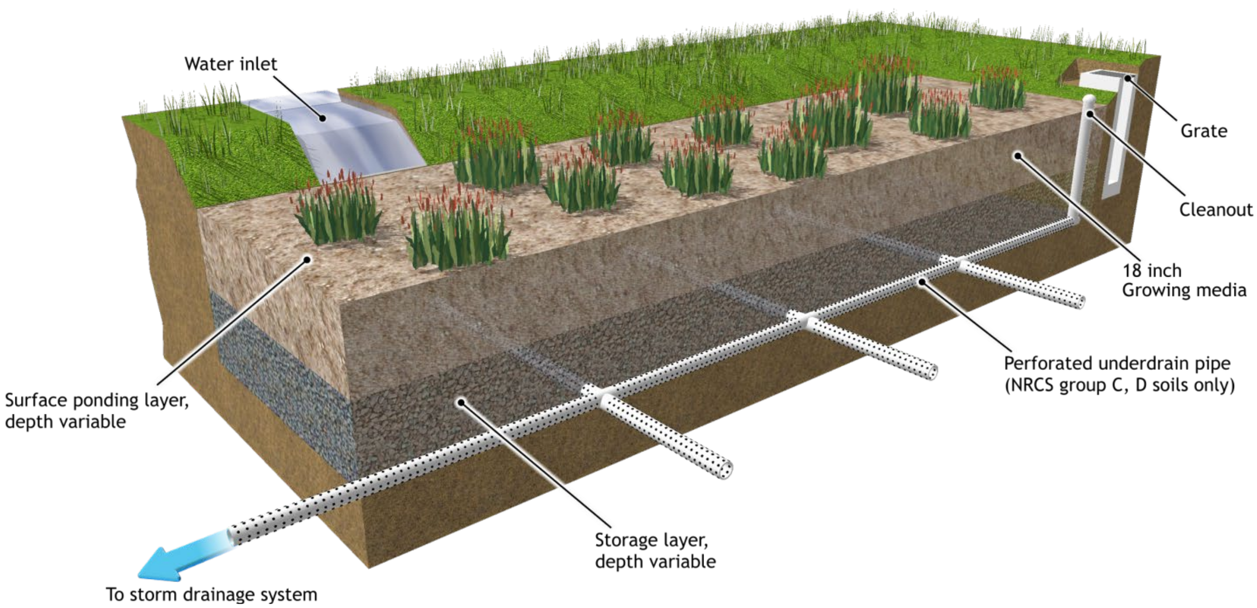
- Soil groups A and B: N/A in column V2 means there is no V2 element in this bioretention BMP for soil groups A and B
- Soil groups C and D: N/A in all elements (A, V1, V2) for soil groups C and D means sizing factors developed for "bioretention" in soil groups C and D under the 2007 MS4 Permit are not applicable in the "bioretention" category under the 2013 MS4 Permit because they were developed with the assumption that an underdrain is operating. Refer to Appendix G.2.4, Sizing Factors for Biofiltration with Partial Retention and Biofiltration

G.2.4 Sizing Factors for Biofiltration with Partial Retention and Biofiltration

Table G.2-5 presents sizing factors for calculating the required surface area (A), surface volume (V1), and sub-surface volume (V2) for a biofiltration with partial retention and biofiltration BMP. The BMPs consist of three layers:

- Ponding layer: 10-inches active storage, [minimum] 2-inches of freeboard above overflow relief
- Growing medium: 18-inches of soil [bioretention soil media]
- Storage layer: 30-inches of gravel at 40 percent porosity [18 inches active storage above underdrain is required, additional dead storage depth below underdrain is optional and can vary]

This BMP is applicable in soil groups C and D. This BMP includes an underdrain with a low flow orifice 18 inches (1.5 feet) below the bottom of the growing medium. This BMP can include additional dead storage below the underdrain. This BMP does not include an impermeable layer at the bottom of the facility to prevent infiltration into underlying soils, regardless of hydrologic soil group. If a facility is to be lined, the designer must use the sizing factors for biofiltration with impermeable liner (formerly known as "flow-through planter").



Biofiltration BMP Example Illustration

Reference: "San Diego BMP Sizing Calculator Methodology," prepared by Brown and Caldwell, dated January 2012

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-5 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet), surface volume (V1, cubic feet), and sub-surface volume (V2, cubic feet). Select a low flow orifice for the underdrain that will discharge the lower flow threshold flow when there is 1.5 feet of head over the underdrain orifice. The civil engineer shall provide the necessary volume and surface area of the BMP and the underdrain and orifice detail on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size of the BMP using the sizing factors. For BMPs without dead storage below the underdrain, then refer to Appendix B.5 and Appendix F to check whether the BMP meets performance standards for biofiltration for pollutant control. If necessary, adjust the surface area, depth of storage layer, or depth of growing medium as needed to meet pollutant control standards. For BMPs with dead storage below the underdrain, refer to Appendix B.4 to determine the portion of the DCV to be infiltrated for pollutant control, then Appendix B.5 and Appendix F to check whether the BMP meets performance standards for biofiltration for pollutant control for the balance of the DCV. If necessary, adjust the surface area, depth of storage layer, or depth of growing medium as needed to meet pollutant control standards.

Table G.2-5: Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Lindbergh	0.100	0.0833	0.0600
$0.5Q_2$	C	Moderate	Lindbergh	0.100	0.0833	0.0600
$0.5Q_2$	C	Steep	Lindbergh	0.075	0.0625	0.0450
$0.5Q_2$	D	Flat	Lindbergh	0.080	0.0667	0.0480

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	D	Moderate	Lindbergh	0.080	0.0667	0.0480
$0.5Q_2$	D	Steep	Lindbergh	0.060	0.0500	0.0360
$0.5Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Moderate	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Steep	Oceanside	0.060	0.0500	0.0360
$0.5Q_2$	D	Flat	Oceanside	0.065	0.0542	0.0390
$0.5Q_2$	D	Moderate	Oceanside	0.065	0.0542	0.0390
$0.5Q_2$	D	Steep	Oceanside	0.050	0.0417	0.0300
$0.5Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Flat	L Wohlford	0.065	0.0542	0.0390
$0.5Q_2$	C	Moderate	L Wohlford	0.065	0.0542	0.0390
$0.5Q_2$	C	Steep	L Wohlford	0.050	0.0417	0.0300
$0.5Q_2$	D	Flat	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Moderate	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Steep	L Wohlford	0.045	0.0375	0.0270
$0.3Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Lindbergh	0.110	0.0917	0.0660

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	C	Moderate	Lindbergh	0.110	0.0917	0.0660
$0.3Q_2$	C	Steep	Lindbergh	0.085	0.0708	0.0510
$0.3Q_2$	D	Flat	Lindbergh	0.100	0.0833	0.0600
$0.3Q_2$	D	Moderate	Lindbergh	0.100	0.0833	0.0600
$0.3Q_2$	D	Steep	Lindbergh	0.070	0.0583	0.0420
$0.3Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Oceanside	0.100	0.0833	0.0600
$0.3Q_2$	C	Moderate	Oceanside	0.100	0.0833	0.0600
$0.3Q_2$	C	Steep	Oceanside	0.080	0.0667	0.0480
$0.3Q_2$	D	Flat	Oceanside	0.085	0.0708	0.0510
$0.3Q_2$	D	Moderate	Oceanside	0.085	0.0708	0.0510
$0.3Q_2$	D	Steep	Oceanside	0.065	0.0542	0.0390
$0.3Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Flat	L Wohlford	0.075	0.0625	0.0450
$0.3Q_2$	C	Moderate	L Wohlford	0.075	0.0625	0.0450
$0.3Q_2$	C	Steep	L Wohlford	0.060	0.0500	0.0360
$0.3Q_2$	D	Flat	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Moderate	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Steep	L Wohlford	0.050	0.0417	0.0300
$0.1Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	**Soil Group**	**Slope**	**Rain Gauge**	**A**	**V_1**	**V_2**
$0.1Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Lindbergh	0.145	0.1208	0.0870
$0.1Q_2$	C	Moderate	Lindbergh	0.145	0.1208	0.0870
$0.1Q_2$	C	Steep	Lindbergh	0.120	0.1000	0.0720
$0.1Q_2$	D	Flat	Lindbergh	0.160	0.1333	0.0960
$0.1Q_2$	D	Moderate	Lindbergh	0.160	0.1333	0.0960
$0.1Q_2$	D	Steep	Lindbergh	0.115	0.0958	0.0690
$0.1Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	C	Moderate	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	C	Steep	Oceanside	0.110	0.0917	0.0660
$0.1Q_2$	D	Flat	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	D	Moderate	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	D	Steep	Oceanside	0.065	0.0542	0.0390
$0.1Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Flat	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	C	Moderate	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	C	Steep	L Wohlford	0.090	0.0750	0.0540
$0.1Q_2$	D	Flat	L Wohlford	0.100	0.0833	0.0600
$0.1Q_2$	D	Moderate	L Wohlford	0.100	0.0833	0.0600
$0.1Q_2$	D	Steep	L Wohlford	0.075	0.0625	0.0450

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Surface volume sizing factor for flow control

V_2 = Subsurface volume sizing factor for flow control

Definitions for "N/A"

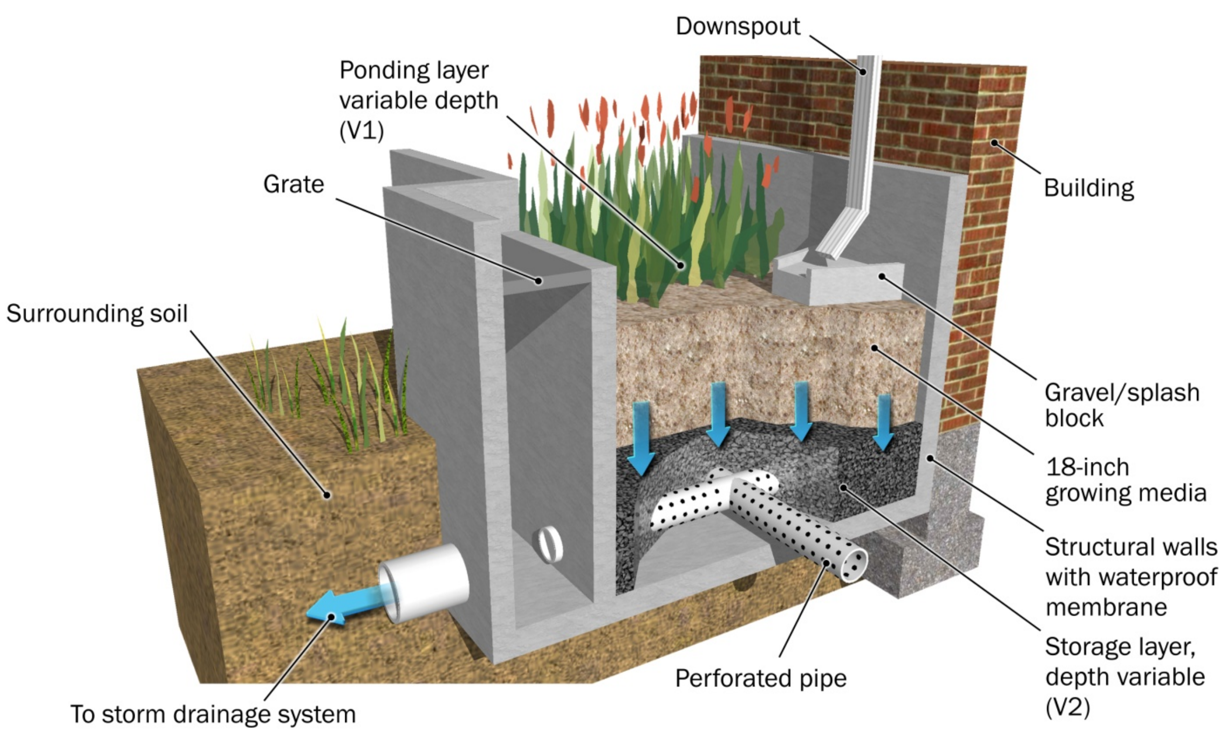
- Soil groups A and B: N/A in all elements (A, V1, V2) for soil groups A and B means sizing factors were not developed for biofiltration (i.e., with an underdrain) for soil groups A and B. If no underdrain is proposed, refer to Appendix G.2.3, Sizing Factors for Bioretention. If an underdrain is proposed, use project-specific continuous simulation modeling.

G.2.5 Sizing Factors for Biofiltration with Impermeable Liner

Table G.2-6 presents sizing factors for calculating the required surface area (A), surface volume (V1), and sub-surface volume (V2) for a biofiltration BMP with impermeable liner (formerly known as flow-through planter). The BMP consists of three layers:

- Ponding layer: 10-inches active storage, [minimum] 2-inches of freeboard above overflow relief
- Growing medium: 18-inches of soil [bioretention soil media]
- Storage layer: 30-inches of gravel at 40 percent porosity [18 inches active storage above underdrain is required, additional dead storage depth below underdrain is optional and can vary]

This BMP includes an underdrain with a low flow orifice 18 inches (1.5 feet) below the bottom of the growing medium. This BMP includes an impermeable liner to prevent infiltration into underlying soils.



Biofiltration with impermeable liner BMP Example Illustration

Reference: "San Diego BMP Sizing Calculator Methodology," prepared by Brown and Caldwell, dated January 2012

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-6 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet), surface volume (V1, cubic feet), and sub-surface volume (V2, cubic feet). Select a low flow orifice for the underdrain that will discharge the lower flow threshold flow when there is 1.5 feet of head over the underdrain orifice. The civil engineer shall provide the necessary volume and surface area of the BMP and the underdrain and orifice detail on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size using the sizing factors, then refer to Appendix B.5 and Appendix F to check whether the BMP meets performance standards for biofiltration for pollutant control. If necessary, adjust the surface area, depth of growing medium, or depth of storage layer as needed to meet pollutant control standards.

Table G.2-6: Sizing Factors for Hydromodification Flow Control Biofiltration BMPs (formerly known as Flow-Through Planters) Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Lindbergh	0.115	0.0958	0.0690
$0.5Q_2$	C	Moderate	Lindbergh	0.115	0.0958	0.0690
$0.5Q_2$	C	Steep	Lindbergh	0.080	0.0667	0.0480
$0.5Q_2$	D	Flat	Lindbergh	0.085	0.0708	0.0510
$0.5Q_2$	D	Moderate	Lindbergh	0.085	0.0708	0.0510
$0.5Q_2$	D	Steep	Lindbergh	0.065	0.0542	0.0390
$0.5Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Moderate	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Steep	Oceanside	0.065	0.0542	0.0390
$0.5Q_2$	D	Flat	Oceanside	0.070	0.0583	0.0420
$0.5Q_2$	D	Moderate	Oceanside	0.070	0.0583	0.0420
$0.5Q_2$	D	Steep	Oceanside	0.050	0.0417	0.0300
$0.5Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Flat	L Wohlford	0.070	0.0583	0.0420
$0.5Q_2$	C	Moderate	L Wohlford	0.070	0.0583	0.0420
$0.5Q_2$	C	Steep	L Wohlford	0.050	0.0417	0.0300
$0.5Q_2$	D	Flat	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Moderate	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Steep	L Wohlford	0.045	0.0375	0.0270
$0.3Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Lindbergh	0.130	0.1083	0.0780
$0.3Q_2$	C	Moderate	Lindbergh	0.130	0.1083	0.0780
$0.3Q_2$	C	Steep	Lindbergh	0.100	0.0833	0.0600
$0.3Q_2$	D	Flat	Lindbergh	0.105	0.0875	0.0630
$0.3Q_2$	D	Moderate	Lindbergh	0.105	0.0875	0.0630
$0.3Q_2$	D	Steep	Lindbergh	0.075	0.0625	0.0450

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Oceanside	0.105	0.0875	0.0630
$0.3Q_2$	C	Moderate	Oceanside	0.105	0.0875	0.0630
$0.3Q_2$	C	Steep	Oceanside	0.085	0.0708	0.0510
$0.3Q_2$	D	Flat	Oceanside	0.090	0.0750	0.0540
$0.3Q_2$	D	Moderate	Oceanside	0.090	0.0750	0.0540
$0.3Q_2$	D	Steep	Oceanside	0.070	0.0583	0.0420
$0.3Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Flat	L Wohlford	0.085	0.0708	0.0510
$0.3Q_2$	C	Moderate	L Wohlford	0.085	0.0708	0.0510
$0.3Q_2$	C	Steep	L Wohlford	0.060	0.0500	0.0360
$0.3Q_2$	D	Flat	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Moderate	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Steep	L Wohlford	0.050	0.0417	0.0300
$0.1Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Lindbergh	0.250	0.2083	0.1500
$0.1Q_2$	C	Moderate	Lindbergh	0.250	0.2083	0.1500
$0.1Q_2$	C	Steep	Lindbergh	0.185	0.1542	0.1110

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	D	Flat	Lindbergh	0.200	0.1667	0.1200
$0.1Q_2$	D	Moderate	Lindbergh	0.200	0.1667	0.1200
$0.1Q_2$	D	Steep	Lindbergh	0.130	0.1083	0.0780
$0.1Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Oceanside	0.190	0.1583	0.1140
$0.1Q_2$	C	Moderate	Oceanside	0.190	0.1583	0.1140
$0.1Q_2$	C	Steep	Oceanside	0.140	0.1167	0.0840
$0.1Q_2$	D	Flat	Oceanside	0.160	0.1333	0.0960
$0.1Q_2$	D	Moderate	Oceanside	0.160	0.1333	0.0960
$0.1Q_2$	D	Steep	Oceanside	0.105	0.0875	0.0630
$0.1Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Flat	L Wohlford	0.135	0.1125	0.0810
$0.1Q_2$	C	Moderate	L Wohlford	0.135	0.1125	0.0810
$0.1Q_2$	C	Steep	L Wohlford	0.105	0.0875	0.0630
$0.1Q_2$	D	Flat	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	D	Moderate	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	D	Steep	L Wohlford	0.080	0.0667	0.0480

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Surface volume sizing factor for flow control

V_2 = Subsurface volume sizing factor for flow control

Definitions for "N/A"

- Soil groups A and B: N/A in all elements (A, V1, V2) for soil groups A and B means sizing factors were not developed for biofiltration (i.e., with an underdrain) for soil groups A and B. If no underdrain is proposed, refer to Appendix G.2.3, Sizing Factors for Bioretention. If an underdrain is proposed, use project-specific continuous simulation modeling.

G.2.6 Sizing Factors for "Cistern" BMP

Table G.2-7 presents sizing factors for calculating the required volume (V1) for a cistern BMP. In this context, a "cistern" is a detention facility that stores runoff and releases it at a controlled rate. A cistern can be a component of a harvest and use system, however the sizing factor method will not account for any retention occurring in the system. The sizing factors were developed assuming runoff is released from the cistern. The sizing factors presented in this section are to meet the hydromodification management performance standard only. The cistern BMP is based on the following assumptions:

- Cistern configuration: The cistern is modeled as a 4-foot tall vessel. However, designers could use other configurations (different cistern heights), as long as the lower outlet orifice is sized to properly restrict outflows and the minimum required volume is provided.
- Cistern upper outlet: The upper outlet from the cistern would consist of a weir or other flow control structure with the overflow invert set at an elevation of 7/8 of the water height associated with the required volume of the cistern – V1. For the assumed 4-foot water depth in the cistern associated with the sizing factor analysis, the overflow invert is assumed to be located at an elevation of 3.5 feet above the bottom of the cistern. The overflow weir would be sized to pass the peak design flow based on the tributary drainage area.

How to use the sizing factors:

Obtain sizing factors from Table G.2-7 based on the project's lower flow threshold fraction of Q_2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required volume (V_1, cubic feet). Select a low flow orifice that will discharge the lower flow threshold flow when there is 4 feet of head over the lower outlet orifice (or adjusted head as appropriate if the cistern configuration is not 4 feet tall). The civil engineer shall provide the necessary volume of the BMP and the lower outlet orifice detail on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

A cistern could be a component of a full retention, partial retention, or no retention BMP depending on how the outflow is disposed. However use of the sizing factor method for design of the cistern in a combined pollutant control and flow control system is not recommended. The sizing factor method for designing a cistern does not account for any retention or storage occurring in BMPs combined with the cistern (i.e., cistern sized using sizing factors may be larger than necessary because sizing factor method does not recognize volume losses occurring in other elements of a combined system). Furthermore when the cistern is designed using the sizing factor method, the cistern outflow must be set to the low flow threshold flow for the drainage area, which may be inconsistent with requirements for other elements of a combined system. To optimize a system in which a cistern provides temporary storage for runoff to be either used onsite (harvest and use), infiltrated, or biofiltered, project-specific continuous simulation modeling is recommended. Refer to Sections 5.6 and 6.3.6.

Table G.2-7: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	0.3900	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	0.2000	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.5Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	0.1900	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	0.1000	N/A
$0.5Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	0.2100	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	0.2000	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Steep	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	0.5900	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	0.3600	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	0.2200	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	0.1800	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Steep	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	B	Flat	L Wohlford	N/A	0.2600	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	0.2400	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	0.1000	N/A
$0.1Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	0.5400	N/A
$0.1Q_2$	B	Moderate	Lindbergh	N/A	0.7800	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	0.3400	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	0.2400	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	0.1600	N/A
$0.1Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	0.5100	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	0.3400	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	0.2400	N/A
$0.1Q_2$	C	Flat	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	0.1800	N/A
$0.1Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	0.4400	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	0.4000	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Flat	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	0.2200	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	0.1800	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Bioretention surface area sizing factor (not applicable under this manual standards – use methods presented in Chapter 5 and Appendix B or Appendix F to size bioretention or biofiltration facility for pollutant control)
V_1 = Cistern volume sizing factor

Definitions for "N/A"

- Column V2: N/A in column V2 means there is no V2 element in the cistern BMP
- Column A: N/A in column A means there is no A element in the cistern BMP. Note sizing factors previously created for sizing a bioretention or biofiltration facility downstream of a cistern under the 2007 MS4 Permit are not applicable under the MS4 Permit.

Appendix

H

Guidance for Investigating Potential Critical Coarse Sediment Yield Areas

Appendix H Guidance for Investigating Potential Critical Coarse Sediment Yield Areas

Introduction

Identification of potential critical coarse sediment yield areas for San Diego County has been prepared based on GLU analysis. Criteria for the GLU analysis were developed and documented in the "San Diego County Regional WMAA" (herein "Regional WMAA"). Regional-level mapping of potential critical coarse sediment yield areas was prepared using regional data sets and included in the Regional WMAA. The original Regional WMAA document can be found on the Project Clean Water website at the following address:

http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=75&Itemid=99

The regional-level mapping was distributed to WQIP preparers to incorporate into the WMAA attachment to the WQIP for all watersheds in San Diego County. The regional-level mapping is based on the following sources:

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3rd Arc Second (~10 meter cells) digital elevation model for San Diego County
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California, United States Geological Survey, Southern California Areal Mapping Project, Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	"Geologic Map of California," California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale

The regional data set is a function of the inherent data resolution of the macro-level data sets and may not conform to all site conditions, or does not reflect changes to particular areas that have occurred since the underlying data was developed. This means slopes, geology, or land cover at the project site can be mischaracterized in the regional data set. This Appendix presents criteria for the GLU analysis, excerpted from the Regional WMAA, to be used when detailed project-level investigation of GLUs onsite is needed.

A project applicant should first check the map included in the WMAA for the watershed in which the project resides to determine if potential critical coarse sediment yield areas may exist within the project drainage boundaries (i.e., within or draining through the project). Generally, if the WMAA map does not indicate potential critical coarse sediment yield areas may exist within the project drainage boundaries, no further analysis is necessary. However, the Port has the discretion to require additional project-level investigation even when the WMAA map does not indicate the presence of potential critical coarse sediment yield areas within the project site.

If the project is shown to impact potential critical coarse sediment yield areas based on the WMAA map, or if the Port requires, project-level GLU analysis can be performed (see Section 6.2.1). Project-level GLU analysis will either confirm or invalidate the finding of the Regional WMAA maps. For project-level GLU analysis, the civil engineer shall determine slopes, geology, and land cover categories existing at the project site, and intersect this data to determine GLUs existing at the project site. The data provided in H.1 will assist the civil engineer to characterize the site.

When it has been determined based on the GLU analysis that potential critical coarse sediment yield areas are present within the project boundary, and it has been determined that downstream systems require protection (see Section 6.2.2), additional analysis may be performed that may refine the extents of actual critical coarse sediment yield areas to be protected onsite (see Section 6.2.3). Procedures for additional analysis are provided in H.2.

H.1 Criteria for GLU Analysis

There are four slope categories in the GLU analysis. Category numbers shown (1 to 4) were assigned for the purpose of GIS processing.

- 0% to 10% (1)
- 10% to 20% (2)
- 20% to 40% (3)
- >40% (4)

There are seven geology categories in the GLU analysis:

- Coarse bedrock (CB)
- Coarse sedimentary impermeable (CSI)
- Coarse sedimentary permeable (CSP)
- Fine bedrock (FB)
- Fine sedimentary impermeable (FSI)
- Fine sedimentary permeable (FSP)
- Other (O)

There are six land cover categories in the GLU analysis:

- Agriculture/grass
- Forest
- Developed
- Scrub/shrub
- Other
- Unknown

Project site slopes shall be classified into the categories based on project-level topography. Project site geology may be determined from geologic maps (may be the same as regional-level information) or classified in the field by a qualified geologist. Table H-1.1 provides information to classify geologic map units into each geology category. Project site land cover shall be determined from aerial photography and/or field visit. For reference, Table H-1.2 provides information to classify land cover categories from the SanGIS Ecology-Vegetation data set into land cover categories. The civil engineer shall not rely on the SanGIS Ecology-Vegetation data set to identify actual land cover at the project site (for project-level investigation land cover must be confirmed by aerial photo or field visit). Intersect the geologic categories, land cover categories, and slope categories within the project boundary to create GLUs. The GLUs listed in Table H-1.3 (also shown in Table 6-1) are considered to be potential critical coarse sediment yield areas. Note the GLU nomenclature is presented in the following format: Geology – Land Cover – Slope Category (e.g., "CB-Agricultural/Grass-3" for a GLU consisting of coarse bedrock geology, agricultural/grass land cover, and 20% to 40% slope).

Table H.1-1: Geologic Grouping for Different Map Units

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
gr-m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
grMz	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Jcr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jhc	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jsp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ka	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kdl	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgbf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgdf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgh	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm1	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm2	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm3	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm4	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgu	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Khg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ki	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kis	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJem	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJld	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Kjv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klb	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klh	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Km	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmgp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpa	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kqbd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kt	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ktr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kvc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwsr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Mzd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzq	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzs	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
sch	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Kp	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ql	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
QTf	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ec	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
K	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Kccg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kcs	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Kl	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ku	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Qvof	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tp	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tpm	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tscu	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsd	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdcg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsm	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tso	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tst	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tt	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tta	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmv	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsi	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa11	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa12	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa13	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoc	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop1	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvop10	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop12	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop13	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop2	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop3	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop4	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop5	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop6	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsa	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qof	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Q	Jennings; CA	Coarse	Sedimentary	Permeable	CSP
Qa	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qd	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qmb	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qw	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qt	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa1-2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa2-6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa5	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa7	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoc	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qc	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qu	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop2-4	San Diego 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop3	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop4	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop6	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qya	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyc	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Mzu	San Diego & Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
gb	Jennings; CA	Fine	Bedrock	Impermeable	FB
JTRm	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kat	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kc	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgb	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
KJvs	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kmv	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Ksp	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Kvsp	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kwmt	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Qv	Jennings; CA	Fine	Bedrock	Impermeable	FB
Tba	San Diego 30' x 60'	Fine	Bedrock	Impermeable	FB
Tda	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tv	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tvsr	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgdfg	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Ta	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tcs	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td+Tf	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qls	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tm	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tf	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tfr	El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
To	San Diego & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qpe	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Permeable	FSP
Mexico	San Diego 30' x 60'	NA	NA	Permeable	Other
Kuo	San Diego 30' x 60'	NA (Offshore)	NA	Permeable	Other
Teo	San Diego & Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Tmo	Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Qmo	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
QTso	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
af	San Diego & Oceanside 30' x 60'	Variable, dependent on source material	Sedimentary		Other

Table H.1-2: Land Cover Grouping for SanGIS Ecology-Vegetation Data Set

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
1	42000 Valley and Foothill Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
2	42100 Native Grassland		Agricultural/Grass
3	42110 Valley Needlegrass Grassland		Agricultural/Grass
4	42120 Valley Sacaton Grassland		Agricultural/Grass
5	42200 Non-Native Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
6	42300 Wildflower Field		Agriculture/Grass
7	42400 Foothill/Mountain Perennial Grassland		Agriculture/Grass
8	42470 Transmontane Dropseed Grassland		Agriculture/Grass
9	45000 Meadow and Seep		Agriculture/Grass
10	45100 Montane Meadow		Agriculture/Grass
11	45110 Wet Montane Meadow		Agriculture/Grass
12	45120 Dry Montane Meadows		Agriculture/Grass
13	45300 Alkali Meadows and Seeps		Agriculture/Grass
14	45320 Alkali Seep		Agriculture/Grass
15	45400 Freshwater Seep		Agriculture/Grass
16	46000 Alkali Playa Community		Agriculture/Grass
17	46100 Badlands/Mudhill Forbs		Agriculture/Grass
18	Non-Native Grassland		Agriculture/Grass
19	18000 General Agriculture	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Agriculture/Grass
20	18100 Orchards and Vineyards		Agriculture/Grass
21	18200 Intensive Agriculture		Agriculture/Grass
22	18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches		Agriculture/Grass
23	18300 Extensive Agriculture - Field/Pasture, Row Crops		Agriculture/Grass
24	18310 Field/Pasture		Agriculture/Grass
25	18310 Pasture		Agriculture/Grass
26	18320 Row Crops		Agriculture/Grass
27	12000 Urban/Developed		Developed
28	12000 Urban/Developed		Developed
29	81100 Mixed Evergreen Forest	Forest	Forest
30	81300 Oak Forest		Forest
31	81310 Coast Live Oak Forest		Forest
32	81320 Canyon Live Oak Forest		Forest
33	81340 Black Oak Forest		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
34	83140 Torrey Pine Forest		Forest
35	83230 Southern Interior Cypress Forest		Forest
36	84000 Lower Montane Coniferous Forest		Forest
37	84100 Coast Range, Klamath and Peninsular Coniferous Forest		Forest
38	84140 Coulter Pine Forest	Forest	Forest
39	84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest		Forest
40	84230 Sierran Mixed Coniferous Forest		Forest
41	84500 Mixed Oak/Coniferous/Bigcone/Coulter		Forest
42	85100 Jeffrey Pine Forest		Forest
43	11100 Eucalyptus Woodland	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Forest
44	60000 RIPARIAN AND BOTTOMLAND HABITAT	Riparian and Bottomland Habitat	Forest
45	61000 Riparian Forests		Forest
46	61300 Southern Riparian Forest		Forest
47	61310 Southern Coast Live Oak Riparian Forest		Forest
48	61320 Southern Arroyo Willow Riparian Forest		Forest
49	61330 Southern Cottonwood-willow Riparian Forest		Forest
50	61510 White Alder Riparian Forest		Forest
51	61810 Sonoran Cottonwood-willow Riparian Forest		Forest
52	61820 Mesquite Bosque		Forest
53	62000 Riparian Woodlands		Forest
54	62200 Desert Dry Wash Woodland		Forest
55	62300 Desert Fan Palm Oasis Woodland		Forest
56	62400 Southern Sycamore-alder Riparian Woodland		Forest
57	70000 WOODLAND	Woodland	Forest
58	71000 Cismontane Woodland		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
59	71100 Oak Woodland		Forest
60	71120 Black Oak Woodland		Forest
61	71160 Coast Live Oak Woodland		Forest
62	71161 Open Coast Live Oak Woodland		Forest
63	71162 Dense Coast Live Oak Woodland		Forest
64	71162 Dense Coast Love Oak Woodland		Forest
65	71180 Engelmann Oak Woodland	Woodland	Forest
66	71181 Open Engelmann Oak Woodland		Forest
67	71182 Dense Engelmann Oak Woodland		Forest
68	72300 Peninsular Pinon and Juniper Woodlands		Forest
69	72310 Peninsular Pinon Woodland		Forest
70	72320 Peninsular Juniper Woodland and Scrub		Forest
71	75100 Elephant Tree Woodland		Forest
72	77000 Mixed Oak Woodland		Forest
73	78000 Undifferentiated Open Woodland		Forest
74	79000 Undifferentiated Dense Woodland		Forest
75	Engelmann Oak Woodland		Forest
76	52120 Southern Coastal Salt Marsh	Bog and Marsh	Other
77	52300 Alkali Marsh		Other
78	52310 Cismontane Alkali Marsh		Other
79	52400 Freshwater Marsh		Other
80	52410 Coastal and Valley Freshwater Marsh		Other
81	52420 Transmontane Freshwater Marsh		Other
82	52440 Emergent Wetland		Other
83	44000 Vernal Pool	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Other
84	44320 San Diego Mesa Vernal Pool		Other
85	44322 San Diego Mesa Claypan Vernal Pool (southern mesas)		Other
86	13100 Open Water		Other

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
87	13110 Marine	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
88	13111 Subtidal		Other
89	13112 Intertidal		Other
90	13121 Deep Bay		Other
91	13122 Intermediate Bay		Other
92	13123 Shallow Bay		Other
93	13130 Estuarine		Other
94	13131 Subtidal		Other
95	13133 Brackishwater		Other
96	13140 Freshwater	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
97	13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe		Other
98	13300 Saltpan/Mudflats		Other
99	13400 Beach		Other
100	21230 Southern Foredunes	Dune Community	Scrub/Shrub
101	22100 Active Desert Dunes		Scrub/Shrub
102	22300 Stabilized and Partially-Stabilized Desert Sand Field		Scrub/Shrub
103	24000 Stabilized Alkaline Dunes		Scrub/Shrub
104	29000 ACACIA SCRUB		Scrub/Shrub
105	63000 Riparian Scrubs	Riparian and Bottomland Habitat	Scrub/Shrub
106	63300 Southern Riparian Scrub		Scrub/Shrub
107	63310 Mule Fat Scrub		Scrub/Shrub
108	63310 Mulefat Scrub		Scrub/Shrub
109	63320 Southern Willow Scrub		Scrub/Shrub
110	63321 Arundo donnax Dominant/Southern Willow Scrub		Scrub/Shrub
111	63330 Southern Riparian Scrub		Scrub/Shrub
112	63400 Great Valley Scrub		Scrub/Shrub
113	63410 Great Valley Willow Scrub		Scrub/Shrub
114	63800 Colorado Riparian Scrub		Scrub/Shrub
115	63810 Tamarisk Scrub		Scrub/Shrub
116	63820 Arrowweed Scrub		Scrub/Shrub
117	31200 Southern Coastal Bluff Scrub	Scrub and Chaparral	Scrub/Shrub
118	32000 Coastal Scrub		Scrub/Shrub
119	32400 Maritime Succulent Scrub		Scrub/Shrub
120	32500 Diegan Coastal Sage Scrub		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
121	32510 Coastal form		Scrub/Shrub
122	32520 Inland form (> 1,000 ft. elevation)		Scrub/Shrub
123	32700 Riversidian Sage Scrub		Scrub/Shrub
124	32710 Riversidian Upland Sage Scrub		Scrub/Shrub
125	32720 Alluvial Fan Scrub		Scrub/Shrub
126	33000 Sonoran Desert Scrub		Scrub/Shrub
127	33100 Sonoran Creosote Bush Scrub		Scrub/Shrub
128	33200 Sonoran Desert Mixed Scrub		Scrub/Shrub
129	33210 Sonoran Mixed Woody Scrub		Scrub/Shrub
130	33220 Sonoran Mixed Woody and Succulent Scrub	Scrub and Chaparral	Scrub/Shrub
131	33230 Sonoran Wash Scrub		Scrub/Shrub
132	33300 Colorado Desert Wash Scrub		Scrub/Shrub
133	33600 Encelia Scrub		Scrub/Shrub
134	34000 Mojavean Desert Scrub		Scrub/Shrub
135	34300 Blackbush Scrub		Scrub/Shrub
136	35000 Great Basin Scrub		Scrub/Shrub
137	35200 Sagebrush Scrub		Scrub/Shrub
138	35210 Big Sagebrush Scrub		Scrub/Shrub
139	35210 Sagebrush Scrub		Scrub/Shrub
140	36110 Desert Saltbush Scrub		Scrub/Shrub
141	36120 Desert Sink Scrub		Scrub/Shrub
142	37000 Chaparral		Scrub/Shrub
143	37120 Southern Mixed Chaparral		Scrub/Shrub
144	37120 Southern Mixed Chapparal		Scrub/Shrub
145	37121 Granitic Southern Mixed Chaparral		Scrub/Shrub
146	37121 Southern Mixed Chaparral		Scrub/Shrub
147	37122 Mafic Southern Mixed Chaparral		Scrub/Shrub
148	37130 Northern Mixed Chaparral		Scrub/Shrub
149	37131 Granitic Northern Mixed Chaparral		Scrub/Shrub
150	37132 Mafic Northern Mixed Chaparral		Scrub/Shrub
151	37200 Chamise Chaparral		Scrub/Shrub
152	37210 Granitic Chamise Chaparral		Scrub/Shrub
153	37220 Mafic Chamise Chaparral		Scrub/Shrub
154	37300 Red Shank Chaparral		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
155	37400 Semi-Desert Chaparral		Scrub/Shrub
156	37500 Montane Chaparral		Scrub/Shrub
157	37510 Mixed Montane Chaparral		Scrub/Shrub
158	37520 Montane Manzanita Chaparral		Scrub/Shrub
159	37530 Montane Ceanothus Chaparral		Scrub/Shrub
160	37540 Montane Scrub Oak Chaparral		Scrub/Shrub
161	37800 Upper Sonoran Ceanothus Chaparral		Scrub/Shrub
162	37830 Ceanothus crassifolius Chaparral		Scrub/Shrub
163	37900 Scrub Oak Chaparral		Scrub/Shrub
164	37A00 Interior Live Oak Chaparral		Scrub/Shrub
165	37C30 Southern Maritime Chaparral	Scrub and Chaparral	Scrub/Shrub
166	37G00 Coastal Sage-Chaparral Scrub		Scrub/Shrub
167	37K00 Flat-topped Buckwheat		Scrub/Shrub
168	39000 Upper Sonoran Subshrub Scrub		Scrub/Shrub
169	Diegan Coastal Sage Scrub		Scrub/Shrub
170	Granitic Northern Mixed Chaparral		Scrub/Shrub
171	Southern Mixed Chaparral		Scrub/Shrub
172	11000 Non-Native Vegetation	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Unknown
173	11000 Non-Native VegetionVegetation		Unknown
174	11200 Disturbed Wetland		Unknown
175	11300 Disturbed Habitat		Unknown
176	13000 Unvegetated Habitat		Unknown
177	Disturbed Habitat		Unknown

Table H.1-3: Potential Critical Coarse Sediment Yield Areas

GLU	Geology	Land Cover	Slope (%)
CB-Agricultural/Grass-3	Coarse Bedrock	Agricultural/Grass	20% - 40%
CB-Agricultural/Grass-4	Coarse Bedrock	Agricultural/Grass	>40%
CB-Forest-2	Coarse Bedrock	Forest	10 – 20%
CB-Forest-3	Coarse Bedrock	Forest	20% - 40%
CB-Forest-4	Coarse Bedrock	Forest	>40%
CB-Scrub/Shrub-4	Coarse Bedrock	Scrub/Shrub	>40%
CB-Unknown-4	Coarse Bedrock	Unknown	>40%
CSI-Agricultural/Grass-2	Coarse Sedimentary Impermeable	Agricultural/Grass	10 – 20%
CSI-Agricultural/Grass-3	Coarse Sedimentary Impermeable	Agricultural/Grass	20% - 40%
CSI-Agricultural/Grass-4	Coarse Sedimentary Impermeable	Agricultural/Grass	>40%
CSP-Agricultural/Grass-4	Coarse Sedimentary Permeable	Agricultural/Grass	>40%
CSP-Forest-3	Coarse Sedimentary Permeable	Forest	20% - 40%
CSP-Forest-4	Coarse Sedimentary Permeable	Forest	>40%
CSP-Scrub/Shrub-4	Coarse Sedimentary Permeable	Scrub/Shrub	>40%

H.2 Optional Additional Analysis When Potential Critical Coarse Sediment Yield Areas are Present Onsite

(Adapted from "Step 1" of Section 2.3.i of "Santa Margarita Region HMP," dated May 2014)

As stated in Chapter 6.2.3 of this manual, when it has been determined based on a GLU analysis that potential critical coarse sediment yield areas are present within the project boundary, and it has been determined that downstream systems require protection, additional analysis may be performed that may refine the extents of actual critical coarse sediment yield areas to be protected onsite. The following text, adapted from Chapter 2 of the Santa Margarita Region HMP dated May 2014, describes the process.

Step 1: Determine whether the Portion of the Project Site is a Significant Source of Bed Sediment Supply to the Channel Receiving Runoff

A triad approach will be completed to determine whether the project site is a Significant Source of Bed Sediment Supply to the channel receiving runoff and includes the following components:

A. Site soil assessment, including an analysis and comparison of the Bed Sediment in the receiving channel and the onsite channel;

B. Determination of the capability of the channels on the project site to deliver the site Bed Sediment (if present) to the receiving channel; and

C. Present and potential future condition of the receiving channel.

A. Site soil assessment, including an analysis and comparison of the Bed Sediment in the channel receiving runoff and the onsite channels

A geotechnical and sieve analysis is the first piece of information to be used in a triad approach to determine if the project site is a Significant Source of Bed Sediment Supply to the assessment channel. An investigation must be completed of the assessment channel to complete a sieve analysis of the Bed Sediment. Two samples will be taken of the assessment channel using the “reach” approach (TS13A, 2007 [United States Army Corps of Engineers. 2007. Guidelines for Sampling Bed Material, Technical Supplement 13A, Part 654 of National Engineering Handbook, New England District. August]). Samples in each of the two locations should be taken using the surface and subsurface bulk sample technique (TS13A, 2007) for a total of four samples. Pebble counts may be required for some channels.

A similar sampling assessment should be conducted on the project site. First-order and greater channels that may be impacted by the PDP (drainage area changed, stabilized, lined or replaced with underground conduits) will be analyzed in each subwatershed. First-order channels are identified as the unbranched channels that drain from headwater areas and develop in the uppermost topographic depressions, where two or more contour crenulations (notches or indentations) align and point upslope (National Engineering Handbook, 2007). First-order channels may, in fact, be field ditches, gullies, or ephemeral gullies (National Engineering Handbook, 2007). One channel per subwatershed that may be impacted on the project site must be assessed. A subwatershed is defined as tributary to a single discharge point at the project site boundary.

The sieve analysis should report the coarsest 90% (by weight) of the sediment for comparison between the site and the assessment channel. The User should render an opinion if the Bed Sediment found on the site is of similar gradation to the Bed Sediment found in the receiving channel. The opinion will be based on the following information:

- Sieve analysis results
- Soil erodibility (K) factor
- Topographic relief of the project area
- Lithology of the soils on the project site

The User should rate the similarity of onsite Bed Sediment and Bed Sediment collected in the receiving channel as high, medium, or low.

This site soil assessment serves as the first piece of information for the triad approach.

B. Determination of the capability of the onsite channels to deliver Bed Sediment Supply (if present) to the channel receiving runoff from the project site.

The second piece of information is to qualitatively assess the sediment delivery potential of the channels on the project site to deliver the Bed Sediment Supply to the channel receiving runoff from the project site, or the Bed Sediment delivery potential or ratio. There are few documented procedures to estimate the Bed Sediment delivery ratio (see: Williams, J. R., 1977: Sediment delivery ratios determined with sediment and runoff models. IAHS Publication (122): 168-179, as an example); it is affected by a number of factors, including the sediment source, proximity to the receiving channel, onsite channel density, project sub-watershed area, slope, length, land use and land cover, and rainfall intensity. The User will qualitatively assess the Bed Sediment delivery potential and rate the potential as high, medium, or low.

C. Present and potential future condition of the channel receiving runoff from the project site.

The final piece of information is the present and potential future condition of the channel receiving runoff from the project site. The User should assess the receiving channel for the following:

- Bank stability – Receiving channels with unstable banks may be more sensitive to changes in Bed Sediment Load.
- Degree of incision – Receiving channels with moderate to high incision may be more sensitive to changes in Bed Sediment Load.
- Bed Sediment gradation – Receiving channels with more coarse Bed Sediment (such as gravel) are better able to buffer change in Bed Sediment Load as compared to beds with finer gradation of Bed Sediment (sand).
- Transport vs. supply limited channels. Receiving channels that are transport limited may be better able to buffer changes in Bed Sediment Load as compared to channels that are supply limited.

The User will qualitatively assess the channel receiving runoff from the project site using the gathered observations and rate the potential for adverse response based on a change in Bed Sediment Load as high, medium, or low.

[Interpreting the results of A, B, and C]

The User should use the triad assessment approach, weighting each of the components based on professional judgment to determine if the project site provides a Significant Source of Bed Sediment Supply to the receiving channel, and the impact the PDP would have on the receiving channel. The final assessment and recommendation must be documented in the HMP portion of the [SWQMP].

The recommendation may be any of the following:

- Site is a Significant Source of Bed Sediment Supply – all channels on the project site must be preserved or by-passed within the site plan.
- Site is a source of Bed Sediment Supply – some of the channels on the project site must be preserved (with identified channels noted).
- Site is not a Significant Source of Bed Sediment Supply.

The final recommendation will be guided by the triad assessment. Projects with predominantly "high" values for each of the three assessment areas would indicate preservation of channels on the project site. Sites with predominantly "medium" values may warrant preservation of some of the channels on the project site, and sites with generally "low" values would not require site design considerations for Bed Sediment Load.

Appendix I

BMP DESIGN MANUAL

Forms and Checklists

Appendix I Forms and Checklists

1) For projects that will start construction prior to the effective date of Order No. R9-2013-0001, project applicants should use the current Port Storm Water Requirements Applicability Checklist. The current checklist for tenant projects is available at:

   https://www.portofsandiego.org/environment/stormwater/stormwater-development.html

   For capital projects, please contact the Port Environmental and Land Use Management Department for a copy of the current applicability checklist.

2) For projects that will start construction after the effective date of Order No. R9-2013-0001, projects should use the forms included with Appendix I to document whether the project is a standard or priority development project and to document selection of applicable Source Control and Site Design (Both Standard and PDPs) and Storm Water Pollutant Control BMPs (PDPs only). In addition, Section 2 of the Port Storm Water Requirements Applicability Checklist should be used to determine Construction Phase BMP requirements for the Project.

   The Port Storm Water Requirements Applicability Checklist is in the process of being tailored to meet the procedures and requirements of the BMP Design Manual and the forms in Appendix I will be updated / amended once the forms are tailored.

The following Forms/Checklists/Worksheets were developed for use by the project applicant to document the storm water management design:

- I-1: Applicability of Permanent, Post-Construction Storm Water BMP Requirements
- I-2: Project Type Determination Checklist (Standard Project or PDP)
- I-3A: Site Information Checklist for Standard Projects
- I-3B: Site Information Checklist for PDPs
- I-4: Source Control BMP Checklist for All Development Projects
- I-5: Site Design BMP Checklist for All Development Projects
- I-6: Summary of PDP Structural BMPs
- I-7: Harvest and Use Feasibility Screening Checklist
- I-8: Categorization of Infiltration Feasibility Condition
- I-9: Factor of Safety and Design Infiltration Rate
- I-10: Determination of Downstream Systems Requirements for Preservation of Coarse Sediment Supply

Applicability of Permanent, Post-Construction Storm Water BMP Requirements (Storm Water Intake Form for all Development Permit Applications)			Form I-1
Project Identification			
Project Name:			
Permit Application Number:			Date:
Determination of Requirements			
The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short <u>summary</u> of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements. Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop". Refer to the manual sections and/or separate forms referenced in each step below.			
Step	**Answer**	**Progression**	
Step 1: Is the project a "development project"? See Section 1.3 of the manual for guidance.	☐ Yes	Go to Step 2.	
	☐ No	Stop. Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.	
Discussion / justification if the project is <u>not</u> a "development project" (e.g., the project includes *only* interior remodels within an existing building):			
Step 2: Is the project a Standard Project, PDP, or exception to PDP definitions? To answer this item, see Section 1.4 of the manual *in its entirety* for guidance, AND complete Form I-2, Project Type Determination.	☐ Standard Project	Stop. Standard Project requirements apply, including Standard Project SWQMP.	
	☐ PDP	PDP requirements apply, including PDP SWQMP. Go to Step 3.	
	☐ Exception to PDP definitions	Stop. Standard Project requirements apply. Provide discussion and list any additional requirements below. Prepare Standard Project SWQMP.	
Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:			

<table>
<tr><th colspan="3">Form I-1 Page 2 of 2</th></tr>
<tr><th>Step</th><th>Answer</th><th>Progression</th></tr>
<tr><td rowspan="2">Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval?
See Section 1.10 of the manual for guidance.</td><td>☐ Yes</td><td>Consult the Port to determine requirements.
Provide discussion and identify requirements below.
Go to Step 4.</td></tr>
<tr><td>☐ No</td><td>BMP Design Manual PDP requirements apply.
Go to Step 4.</td></tr>
<tr><td colspan="3">Discussion / justification of prior lawful approval, and identify requirements (not required if prior lawful approval does not apply):</td></tr>
<tr><td rowspan="2">Step 4. Do hydromodification control requirements apply?
See Section 1.6 of the manual for guidance.</td><td>☐ Yes</td><td>PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6).
Go to Step 5.</td></tr>
<tr><td>☐ No</td><td>Stop.
PDP structural BMPs required for pollutant control (Chapter 5) only.
Provide brief discussion of exemption to hydromodification control below.</td></tr>
<tr><td colspan="3">Discussion / justification if hydromodification control requirements do <u>not</u> apply:</td></tr>
<tr><td rowspan="2">Step 5. Does protection of critical coarse sediment yield areas apply?
See Section 6.2 of the manual for guidance.</td><td>☐ Yes</td><td>Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2).
Stop.</td></tr>
<tr><td>☐ No</td><td>Management measures not required for protection of critical coarse sediment yield areas.
Provide brief discussion below.
Stop.</td></tr>
<tr><td colspan="3">Discussion / justification if protection of critical coarse sediment yield areas does <u>not</u> apply:</td></tr>
</table>

Project Type Determination Checklist			Form I-2
Project Information			
Project Name:			
Permit Application Number:			
Project Type Determination: Standard Project or PDP			
The project is (select one): ϒ New Development ϒ Redevelopment			
The total proposed newly created or replaced impervious area is: ________ ft^2 (________) acres			
Is the project in any of the following categories, (a) through (f)?			
Yes ϒ	No ϒ	(a)	New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ϒ	No ϒ	(b)	Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
Yes ϒ	No ϒ	(c)	New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses: (i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption SIC code 5812). (ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater. (iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce. (iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

Form I-2 Page 2 of 2			
Yes ϒ	No ϒ	(d)	New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and SDRWQCB; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and SDRWQCB; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees. See manual Section 1.4.2 for additional guidance.
Yes ϒ	No ϒ	(e)	New development projects, or redevelopment project that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses: (i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539. (ii) Retail gasoline outlets. This category includes retail gasoline outlets that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic of 100 or more vehicles per day.
Yes ϒ	No ϒ	(f)	New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction. *Note: See manual Section 1.4.2 for additional guidance.*

Does the project meet the definition of one or more of the PDP categories (a) through (f) listed above?

ϒ No – the project is not a PDP (Standard Project).

ϒ Yes – the project is a PDP.

The following is for redevelopment PDPs only:

The area of existing (pre-project) impervious area at the project site is: _________ ft^2 (A)
The total proposed newly created or replaced impervious area is: _________ ft^2 (B)
Percent impervious surface created or replaced (B/A)*100: ________%
The percent impervious surface created or replaced is (select one based on the above calculation):

ϒ less than or equal to fifty percent (50%) – only new impervious areas are considered PDP

OR

ϒ greater than fifty percent (50%) – the entire project site is a PDP

Site Information Checklist For Standard Projects	Form I-3A (Standard Projects)
Project Summary Information	
Project Name	
Project Address	
Assessor's Parcel Number(s)	
Permit Application Number	
Project Watershed (Hydrologic Unit)	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ☐ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906 ☐ San Diego 907 ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☐ Otay 910 ☐ Tijuana 911
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	________ Acres (____________ Square Feet)
Area to be disturbed by the project (Project Area)	________ Acres (____________ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	________ Acres (____________ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	________ Acres (____________ Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form I-3A Page 2 of 4
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply) ☐ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Description / Additional Information
Existing Land Cover Includes (select all that apply) ☐ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Description / Additional Information
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☐ NRCS Type D
Existing Natural Hydrologic Features (select all that apply) ☐ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information
Description of Existing Site Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? If so, describe.]

Form I-3A Page 3 of 4
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities
List proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features)
List proposed pervious features of the project (e.g., landscape areas)
Does the project include grading and changes to site topography? ☐ Yes ☐ No Description / Additional Information
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? ☐ Yes ☐ No Description / Additional Information

Form I-3A Page 4 of 4
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply) ☐ Onsite storm drain inlets ☐ Interior floor drains and elevator shaft sump pumps ☐ Interior parking garages ☐ Need for future indoor & structural pest control ☐ Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, and other water features ☐ Food service ☐ Refuse areas ☐ Industrial processes ☐ Outdoor storage of equipment or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☐ Loading docks ☐ Fire sprinkler test water ☐ Miscellaneous drain or wash water ☐ Plazas, sidewalks, and parking lots

Site Information Checklist For PDPs	Form I-3B (PDPs)

Project Summary Information	
Project Name	
Project Address	
Assessor's Parcel Number(s)	
Permit Application Number	
Project Watershed (Hydrologic Unit)	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ☐ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906 ☐ San Diego 907 ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☐ Otay 910 ☐ Tijuana 911
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	_________ Acres (_____________ Square Feet)
Area to be disturbed by the project (Project Area)	_________ Acres (_____________ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	_________ Acres (_____________ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	_________ Acres (_____________ Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form I-3B Page 2 of 9
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☐ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Description / Additional Information:
Existing Land Cover Includes (select all that apply): ☐ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Description / Additional Information:
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☐ NRCS Type D
Approximate Depth to Groundwater: ☐ Groundwater Depth < 5 feet ☐ 5 feet < Groundwater Depth < 10 feet ☐ 10 feet < Groundwater Depth < 20 feet ☐ Groundwater Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☐ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information:

Form I-3B Page 3 of 9
Description of Existing Site Topography and Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? If so, describe]:

Form I-3B Page 4 of 9
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities:
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):
List/describe proposed pervious features of the project (e.g., landscape areas):
Does the project include grading and changes to site topography? ☐ Yes ☐ No Description / Additional Information:
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? ☐ Yes ☐ No Description / Additional Information:

Form I-3B Page 5 of 9
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply): ☐ Onsite storm drain inlets ☐ Interior floor drains and elevator shaft sump pumps ☐ Interior parking garages ☐ Need for future indoor & structural pest control ☐ Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, and other water features ☐ Food service ☐ Refuse areas ☐ Industrial processes ☐ Outdoor storage of equipment or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☐ Loading docks ☐ Fire sprinkler test water ☐ Miscellaneous drain or wash water ☐ Plazas, sidewalks, and parking lots

Form I-3B Page 6 of 9		
Identification of Receiving Water Pollutants of Concern		
Describe path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):		
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs for the impaired water bodies:		
303(d) Impaired Water Body	**Pollutant(s)/Stressor(s)**	**TMDLs**

Identification of Project Site Pollutants*			
***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**			
Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see manual Appendix B.6):			
Pollutant	**Not Applicable to the Project Site**	**Anticipated from the Project Site**	**Also a Receiving Water Pollutant of Concern**
Sediment			
Nutrients			
Heavy Metals			
Organic Compounds			
Trash & Debris			
Oxygen Demanding Substances			
Oil & Grease			
Bacteria & Viruses			
Pesticides			

Form I-3B Page 7 of 9
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the manual)? ☐ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above):
Critical Coarse Sediment Yield Areas* ***This Section only required if hydromodification management requirements apply**
Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries? ☐ Yes ☐ No, no critical coarse sediment yield areas to be protected based on WMAA maps If yes, have any of the optional analyses presented in Section 6.2 of the manual been performed? ☐ 6.2.1 Verification of GLUs Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite ☐ No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps If optional analyses were performed, what is the final result? ☐ No critical coarse sediment yield areas to be protected based on verification of GLUs onsite. ☐ Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 8 of the SWQMP. ☐ Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit. Discussion / Additional Information:

Form I-3B Page 8 of 9
Flow Control for Post-Project Runoff* ***This Section only required if hydromodification management requirements apply**
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.
Has a geomorphic assessment been performed for the receiving channel(s)? ☐ No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: Discussion / Additional Information: (optional)

Form I-3B Page 9 of 9
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

Source Control BMP Checklist for All Development Projects (Standard Projects and PDPs)			Form I-4
Project Identification			
Project Name			
Permit Application Number			
Source Control BMPs			
All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.			
Source Control Requirement	**Applied?**		
SC-1 Prevention of Illicit Discharges into the MS4	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-3 not implemented:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-4 not implemented:			

Form I-4 Page 2 of 2			
Source Control Requirement	**Applied?**		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
☐ Onsite storm drain inlets	☐ Yes	☐ No	☐ N/A
☐ Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☐ N/A
☐ Interior parking garages	☐ Yes	☐ No	☐ N/A
☐ Need for future indoor & structural pest control	☐ Yes	☐ No	☐ N/A
☐ Landscape/outdoor pesticide use	☐ Yes	☐ No	☐ N/A
☐ Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	☐ N/A
☐ Food service	☐ Yes	☐ No	☐ N/A
☐ Refuse areas	☐ Yes	☐ No	☐ N/A
☐ Industrial processes	☐ Yes	☐ No	☐ N/A
☐ Outdoor storage of equipment or materials	☐ Yes	☐ No	☐ N/A
☐ Vehicle and equipment cleaning	☐ Yes	☐ No	☐ N/A
☐ Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☐ N/A
☐ Fuel dispensing areas	☐ Yes	☐ No	☐ N/A
☐ Loading docks	☐ Yes	☐ No	☐ N/A
☐ Fire sprinkler test water	☐ Yes	☐ No	☐ N/A
☐ Miscellaneous drain or wash water	☐ Yes	☐ No	☐ N/A
☐ Plazas, sidewalks, and parking lots	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

<table>
<tr><td colspan="3">Site Design BMP Checklist
for All Development Projects
(Standard Projects and PDPs)</td><td>Form I-5</td></tr>
<tr><td colspan="4">Project Identification</td></tr>
<tr><td colspan="4">Project Name</td></tr>
<tr><td colspan="4">Permit Application Number</td></tr>
<tr><td colspan="4">Site Design BMPs</td></tr>
<tr><td colspan="4">All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.
"Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required.
"No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
"N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.</td></tr>
<tr><td>Site Design Requirement</td><td colspan="3">Applied?</td></tr>
<tr><td>SD-1 Maintain Natural Drainage Pathways and Hydrologic Features</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="4">Discussion / justification if SD-1 not implemented:</td></tr>
<tr><td>SD-2 Conserve Natural Areas, Soils, and Vegetation</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="4">Discussion / justification if SD-2 not implemented:</td></tr>
<tr><td>SD-3 Minimize Impervious Area</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="4">Discussion / justification if SD-3 not implemented:</td></tr>
<tr><td>SD-4 Minimize Soil Compaction</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="4">Discussion / justification if SD-4 not implemented:</td></tr>
</table>

Form I-5 Page 2 of 2			
Site Design Requirement	**Applied?**		
SD-5 Impervious Area Dispersion	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented:			
SD-6 Runoff Collection	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented:			
SD-7 Landscaping with Native or Drought Tolerant Species	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-8 not implemented:			

Summary of PDP Structural BMPs	Form I-6 (PDPs)
Project Identification	
Project Name	
Permit Application Number	
PDP Structural BMPs	
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the manual). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).	
Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate. (Continue on page 2 as necessary.)	

Form I-6 Page 2 of 3
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No.	
Construction Plan Sheet No.	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the Port (See Section 1.12 of the manual)	
Who will be the final owner of this BMP?	
Who will maintain this BMP into perpetuity?	
What is the funding mechanism for maintenance?	
Discussion (as needed):	

Harvest and Use Feasibility Checklist			Form I-7
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☐ Toilet and urinal flushing ☐ Landscape irrigation ☐ Other:_______________			
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. [Provide a summary of calculations here]			
3. Calculate the DCV using worksheet B-2.1. DCV = ___________ (cubic feet)			
3a. Is the 36 hour demand greater than or equal to the DCV? ϒ Yes / ϒ No ⇨ ⇩	3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV? ϒ Yes / ϒ No ⇨ ⇩	3c. Is the 36 hour demand less than 0.25DCV? ϒ Yes ⇩	
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.	
Is harvest and use feasible based on further evaluation? ϒ Yes, refer to Appendix E to select and size harvest and use BMPs. ϒ No, select alternate BMPs.			

Categorization of Infiltration Feasibility Condition			Form I-8
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

<table>
<tr><th colspan="4">Form I-8 Page 2 of 4</th></tr>
<tr><td>Criteri a</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>Part 1 Result *</td><td colspan="2">If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Form I-8 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		

Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Criteria	Screening Question	Yes	No
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		

Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

<table>
<tr><th colspan="4">Form I-8 Page 4 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.

If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Factor of Safety and Design Infiltration Rate Worksheet					Form I-9
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25		
		Predominant soil texture	0.25		
		Site soil variability	0.25		
		Depth to groundwater / impervious layer	0.25		
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Level of pretreatment/ expected sediment loads	0.5		
		Redundancy/resiliency	0.25		
		Compaction during construction	0.25		
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{total} = S_A \times S_B$					
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					

Downstream Systems Requirements for Preservation of Coarse Sediment Supply		Form I-10	
When it has been determined that potential critical coarse sediment yield areas exist within the project site, the next step is to determine whether downstream systems would be sensitive to reduction of coarse sediment yield from the project site. Use this form to document the evaluation of downstream systems requirements for preservation of coarse sediment supply.			
Project Name:			
Project Tracking Number / Permit Application Number:			
1	Will the project discharge runoff to a hardened MS4 system (pipe or lined channel) or an un-lined channel?	ϒ Hardened MS4 system	Go to 2
		ϒ Un-lined channel	Go to 4
2	Will the hardened MS4 system convey sediment (e.g., a concrete-lined channel with steep slope and cleansing velocity) or sink sediment (e.g., flat slopes, constrictions, treatment BMPs, or ponds with restricted outlets within the system will trap sediment and not allow conveyance of coarse sediment from the project site to an un-lined system).	ϒ Convey	Go to 3
		ϒ Sink	Go to 7
3	What kind of receiving water will the hardened MS4 system convey the sediment to?	ϒ Un-lined channel	Go to 4
		ϒ Lake ϒ Reservoir ϒ Bay	Go to 7
		ϒ Lagoon ϒ Ocean	Go to 6
4	Is the un-lined channel impacted by deposition of sediment? This condition must be documented by the local agency.	ϒ Yes	Go to 7
		ϒ No	Go to 5

Form I-10 Page 2 of 2	
5	End – Preserve coarse sediment supply to protect un-lined channels from accelerated erosion due to reduction of coarse sediment yield from the project site unless further investigation determines the sediment is not critical to the receiving stream. Sediment that is critical to receiving streams is the sediment that is a significant source of bed material to the receiving stream (bed sediment supply) (see Section 6.2.3 and Appendix H.2 of the manual).
6	End – Provide management measures for preservation of coarse sediment supply (protect beach sand supply).
7	End – Downstream system does not warrant preservation of coarse sediment supply, no measures for protection of critical coarse sediment yield areas onsite are necessary. Use the space below to describe the basis for this finding for the project.

Appendix

J

BMP DESIGN MANUAL

Tidal Influence Study

Insert PDF

Glossary of Key Terms

50% Rule Refers to an MS4 Permit standard for redevelopment PDPs (PDPs on previously developed sites) that defines whether the redevelopment PDP must meet storm water management requirements for the entire development or only for the newly created or replaced impervious surface. Refer to **Section 1.7**.

Aggregate Hard, durable material of mineral origin typically consisting of gravel, crushed stone, crushed quarry or mine rock. Gradation varies depending on application within a BMP as bedding, filter course, or storage.

Aggregate Storage Layer Layer within a BMP that serves to provide a conduit for conveyance, detention storage, infiltration storage, saturated storage, or a combination thereof.

Alternative Compliance Programs A program that allows PDPs to participate in an offsite mitigation project in lieu of implementing the onsite structural BMP performance requirements required under the MS4 Permit. Refer to **Section 1.8** for more information on alternative compliance programs.

Bed Sediment The part of the sediment load in channel flow that moves along the bed by sliding or saltation, and part of the suspended sediment load, that principally constitutes the channel bed.

Bedding Aggregate used to establish a foundation for structures such as pipes, manholes, and pavement.

Biodegradation Decomposition of pollutants by biological means.

Biofiltration BMPs Biofiltration BMPs are shallow basins filled with treatment media and drainage rock that treat storm water runoff by capturing and detaining inflows prior to controlled release through minimal incidental infiltration, evapotranspiration, or discharge via underdrain or surface outlet structure. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and/or vegetative uptake. These BMPs must be sized to: [a] Treat 1.5 times the DCV not reliably retained onsite, OR [b] Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite. (See **Section 5.5.3** and **Appendix B.5** for illustration and additional information).

Biofiltration Treatment	Treatment from a BMP meeting the biofiltration standard.
Biofiltration with Partial Retention BMPs	Biofiltration with partial retention BMPs are shallow basins filled with treatment media and drainage rock that manage storm water runoff through infiltration, evapotranspiration, and biofiltration. Partial retention is characterized by a subsurface stone infiltration storage zone in the bottom of the BMP below the elevation of the discharge from the underdrains. The discharge of biofiltered water from the underdrain occurs when the water level in the infiltration storage zone exceeds the elevation of the underdrain outlet. (See **Section 5.5.2.1** for illustration and additional information).
Bioretention BMPs	Vegetated surface water systems that filter water through vegetation and soil, or engineered media prior to infiltrating into native soils. Bioretention BMPs in this manual retain the entire DCV prior to overflow to the downstream conveyance system. (See **Section 5.5.1.2** for illustration and additional information).
BMP	A procedure or device designed to minimize the quantity of runoff pollutants and / or volumes that flow to downstream receiving water bodies. Refer to **Section 2.2.2.1**.
BMP Sizing Calculator	An on-line tool that was developed under the 2007 MS4 Permit to facilitate the sizing factor method for designing flow control BMPs for hydromodification management. The BMP Sizing Calculator has been discontinued as of June 30, 2014.
Cistern	A vessel for storing water. In this manual, a cistern is typically a rain barrel, tank, vault, or other artificial reservoir.
Coarse Sediment Yield Area	A GLU with coarse-grained geologic material (material that is expected to produce greater than 50% sand when weathered). See the following terms modifying coarse sediment yield area: critical, potential critical.

Compact Biofiltration BMP	A biofiltration BMP, either proprietary or non-proprietary in origin, that is designed to provide storm water pollutant control within a smaller footprint than a typical biofiltration BMP, usually through use of specialized media that is able to efficiently treat high storm water inflow rates.
Conditions of Approval	Requirements a jurisdiction may adopt for a project in connection with a discretionary action (e.g., issuance of a use permit). COAs may include features to be incorporated into the final plans for the project and may also specify uses, activities, and operational measures that must be observed over the life of the project.
Contemporary Design Standards	This term refers to design standards that are reasonably consistent with the current state of practice and are based on desired outcomes that are reasonably consistent with the context of the MS4 Permit and Model BMP Design Manual. For example, a detention basin that is designed solely to mitigate peak flow rates would not be considered a contemporary water quality BMP design because it is not consistent with the goal of water quality improvement. Current state of the practice recognizes that a drawdown time of 24 to 72 hour is typically needed to promote settling. For practical purposes, design standards can be considered "contemporary" if they have been published within the last 10 years, preferably in California or Washington State, and are specifically intended for storm water quality management.
Continuous Simulation Modeling	A method of hydrological analysis in which a set of rainfall data (typically hourly for 30 years or more) is used as input, and a continuous runoff hydrograph is calculated over the same time period. Continuous simulation models typical track dynamic soil and storage conditions during and between storm events. The output is then analyzed statistically for the purposes of comparing runoff patterns under different conditions (for example, pre- and post-development-project).
Copermittees	See Jurisdiction.
Critical Channel Flow (Qc)	The channel flow that produces the critical shear stress that initiates bed movement or that erodes the toe of channel banks. When measuring Qc, it should be based on the weakest boundary material – either bed or bank.

Critical Coarse Sediment Yield Areas	A GLU with coarse-grained geologic material and high relative sediment production, where the sediment produced is critical to the receiving stream (a source of bed material to the receiving stream). See also: potential critical coarse sediment yield area.
Critical Shear Stress	The shear stress that initiates channel bed movement or that erodes the toe of channel banks. See also critical channel flow.
DCV	A volume of storm water runoff produced from the 85th percentile, 24-hour storm event. See **Section 2.2.2.2**.
De Minimis DMA	De minimis DMAs are very small areas that are not considered to be significant contributors of pollutants, and are considered not practicable to drain to a BMP. See **Section 5.2.2**.
Depth	The distance from the top, or surface, to the bottom of a BMP component.
Detention	Temporarily holding back storm water runoff via a designed outlet (e.g., underdrain, orifice) to provide flow rate and duration control.
Detention Storage	Storage that provides detention as the outflow mechanism.
Development Footprint	The limits of all grading and ground disturbance, including landscaping, associated with a project.
Development Project	Construction, rehabilitation, redevelopment, or reconstruction of any capital or tenant projects. Includes both new development and redevelopment. Also includes whole of the action as defined by CEQA. See **Section 1.3.**
Direct Discharge	The connection of project site runoff to an exempt receiving water body, which could include an exempt river reach, reservoir or lagoon. To qualify as a direct discharge, the discharge elevation from the project site outfall must be at or below either the normal operating water surface elevation or the reservoir spillway elevation, and properly designed energy dissipation must be provided. "Direct discharge" may be more specifically defined by each municipality.

Direct Infiltration	Infiltration via methods or devices, such as dry wells or infiltration trenches, designed to bypass the mantle of surface soils that is unsaturated and more organically active and transmit runoff directly to deeper subsurface soils.
DMAs	See **Section 3.3.3**.
Drawdown Time	The time required for a storm water detention or infiltration facility to drain and return to the dry-weather condition. For detention facilities, drawdown time is a function of basin volume and outlet orifice size. For infiltration facilities, drawdown time is a function of basin volume and infiltration rate.
Enclosed Embayments (Enclosed Bays)	Enclosed bays are indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost bay works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays do not include inland surface waters or ocean waters. In San Diego: Mission Bay and San Diego Bay.
Environmentally Sensitive Areas (ESAs)	Areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees.
Filter Course	Aggregate used to prevent particle migration between two different materials when storm water runoff passes through.
Filter Fabric	A permeable textile material, also termed a non-woven geotextile, that prevents particle migration between two different materials when storm water runoff passes through.
Filtration	Controlled seepage of storm water runoff through media, vegetation, or aggregate to reduce pollutants via physical separation.
Flow Control	Control of runoff rates and durations as required by the HMP.

Flow Control BMP	A structural BMP designed to provide control of post-project runoff flow rates and durations for the purpose of hydromodification management.
Flow-thru Treatment	Treatment from a BMP meeting the flow-thru treatment control standard.
Flow-Thru Treatment BMPs	Flow-thru treatment control BMPs are structural, engineered facilities that are designed to remove pollutants from storm water runoff using treatment processes that do not incorporate significant biological methods. Flow-thru BMPs include vegetated swales, media filters, sand filters, and dry extended detention basins. (See **Section 5.5.4** for illustration and additional information).
Forebay	An initial storage area at the entrance to a structural BMP designed to trap and settle out solid pollutants such as sediment in a concentrated location, to provide pre-treatment within the structural BMP and facilitate removal of solid pollutants during maintenance operations.
Full Infiltration	Infiltration of a storm water runoff volume equal to the DCV.
Geomorphic Assessment	A quantification or measure of the changing properties of a stream channel.
Geomorphically Significant Flows	Flows that have the potential to cause, or accelerate, stream channel erosion or other adverse impacts to beneficial stream uses. The range of geomorphically significant flows was determined as part of the development of the March 2011 Final HMP, and has not changed under the 2013 MS4 Permit. However, under the 2013 MS4 Permit, Q2 and Q10 must be based on the pre-development condition rather than the pre-project condition, meaning that no pre-project impervious area may be considered in the computation of pre-development Q2 and Q10.
GLUs	Classifications that provide an estimate of sediment yield based upon three factors: geology, hillslope, and land cover. GLUs are developed based on the methodology presented in the SCCWRP Technical Report 605 titled "Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge" (SCCWRP, 2010).

Gross Pollutants In storm water, generally litter (trash), organic debris (leaves, branches, seeds, twigs, grass clippings), and coarse sediments (inorganic breakdown products from soils, pavement, or building materials).

Harvest and Use BMP Harvest and use (aka rainwater harvesting) BMPs capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. (See **Section 5.5.1.1** for illustration and additional information).

HMP A plan implemented by the Copermittees so that post-project runoff shall not exceed estimated pre-development rates and/or durations by more than 10%, where increased runoff would result in increased potential for erosion or other adverse impacts to beneficial uses. The March 2011 Final HMP and the updated MS4 Permit are the basis of the flow control requirements of this manual.

Hungry Water Also known as "sediment-starved" water, "hungry" water refers to channel flow that is hungry for sediment from the channel bed or banks because it currently contains less bed material sediment than it is capable of conveying. The "hungry water" phenomenon occurs when the natural sediment load decreases and the erosive force of the runoff increases as a natural counterbalance, as described by Lane's Equation.

Hydraulic Head Energy represented as a difference in elevation, typically as the difference between the inlet and outlet water surface elevation for a BMP.

Hydraulic Residence Time The length of time between inflow and outflow that runoff remains in a BMP.

Hydrologic Soil Group Classification of soils by the Natural Resources Conservation Service (NRCS) into A, B, C, and D groups according to infiltration capacity.

Hydromodification The change in the natural watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport. In addition, alteration of stream and river channels, installation of dams and water impoundments, and excessive stream-bank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Hydromodification Management BMP A structural BMP for the purpose of hydromodification management, either for protection of critical coarse sediment yield areas or for flow control. See also flow control BMP.

Impervious Surface Any material that prevents or substantially reduces infiltration of water into the soil.

Infeasible As applied to BMPs, refers to condition in which a BMP approach is not practicable based on technical constraints specific to the site, including by not limited to physical constraints, risks of impacts to environmental resources, risks of harm to human health, or risk of loss or damage to property. Feasibility criteria are provided in this manual.

Infiltration In the context of LID, infiltration is defined as the percolation of water into the ground. Infiltration is often expressed as a rate (inches per hour), which is determined through an infiltration test. In the context of non-storm water, infiltration is water other than wastewater that enters a sewer system (including sewer service connections and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow [40 CFR 35.2005(20)].

Infiltration BMP Infiltration BMPs are structural measures that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. These types of BMPs may also support evapotranspiration processes, but are characterized by having their most dominant volume losses due to infiltration. (See **Section 5.5.1.2** for illustration and additional information).

Jurisdiction	The term "jurisdiction" is used in this manual to refer to individual copermittees who have independent responsibility for implementing the requirements of the MS4 Permit.
LID	A storm water management and land development strategy that emphasizes conservation and the use of onsite natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions. See **Site Design**.
Lower Flow Threshold	The lower limit of the range of flows to be controlled for hydromodification management. The lower flow threshold is the flow at which erosion of sediment from the stream bed or banks begins to occur. See also critical channel flow. For the San Diego region, the lower flow threshold shall be a fraction (0.1, 0.3, or 0.5) of the pre-development 2-year flow rate based on continuous simulation modeling (0.1Q2, 0.3Q2, or 0.5Q2).
Media	Storm water runoff pollutant treatment material, typically included as a permeable constructed bed or container (cartridge) within a BMP.
MEP	Refer to the definition in the MS4 Permit. [Appendix C, Definitions, Page C-6]
National Pollutant Discharge Elimination System	The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of the Clean Water Act.
New Development	Land disturbing activities; structural development, including construction or installation of a building or structure, the creation of impervious surfaces; and land subdivision.
O&M	Requirements in the MS4 Permit to inspect structural BMPs and verify the implementation of operational practices and preventative and corrective maintenance in perpetuity.
Partial Infiltration	Infiltration of a storm water runoff volume less than the DCV.
Partial Retention	Partial retention category is defined by structural measures that incorporate both infiltration (in the lower treatment zone) and biofiltration (in the upper treatment zone).

PDPs	As defined by the MS4 Permit provision E.3.b, land development projects that fall under the planning and building authority of the Copermittee for which the Copermittee must impose specific requirements in addition to those required of Standard Projects. Refer to **Section 1.4** to determine if your project is a PDP.
PDPs with only Pollutant Control Requirements	PDPs that need to meet Source Control, Site Design and Pollutant Control Requirements (but are exempt from Hydromodification Management Requirements).
PDPs with Pollutant Control and Hydromodification Management Requirements	PDPs that need to meet Source Control, Site Design, Pollutant Control and Hydromodification Management Requirements.
Point of Compliance	1. For channel screening and determination of low flow threshold: the point at which collected storm water from a development is delivered from a constructed or modified drainage system into a natural or un-lined channel. POC for channel screening may be located onsite or offsite, depending on where runoff from the project meets a natural or un-lined channel. 2. For flow control: the point at which pre-development and post-development flow rates and durations will be compared. POC for flow control is typically onsite. A project may have a different POC for channel screening vs. POC for flow control if runoff from the project site is conveyed in hardened systems from the project site boundary to the natural or un-lined channel.
Pollutant Control	Control of pollutants via physical, chemical or biological processes
Pollution Prevention	Pollution prevention is defined as practices and processes that reduce or eliminate the generation of pollutants, in contrast to source control BMPs, treatment control BMPs, or disposal.
Post-Project Hydrology Flows, Volumes	The peak runoff flows and runoff volume anticipated after the project has been constructed taking into account all permeable and impermeable surfaces, soil and vegetation types and conditions after landscaping is complete, detention or retention basins or other water storage elements incorporated into the site design, and any other site features that would affect runoff volumes and peak flows.

Potential Critical Coarse Sediment Yield Area	A GLU with coarse-grained geologic material and high relative sediment production, as defined in the Regional WMAA. The Regional WMAA identified GLUs as potential critical coarse sediment yield areas based on slope, geology, and land cover. GLU analysis does not determine whether the sediment produced is critical to the receiving stream (a source of bed material to the receiving stream) therefore the areas are designated as potential.
Pre-Development Runoff Conditions	Approximate flow rates and durations that exist or existed onsite before land development occurs. For new development projects, this equates to runoff conditions immediately before any new project disturbance or grading. For redevelopment projects, this equates to runoff conditions from the project footprint assuming infiltration characteristics of the underlying soil, and existing grade. Runoff coefficients of concrete or asphalt must not be used. A redevelopment PDP must use available information pertaining to existing underlying soil type and onsite existing grade to estimate pre-development runoff conditions.
Pre-Project Condition	The condition prior to any project work or the existing condition. Note that pre-project condition and pre-development condition will not be the same for redevelopment projects.
Pretreatment	Removal of gross solids, including organic debris and coarse sediment, from runoff to minimize clogging and increase the effectiveness of BMPs.
Project Area	All areas proposed by an applicant to be altered or developed, plus any additional areas that drain on to areas to be altered or developed. Also see **Section 1.3**.
Project Submittal	Documents submitted to a jurisdiction or Copermittee in connection with an application for development approval and demonstrating compliance with MS4 Permit requirements for the project. Specific requirements vary from municipality to municipality.
Proprietary BMP	BMP designed and marketed by private business for treatment of storm water. Check with Port prior to proposing to use a proprietary BMP.
Receiving Waters	See **Waters of the United States**.

Redevelopment — The creation and/or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, and the addition to or replacement of a structure. Replacement of impervious surfaces includes any activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include routine maintenance activities, such as trenching and resurfacing associated with utility work; pavement grinding; resurfacing existing roadways, sidewalks, pedestrian ramps, or bike lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair.

Retrofitting — Storm water management practice put into place after development has occurred in watersheds where the practices previously did not exist or are ineffective. Retrofitting of developed areas is intended to improve water quality, protect downstream channels, reduce flooding, or meet other specific objectives. Retrofitting developed areas may include, but is not limited to replacing roofs with green roofs, disconnecting downspouts or impervious surfaces to drain to pervious surfaces, replacing impervious surfaces with pervious surfaces, installing rain barrels, installing rain gardens, and trash area enclosures.

Regional Water Quality Control Board (San Diego Water Board) — California Water Boards are responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within their jurisdiction. There are nine California Water Boards.

Retention (Retention BMPs) — A category of BMP that does not have any service outlets that discharge to surface water or to a conveyance system that drains to surface waters for the design event (i.e. 85^{th} percentile 24-hour). Mechanisms used for storm water retention include infiltration, evapotranspiration, and use of retained water for non-potable or potable purposes.

Saturated Storage — Storage that provides a permanent volume of water at the bottom of the BMP as an anaerobic zone to promote denitrification and/or thermal pollution control. Also known as internal water storage or a saturation zone.

Self-mitigating Areas — A natural, landscaped, or turf area that does not generate significant pollutants and drains directly offsite or to the public storm drain system without being treated by a structural BMP. See **Section 5.2.1**.

Self-retaining DMA via Qualifying Site Design BMPs — An area designed to retain runoff to fully eliminate storm water runoff from the 85th percentile 24 hours storm event; See **Section 5.2.3**.

SIC — A Federal government system for classifying industries by 4-digit code. It is being supplanted by the North American Industrial Classification System but SIC codes are still referenced by the Regional Water Board in identifying development sites subject to regulation under the National Pollutant Discharge Elimination System permit. Information and an SIC search function are available at https://www.osha.gov/pls/imis/sicsearch.html

Significant Redevelopment — Redevelopment that meets the definition of a "PDP" in this manual. See **Section 1.4**.

Site Design — A storm water management and land development strategy that emphasizes conservation of natural features and the use of onsite natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions.

Sizing Factor Method — A method for designing flow control BMPs for hydromodification management using sizing factors developed from unit area continuous simulation models.

Sorption — Physical and/or chemical process where pollutants are taken out of runoff through attachment to another substance.

Source Control — Land use or site planning practices, or structures that aim to prevent runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimizes the contact between pollutants and storm water runoff. Examples include roof structures over trash or material storage areas, and berms around fuel dispensing areas. Source control BMPs are described within this manual.

Standard Project — Any development project that is not defined as a PDP by the MS4 Permit.

Storm Water Conveyance System	A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or designated and approved management agency under section 208 of the Clean Water Act that discharges to waters of the United States; (ii) Designated or used for collecting or conveying storm water; (iii) Which is not a combined sewer; (iv) Which is not part of the Publicly Owned Treatment Works as defined at 40 CFR 122.26.
Storm Water Pollutant Control BMP	A category of storm water management requirements that includes treatment of storm water to remove pollutants by measures such as retention, biofiltration, and/or flow-thru treatment control, as specified in this manual. Also called a Pollutant Control BMP.
Structural BMP	Throughout the manual, the term "structural BMP" is a general term that encompasses the pollutant control BMPs and hydromodification BMPs required for PDPs under the MS4 Permit. A structural BMP may be a pollutant control BMP, a hydromodification management BMP, or an integrated pollutant control and hydromodification management BMP. Structural BMPs as defined in the MS4 Permit are: a subset of BMPs which detains, retains, filters, removes, or prevents the release of pollutants to surface waters from development projects in perpetuity, after construction of a project is completed.
Subgrade	In-situ soil that lies underneath a BMP.
Tributary Area	The total surface area of land or hardscape that contributes runoff to the BMP; including any offsite or onsite areas that comingles with project runoff and drains to the BMP. Refer to **Section 3.3.3** for additional guidance Also termed the drainage area or catchment area.

Unified BMP Design Approach
This term refers to the standardized process for site and watershed investigation, BMP selection, BMP sizing, and BMP design that is outlined and described in this manual with associated appendices and templates. This approach is considered to be "unified" because it represents a pathway for compliance with MS4 Permit requirements that is anticipated to be reasonably consistent across the local jurisdictions in San Diego County. In contrast, applicants may choose to take an alternative approach where they demonstrate to the satisfaction of the Port, in their submittal, compliance with applicable performance standards without necessarily following the process identified in this manual.

Upper Flow Threshold
The upper limit of the range of flows to be controlled for hydromodification management. For the San Diego region, the upper flow threshold shall be the pre-development 10-year flow rate (Q10) based on continuous simulation modeling.

Vactor
Refers to a sewer or storm drain cleaning truck equipped to remove materials from sewer or storm drain pipes or structures, including some storm water BMPs.

Vector
An animal or insect capable of transmitting the causative agent of human disease. An example of a vector in San Diego County that is of concern in storm water management is a mosquito.

Water Quality Improvement Plan
Copermittees are required to develop a Water Quality Improvement Plan for each Watershed Management Area in the San Diego Region. The purpose of the Water Quality Improvement Plans is to guide the Copermittees' jurisdictional runoff management programs towards achieving the outcome of improved water quality in MS4 discharges and receiving waters. WQIPs requirements are defined in the MS4 Permit provision B.

Waters of the United States

Surface bodies of water, including naturally occurring wetlands, streams (perennial, intermittent, and ephemeral (exhibiting bed, bank, and ordinary high water mark)), creeks, rivers, reservoirs, lakes, lagoons, estuaries, harbors, bays and the Pacific Ocean which directly or indirectly receive discharges from storm water conveyance systems. The Port shall determine the definition for wetlands and the limits thereof for the purposes of this definition, which shall be as protective as the Federal definition utilized by the United States Army Corps of Engineers and the United States Environmental Protection Agency. Constructed wetlands are not considered wetlands under this definition, unless the wetlands were constructed as mitigation for habitat loss. Other constructed BMPs are not considered receiving waters under this definition, unless the BMP was originally constructed within the boundaries of the receiving waters. Also see MS4 permit definition.

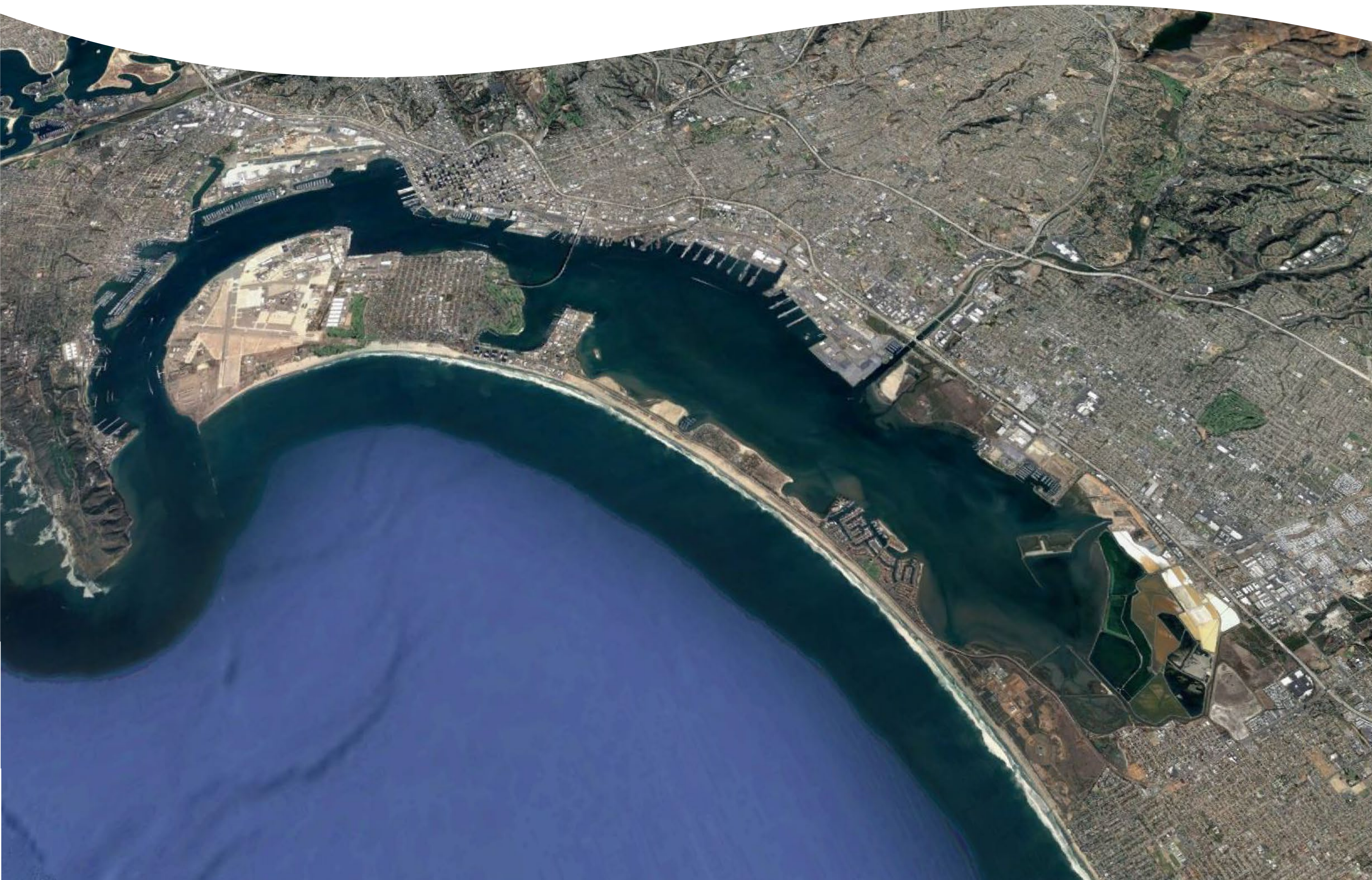
Watershed Management Area

The ten areas defined by the San Diego Water Board in Regional MS4 Permit provision B.1, Table B-1. Each Watershed Management Area is defined by one or more Hydrologic Unit, major surface water body, and responsible Copermittee.

Watershed Management Area Analysis

For each Watershed Management Area, the Copermittees have the option to perform a WMAA for the purpose of developing watershed-specific requirements for structural BMP implementation. Each WMAA includes: GIS layers developed to provide physical characteristics of the watershed management area, a list of potential offsite alternative compliance projects, and areas exempt from hydromodification management requirements.

May 22, 2024



Port of San Diego's BMP Design Manual

Page intentionally left blank.

Summary

In May 2013, the California Regional Water Quality Control Board for the San Diego Region reissued a municipal storm water, National Pollutant Discharge Elimination System permit (Municipal Separate Storm Sewer Systems [MS4] Permit) to San Diego area municipal Copermittees (Order No. R9-2013-0001). The reissued MS4 Permit updates and expands storm water requirements for new developments and redevelopments. The MS4 Permit was amended by Order No. R9-2015-001 in February 2015 and again in November 2015 by Order No. R9-2015-0100

As required by the reissued MS4 Permit, the Copermittees prepared a Model Best Management Practices (BMP) Design Manual to replace the current Countywide Model Standard Urban Stormwater Mitigation Plan (SUSMP), dated March 25, 2011, which was based on the requirements of the 2007 MS4 Permit. The Model BMP Design Manual (Model Manual) is available at www.projectcleanwater.org. The Model Manual content was made available for public review and comment from January 20, 2015 to February 20, 2015. Comments from the public review of the Model Manual have been incorporated into the final version submitted for regulatory approval in June 2015.

The Port of San Diego (Port) is required to adopt a jurisdiction specific local BMP Design Manual. This BMP Design Manual is applicable to projects carried out on Port managed tidelands. The manual closely follows the outline and requirements of the Model Manual with modifications to fit Port-specific project processing requirements. The Port also held a public review and comment period for the Port BMP Design Manual from May 5 through May 27, 2015. Although no comments were received, comments received on the Model Manual have also been incorporated into the Port's manual.

The BMP Design Manual has since been revised to incorporate changes based on the recent guidance and anticipated letter from the Water Board on the use of proprietary biofiltration BMPs, and due to unique constraints impacting certain Port projects (green streets exemption and routine maintenance language).

This BMP Design Manual is designed to comply with the Port's Stormwater Management and Discharge Control Ordinance (Article 10) and the enforcement and development and review process described in the Port's Jurisdictional Runoff Management Plan (JRMP). The effective date of this manual

What this manual is intended to address:

This manual addresses updated onsite post-construction storm water requirements for Standard Projects and Priority Development Projects (PDPs), and provides updated procedures for planning, preliminary design, selection, and design of permanent storm water BMPs based on the performance standards presented in the MS4 Permit.

The intended users of the BMP Design Manual include project applicants, for both tenant and capital developments, their representatives responsible for preparation of Storm Water Quality Management Plans (SWQMPs) and Port personnel responsible for review of these plans.

The following are significant updates to storm water requirements of the MS4 Permit compared to the 2007 MS4 Permit and 2011 Countywide Model SUSMP:

- PDP categories have been updated, and the minimum threshold of impervious area to qualify as a PDP has been reduced.
- Many of the low impact development (LID) requirements for site design that were applicable only to PDPs under the 2007 MS4 Permit are applicable to all projects (Standard Projects and PDPs) under the MS4 Permit.
- The standard for storm water pollutant control (formerly treatment control) is retention of the 24-hour 85th percentile storm volume, defined as the event that has a precipitation total greater than or equal to 85 percent of all daily storm events larger than 0.01 inches over a given period of record in a specific area or location.
- For situations where onsite retention of the 85th percentile storm volume is technically not feasible, biofiltration must be provided to satisfy specific "biofiltration standards". These standards consist of a set of siting, selection, sizing, design and operation and maintenance (O&M) criteria that must be met for a BMP to be considered a "biofiltration BMP" – see Section 2.2.1 and Appendix F.
- Exemptions from hydromodification management are reduced, and certain categories of exemptions that are not identified in the MS4 Permit must be identified in a Watershed Management Area Analysis (WMAA).
- The flow control performance standard for hydromodification management is based on controlling flow to pre-development condition (natural) rather than pre-project condition.
- The flow control performance standard is updated. Requirement to compare flow frequency curves is removed. Performance standard for comparing pre-development and post-project flow duration curves is revised.
- Hydromodification management requirements are expanded to include requirements to protect critical coarse sediment yield areas.
- Alternative compliance approaches are provided as an option to satisfy pollutant control or hydromodification management performance standards if a Copermittee implements an alternative compliance program. Copermittees are given discretion by the MS4 Permit to allow the project applicants to participate in an alternative compliance program without demonstrating technical infeasibility of retention and/or biofiltration BMPs onsite.

What this manual does <u>not</u> address:

This manual provides guidelines for compliance with onsite post-construction storm water requirements in the MS4 Permit, which apply to both tenant and capital projects. The MS4 Permit includes provisions for discretionary participation in an alternative compliance program. As this element is jurisdiction-specific and in different stages of development across the San Diego region, this manual **does not provide guidance for participation in an alternative compliance program**. This manual only indicates the conditions under which project applicants, capital or tenant, can seek to participate in alternative compliance at the discretion of the Port. Additionally, This manual addresses only post-construction storm water requirements and is not intended to serve as a guidance or criteria document for construction-phase storm water controls.

Disclaimer

Currently, some of the Copermittees are pursuing a subvention of funds from the State to pay for certain activities required by the 2007 Municipal Permit, including activities that require Copermittees to perform activities outside their jurisdictional boundaries and on a regional or watershed basis. Nothing in this manual should be viewed as a waiver of those claims or as a waiver of the rights of

Copermittees to pursue a subvention of funds from the State to pay for certain activities required by the MS4 Permit, including the preparation and implementation of the BMP Design Manual. In addition, several Copermittees have filed petitions with the State Board challenging some of the requirements of Provision E of the MS4 Permit. Nothing in this manual should be viewed as a waiver of those claims. Because the State Board has not issued a stay of the 2013 Municipal Permit, Copermittees must comply with the MS4 Permit's requirements while the State Board process is pending.

This manual is organized in the following manner:

An introductory section titled **"How to Use this Manual"** provides a practical orientation to intended uses and provides examples of recommended workflows for using the manual.

Chapter 1 provides information to help the manual user determine which of the storm water management requirements are applicable to the project; source controls/site design, pollutant controls, and hydromodification management. This chapter also introduces the procedural requirements for preparation, review, and approval of project submittals. Port requirements for processing project submittals are provided in this chapter.

Chapter 2 defines the performance standards for source control and site design BMPs, storm water pollutant control BMPs, and hydromodification management BMPs based on the MS4 Permit. These are the underlying criteria that must be met by projects, as applicable. This chapter also presents information on the underlying concepts associated with these performance standards to provide the project applicant with technical background; explains why the performance standards are important; and gives a general description of how the performance standards can be met.

Chapter 3 describes the essential steps in preparing a comprehensive storm water management design and explains the importance of starting the process early during the preliminary design phase. By following the recommended procedures in Chapter 3, project applicants can develop a design that complies with the complex and overlapping storm water requirements. This chapter is intended to be used by both Standard Projects and PDPs; however, certain steps will not apply to Standard Projects (as identified in the chapter).

Chapter 4 presents the source control and site design requirements to be met by all development projects and is therefore intended to be used by Standard Projects and PDPs.

Chapter 5 applies to PDPs. It presents the specific process for determining which category of onsite pollutant control BMP, or combination of BMPs, is most appropriate for the PDP site and how to design the BMP to meet the storm water pollutant control performance standard. The prioritization order of onsite pollutant control BMPs begins with retention, then biofiltration, and finally flow-thru treatment control (in combination with offsite alternative compliance). Chapter 5 does not apply to Standard Projects.

Chapter 6 applies to PDPs that are subject to hydromodification management requirements. This chapter provides guidance for meeting the performance standards for the two components of hydromodification management: protection of critical coarse sediment yield areas and flow control for post-project runoff from the project site. Chapter 6 incorporates applicable requirements of the "Final Hydromodification Management Plan (HMP) Prepared for County of San Diego, California," dated March 2011, with modifications based on updated requirements in the MS4 Permit. Chapter 6 does not apply to Standard Projects or to PDPs with only pollutant control requirements.

Chapter 7 addresses the long term O&M requirements of structural BMPs presented in this manual, and mechanisms to ensure O&M in perpetuity. Chapter 7 applies to PDPs only and is not required for Standard Projects; however Standard Projects may use this chapter as a reference.

Chapter 8 describes the specific requirements for the content of project submittals to facilitate Port review of project plans for compliance with applicable requirements of the manual and the MS4 Permit. This chapter is applicable to Standard Projects and PDPs. This chapter pertains specifically to the content of project submittals, and not to specific details of Port requirements for processing of submittals; it is intended to complement the requirements for processing of project submittals that are included in Chapter 1.

Appendices to this manual provide detailed guidance for BMP design, calculation procedures, worksheets, maps and other figures to be referenced for BMP design. These Appendices are not intended to be used independently from the overall manual – rather they are intended to be used only as referenced in the main body of the manual.

This manual is organized based on project category. Requirements that are applicable to both Standard Projects and PDPs are presented in Chapter 4. Additional requirements applicable only to PDPs are presented in Chapters 5 through 7. While source control and site design BMPs are required for all projects inclusive of Standard Projects and PDPs, structural BMPs are only required for PDPs. Throughout this manual, the term "structural BMP" is a general term that encompasses the pollutant control BMPs and hydromodification management BMPs required for PDPs under the MS4 Permit. A structural BMP may be a pollutant control BMP, a hydromodification management BMP, or an integrated pollutant control and hydromodification management BMP. Hydromodification management BMPs are also referred to as flow control BMPs in this manual.

Table of Contents

Appendices

Figures

Tables

List of Acronyms

303(d)	Refers to Clean Water Act Section 303(d) list of impaired and threatened waters
ASTM	American Society for Testing and Materials
BF	Biofiltration (BMP Category)
BMPs	Best Management Practices
CEQA	California Environmental Quality Act
CWA	Clean Water Act
DCV	Design Capture Volume
DMA	Drainage Management Area
ESA	Environmentally Sensitive Area
FT	Flow-thru Treatment Control BMP (BMP Category)
GLUs	Geomorphic Landscape Units
GR	General Requirements
HMP	Hydromodification Management Plan
HSG	Hydrologic Soils Group
HSPF	Hydrologic Simulation Program-FORTRAN
HU	Harvest and Use
INF	Infiltration (BMP Category)
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NRCS	Natural Resource Conservation Service
O&M	Operation and Maintenance
PDPs	Priority Development Projects
POC	Point of Compliance
PR	Partial Retention (BMP Category)
R9	Region 9 (of the California Regional Water Quality Control Board)
SC	Source Control
SCCWRP	Southern California Coastal Water Research Project
SD	Site Design
SDHM	San Diego Hydrology Model
SIC	Standard Industrial Classification
SUSMP	Standard Urban Stormwater Mitigation Plan
SWMM	Storm Water Management Model
SWQMP	Storm Water Quality Management Plan
TN	Total Nitrogen
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WMAA	Watershed Management Area Analysis
WQIP	Water Quality Improvement Plan

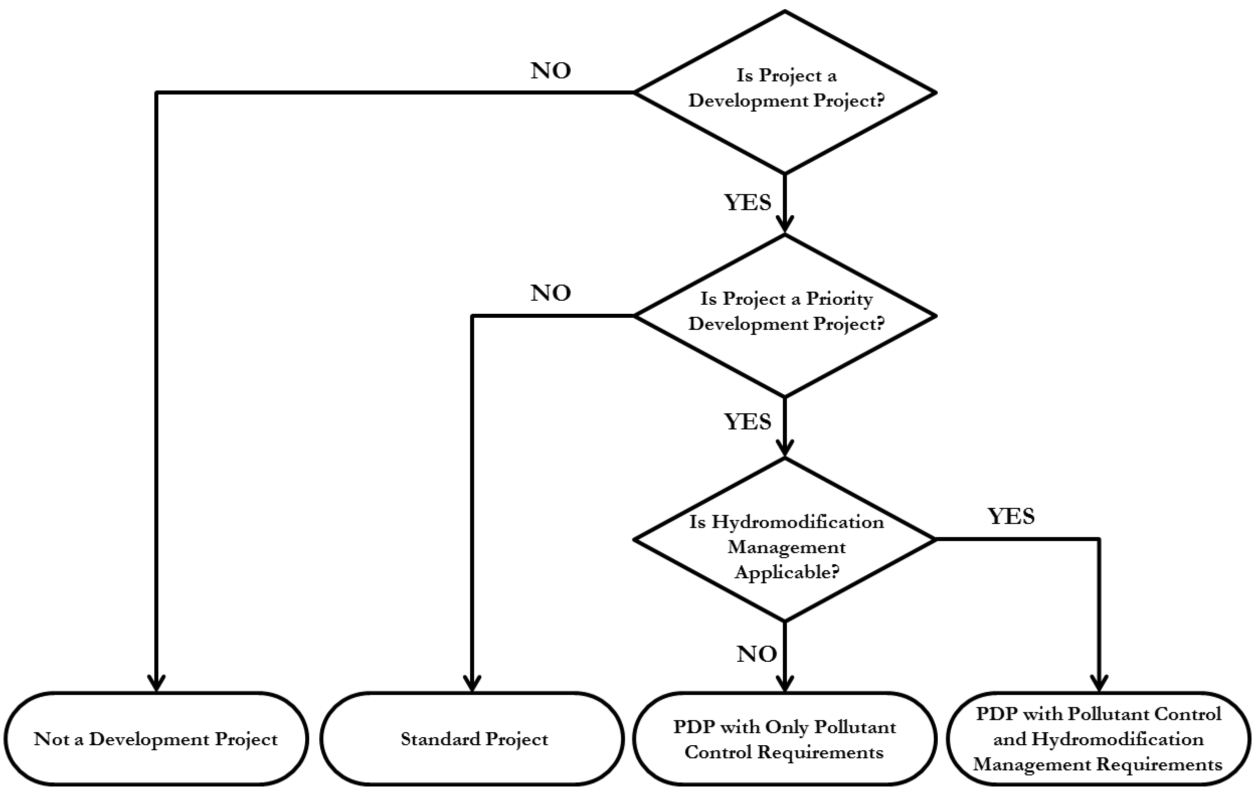
How to Use this Manual

This manual is intended to help a project applicant, in coordination with Port staff, develop a SWQMP for a development project (capital or tenant) that complies with local and MS4 Permit requirements. Most applicants will require the assistance of a qualified civil engineer, architect, and/or landscape architect to prepare a SWQMP. As every project is different, the applicant should begin by checking specific requirements with the Port.

Beginning Steps for All Projects: What requirements apply?

To use this manual, start by reviewing **Chapter 1** to determine whether your project is a "Standard Project" or a "PDP" and which storm water quality requirements apply to your project.

Not all of the requirements and processes described in this manual apply to all projects. Therefore, it is important to begin with a careful analysis of which requirements apply. Chapter 1 also provides an overview of the process of planning, design, construction, operation, and maintenance, with associated Port review and approval steps, leading to compliance. A flow chart that shows how to categorize a project in terms of applicable post-construction storm water requirements is included below. The flow chart is followed by a table that lists the applicable section of this manual for each project type.



Project Type	Applicable Requirements		
	Source Control and Site Design (Chapter 4)	Storm Water Pollutant Control BMPs (Chapter 5)	Hydromodification Management BMPs (Chapter 6)
Not a Development Project (without impact to storm water quality or quantity – e.g. interior remodels, routine maintenance; Refer to Section 1.3)	Requirements in this manual do not apply		
Standard Projects	X		
PDPs with only Pollutant Control Requirements	X	X	
PDPs with Pollutant Control and Hydromodification Management Requirements	X	X	X

Once an applicant has determined which requirements apply, **Chapter 2** describes the specific performance standards associated with each requirement. For example, an applicant may learn from Chapter 1 that the project must meet storm water pollutant control requirements. Chapter 2 describes what these requirements entail. This chapter also provides background on key storm water concepts to help understand why these requirements are in place and how they can be met. Refer to the list of acronyms and glossary as guidance to understanding the meaning of key terms within the context of this manual.

Next Steps for All Projects: How should an applicant approach a project storm water management design?

Most projects will then proceed to **Chapter 3** to follow the step-by-step guidance to prepare a storm water project submittal for the site. This chapter does not specify any regulatory criteria beyond those already specified in Chapter 1 and 2 – rather it is intended to serve as a resource for project applicants to help navigate the task of developing a compliant storm water project submittal. Note that the first steps in Chapter 3 apply to both Standard Projects and PDPs; while other steps in Chapter 3 only apply to PDPs.

The use of a step-by-step approach is highly recommended because it helps ensure that the right information is collected, analyzed, and incorporated in to project plans and submittal at the appropriate time in the Port review process. It also helps facilitate a common framework for discussion between the applicant and the reviewer. However, each project is different and it may be appropriate to use a different approach as long as the applicant demonstrates compliance with the MS4 Permit requirements that apply to the project.

Final Steps in Using This Manual: How should an applicant design BMPs and prepare documents for compliance?

Standard Projects	PDPs
Standard Projects will proceed to **Chapter 4** for guidance on implementing source control and site design requirements. After Chapter 4, Standard Projects will proceed to **Chapter 8** for project submittal requirements.	PDPs will also proceed to **Chapter 4** for guidance on implementing source control and site design requirements. PDPs will use **Chapters 5 through 7** and associated Appendices to implement pollutant control requirements, and hydromodification management requirements for the project site, as applicable. These projects will proceed to **Chapter 8** for project submittal requirements.

Plan Ahead to Avoid Common Mistakes

The following list identifies some common errors made by applicants that delay or compromise development approvals with respect to storm water compliance.

- Not planning for compliance early enough. The strategy for storm water quality compliance should be considered before completing a conceptual site design or sketching a layout of project site or subdivision lots (see Chapter 3). Planning early is crucial under current requirements compared to previous requirements; for example, LID/Site Design is required for all development projects and onsite retention of storm water runoff is required for PDPs. Additionally, collection of necessary information early in the planning process (e.g. geotechnical conditions, groundwater conditions) can help avoid delays resulting from redesign.

- Assuming proprietary storm water treatment facilities will be adequate for compliance and/or relying on strategies acceptable under previous MS4 Permits may not be sufficient to meet compliance. Under the MS4 Permit, the standard for pollutant control for PDPs is **retention of the 85th percentile storm volume** (see Chapter 5). Flow-thru treatment cannot be used to satisfy permit requirements unless the project also participates in an alternative compliance program. Under some conditions, certain proprietary BMPs may be equivalent to "biofiltration" according to Appendix F of this manual and can be used for primary compliance with storm water pollutant treatment requirements (i.e. without alternative compliance); see description and further references in Chapter 2.2 for additional guidance.

- Not planning for on-going inspections and maintenance of PDP structural BMPs in perpetuity. It is essential to secure a mechanism for funding of long term O&M of structural BMPs, select structural BMPs that can be effectively operated and maintained by the tenant/Port, and include design measures to ensure access for maintenance and to control maintenance costs (see Chapter 7).

Chapter

1

BMP DESIGN MANUAL

Policies and Procedural Requirements

This chapter introduces storm water management policies and is intended to help categorize a project and determine the applicable storm water management requirements as well as options for compliance. This chapter also introduces the procedural requirements for preparation, review, and approval of project submittals.

1.1 Introduction to Storm Water Management Policies

MS4 Permit Provision E.3.a-c; E.3.d.(1)

Storm water management requirements for development projects are derived from the MS4 Permit and implemented by the Port.

On May 8, 2013, the California Regional Water Quality Control Board San Diego Region (referred to as "San Diego Water Board") reissued a municipal storm water permit titled "National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharges from the MS4s draining the watersheds within the San Diego Region" (Order No. R9-2013-0001; referred to as MS4 Permit) to the municipal Copermittees. The MS4 Permit was amended in February 2015 by Order R9-2015-0001, and again in November 2015 by Order R9-2015-0100. The MS4 Permit was issued by the San Diego Water Board pursuant to section 402 of the federal Clean Water Act and implementing regulations (Code of Federal Regulations Title 40, Part 122) adopted by the United States Environmental Protection Agency, and Chapter 5.5, Division 7 of the California Water Code. The MS4 Permit, in part, requires each Copermittee to use its land use and planning authority to implement a development planning program to control and reduce the discharge of pollutants in storm water from new development and significant redevelopment to the maximum extent practicable (MEP). MEP is defined in the MS4 Permit.

Different requirements apply to different project types.

The MS4 Permit requires all development projects to implement source control and site design practices that will minimize the generation of pollutants. While all development projects are required to implement source control and site design/LID practices, the MS4 Permit has additional requirements for development projects that exceed size thresholds and/or fit under specific use categories. These projects, referred to as PDPs, are required to incorporate structural BMPs into the project plan to reduce the discharge of pollutants, and address potential hydromodification impacts from changes in flow and sediment supply.

1.2 Purpose and Use of the Manual

This manual presents a "unified BMP design approach."

To assist the land development community, streamline project reviews, and maximize cost-effective environmental benefits, the regional Copermittees have developed a unified BMP design approach[1] that meets the performance standards specified in the MS4 Permit. By following the process outlined in this manual, project applicants (for both tenant and capital developments) can develop a single integrated design that complies with the complex and overlapping MS4 Permit source control and site design requirements, storm water pollutant control requirements (i.e. water quality), and hydromodification management (flow-control and sediment supply) requirements.

1.2.1 Determining Applicability of Permanent BMP Requirements

Figure 1-1 below presents a flow chart of the decision process that the manual user should use to:

1. Categorize a project;
2. Determine storm water requirements; and
3. Understand how to submit projects for review and verification.

This figure also indicates where specific procedural steps associated with this process are addressed in Chapter 1. An applicability checklist for project applicants to determine which project category and requirements apply to their projects is available on the Port's website at https://www.portofsandiego.org/stormwater-management.

Alternative BMP design approaches that meet applicable performance standards may also be acceptable.

Applicants may choose not to use the unified BMP design approach present in this manual, in which case they will need to demonstrate to the satisfaction of the Port, in their submittal, compliance with applicable performance standards. These performance standards are described in **Chapter 2** and in Section E.3.c of the MS4 Permit.

[1] The term "unified BMP design approach" refers to the standardized process for site and watershed investigation, BMP selection, BMP sizing, and BMP design that is outlined and described in this manual with associated appendices and templates. This approach is considered to be "unified" because it represents a pathway for compliance with the MS4 Permit requirements that is anticipated to be reasonably consistent across the local jurisdictions in San Diego County. In contrast, applicants may choose to take an alternative approach where they demonstrate to the satisfaction of the Port, in their submittal, compliance with applicable performance standards without necessarily following the process identified in this manual.

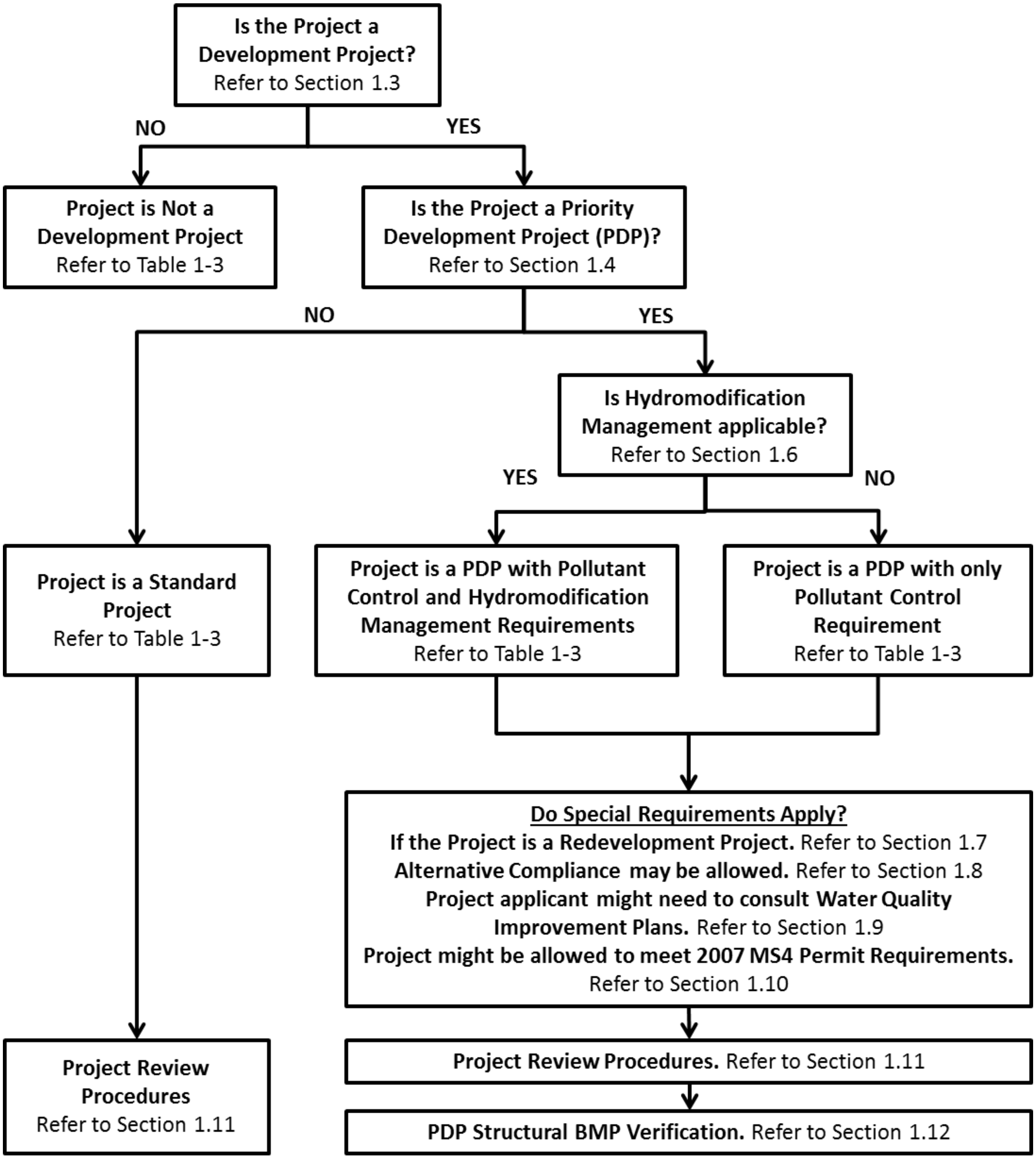


FIGURE 1-1. Procedural Requirements for a Project to Identify Storm Water Requirements

1.2.2 Determine Applicability of Construction BMP Requirements

All projects, or phases of projects, even if exempted from meeting some or all of the Permanent BMP Requirements, are required to implement temporary erosion, sediment, good housekeeping and pollution prevention BMPs to mitigate storm water pollutants during the construction phase. See the Port's Storm Water Requirements Applicability Checklist for information on and project applicability of these requirements.

1.3 Defining a Project

Not all site improvements are considered "development projects" under the MS4 Permit.

Development projects are defined by the MS4 Permit as "construction, rehabilitation, redevelopment, or reconstruction of any capital or tenant projects". Development projects are issued local permits to allow construction activities. This manual applies only to development or redevelopment activities that have the potential to contact storm water and contribute an anthropogenic source of pollutants, or reduce the natural absorption and infiltration abilities of the land.

A project must be defined consistent with the California Environmental Quality Act (CEQA) definitions of "project."

CEQA defines a project as: a discretionary action being undertaken by a public agency that would have a direct or reasonably foreseeable indirect impact on the physical environment. This includes actions by the agency, financing and grants, and permits, licenses, plans, regulations or other entitlements granted by the agency. CEQA requires that the project include "the whole of the action" before the agency. This requirement precludes "piecemealing," which is the improper (and often artificial) separation of a project into smaller parts in order to avoid preparing EIR-level documentation.

In the context of this manual, the "project" is the "whole of the action" which has the potential for adding or replacing or resulting in the addition or replacement of, roofs, pavement, or other impervious surfaces and thereby resulting in increased flows and storm water pollutants. "Whole of the action" means the project may not be segmented or phased into small parts either onsite or offsite if the effect is to reduce the quantity of impervious area and fall below thresholds for applicability of storm water requirements.

When defining the project, the following questions are considered:

- What are the project activities?
- Do they occur onsite or offsite?
- What are the limits of the project (project boundary)?
- What is the whole of the action associated with the project (i.e., what is the total amount of new or replaced impervious area considering all of the collective project components through all phases of the project)?
- Are any facilities or agreements to build facilities offsite in conjunction with providing service to the project (street widening, utilities)?

Table 1-1 is used to determine whether storm water management requirements defined in the MS4 Permit and presented in this manual apply to the project.

If a project meets one of the exemptions in Table 1-1 then the project is exempt. If permanent BMP requirements apply to a project, Sections 1.4 to 1.7 will define the extent of the applicable requirements based on the MS4 Permit. The MS4 Permit contains standard requirements that are applicable to all projects (Standard Projects and PDPs), and specific requirements for projects that are classified as

PDPs.

TABLE 1-1. Applicability of Permanent, Post-Construction Storm Water Requirements

Do permanent storm water requirements apply to your project?
Requirements DO NOT apply to:
1. Routine Maintenance Replacement of impervious surfaces that are part of a routine maintenance activity, such as: • Replacing roof material on an existing building • Resurfacing existing roadways, parking lots, sidewalks, pedestrian ramps, and bike lanes, including slurry, overlay and restriping • Restoring a historic building to its original historic design • Installation of ground mounted solar arrays over existing impermeable surfaces **Note**: Work in any of the above categories that creates impervious surface outside the existing impervious footprint is not considered routine maintenance. **2. Work Over Water** Work that occurs over water and does not disturb or expose uncompacted or compacted placed fill placed as part of a structural cross section or native soil. This includes, for example, work on pile supported piers or marinas, such as replacing the pier pavement or surface, adding or replacing buildings, and berth repair. Work on mole piers that disturbs or exposes the fill portion of the mole pier is not considered work over water, but certain work on mole piers may be considered routine maintenance. See the "Conditional Routine Maintenance" category below; Section 1.3.1 provides additional details. **3. Conditional Routine Maintenance** Several other types of work are also considered routine maintenance when completed in accordance with the conditions described in Section 1.3.1. These include the following; see Section 1.3.1 for additional details: • Full depth replacement of damaged pavement, including pavement on mole piers and boat ramps, that does not disturb native soil • Replacement of pavement or other surface materials affected by trenching for underground utility work (e.g., pipe replacement) • Replacement or addition of curb ramps for ADA purposes • Replacement of driveway aprons for ADA purposes • Repair or replacement of shoreline protection structures Note that some additional types of pavement work that does not qualify as routine maintenance per Section 1.3.1 may qualify to use the Green Street Exemption; see Section 1.3.1 for additional details. **4. Interior or Exterior Repair or Improvements to Existing Buildings** Repair or improvements to an existing building or structure that do not alter the size: • Plumbing, electrical and HVAC work • Interior alterations including major interior remodels and tenant build-out within an existing commercial building • Exterior alterations that do not change the general dimensions and structural framing of the

Do permanent storm water requirements apply to your project?
Requirements DO NOT apply to:
building (does not include building additions or projects where the existing building is demolished)

1.3.1 Conditional Routine Maintenance Determination for Pavement and Shoreline Projects

Table 1-2 provides additional detail about whether several types of projects that typically occur in or along streets, alleys, shorelines, and similar areas can be considered routine maintenance. This table reflects guidance provided by the San Diego Water Board to the Port District in August 2023, and builds off similar guidance previous provided by the Board to the Cities of Lemon Grove (March 2022), Poway (September 2021), and San Diego (October 2020). Based on this guidance, both Port and tenant implemented projects may be considered routine maintenance as described in this section, provided all conditions enumerated below Table 1-2 are met.

TABLE 1-2. Applicability of Conditional Routine Maintenance Exemptions

Project Scenarios	Routine Maintenance
1. Full depth replacement of damaged impervious pavement, including work that disturbs the subgrade or other parts of the structural pavement section, but not including work that disturbs the underlying uncompacted native soil outside the structural pavement section. This category applies to replacement of damaged pavement locations such as roads, parking lots, sidewalks, walkways, boat ramps, and over mole piers. The following are common examples of when this scenario applies: a. A single contiguous area of pavement replacement that exceeds the applicable PDP threshold size (2,500 or 5,000 sf, depending on whether the project directly discharges to an ESA). b. Several non-contiguous pavement patches, with each patch being below the applicable PDP threshold size, but cumulatively the sum of the area of the patches is over the applicable PDP threshold size c. Pavement replacement that takes place on a mole pier or marina, including pavement replacement that disturbs fill placed under the mole pier surface for structural support.	**Yes**[1, 3]
2. Pavement replacement when the pavement is disturbed as a result of trenching for utility work. Utility work includes access subsurface	**Yes**[1, 3]

Project Scenarios	Routine Maintenance
assets, such as pipes or curtain walls, for maintenance purposes. The following are common examples of when this scenario applies: a. Replacing an entire concrete panel when a portion of the panel is disturbed by trenching b. Replacing asphalt, other types of impervious pavement, or other surface materials disturbed by trenching, provided that the limits of the trench are no larger than what is needed to complete maintenance on the applicable subsurface asset(s)	
3. Routine replacement or repair of shoreline protection structures, including disturbance of native soil and excavation behind sea wall to access/repair tieback structures as needed.	**Yes**[1]
4. Creating and/or replacing curb ramps in any of the following situations, with the disturbed area being the minimum footprint needed to meet ADA requirements: a. Curb ramp replacement completely within existing curb ramp footprint b. Curb ramp replacement encroaches into the street without creating new impervious area c. Curb ramp replacement encroaches into the pervious parkway and creates new impervious area d. New curb ramp that encroaches into street without creating new impervious area e. New curb ramp encroaches into pervious parkway and creates new impervious area	**Yes**[1]
5. Replacing driveway aprons, with the disturbed area being the minimum footprint needed to meet ADA requirements that includes one or more of the following: a. Driveway apron replacement completely within existing driveway apron footprint b. Driveway apron replacement encroaches into the street as needed without creating new impervious area c. Driveway apron replacement encroaches into the pervious parkway as needed and creates new impervious area	**Yes**[1]
6. Creating driveway aprons, with the disturbed area being the minimum footprint needed to meet ADA requirements that include one or more of the following:	No[2]

Project Scenarios	Routine Maintenance
a. New driveway apron encroaches into the street as needed without creating new impervious area b. New driveway apron encroaches into pervious parkway as needed and creates new impervious area	
7. Replacing a sidewalk or walkway that otherwise based on its condition does not require replacement for ADA compliance or adding a new sidewalk or walkway for ADA compliance. The following are common examples of when this scenario applies: a. Replacement occurs within the same footprint. b. Replacing a sidewalk outside an existing impervious footprint, e.g., when a straight walkway is converted to a meandering walkway, or when the location of a walkway is modified. c. Adding a new sidewalk or walkway where one did not exist previously, including over area that was previously pervious. d. Creating new, shared use sidewalks, walkways, or pathways wider than the minimum width required for ADA compliance that includes one or more of the following: entire width of shared ADA walkway and pedestrian/vehicle access pathway, only the minimum ADA width portion of the pathway (i.e. 5 feet), entire width of any pathway greater than the minimum ADA width. *Note: sidewalk or walkway pavement repair or replacement that is necessary based on the condition of the sidewalk or walkway (e.g., broken concrete) is considered routine maintenance as described in scenario 1 earlier in this table. Resurfacing sidewalks or walkways is considered routine maintenance per Table 1-2.*	No[2] *(But see note at left about sidewalk or walkway work that is considered routine maintenance)*

[1] Must also meet all of the numbered criteria described in the discussion following this table to be considered routine maintenance.

[2] Project may use the PDP exemptions described in Section 1.4.3 if designed in a way that meets the requirements necessary to qualify for those exemptions. These PDP exemptions include, for example, hydraulically disconnected sidewalks and street improvements that follow Green Street guidance.

[3] Full depth replacement of pavement that includes disturbance of uncompacted native soil is not considered routine maintenance, but may qualify for PDP Exemptions as noted in table footnote 2, above. Soil that is compacted or otherwise part of the structural pavement section is not considered native soil.

To qualify as routine maintenance, project scenarios identified as routine maintenance in Table 1-2 must also meet all of the requirements in the numbered list below.

1. The project is identified as part of the Port's regularly scheduled pavement maintenance on

existing facilities or is an existing private road or parking lot that requires scheduled maintenance only.

2. The project is not part of, or associated with, development project mitigation requirements, development project construction, development project construction agreement, or conditions of approval.
3. No street widening or other enhancements are occurring in association with the damaged pavement project that would normally trigger PDP requirements or be PDP exempt per MS4 Permit Provision E.3.b.(3) – Green Streets Exemption (see "PDP Exemption Category 2" in Section 1.4.3 for more information).
4. The project would normally be CEQA exempt.
5. Construction BMPs must be implemented to control sediment and other pollutants associated with construction activity in accordance with the requirements the Port of San Diego Jurisdictional Runoff Management Plan (JRMP). More detail about construction BMPs for projects considered routine maintenance as described in this section is provided in Section 1.3.1.1 below.
6. The Port shall maintain a list of projects that fall under this category. The Port's project manager (capital/CIPs) or reviewer (tenant/private projects) is responsible for documenting that the project qualifies as routine maintenance per Section 1.3.1 and satisfies all the criteria in this numbered list. The Port's project manager (capital/CIPs) or reviewer (tenant/private projects) shall keep this documentation in the project file or an equivalent location.

Form RM-1 should be completed for each project considered routine maintenance per this section as documentation that the above conditions have been met.

Different routine maintenance scenarios combined together still are considered routine maintenance as long as they are not combined with an activity type that is not routine maintenance. For example, a project that includes full depth pavement replacement (scenario 1) and curb ramp replacement that encroaches into the street (scenario 4) but no other activities would be considered routine maintenance.

Note, however, that if an activity that otherwise would be considered routine maintenance per Section 1.3.1 is combined with other activities that are classified as a PDP or use the Green Streets Exemption, then the activities that would have been considered routine maintenance are no longer considered routine maintenance since they are part of a PDP. They require treatment in that case; see Section 1.4.1 for additional information.

1.3.1.1 Construction BMP Requirements for Routine Maintenance Pavement Projects

As noted in item 6 in Section 1.3.1 above, construction BMP requirements must be met for a routine maintenance exemption to apply. All applicable BMPs from the Port of San Diego JRMP must be implemented and documented via the appropriate Construction BMP Plan. The following highlights the construction (temporary) BMPs most likely to be applicable for routine maintenance work that occurs along streets:

- Cover and berm (perimeter controls) stockpiles at the end of each work day. Stockpiles must be placed at least 18 inches from the face of curb and are prohibited where they obstruct flow.

- Implement at least one of the following at the end of each work day for demolished curbs, gutters, ribbon gutters, and any other concentrated flow pathways that re impacted by the project even when there is no forecasted rain. These BMPs help prevent sediment transport from non-stormwater discharges such as irrigation runoff, water main breaks, water line flushing, etc.
    - Install check dams along the impacted concentrated flow pathways.
    - Install run-on controls (e.g., gravel bag berms) to divert water around the impacted concentrated flow pathways.
    - Cover and secure the impacted concentrated flow pathways with an erosion control product such as mats, plastic sheeting (e.g., Visqueen), or equivalent.
- Implement erosion control for disturbed areas (any areas where pavement has been removed, soil or base is exposed, and any other areas where project work has disturbed soil, such as landscaping adjacent to the work area) when either (a) there is a 50% chance of rain within 24 hours, OR (b) the disturbed area is inactive (no soil disturbing activities for a period of 14 days or greater).
    - Use pavement replacement approach that results in no exposed disturbed soil at the end of the work day (e.g. full depth reclamation, or applying compacted cold mix or hot mix at the end of the day to areas where pavement has been removed).
        - Note: Contractors must obtain written approval from the Port to utilize a full depth asphalt restoration method(s) if it differs from the approved construction plans, Standard Drawings, and/or Special Provisions.

    OR

    - Implement and effective combination of one or more of the following:
        - Install run-on controls (e.g., gravel bag berms) and/or use by-pass method(s) to prevent run-on to areas where soil has been disturbed.
        - Cover the areas where pavement has been removed, soil or base is exposed, and any other areas where project work has disturbed soil with an erosion control product or technique such as steel traffic plates in conjunction with cold patches around the edges, mats, plastic sheeting (e.g., Visqueen), or an equivalent method.
        - Cover and secure demolished curb gutter, ribbon gutters, and any other impacted concentrated flow pathway with an erosion control product such as mats, plastic sheeting (e.g., Visqueen), or equivalent.

1.4 Is the Project a PDP?

MS4 Permit Provision E.3.b.(1)

PDP categories are defined by the MS4 Permit, but the PDP categories can be expanded by local jurisdictions, and local jurisdictions can offer specific exemptions from PDP categories.

Section 1.4.1 presents the PDP categories defined in the MS4 Permit. Section 1.4.2 presents additional PDP categories and/or expanded PDP definitions that apply to the Port. Section 1.4.3 presents specific Port exemptions.

1.4.1 PDP Categories

In the MS4 Permit, PDP categories are defined based on project size, type and design features.

Projects shall be classified as PDPs if they are in one or more of the PDP categories presented in the MS4 Permit, which are listed below. Review each category, defined in (a) through (f), below. A PDP applicability checklist for these categories is also provided in Appendix I-2. If any of the categories match the project, the entire project is a PDP. For example, if a project feature such as a parking lot falls into a PDP category, then the entire development footprint including project components that otherwise would not have been designated a PDP on their own (such as other impervious components that did not meet PDP size thresholds, and/or landscaped areas), shall be subject to PDP requirements. Note that size thresholds for impervious surface created or replaced vary based on land use, land characteristics, and whether the project is a new development or redevelopment project. Therefore, all definitions must be reviewed carefully. Also, note that categories are defined by the total quantity of "added or replaced" impervious surface, not the **net change** in impervious surface.

For example, consider a redevelopment project that adds 7,500 square feet of new impervious surface and removes 4,000 square feet of existing impervious surface. The project has a net increase of 3,500 square feet of impervious surface. However, the project is still classified as a PDP because the total added or replaced impervious surface is 7,500 square feet, which is greater than 5,000 square feet.

"Collectively" for the purposes of the manual means that all contiguous and non-contiguous parts of the project that represent the whole of the action must be summed up. For example, consider a development project that will include the following impervious components:

- 3,600 square feet of roadway
- 350 square feet of sidewalk
- 4,800 square feet of roofs
- 1,200 square feet of driveways
- 500 square feet of walkways/porches

The collective impervious area is 10,450 square feet.

PDP Categories defined by the MS4 Permit:

(a) New development projects that create 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, mixed-use, and capital development projects on Port tidelands.

(b) Redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, mixed-use, and capital development projects on Port tidelands.

(c) New and redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface (collectively over the entire project site), and support one or more of the following uses:

(i) Restaurants. This category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (Standard Industrial Classification (SIC) code 5812).

Information and an SIC search function are available at https://www.osha.gov/pls/imis/sicsearch.html.

(ii) Hillside development projects. This category includes development on any natural slope that is twenty-five percent or greater.

(iii) Parking lots. This category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce.

(iv) Streets, roads, highways, freeways, and driveways. This category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles.

(d) New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharging directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).

Note: ESAs are areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Port (see Section 1.4.2 below to determine if any other local areas have been identified). Note that San Diego Bay is identified as an ESA.

For projects adjacent to an ESA, but not discharging to an ESA, the 2,500 sq-ft threshold does not apply if the project does not physically disturb the ESA and the ESA is upstream of the project.

(e) New development projects, or redevelopment projects that create and/or replace 5,000 square feet or more of impervious surface, that support one or more of the following uses:

(i) Automotive repair shops. This category is defined as a facility that is categorized in any one of the following SIC codes: 5013, 5014, 5541, 7532-7534, or 7536-7539.

Information and an SIC search function are available at https://www.osha.gov/pls/imis/sicsearch.html.

(ii) Retail gasoline outlets. This category includes Retail gasoline outlets that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic of 100 or more vehicles per day.

(f) New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.

Note: Pollutant generating development projects are those projects that generate pollutants at levels greater than background levels. Background pollutant levels means the pollutants generated from an undeveloped site. Projects disturbing one or more acres of land are presumed to generate pollutants post construction unless the applicant presents a design that demonstrates to the satisfaction of the Port that pollutants in stormwater discharges will not exceed pre-construction background levels.

Area that may be excluded from impervious area calculations for determining if the project is a PDP:

(a) Based on guidance from the San Diego Water Board, activities defined as routine maintenance per Section 1.3.1 cannot be combined with work that is a PDP or uses the Green Streets Exemption. If combined with work that is a PDP or uses the Green Streets Exemption, work described in Section 1.3.1 that would be routine maintenance if done on its own is no longer routine maintenance, and it requires treatment as described in Section 1.3.1 for work that does not qualify as routine maintenance. For additional guidance, see Example 1 below, following this list.

(b) Except as described in item (a), areas of a project that are considered exempt from storm water requirements (e.g., routine maintenance activities such as resurfacing, interior repair or improvements to an existing building, etc.) shall not be included as part of "added or replaced" impervious surface in determining project classification. For additional guidance, see Example 2, following this list.

Example 1: A project includes reconfiguration of an existing road for traffic calming and pedestrian improvements. This project includes creation or replacement of 15,000 square feet of pavement, and the replaced pavement areas are not damaged. This work does not qualify as routine maintenance per Section 1.3.1 but does qualify to use the Green Streets Exemption. The project also includes full depth replacement of several patches of damaged pavement in adjacent parts of the road; these full depth replacement patches are a total of 6,000 square feet. While if done by itself the 6,000 square feet of full depth damaged pavement replacement would qualify to be considered routine maintenance per Section 1.3.1, in this case it is also subject to Green Streets standards since it is combined with work that is using the Green Streets Exemption.

Example 2: A project includes replacing the roof on a 10,000 square foot commercial building. The project also includes building a new trash enclosure (150 square feet). The roof replacement work does not expose underlying soil and is routine maintenance per Table 1-2, so the roof replacement area is not included in determining whether the project is a PDP. Because the trash enclosure work is 150 square feet of impervious area, it is considered a Standard Project. Standard Project requirements apply to the trash enclosure work, and the roof replacement work is considered routine maintenance.

Redevelopment projects may have special considerations with regards to the total area required to be treated. Refer to Section 1.7.

1.4.2 Additional Port Specified PDP Categories and/or Expanded PDP Definitions

There are no Port specific additional BMP categories or expanded PDP definitions.

1.4.3 PDP Exemptions or Alternative PDP Requirements

The following PDP exemptions are recognized for projects within the Port; all standard development requirements still apply:

- Walkways Exemption: new or retrofit paved sidewalks, bicycle lanes, or trails that meet the following criteria:
    - Designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas; OR
    - Designed and constructed to be hydraulically disconnected from paved streets or roads.
- Green Street Exemption: retrofitting or redevelopment of existing paved alleys, streets, roads, sidewalks, bicycle lanes, or trails that are designed and constructed in accordance with the USEPA Green Streets guidance ["Managing Wet Weather with Green Infrastructure – Municipal Handbook: Green Streets" (USEPA, 2008)]. See Appendix K for additional guidance on design of projects that use the Green Street Exemption. As also described in Section 1.3.1, certain project types that do not qualify as routine maintenance may be able to use the Green Street Exemption.

1.5 Determining Applicable Storm Water Management Requirements

MS4 Permit Provision E.3.c.(1)

Depending on project type and receiving water, different storm water management requirements apply.

New development or redevelopment projects that are subject to this manual requirement pursuant to Section 1.3 but are not classified as PDPs based on Section 1.4, are called "Standard Projects." Source control and site design requirements apply to all projects including Standard Projects and PDPs. Additional structural BMP requirements (i.e. pollutant control and hydromodification management) apply only to PDPs. Storm water management requirements for a project, and the applicable sections of this manual, are summarized in Table 1-3.

TABLE 1-3. Applicability of Manual Sections for Different Project Types

Project Type	Project Development Process (Chapter 3 and 8)	Source Control and Site Design (Section 2.1 and Chapter 4)	Structural Pollutant Control (Section 2.2 and Chapter 5 and 7)	Structural Hydromodification Management (Section 2.3, 2.4 and Chapter 6 and 7)
Not a Development Project	The requirements of this manual do not apply, except that projects considered routine maintenance per Section 1.3.1 must document how they met the conditions listed in that section.			
Standard Project	☑	☑	NA	NA
Walkways Exempt Project	See Appendix K.1			NA
Green Street Exempt Project	☑	☑	See Appendix K.2	NA
PDP with only Pollutant Control Requirements*	☑	☑	☑	NA
PDPs with Pollutant Control and Hydromodification Management Requirements	☑	☑	☑	☑

* Some PDPs may be exempt from Structural Hydromodification Management BMPs, refer to Section 1.6 to determine.

1.5.1 Additional Guidance on Shoreline Projects

Due to its location along the San Diego Bay waterfront, certain types of projects that are not common in other jurisdictions may occur within the Port's jurisdiction. Those types of projects are summarized in Table 1-4 below, which also includes references to specific locations in the BMP Design Manual that provide more detail on the applicable requirements.

TABLE 1-4. Applicability of Manual Sections for Different Project Types[1]

Project Type	Requirements	Reference
Shoreline protection structures: repair, replacement, or other maintenance.	Not a Development Project	Section 1.3.1

Project Type	Requirements	Reference
Work over water that does not disturb or expose soil (placed fill or native soil). This includes work on pile supported piers, such as pavement replacement, berth repair, and construction of new structures. It does not include work on mole piers that exposes underlying fill.	Not a Development Project	Section 1.2
Full depth replacement of damaged pavement on mole piers, at marine terminals, or at boat ramps.	Not a Development Project	Section 1.3.1
Pavement replacement associated with trenching for repair, maintenance, or replacement of underground utilities and/or curtain walls.	Not a Development Project	Section 1.3.1
New or replaced impervious surfaces on mole piers or at marine terminals that does not qualify as routine maintenance ("Not a Development Project") where vehicle parking or travel takes place within the project footprint.	Green Street Exemption	Section 1.4.3, Appendix K
New or expanded boat ramps.	Green Street Exemption	Section 1.4.3, Appendix K
Redevelopment at shipyards covered by a separate NPDES permit (e.g., Order No. R9-2013-0026 or successor orders).	Requires project-specific consultation with Water Board[2]	N/A

1. Development projects proposing to dredge or fill materials in waters of the U.S. must obtain a Clean Water Act Section 401 Water Quality Certification. Projects proposing to dredge or fill waters of the state must obtain waste discharge requirements.

2. Dischargers enrolled under a separate NPDES permit (e.g., Order No. R9-2013-0026) that are also subject to Port PDP requirements on a case by case basis may submit a letter request to the San Diego Water Board for a determination that the proposed post construction treatment controls designed to meet the requirements of the separate NPDES Permit also meet the post-construction requirements of the Regional MS4 Permit.

1.6 Applicability of Hydromodification Management Requirements

MS4 Permit Provision E.3.c.(2)

Hydromodification management requirements apply to PDPs only.

If the project is a Standard Project, hydromodification management requirements do not apply. Hydromodification management requirements apply to PDPs (both new and re-development) unless the project meets specific exemptions discussed below.

PDP exemptions from hydromodification management requirements are based on the receiving water system.

Copermittees have the discretion to exempt a PDP from hydromodification management requirements where the project discharges storm water runoff to:

(i) Existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean;

(ii) Conveyance channels whose bed and bank are concrete lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean; or

(iii) An area identified by the Copermittees as appropriate for an exemption by the optional WMAA incorporated into the Water Quality Improvement Plan (WQIP) pursuant to Provision B.3.b.(4) of the MS4 permit.

Refer to Figure 1-2 and the associated criteria describing nodes in Figure 1-2 to determine applicability of hydromodification management requirements. The criteria reflect the latest list of exemptions that are allowed under the 2013 MS4 Permit, and therefore supersede criteria found in earlier publications.

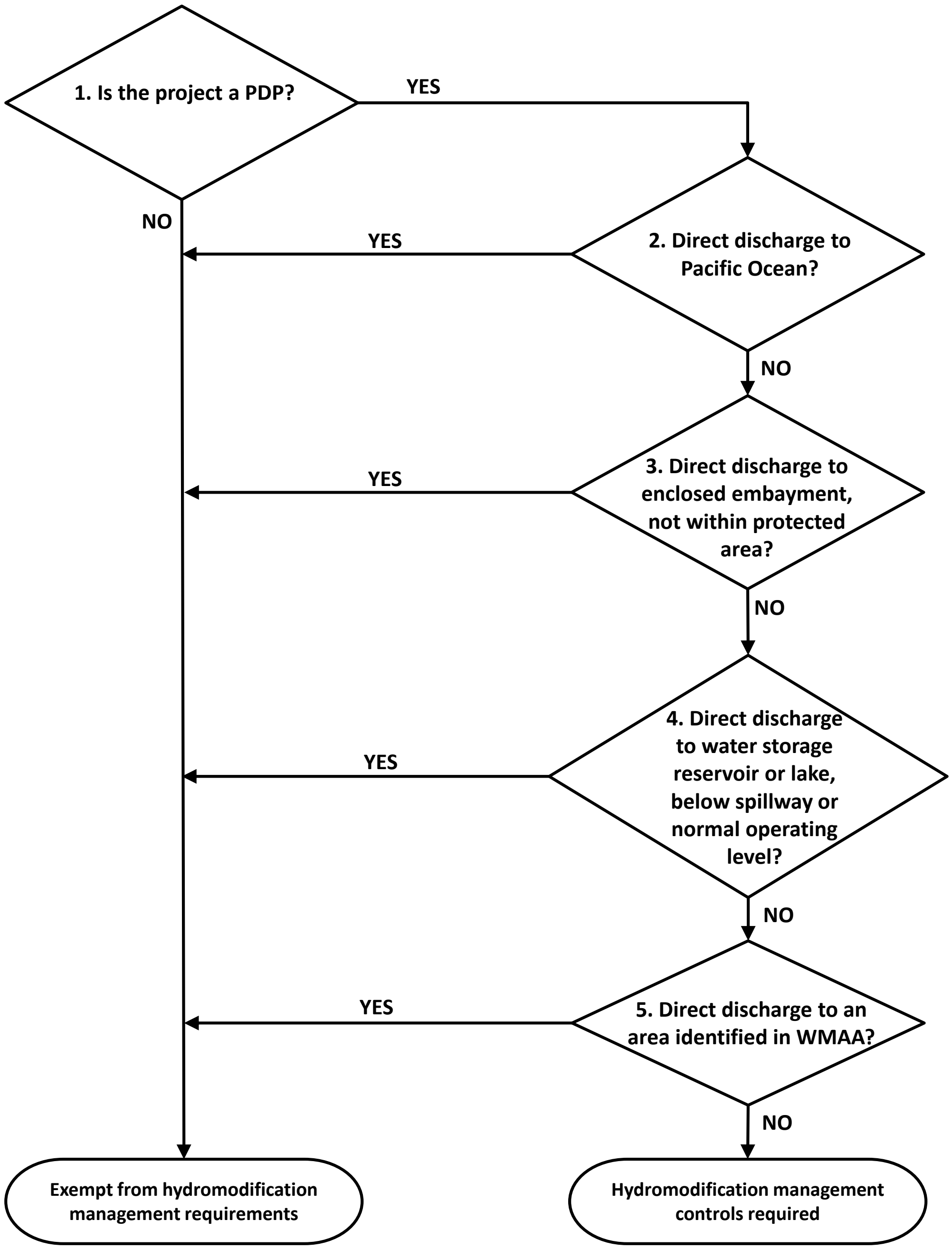
- Figure 1-2, Node 1 – Hydromodification management control measures are only required if the proposed project is a PDP.
- Figure 1-2, Node 2 – As allowed by the MS4 Permit, projects discharging directly to the Pacific Ocean, by either existing underground storm drain systems or conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to the Pacific Ocean, are exempt.
  - This exemption is subject to the following additional criteria defined by this manual:
    a) The outfall must be located on the beach (not within or on top of a bluff),
    b) A properly sized energy dissipation system must be provided to mitigate outlet discharge velocity from the direct discharge to the ocean for the ultimate condition peak design flow of the direct discharge,
    c) The invert elevation of the direct discharge conveyance system (at the point of discharge to the ocean) should be equal to or below the mean high tide water surface elevation at the point of discharge, unless the outfall discharges to quay or other non-erodible shore protection.
- Figure 1-2, Node 3 – As allowed by the MS4 Permit, projects discharging directly to enclosed embayments (e.g., San Diego Bay or Mission Bay), by either existing underground storm drain systems or conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to the enclosed embayment, are exempt.
  - This exemption is subject to the following additional criteria defined by this manual:
    a) The outfall must not be located within a wildlife refuge or reserve area (e.g., Kendall-Frost Mission Bay Marsh Reserve, San Diego Bay National Wildlife Refuge, San Diego National Wildlife Refuge),
    b) A properly sized energy dissipation system must be provided to mitigate outlet discharge velocity from the direct discharge to the enclosed embayment for the ultimate condition peak design flow of the direct discharge,
    c) The invert elevation of the direct discharge conveyance system (at the point of discharge to the enclosed embayment) should be equal to or below the mean high tide water surface elevation at the point of discharge, unless the outfall discharges to a quay or other non-erodible shore protection.

        - For cases in which the direct discharge conveyance system outlet invert elevation is above the mean high tide water surface elevation but below the 100-year water surface elevation, additional analysis is required to determine if energy dissipation should be extended between the conveyance system outlet and the elevation associated with the mean high tide water surface level.
        - No exemption may be granted for conveyance system outlet invert elevations located above the 100-year floodplain elevation.

- Figure 1-2, Node 4 – As allowed by the MS4 Permit, projects discharging directly to a water storage reservoir or lake, by either existing underground storm drain systems or conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to the water storage reservoir or lake, are exempt.
    - This exemption is subject to the following additional criteria defined by this manual:
        a) A properly sized energy dissipation system must be provided in accordance with local design standards to mitigate outlet discharge velocity from the direct discharge to the water storage reservoir or lake for the ultimate condition peak design flow of the direct discharge,
        b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the water storage reservoir or lake) should be equal to or below the lowest normal operating water surface elevation at the point of discharge, unless the outfall discharges to a quay or other non-erodible shore protection. Normal operating water surface elevation may vary by season; contact the reservoir operator to determine the elevation. For cases in which the direct discharge conveyance system outlet invert elevation is above the lowest normal operating water surface elevation but below the reservoir spillway elevation, additional analysis is required to determine if energy dissipation should be extended between the conveyance system outlet and the elevation associated with the lowest normal operating water surface level.
        c) No exemption may be granted for conveyance system outlet invert elevations located above the reservoir spillway elevation.
- Figure 1-2, Node 5 – As allowed by the MS4 Permit, projects discharging directly to an area identified as appropriate for an exemption in the WMAA for the watershed in which the project resides, by either existing underground storm drain systems or conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to the designated area, are exempt. Consult the WMAA within the WQIP for the watershed in which the project resides to determine areas identified as appropriate for an exemption. Exemption is subject to any criteria defined within the WMAA, and criteria defined below by this manual:
    - To qualify as a direct discharge to an exempt river reach:
        a) A properly sized energy dissipation system must be provided to mitigate outlet discharge velocity from the direct discharge to the exempt river reach for the ultimate condition peak design flow of the direct discharge,
        b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the exempt river reach) should be equal to or below the 10-year floodplain elevation. Exceptions may be made at the discretion of the Port, but shall never exceed

the 100-year floodplain elevation. The Port may require additional analysis of the potential for erosion between the outfall and the 10-year floodplain elevation.

c) No exemption may be granted for conveyance system outlet invert elevations located above the 100-year floodplain elevation.



*Direct discharge refers to an uninterrupted hardened conveyance system; Note to be used in conjunction with Node Descriptions.

FIGURE 1-2. Applicability of Hydromodification Management BMP Requirements

1.7 Special Considerations for Redevelopment Projects (50% Rule)

MS4 Permit Provision E.3.b.(2)

Redevelopment PDPs (PDPs on previously developed sites) may need to meet storm water management requirements for ALL impervious areas (collectively) within the ENTIRE project site.

If the project is a redevelopment project, the structural BMP performance requirements and hydromodification management requirements apply to redevelopment PDPs as follows:

(a) Where redevelopment results in the creation or replacement of impervious surface in an amount of less than fifty percent of the surface area of the previously existing development, then the structural BMP performance requirements of Provision E.3.c of the MS4 permit apply only to the creation or replacement of impervious surface, and not the entire development; or

(b) Where redevelopment results in the creation or replacement of impervious surface in an amount of more than fifty percent of the surface area of the previously existing development, then the structural BMP performance requirements of Provision E.3.c of the MS4 permit apply to the entire development.

These requirements for managing storm water on an entire redevelopment project site are commonly referred to as the "50% rule". For the purpose of calculating the ratio, the surface area of the previously existing development shall be the area of <u>impervious surface</u> within the previously existing development. The following steps shall be followed to estimate the area that requires treatment to satisfy the MS4 Permit requirements:

1. How much total impervious area currently exists on the site?
2. How much existing impervious area will be replaced with new impervious area?
3. How much new impervious area will be created in areas that are pervious in the existing condition?
4. Total created and/or replaced impervious surface = Step 2 + Step 3.
5. **<u>50% rule test</u>**: Is step 4 more than 50% of Step 1? If yes, treat all impervious surface on the site. If no, then treat only Step 4 impervious surface and any area that comingles with created and/or replaced impervious surface area.

<u>Note</u>: Step 2 and Step 3 must not overlap as it is fundamentally not possible for a given area to be both "replaced" and "created" at the same time. Also activities that occur as routine maintenance shall not be included in Step 2 and Step 3 calculation.

For example, a 10,000 sq. ft development proposes replacement of 4,000 sq. ft of impervious area. The treated area is less than 50% of the total development area and only the 4,000 sq. ft area is required to be treated.

1.8 Alternative Compliance Program

MS4 Permit Provision E.3.c.(1).(b); E.3.c.(2).(c); E.3.c.(3)

PDPs may be allowed to participate in an alternative compliance program.

Copermittees have the discretion to independently develop an alternative compliance program for their jurisdiction.

Participation in an alternative compliance program would allow a PDP to fulfill the requirement of providing retention and/or biofiltration pollutant controls onsite that completely fulfill the performance standards specified in Chapter 5 (pollutant controls) with onsite flow-thru treatment controls and offsite mitigation of the DCV not retained onsite.

PDPs may be allowed to participate in an alternative compliance program by using onsite BMPs to treat offsite runoff. PDPs must consult the local jurisdiction manuals for specific guidelines and requirements for using onsite facilities for alternative compliance. The PDP utilizing the alternative compliance program would (at a minimum) provide flow-thru treatment control BMPs onsite, then fund, contribute to, or implement an offsite alternative compliance project deemed by the Port-specific alternative compliance program to provide a greater overall water quality benefit for the portion of the pollutants not addressed onsite through retention and/or biofiltration BMPs. Offsite alternative compliance program locations for the purpose of this manual are defined as location within the same watershed management area as the PDP. Participation in an alternative compliance program would also potentially relieve hydromodification management flow control obligations that are not provided onsite (see Chapter 6 for hydromodification management requirements). PDPs must consult the Port for specific guidelines and requirements for participation in potential alternative compliance programs.

Figure 1-3 generally represents two potential pathways for participating in alternative compliance (i.e. offsite projects that supplement the PDPs onsite BMP obligations).

- The first pathway (illustrated using solid line, left side) ultimately ends at alternative compliance if the PDP cannot meet all of the onsite pollutant control obligations via retention and/or biofiltration. This pathway requires performing feasibility analysis for retention and biofiltration BMPs prior to participation in an alternative compliance project.
- The second pathway (illustrated using dashed line, right side) is a discretionary pathway along which jurisdictions <u>may allow for PDPs to proceed directly to an alternative compliance project without demonstrating infeasibility of retention and/or biofiltration BMPs onsite</u>.

Participation in an alternative compliance program also requires onsite flow-thru treatment control BMPs.

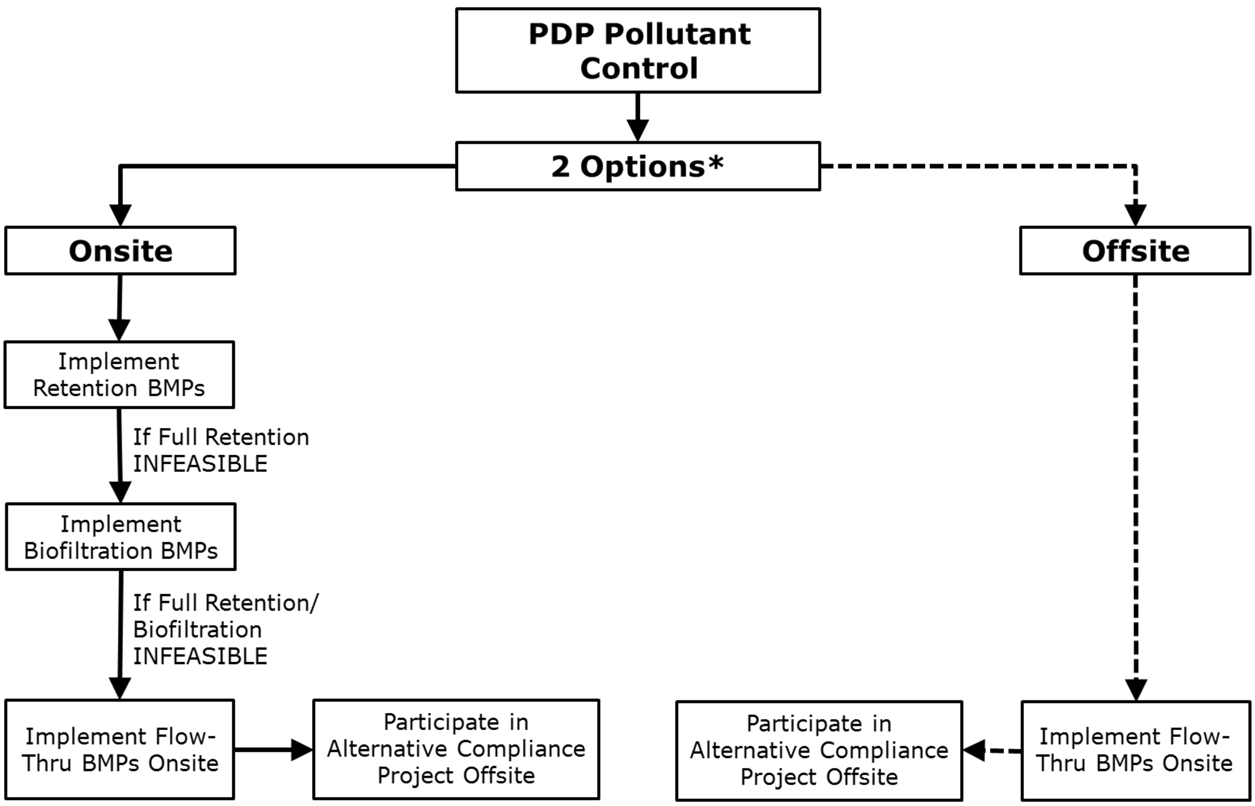
Participation in an offsite alternative compliance project <u>**and**</u> the obligation to implement flow-thru treatment controls for the DCV not reliably retained or biofiltered onsite, are linked and cannot be separated. Therefore, if a jurisdiction either does not have an alternative compliance program or does not allow the PDP to participate in the program or propose a project-specific offsite alternative compliance project, then the PDP may not utilize flow-thru treatment control. The PDP should consult with the jurisdiction regarding processing requirements if this is the case.

PDPs may be required to provide temporal mitigation when participating in an alternative compliance program.

Finally, if the PDP is allowed to participate in an offsite alternative compliance project that is constructed after the completion of the development project, the PDP must provide temporal mitigation to address this interim time period. Temporal mitigation must provide equivalent or better pollutant removal and/or hydrologic control (as applicable) as compared to the case where the offsite alternative compliance project is completed at the same time as the PDP.

Water Quality Equivalency calculations must be accepted by the Regional Board

The Water Quality Equivalency (WQE) calculation must be accepted by the San Diego Water Board's Executive Officer prior to administering an alternative compliance program. The Water Quality Equivalency provides currency calculations to assess water quality and hydromodification management benefits for a variety of potential offsite project types and provides regional and technical basis for demonstrating a greater water quality benefit for the watershed.



*PDP may be allowed to directly participate in an offsite project without demonstrating infeasibility of retention and/or biofiltration BMPs onsite. Consult the local jurisdiction for specific guidelines.

FIGURE 1-3. Pathways to Participating in Alternative Compliance Program

Applicability to Port Tidelands

The Port is currently evaluating options for establishing Alternative Compliance Program(s) for projects in the Port tidelands.

Applicant Implemented Alternative Compliance Project: If the Port does not establish and administer an alternative compliance program, it may allow an applicant to implement an alternative compliance project in lieu of complying on-site. In this scenario, the applicant is fully responsible for the alternative compliance project design, construction, operation and long term maintenance. Applicant proposed alternative compliance projects shall not be authorized by the Port prior to acceptance of the water quality equivalency calculations by the Regional Water Quality Board.

1.9 Relationship between this Manual and WQIPs

This manual is connected to other permit-specified planning efforts.

The MS4 Permit requires each Watershed Management Area within the San Diego Region to develop a **WQIP** that identifies priority and highest priority water quality conditions and strategies that will be implemented with associated goals to demonstrate progress towards addressing the conditions in the watershed. The MS4 Permit also provides an option to perform a **WMAA** as part of the WQIP to develop watershed specific requirements for structural BMP implementation in the watershed management area. PDPs should expect to consult either of these separate planning efforts as appropriate when using this manual as follows:

1. For PDPs that implement flow-thru treatment BMPs, selection of the type of BMP shall consider the pollutants and conditions of concerns. Among the selection considerations, the PDP must consult the highest priority water quality condition as identified in the WQIP for that particular watershed management area.

2. There may be watershed management area specific BMPs or strategies that are identified in WQIPs, for which PDPs should consult and incorporate as appropriate.

3. As part of the hydromodification management obligations that PDPs must comply with, PDPs shall consult the mapping of potential critical coarse sediment yield areas provided in the WMAA attachment to the WQIPs and design the project according to the procedures outlined in this manual if these sediments will be impacted by the project.

4. PDPs may be exempt from implementing hydromodification management BMPs (Chapter 6) based on the exemptions indicated in Section 1.6, and potentially from additional exemptions recommended in the WMAA attachment to the WQIPs. PDPs should consult the WMAA for recommended hydromodification management exemptions to determine if the project is eligible.

5. PDPs may have the option of participating in an alternative compliance program. Refer to Section 1.8.

These relationships between this manual and WQIPs are presented in Figure 1-4.

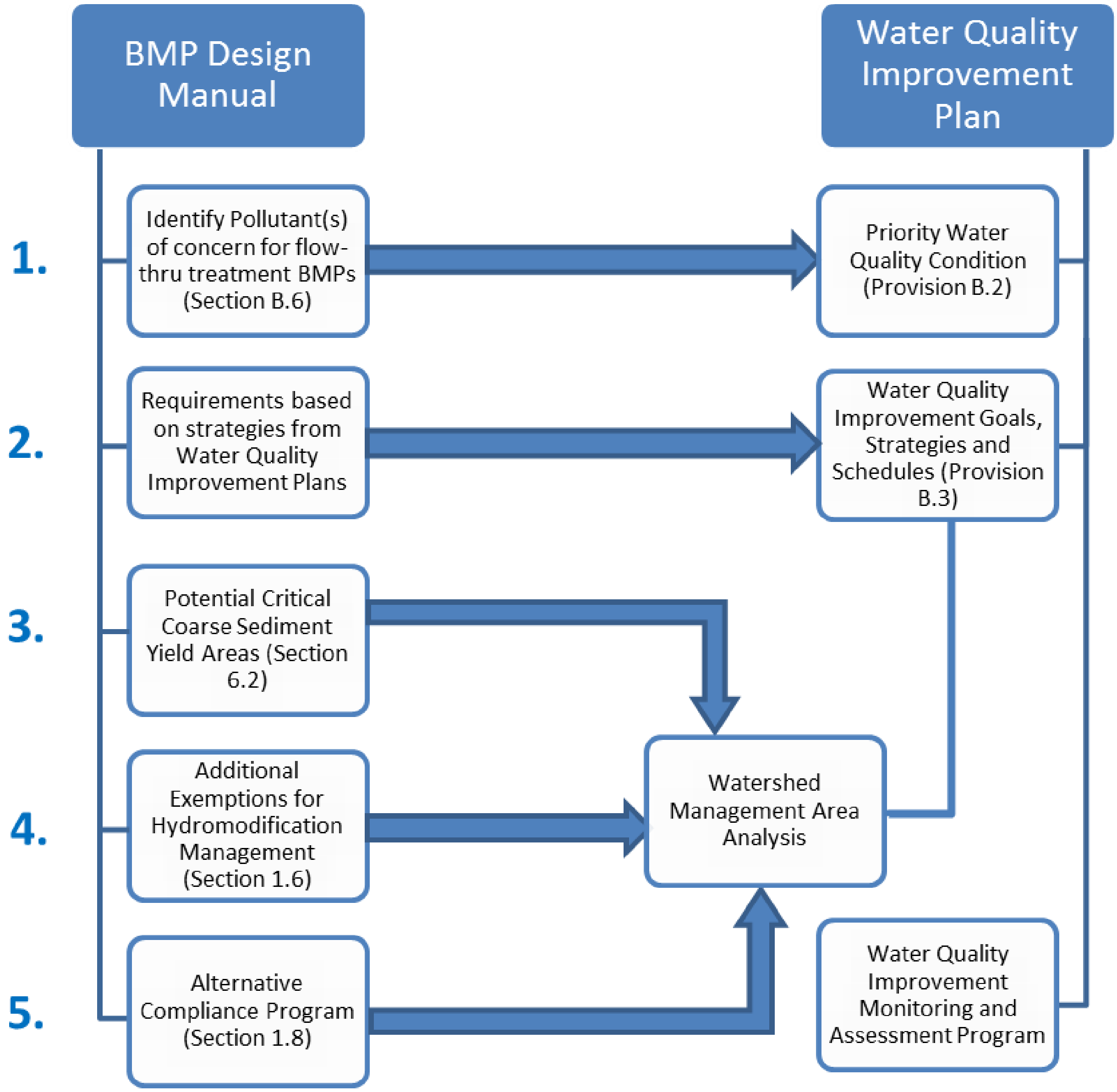


FIGURE 1-4. Relationship between this Manual and WQIP

The San Diego Bay WQIP is available at https://projectcleanwater.org/watersheds/san-diego-bay-wma/.

1.10 Project Review Procedures

Port of San Diego review of project plans for compliance with applicable requirements of this manual and the MS4 Permit.

SWQMPs submitted to the Port must be prepared using the templates available on the Port of San Diego website: https://www.portofsandiego.org/stormwater-management.

For Standard Projects, this means using forms and/or a Standard Project SWQMP or other equivalent documents approved by the Port to document that the following general requirements of the MS4

Permit are met, and showing applicable features onsite grading, building, improvement and landscaping plans:

- BMP Requirements for All Development Projects, which includes general requirements, source control BMP requirements, and narrative (i.e. not numerically-sized) site design requirements (MS4 Permit Provision E.3.a).

For PDPs, this means preparing a PDP SWQMP to document that the following general requirements of the MS4 Permit are met, and showing applicable features onsite grading and landscaping plans:

- BMP Requirements for All Development Projects, which includes general requirements for siting of permanent, post-construction BMPs, source control BMP requirements, and narrative (i.e. not numerically-sized) site design requirements (MS4 Permit Provision E.3.a);
- Storm Water Pollutant Control BMP Requirements, for numerically sized onsite structural BMPs to control pollutants in storm water (MS4 Permit Provision E.3.c.(1)); and
- Hydromodification Management BMP Requirements, which includes protection of critical sediment yield areas and numerically sized onsite BMPs to manage hydromodification that may be caused by storm water runoff discharged from a project (MS4 Permit Provision E.3.c.(2)).

Detailed submittal requirements are provided in Chapter 8 of this manual. Documentation of the permanent, post-construction storm water BMPs at the discretion of the Port must be provided with the **first** submittal of a project or another preliminary planning stage defined by the Port. Storm water requirements will directly affect the layout of the project. Therefore storm water requirements must be considered from the initial project planning phases, and will be reviewed with each submittal, beginning with the first submittal.

1.11 PDP Structural BMP Verification

MS4 Permit Provision E.3.e.(1)

Structural BMPs must be verified by the Port prior to project occupancy.

Pursuant to MS4 Permit Provision E.3.e.(1), each Copermittee must require and confirm the following with respect to PDPs constructed within their jurisdiction:

(a) Each Copermittee must require and confirm that appropriate easements and ownerships are properly recorded in public records and the information is conveyed to all appropriate parties when there is a change in project or site ownership.

(b) Each Copermittee must require and confirm that prior to occupancy and/or intended use of any portion of the PDP, each structural BMP is inspected to verify that it has been constructed and is operating in compliance with all of its specifications, plans, permits, ordinances, and the requirements of the MS4 permit.

For PDPs, this means that after structural BMPs have been constructed, the Port may request the tenant/project proponent provide a certification that the site improvements for the project have been constructed in conformance with the approved storm water management documents and drawings.

The professional in responsible charge for the design of the project must inspect the structural BMPs at each significant construction stage and at completion. Following construction, an addendum to the SWQMP and As Builts are required to address any changes to the structural BMPs that occurred during construction. A final update to the O&M Plan, and/or execution of a maintenance agreement will be recorded for the property.

Certification of structural BMPs, updates to reports, and recordation of a maintenance agreement may occur concurrently with project closeout, but could be required sooner per Port practices. In all cases, it is required prior to occupancy and/or intended use of the project. Specific procedures are provided in Chapter 8 of this manual.

Chapter 2

Performance Standards and Concepts

Projects must meet three separate performance standards, as applicable.

The MS4 Permit establishes separate performance standards for (1) source control and site design practices, (2) storm water pollutant control BMPs, and (3) hydromodification management BMPs. Chapter 1 provided guidance for determining which performance standards apply to a given project. This chapter defines these performance standards based on the MS4 Permit, and presents concepts that provide the project applicant with technical background, explains why the performance standards are important, and gives a general description of how these performance standards can be met. Detailed procedures for meeting the performance standards are presented in Chapters 4, 5, and 6.

Performance standards can be met through an integrated approach.

While three separate performance standards are defined by this manual, an overlapping set of design features can be used as part of demonstrating conformance to each standard. Further discussion of the relationship between performance standards is provided in Section 2.4.

2.1 Source Control and Site Design Requirements for All Development Projects

2.1.1 Performance Standards

MS4 Permit Provision E.3.a

This section defines performance standards for source control and site design practices that are applicable to all projects (regardless of project type or size; both Standard Projects and PDPs) when local permits are issued, including unpaved roads and flood management projects.

2.1.1.1 General Requirements

All projects shall meet the following general requirements:

(a) Onsite BMPs must be located so as to remove pollutants from runoff prior to its discharge to any receiving waters, and as close to the source as possible;

(b) Structural BMPs must not be constructed within waters of the United States (U.S.); and

(c) Onsite BMPs must be designed and implemented with measures to avoid the creation of nuisance or pollution associated with vectors (e.g. mosquitos, rodents, or flies).

2.1.1.2 Source Control Requirements

Pollutant source control BMPs are features that must be implemented to address specific sources of pollutants.

The following source control BMPs must be implemented at all development projects where applicable and technically feasible:

(a) Prevention of illicit discharges into the MS4;

(b) Storm drain system stenciling or signage;

(c) Protection of outdoor material storage areas from rainfall, run-on, runoff, and wind dispersal;

(d) Protection of materials stored in outdoor work areas from rainfall, run-on, runoff, and wind dispersal;

(e) Protection of trash storage areas from rainfall, run-on, runoff, and wind dispersal; and

(f) Use of any additional BMPs determined to be necessary by the Port to minimize pollutant generation at each project.

Further guidance is provided in Section 2.1.2 and Chapter 4.

2.1.1.3 Site Design Requirements

Site design requirements are qualitative requirements that apply to the layout and design of ALL development project sites (Standard Projects and PDPs).

Site design performance standards define minimum requirements for how a site must incorporate LID BMPs, including the location of BMPs and the use of integrated site design practices. The following site design practices must be implemented at all development projects, where applicable and technically feasible:

(a) Maintenance or restoration of natural storage reservoirs and drainage corridors (including topographic depressions, areas of permeable soils, natural swales, and ephemeral and intermittent streams)[2];

(b) Buffer zones for natural water bodies (where buffer zones are technically infeasible, require project applicant to include other buffers such as trees, access restrictions, etc.);

(c) Conservation of natural areas within the project footprint including existing trees, other vegetation, and soils;

(d) Construction of streets, sidewalks, or parking lot aisles to the minimum widths necessary, provided public safety is not compromised;

[2] Development projects proposing to dredge or fill materials in waters of the U.S. must obtain a Clean Water Act Section 401 Water Quality Certification. Projects proposing to dredge or fill waters of the state must obtain waste discharge requirements.

(e) Minimization of the impervious footprint of the project;

(f) Minimization of soil compaction to landscaped areas;

(g) Disconnection of impervious surfaces through distributed pervious areas;

(h) Landscaped or other pervious areas designed and constructed to effectively receive and infiltrate, retain and/or treat runoff from impervious areas, prior to discharging to the MS4;

(i) Small collection strategies located at, or as close as possible to, the source (i.e. the point where storm water initially meets the ground) to minimize the transport of runoff and pollutants to the MS4 and receiving waters;

(j) Use of permeable materials for projects with low traffic areas and appropriate soil conditions;

(k) Landscaping with native or drought tolerant species; and

(l) Harvesting and using precipitation.

A key aspect of this performance standard is that these design features must be used where applicable and feasible. Responsible implementation of this performance standard depends on evaluating applicability and feasibility. Further guidance is provided in Section 2.1.2 and Chapter 4.

Additional site design requirements may apply to PDPs.

Site design decisions may influence the ability of a PDP to meet applicable performance standards for pollutant control and hydromodification management BMPs (as defined in Section 2.2 and 2.3). For example, the layout of the site drainage and reservation of areas for BMPs relative to areas of infiltrative soils may influence the feasibility of capturing and managing storm water to meet storm water pollutant control and/or hydromodification management requirements. As such, the Port may require additional site design practices, beyond those listed above, to be considered and documented as part of demonstrating conformance to storm water pollutant control and hydromodification management requirements.

2.1.2 Concepts and References

Land development tends to increase the amount of pollutants in storm water runoff.

Land development generally alters the natural conditions of the land by removing vegetative cover, compacting soil, and/or placement of concrete, asphalt, or other impervious surfaces. These impervious surfaces facilitate entrainment of urban pollutants in storm water runoff (such as pesticides, petroleum hydrocarbons, heavy metals, and pathogens) that are otherwise not generally found in high concentrations in the runoff from the natural environment. Pollutants that accumulate on impervious surfaces and actively landscaped pervious surfaces may contribute to elevated levels of pollutants in runoff relative to the natural condition.

Land development also impacts site hydrology.

Impervious surfaces greatly affect the natural hydrology of the land because they do not allow natural infiltration, retention, evapotranspiration and treatment of storm water runoff to take place. Instead, storm water runoff from impervious surfaces is typically and has traditionally been directed through pipes, curbs, gutters, and other hardscape into receiving waters, with little treatment, at significantly increased volumes and accelerated flow rates over what would occur naturally. The increased pollutant loads, storm water volume, discharge rates and velocities, and discharge durations from the MS4 adversely impact stream habitat by causing accelerated, unnatural erosion and scouring within creek beds and banks. Compaction of pervious areas can have a similar effect to impervious surfaces on natural hydrology.

Site Design LID involves attempting to maintain or restore the predevelopment hydrologic regime.

LID is a comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds. LID designs seeks to control storm water at the source, using small-scale integrated site design and management practices to mimic the natural hydrology of a site, retain storm water runoff by minimizing soil compaction and impervious surfaces, and disconnecting storm water runoff from conveyances to the storm drain system. Site Design LID BMPs may utilize interception, storage, evaporation, evapotranspiration, infiltration, and filtration processes to retain and/or treat pollutants in storm water before it is discharged from a site. Examples of Site Design LID BMPs include using permeable pavements, rain gardens, rain barrels, grassy swales, soil amendments, and native plants.

Site design must be considered early in the design process.

Site designs tend to be more flexible in the early stages of project planning than later on when plans become more detailed. Because of the importance of the location of BMPs, site design shall be considered as early as the planning/tentative design stage. Site design is critical for feasibility of storm water pollutant control BMPs (Section 2.2) as well as coarse sediment supply considerations associated with hydromodification management (introduced in Section 2.3).

Source control and site design (LID) requirements help avoid impacts by controlling pollutant sources and changes in hydrology.

Source control and site design practices prescribed by the MS4 Permit are the minimum management practices, control techniques and system, design and engineering methods to be included in the planning procedures to reduce the discharge of pollutants from development projects, regardless of size or purpose of the development. In contrast to storm water pollutant control BMPs and hydromodification control BMPs which are intended to mitigate impacts, source control and site design BMPs are intended to avoid or minimize these impacts by managing site hydrology, providing treatment features integrated within the site, and reducing or preventing the introduction of pollutants from specific sources. Implementation of site design BMPs will result in reduction in storm water runoff generated by the site. Methods to estimate effective runoff coefficients and the storm water runoff produced by the site after site design BMPs are implemented are` presented in Appendix B.2. This methodology is applicable for PDPs that are required to estimate runoff produced from the site with site design BMPs implemented so that they can appropriately size storm water pollutant control BMPs and hydromodification control BMPs.

The location of BMPs matters.

The site design BMPs listed in the performance standard include practices that either prevent runoff from occurring or manage runoff as close to the source as possible. This helps create a more hydrologically effective site and reduces the requirements that pollutant control and hydromodification control BMPs must meet, where required. Additionally, because sites may have spatially-variable conditions, the locations reserved for structural BMPs within the site can influence whether these BMPs can feasibly retain, treat, and/or detain storm water to comply with structural pollutant control and hydromodification control requirements, where applicable. Finally, the performance standard specifies that onsite BMPs must remove pollutants from runoff prior to discharge to any receiving waters or the MS4, be located/constructed as close to the pollutant generating source as possible and must not be constructed within waters of the U.S.

The selection of BMPs also matters.

The lists of source control and site design BMPs specified in the performance standard must be used "where applicable and feasible." This is an important concept – BMPs should be selected to meet the R9-2013-0001 permit requirements and are feasible with consideration of site conditions and project type. By using BMPs that are applicable and feasible, the project can achieve benefits of these practices, while not incurring unnecessary expenses (associated with using practices that do not apply or would not be effective) or creating undesirable conditions (for example, infiltration-related issues, vector concerns including mosquito breeding, etc.).

Methods to select and design BMPs and demonstrate compliance with source control and site design requirements are presented in Chapter 4 of this manual.

2.2 Storm Water Pollutant Control Requirements for PDPs

2.2.1 Storm Water Pollutant Control Performance Standard

MS4 Permit Provision E.3.c.(1)

Storm Water Pollutant Control BMPs for PDPs shall meet the following performance standards:

(a) Each PDP shall implement BMPs that are designed to retain (i.e. intercept, store, infiltrate, evaporate, and evapotranspire) onsite the pollutants contained in the volume of storm water runoff produced from a 24-hour, 85th percentile storm event (Design Capture Volume (DCV)). The 24-hour, 85th percentile storm event shall be based on Figure B.1-1 in Appendix B or an approved site-specific rainfall analysis.

(i) If it is not technically feasible to implement retention BMPs for the full DCV onsite for a PDP, then the PDP shall utilize biofiltration BMPs or approved equivalent compact proprietary biofiltration systems for the remaining volume not reliably retained.

[a]. Biofiltration BMPs must be designed as described in Appendix F to have an appropriate hydraulic loading rate to maximize storm water retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP, and must be sized to:

1. Treat 1.5 times the DCV not reliably retained onsite, OR
2. Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite.

[b]. Approved equivalent compact proprietary biofiltration systems use a combination of treatment devices and additional site design BMPs that, as a system, have an equal or greater effectiveness when compared to standard biofiltration BMPs. While these systems, unlike biofiltration BMPs, do not provide the full required amounts of both treatment and retention in the same device or site feature, because they are equally effective to biofiltration they meet the MEP standard as defined in Attachment C of the MS4 Permit. Approved equivalent compact proprietary biofiltration systems must be designed as described below:

1. Demonstrate that the BMP meets applicable effectiveness certifications, e.g., Washington (State) Technology Acceptance Protocol-Ecology (TAPE), and the proposed use of the BMP is in accordance with criteria in the certification (e.g., treatment flow rate), as described in Appendix F.2.1; AND
2. Treat the DCV not reliably retained onsite with a flow-thru design sized in accordance with Appendix F.2.2 and Worksheet F.2-1 (Flow Based Sizing for Proprietary Biofiltration); AND
3. Incorporate additional site design BMPs as necessary to achieve stormwater retention equivalent to what would have been achieved using biofiltration BMPs as described earlier in this section, and as described in Appendix F, Appendix B.5, and worksheet F.2-2 (Target Volume Retention Criteria). Worksheet F.2-3 (Volume Retention for Site Design BMPs) must also be completed as applicable.

(ii) If biofiltration BMPs or approved equivalent compact proprietary biofiltration systems are not technically feasible, then the PDP shall utilize flow-thru treatment control BMPs (selected and designed per Appendix B.6) to treat runoff leaving the site, AND participate in alternative compliance to mitigate for the pollutants from the DCV not reliably retained onsite pursuant to Section 2.2.1.(b). Flow-thru treatment control BMPs must be sized and designed to:

[a]. Remove pollutants from storm water to the MEP (defined by the MS4 Permit) by following the guidance in Appendix B.6; and

[b]. Filter or treat either: 1) the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of a storm event, or 2) the maximum flow rate of runoff produced by the 85th percentile hourly rainfall intensity (for each hour of a storm event), as determined from the local historical rainfall record, multiplied by a factor of two (both methods may be adjusted for the portion of the DCV retained onsite as described in Appendix B.6) and

[c]. Meet the flow-thru treatment control BMP treatment performance standard described in Appendix B.6.

(b) A PDP may be allowed to participate in an alternative compliance program in lieu of fully complying with the performance standards for storm water pollutant control BMPs onsite. The Port is currently evaluating options for establishing Alternative Compliance Programs(s) for projects in the Port tidelands, see Section 1.8. When an alternative compliance program is utilized:

(i) The PDP must mitigate for the portion of the DCV not reliably retained onsite and

(ii) Flow-thru treatment control BMPs must be implemented to treat the portion of the DCV that is not reliably retained onsite. Flow-thru treatment control BMPs must be selected and sized in accordance with Appendix B.6.

(iii) A PDP may be allowed to propose an alternative compliance project not identified in the WMAA of the WQIP if the requirements in Section 1.8 are met at the discretion of the Port.

Demonstrations of feasibility findings and calculations to justify BMP selection and design shall be provided by the project applicant in the SWQMP to the satisfaction of the Port. Methodology to demonstrate compliance with the performance standards, described above, applicable to storm water pollutant control BMPs for PDPs is detailed in Chapter 5.

2.2.2 Concepts and References

Retention BMPs are the most effective type of BMPs to reduce pollutants discharging to MS4s when they are sited and designed appropriately.

Retention of the required DCV will achieve 100 percent pollutant removal efficiency (i.e. prevent pollutants from discharging directly to the MS4). Thus, retention of as much storm water onsite as technically feasible is the most effective way to reduce pollutants in storm water discharges to, and consequently from the MS4, and remove pollutants in storm water discharges from a site to the MEP.

However, in order to accrue these benefits, retention BMPs must be technically feasible and suitable for the project. Retention BMPs that fail prematurely, under-perform, or result in unintended consequences as a result of improper selection or siting may achieve performance that is inferior to other BMP types while posing other issues for the tenant/project proponent and the Port. Therefore, this manual provides criteria for evaluating feasibility and provides options for other types of BMPs to be used if retention is not technically feasible.

Biofiltration BMPs or approved equivalent compact proprietary biofiltration systems can be sized to achieve approximately the same pollutant removal as retention BMPs.

In the case, where the entire DCV cannot be retained onsite because it is not technically feasible, PDPs are required to use biofiltration BMPs with specific sizing and design criteria listed in Appendix B.5 and Appendix F or approved equivalent compact proprietary biofiltration systems. Sizing and design criteria for approved equivalent compact proprietary biofiltration systems are also included in Appendix B.5 and Appendix F, with specific details and worksheets included in Appendix F.2. These sizing and design criteria are intended to provide a level of long term pollutant removal that is reasonably equivalent to retention of the DCV.

Flow-thru treatment BMPs are required to treat the pollutant loads in the DCV not retained or biofiltered onsite to the MEP.

If the pollutant loads from the full DCV cannot feasibly be retained or biofiltered onsite, then PDPs are required to implement flow-thru treatment control BMPs to remove the pollutants to the MEP for the portion of the DCV that could not be feasibly retained or biofiltered. Flow-thru treatment

BMPs may only be implemented to address onsite storm water pollutant control requirements if coupled with an offsite alternative compliance project that mitigates for the portion of the pollutant load in the DCV not retained or biofiltered onsite.

Offsite Alternative Compliance Program may be available.

The MS4 Permit allows the Copermittee to grant PDPs permission to utilize an alternative compliance program for meeting the pollutant control performance standard. Onsite and offsite mitigation is required when a PDP is allowed to use an alternative compliance program. The existence and specific parameters of an alternative compliance program will be specific to each jurisdiction if one is available (Refer to Section 1.8).

Methods to design and demonstrate compliance with storm water pollutant control BMPs are presented in Chapter 5 of this manual. Definitions and concepts that should be understood when sizing storm water pollutant control BMPs to be in compliance with the performance standards are explained below:

2.2.2.1 Best Management Practices

To minimize confusion, this manual considers all references to "facilities," "features," or "controls" to be incorporated into development projects as BMPs.

2.2.2.2 DCV

The MS4 Permit requires pollutants be addressed for the runoff from the 24-hour 85th percentile storm event ("DCV") as the design standard to which PDPs must comply.

The 85th percentile, 24-hour storm event is the event that has a precipitation total greater than or equal to 85 percent of all storm events over a given period of record in a specific area or location. For example, to determine what the 85th percentile storm event is in a specific location, the following steps would be followed:

- Obtain representative precipitation data, preferably no less than 30-years period if possible.
- Divide the recorded precipitation into 24-hour precipitation totals.
- Filter out events with no measurable precipitation (less than 0.01 inches of precipitation).
- Of the remaining events, calculate the 85th percentile value (i.e. 15 percent of the storms would be greater than the number determined to be the 85th percentile, 24-hour storm).

The 85th percentile, 24-hour storm event depth is then used in hydrologic calculations to calculate the DCV for sizing storm water pollutant control BMPs. An exhibit showing the 85th percentile, 24-hour storm depth across San Diego County and the methodology used to develop this exhibit is included in Appendix B.1.3. Guidance to estimate the DCV is presented in Appendix B.1.

2.2.2.3 Implementation of Storm Water Pollutant Control BMPs

The MS4 Permit requires that the PDP applicants proposing to meet the performance standards onsite implement storm water pollutant control BMPs in the order listed below. That is, the PDP applicant first needs to implement **all** feasible onsite retention BMPs needed to meet the storm water pollutant control BMP requirements prior to installing onsite biofiltration BMPs, and then onsite biofiltration

BMPs prior to installing onsite flow-thru treatment control BMPs.

PDPs may be allowed to participate in an alternative compliance program. Refer to Section 1.8 for additional guidance.

Retention BMPs: Structural measures that provide retention (i.e. intercept, store, infiltrate, evaporate and evapotranspire) of storm water as part of pollutant control strategy. Examples include infiltration BMPs and cisterns, bioretention BMP's and biofiltration with partial retention BMP's.

Biofiltration BMPs: Structural measures that provide biofiltration of storm water as part of the pollutant control strategy. Example includes Biofiltration BMP's.

Approved equivalent compact proprietary biofiltration systems: Approved equivalent compact proprietary biofiltration systems use a combination of treatment devices and additional site design BMPs that, as a system, have an equal or greater effectiveness than biofiltration BMPs. While these systems, unlike biofiltration BMPs, do not provide the full required amounts of both treatment and retention in the same device or site feature, because they are equally effective to biofiltration they meet the MEP standard as defined in Attachment C of the MS4 Permit. The treatment devices in an approved equivalent compact proprietary biofiltration system must meet the requirements in Appendix B.5 and Appendix F.

Flow-thru treatment control BMPs: Structural measures that provide flow-thru treatment as part of the pollutant control strategy. Examples include vegetated swales and media filters.

For example, if the DCV from a site is 10,000 cubic feet (ft^3) and it is technically feasible to implement 2,000 ft^3 of retention BMPs and 9,000 ft^3 of biofiltration BMPs sized using Section 2.2.1.(a)(i)[a], and the jurisdiction has an alternative compliance program to satisfy the requirements of this manual the project applicant should:

1) First, design retention BMPs for 2,000 ft^3.
2) Then complete a technical feasibility form for retention BMPs (included in Appendix C and D) demonstrating that it's only technically feasible to implement retention BMPs for 2,000 ft^3.
3) Then design biofiltration BMPs for 9,000 ft^3 (calculate equivalent volume for which the pollutants are retained = 9,000/1.5 = 6,000 ft^3).
4) Then complete a technical feasibility for biofiltration BMPs and approved equivalent compact proprietary biofiltration systems demonstrating that it's only technically feasible to implement biofiltration BMPs or approved equivalent compact proprietary biofiltration systems for 9,000 ft^3.
5) Estimate the DCV that could not be retained or biofiltered = 10,000 ft^3 – (2,000 ft^3 + 6,000 ft^3) = 2,000 ft^3.
6) Implement flow-thru treatment control BMPs to treat the pollutants in the remaining 2,000 ft^3. Refer to Appendix B.6 for guidance for designing flow-thru treatment control BMPs.
7) Also participate in an alternative compliance project for 2,000 ft^3. Refer to Section 1.8 for additional guidance on participation in an alternative compliance program.

2.2.2.4 Technical Feasibility

MS4 Permit Requirement E.3.c.(5)

Analysis of technical feasibility is necessary to select the appropriate BMPs for a site.

PDPs are required to implement pollutant control BMPs in the order of priority in Section 2.2.2.3 based on determinations of technical feasibility. In order to assist the project applicant in selecting BMPs, this manual includes a defined process for evaluating feasibility. Conceptually, the feasibility criteria contained in this manual are intended to:

- Promote reliable and effective long term operations of BMPs by providing a BMP selection process that eliminates the use of BMPs that are not suitable for site conditions, project type or other factors;
- Minimize significant risks to property, human health, and/or environmental degradation (e.g. geotechnical stability, groundwater quality) as a result of selection of BMPs that are undesirable for a given site; and
- Describe circumstances under which regional and watershed-based strategies may be selected.

Steps for performing technical feasibility analyses are described in detail in Chapter 5. More specific guidance related to geotechnical investigation guidelines for feasibility of storm water infiltration and groundwater quality and water balance factors is provided in Appendices C and D, respectively.

2.2.2.5 Biofiltration BMPs

The MS4 Permit requires Biofiltration BMPs be designed to have an appropriate hydraulic loading rate to maximize storm water retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP. Appendix F of this manual has guidance for hydraulic loading rates and other biofiltration design criteria to meet these required goals. Appendix F also has a checklist that will need to be completed by the project SWQMP preparer during plan submittal. Guidance for sizing Biofiltration BMPs is included in Chapter 5 and Appendices B.5 and F.

2.2.2.6 Flow-thru Treatment Control BMPs (for use with Alternative Compliance)

MS4 Permit Requirement E.3.d.2-3

The MS4 Permit requires that the flow-thru treatment control BMP selected by the PDP applicant be ranked with high or medium pollutant removal efficiency for the most significant pollutant of concern. Steps to select the flow-thru treatment control BMP include:

- Step 1: Identify the pollutant(s) of concern by considering the following at a minimum a) Receiving water quality; b) Highest priority water quality conditions identified in the Watershed Management Areas Water Quality Improvement Plan; c) Land use type of the project and pollutants associated with that land use type and d) Pollutants expected to be present onsite
- Step 2: Identify the most significant pollutant of concern. A project could have multiple most significant pollutants of concerns and shall include the highest priority water quality condition identified in the watershed WQIP and pollutants expected to be presented onsite/from land

use.

- Step 3: Effectiveness of the flow-thru treatment control BMP for the identified most significant pollutant of concern

Methodology for sizing flow-thru treatment control BMPs and the resources required to identify the pollutant(s) of concern and effectiveness of flow-thru treatment control BMPs are included in Chapter 5 and Appendix B.6.

2.3 Hydromodification Management Requirements for PDPs

2.3.1 Hydromodification Management Performance Standards

MS4 Permit Provision E.3.c.(2)

This section defines performance standards for hydromodification management, including flow control of post-project storm water runoff and protection of critical sediment yield areas, that shall be met by all PDPs unless exempt from hydromodification management requirements per Section 1.6 of this manual. Each PDP shall implement onsite BMPs to manage hydromodification that may be caused by storm water runoff discharged from a project as follows:

(a) Post-project runoff conditions (flow rates and durations) must not exceed pre-development runoff conditions by more than 10 percent (for the range of flows that result in increased potential for erosion, or degraded instream habitat downstream of PDPs).

  (i) In evaluating the range of flows that results in increased potential for erosion of natural (non-hardened) channels, the lower boundary must correspond with the critical channel flow that produces the critical shear stress that initiates channel bed movement or that erodes the toe of channel banks.

  (ii) The Copermittees may use monitoring results collected pursuant to Provision D.1.a.(2) of the MS4 permit to re-define the range of flows resulting in increased potential for erosion, or degraded instream habitat conditions, as warranted by the data.

(b) Each PDP must avoid critical sediment yield areas known to the Copermittee or identified by the optional WMAA pursuant to Provision B.3.b.(4) of the MS4 permit, or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water.

(c) A PDP may be allowed to utilize alternative compliance under Provision E.3.c.(3) of the MS4 permit in lieu of complying with the performance requirements of Provision E.3.c.(2)(a). The PDP must mitigate for the post-project runoff conditions not fully managed onsite if Provision E.3.c.(3) is utilized.

Hydromodification management requirements apply to both new development and redevelopment PDPs, except those that are exempt based on discharging to downstream channels or water bodies that are not subject to erosion, as defined in either the MS4 Permit (Provision E.3.c.(2).(d)) or the WMAA for the watershed in which the project resides. Exemptions from hydromodification management requirements are described in Section 1.6 of this manual.

For undisturbed sites, the existing condition shall be taken to be the pre-development runoff condition. For redevelopment PDPs or sites that have been previously disturbed, pre-development runoff conditions shall be approximated by applying the parameters of a pervious area rather than an impervious area to the existing site, using the existing onsite grade and assuming the infiltration characteristics of the underlying soil.

For San Diego area watersheds, the range of flows that result in increased potential for erosion or degraded instream habitat downstream of PDPs and the critical channel flow shall be based on the "Final Hydromodification Management Plan Prepared for County of San Diego, California March 2011" (herein, "March 2011 Final HMP"). For PDPs subject to hydromodification management requirements, the range of flows to control depends on the erosion susceptibility of the receiving stream and shall be:

- 0.1Q2 to Q10 for streams with high susceptibility to erosion (this is the default range of flows to control when a stream susceptibility study has not been prepared);
- 0.3Q2 to Q10 for streams with medium susceptibility to erosion and which has a stream susceptibility study prepared and approved by the Port; or
- 0.5Q2 to Q10 for streams with low susceptibility to erosion and which has a stream susceptibility study prepared and approved by the Port.

Tools for assessing stream susceptibility to erosion have been developed by Southern California Coastal Water Research Project (SCCWRP). The tools are presented in the March 2011 Final HMP and also available through SCCWRP's website. If a PDP intends to select the 0.3Q2 or 0.5Q2 threshold, the SCCWRP screening tool must be completed and submitted with other project documentation.

The March 2011 Final HMP does not provide criteria for protection of critical sediment yield areas. The standard as presented in the MS4 Permit and shown above is: avoid critical sediment yield areas or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water.

Methods to demonstrate compliance with hydromodification management requirements, including protection of critical coarse sediment yield areas and flow control for post-project runoff from the project site, are presented in Chapter 6 of this manual. Hydromodification management concepts, theories, and references are described below.

2.3.2 Hydromodification Management Concepts and References

2.3.2.1 What is Hydromodification?

The MS4 Permit defines hydromodification as the change in the natural watershed hydrologic processes and runoff characteristics (i.e. interception, infiltration, overland flow, and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport. In addition, alteration of stream and river channels, such as stream channelization, concrete lining, installation of dams and water impoundments, and excessive streambank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Typical impacts to natural watershed hydrologic processes and runoff characteristics resulting from new development and redevelopment include:

- Decreased interception and infiltration of rainfall at the project site due to removal of native vegetation, compaction of pervious area soils, and the addition of impervious area;
- Increased connectivity and efficiency of drainage systems serving the project site, including concentration of project-site runoff to discrete outfalls;
- Increased runoff volume, flow rate, and duration from the project site due to addition of impervious area, removal of native vegetation, and compaction of pervious area soils;
- Reduction of critical coarse sediment supply from the project site to downstream natural systems (e.g. streams) due to stabilization of developed areas, stabilization of streams, and addition of basins that trap sediment (either by design as a permanent desilting basin or storm water quality treatment basin that settles sediment, or incidentally as a peak flow management basin); and
- Interruption of critical coarse sediment transport in streams due to stream crossings such as culverts or ford crossings that incidentally slow stream flow and allow coarse sediment to settle upstream of the crossing.

Any of these changes can result in increased potential for erosion, or degraded instream habitat downstream of PDPs. The changes to delivery of runoff to streams typically modify the timing, frequency, magnitude, and duration of both storm flows and baseflow. Changes to delivery of coarse sediment and transport of coarse sediment result in increased transport capacity and the potential for adverse channel erosion.

Note that this manual is intended for design of permanent, post-construction BMPs, therefore this discussion is focused on the permanent, post-construction effects of development. The process of construction also has impacts, such as a temporary increase in sediment load produced from surfaces exposed by vegetation removal and grading, which is often deposited within stream channels, initiating aggradation and/or channel widening. Temporary construction BMPs to mitigate the sediment delivery are outside the purview of this manual.

Channel erosion resulting from PDP storm water discharge can begin at the point where runoff is discharged to natural systems, regardless of the distance from the PDP to the natural system. It could also begin some distance downstream from the actual discharge point if the stream condition is stable at the discharge point but more susceptible to erosion at a downstream location. The March 2011 HMP defines a domain of analysis for evaluation of stream susceptibility to erosion from PDP storm water discharge.

2.3.2.2 How Can Hydromodification be Controlled?

In the big picture, watershed-scale solutions are necessary to address hydromodification. Factors causing hydromodification are watershed-wide, and all of San Diego's major watersheds include some degree of legacy hydromodification effects from existing development and existing channel modifications, which cannot be reversed by onsite measures implemented at new development and redevelopment projects alone. As recommended by SCCWRP in Technical Report 667, "Hydromodification Assessment and Management in California," dated April 2012, "management strategies should be tailored to meet the objectives, desired future conditions, and constraints of the specific channel reach being addressed," and "potential objectives for specific stream reaches may include: protect, restore, or manage as a new channel form."

Development of such management strategies and objectives for San Diego watersheds will evolve over successive MS4 Permit cycles. The current MS4 Permit requires the Copermittees to prepare WQIPs for all Watershed Management Areas within the San Diego Region. The WQIPs may include WMAAs which would assess watershed-wide hydrologic processes. These documents may be used to develop watershed-specific requirements for structural BMP implementation, including watershed-scale hydromodification management strategies.

This manual addresses development and redevelopment project-level hydromodification management measures currently required for PDPs by the MS4 Permit. Until optional watershed-specific performance recommendations or alternative compliance programs are developed, hydromodification management strategies for new development and redevelopment projects will consist of onsite measures designed to meet the performance requirements of Provisions E.3.c.(2).(a) and (b) of the MS4 Permit shown in Section 2.3.1. While development project-level measures alone will not reverse hydromodification of major streams, onsite measures are a necessary component of a watershed-wide solution, particularly while watershed-wide management strategies are still being developed. Also, development project-level measures are necessary to protect a project's specific storm water discharge points, which are typically discharging in smaller tributaries not studied in detail in larger watershed studies. Typical measures for development projects include:

- Protecting critical sediment yield areas by designing the project to avoid them or implementing measures that would allow coarse sediment to be discharged to receiving waters, such that the natural sediment supply is unaffected by the project;
- Using site design/LID measures to minimize impervious areas onsite and reduce post-project runoff; and
- Providing structural BMPs designed using continuous simulation hydrologic modeling to provide flow control of post-project runoff (e.g. BMPs that store post-project runoff and infiltrate, evaporate, harvest and use, or discharge excess runoff at a rate below the critical flow rate).

Structural BMPs for hydromodification management provide volume to control a range of flows from a fraction of Q2 to Q10. The volume determined for hydromodification management is different from the DCV for pollutant control. Methodology to demonstrate compliance with hydromodification management requirements are presented in Chapter 6 of this manual. See Section 2.4 regarding the relationship between pollutant control and hydromodification management performance standards.

2.4 Relationship between Performance Standards

An integrated approach can provide significant cost savings by utilizing design features that meet multiple standards.

Site design/LID, storm water pollutant control, and hydromodification management are separate requirements to be addressed in development project design. Each has its own purpose and each has separate performance standards that must be met. However, effective project planning involves understanding the ways in which these standards are related and how single suites of design features can meet more than one standard.

Site design features (aka LID) can be effective at reducing the runoff to downstream BMPs.

Site design BMPs serve the purpose of minimizing impervious areas and therefore reducing post-project runoff, and reducing the potential transport of pollutants offsite and reducing the potential for downstream erosion caused by increased flow rates and durations. By reducing post-project runoff through, site design BMPs, the amount of runoff that must be managed for pollutant control and hydromodification flow control can be reduced.

Single structural BMPs, particularly retention BMPs, can meet or contribute to both pollutant control and hydromodification management objectives.

The objective of structural BMPs for pollutant control is to reduce offsite transport of pollutants, and the objective of structural BMPs for hydromodification management is to control flow rates and durations for control of downstream erosion. In either case, the most effective structural BMP to meet the objective are BMPs that are based on retention of storm water runoff where feasible. Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). However, demonstrating that the separate performance requirements for pollutant control and hydromodification management are met must be shown separately.

The design process should start with an assessment of the feasibility to retain or partially retain the DCV for pollutant control, then determine what kind of BMPs will be used for pollutant control and hydromodification management.

A typical design process for a single structural BMP to meet two separate performance standards at once involves (1) initiating the structural BMP design based on the performance standard that is expected to require the largest volume of storm water to be retained, (2) checking whether the initial design incidentally meets the second performance standard, and (3) adjusting the design as necessary until it can be demonstrated that both performance standards are met.

Chapter

3

Development Project Planning and Design

Compliance with source control/site design, pollutant control, and hydromodification management BMPs, as applicable, requires coordination of site, landscape, and project storm water plans. It also involves provisions for O&M of structural BMPs. In order to effectively comply with applicable requirements, a step-wise approach is recommended. This chapter outlines a step-wise, systematic approach (Figure 3-1) to preparing a comprehensive storm water management design for Standard Projects and PDPs.

STEP 1: **Coordinate Between Disciplines** Refer to Section 3.1	*Purpose:* Engage and coordinate with tenant/project proponent and other project disciplines (e.g. architect, engineer) early in the design and throughout the design process to support appropriate project decisions.
STEP 2: **Gather Project Site Information** Refer to Section 3.2	*Purpose:* Gather information necessary to inform overall storm water planning process and specific aspects of BMP selection; determine the applicable storm water requirements for the project.
STEP 3: **Develop Conceptual Site Layout and Storm Water Control Strategies** Refer to Section 3.3	*Purpose:* Use the information obtained in Step 2 to inform the preliminary site design and storm water management strategy. The scope of this step varies depending on whether the project is a Standard Project or a PDP.
STEP 4: **Develop Complete Storm Water Management Design** Refer to Section 3.4	*Purpose:* Develop the complete storm water management design by incorporating the site design and storm water management strategies identified in Step 3 and conducting design level analyses. Integrate the storm water design with the site plan and other infrastructure plans.

FIGURE 3-1. Approach for Developing a Comprehensive Storm Water Management Design

A step-wise approach is not mandatory, and adaptation of this step-wise approach to better fit with unique project features is encouraged. However, taking a step-wise, systematic approach of some sort for planning and design has a number of advantages. First, it helps ensure that applicable requirements and design goals are identified early in the process. Secondly, it helps ensure that key data about the site, watershed, and project are collected at the appropriate time in the project development process, and the analyses are suited to the decisions that need to be made at each phase. Third, taking a systematic approach helps identify opportunities for retention of storm water that may not be identified in a less systematic process. Finally, a systematic approach helps ensure that constraints and unintended consequences are considered and used to inform BMP selection and design, and related project decisions.

Port specific special requirements are listed in Section 3.5 and requirements for phased projects are in Section 3.6.

3.1 Coordination Between Disciplines

Storm water management design requires close coordination between multiple disciplines, as storm water management design will affect the site layout and should therefore be coordinated among the project team as necessary from the start. The following list describes entities/disciplines that are frequently involved with storm water management design and potential roles that these entities/disciplines may plan.

Tenant/Project Proponent:

- Engage the appropriate disciplines needed for the project and facilitate exchange of information between disciplines.
- Identify who will be responsible for long term O&M of storm water management features, and initiate maintenance agreements when applicable.
- Ensure that whole lifecycle costs are considered in the selection and design of storm water management features and a source of funding is provided for long term maintenance.
- Identify the party responsible to inspect structural BMPs at each significant construction stage and at completion in order to provide certification of structural BMPs following construction.

Planner:

- Communicate overall project planning criteria to the team, such as planned development density, parking requirements, project-specific planning conditions, conditions of approval from prior entitlement actions (e.g. CEQA, 401 certifications), etc. and locations of open space and conservation easements and environmentally sensitive areas that are protected from disturbance), etc.
- Consider location of storm water facilities early in the conceptual site layout process.
- Assist in developing the site plan.

Architect:

- Participate in siting and design (architectural elements) of storm water BMPs.

Civil Engineer:

- Determine storm water requirements applicable to the site (e.g. Standard Project vs. PDP).
- Obtain site-specific information (e.g. watershed information, infiltration rates) and develop viable storm water management options that meet project requirements.
- Reconcile storm water management requirements with other site requirements (e.g. fire access, Americans with Disabilities Act accessibility, parking, open space).

- Develop site layout and site design including preliminary and final design documents or plans.
- Select and design BMPs; conduct and document associated analyses; prepare BMP design sheets, details, and specifications.
- Prepare project SWQMP submittals.

Landscape Architect and/or Horticulturist/Agronomist:

- Select appropriate plants for vegetated storm water features, BMPs and prepare planting plans.
- Develop specifications for planting, vegetation establishment, and maintenance.
- Assist in developing irrigation plans/rates to minimize water application and non-storm water runoff from the project site.

Geotechnical Engineer

- Assist in preliminary infiltration feasibility screening of the site to help inform project layout and initial BMP selection, including characterizing soil, groundwater, geotechnical hazards, utilities, and any other factors, as applicable for the site.
- Conduct detailed analyses at proposed infiltration BMP locations to confirm or revise feasibility findings and provide design infiltration rates.
- Provide recommendations for infiltration testing that must be conducted during the construction phase, if needed to confirm pre-construction infiltration estimates.

Geomorphologist and/or Geologist

- Provide specialized services, as needed, related to sediment source assessment and/or channel stability or sensitivity assessment.

3.2 Gathering Project Site Information

To make decisions related to selection and design of storm water management BMPs, it is necessary to gather relevant project site information. This could include physical site information, proposed uses of the site, level of storm water management requirements (i.e. is it a Standard Project or a PDP?), proposed storm water discharge locations, potential/anticipated storm water pollutants based on the proposed uses of the site, receiving water sensitivity to pollutants and susceptibility to erosion, hydromodification management requirements, and other site requirements and constraints.

The amount and type of information that should be collected depends on the project type (i.e. is it a Standard Project, a PDP with all requirements or with only pollutant control requirements?). Refer to Figure 1-1 in Chapter 1 to identify the project type.

Information should only be gathered to the extent necessary to inform the storm water management design. In some cases, it is not necessary to conduct site specific analyses to precisely characterize conditions. For example, if depth to groundwater is known to be approximately 100 feet based on regional surveys, it is not necessary to also conduct site specific assessment of depth to groundwater to determine whether it is actually 90 feet or 110 feet on the project site. The difference between these values would not influence the storm water management design. In other cases, some information will not be applicable. For example, on an existing development site, there may be no natural hydrologic features remaining, therefore these features do not need to be characterized. The lack of natural hydrologic features can be simply noted without further effort required.

Checklists (in Appendix I) and submittal templates (in Appendix A) are provided to facilitate gathering information about the project site for BMP selection and design. As part of planning for site investigation, it is helpful to review the subsequent steps (Section 3.3 and 3.4) to gain familiarity with how the site information will be used in making decisions about site layout and storm water BMP selection and design. This can help prioritize the data that are collected.

3.3 Developing Conceptual Site Layout and Storm Water Control Strategies

Once preliminary site information has been obtained, the site can be assessed for storm water management opportunities and constraints that will inform the overall site layout. Considering the project site data discussed above, it is essential to identify potential locations for storm water management features at a conceptual level during the site planning phase. Storm water management requirements must be considered as a key factor in laying out the overall site. Preliminary design of permanent storm water BMPs is partially influenced by whether the project is a Standard Project or a PDP. Table 3-1 presents the applicability of different subsections in this manual based on project type and must be used to determine which requirements apply to a given project.

TABLE 3-1. Applicability of Section 3.3 Sub-sections for Different Project Types

Project Type	Section 3.3.1	Section 3.3.2	Section 3.3.3	Section 3.3.4
Standard Project	☑	NA	NA	NA
PDP with only Pollutant Control Requirements	☑	NA	☑	☑
PDP with Pollutant and Hydromodification Management Requirements	☑	☑	☑	☑

3.3.1 Preliminary Design Steps for All Development Projects

All projects must incorporate source control and site design BMPs. The following systematic approach outlines these site planning considerations for all development projects:

1 Review Chapter 4 of this manual to become familiar with the menu of source control and site design practices that are required.

2 Review the preliminary site information gathered in Section 3.2, specifically related to:

   a. Natural hydrologic features that can be preserved and/or protected;

   b. Soil information;

   c. General drainage patterns (i.e. general topography, points of connection to the storm drain or receiving water);

   d. Pollutant sources that require source controls; and

   e. Information gathered and summarized in the Site Information Checklist for Standard Projects (Appendix I-3A).

3 Create opportunities for source control and site design BMPs by developing an overall conceptual site layout that allocates space for site design BMPs and promotes drainage patterns that are effective for hydrologic control and pollutant source control. For example:
   a. Locate pervious areas down gradient from buildings where possible to allow for dispersion.
   b. Identify parts of the project that could be drained via overland vegetated conveyance rather than piped connections.
   c. Develop traffic circulation patterns that are compatible with minimizing street widths.

4 As part of Section 3.4, refine the selection and placement of source control and site design BMPs and incorporate them into project plans. Compliance with site design and source control requirements shall be documented as described in Chapter 4.

3.3.2 Evaluation of Critical Coarse Sediment Yield Areas

For PDPs that are required to meet hydromodification management requirements, evaluate whether critical coarse sediment yield areas exist within or upstream of the project site. Identification of critical coarse sediment yield areas is discussed in Chapter 6 of this manual, additional guidance on identification and protection of critical coarse sediment yield areas is provided in Appendix H. Conceptual layout of the project site must consider the following items:

a. Have critical coarse sediment areas been identified within the project site? Does the proposed project impact these onsite critical coarse sediment areas? What measures are necessary to avoid impacts to these areas? What measures are necessary to convey critical coarse sediment from these areas through the site?

b. b. Have critical coarse sediment areas been identified upstream of the project site? Does the proposed project impact upstream critical coarse sediment areas? What measures are necessary to avoid impacts to these areas or convey critical coarse sediment from these areas through the site?

c. c. If impacts to onsite and offsite critical course sediment areas are not avoided, what mitigation practices will be implemented to ensure no net impact to the receiving water?

3.3.3 Drainage Management Areas

Drainage management areas (DMAs) provide an important framework for feasibility screening, BMP prioritization, and storm water management system configuration. BMP selection, sizing, and feasibility determinations must be made at the DMA level; therefore delineation of DMAs is highly recommended at the conceptual site planning phase and is mandatory for completing the project design and meeting submittal requirements. This section provides guidance on delineating DMAs that is intended to be used as part of Section 3.3 and 3.4.

DMAs are defined based on the proposed drainage patterns of the site and the BMPs to which they drain. During the early phases of the project, DMAs shall be delineated based onsite drainage patterns and possible BMP locations identified in the site planning process. DMAs should not overlap and should be similar with respect to BMP opportunities and feasibility constraints. More than one DMA can drain to the same BMP. However, because the BMP sizes are determined by the runoff from the DMA, a single DMA may not drain to more than one BMP. See Figure 3-2.

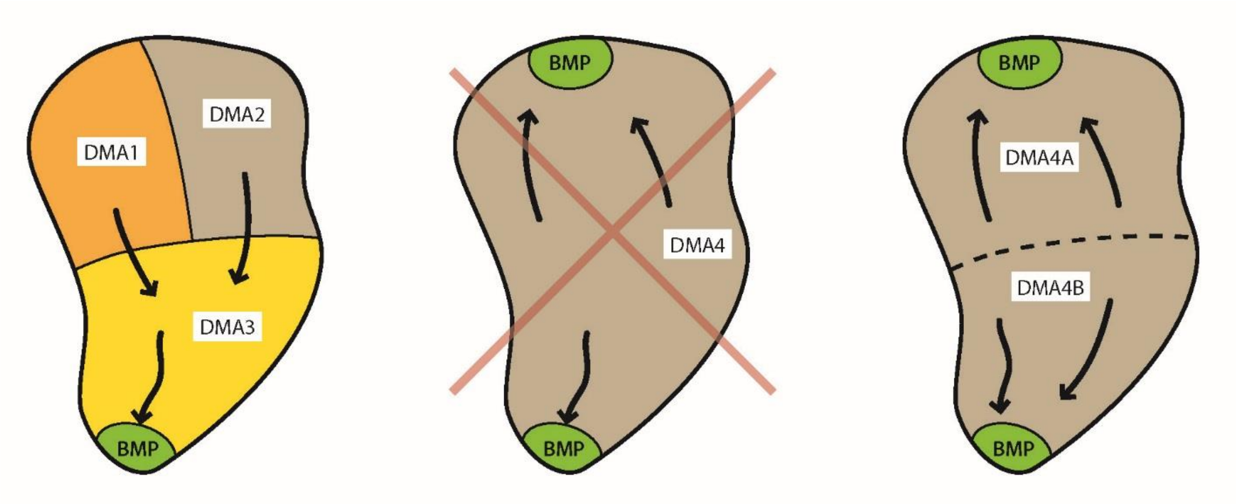


FIGURE 3-2. DMA Delineation

In some cases, in early planning phases, it may be appropriate to generalize the proposed treatment plan by simply assigning a certain BMP type to an entire planning area (e.g. Parking lot X will be treated with bioretention) and calculating the total sizing requirement without identifying the specific BMP locations at that time. This planning area would be later subdivided for design-level calculations. Section 5.2 provides additional guidance on DMA delineation. A runoff factor (similar to a "C" factor used in the rational method) should be used to estimate the runoff draining to the BMP. Appendix B.1 provides guidance in estimating the runoff factor for the drainage area draining to a BMP.

BMPs must be sized to treat the DCV from the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drains to the BMP. To minimize offsite flows treated by project BMPs, consider diverting upgradient flows subject to local drainage and flood control regulation. An example is shown in Figure 3-3.

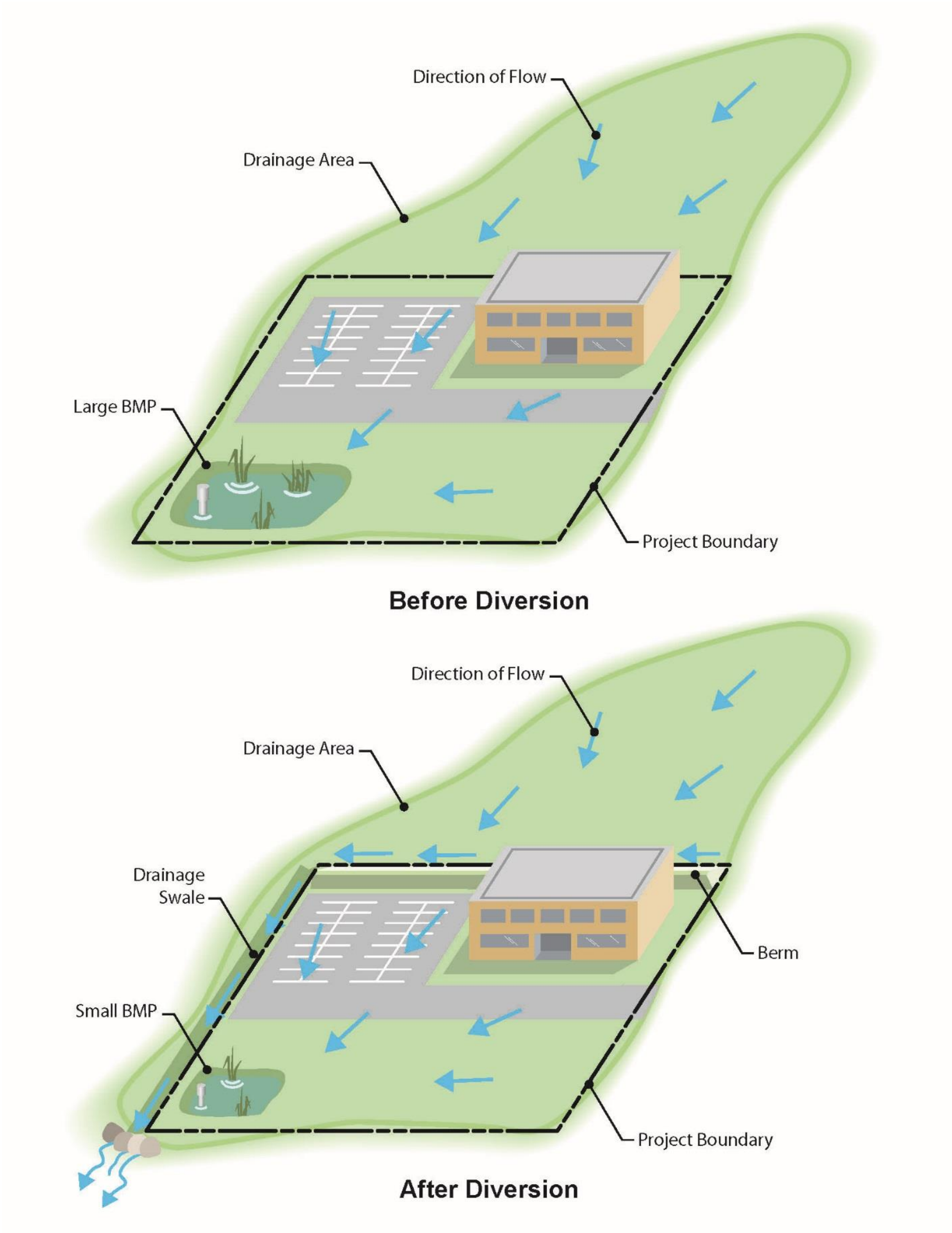


FIGURE 3-3. Tributary Area for BMP Sizing

3.3.4 Developing Conceptual Storm Water Control Strategies

This step applies to PDPs only. The goal of this step is to develop conceptual storm water control strategies that are compatible with the site conditions, including siting and preliminary selection of structural BMPs. At this phase of project planning, it is typically still possible for storm water considerations to influence the site layout to better accommodate storm water design requirements. The end product of this step should be a general, but concrete understanding of the storm water management parameters for each DMA, the compatibility of this approach with the site design, and preliminary estimates of BMP selection. For simpler sites, this step could be abbreviated in favor of skipping forward to design-level analyses in Section 3.4. However, for larger and/or more complex sites, this section can provide considerable value and help allow evaluation of storm water management requirements on common ground with other site planning considerations.

The following systematic approach is recommended:

1. Review the preliminary site information gathered in Section 3.2, specifically related to information gathered and summarized in the Site Information Checklist for PDPs (Appendix I-3B).
2. Identify self-mitigating, de minimis areas, and/or potential self-retaining DMAs that can be isolated from the remainder of the site (See Section 5.2).
3. Estimate DCV for each remaining DMAs (See Appendix B.1).
4. Determine if there is a potential opportunity for harvest and use of storm water from the project site. See Section 5.4.1 for harvest and use feasibility screening, which is based on water demand at the project site. For most sites, there is limited opportunity; therefore evaluating this factor early can help simplify later decisions.
5. Estimate potential runoff reduction and the DCV that could be achieved with site design BMPs (See Section 5.3 and Appendix B.2) and harvest and use BMPs (See Appendix B.3).
6. Based on the remaining runoff after accounting for steps 2 to 5, estimate BMP space requirements. Identify applicable structural BMP requirements (i.e. storm water pollutant control versus hydromodification management) and conduct approximate sizing calculations to determine the overall amount of storage volume and/or footprint area required for BMPs. Use worksheets presented in Appendices B.4 and B.5 to estimate sizing requirements for different types of BMPs.
7. Conduct preliminary screening of infiltration feasibility conditions. A preliminary screening of infiltration feasibility should be conducted as part of site planning to identify areas that are more or less conducive to infiltration. Recommended factors to consider include:
   a. Soil types (determined from available geotechnical testing data, soil maps, site observations, and/or other data sources)
   b. Approximate infiltration rates at various points on the site, obtained via approximate methods (e.g. simple pit test), if practicable
   c. Groundwater elevations
   d. Proposed depths of fill
   e. New or existing utilities that will remain with development
   f. Soil or groundwater contamination issues within the site or in the vicinity of the site

   g. Slopes and other potential geotechnical hazards that are unavoidable as part of site development
   h. Safety and accessibility considerations

   This assessment is not intended to be final or account for all potential factors. Rather, it is intended to help in identifying site opportunities and constraints as they relate to site planning. After potential BMP locations are established, a more detailed feasibility analysis is necessary (see Section 3.4 and 5.4.2). Additionally, Appendix C and D provide methods for geotechnical and groundwater assessment applicable for screening at the planning level and design-level requirements. The jurisdiction may allow alternate assessment methods with appropriate documentation at the discretion of the Port.

8. Identify tentative BMP locations based on preliminary feasibility screening, natural opportunities for BMPs (e.g. low areas of the site, areas near storm drain or stream connections), and other BMP sites that can potentially be created through effective site design (e.g. oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers which can double as locations for bioretention or biofiltration facilities).

9. Determine tentative BMP feasibility categories for infiltration for each DMA or specific BMP location. Based on the results of feasibility screening and tentative BMP locations, determine the general feasibility categories that would apply to BMPs in these locations. Categories are described in Section 5.4.2 and include:
   a. Full infiltration condition;
   b. Partial infiltration condition; and
   c. No infiltration condition.

   Adapt the site layout to attempt to achieve infiltration to the greatest extent feasible.

10. Consider how storm water management BMPs will be accessed for inspection and maintenance and provide necessary site planning allowances (access roads, inspection openings, setbacks, etc.) and coordinate with jurisdiction public works departments for additional design requirements or allowed BMPs if required for BMPs in public easements or are part of a community facilities district maintained by the jurisdiction. In addition consider the use of the site.

11. Document site planning and opportunity assessment activities as a record of the decisions that led to the development of the final storm water management plan. The SWQMP primarily shows the complete design rather than the preliminary steps in the process. However, to comply with the requirements of this manual, the applicant is required to describe how storm water management objectives have been considered as early as possible in the site planning process and how opportunities to incorporate BMPs have been identified.

3.4 Developing Complete Storm Water Management Design

The complete storm water management design consists of all of the elements describing the BMPs to be implemented, as well as integration of the BMPs with the site design and other infrastructure. The storm water management design shall be developed by taking into consideration the opportunities and/or constraints identified during the site planning phase of the project and then performing the final design level analysis. The scope of this step varies depending on whether the project is a Standard Project, PDP with only pollutant control BMP requirements or PDP with pollutant control and hydromodification management requirements. The following systematic approach is recommended to develop a final site layout and storm water management design. Table 3-2 presents the applicability of different subsections based on project type and must be used to determine which requirements apply to a given project.

TABLE 3-2. Applicability of Section 3.4 Sub-sections for Different Project Types

Project Type	Section 3.4.1	Section 3.4.2	Section 3.4.3
Standard Project	☑	NA	NA
PDP with only Pollutant Control Requirements	☑	☑	NA
PDP with Pollutant Control and Hydromodification Management Requirements	☑	NA	☑

3.4.1 Steps for All Development Projects

Standard Projects need to only satisfy the source control and site design requirements of Chapter 4 of this manual, and then proceed to Chapter 8 of this manual to determine submittal requirements.

1. Select, identify and detail specific source control BMPs. See Section 4.2.
2. Select, identify and detail specific site design BMPs. See Section 4.3.
3. Document that all applicable source control and site design BMPs have been used. See Chapter 8.

3.4.2 Steps for PDPs with only Pollutant Control Requirements

The steps below primarily consist of refinements to the conceptual steps completed as part of Section 3.3, accompanied by design-level detail and calculations. More detailed instructions for selection and design of storm water pollutant treatment BMPs are provided in Chapter 5.

1. Select locations for storm water pollutant control BMPs, and delineate and characterize DMAs using information gathered during the site planning phase.
2. Conduct feasibility analysis for harvest and use BMPs. See Section 5.4.1.
3. Conduct feasibility analysis for infiltration to determine the infiltration condition. See Section 5.4.2.
4. Based on the results of steps 2 and 3, select the BMP category that is most appropriate for the site. See Section 5.5.
5. Calculate required BMP sizes and footprints. See Appendix B (sizing methods) and Appendix E (design criteria).

6. Evaluate if the required BMP footprints will fit within the site considering the site constraints; if not, then document infeasibility and move to the next step.
7. If using biofiltration BMPs, document conformance with the criteria for biofiltration BMPs found in Appendix F, including Appendix F.1, as applicable.
8. If needed, implement flow-thru treatment control BMPs (for use with Alternative Compliance) for the remaining DCV. See Section 5.5.4 and Appendix B.6 for additional guidance.
9. If flow-thru treatment control BMPs (for use with Alternative Compliance) were implemented refer to Section 1.8.
10. Prepare SWQMP documenting site planning and opportunity assessment activities, final site layout and storm water management design. See Chapter 8.
11. Determine and document O&M requirements. See Chapters 7 and 8.

3.4.3 Steps for Projects with Pollutant Control and Hydromodification Management Requirements

The steps below primarily consist of refinements to the conceptual steps completed as part of Section 3.3, accompanied by design-level detail and calculations. More detailed instruction for selection and design of storm water pollutant treatment and hydromodification control BMPs are provided in Chapter 5 and 6, respectively.

1. If critical coarse sediment yield areas were determined to exist within or upstream of the project site (Section 3.3.2) incorporate mitigation measures when applicable (Section 6.2).
2. Select locations for storm water pollutant control and hydromodification management BMPs and delineate and characterize DMAs using information gathered during the site planning phase.
3. Conduct feasibility analysis for harvest and use BMPs. See Section 5.4.1.
4. Conduct feasibility analysis for infiltration to determine the infiltration condition. See Section 5.4.2.
5. Based on the results of steps 3 and 4, select the BMP category for pollutant treatment BMPs that is most appropriate for the site. See Section 5.5.
6. Develop the design approach for integrating storm water pollutant treatment and hydromodification control. The same location(s) can serve both functions (e.g. a biofiltration area that provides both pollutant control and flow control), or separate pollutant control and flow control locations may be identified (e.g. several dispersed retention areas for pollutant control, with overflow directed to a single location of additional storage for flow control).
7. Calculate BMP sizing requirements for pollutant control and flow control. See Appendix B (sizing methods) and Appendix E (design criteria).
    a. When the same BMP will serve both functions, Section 6.3.6 of this manual provides recommendations for assessing the controlling design factor and initiating the design process.
8. Evaluate if the required BMP footprints will fit within the site considering the site constraints:

   a. If they fit within the site, design BMPs to meet applicable sizing and design criteria. Document sizing and design separately for pollutant control and hydromodification management even when the same BMP is serving both functions.
   b. If they do not fit the site then document infeasibility and move to the next step.
9. Implement flow-thru treatment control BMPs (for use with Alternative Compliance) for the remaining DCV. See Section 5.5.4 and Appendix B.6 for additional guidance.
10. If flow-thru treatment control BMPs (for use with Alternative Compliance) were implemented refer to Section 1.8.
11. Prepare a SWQMP documenting site planning and opportunity assessment activities, final site layout, storm water pollutant control design and hydromodification management design. See Chapter 8.
12. Determine and document O&M requirements. See Chapters 7 and 8.

3.5 Project Planning and Design Requirements Specific to Local Jurisdiction

The following additional design requirements apply for development projects within the Port tidelands:

Projects along jurisdictional boundaries: If portions of a project are within other jurisdictions (e.g., roadway realignment; new sidewalk), the project must submit documentation of review and acceptance of the SWQMP from the adjacent jurisdiction, for the portions of the project within their jurisdiction.

Projects within master planned areas: If a master SWQMP exists; projects shall conform to the master SWQMP, or amended the master SWQMP upon approval by the Port.

3.6 Phased Projects

Phased projects typically require a conceptual or master SWQMP followed by more detailed submittals. As part of an application for approval of a phased development project, a conceptual or master SWQMP shall be submitted; which describes and illustrates, in broad outline, how the drainage for the project will comply with the storm water performance standards. The level of detail in the conceptual or master SWQMP should be consistent with the scope and level of detail of the development approval being considered. The conceptual or master SWQMP should specify that a more detailed SWQMP for each later phase or portion of the project will be submitted with subsequent applications for discretionary approvals.

Chapter

4

Source Control and Site Design Requirements for All Development Projects

This chapter presents the source control and site design requirements to be met by all projects, inclusive of Standard Projects and PDPs. Checklists I.4 for source control and I.5 for site design included in Appendix I can be used by both Standard Projects and PDPs to document conformance with the requirements.

4.1 General Requirements (GR)

4.1.1: Onsite BMPs must be located so as to remove pollutants from runoff prior to its discharge to any receiving waters, and as close to the source as possible.

The location of the BMP affects the ability of the BMP to retain, and/or treat, the pollutants from the contributing drainage area. BMPs must remove pollutants from runoff and should be placed as close to the pollutant source as possible.

> **How to comply**: Projects shall comply with this requirement by implementing source control (Section 4.2) and site design BMPs (Section 4.3) that are applicable to their project and site conditions.

4.1.2: Structural BMPs must not be constructed within the Waters of the U.S.

Construction, operation, and maintenance of a structural BMP in a water body can negatively impact the physical, chemical, and biological integrity, as well as the beneficial uses, of the water body. However, alternative compliance opportunities involving restoration of areas within Waters of the U.S. may be identified by local jurisdictions.

> **How to comply**: Projects shall comply with this requirement by preparing project plans that illustrate the location of all storm water BMPs demonstrate compliance with this requirement by showing the location of BMPs on project plans and describing or depicting the location of receiving waters.

4.1.3: Onsite BMPs must be designed and implemented with measures to avoid the creation of nuisances or pollutions associated with vectors (e.g. mosquitos, rodents, or flies).

According to the California Department of Health, structural BMPs that retain standing water for over 96 hours are particularly concerning for facilitating mosquito breeding. Certain site design features that hold standing water may similarly produce mosquitoes.

> **How to comply**: Projects shall comply with this requirement by incorporating design, construction, and maintenance principles to drain retained water within **96 hours** and minimize standing water. Design calculations shall be provided to demonstrate the potential for standing water ponding at surface level and accessible to mosquitos has been addressed. For water retained in biofiltration facilities that are not accessible to mosquitoes this criteria is not applicable (i.e. water ponding in the gravel layer, water retained in the amended soil, etc.).

4.2 Source Control (SC) BMP Requirements

Source control BMPs avoid and reduce pollutants in storm water runoff. Everyday activities, such as recycling, trash disposal and irrigation, generate pollutants that have the potential to drain to the storm water conveyance system. Source control BMPs are defined as an activity that reduces the potential for storm water runoff to come into contact with pollutants. An activity could include an administrative action, design of a structural facility, usage of alternative materials, and operation, maintenance and inspection of an area. Where applicable and feasible, all development projects are required to implement source control BMPs. Source control BMPs (SC-1 through SC-6) are discussed below.

> **How to comply**: Projects shall comply with this requirement by implementing source control BMPs listed in this section that are applicable to their project. Applicability shall be determined through consideration of the development project's features and anticipated pollutant sources. Appendix E provides guidance for identifying source control BMPs applicable to a project. The "Source Control BMP Checklist for All Development Projects" located in Appendix I-4 shall be used to document compliance with source control BMP requirements.

4.2.1: Prevent illicit discharges into the MS4

An illicit discharge is any discharge to the MS4 that is not composed entirely of storm water except discharges pursuant to a National Pollutant Discharge Elimination System permit and discharges resulting from firefighting activities. Projects must effectively eliminate discharges of non-storm water into the MS4. This may involve a suite of housekeeping BMPs which could include effective irrigation, dispersion of non-storm water discharges into landscaping for infiltration, and controlling wash water from vehicle washing. Appendix E describes the following that can be effective in preventing illicit discharges:

- SC-B – Interior floor drains and elevator shaft sump pumps plumbed to sanitary sewer;
- SC-C – Interior parking garage floor drains plumbed to sanitary sewers;
- SC-E – Pools, spas, ponds with accessible sanitary sewer cleanout;
- SC-F – Food service floor mat & equipment cleanout area exposure reduction;
- SC-G – Refuse areas exposure reduction;
- SC-H – Industrial processes performed indoors;
- SC-I – Outdoor storage of equipment or materials exposure reduction;
- SC-J – Vehicle and equipment cleaning area exposure reduction;

- SC-K – Vehicle/Equipment Repair and Maintenance exposure reduction;
- SC-L – Fuel dispensing area coverage and grading requirements;
- SC-M – Loading dock drainage and coverage requirements;
- SC-N – Fire sprinkler test water to sanitary sewer;
- SC-O – Miscellaneous drain or wash water not to storm drain system;
- SC-6A – Large Trash Generating Facilities BMP guidance;
- SC-6B – Animal Facilities BMP guidance;
- SC-6C – Plant Nurseries and Garden Centers BMP guidance; and
- SC-6D – Automotive-related Uses BMP guidance.

4.2.2: Identify the storm drain system using stenciling or signage

Storm drain signs and stencils are visible source controls typically placed adjacent to the inlets. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Stenciling shall be provided for all storm water conveyance system inlets and catch basins within the project area. Inlet stenciling may include concrete stamping, concrete painting, placards, or other methods approved by the local municipality. In addition to storm drain stenciling, projects are encouraged to post signs and prohibitive language (with graphical icons) which prohibit illegal dumping at trailheads, parks, building entrances and public access points along channels and creeks within the project area. Storm drain inlets within the Port jurisdiction must be placarded with an official Port inlet placard. Prior to project close out, contact the Port to obtain an official inlet placard. The following factsheet provided in Appendix E provides more information:

- SC-A – Onsite storm drain inlet labeling

4.2.3: Protect ***<u>outdoor material storage areas</u>*** from rainfall, run-on, runoff, and wind dispersal

Materials with the potential to pollute storm water runoff shall be stored in a manner that prevents contact with rainfall and storm water runoff. Contaminated runoff shall be managed for treatment and disposal (e.g. secondary containment directed to sanitary sewer). All development projects shall incorporate the following structural or pollutant control BMPs for outdoor material storage areas, as applicable and feasible:

- Materials with the potential to contaminate storm water shall be:
    - Placed in an enclosure such as, but not limited to, a cabinet, or similar structure, or under a roof or awning that prevents contact with rainfall runoff or spillage to the storm water conveyance system; or
    - Protected by secondary containment structures such as berms, dikes, or curbs.
- The storage areas shall be paved and sufficiently impervious to contain leaks and spills, where necessary.
- The storage area shall be sloped towards a sump or another equivalent measure that is effective to contain spills.

- Runoff from downspouts/roofs shall be directed away from storage areas.
- The storage area shall have a roof or awning that extends beyond the storage area to minimize collection of storm water within the secondary containment area. A manufactured storage shed may be used for small containers.

The following fact sheets provided in Appendix E describe outdoor material storage area BMPs:

- SC-I – Outdoor storage of equipment or materials exposure reduction;
- SC-M – Loading dock drainage and coverage requirements;
- SC-O – Miscellaneous drain or wash water not to storm drain system;
- SC-6A – Large Trash Generating Facilities BMP guidance;
- SC-6B – Animal Facilities BMP guidance;
- SC-6C – Plant Nurseries and Garden Centers BMP guidance; and
- SC-6D – Automotive-related Uses BMP guidance.

4.2.4: Protect _materials stored in outdoor work areas_ from rainfall, run-on, runoff, and wind dispersal

Outdoor work areas have an elevated potential for pollutant loading and spills. All development projects shall include the following structural or pollutant control BMPs for any outdoor work areas with potential for pollutant generation, as applicable and feasible:

- Create an impermeable surface such as concrete or asphalt, or a prefabricated metal drip pan, depending on the size needed to protect the materials.
- Cover the area with a roof or other acceptable cover.
- Berm the perimeter of the area to prevent water from adjacent areas from flowing on to the surface of the work area.
- Directly connect runoff to sanitary sewer or other specialized containment system(s), as needed and where feasible. This allows the more highly concentrated pollutants from these areas to receive special treatment that removes particular constituents. Approval for this connection must be obtained from the appropriate sanitary sewer agency.
- Locate the work area away from storm drains or catch basins.

The following fact sheets provided in Appendix E describe materials stored in outdoor work area BMPs:

- SC-F – Food service floor mat & equipment cleanout area exposure reduction;
- SC-J – Vehicle and equipment cleaning area exposure reduction;
- SC-K – Vehicle/Equipment Repair and Maintenance exposure reduction;
- SC-L – Fuel dispensing area coverage and grading requirements;
- SC-6A – Large Trash Generating Facilities BMP guidance;
- SC-6B – Animal Facilities BMP guidance;
- SC-6C – Plant Nurseries and Garden Centers BMP guidance; and

- SC-6D – Automotive-related Uses BMP guidance

4.2.5: Protect *trash storage areas* from rainfall, run-on, runoff, and wind dispersal

Storm water runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. All development projects shall include the following structural or pollutant control BMPs, as applicable:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This can include berming or grading the waste handling area to prevent run-on of storm water.
- Ensure trash container areas are screened or walled to prevent offsite transport of trash.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Locate storm drains away from immediate vicinity of the trash storage area and vice versa.
- Post signs on all dumpsters informing users that hazardous material are not to be disposed.

The following fact sheets provided in Appendix E describe trash storage area BMPs:

- SC-G – Refuse areas exposure reduction;
- SC-6A – Large Trash Generating Facilities BMP guidance.

4.2.6: Use any additional BMPs determined to be necessary by the Port to minimize pollutant generation at each project site

Appendix E provides guidance on permanent controls and operational BMPs that are applicable at a project site based on potential sources of runoff pollutants at the project site or priority pollutants in the watershed. The applicant shall implement all applicable and feasible source control BMPs listed in Appendix E as required by and approved by the Port.

4.3 Site Design (SD) BMP Requirements

Site design BMPs (also referred to as LID BMPs) are intended to reduce the rate and volume of storm water runoff and associated pollutant loads. Site design BMPs include practices that reduce the rate and/or volume of storm water runoff by minimizing surface soil compaction, reducing impervious surfaces, and/or providing flow pathways that are "disconnected" from the storm drain system, such as by routing flow over pervious surfaces. Site design BMPs may incorporate interception, storage, evaporation, evapotranspiration, infiltration, and/or filtration processes to retain and/or treat pollutants in storm water before it is discharged from a site.

Site design BMPs shall be applied to all development projects as appropriate and practicable for the project site and project conditions. Site design BMPs are described in the following subsections.

Appendix E also provides the following fact sheets to assist applicants with the proper design of site design features:

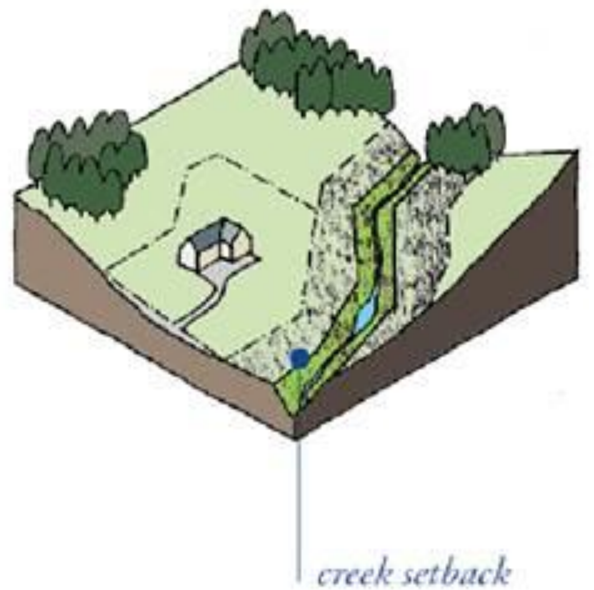
- SD-A – Trees;
- SD-B – Impervious Area Dispersion;
- SD-C – Green Roofs;
- SD-D – Permeable Pavement (Site Design BMP);
- SD-E – Rain Barrels; and
- SD-F – Amended Soil.

How to comply: Projects shall comply with this requirement by using all of the site design BMPs listed in this section that are applicable and practicable to their project type and site conditions. Applicability of a given site design BMP shall be determined based on project type, soil conditions, presence of natural features (e.g. streams), and presence of site features (e.g. parking areas). Explanation shall be provided by the applicant when a certain site design BMP is considered to be not applicable or not practicable/feasible. Site plans shall show site design BMPs and provide adequate details necessary for effective implementation of site design BMPs. The "Site Design BMP Checklist for All Development Projects" located in Appendix I-5 shall be used to document compliance with site design BMP requirements. In some cases, implementation of Site Design BMPs may result in quantifiable reductions in the site's DCV (refer to Appendix B.2); however, failure to meet the minimum thresholds for DCV reductions does not eliminate requirements to implement applicable Site Design BMPs. All applicable and feasible Site Design BMPs must be implemented to the maximum extent practicable.

4.3.1: Maintain natural drainage pathways and hydrologic features

- ☐ Maintain or restore natural storage reservoirs and drainage corridors (including topographic depressions, areas of permeable soils, natural swales, and ephemeral and intermittent streams)
- ☐ Buffer zones for natural water bodies (where buffer zones are technically infeasible, require project applicant to include other buffers such as trees, access restrictions, etc.)

During the site assessment, natural drainages must be identified along with their connection to creeks and/or streams, if any. Natural drainages offer a benefit to storm water management as the soils and habitat already function as a natural filtering/infiltrating swale. When determining the development footprint of the site, altering natural drainages should be avoided. By providing a development envelope set back from natural drainages, the drainage can retain some water quality benefits to the watershed. In some situations, site constraints, regulations, economics, or other factors may not allow avoidance of drainages and sensitive areas. Projects proposing to dredge or fill materials in Waters of the U.S. must obtain Clean Water Act Section 401 Water Quality Certification. Projects proposing to dredge or fill waters of the State must obtain waste discharge requirements. Both the 401 Certification and the Waste Discharge Requirements are administered by the San Diego Water Board. The project applicant shall consult the local jurisdiction for other specific requirements.



Source: County of San Diego LID Handbook

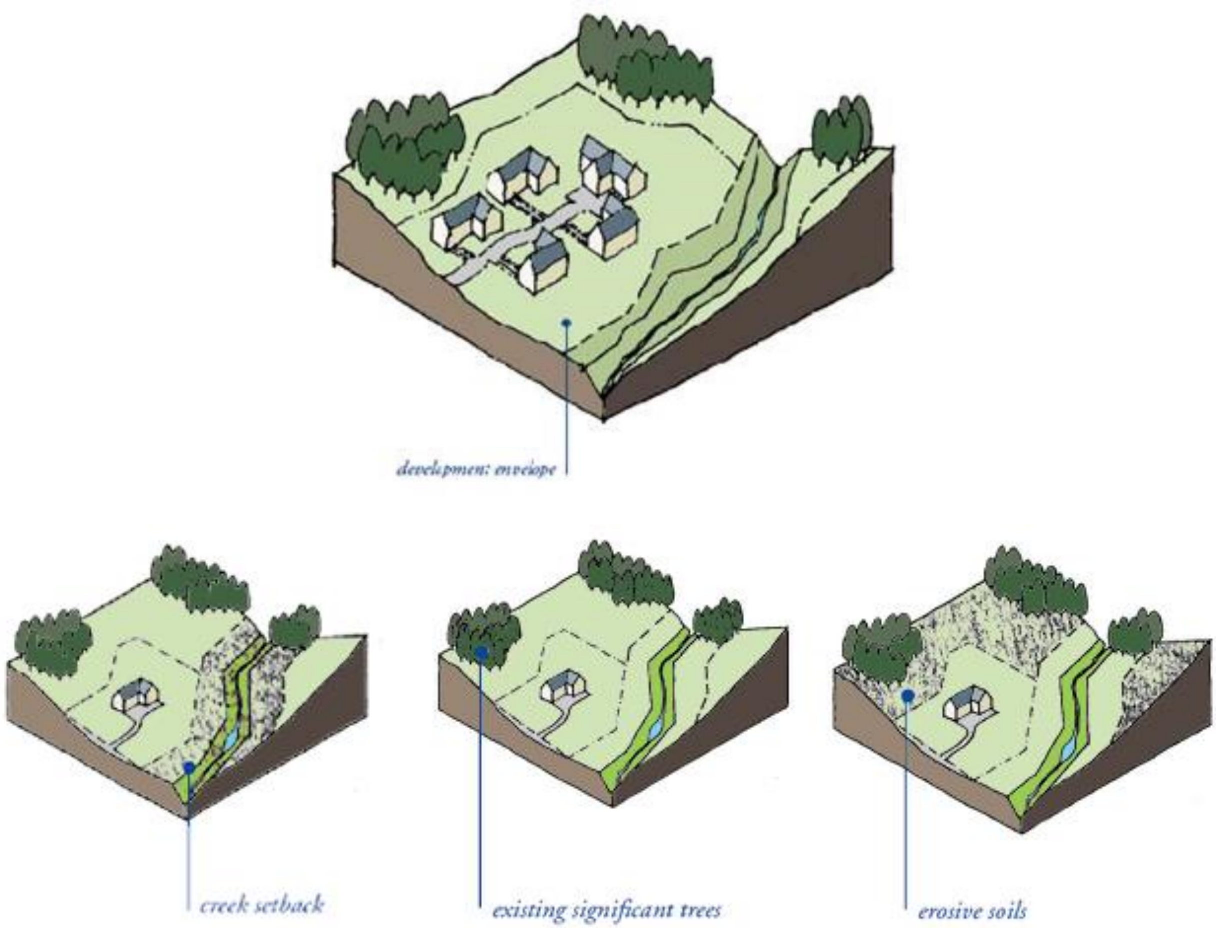
Projects can incorporate 4.3.1 into a project by implementing the following planning and design phase techniques as applicable and practicable:

- Evaluate surface drainage and topography in considering selection of Site Design BMPs that will be most beneficial for a given project site. Where feasible, maintain topographic depressions for infiltration.
- Optimize the site layout and reduce the need for grading. Where possible, conform the site layout along natural landforms, avoid grading and disturbance of vegetation and soils, and replicate the site's natural drainage patterns. Integrating existing drainage patterns into the site plan will help maintain the site's predevelopment hydrologic function.
- Preserve existing drainage paths and depressions, where feasible and applicable, to help maintain the time of concentration and infiltration rates of runoff, and decrease peak flow.
- Structural BMPs cannot be located in buffer zones if a State and/or Federal resource agency (e.g. San Diego Water Board, California Department of Fish and Wildlife; U.S. Army Corps of Engineers, etc.) prohibits maintenance or activity in the area.

4.3.2: Conserve natural areas, soils and vegetation

- Conserve natural areas within the project footprint including existing trees, other vegetation, and soils

To enhance a site's ability to support source control and reduce runoff, the conservation and restoration of natural areas must be considered in the site design process. By conserving or restoring the natural drainage features, natural processes are able to intercept storm water, thereby reducing the amount of runoff.

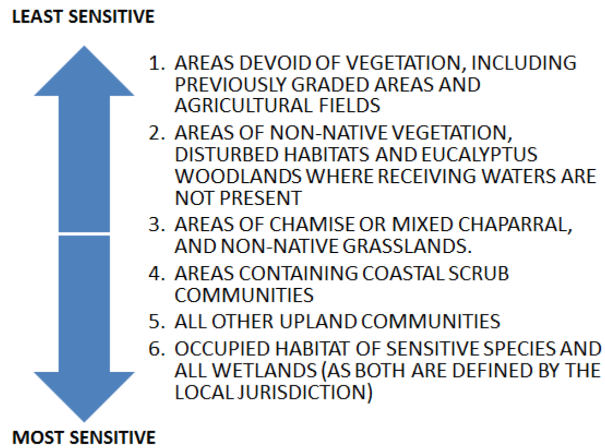


Source: County of San Diego LID Handbook

The upper soil layers of a natural area contain organic material, soil biota, vegetation, and a configuration favorable for storing and slowly conveying storm water and establishing or restoring vegetation to stabilize the site after construction. The canopy of existing native trees and shrubs also provide a water conservation benefit by intercepting rain water before it hits the ground. By minimizing disturbances in these areas, natural processes are able to intercept storm water, providing a water quality benefit. By keeping the development concentrated to the least environmentally sensitive areas of the site and set back from natural areas, storm water runoff is reduced, water quality can be improved, environmental impacts can be decreased, and many of the site's most attractive native landscape features can be retained. In some situations, site constraints, regulations, economics, and/or other factors may not allow avoidance of all sensitive areas on a project site. Project applicant shall consult the local municipality for jurisdictional specific requirements for mitigation of removal of sensitive areas.

Projects can incorporate 4.3.2 by implementing the following planning and design phase techniques as applicable and practicable:

- Identify areas most suitable for development and areas that should be left undisturbed. Additionally, reduced disturbance can be accomplished by increasing building density and increasing height, if possible.



- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Avoid areas with thick, undisturbed vegetation. Soils in these areas have a much higher capacity to store and infiltrate runoff than disturbed soils, and reestablishment of a mature vegetative community can take decades. Vegetative cover can also provide additional volume storage of rainfall by retaining water on the surfaces of leaves, branches, and trunks of trees during and after storm events.
- Preserve trees, especially native trees and shrubs, and identify locations for planting additional native or drought tolerant trees and large shrubs.
- In areas of disturbance, topsoil should be removed before construction and replaced after the project is completed. When handled carefully, such an approach limits the disturbance to native soils and reduces the need for additional (purchased) topsoil during later phases.
- Avoid sensitive areas, such as wetlands, biological open space areas, biological mitigation sites, streams, floodplains, or particular vegetation communities, such as coastal sage scrub and intact forest. Also, avoid areas that are habitat for sensitive plants and animals, particularly those, State or federally listed as endangered, threatened or rare. Development in these areas is often restricted by federal, state and local laws.

4.3.3: Minimize impervious area

- ☐ Construct streets, sidewalks or parking lots aisles to the minimum widths necessary, provided public safety is not compromised
- ☐ Minimize the impervious footprint of the project

One of the principal causes of environmental impacts by development is the creation of impervious surfaces. Imperviousness links urban land development to degradation of aquatic ecosystems in two ways:

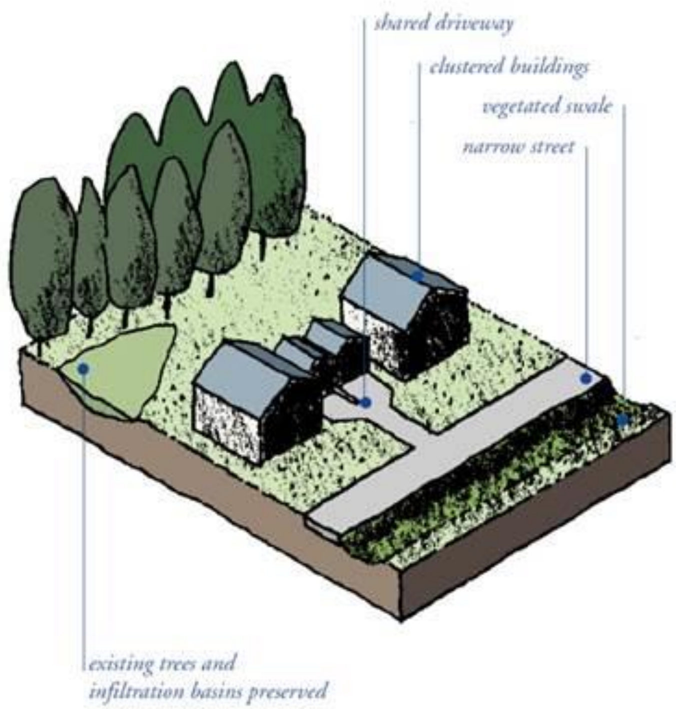
- First, the combination of paved surfaces and piped runoff efficiently collects urban pollutants and transports them, in suspended or dissolved form, to surface waters. These pollutants may originate as airborne dust, be washed from the atmosphere during rains, or may be generated by automobiles and outdoor work activities.

- Second, increased peak flows and runoff durations typically cause erosion of stream banks and beds, transport of fine sediments, and disruption of aquatic habitat. Measures taken to control stream erosion, such as hardening banks with riprap or concrete, may permanently eliminate habitat.

Impervious cover can be minimized through identification of the smallest possible land area that can be practically impacted or disturbed during site development. Reducing impervious surfaces retains the permeability of the project site, allowing natural processes to filter and reduce sources of pollution.

Projects can incorporate 4.3.3 by implementing the following planning and design phase techniques as applicable and practicable:

- Decrease building footprint through (the design of compact and taller structures when allowed by local zoning and design standards and provided public safety is not compromised.
- Construct walkways, trails, patios, overflow parking lots, alleys and other low-traffic areas with permeable surfaces.
- Construct streets, sidewalks and parking lot aisles to the minimum widths necessary, provided that public safety and alternative transportation (e.g. pedestrians, bikes) are not compromised.
- Consider the implementation of shared parking lots and driveways where possible.
- Landscaped area in the center of a cul-de-sac can reduce impervious area depending on configuration. Design of a landscaped cul-de-sac must be coordinated with fire department personnel to accommodate turning radii and other operational needs.



Source: County of San Diego LID Handbook

- Design smaller parking lots with fewer stalls, smaller stalls, more efficient lanes.
- Design indoor or underground parking.
- Minimize the use of impervious surfaces in the landscape design.

4.3.4: Minimize soil compaction

- Minimize soil compaction in landscaped areas

The upper soil layers contain organic material, soil biota, and a configuration favorable for storing and slowly conveying storm water down gradient. By protecting native soils and vegetation in appropriate areas during the clearing and grading phase of development the site can retain some of its existing beneficial hydrologic function. Soil compaction resulting from the movement of heavy construction equipment can reduce soil infiltration rates. It is important to recognize that areas adjacent to and under building foundations, roads and manufactured slopes must be compacted with minimum soil density requirements in compliance with local building and grading ordinances.

Projects can incorporate 4.3.4 by implementing the following planning and design phase techniques as applicable and practicable:

- Avoid disturbance in planned green space and proposed landscaped areas where feasible. These areas that are planned for retaining their beneficial hydrological function should be protected during the grading/construction phase so that vehicles and construction equipment do not intrude and inadvertently compact the area.
- In areas planned for landscaping where compaction could not be avoided, re-till the soil surface to allow for better infiltration capacity. Soil amendments are recommended and may be necessary to increase permeability and organic content. Soil stability, density requirements, and other geotechnical considerations associated with soil compaction must be reviewed by a qualified landscape architect or licensed geotechnical, civil or other professional engineer.

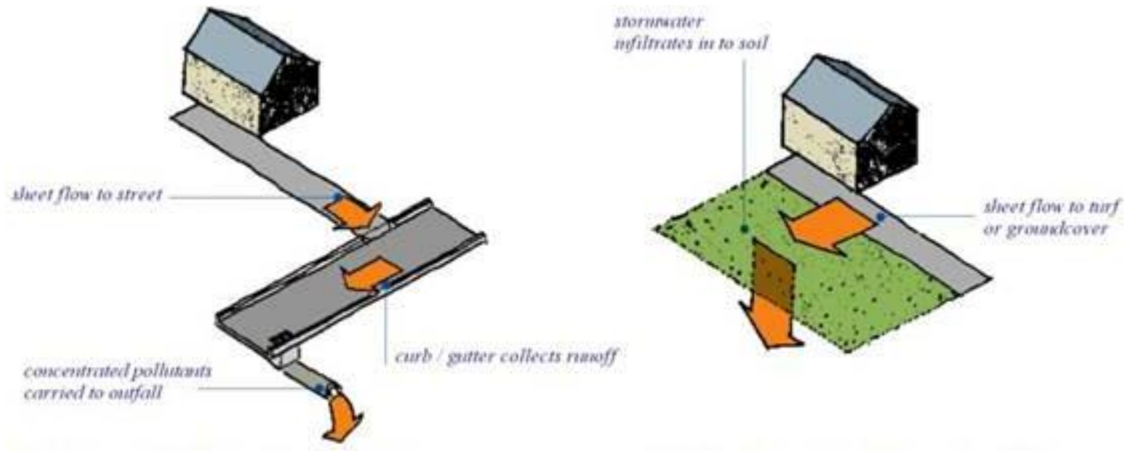
4.3.5: Disperse impervious areas

- Disconnect impervious surfaces through disturbed pervious areas
- Design and construct landscaped or other pervious areas to effectively receive and infiltrate, retain and/or treat runoff from impervious areas prior to discharging to the MS4

Impervious area dispersion (dispersion) refers to the practice of essentially disconnecting impervious areas from directly draining to the storm drain system by routing runoff from impervious areas such as rooftops, walkways, and driveways onto the surface of adjacent pervious areas. The intent is to slow runoff discharges, and reduce volumes while achieving incidental treatment. Volume reduction from dispersion is dependent on the infiltration characteristics of the pervious area and the amount of impervious area draining to the pervious area. Treatment is achieved through filtration, shallow sedimentation, sorption, infiltration, evapotranspiration, biochemical processes and plant uptake.

The effects of imperviousness can be mitigated by disconnecting impervious areas from the drainage system and by encouraging detention and retention of runoff near the point where it is generated. Detention and retention of runoff reduces peak flows and volumes and allows pollutants to settle out or adhere to soils before they can be transported downstream. Disconnection practices may be applied in almost any location, but impervious surfaces must discharge into a suitable receiving area for the practices to be effective. Information gathered during the site assessment will help determine appropriate receiving areas.

Project designs should direct runoff from impervious areas to adjacent landscaping areas that have higher potential for infiltration and surface water storage. This will limit the amount of runoff generated, and therefore the size of the mitigation BMPs downstream. The design, including consideration of slopes and soils, must reflect a reasonable expectation that runoff will soak into the soil and produce no runoff of the DCV. On hillside sites, drainage from upper areas may be collected in conventional catch basins and piped to landscaped areas that have higher potential for infiltration. Or use low retaining walls to create terraces that can accommodate BMPs.



Source: County of San Diego LID Handbook

Projects can incorporate 4.3.5 by implementing the following planning and design phase techniques as applicable and practicable:

- Implement design criteria and considerations listed in impervious area dispersion fact sheet (4.3.5) presented in Appendix E.
- Drain rooftops into adjacent landscape areas.
- Drain impervious parking lots, sidewalks, walkways, trails, and patios into adjacent landscape areas.
- Reduce or eliminate curb and gutters from roadway sections, thus allowing roadway runoff to drain to adjacent pervious areas.
- Replace curbs and gutters with roadside vegetated swales and direct runoff from the paved street or parking areas to adjacent LID facilities. Such an approach for alternative design can reduce the overall capital cost of the site development while improving the storm water quantity and quality issues and the site's aesthetics.
- Plan site layout and grading to allow for runoff from impervious surfaces to be directed into distributed permeable areas such as turf, landscaped or permeable recreational areas, medians, parking islands, planter boxes, etc.
- Detain and retain runoff throughout the site. On flatter sites, landscaped areas can be interspersed among the buildings and pavement areas. On hillside sites, drainage from upper areas may be collected in conventional catch basins and conveyed to landscaped areas in lower areas of the site.
- Pervious area that receives run on from impervious surfaces shall have a minimum width of 10 feet and a maximum slope of 5%.

SD-6: Collect runoff

- Use small collection strategies located at, or as close to as possible to the sources (i.e. the point where storm water initially meets the ground) to minimize the transport of runoff and pollutants to the MS4 and receiving waters

- Use permeable material for projects with low traffic areas and appropriate soil conditions

Distributed control of storm water runoff from the site can be accomplished by applying small collection techniques (e.g. green roofs) or integrated management practices on small sub-catchments. Small collection techniques foster opportunities to maintain the natural hydrology provide a much greater range of control practices. Integration of storm water management into landscape design and natural features of the site, reduce site development and long-term maintenance costs, and provide redundancy if one technique fails. On flatter sites, it typically works best to intersperse landscaped areas and integrate small scale retention practices among the buildings and paving.

Permeable pavements contain small voids that allow water to pass through to a gravel base. They come in a variety of forms; they may be a modular paving system (concrete pavers, grass-pave, or gravel-pave) or poured in place pavement (porous concrete, permeable asphalt). Project applicants should identify locations where permeable pavements could be substituted for impervious concrete or asphalt paving. The O&M of the site must ensure that permeable pavements will not be sealed in the future. In areas where infiltration is not appropriate, permeable paving systems can be fitted with an under drain to allow filtration, storage, and evaporation, prior to drainage into the storm drain system.

Projects can incorporate SD-6 by implementing the following planning and design phase techniques as applicable and practicable:

- Implementing distributed small collection techniques to collect and retain runoff
- Installing permeable pavements (see SD-6B in Appendix E)

SD-7: Landscape with native or drought tolerant species

All development projects are required to select a landscape design and plant palette that minimizes required resources (irrigation, fertilizers and pesticides) and pollutants generated from landscape areas. Native plants require less fertilizers and pesticides because they are already adapted to the rainfall patterns and soils conditions. Plants should be selected to be drought tolerant and not require watering after establishment (2 to 3 years). Watering should only be required during prolonged dry periods after plants are established. Final selection of plant material needs to be made by a landscape architect experienced with LID techniques. Microclimates vary significantly throughout the region and consulting local municipal resources will help to select plant material suitable for a specific geographic location. Landscaping shall be designed using Integrated Pest Management (IPM) practices.

Projects can incorporate SD-7 by landscaping with native and drought tolerant species. Recommended plant list is included in Appendix E (Fact Sheet PL).

SD-8: Harvest and use precipitation

Photograph Courtesy of Arid Solutions, Inc.

Harvest and use BMPs capture and stores storm water runoff for later use. Harvest and use can be applied at smaller scales (Standard Projects) using rain barrels or at larger scales (PDPs) using cisterns. This harvest and use technique has been successful in reducing runoff discharged to the storm drain system conserving potable water and recharging groundwater.

Rain barrels are above ground storage vessels that capture runoff from roof downspouts during rain events and detain that runoff for later reuse for irrigating landscaped areas. The temporary storage of roof runoff reduces the runoff volume from a property and may reduce the peak runoff velocity for small, frequently occurring storms. In addition, by reducing the amount of storm water runoff that flows overland into a storm water conveyance system (storm drain inlets and drain pipes), less pollutants are transported through the conveyance system into local creeks and the ocean. The reuse of the detained water for irrigation purposes leads to the conservation of potable water and the recharge of groundwater. SD-8 fact sheet in Appendix E provides additional detail for designing Harvest and Use BMPs. Projects can incorporate SD-8 by installing rain barrels or cisterns, as applicable.

Chapter 5

Storm Water Pollutant Control Requirements for PDPs

In addition to the site design and source control BMPs discussed in Chapter 4, PDPs are required to implement storm water pollutant control BMPs to reduce the quantity of pollutants in storm water discharges. Storm water pollutant control BMPs are engineered facilities that are designed to retain (i.e. intercept, store, infiltrate, evaporate and evapotranspire), biofilter and/or provide flow-thru treatment of storm water runoff generated on the project site.

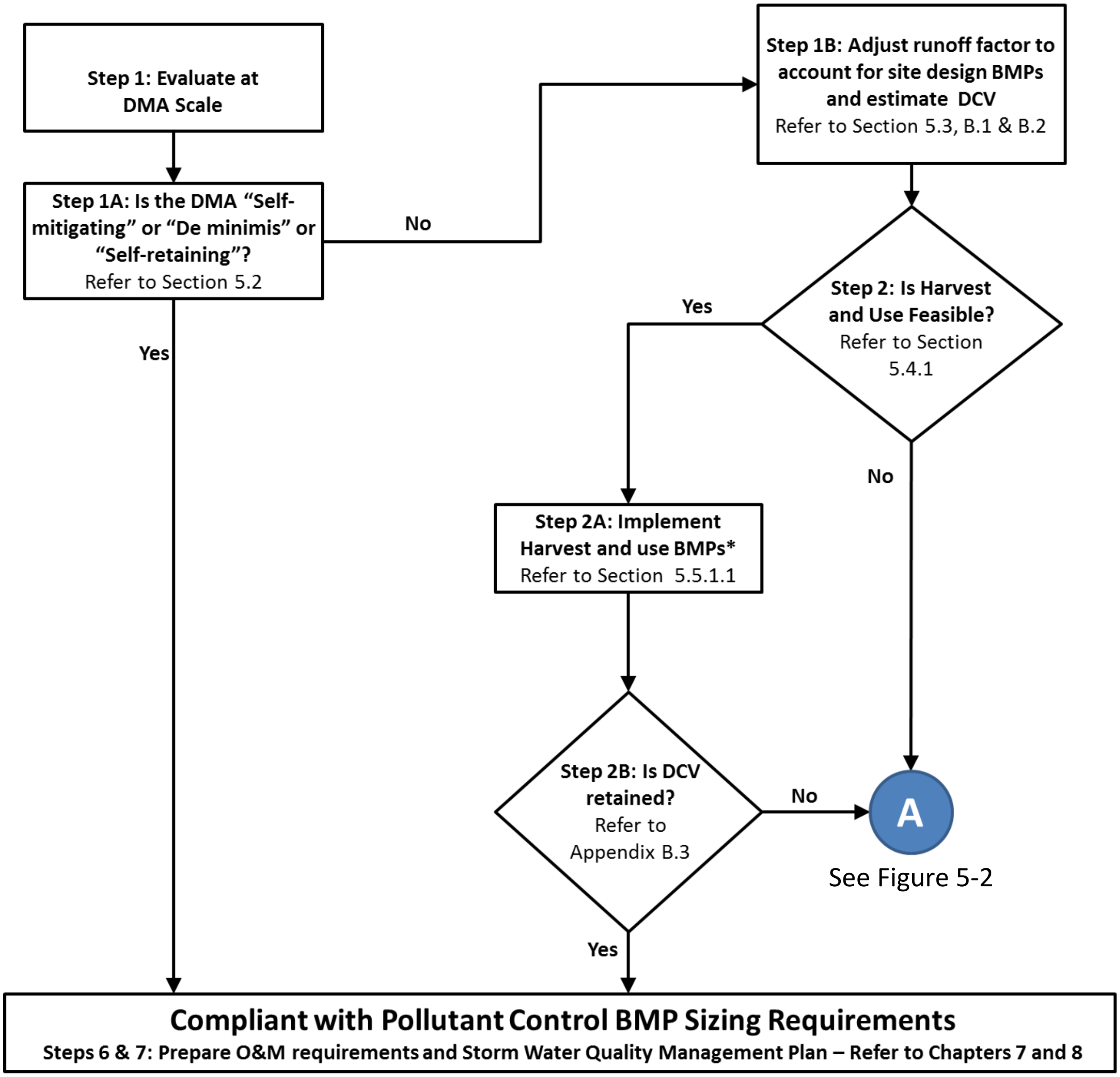
This chapter describes the specific process for determining which category of pollutant control BMP, or combination of BMPs, is most appropriate for the PDP site and how to design the BMP to meet the storm water pollutant control performance standard (per Section 2.2).

This chapter by itself is not a complete design guide for project development. It is intended to provide guidance for selecting and designing storm water pollutant control BMPs. Specifically:

- This chapter should be followed after having conducted site planning that maximizes opportunities for storm water retention and biofiltration as discussed in Chapter 3.
- The steps in this chapter pertain specifically to storm water pollutant control BMPs. These criteria must be met regardless of whether or not hydromodification management applies, however the overall sequencing of project development may be different if hydromodification management applies. For guidance on how to integrate both hydromodification management and pollutant control BMPs (in cases where both requirements apply), see Sections 3.4.3, 5.6 and Chapter 6.

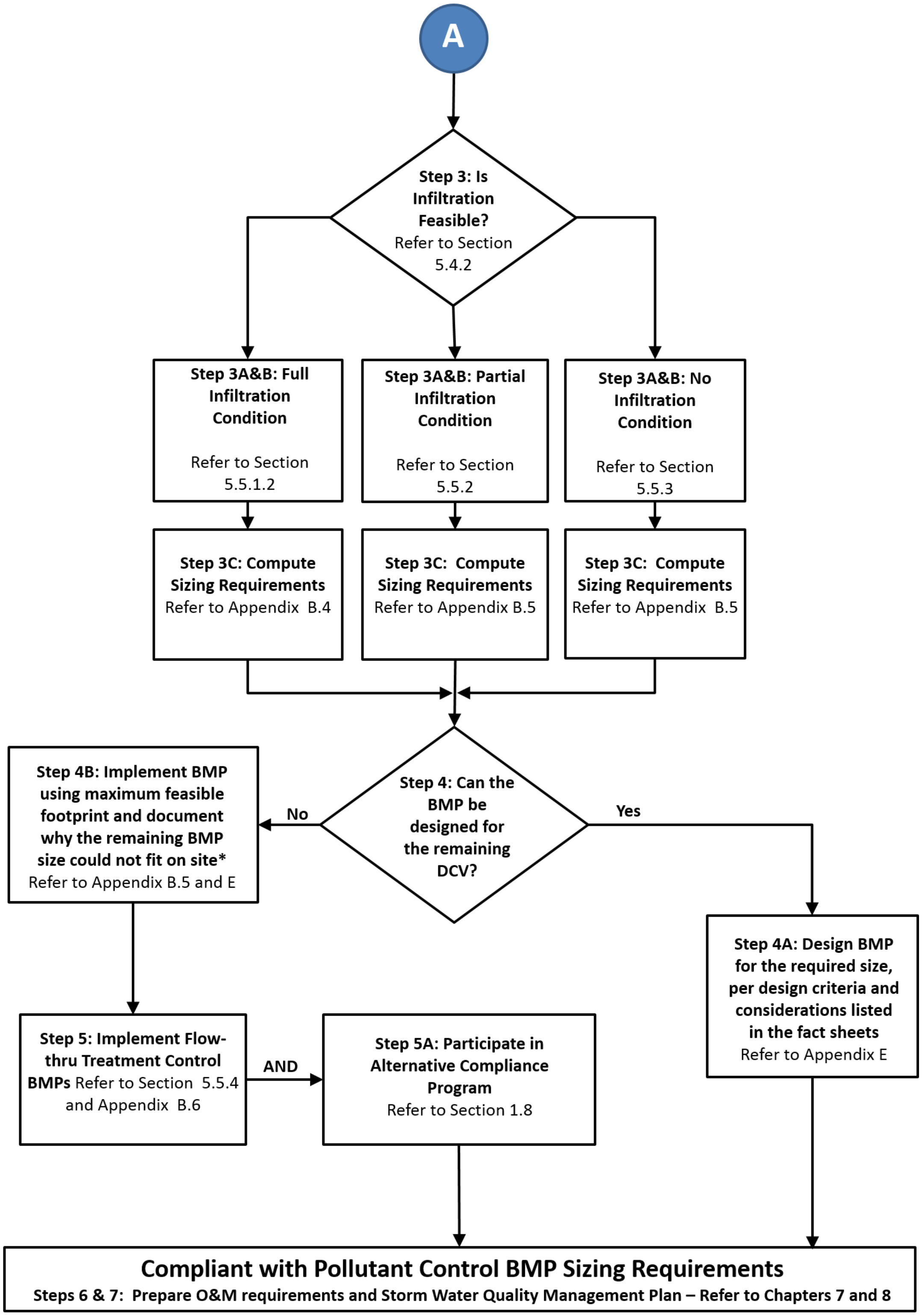
5.1 Steps for Selecting and Designing Storm Water Pollutant Control BMPs

Figures 5-1 and 5-2 present the flow chart for complying with storm water pollutant control BMP requirements. The steps associated with this flow chart are described below. A project is considered to be in compliance with storm water pollutant control performance standards if it follows and implements this flow chart and follows the supporting technical guidance referenced from this flow chart. This section is applicable whether or not hydromodification management requirements apply, however the overall sequencing of project development may be different if hydromodification management requirements apply.



* Step 2C: Project applicant has an option to also conduct feasibility analysis for infiltration and if infiltration is fully or partially feasible has an option to choose between infiltration and harvest and use BMPs. But if infiltration is not feasible and harvest and use is feasible, project applicant must implement harvest and use BMPs

FIGURE 5-1. Storm Water Pollutant Control BMP Selection Flow Chart



* Project approval at the discretion of the Port

FIGURE 5-2. Storm Water Pollutant Control BMP Selection Flow Chart

Description of Steps:

Step 1. Based on the locations for storm water pollutant control BMPs and the DMA delineations developed during the site planning phase (See Section 3.3.3), calculate the DCV.

A. Identify DMAs that meet the criteria in Section 5.2 (self-mitigating and/or de minimis areas and/or self-retaining via qualifying site design BMPs).

B. Estimate DCV for each remaining DMA. See Section 5.3.

Step 2. Conduct feasibility screening analysis for harvest and use BMPs. See Section 5.4.1.

A. If it is feasible, implement harvest and use BMPs (See Section 5.5.1.1) or go to Step 3.

B. Evaluate if the DCV can be retained onsite using harvest and use BMPs. See Appendix B.3. If the DCV can be retained onsite then the pollutant control performance standards are met.

C. The applicant has an option to also conduct a feasibility analysis for infiltration and if infiltration is feasible has an option to choose between infiltration and harvest and use BMPs. But if infiltration is not feasible and harvest and use is feasible, the applicant must implement harvest and use BMPs.

Step 3. Conduct feasibility analysis for infiltration for the BMP locations selected. See Section 5.4.2.

A. Determine the preliminary feasibility categories of BMP locations based on available site information. Determine the additional information needed to conclusively support findings. Use the "Categorization of Infiltration Feasibility Condition" checklist located in Appendix I-8 to conduct preliminary feasibility screening.

B. Select the storm water pollutant control BMP category based on preliminary feasibility condition.

i. Full Infiltration Condition– Implement infiltration BMP category, See Section 5.5.1.2

ii. Partial Infiltration Condition – Implement partial retention BMP category. See Section 5.5.2

iii. No Infiltration Condition – Implement biofiltration BMP category. See Section 5.5.3

C. After selecting BMPs, conduct design level feasibility analyses at BMP locations. The purpose of these analyses is to conform or adapt selected BMPs to maximize storm water retention and develop design parameters (e.g. infiltration rates, elevations). Document findings to substantiate BMP selection, feasibility, and design in the SWQMP. See Appendix C and D for additional guidance.

Step 4. Evaluate if the required BMP footprint will fit considering the site design and constraints.

A. If the calculated footprint fits, then size and design the selected BMPs accordingly using design criteria and considerations from fact sheets presented in Appendix E. The project has met the pollutant control performance standards.

B. If the calculated BMP footprint does not fit, evaluate additional options to make space for BMPs. Examples include potential design revisions, reconfiguring DMAs, evaluating other or additional BMP locations and evaluating other BMP types. If no additional options are practicable for making adequate space for the BMPs, then document why the remaining DCV could not be treated onsite and then implement the BMP using the maximum feasible footprint, design criteria and considerations from fact sheets presented in Appendix E then continue to the next step. Project approval if the entire DCV could not be treated because the BMP size could not fit within the project footprint is at the discretion of the Port.

Step 5. Implement flow-thru treatment control BMPs for the remaining DCV. See Section 5.5.4 and B.6 for additional guidance.

A. When flow-thru treatment control BMPs are implemented the project applicant must also participate in an alternative compliance program. See Section 1.8.

Step 6. Prepare a SWQMP documenting site planning and opportunity assessment activities, final site layout and storm water management design. See Chapter 8.

Step 7. Identify and document O&M requirements and confirm acceptability to the responsible party. See Chapters 7 and Chapter 8.

5.2 DMAs Excluded from DCV Calculation

This manual provides project applicants the option to exclude DMAs from DCV calculations if they meet the criteria specified below. These DMAs must implement source control and site design BMPs from Chapter 4 as applicable and feasible. These exclusions will be evaluated on a case-by-case basis and approvals of these exclusions are at the discretion of the Port.

5.2.1 Self-mitigating DMAs

Self-mitigating DMAs consist of natural or landscaped areas that drain directly offsite or to the public storm drain system. Self-mitigating DMAs must meet **ALL** the following characteristics to be eligible for exclusion:

- Vegetation in the natural or landscaped area is native and/or non-native/non-invasive drought tolerant species that do not require regular application of fertilizers and pesticides.
- Soils are undisturbed native topsoil, or disturbed soils that have been amended and aerated to promote water retention characteristics equivalent to undisturbed native topsoil.
- The incidental impervious areas are less than 5 percent of the self-mitigating area.
- Impervious area within the self-mitigated area should not be hydraulically connected to other impervious areas unless it is a storm water conveyance system (such as brow ditches).
- The self-mitigating area is hydraulically separate from DMAs that contain permanent storm water pollutant control BMPs.

Figure 5.3 illustrates the concept of self-mitigating DMAs.

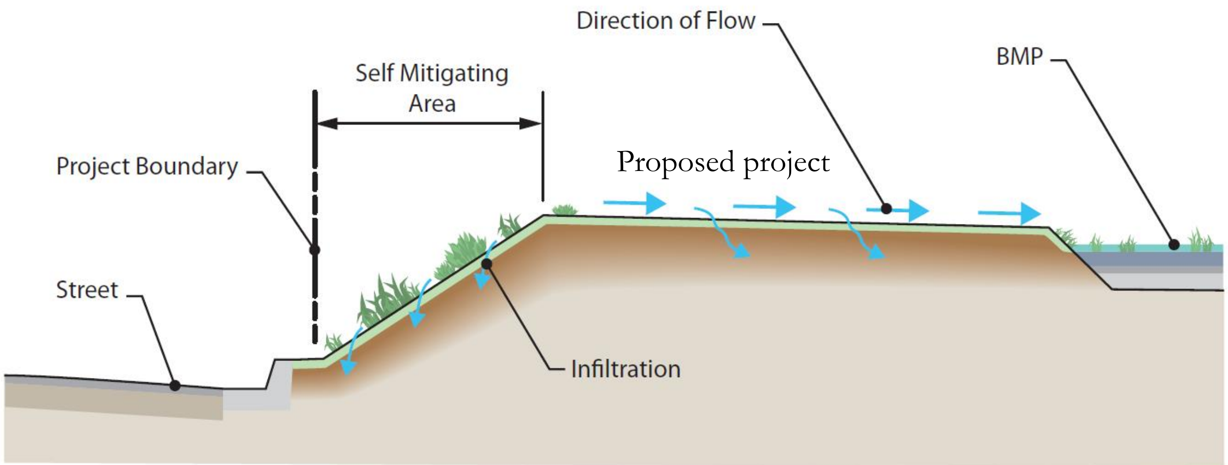


FIGURE 5-3. Self Mitigating Area

5.2.2 De Minimis DMAs

De minimis DMAs consist of areas that are very small, and therefore are not considered to be significant contributors of pollutants, and are considered by the tenant/project proponent and the Port not practicable to drain to a BMP. It is anticipated that only a small subset of projects will qualify for de minimis DMA exclusion. Examples include driveway aprons connecting to existing streets, portions of sidewalks, retaining walls at the external boundaries of a project, and similar features. De minimis DMAs must include **ALL** of the following characteristics to be eligible for exclusion:

- Areas abut the perimeter of the development site.
- Topography and land ownership constraints make BMP construction to reasonably capture runoff technically infeasible.
- The portion of the site falling into this category is minimized through effective site design
- Each DMA should be less than 250 square feet and the sum of all de minimis DMAs should represent less than 2 percent of the total added or replaced impervious surface of the project. Except for projects where 2 percent of the total added or replaced impervious surface of the project is less than 250 square feet, a de minimis DMA of 250 square feet or less is allowed.
- Two de minimis DMAs cannot be adjacent to each other and hydraulically connected.
- The SWQMP must document the reason that each de minimis area could not be addressed otherwise.

5.2.3 Self-retaining DMAs via Qualifying Site Design BMPs

Self-retaining DMAs are areas that are designed with site design BMPs to retain runoff to a level equivalent to pervious land. BMP Fact Sheets for impervious area dispersion (SD-5 in Appendix E) and permeable pavement (SD-6B in Appendix E) describe the design criteria by which BMPs can be considered self-retaining. DMAs that are categorized as self-retaining DMAs are considered to **only** meet the storm water pollutant control obligations.

Requirements for utilizing this category of DMA:

- Site design BMPs such as impervious area dispersion and permeable pavement may be used individually or in combination to reduce or eliminate runoff from a portion of a PDP.
- If a site design BMP is used to create a self-retaining DMA, then the site design BMPs must be designed and implemented per the criteria in the applicable fact sheet. These criteria are conservatively developed to anticipate potential changes in DMA characteristics with time. The fact sheet criteria for impervious area dispersion and permeable pavement for meeting pollutant control requirement developed using continuous simulation are summarized below:
    - SD-5 Impervious Area Dispersion: a DMA is considered self-retaining if the impervious to pervious ratio is:
        - 2:1 when the pervious area is composed of Hydrologic Soil Group A
        - 1:1 when the pervious area is composed of Hydrologic Soil Group B
    - SD-6B Self-retaining permeable pavement: a DMA is considered self-retaining if the ratio of total drainage area (including permeable pavement) to area of permeable pavement of 1.5:1 or less.
    - Note: Left side of ratios presented above represents the portion of the site that receives volume reduction and the right side of the ratio represents the site design BMP that promotes the achieved volume reduction.
- Site design BMPs used as part of a self-retaining DMA or as part of reducing runoff coefficients from a DMA must be clearly called out on project plans and in the SWQMP.
- The Port may accept or reject a proposed self-retaining DMA meeting these criteria at its discretion. Examples of rationale for rejection may include the potential for negative impacts (such as infiltration or vector issues), potential for significant future alteration of this feature, inability to visually inspect and confirm the feature, etc.
- PDPs subject to hydromodification requirements should note that Self-retaining DMAs must be included in hydromodification analysis. Reductions in DCV realized through Site Design BMPs are applicable to treatment control only and do not relax hydromodification requirements.

Other site design BMPs can be considered self-retaining for meeting storm water pollutant control obligations if the long term annual runoff volume (estimated using continuous simulation following guidelines listed in Appendix G) from the DMA is reduced to a level equivalent to pervious land and the applicant provides supporting analysis and rationale for the reduction in long term runoff volume. Approval of other self-retaining areas is at the discretion of the Port. Figure 5.4 illustrates the concept of self-retaining DMAs.

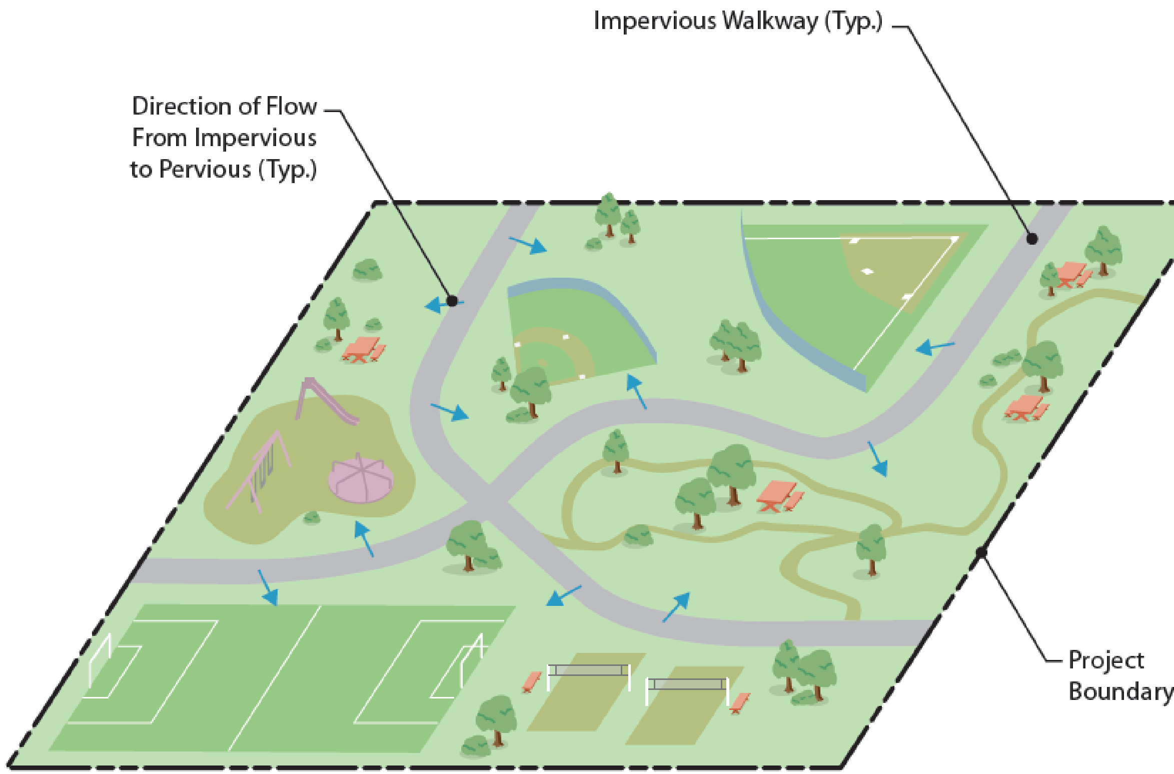


FIGURE 5-4. Self-retaining Site

5.3 DCV Reduction through Site Design BMPs

Site design BMPs as discussed in Chapter 4 reduce the rate and volume of storm water runoff from the project site. This manual provides adjustments to runoff factors for the following site design BMPs that may be incorporated into the project as part of an effective site design so that the downstream structural BMPs can be sized appropriately:

- SD-1 Street trees
- SD-5 Impervious area dispersion
- SD-6A Green roofs
- SD-6B Permeable pavement
- SD-8 Rain barrels

Methods for adjusting runoff factors for the above listed site design BMPs are presented in Appendix B.2. Site design BMPs used for reducing runoff coefficients from a DMA must be clearly called out on project plans and in the SWQMP. Approval of the claimed reduction of runoff factors is at the discretion of the Port.

5.4 Evaluating Feasibility of Storm Water Pollutant Control BMP Options

This section provides the fundamental process to establish which category, or combination of categories, of pollutant control BMP is feasible and to determine the volume of onsite retention that is feasible, either through harvest and use, or infiltration of the DCV. The feasibility screening process presented below establishes the volume of retention that can be achieved to fully or partially meet the pollutant control performance standards.

5.4.1 Feasibility Screening for Harvest and Use Category BMPs

Harvest and use is a BMP that captures and stores storm water runoff for later use. The primary question to be evaluated is:

- Is there a demand for harvested water within the project or project vicinity that can be met or partially met with rainwater harvesting in a practical manner?

Appendix B.3 provides guidance for determining the feasibility for using harvested storm water based on onsite demand. Step 2 from Section 5.1 describes how the feasibility results need to be considered in the pollutant control BMP selection process.

5.4.2 Feasibility Screening for Infiltration Category BMPs

After accounting for any potential onsite use of storm water, the next step is to evaluate how much storm water can be retained onsite primarily through infiltration of the DCV. Infiltration of storm water is dependent on many important factors that must be evaluated as part of infiltration feasibility screening. The key questions to determining the degree of infiltration that can be accomplished onsite are:

- Is infiltration potentially feasible and desirable?
- If so, what quantity of infiltration is potentially feasible and desirable?

These questions must be addressed in a systematic fashion to determine if full infiltration of the DCV is potentially feasible. If when answering these questions it is determined that full infiltration is not feasible, then the portion of the DCV that could be infiltrated must be quantified, or a determination that infiltration in any appreciable quantity is infeasible or must be avoided. **This process is illustrated in Figure 5-5.** As a result of this process, conditions can be characterized as one of the three categories listed and defined below.

- **Full Infiltration Condition**: Infiltration of the full DCV is potentially feasible and desirable. More rigorous design-level analyses should be used to confirm this classification and establish specific design parameters such as infiltration rate and factor of safety. BMPs in this category may include bioretention and infiltration basins. See Section 5.5.1.2.
- **Partial Infiltration Condition**: Infiltration of a significant portion of the DCV may be possible, but site factors may indicate that infiltration of the full DCV is either infeasible or not desirable. Select BMPs that provide opportunity for partial infiltration, e.g. biofiltration with partial retention. See Section 5.5.2.

- **No Infiltration Condition**: Infiltration of any appreciable volume should be avoided. Some incidental volume losses may still be possible, but any appreciable quantity of infiltration would introduce undesirable conditions. Other pollutant control BMPs should be considered e.g. biofiltration or flow-thru treatment control BMPs and participation in alternative compliance (Section 1.8) for the portion of the DCV that is not retained or biofiltered onsite. See Section 5.5.3 and 5.5.4.

The "Categorization of Infiltration Feasibility Condition" checklist located in Appendix I must be used to document the findings of the infiltration feasibility assessment and must be supported by all associated information used in the feasibility findings. Appendix C and D in this manual provides additional guidance and criteria for performing feasibility analysis for infiltration. All PDPs are required to complete this worksheet. At the site planning phase, this worksheet can help guide the design process by influencing project layout and selection of infiltration BMPs, and identifying whether more detailed studies are needed. At the design and final report submittal phase, planning level categorizations related to infiltration must be confirmed or revised and rigorously documented and supported based on design-level investigations and analyses, as needed. A Geological Investigation Report must be prepared for all PDPs implementing onsite structural BMPs. This report should be attached to the SWQMP. Geotechnical and groundwater investigation report requirements are listed in Appendix C.

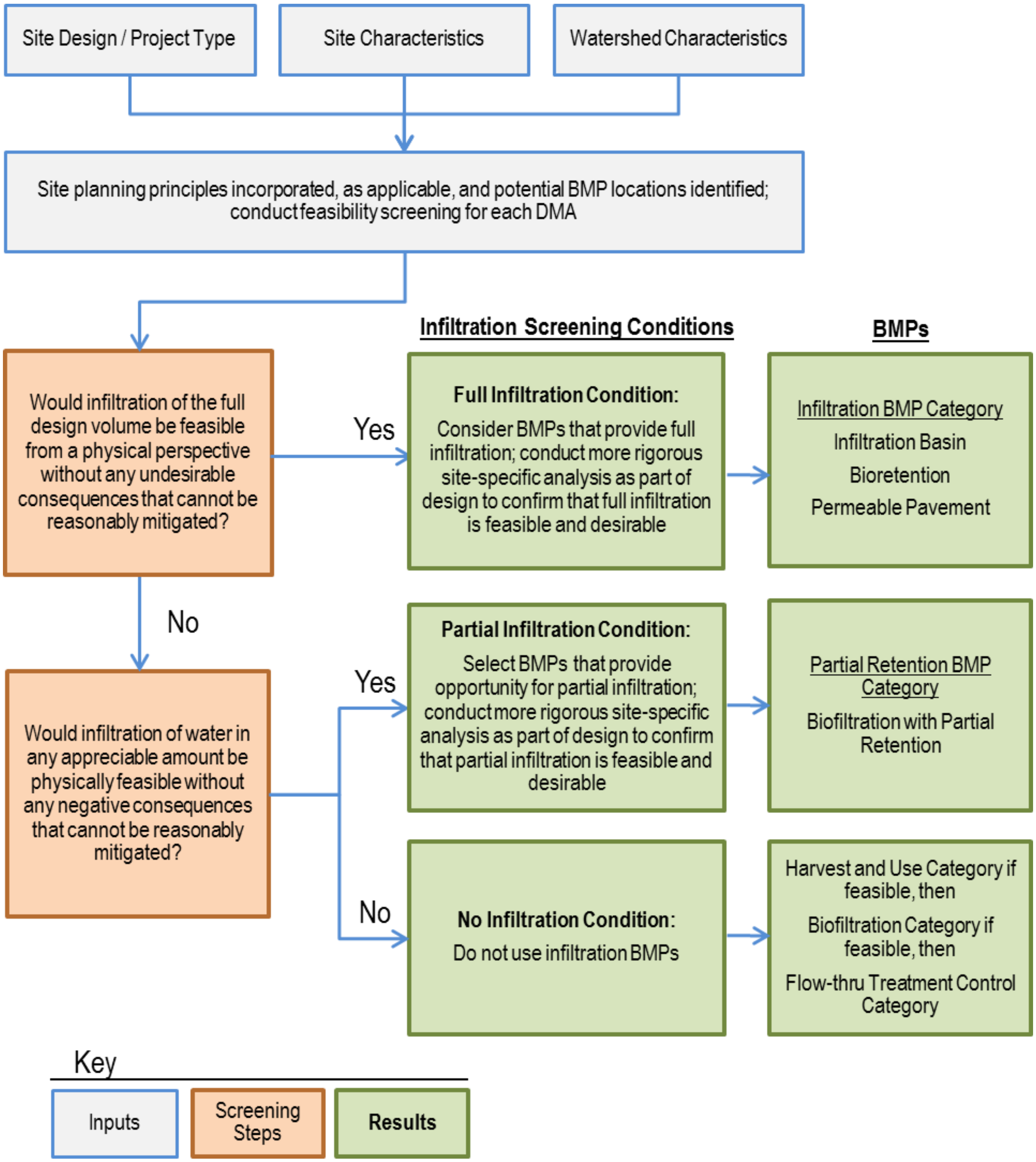


FIGURE 5-5. Infiltration Feasibility and Desirability Screening Flow Chart

5.5 BMP Selection and Design

BMP selection shall be based on steps listed in Section 5.1 and the feasibility screening process described in Section 5.4. When selecting BMPs designated for placement within public agency land, such as easements or rights-of-way, it is important to contact that public agency to inquire about additional design requirements that must be met. Selected BMPs must be designed based on accepted design standards. The BMP designs described in the BMP Fact Sheets (Appendix E) shall constitute the allowable storm water pollutant control BMPs for the purpose of meeting storm water management requirements. Other BMP types and variations on these designs may be approved at the discretion of the Port if documentation is provided demonstrating that the BMP is functionally equivalent or better than those described in this manual.

This section provides an introduction to each category of BMP and provides links to fact sheets that contain recommended criteria for the design and implementation of BMPs. Table 5-1 maps the BMP category to the fact sheets provided in Appendix E. Criteria specifically described in these fact sheets override guidance contained in outside referenced source documents. Where criteria are not specified, the applicant and the project review staff should use best professional judgment based on the recommendations of the referenced guidance material or other published and generally accepted sources. When an outside source is used, the preparer must document the source in the SWQMP.

TABLE 5-1. Permanent Structural BMPs for PDPs

MS4 Permit Category	Manual Category	BMPs
Retention	Harvest and Use (HU)	HU-1: Cistern
Retention	Infiltration (INF)	INF-1: Infiltration basin INF-2: Bioretention INF-3: Permeable pavement
NA	Partial Retention (PR)	PR-1: Biofiltration with partial retention
Biofiltration	Biofiltration (BF)	BF-1: Biofiltration BF-2: Nutrient Sensitive Media Design BF-3: Proprietary Biofiltration
Flow-thru treatment control	Flow-thru treatment control with Alternative Compliance (FT)	FT-1: Vegetated swales FT-2: Media filters FT-3: Sand filters FT-4: Dry extended detention basins FT-5: Proprietary flow-thru treatment control

5.5.1 Retention Category

5.5.1.1 Harvest and Use BMP Category

Harvest and use (typically referred to as rainwater harvesting) BMPs capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. Uses of captured water shall not result in runoff to storm drains or receiving waters. Potential uses of captured water may include irrigation demand, indoor non-potable demand, industrial process water demand, or other demands.

Selection: Harvest and use BMPs shall be selected after performing a feasibility analysis per Section 5.4.1. Based on findings from Section 5.4 if both harvest and use and full infiltration of the DCV is feasible onsite the project applicant has an option to implement either harvest and use BMPs and/or infiltration BMPs to meet the storm water requirements.

Design: A worksheet for sizing harvest and use BMPs is presented in Appendix B.3 and the fact sheet for sizing and designing the harvest and use BMP is presented in Appendix E. Figure 5-6 shows a schematic of a harvest and use BMP.

BMP option under this category:

- HU-1: Cistern

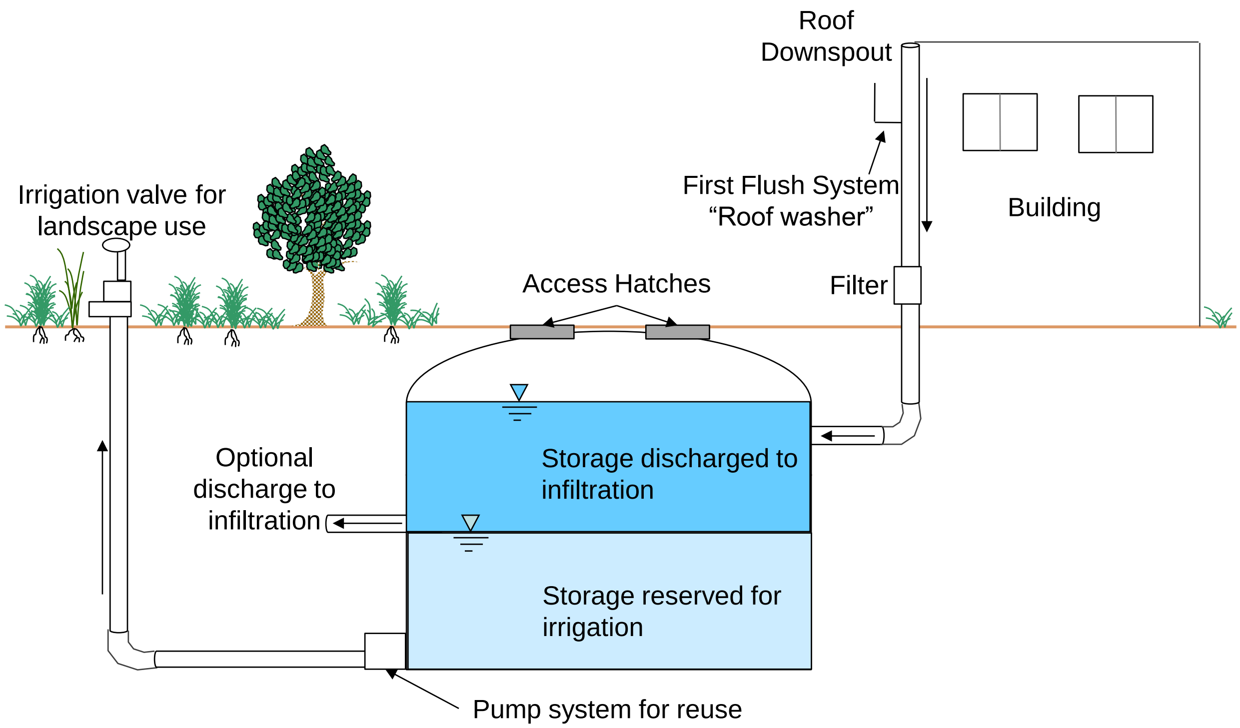


FIGURE 5-6. Schematic of a Typical Cistern

5.5.1.2 Infiltration BMP Category

Infiltration BMPs are structural measures that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. These types of BMPs may also support evapotranspiration processes but are characterized by having their most dominant volume losses due to infiltration. Pollution prevention and source control BMPs shall be implemented at a level appropriate to protect groundwater quality for areas draining to infiltration BMPs and runoff must undergo pretreatment such as sedimentation or filtration prior to infiltration.

Selection: Selection of this BMP category shall be based on analysis according to Sections 5.1 and 5.4.2. Dry wells are considered Class V injection wells and are subject to underground injection control (UIC) regulations. Dry wells are only allowed when registered with the US EPA.

Design: Appendix B.4 has a worksheet for sizing infiltration BMPs, Appendix D has guidance for estimating infiltration rates for use in design the BMP and Appendix E provides fact sheets to design the infiltration BMPs. Appendices B.6.2.1, B.6.2.2 and D.5.3 have guidance for selecting appropriate pretreatment for infiltration BMPs. Figure 5-7 shows a schematic of an infiltration basin.

BMP options under this category:

- INF-1: Infiltration basins
- INF-2: Bioretention
- INF-3: Permeable pavement
- Dry Wells

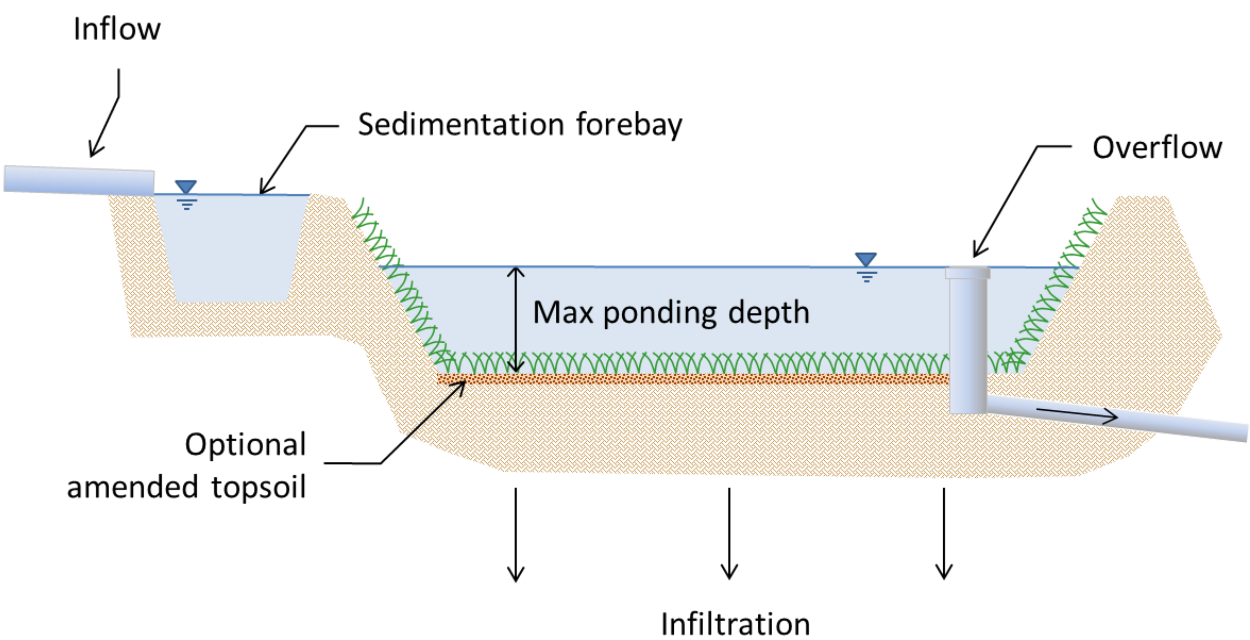


FIGURE 5-7. Schematic of a Typical Infiltration Basin

5.5.2 Partial Retention BMP Category

Partial retention category is defined by structural measures that incorporate both infiltration (in the lower treatment zone) and biofiltration (in the upper treatment zone). Example includes biofiltration with partial retention BMP.

5.5.2.1 Biofiltration with Partial Retention BMP

Biofiltration with partial retention BMPs are shallow basins filled with treatment media and drainage rock that manage storm water runoff through infiltration, evapotranspiration, and biofiltration. These BMPs are characterized by a subsurface stone infiltration storage zone in the bottom of the BMP below the elevation of the discharge from the underdrains. The discharge of biofiltered water from the underdrain occurs when the water level in the infiltration storage zone exceeds the elevation of the underdrain outlet. The storage volume can be controlled by the elevation of the underdrain outlet (shown in Figure 5-8), or other configurations. Other typical biofiltration with partial retention components include a media layer and associated filtration rates, drainage layer with associated in-situ soil infiltration rates, and vegetation.

Selection: Biofiltration with partial retention BMP shall be selected if the project site feasibility analysis performed according to Section 5.4.2 determines a partial infiltration feasibility condition.

Design: Appendix B.5 provides guidance for sizing biofiltration with partial retention BMP and Appendix E provides a fact sheet to design biofiltration with partial retention BMP.

BMP option under this category:

- PR-1: Biofiltration with partial retention

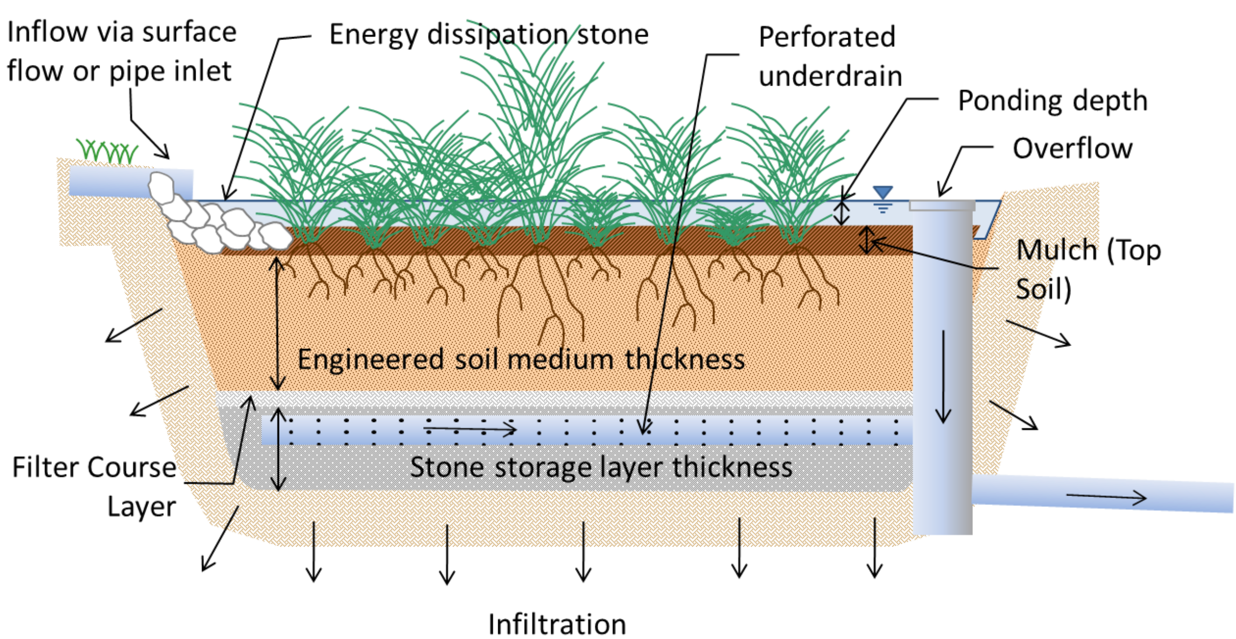


FIGURE 5-8. Schematic of a Typical Biofiltration with Partial Retention BMP

5.5.3 Biofiltration BMP Category

Biofiltration BMPs are shallow basins filled with treatment media and drainage rock that treat storm water runoff by capturing and detaining inflows prior to controlled release through minimal incidental infiltration, evapotranspiration, or discharge via underdrain or surface outlet structure. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and/or vegetative uptake. Biofiltration BMPs can be designed with or without vegetation, provided that biological treatment processes are present throughout the life of the BMP via maintenance of plants, media base flow, or other biota-supporting elements. By default, BMP BF-1 shall include vegetation unless it is demonstrated, to the satisfaction of the Port, that effective biological treatment process will be maintained without vegetation. Typical biofiltration components include a media layer with associated filtration rates, drainage layer with associated in-situ soil infiltration rates, underdrain, inflow and outflow control structures, and vegetation, with an optional impermeable liner installed on an as needed basis due to site constraints.

Selection: Biofiltration BMPs shall be selected if the project site feasibility analysis performed according to Section 5.4.2 determines a No Infiltration Feasibility Condition.

Design: Appendix B.5 has a worksheet for sizing biofiltration BMPs and Appendix E provides fact sheets to design the biofiltration BMP. Figure 5-9 shows the schematic of a biofiltration Basin.

BMP option under this category:

- BF-1: Biofiltration
- BF-2: Nutrient Sensitive Media Design
- BF-3: Proprietary Biofiltration

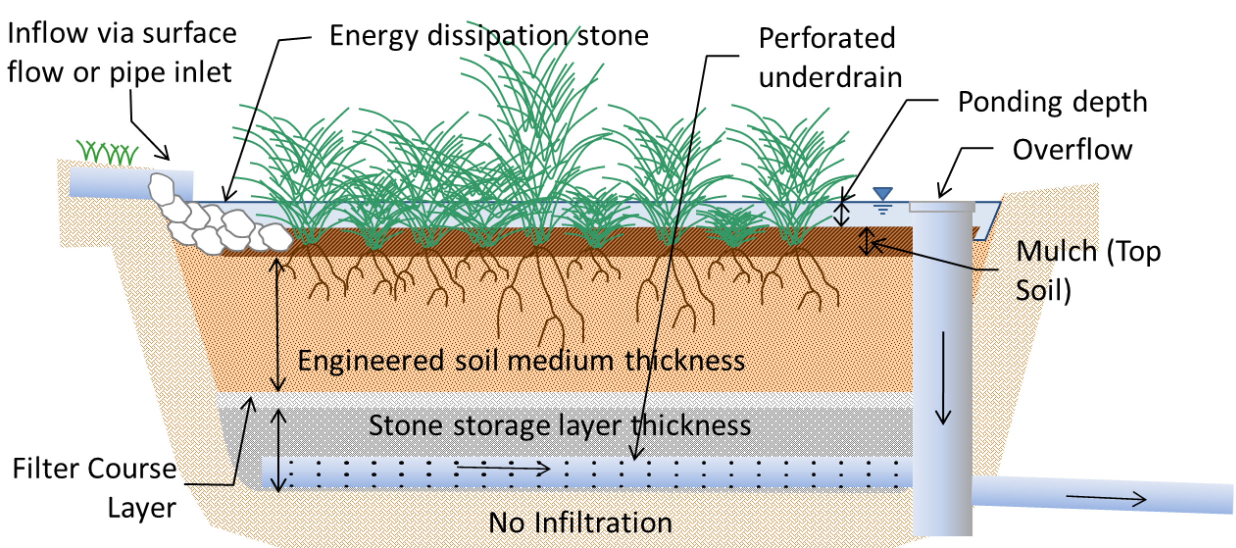


FIGURE 5-9. Schematic of a Typical Biofiltration Basin

5.5.4 Alternative Biofiltration Options:

Other BMPs, including proprietary BMPs (See fact sheet BF-3) may be classified as biofiltration BMPs if they qualify as approved equivalent compact proprietary biofiltration systems under the following criteria: (1) meet the minimum design criteria listed in Appendix F, including the pollutant treatment performance standard in Appendix F.1, (2) are designed and maintained in a manner consistent with their performance certifications, if applicable, (3) the overall design incorporates sufficient volume reduction to meet equivalent targets and (4) are acceptable at the discretion of the Port. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met. In determining the acceptability of an alternative biofiltration BMP, Port staff should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by Port staff, a written explanation/reason will be provided to the applicant.

5.5.5 Flow-thru Treatment Control BMPs (for use with Alternative Compliance) Category

Flow-thru treatment control BMPs are structural, engineered facilities that are designed to remove pollutants from storm water runoff using treatment processes that do not incorporate significant biological methods.

Selection: Flow-thru treatment control BMPs shall be selected based on the criteria in Appendix B.6. Flow-thru treatment control BMPs may only be implemented to satisfy PDP structural BMP performance requirements if an appropriate offsite alternative compliance project is also constructed to mitigate for the pollutant load in the portion of the DCV not retained onsite. The alternative compliance program is an optional element that may be developed by each jurisdiction (See Section 1.8).

Design: Appendix B.6 provides the methodology, required tables and worksheet for sizing flow-thru treatment control BMPs and Appendix E provides fact sheets to design the following flow-thru treatment control BMPs. Figure 5-10 shows a schematic of a Vegetated Swale as an example of a flow-thru treatment control BMP.

BMP options under this category:

- FT-1: Vegetated swales
- FT-2: Media filters
- FT-3: Sand filters
- FT-4: Dry extended detention basin
- FT-5: Proprietary flow-thru treatment control

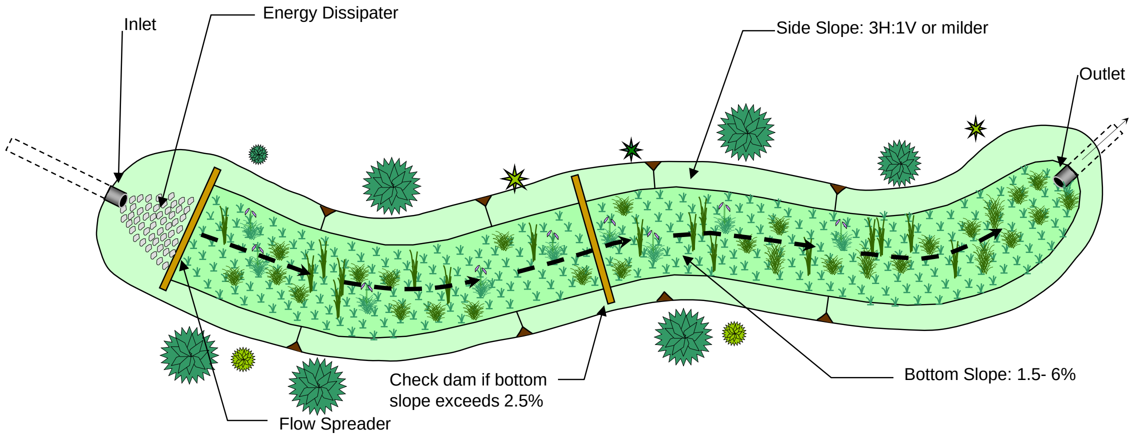


FIGURE 5-10. Schematic of a Vegetated Swale

Use of Proprietary BMP Options: A proprietary BMP (see fact sheet FT-5) can be classified as a flow-thru treatment control BMP if (1) it is demonstrated to meet the flow-thru treatment performance criteria in Appendix B.6, (2) is designed and maintained in a manner consistently with is applicable performance certifications, and (3) is acceptable at the discretion of the Port. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to justify the use of a proprietary flow-thru treatment control BMP. In determining the acceptability of an proprietary flow-thru treatment control BMP, Port staff should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by Port staff, a written explanation/reason will be provided to the applicant.

5.5.6 Alternate BMPs

New and proprietary BMP technologies may be available that meet the performance standards in Chapter 2 but are not discussed in this manual. Use of these alternate BMPs to comply with permit obligations is at the discretion of the Port. Alternate BMPs must meet the standards for biofiltration BMPs or flow-thru BMPs (depending on how they are used), as described in Appendix F and Appendix B.6, respectively.

5.6 Documenting Storm Water Pollutant Control BMP Compliance when Hydromodification Management Applies

The steps and guidance presented in Chapter 5 apply to all PDPs for demonstrating conformance to storm water pollutant control requirements regardless of whether hydromodification management applies. However, when hydromodification management applies, the approach for project design may be different. The following process can be used to document compliance with storm water pollutant control BMPs in cases when hydromodification management also applies:

1. Develop a combined BMP or treatment train (BMPs constructed in series) based on both storm water pollutant control and hydromodification management requirements. Appendix E provides specific examples of how storm water pollutant control BMPs can be configured to also address hydromodification management.
2. Dedicate a portion of the combined BMP or treatment train as the portion that is intended to comply with storm water pollutant control requirements.
3. Follow all of the steps in this chapter related to demonstrating that the dedicated portion of the BMP or treatment train meets the applicable storm water pollutant control criteria.
4. Check BMP design criteria in Appendix E and F to ensure that the hydromodification management design features (additional footprint, additional depth, modified outlet structure, lower discharge rates, etc.) do not compromise the treatment function of the BMP.
5. On project plans and in the O&M manual, clearly denote the portion of the BMP that serves the storm water pollutant control function.

Alternative approaches that meet both the storm water pollutant control and hydromodification management requirements may be acceptable at the discretion of the Port and shall be documented in the SWQMP. Also refer to Section 6.3.6 for additional guidance.

Chapter 6

BMP DESIGN MANUAL

Hydromodification Management Requirements for PDPs

The purpose of hydromodification management requirements for PDPs is to minimize the potential of storm water discharges from the MS4 from causing altered flow regimes and excessive downstream erosion in receiving waters. Hydromodification management implementation for PDPs includes two components: protection of critical coarse sediment yield areas and flow control for post-project runoff from the project site. For PDPs subject to hydromodification management requirements, this Chapter provides guidance to meet the performance standards for the two components of hydromodification management.

The civil engineer preparing the hydromodification management study for a project will find within this Chapter and Appendix G of this manual, along with watershed-specific information in the WMAA, all necessary information to meet the MS4 Permit standards. Should unique project circumstances require an understanding beyond what is provided in this manual, then consult the March 2011 Final HMP, which documents the historical development of the hydromodification management requirements.

Guidance for flow control of post-project runoff is based on the March 2011 Final HMP, with modifications in this manual based on updated requirements in the MS4 Permit. The March 2011 Final HMP was prepared based on the 2007 MS4 Permit, not the MS4 Permit that drives this manual. In instances where there are changes to hydromodification management criteria or procedures based on the MS4 Permit, the criteria and procedures presented in this manual supersede the March 2011 Final HMP.

Protection of critical coarse sediment yield areas is a new requirement of the MS4 Permit and is not covered in the March 2011 Final HMP. The standards and management practices for protection of critical coarse sediment yield areas are presented here in the manual.

6.1 Hydromodification Management Applicability and Exemptions

As noted in Chapter 1, Section 1.6 a project may be exempt from hydromodification

management requirements if it meets any one of the following conditions:

- The project is not a PDP;
- The proposed project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean;
- The proposed project will discharge runoff directly to conveyance channels whose bed and bank are concrete lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean; or
- The proposed project will discharge runoff directly to an area identified by the Copermittees as appropriate for an exemption by the WMAA for the watershed in which the project resides.

The above criteria reflects the latest list of exemptions that are allowed under the MS4 Permit and therefore supersedes criteria found in earlier publications.

Applicants electing to perform an exemption analysis to exempt a project from hydromodification management requirements shall use the methodology for hydromodification management exemption presented in Attachment E of the Regional Watershed Management Area Analysis. However, any future proposed hydromodification management exemptions would need to be approved by the RWQCB through the WQIP Annual Update process (Regional MS4 Permit Section F.1.2.c.) prior to the project being exempt from hydromodification management exemptions.

Most areas within the Port are exempt from hydromodification with the exception of areas draining to San Diego Bay National Wildlife Refuge, areas that drain to undeveloped land, or areas that drain first to other receiving waters.

6.2 Protection of Critical Coarse Sediment Yield Areas

Potential critical coarse sediment yield areas for each watershed management area are delineated in the WMAA. No potential critical coarse sediment yield areas were identified within the Port jurisdiction.

6.3 Flow Control for Hydromodification Management

PDPs subject to hydromodification management requirements must provide flow control for post-project runoff to meet the flow control performance standard.

This is typically accomplished using structural BMPs that may include any combination of infiltration basins; bioretention, biofiltration with partial retention, or biofiltration basins; or detention basins. This Section will discuss design of flow control measures for hydromodification management. This Section is intended to be used following the source control and site design processes described in Chapter 4 and the storm water pollutant control design process described in Chapter 5.

The flow control performance standard is as follows:

1 For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-development 2-year runoff event ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-development 10-year runoff event (Q_{10}), the post-project discharge rates and durations must not exceed

the pre-development rates and durations by more than 10 percent. The specific lower flow threshold will depend on the erosion susceptibility of the receiving stream for the project site (see Section 6.3.4).

In this context, Q_2 and Q_{10} refer to flow rates determined based on either continuous simulation hydrologic modeling or an approved regression equation. The range from a fraction of Q_2 to Q_{10} represents the range of geomorphically significant flows for hydromodification management in San Diego. The upper bound of the range of flows to control is pre-development Q_{10} for all projects. The lower bound of the range of flows to control, or "lower flow threshold" is a fraction of pre-development Q_2 that is based on the erosion susceptibility of the stream and depends on the specific natural system (stream) that a project will discharge to. Tools have been developed in the March 2011 Final HMP for assessing the erosion susceptibility of the stream (see Section 6.3.4 below for further discussion of the lower flow threshold).

When selecting the type of structural BMP to be used for flow control, consider the types of structural BMPs that will be utilized onsite for pollutant control.

Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMPs. For example, a full infiltration BMP that infiltrates the DCV for pollutant control could include additional storage volume above or below ground to provide either additional infiltration of storm water or control of outflow for hydromodification management. If possible, the structural BMPs for pollutant control should be modified to meet flow control performance standards in addition to the pollutant control performance standards. See Section 6.3.6 for further discussion of integrating structural BMPs for pollutant control and flow control.

6.3.1 Point(s) of Compliance

For PDPs subject to hydromodification management requirements, the flow control performance standard must be met for each natural or un-lined channel that will receive runoff from the project.

This may require multiple structural BMPs within the project site if the project site discharges to multiple discrete outfalls. When runoff is discharged to multiple natural or un-lined channels within a project site, each natural or un-lined channel must be considered separately and points of compliance (POCs) for flow control must be provided for each natural or un-lined channel, including situations where the channels will confluence before leaving the project boundary. When runoff from the project site does not meet a natural or un-lined channel onsite, instead traveling some distance downstream of the project in storm drain systems or lined channels prior to discharge to natural or un-lined channels, the POC(s) for flow control analysis shall be placed at the project boundary (i.e., comparing the pre-development and post-project flows from the project area only, not analyzing the total watershed draining to the offsite POC), unless the project is draining to and accommodated by an approved master planned or regional flow control BMP.

For individual projects draining to approved master planned or regional flow control BMPs, the POC for flow control analysis may be offsite of the specific project application.

In these instances, the individual project draining to a master planned or regional flow control BMP shall reference the approved design documents for the BMP, and shall demonstrate that either (a) the individual project design is consistent with assumptions made for imperviousness and features of the project area when the master planned or regional BMP was designed, or (b) the master planned or regional BMP still meets performance standards when the actual proposed imperviousness and features of the project area are considered.

6.3.2 Offsite Area Restrictions

Runoff from offsite undeveloped areas should be routed around structural BMPs for flow control whenever feasible.

Methods to route flows around structural BMPs include designing the site to avoid natural drainage courses, or using parallel storm drain systems. If geometric constraints prohibit the rerouting of flows from undeveloped areas around a structural BMP, a detailed description of the constraints must be submitted to the Port.

Structural BMPs for flow control must be designed to avoid trapping sediment from natural areas regardless of whether the natural areas are critical coarse sediment yield areas or not.

Reduction in coarse sediment supply contributes to downstream channel instability. Capture and removal of natural sediment from the downstream watercourse can create "hungry water" conditions and the increased potential for downstream erosion. Additionally, coarse or fine sediment from natural areas can quickly fill the available storage volume in the structural BMP and/or clog a small flow control outlet, which can cause the structural BMP to overflow during events that should have been controlled, and will require frequent maintenance. Failure to prevent clogging of the principal control orifice defeats the purpose of a flow control BMP, since basin inflows would simply overtop the control structure and flow unattenuated downstream, potentially worsening downstream erosion.

6.3.3 Requirement to Control to Pre-Development (Not Pre-Project) Condition

The MS4 Permit requires that post-project runoff must be controlled to match pre-development runoff conditions, not pre-project conditions, for the range of flow rates to be controlled.

Pre-development runoff conditions are defined in the MS4 Permit as "approximate flow rates and durations that exist or existed onsite before land development occurs."

- **Redevelopment PDPs:** Use available maps or development plans that depict the topography of the site prior to development, otherwise use existing onsite grades if historic topography is not available. Assume the infiltration characteristics of the underlying soil. Use available information pertaining to existing underlying soil type such as soil maps published by the Natural Resource Conservation Service (NRCS). Do not use runoff parameters for concrete or asphalt to estimate pre-development runoff conditions. If compacted soils condition exists, however, infiltration characteristics (refer to Appendix G, Table G.1.4 for allowable adjustments) for that runoff condition may be assumed.
- **New development PDPs:** The pre-development condition typically equates to runoff conditions immediately before project construction. However if there is existing impervious area onsite, as with redevelopment, the new development project must not use runoff parameters for concrete or asphalt to estimate pre-development runoff conditions. If compacted soils condition exists, however, infiltration characteristics (refer to Appendix G, Table G.1.4 for allowable adjustments) for that runoff condition may be assumed.

When it is necessary for runoff from offsite impervious area (not a part of the project) to co-mingle with project site runoff and be conveyed through a project's structural flow control BMP, the offsite impervious area may be modeled as impervious in both the pre- and post- condition models. A project is not required to provide flow control for storm water from offsite. This also means that for redevelopment projects not subject to the 50% rule (i.e., redevelopment projects that result in the creation or replacement of impervious surface in an amount of less than 50% of the area of impervious surface of the previously existing development), comingled runoff from undisturbed portions of the previously existing development (i.e., areas that are not a part of the project) will not require flow control. Flow control facilities for comingled offsite and onsite runoff would be designed to process the total volume of the comingled runoff through the facility, but would provide mitigation for the excess runoff (difference of developed to pre-developed condition) based on onsite impervious areas only. The project applicant must clearly explain why it was not feasible or practical to provide a bypass system for storm water from offsite. The Port may request that the project applicant provide a supplemental analysis of onsite runoff only (i.e., supplemental model of the project area only).

6.3.4 Determining the Low Flow Threshold for Hydromodification Flow Control

The range of flows to control for hydromodification management depends on the erosion susceptibility of the receiving stream.

The range of flows to control is either:

- $0.1Q_2$ to Q_{10} for projects discharging to streams with high susceptibility to erosion (and this is the default range of flows to control when a stream susceptibility study has not been prepared),
- $0.3Q_2$ to Q_{10} for projects discharging to streams with medium susceptibility to erosion as determined by a stream susceptibility study approved by the Port, or
- $0.5Q_2$ to Q_{10} for projects discharging to streams with low susceptibility to erosion as determined by a stream susceptibility study approved by the Port.

The project applicant may opt to design to the default low flow threshold of 0.1Q2, or provide assessment of the receiving stream ("channel screening" a.k.a. "geomorphic assessment"), which may result in a higher low flow threshold of 0.3Q2 or 0.5Q2 for project hydromodification management.

Use of a higher low flow threshold of 0.3Q2 or 0.5Q2 must be supported by a channel screening report. Channel screening is based on a tool developed by the Southern California Coastal Water Research Project (SCCWRP), documented in SCCWRP's Technical Report 606 dated March 2010, "Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility." The SCCWRP channel screening tool considers channel conditions including channel braiding, mass wasting, and proximity to the erosion threshold. SCCWRP's Technical Report 606 is included in Appendix B of the March 2011 Final HMP, and can also be accessed through SCCWRP's website. The result of applying the channel screening tool will be classification of high, medium, or low susceptibility to erosion, corresponding to low flow thresholds of 0.1Q2, 0.3Q2, and 0.5Q2, respectively, for the receiving stream. Note that the Port may require that the channel screening study has been completed within a specific time frame prior to their review, and/or may apply a sunset date to their approval of a channel screening study.

The receiving stream is the location where runoff from the project is discharged to natural or

un-lined channels.

The receiving stream may be onsite or offsite. The POC for channel screening is the point where runoff initially meets an un-lined or natural channel, regardless of whether the POC for flow control facility sizing is at or within the project boundary or is offsite. A project may have a different POC for channel screening vs. POC for flow control facility sizing if runoff from the project site is conveyed in hardened systems from the project site to the un-lined or natural channel. The erosion susceptibility of the receiving stream must be evaluated at the POC for channel screening, and for an additional distance known as the domain of analysis, defined in SCCWRP's Technical Report 606.

6.3.5 Designing a Flow Control Facility

Flow control facilities for hydromodification management must be designed based on continuous simulation hydrologic modeling.

Continuous simulation hydrologic modeling uses an extended time series of recorded precipitation data and evapotranspiration data as input and generates hydrologic output, such as surface runoff, groundwater recharge, and evapotranspiration, for each model time step. Using the continuous flow output, peak flow frequency and duration statistics can be generated for the pre-development and post-project conditions for the purpose of matching pre-development hydrologic conditions in the range of geomorphically significant flow rates. Peak flow frequency statistics estimate how often flow rates will exceed a given threshold. Flow duration statistics determine how often a particular flow rate is exceeded. To determine if a flow control facility meets hydromodification management performance standards, peak flow frequency and flow duration curves must be generated and compared for pre-development and post-project conditions.

Flow control facilities may be designed using either sizing factors presented in Appendix B of this manual, or using project-specific continuous simulation modeling. The sizing factors were developed based on unit-area continuous simulation models. This means the continuous simulation hydrologic modeling has already been done and the project applicant needs only to apply the sizing factors to the project's effective impervious area to size a facility that meets flow control performance standards. The sizing factor method is intended for simple studies that do not include diversion, do not include significant offsite area draining through the project from upstream, and do not include offsite area downstream of the project area. Use of the sizing factors is limited to the specific structural BMPs for which sizing factors were prepared. Project-specific continuous simulation modeling offers the most flexibility in the design, but requires the project applicant to prepare and submit a complete continuous simulation hydrologic model for review.

6.3.5.1 Sizing Factor Method

A project applicant may use sizing factors that were created to facilitate sizing of certain specific BMPs for hydromodification management.

Unit runoff ratios for determination of pre-development Q_2 and sizing factors for certain specific structural BMPs were previously developed based on continuous simulation hydrologic modeling of hypothetical unit watersheds. Details and descriptions for the sizing factors and specific BMPs are presented in the "San Diego BMP Sizing Calculator Methodology," dated January 2012, prepared by Brown and Caldwell (herein "BMP Sizing Calculator Methodology"). Although the sizing factors were developed under the 2007 MS4 Permit, the unit runoff ratios and some sizing factors developed for flow control facility sizing may still be applied at the discretion of Port staff. Users should note that due to the MS4 Permit requirement to control flow rates to pre-development condition instead of pre-project condition, unit runoff ratios for "impervious" soil cover categories from Table 1-6 of the BMP Sizing Calculator Methodology shall not be used when determining pre-development Q_2. Sizing factors are to be applied to the effective impervious area draining to the facility. Calculations may be prepared using either the BMP Sizing Spreadsheet that was developed by the County of San Diego and is available on the Project Clean Water website, or using hand calculations. Refer to Appendix G.2 of this manual for guidance to use the sizing factor method.

6.3.5.2 Project-Specific Continuous Simulation Modeling

A project applicant may prepare a project-specific continuous simulation model to demonstrate compliance with hydromodification management performance standards.

This option offers the most flexibility in the design. In this case, the project applicant shall prepare continuous simulation hydrologic models for pre-development and post-project conditions, and compare the pre-development and post-project (with hydromodification flow control BMPs) runoff rates and durations until compliance with the flow control performance standards is demonstrated. The project applicant will be required to quantify the long term pre-development and post-project runoff response from the site and establish runoff routing and stage-storage-discharge relationships for the planned flow control BMPs. There are several available hydrologic models that can perform continuous simulation analyses. Refer to Appendix G.1 of this manual for guidance for continuous simulation hydrologic modeling.

6.3.6 Integrating HMP Flow Control Measures with Pollutant Control BMPs

Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s) or by a series of structural BMP(s).

The design process should start with an assessment of the controlling design factor, then the typical design process for an integrated structural BMP or series of BMPs to meet two separate performance standards at once involves (1) initiating the design based on the performance standard that is expected to require the largest volume of storm water to be retained, (2) checking whether the initial design incidentally meets the second performance standard, and (3) adjusting the design as necessary until it can be demonstrated that both performance standards are met. The following are recommendations for initiating the design process:

- **Full infiltration condition:** retention for pollutant control performance standard is the controlling design factor. For a system that is based on full retention for storm water pollutant control, first design an initial retention area to meet storm water pollutant control standards for retention, then check whether the facility meets flow control performance standards. If the initial retention facility does not meet flow control performance standards: increase the volume of the facility, increasing retention if feasible or employing outflow control for runoff to be discharged from the facility; as needed to meet the flow control performance standards.
- **Partial infiltration condition:** retention for pollutant control performance standard is the controlling design factor. For a system that is based on partial retention for storm water pollutant control, first design the retention area to maximize retention as feasible. Then design an additional runoff storage area with outflow control for runoff to be discharged from the facility; as needed

to meet the flow control performance standards. Then address pollutant control needs for the portion of the storm water pollutant control DCV that could not be retained onsite.

- **No infiltration condition:** flow control for hydromodification management standard is the controlling design factor. For a system that is based on biofiltration with no infiltration for storm water pollutant control, first design the facility to meet flow control performance standards, then check whether the facility meets biofiltration design standards for storm water pollutant control. If the flow control biofiltration facility does not meet performance standards for storm water pollutant control by biofiltration, increase the volume of the biofiltration facility as needed to meet pollutant control performance standards, or identify other methods to address pollutant control needs for the portion of the storm water pollutant control DCV that could not be processed with biofiltration onsite.

When an integrated structural BMP or series of BMPs is used for both storm water pollutant control and flow control for hydromodification management, separate calculations are required to demonstrate that pollutant control performance standards and hydromodification management standards are met.

When an integrated structural BMP or series of BMPs is proposed to meet the storm water pollutant control and flow control for hydromodification management obligations, the applicant shall either:

- Perform separate calculations to show that both hydromodification management and pollutant control performance standards are met independently by using guidance from Appendices B and G. Calculations performed shall be documented in the SQWMP. **or**

- Develop an integrated design that meets the separate performance standards presented in Chapter 2 for both hydromodification management and pollutant control. In this option the BMP requirements to meet the pollutant control performance standard are optimized to account for the BMP storage provided for flow control, and vice versa. Calculations performed to develop an integrated design shall be documented in the SQWMP. Project approval when this option is selected is at the discretion of the Port. Proposed methods to optimize pollutant control performance to account for flow control benefits and vice versa shall be proposed by the project proponent and evaluated by the Port on a project-specific basis.

Appendix B.5.2 provides a methodology to optimize the footprint of the downstream biofiltration BMP that is required to meet the pollutant control performance standard, when there is an upstream hydromodification flow control BMP (e.g. cistern, vault, etc.)

6.3.7 Drawdown Time

The maximum recommended drawdown time for hydromodification management facilities is 96 hours based on Section 6.4.6 of the March 2011 Final HMP.

This is based on instruction from the County of San Diego Department of Environmental Health for mitigation of potential vector breeding issues and the subsequent risk to human health. This standard applies to, but is not limited to, detention basins, underground storage vaults, and the above-ground storage portion of LID facilities. When this standard cannot be met due to large stored runoff volumes with limited maximum release rates, a Vector Management Plan may be an acceptable solution if approved by the Port.

In cases where a Vector Management Plan is necessary, it shall be incorporated into the SWQMP as an attachment. A Vector Management Plan will only be accepted after the applicant has proven infeasibility of meeting the required drawdown time using any and all allowable BMPs. The information included in the plan will vary based on the nature, extent and variety of potential vector sources. It is recommended that preparers consult with the Department of Environmental Health Vector Control Program for technical guidance. Plans should include the following information at a minimum:

- Project identification information;
- A description of the project, purpose of the report, and existing environmental conditions;
- A description of the management practices that will be employed to minimize vector breeding sources and any associated employee education required to run facilities and operations;
- A discussion of long term maintenance requirements;
- A summary of mitigation measures;
- References; and
- A list of persons and organizations contacted (project proponents are expected to obtain review and concurrence of proposed management practices from Department of Environmental Health Vector control program staff prior to submission).

The property tenant/project proponent and applicant must include and sign the following statement: "The measures identified herein are considered part of the proposed project design and will be carried out as part of project implementation. I understand the breeding of mosquitoes is unlawful under the State of California Health and Safety Code Section 2060-2067. I will permit the Vector Surveillance and Control program to place adult mosquito monitors and to enforce this document as needed."

Refer to the sources below for additional guidance:

Report Guidance- http://www.sandiegocounty.gov/dplu/docs/Vector_Report_Formats.pdf

Department of Environmental Health Vector Control Program Department of Environmental Health - http://www.sandiegocounty.gov/deh/pests/vector_disease.html

It should be noted that other design factors may influence the required drawdown when hydromodification management BMPs are integrated with storm water pollutant control BMPs. Since hydromodification flow control BMPs are designed based on continuous simulation modeling, which is based on a continuous rainfall record and analyzes a continuous inflow and outflow of the BMPs, inter-event drawdown time and availability of the BMP for subsequent event inflow has been accounted for in the sizing. Therefore, drawdown recommendations for hydromodification management are based on public safety, not availability of the BMP for the next inflow event. Storm water pollutant control BMPs are designed on a single-event basis for a DCV (the 85th percentile storm event). Some of the design standards presented in Chapter 5 or Appendix B require that the pollutant control portion of the BMP drain within a specific time frame to ensure the pollutant control portion of the BMP is available for subsequent storm events. When hydromodification management BMPs are integrated with storm water pollutant control BMPs, the designer must evaluate drawdown time based on both standards.

Chapter 7

BMP DESIGN MANUAL

Long Term Operation & Maintenance

Permanent structural BMPs require on-going inspection and maintenance into perpetuity to preserve the intended pollution control and/or flow control performance.

This Chapter addresses procedural requirements for implementation of long term O&M and the typical maintenance requirements of structural BMPs presented in the manual. Specific requirements for O&M Plan reports will be discussed in Chapter 8 with the Submittal Requirements.

7.1 Need for Permanent Inspection and Maintenance

7.1.1 MS4 Permit Requirements

The MS4 Permit requires that each Copermittee implement a program that requires and confirms structural BMPs on all PDPs are designed, constructed, and maintained to remove pollutants in storm water to the MEP.

Routine inspection and maintenance of BMPs will preserve the design and MS4 Permit objective to remove pollutants in storm water to the MEP. The MS4 Permit requirement specifically applies to PDP structural BMPs. However, source control BMPs and site design / LID BMPs within a PDP are components in the storm water management scheme that determine the amount of runoff to be treated by structural BMPs; and when source control, site design, or LID BMPs are not maintained, this can lead to clogging or failure of structural BMPs due to greater delivery of runoff and pollutants than intended. Therefore, the Port may also require confirmation of maintenance of source control BMPs and site design / LID BMPs as part of their PDP structural BMP maintenance documentation requirements (see Section 7.4).

7.1.2 Practical Considerations

Why do permanent structural BMPs require on-going inspection and maintenance into perpetuity?

By design, structural BMPs will trap pollutants transported by storm water. Structural BMPs are subject to deposition of solids such as sediment, trash, and other debris. Some structural BMPs are also subject to growth of vegetation, either by design (e.g. biofiltration) or incidentally. The pollutants and any overgrown vegetation must be removed on a periodic basis for the life of the BMP to maintain the capacity of the structural BMP to process storm water and capture pollutants from every storm event. Structural BMP components are also subject to clogging from trapped pollutants and growth of vegetation. Clogged BMPs can result in flooding, standing water and mosquito breeding habitat. Maintenance is critical to ensure the ongoing drainage of the facility. All components of the BMP must be maintained, including both the surface and any sub-surface components.

Vegetated structural BMPs, including vegetated infiltration or partial infiltration BMPs, and above-ground detention basins, also require routine maintenance so that they don't inadvertently become wetlands, waters of the state, or sensitive species habitat under the jurisdiction of the United States Army Corps of Engineers, San Diego Water Board, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. A structural BMP that is constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of one or more of the above-mentioned resource agencies. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, routine maintenance is key to preventing this scenario.

7.2 Summary of Steps to Maintenance Agreement

Ownership and maintenance responsibility for structural BMPs should be discussed at the *beginning of project planning*, typically at the pre-application meeting with the planning and zoning agency.

Tenant/project proponents shall be aware of their responsibilities regarding storm water BMP maintenance and need to be familiar with the contents of the O&M Plan prepared for the project. Chapter 8 provides the guidelines for preparation of a site specific O&M Plan. A maintenance mechanism must be determined prior to the issuance of any construction, grading, building permit, site development permit, or any other applicable permit. Below are typical steps and schedule for establishing a plan and mechanism to ensure on-going maintenance of structural BMPs.

TABLE 7-1. Schedule for Developing O&M Plan and Agreement

Item	Description	Time Frame
1	Identify expected maintenance actions	First submittal of a project application – identify in SWQMP
2	Develop detailed O&M Plan	As required by the Port, prior to issuance of construction, grading, building, site development, or other applicable permits
3	Update/finalize O&M Plan to reflect constructed structural BMPs with as-built plans and baseline photos	As required by the Port, upon completion of construction of structural BMPs

The Port maintains rights to access tenant properties as part of lease provisions. These rights extend to any access required related to structural BMPs.

7.3 Maintenance Responsibility

Who is responsible for the maintenance of the permanent structural BMPs into perpetuity?

The tenant/project proponent is responsible to ensure inspection, operation and maintenance of permanent structural BMPs on a leasehold or Port maintained property. As part of project review for both capital and tenant priority projects that include interim or permanent structural BMPs, the Port will verify that appropriate mechanisms are in-place.

The Port will require that a copy of a satisfactory Operation & Maintenance (O&M) plan, prepared by the tenant/project proponent is included with the SWQMP. The O&M Plan must describe the designated responsible party to manage the storm water BMP(s), any necessary employee training and duties, operating schedule, maintenance frequency, specific maintenance activities, copies of resource agency permits, and any other necessary activities. At a minimum, the O&M Plan shall require the inspection and servicing of all structural BMPs on an annual basis. Further, annual written verification of effective operation and maintenance of each approved treatment control BMP by the responsible party is required to be submitted to the Port prior to each wet season. The tenant shall document all maintenance requirements and shall retain records for at least 5 years. These documents shall be made available to the Port for inspection upon request at any time. O&M Plans will also be prepared for capital projects that include structural BMPs. The Port's O&M template is to be used to fulfill the O&M planning requirement.

7.4 Long-Term Maintenance Documentation

As part of on-going structural BMP maintenance into perpetuity, tenants are required to provide documentation of maintenance for the structural BMPs on their property to support the Port's reporting requirements to the San Diego Water Board.

The MS4 Permit requires each Copermittee to verify that structural BMPs on each PDP "are adequately maintained, and continue to operate effectively to remove pollutants in storm water to the MEP through inspections, self-certifications, surveys, or other equally effective approaches." Each Copermittee must also identify the party responsible for structural BMP maintenance for the PDP and report the dates and findings of structural BMP maintenance verifications, and corrective actions and/or resolutions when applicable, in their PDP inventory. The PDP inventory and findings of maintenance verifications must be reported to the San Diego Water Board annually. Based on these MS4 Permit requirements, the Port will require tenants to provide annual self-certification that inspection and maintenance has been performed, provide details of the inspection results and maintenance activities, and confirm or update the contact information for the party responsible to ensure inspection and maintenance is performed. All facilities are to be inspected on an annual basis at a minimum. A copy of each inspection form shall be kept by the lessee a minimum of 5 years.

7.5 Inspection and Maintenance Frequency

The minimum inspection and maintenance frequency is annual and must be reported annually.

However, actual maintenance needs are site specific, and maintenance may be needed more frequently than annually. The need for maintenance depends on the amount and quality of runoff delivered to the structural BMP. Maintenance must be performed whenever needed, based on maintenance indicators presented in Section 7.7. The optimum maintenance frequency is each time the maintenance threshold for removal of materials (sediment, trash, debris or overgrown vegetation) is met. If this maintenance threshold has been exceeded by the time the structural BMP is inspected, the BMP has been operating at reduced capacity. This would mean it is necessary to inspect and maintain the structural BMP more frequently. Routine maintenance will also help avoid more costly rehabilitative maintenance to repair damages that may occur when BMPs have not been adequately maintained on a routine basis.

During the first year of normal operation of a structural BMP (i.e. when the project is fully built out and occupied), inspection by the property's representative is recommended at least once prior to August 31 and then monthly from September through May. Inspection during a storm event is also recommended. It is during and after a rain event when one can determine if the components of the BMP are functioning properly. After the initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year inspections.

7.6 Measures to Control Maintenance Costs

Because structural BMPs must be maintained into perpetuity, it is essential to include measures to control maintenance costs.

The most effective way to reduce maintenance of structural BMPs is to prevent or reduce pollutants generated onsite and delivered to the structural BMP by implementation of source control and site design BMPs onsite, as required and described in Chapter 4 of this manual. Second, vegetated BMPs should be placed properly to reduce the potential to come under the jurisdiction of one or more resource agencies that could require permits and costly mitigation to perform maintenance of the structural BMP. Third, the structural BMP should include design features to facilitate maintenance, as listed below.

Considerations for placement of vegetated BMPs:

- Locate structural BMPs outside of floodway, floodplain, and other jurisdictional areas.
- Avoid direct connection to a natural surface water body.
- Discuss the location of the structural BMP with a wetland biologist to avoid placing a structural BMP in a location where it could become jurisdictional or be connected to a jurisdictional area.

Measures to facilitate collection of the trapped pollutants:

- Design a forebay to trap gross pollutants in a contained area that is readily accessible for maintenance. A forebay may be a dedicated area at the inlet entrance to an infiltration BMP, biofiltration BMP, or detention basin, or may be a gross pollutant separator installed in the storm drain system that drains to the primary structural BMP.

Measures to access the structural BMP:

- The BMP must be accessible to equipment needed for maintenance. Access requirements for maintenance will vary with the type of facility selected.

- Infiltration BMPs, biofiltration BMPs and most above-ground detention basins and sand filters will typically require routine landscape maintenance using the same equipment that is used for general landscape maintenance. At times these BMPs may require excavation of clogged media (e.g. bioretention soil media, or sand for the sand filter), and should be accessible to appropriate equipment for excavation and removal/replacement of media.
- Above-ground detention basins should include access ramps for trucks to enter the basin to bring equipment and to remove materials.
- Underground BMPs such as detention vaults, media filters, or gross pollutant separators used as forebays to other BMPs, typically require access for a vactor truck to remove materials. Proprietary BMPs such as media filters or gross pollutant separators may require access by a forklift or other truck for delivery and removal of media cartridges or other internal components. Access requirements must be verified with the manufacturer of proprietary BMPs.
- Vactor trucks are large, heavy, and difficult to maneuver. Structural BMPs that are maintained by vactor truck must include a level pad adjacent to the structural BMP, preferably with no vegetation or irrigation system (otherwise vegetation or irrigation system may be destroyed by the vactor truck).
- The sump area of a structural BMP should not exceed 20 feet in depth due to the loss of efficiency of a vactor truck. The water removal rate is three to four times longer when the depth is greater than 20 feet. Deep structures may require additional equipment (stronger vactor trucks, ladders, more vactor pipe segments).
- All manhole access points to underground structural BMPs must include a ladder or steps.

Measures to facilitate inspection of the structural BMP

- Structural BMPs shall include inspection ports for observing all underground components that require inspection and maintenance.
- Silt level posts or other markings shall be included in all BMP components that will trap and store sediment, trash, and/or debris, so that the inspector may determine how full the BMP is, and the maintenance personnel may determine where the bottom of the BMP is. Posts or other markings shall be indicated and described on structural BMP plans.
- Vegetation requirements including plant type, coverage, and minimum height when applicable shall be provided on the structural BMP and/or landscaping plans as appropriate or as required by the Port.
- Signage indicating the location and boundary of the structural BMP is recommended.

When designing a structural BMP, the engineer should review the typical structural BMP maintenance actions listed in Section 7.7 to determine the potential maintenance equipment and access needs.

When selecting permanent structural BMPs for a project, the engineer and tenant/project proponent should consider the long term cost of maintenance and what type of maintenance contracts a future tenant will need to manage. The types of materials used (e.g. proprietary vs. non-proprietary parts), equipment used (e.g. landscape equipment vs. vactor truck), actions/labor expected in the maintenance process and required qualifications of maintenance personnel (e.g. confined space entry) affect the cost of long term O&M of the structural BMPs presented in the manual.

7.7 Maintenance Indicators and Actions for Structural BMPs

This Section presents typical maintenance indicators and expected maintenance actions (routine and corrective) for typical structural BMPs.

There are many different variations of structural BMPs, and structural BMPs may include multiple components. For the purpose of maintenance, the structural BMPs have been grouped into four categories based on common maintenance requirements:

- Vegetated infiltration or filtration BMPs
- Non-vegetated infiltration BMPs
- Non-vegetated filtration BMPs
- Detention BMPs

The project civil engineer is responsible for determining which categories are applicable based on the components of the structural BMP, and identifying the applicable maintenance indicators from within the category. Maintenance indicators and actions shall be shown on the construction plans and in the project-specific O&M Plan.

During inspection, the inspector checks the maintenance indicators. If one or more thresholds are met or exceeded, maintenance must be performed to ensure the structural BMP will function as designed during the next storm event.

7.7.1 Maintenance of Vegetated Infiltration or Filtration BMPs

"Vegetated infiltration or filtration BMPs" are BMPs that include vegetation as a component of the BMP. Applicable Fact Sheets may include INF-2 (bioretention), PR-1 (biofiltration with partial retention), BF-1 (biofiltration) or FT-1 (vegetated swale). The vegetated BMP may or may not include amended soils, subsurface gravel layer, underdrain, and/or impermeable liner. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

7.7.2 Maintenance of Non-Vegetated Infiltration BMPs

"Non-vegetated infiltration BMPs" are BMPs that store storm water runoff until it infiltrates into the ground, and do not include vegetation as a component of the BMP (refer to the "vegetated BMPs" category for infiltration BMPs that include vegetation). Non-vegetated infiltration BMPs generally include non-vegetated infiltration trenches and infiltration basins, dry wells, underground infiltration galleries, and permeable pavement with underground infiltration gallery. Applicable Fact Sheets may include INF-1 (infiltration basin) or INF-3 (permeable pavement). The non-vegetated infiltration BMP may or may not include a pre-treatment device, and may or may not include above-ground storage of runoff. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

TABLE 7-2. Maintenance Indicators and Actions for Vegetated BMPs

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation per original plans when applicable (e.g. a vegetated swale may require a minimum vegetation height).
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the Port shall be contacted prior to any additional repairs or reconstruction.
Standing water in vegetated swales	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, loosening or replacing top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the BMP to the original plan and grade, the Port shall be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

TABLE 7-3. Maintenance Indicators and Actions for Non-Vegetated Infiltration BMPs

Typical Maintenance Indicator(s) for Non-Vegetated Infiltration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris in infiltration basin, pre-treatment device, or on permeable pavement surface	Remove and properly dispose accumulated materials.
Standing water in infiltration basin without subsurface infiltration gallery for longer than 96 hours following a storm event	Remove and replace clogged surface soils.
Standing water in subsurface infiltration gallery for longer than 96 hours following a storm event	This condition requires investigation of why infiltration is not occurring. If feasible, corrective action shall be taken to restore infiltration (e.g. flush fine sediment or remove and replace clogged soils). BMP may require retrofit if infiltration cannot be restored. If retrofit is necessary, the Port shall be contacted prior to any repairs or reconstruction.
Standing water in permeable paving area	Flush fine sediment from paving and subsurface gravel. Provide routine vacuuming of permeable paving areas to prevent clogging.
Damage to permeable paving surface	Repair or replace damaged surface as appropriate.
Note: When inspection or maintenance indicates sediment is accumulating in an infiltration BMP, the DMA draining to the infiltration BMP should be examined to determine the source of the sediment, and corrective measures should be made as applicable to minimize the sediment supply.	

7.7.3 Maintenance of Non-Vegetated Filtration BMPs

"Non-vegetated filtration BMPs" include media filters (FT-2) and sand filters (FT-3). These BMPs function by passing runoff through the media to remove pollutants. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

TABLE 7-4. Maintenance Indicators and Actions for Filtration BMPs

Typical Maintenance Indicator(s) for Filtration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.
Clogged filter media	Remove and properly dispose filter media, and replace with fresh media.
Damage to components of the filtration system	Repair or replace as applicable.
Note: For proprietary media filters, refer to the manufacturer's maintenance guide.	

7.7.4 Maintenance of Detention BMPs

"Detention BMPs" includes basins, cisterns, vaults, and underground galleries that are primarily designed to store runoff for controlled release to downstream systems. For the purpose of the maintenance discussion, this category does not include an infiltration component (refer to "vegetated infiltration or filtration BMPs" or "non-vegetated infiltration BMPs" above). Applicable Fact Sheets may include HU-1 (cistern) or FT-4 (extended detention basin). There are many possible configurations of above ground and underground detention BMPs, including both proprietary and non-proprietary systems. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

TABLE 7-5. Maintenance Indicators and Actions for Detention BMPs

Typical Maintenance Indicator(s) for Detention Basins	Maintenance Actions
Poor vegetation establishment	Re-seed, re-establish vegetation.
Overgrown vegetation	Mow or trim as appropriate.
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or re-grading where necessary.
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials.
Standing water	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, or minor re-grading for proper drainage.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.

Chapter

8

BMP DESIGN MANUAL

Submittal Requirements

It is necessary for the Port to review project plans for compliance with applicable requirements of this manual and the MS4 Permit.

The review process must verify that storm water management objectives were considered in the project planning process and that opportunities to incorporate BMPs have been identified. The review process must confirm the site plan, landscape plan, and project storm water documents are congruent. Therefore, every jurisdiction in San Diego County requires a submittal documenting the storm water management design for every project that is subject to the requirements of this manual. Herein the submittal is called a “SWQMP." A complete and thorough project submittal will facilitate and expedite the review and approval, and may result in fewer submittals by the applicant. The Sections below discuss submittal requirements. In all cases the project applicant must provide sufficient documentation to demonstrate that applicable requirements of this manual and the MS4 Permit will be met.

8.1 Submittal Requirement for Standard Projects

8.1.1 Standard Project SWQMP

For Standard Projects, the project submittal shall include a "Standard Project SWQMP."

The Standard Project SWQMP is a compilation of checklists that document that all permanent source control and site design BMPs have been considered for the project and implemented where feasible. All applicable features shall be shown on site plans and landscaping plans. The Standard Project SWQMP shall consist of the following forms and/or checklists included in Appendix I of this manual:

- Form I-1: Applicability of Permanent BMP Requirements
- Form I-2: Project Type Determination (Standard Project or PDP)
- Form I-3A: Site Information for Standard Projects
- Form I-4: Source Control BMP Checklist
- Form I-5: Site Design BMP Checklist

The Standard Project SWQMP shall also include copies of the relevant plan sheets showing source control and site design BMPs.

8.2 Submittal Requirements for PDPs

8.2.1 PDP SWQMP

For PDPs, the project submittal shall include a "PDP SWQMP."

The PDP SWQMP shall document that all permanent source control and site design BMPs have been considered for the project and implemented where feasible; document the planning process and the decisions that led to the selection of structural BMPs; provide the calculations for design of structural BMPs to demonstrate that applicable performance standards are met by the structural BMP design; identify O&M requirements of the selected structural BMPs; and identify the maintenance mechanism (see Sections 7.2 and 7.3) for long term O&M of structural BMPs. PDPs shall use the PDP SWQMP Template provided in Appendix A, which will include forms and/or checklists included in Appendix I of this manual as well as checklists for documentation of pollutant control and hydromodification management structural BMP design. The PDP SWQMP shall include copies of the relevant plan sheets showing site design, source control, and structural BMPs, and structural BMP maintenance requirements.

A PDP SWQMP must be provided with the first submittal of project drawings.

Storm water requirements will directly affect the layout of the project. Storm water requirements must be considered from the initial project planning or in project concept stage, and will be reviewed upon each submittal, beginning with the first submittal. The process from initial project application through approval of the project plans often includes design changes to the site layout and features. Changes may be driven by storm water management requirements or other site requirements. Each time the site layout is adjusted, whether the adjustment is directly due to storm water management requirements identified during the Port review of the storm water submittal, or is driven by other site requirements, the storm water management design must be revisited to ensure the revised project layout and features meet the requirements of this manual and the MS4 Permit. An updated PDP SWQMP must be provided with each submittal of revised project plans. The updated PDP SWQMP should include documentation of changes to the site layout and features, and reasons for the changes. In the event that other site requirements identified during plan review render certain proposed storm water features infeasible (e.g. if fire department access requirements were identified that precluded use of certain surfaces or landscaping features that had been proposed), this must be documented as part of the decisions that led to the development of the final storm water management design.

8.2.1.1 PDP O&M Plan

While the PDP SWQMP must include general O&M requirements for structural BMPs, the PDP SWQMP may not be the final O&M Plan.

The O&M requirements documented in the PDP SWQMP must be sufficient to show that O&M requirements have been considered in the project planning and design. However, a final O&M Plan should reflect actual constructed structural BMPs to be maintained. Photographs and as-built plans for the constructed structural BMPs should be included. See Section 8.2.3 for project closeout procedures including local requirements for final O&M Plans, and Section 8.2.4 for additional requirements for private entity O&M of structural BMPs.

8.2.2 Requirements for Construction Plans

8.2.2.1 BMP Identification and Display on Construction Plans

Plans for construction of the project (grading plans, improvement plans, and landscaping plans, as applicable) must show all permanent site design, source control, and structural BMPs, and must be congruent with the PDP SWQMP.

BMPs, including source control and site design BMPs shall be incorporated into the civil drawing set complete with designated DMA. The following information shall be provided on the SWQMP exhibit:

a) Entire property included on one map (use key map if multi-sheets)

b) BMP sheet which includes the following (BMP type, size, dimensions for location, cross section and elevation detail); global positioning system coordinates of property

c) Drainage areas and direction of flow

d) Storm drain system(s)

e) Nearby water bodies and municipal storm drain inlets

f) Location and details of storm water conveyance systems (ditches, inlets, outlets, storm drains, overflow structures, etc.)

g) Location of existing and proposed storm water controls

h) Location of "impervious" areas- paved areas, buildings, covered areas

i) Locations where materials would be directly exposed to storm water

j) Location of building and activity areas (e.g. fueling islands, garages, waste container area, wash racks, hazardous material storage areas, etc.)

k) Areas of potential soil erosion (including areas downstream of project)

l) Location of existing drinking water wells

m) Location of existing vegetation to be preserved

n) Location of LID landscaping features, site design BMPs.

8.2.2.2 Structural BMP Maintenance Information on Construction Plans

Plans for construction of the project must provide sufficient information to describe maintenance requirements (thresholds and actions) for structural BMPs such that in the event all other separate O&M documents were lost, a new party studying plans for the project could identify the structural BMPs and identify the required maintenance actions based on the plans.

For the purpose of long term O&M, the project plans must identify the following:

- How to access the structural BMP to inspect and perform maintenance;
- Features that are provided to facilitate inspection (e.g. observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds);

- Manufacturer and part number for proprietary parts;
- Maintenance thresholds specific to the structural BMP, with a location-specific frame of reference (e.g. level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP);
- Recommended equipment to perform maintenance; and
- When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management.

8.2.3 Design Changes During Construction and Project Closeout Procedures

8.2.3.1 Design Changes During Construction

Prior to occupancy and/or intended use of any portion of a PDP, the site must be in compliance with the requirements of this manual and the MS4 Permit.

Therefore during construction, any changes that affect the design of storm water management features must be reviewed and approved by the Port. Approved documents and additional design may be required prior to implementation of design changes during construction. This might include changes to drainage patterns that occurred based on actual site grading and construction of storm water conveyance structures, or substitutions to storm water management features. Just as during the design phase, when there are changes to the site layout and features, the storm water management design must be revisited to ensure the revised project layout and features meet the requirements of this manual and the MS4 Permit.

Design changes must be reviewed and approved by the Engineer of Record and the Port prior to continuing construction.

8.2.3.2 Certification of Constructed BMPs

As part of the "Structural BMP Approval and Verification Process" required by the MS4 Permit, each structural BMP must be inspected to verify that it has been constructed and is operating in compliance with all of its specifications, plans, permits, ordinances, and the requirements of the MS4 Permit.

Since some portions of the structural BMP will not be readily visible after completion of construction (e.g. subsurface layers), the Port will require inspections during construction, photographs taken during construction, and/or other certification that the BMP has been constructed in conformance with the approved plans. The Port may require forms or other documentation be submitted prior to the inspection in order to facilitate the structural BMP inspection.

8.2.3.3 Final O&M Plan

Upon completion of project construction, the Port may require a final O&M Plan to be submitted.

A final O&M Plan reflects project-specific constructed structural BMPs with project-specific drawings, photographs, and maps, and identifies specific maintenance requirements and actions for the constructed structural BMPs.

8.2.4 Additional Requirements for Tenant BMP O&M

This Section discusses tenant structural BMPs to be operated and maintained on tenant property by the tenant or manager.

8.2.4.1 O&M Agreements for Tenant Structural BMP Maintenance

For tenant operated structural BMPs, the Port requires execution of an O&M Agreement document.

An O&M Agreement is a recorded document signed by the Port and the tenant committing the tenant to maintain the permanent structural BMPs into perpetuity. The O&M Agreement may provide that, if the tenant fails to maintain the storm water facilities, the Port may enter the property, restore the storm water facilities to operable condition, and obtain reimbursement, including administrative costs, from the tenant.

The Port maintains rights to access tenant properties as part of lease provisions. These rights extend to any access required related to structural BMPs.

8.2.4.2 Interim Security Period of Maintenance Funding for Tenant Structural BMP Maintenance

For tenant operated structural BMPs, the Port may require an interim security period of maintenance funding in the event that the tenant fails to maintain the storm water features.

The Port will assure stormwater BMP maintenance, repair and replacement of tenant projects through conditions in tenant leases.

Bibliography

ASTM International. 2009. ASTM Standard D3385-09. Retrieved from http://www.astm.org/Standards/D3385.htm

Breuer, L., Eckhardt, K, and Frede, H. 2003. Plant Parameter Values for Models in Temperate Climates. Ecological Modelling. 169:237-293. November.

California Department of Water Resources. 1947. Evaporation from Water Surfaces in California, A Summary of Pan Records and Coefficients, 1881 to 1946. Bulletin No. 54. California State Printing Office.

California Department of Water Resources. 2012. California Irrigation Management Information System Reference Evapotranspiration Zones.

Caltrans. 1986. Method for Determining the Percolation Rate of Soil Using a 6-inch-diameter Test Hole. California Test 750. http://www.dot.ca.gov/hq/esc/sdsee/wwe/documents/Test_750.pdf

Cedergren, H.R. 1997. Seepage, drainage, and flow nets, third ed. John Wiley and Sons, Inc., New York.

Cities and County of Riverside. 2012. Water Quality Management Plan for the Santa Margarita Region of Riverside County.

City of Los Angeles. 2011. Development Best Management Practices Handbook. Low Impact Development Manual.

City of Portland. 2008. Storm water Management Manual

City of San Diego. 2011. Guidelines for Geotechnical Reports.

City of San Diego. 2011. San Diego Low Impact Development Design Manual.

City of San Diego. 2012. Storm Water Standards.

City of Santa Barbara. 2013. Storm Water BMP Guidance Manual.

Clear Creek Solutions, Inc. 2012. San Diego Hydrology Model User Manual.

County of Los Angeles Department of Public Works. 2014. Low Impact Development, Standards Manual.

County of Orange. 2011. Model Water Quality Management Plan (Model WQMP).

County of Orange. 2011. Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs).

County of San Bernardino. 1992. Suitability of Lots and Soils for Use of Leachlines or Seepage Pits, Soil Percolation (PERC) Test Report Standards, Onsite Waste Water Disposal System, August 1992.

County of San Diego. 2007. Low Impact Development Handbook: Stormwater Management

Strategies.

County of San Diego. 2011. Final Hydromodification Management Plan

County of San Diego. 2012. County of San Diego SUSMP: Standard Urban Stormwater Mitigation Plan Requirements for Development Applications.

County of San Diego. 2014. Low Impact Development Handbook: Stormwater Management Strategies.

County of San Diego. 2003. Stormwater Standards Manual.

County of Ventura. 2011. Ventura County Technical Guidance Manual for Stormwater Quality Control Measures.

Darcy, H, 1856. Les fontaines publiques de la Ville de Dijon (The public fountains of the City of Dijon). Trans. Patricia Bobeck. Paris: Dalmont. (Kendall/Hunt, 2004) 506 p

Double Ring Infiltrometer Test (ASTM 3385)-ASTM International. 2009.

Emerson, C. 2008. Evaluation of Infiltration Practices as a Means to Control Stormwater Runoff. Civil and Environmental Engineering. Villanova University.

Emerson, C.H. 2008. Evaluation of Infiltration Practices as a Means to Control Stormwater Runoff. Doctoral dissertation, Villanova University. May 2008.

Galli, J. 1992. Analysis of urban stormwater BMP performance and longevity in Prince George's County, Maryland. Metropolitan Washington Council of Governments, Washington, D.C.

Gobel, P. et al. 2004. Near-Natural Stormwater Management and its Effects on the Water Budget and Groundwater Surface in Urban Areas Taking Account of the Hydrogeological Conditions. Journal of Hydrology 299, 267-283.

Gulliver, J., Erickson, A., and Weiss, P. 2010. Optimizing Stormwater Treatment Practices: A Handbook of Assessment and Maintenance.

Hazen, A. 1892. Some Physical Properties of Sands And Gravels, With Special Reference To Their Use In Filtration. 24th Annual Rep., Massachusetts State Board of Health, Pub. Doc. No. 34, 539-556.

Hazen, A. 1911. Discussion of Dams On Sand Foundations' by A.C. Koenig. Trans. Am. Soc. Civ. Eng., 73, 199-203

Hazen, A., 1892. Some Physical Properties of Sands and Gravels, With Special Reference to their Use in Filtration. 24th Annual Rep., Massachusetts State Board of Health, Pub. Doc. No. 34, 539-556.

Hazen, A., 1911. Discussion of Dams on Sand Foundations' by A.C. Koenig. Trans. Am. Soc. Civ. Eng., 73, 199-203

King County Department of Natural Resources and Parks. 2009. King County, Washington Surface Water Design Manual. Retrieved from http://your.kingcounty.gov/dnrp/library/water-and-land/stormwater/surface-water-design-manual/SWDM-2009.pdf

Lindsey, G., L. Roberts, and W. Page. 1991. Storm Water Management Infiltration. Maryland Department of the Environment, Sediment and Storm Water Administration.

Lindsey, P. and Bassuk, N. 1991. Specifying Soil Volumes to Meet the Water Needs of Mature Urban Street Trees and Trees in Containers. Journal of Arboriculture 17(6): 141-149.

Minnesota Pollution Control Agency (MPCA). (n.d.). Minnesota Stormwater Manual. Retrieved October 2014 from: http://stormwater.pca.state.mn.us/index.php/Calculating_credits_for_tree_trenches_and_tree_boxes

Orange County Watersheds Protection Program. 2011. Project-Specific Alternatives to the Interim Sizing Tool.

Philips C. and W. Kitch 2011. A review of methods for characterization of site infiltration with design recommendations. California State Polytechnic University-Pomona. http://www.csupomona.edu/~wakitch/arts/Philips_&_Kitch_2011.pdf

Phillips, E., and Kitch, W. 2011. A Review of Methods for Characterization of Site Infiltration with Design Recommendations. Journal of the Nevada Water Resources Association, Summer 2011, Vol. 6, No. 1, pp. 29-46.

Pitt, R., Chen, S., Clark, S., Lantrip, J., and C. Ong. 2008. Compaction's Impacts on Urban Stormwater Infiltration, J. Irr. and Drainage Eng., January 2008.

Pitt, R., Chen, S., Clark, S., Swenson, J., and Ong, C. 2008. "Compaction's Impacts on Urban Storm-Water Infiltration." J. Irrig. Drain Eng. 134, SPECIAL ISSUE: Urban Storm-Water Management, 652–658.

Riverside County. 2011. Riverside County - Low Impact Development BMP Design Handbook – Appendix A – Infiltration Testing http://rcflood.org/downloads/NPDES/Documents/LIDManual/Appendix%20A_Infiltration_Testing.pdf

Riverside County Copermittees. 2014. Santa Margarita Region Hydromodification Management Plan.

Riverside County Flood Control and Water Conservation District. 2011. Design Handbook for Low Impact Development Best Management Practices.

Riverside County Percolation Test (2011), California Test 750 (1986), San Bernardino County Percolation Test (1992); USEPA Falling Head Test (1980).

Rossman, Lewis A. 2010. Storm Water Management Model User's Manual Version 5.0. EPA/600/R-05/040.

San Diego County Copermittees. 2002. Model Standard Urban Storm Water Mitigation Plan for San Diego County, Port of San Diego, and Cities in San Diego County.

San Diego County Copermittees, 2011. Countywide Model SUSMP

San Diego County Copermittees. 2012. San Diego BMP Sizing Calculator Methodology

San Diego County Copermittees. 2014. San Diego County Regional Watershed Management Area Analysis

San Diego County Copermittees. 2008. Countywide Model SUSMP.

SCCWRP. 2010. Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility. Brian P. Bledsoe; Robert J. Hawley; Eric D. Stein; Derek B. Booth. Technical Report 606.

SCCWRP. 2012. Hydromodification Assessment and Management in California. Eric D. Stein; Felicia Federico; Derek B. Booth; Brian P. Bledsoe; Chris Bowles; Zan Rubin; G. Mathias Kondolf and Ashmita Sengupta. Technical Report 667.

Schwab, G., Fangmeier, D., Elliot, W., and Frevert, R. 1993. Soil and Water Conservation Engineering. Fourth Edition. John Wiley & Sons, Inc.

Scurlock, J., Asner, G., and Gower, S. 2001. Global Leaf Area Index from Field Measurements, 1932-2000. Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/584.

U.S. Department of the Interior, Bureau of Reclamation. 1990. "Procedure for Performing Field Permeability Testing by the Well Permeameter Method (USBR 7300-89)" in Earth Manual, Part 2. Materials Engineering Branch Research and Laboratory Services Division, Denver, Colorado.

U.S. Department of the Interior, Bureau of Reclamation. 1993. Drainage Manual: A Water Resources Technical Publication. Retrieved from http://www.usbr.gov/pmts/wquality_land/DrainMan.pdf

United States Environmental Protection Agency. 2000. BASINS Technical Note 6 – Estimating Hydrology and Hydraulic Parameters for HSPF. EPA-823-R00-012.

Urban Drainage and Flood Control District, Denver, CO. (2010). Urban Storm Drainage Criteria Manual. Volume 3, Best Management Practices.

US Department of Interior Bureau of Reclamation. 1993. Drainage Design Manual.

USEPA. 1980. Onsite Wastewater Treatment and Disposal Systems (EPA No. 625/1-80-012). Retrieved from nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=300043XO.txt

USEPA. 1999. Preliminary data summary of urban storm water best management practices. EPA-821-R-99-012, U. S. Environmental Protection Agency, Washington, D.C.

Washington Department of Ecology. 2012. Stormwater Management Manual for Western Washington.

Washington State Department of Ecology. 2012. Stormwater Management Manual for Western Washington - Volume 3: Hydrologic Analysis and Flow Control BMPs. Retrieved from https://fortress.wa.gov/ecy/publications/summarypages/1210030.html

Page intentionally left blank.

Table of Contents

Appendix A

BMP DESIGN MANUAL

Submittal Templates

Appendix A Submittal Templates

Port-specific SWQMP templates can be found at https://www.portofsandiego.org/stormwater-management

Appendix

B

BMP DESIGN MANUAL

Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Appendix B Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Table of Contents:

B.1 DCV

DCV is defined as the volume of storm water runoff resulting from the 85th percentile, 24-hr storm event. The following hydrologic method shall be used to calculate the DCV:

$$DCV = C \times d \times A \times 43{,}560\ sf/ac \times 1/12\ in/ft$$
$$DCV = 3{,}630 \times C \times d \times A$$

Where:

DCV = Design Capture Volume in cubic feet

C = Runoff factor (unitless); refer to section B.1.1

d = 85th percentile, 24-hr storm event rainfall depth (inches), refer to section B.1.3

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingles with project runoff and drains to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects consult section 1.4.3.

B.1.1 Runoff Factor

Estimate the area weighted runoff factor for the tributary area to the BMP using runoff factor (from Table B.1-1) and area of each surface type in the tributary area and the following equation:

$$C = \frac{\sum C_x A_x}{\sum A_x}$$

Where:

C_x = Runoff factor for area X

A_x = Tributary area X (acres)

These runoff factors apply to areas receiving direct rainfall only. For conditions in which runoff is routed onto a surface from an adjacent surface, see Section B.2 for determining composite runoff factors for these areas.

Table B.1-1: Runoff factors for surfaces draining to BMPs – Pollutant Control BMPs

Surface	Runoff Factor
Roofs[1]	0.90
Concrete or Asphalt[1]	0.90
Unit Pavers (grouted)[1]	0.90
Decomposed Granite	0.30
Cobbles or Crushed Aggregate	0.30
Amended, Mulched Soils or Landscape	0.10
Compacted Soil (e.g., unpaved parking)	0.30
Natural (A Soil)	0.10
Natural (B Soil)	0.14
Natural (C Soil)	0.23
Natural (D Soil)	0.30

1. Surface is considered impervious and could benefit from use of Site Design BMPs and adjustment of the runoff factor per Section B.2.1.

B.1.2 Offline BMPs

Diversion flow rates for offline BMPs shall be sized to convey the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The following hydrologic method shall be used to calculate the diversion flow rate for off-line BMPs:

$$Q = C \times i \times A$$

Where:

Q = Diversion flow rate in cubic feet per second

C = Runoff factor, area weighted estimate using Table B.1

i = Rainfall intensity of 0.2 in/hr

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects also consult Section 1.4.3.

B.1.3 85th Percentile, 24-Hour Storm Event

The 85th percentile, 24-hour isopluvial map is provided as Figure B.1-1. The rainfall depth to estimate the DCV shall be determined using Figure B.1-1. The methodology used to develop this map is presented below:

B.1.3.1 Gage data and calculation of 85th percentile

The method of calculating the 85th percentile is to produce a list of values, order them from smallest to largest, and then pick the value that is 85 percent of the way through the list. Only values that are capable of producing run off are of interest for this purpose. Lacking a legislative definition of rainfall values capable of producing runoff, Flood Control staff in San Diego County have observed that the point at which significant runoff begins is rather subjective, and is affected by land use type and soil moisture. In highly-urbanized areas, the soil has a high impermeability and runoff can begin with as little as 0.02" of rainfall. In rural areas, soil impermeability is significantly lower and even 0.30" of rain on dry soil will frequently not produce significant runoff. For this reason, San Diego County has chosen to use the more objective method of including all non-zero 24-hour rainfall totals when calculating the 85th percentile. To produce a statistically significant number, only stations with 30 years or greater of daily rainfall records are used.

B.1.3.2 Mapping the gage data

A collection of 56 precipitation gage points was developed with 85th percentile precipitation values based on multiple years of gage data. A raster surface (grid of cells with values) was interpolated from that set of points. The surface initially did not cover the County's entire jurisdiction. A total of 13 dummy points were added. Most of those were just outside the County boundary to enable the software to generate a surface that covered the entire County. A handful of points were added to enforce a plausible surface. In particular, one point was added in the desert east of Julian, to enforce a gradient from high precipitation in the mountains to low precipitation in the desert. Three points were added near the northern boundary of the County to adjust the surface to reflect the effect of elevation in areas lacking sufficient operating gages.

Several methods of interpolation were considered. The method chosen is named by Environmental Systems Research Institute as the Natural Neighbor technique. This method produces a surface that is highly empirical, with the value of the surface being a product of the values of the data points nearest each cell. It does not produce peaks or valleys of surface based on larger area trends, and is free of artifacts that appeared with other methods.

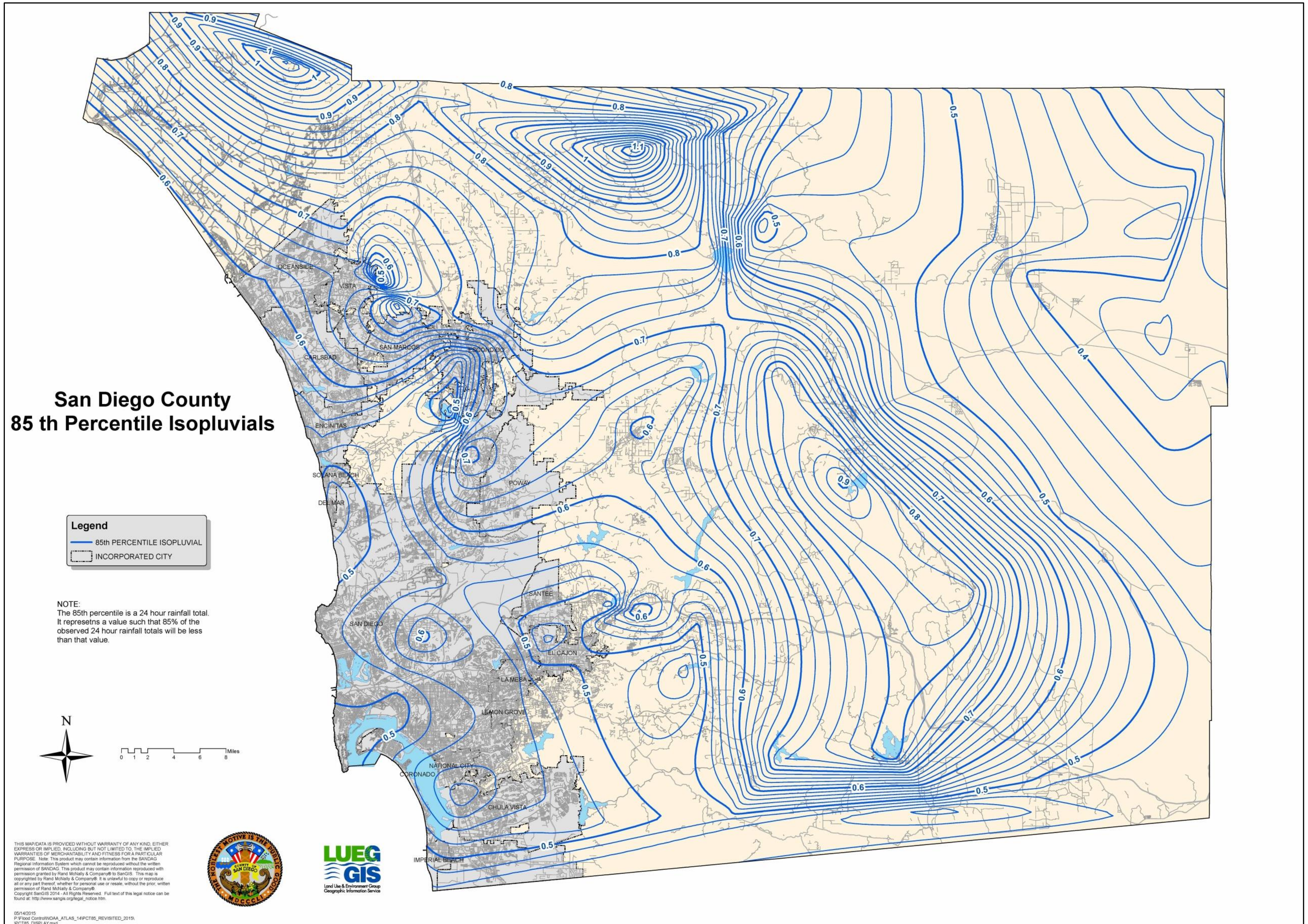


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

B.2 Adjustments to Account for Site Design BMPs

This section provides methods to adjust the DCV (for sizing pollutant control BMPs) as a result of implementing site design BMPs. The adjustments are provided by one of the following two methods:

- Adjustment to impervious runoff factor
- Adjustment to DCV

B.2.1 Adjustment to Impervious Runoff Factor

When one of the following site design BMPs is implemented the runoff factor of 0.9 for impervious surfaces identified in Table B.1-1 should be adjusted using the factors listed below and an adjusted area weighted runoff factor shall be estimated following guidance from Section B.1.1 and used to calculate the DCV.

- SD-5 Impervious area dispersion
- SD-6A Green roofs
- SD-6B Permeable pavement

B.2.1.1 Impervious area dispersion (SD-5)

Dispersion of impervious areas through pervious areas: The following adjustments are allowed to impervious runoff factors when dispersion is implemented in accordance with the SD-5 fact sheet (Appendix E). Adjustments are only credited up to a 4:1 maximum ratio of impervious to pervious areas. In order to adjust the runoff factor, the pervious area shall have a minimum width of 10 feet and a maximum slope of 5%. Based on the ratio of **impervious area to pervious area** and the hydrologic soil group of the pervious area, the adjustment factor from Table B.2-1 shall be multiplied with the unadjusted runoff factor (Table B.1-1) of the impervious area to estimate the adjusted runoff factor for sizing pollutant control BMPs. The adjustment factors in Table B.2-1 are **only** valid for impervious surfaces that have an unadjusted runoff factor of 0.9.

Table B.2-1: Impervious area adjustment factors that accounts for dispersion

Pervious area hydrologic soil group	Ratio = Impervious area/Pervious area			
	<=1	2	3	4
A	0.00	0.00	0.23	0.36
B	0.00	0.27	0.42	0.53
C	0.34	0.56	0.67	0.74
D	0.86	0.93	0.97	1.00

Continuous simulation modeling in accordance with Appendix G is required to develop adjustment factors for surfaces that have an unadjusted runoff factor less than 0.9. Approval of adjustment factors for surfaces that have an unadjusted runoff factor less than 0.9 is at the discretion of the Port.

The adjustment factors in Table B.2-1 were developed by performing continuous simulations in SWMM with default parameters from Appendix G and impervious to pervious area ratios of 1, 2, 3, and 4. When using adjustment factors from Table B.2-1:

- **Linear interpolation** shall be performed if the impervious to pervious area ratio of the site is in between one of ratios for which an adjustment factor was developed;
- Use adjustment factor for a ratio of 1 when the impervious to pervious area ratio is less than 1; and
- Adjustment factor is not allowed when the impervious to pervious area ratio is greater than 4, when the pervious area is designed as a site design BMP.

Example B.2-1: DMA is comprised of one acre of impervious area that drains to a 0.4 acre hydrologic soil group B pervious area and then the pervious area drains to a BMP. Impervious area dispersion is implemented in the DMA in accordance with SD-5 factsheet. Estimate the adjusted runoff factor for the DMA.

- Baseline Runoff Factor per Table B.1-1 = [(1*0.9+0.4*0.14)/1.4] = 0.68.
- Impervious to Pervious Ratio = 1 acre impervious area/ 0.4 acre pervious area = 2.5; since the ratio is 2.5 adjustment can be claimed.
- From Table B.2-1 the adjustment factor for hydrologic soil group B and a ratio of 2 = 0.27; ratio of 3 = 0.42.
- Linear interpolated adjustment factor for a ratio of 2.5 = 0.27 + {[(0.42 -0.27)/(3-2)]*(2.5-2)} = 0.345.
- Adjusted runoff factor for the DMA = [(1*0.9*0.345+0.4*0.14)/1.4] = 0.26.
- Note only the runoff factor for impervious area is adjusted, there is no change made to the pervious area.

B.2.1.2 Green Roofs

When green roofs are implemented in accordance with the SD-6A factsheet the green roof footprint shall be assigned a runoff factor of 0.10 for adjusted runoff factor calculations.

B.2.1.3 Permeable Pavement

When a permeable pavement is implemented in accordance with the SD-6B factsheet and it does not have an impermeable liner and has storage greater than the 85th percentile depth below the underdrain, if an underdrain is present, then the footprint of the permeable pavement shall be assigned a runoff factor of 0.10 for adjusted runoff factor calculations.

Permeable Pavement can also be designed as a structural BMP to treat run on from adjacent areas. Refer to INF-3 factsheet and Appendix B.4 for additional guidance.

B.2.2 Adjustment to DCV

When the following site design BMPs are implemented the anticipated volume reduction from these BMPs shall be deducted from the DCV to estimate the volume for which the downstream structural BMP should be sized for:

- SD-1: Street trees
- SD-8 Rain barrels

B.2.2.1 Street Trees

Street tree credit volume from tree trenches or boxes (tree BMPs) is a sum of three runoff reduction volumes provided by trees that decrease the required DCV for a tributary area. The following reduction in DCV is allowed per tree based on the mature diameter of the tree canopy, when trees are implemented in accordance with SD-1 factsheet and meet the following criteria:

- Total tree credit volume is less than 0.25DCV of the project footprint and
- Single tree credit volume is less than 400 ft^3

Credit for trees that do not meet the above criteria shall be based on the criteria for sizing the tree as a storm water pollutant control BMP in SD-1 fact sheet.

Mature Tree Canopy Diameter (ft)	Tree Credit Volume (ft^3/tree)
5	10
10	40
15	100
20	180
25	290
30	420

Basis for the reduction in DCV:

Tree credit volume was estimated based on typical characteristics of street trees as follows:

It is assumed that each tree and associated trench or box is considered a single BMP, with calculations based on the media storage volume and/or the individual tree within the tree BMP as appropriate. Tree credit volume is calculated as:

$$\boldsymbol{TCV = TIV + TCIV + TETV}$$

Where:

- *TCV* = Tree credit volume (ft^3)
- *TIV* = Total infiltration volume of all storage layers within tree BMPs (ft^3)
- *TCIV* = Total canopy interception volume of all individual trees within tree BMPs (ft^3)
- *TETV* = Total evapotranspiration volume, sums the media evapotranspiration storage within each tree BMP (ft^3)

Total infiltration volume was calculated as the total volume infiltrated within the BMP storage layers. Infiltration volume was assumed to be 20% of the total BMP storage layer volume, the available pore space in the soil volume (porosity – field capacity). Total canopy interception volume was calculated for all street trees within the tributary area as the average interception capacity for the entire mature tree total canopy projection area. Interception capacity was determined to be 0.04 inches for all street tree sizes, an average from the findings published by Breuer et al (2003) for coniferous and deciduous trees. Total evapotranspiration volume is the available evapotranspiration storage volume (field capacity – wilting point) within the BMP storage layer media. TEVT is assumed to be 10% of the minimum soil volume. The minimum soil volume as required by SD-1 fact sheet of 2 cubic feet per unit canopy projection area was assumed for estimating reduction in DCV.

B.2.2.2 Rain Barrels

Rain barrels are containers that can capture rooftop runoff and store it for future use. Credit can be taken for the full rain barrel volume when each barrel volume is smaller than 100 gallons, implemented per SD-8 fact sheet and meet the following criteria:

- Total rain barrel volume is less than 0.25 DCV and
- Landscape areas are greater than 30 percent of the project footprint.

Credit for harvest and use systems that do not meet the above criteria shall be based on the criteria in Appendix B.3 and HU-1 fact sheet.

Worksheet B.2-1. DCV

Design Capture Volume		Worksheet B-2.1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=		inches
2	Area tributary to BMP (s)	A=		acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=		unitless
4	Street trees volume reduction	TCV=		cubic-feet
5	Rain barrels volume reduction	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=		cubic-feet

B.3 Harvest and Use BMPs

The purpose of this section is to provide guidance for evaluating feasibility of harvest and use BMPs, calculating harvested water demand and sizing harvest and use BMPs.

B.3.1 Planning Level Harvest and Use Feasibility

Harvest and use feasibility should be evaluated at the scale of the entire project, and not limited to a single DMA. For the purpose of initial feasibility screening, it is assumed that harvested water collected from one DMA could be used within another. Types of non-potable water demand that may apply within a project include:

- Toilet and urinal flushing
- Irrigation
- Vehicle washing
- Evaporative cooling
- Dilution water for recycled water systems
- Industrial processes
- Other non-potable uses

Worksheet B.3-1 provides a screening process for determining the preliminary feasibility for harvest and use BMPs. This worksheet should be completed for the overall project.

Worksheet B.3-1. Harvest and Use Feasibility Screening

<table>
<tr><th colspan="2">Harvest and Use Feasibility Screening</th><th>Worksksheet B.3-1</th></tr>
<tr><td colspan="3">1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?
☐ Toilet and urinal flushing
☐ Landscape irrigation
☐ Other:_______________</td></tr>
<tr><td colspan="3">2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

[Provide a summary of calculations here]</td></tr>
<tr><td colspan="3">3. Calculate the DCV using worksheet B-2.1.

[Provide a results here]</td></tr>
<tr><td>3a. Is the 36-hour demand greater than or equal to the DCV?
Yes / No ⇨
⇩</td><td>3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV?
Yes / No ⇨
⇩</td><td>3c. Is the 36-hour demand less than 0.25DCV?
Yes
⇩</td></tr>
<tr><td>Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.</td><td>Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.</td><td>Harvest and use is considered to be infeasible.</td></tr>
</table>

B.3.2 Harvested Water Demand Calculation

The following sections provide technical references and guidance for estimating the harvested water demand of a project. These references are intended to be used for the planning phase of a project for feasibility screening purposes.

B.3.2.1 Toilet and Urinal Flushing Demand Calculations

The following guidelines should be followed for computing harvested water demand from toilet and urinal flushing:

- If reclaimed water is planned for use for toilet and urinal flushing, then the demand for harvested storm water is equivalent to the total demand minus the reclaimed water supplied, and should be reduced by the amount of reclaimed water that is available during the wet season.
- Demand calculations for toilet and urinal flushing should be based on the average rate of use during the wet season for a typical year.
- Demand calculations should include changes in occupancy over weekends and around holidays and changes in attendance/enrollment over school vacation periods.
- For facilities with generally high demand, but periodic shut downs (e.g., for vacations, maintenance, or other reasons), a project specific analysis should be conducted to determine whether the long term storm water capture performance of the system can be maintained despite shut downs.
- Such an analysis should consider the statistical distributions of precipitation and demand, most importantly the relationship of demand to the wet seasons of the year.

Table B.3-1 provides planning level demand estimates for toilet and urinal flushing per resident, or employee, for a variety of project types. The per capita use per day is based on daily employee or resident usage. For non-residential types of development, the "visitor factor" and "student factor" (for schools) should be multiplied by the employee use to account for toilet and urinal usage for non-employees using facilities.

Table B.3-1. Toilet and Urinal Water Usage per Resident or Employee

Land Use Type	Toilet User Unit of Normalization	Per Capita Use per Day		Visitor Factor[4]	Water Efficiency Factor	Total Use per Resident or Employee
		Toilet Flushing[1,2]	Urinals[3]			
Residential	Resident	18.5	NA	NA	0.5	9.3
Office	Employee (non-visitor)	9.0	2.27	1.1	0.5	7 (avg)
Retail	Employee (non-visitor)	9.0	2.11	1.4	0.5	
Schools	Employee (non-student)	6.7	3.5	6.4	0.5	33
Various Industrial Uses (excludes process water)	Employee (non-visitor)	9.0	2	1	0.5	5.5

1- Based on American Waterworks Association Research Foundation,1999. Residential End Uses of Water. Denver, CO: AWWARF

2 - Based on use of 3.45 gallons per flush and average number of per employee flushes per subsector, Table D-1 for MWD (Pacific Institute, 2003)

3 - Based on use of 1.6 gallons per flush, Table D-4 and average number of per employee flushes per subsector, Appendix D (Pacific Institute, 2003)

4 - Multiplied by the demand for toilet and urinal flushing for the project to account for visitors. Based on proportion of annual use allocated to visitors and others (includes students for schools; about 5 students per employee) for each subsector in Table D-1 and D-4 (Pacific Institute, 2003)

5 – Accounts for requirements to use ultra low flush toilets in new development projects; assumed that requirements will reduce toilet and urinal flushing demand by half on average compared to literature estimates. Ultra low flush toilets are required in all new construction in California as of January 1, 1992. Ultra low flush toilets must use no more than 1.6 gallons per flush and Ultra low flush urinals must use no more than 1 gallon per flush. Note: If zero flush urinals are being used, adjust accordingly.

B.3.2.2 General Requirements for Irrigation Demand Calculations

The following guidelines should be followed for computing harvested water demand from landscape irrigation:

- If reclaimed water is planned for use for landscape irrigation, then the demand for harvested storm water should be reduced by the amount of reclaimed water that is available during the wet season.
- Irrigation rates should be based on the irrigation demand exerted by the types of landscaping that are proposed for the project, with consideration for water conservation requirements.
- Irrigation rates should be estimated to reflect the average wet season rates (defined as October through April) accounting for the effect of storm events in offsetting harvested water demand. In the absence of a detailed demand study, it should be assumed that irrigation demand is not present during days with greater than 0.1 inches of rain and the subsequent 3-day period. This irrigation shutdown period is consistent with standard practice in land application of wastewater and is applicable to storm water to prevent irrigation from resulting in dry weather

runoff. Based on a statistical analysis of San Diego County rainfall patterns, approximately 30 percent of wet season days would not have a demand for irrigation.

- If land application of storm water is proposed (irrigation in excess of agronomic demand), then this BMP must be considered to be an infiltration BMP and feasibility screening for infiltration must be conducted. In addition, it must be demonstrated that land application would not result in greater quantities of runoff as a result of saturated soils at the beginning of storm events. Agronomic demand refers to the rate at which plants use water.

The following sections describe methods that should be used to calculate harvested water irrigation demand. While these methods are simplified, they provide a reasonable estimate of potential harvested water demand that is appropriate for feasibility analysis and project planning. These methods may be replaced by a more rigorous project-specific analysis that meets the intent of the criteria above.

B.3.2.2.1 Demand Calculation Method

This method is based on the San Diego Municipal Code Land Development Code Landscape Standards Appendix E which includes a formula for estimating a project's annual estimated total water use based on reference evaporation, plant factor, and irrigation efficiency.

For the purpose of calculating harvested water irrigation demand applicable to the sizing of harvest and use systems, the estimated total water use has been modified to reflect typical wet-season irrigation demand. This method assumes that the wet season is defined as October through April. This method further assumes that no irrigation water will be applied during days with precipitation totals greater than 0.1 inches or within the 3 days following such an event. Based on these assumptions and an analysis of Lake Wohlford, Lindbergh and Oceanside precipitation patterns, irrigation would not be applied during approximately 30 percent of days from October through April.

The following equation is used to calculate the Modified Estimated Total Water Usage:

$$\text{Modified ETWU} = ETo_{Wet} \times [[\Sigma(PF \times HA)/IE] + SLA] \times 0.015$$

Where:

Modified ETWU = Estimated daily average water usage during wet season
ETo_{Wet} = Average reference evapotranspiration from October through April (use 2.8 inches per month, using CIMS Zone 4 from Table G.1-1)
PF = Plant Factor

Table B.3-2. Planning Level Plant Factor Recommendations

Plant Water Use	Plant Factor	Also Includes
Low	< 0.1 – 0.2	Artificial Turf
Moderate	0.3 – 0.7	
High	0.8 and greater	Water features
Special Landscape Area	1.0	

HA = Hydrozone Area (sq-ft); A section or zone of the landscaped area having plants with similar water needs.
Σ(PF x HA) = The sum of PF x HA for each individual Hydrozone (accounts for different landscaping zones).
IE = Irrigation Efficiency (assume 90 percent for demand calculations)
SLA = Special Landscape Area (sq-ft); Areas used for active and passive recreation areas, areas solely dedicated to the production of fruits and vegetables, and areas irrigated with reclaimed water.

In this equation, the coefficient (0.015) accounts for unit conversions and shut down of irrigation during and for the three days following a significant precipitation event:

0.015 = (1 mo/30 days)×(1 ft/12 in)×(7.48 gal/cu-ft)×(approximately 7 out of 10 days with irrigation demand from October through April)

B.3.2.2.2 Planning Level Irrigation Demands

To simplify the planning process, the method described above has been used to develop daily average wet season demands for a one-acre irrigated area based on the plant/landscape type. These demand estimates can be used to calculate the drawdown of harvest and use systems for the purpose of LID BMP sizing calculations.

Table B.3-3. Planning Level Irrigation Demand by Plant Factor and Landscape Type

General Landscape Type	36-Hour Planning Level Irrigation Demand (gallons per irrigated acre per 36 hour period)
Hydrozone – Low Plant Water Use	390
Hydrozone – Moderate Plant Water Use	1,470
Hydrozone – High Plant Water Use	2,640
Special Landscape Area	2,640

B.3.2.3 Calculating Other Harvested Water Demands

Calculations of other harvested water demands should be based on the knowledge of land uses, industrial processes, and other factors that are project-specific. Demand should be calculated based on the following guidelines:

- Demand calculations should represent actual demand that is anticipated during the wet season (October through April).
- Sources of demand should only be included if they are reliably and consistently present during the wet season.
- Where demands are substantial but irregular, a more detailed analysis should be conducted based on a statistical analysis of anticipated demand and precipitation patterns.

B.3.3 Sizing Harvest and Use BMPs

Sizing calculations shall demonstrate that one of two equivalent performance standards is met:

1. Harvest and use BMPs are sized to drain the tank in 36 hours following the end of rainfall. The size of the BMP is dependent on the demand (Section B.3.2) at the site.
2. Harvest and use BMP is designed to capture at least 80 percent of average annual (long term) runoff volume.

It is rare cisterns can be sized to capture the full DCV and use this volume in 36 hours. So when using Worksheet B.3-1 if it is determined that harvest and use BMP is feasible then the BMP should be sized to the estimated 36-hour demand.

B.4 Infiltration BMPs

Sizing calculations shall demonstrate that one of two equivalent performance standards is met:

1. The BMP or series of BMPs captures the DCV and infiltrates this volume fully within 36 hours following the end of precipitation. This can be demonstrated through the Simple Method (Section B.4.1).

2. The BMP or series of BMPs infiltrates at least 80 percent of average annual (long term) runoff volume. This can be demonstrated using the percent capture method (Section B.4.2), through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in Appendix G, as acceptable to the Port. This method is **not** applicable for sizing biofiltration BMPs.

The methods to show compliance with these standards are provided in the following sections.

B.4.1 Simple Method

Stepwise Instructions:

1. Compute DCV using Worksheet B.4-1
2. Estimate design infiltration rate using Worksheet D.5-1
3. Design BMP(s) to ensure that the DCV is fully retained (i.e., no surface discharge during the design event) and the stored effective depth draws down in no longer than 36 hours.

Worksheet B.4-1: Simple Sizing Method for Infiltration BMPs

	Simple Sizing Method for Infiltration BMPs	Worksheet B.4-1		
1	DCV (Worksheet B-2.1)	DCV=		cubic-feet
2	Estimated design infiltration rate (Worksheet D.5-1)	K_{design}=		in/hr
3	Available BMP surface area	A_{BMP}=		sq-ft
4	Average effective depth in the BMP footprint (DCV/A_{BMP})	D_{avg}=		feet
5	Drawdown time, T (D_{avg} *12/K_{design})	T=		hours
6	Provide alternative calculation of drawdown time, if needed.			

Notes:

- Drawdown time must be less than 36 hours. This criterion was set to achieve average annual capture of 80% to account for back to back storms (See rationale in Section B.4.3). In order to use a different drawdown time, BMPs should be sized using the percent capture method (Section B.4.2).
- The average effective depth calculation should account for any aggregate/media in the BMP. For example, 4 feet of stone at a porosity of 0.4 would equate to 1.6 feet of effective depth.
- This method may overestimate drawdown time for BMPs that drain through both the bottom and walls of the system. BMP specific calculations of drawdown time may be provided that account for BMP-specific geometry.

B.4.2 Percent Capture Method

This section describes the recommended method of sizing volume-based BMPs to achieve the 80 percent capture performance criterion. This method has a number of potential applications for sizing BMPs, including:

- Use this method when a BMP can draw down in less than 36 hours and it is desired to demonstrate that 80 percent capture can be achieved using a BMP volume smaller than the DCV.
- Use this method to determine how much volume (greater than the DCV) must be provided to achieve 80 percent capture when the drawdown time of the BMP exceeds 36 hours.
- Use this method to determine how much volume should be provided to achieve 80 percent capture when upstream BMP(s) have achieved some capture, but have not achieved 80 percent capture.

By nature, the percent capture method is an iterative process that requires some initial assumptions about BMP design parameters and subsequent confirmation that these assumptions are valid. For example, sizing calculations depend on the assumed drawdown time, which depends on BMP depth, which may in turn need to be adjusted to provide the required volume within the allowable footprint. In general, the selection of reasonable BMP design parameters in the first iteration will result in minimal required additional iterations. Figure B.4-1 presents the nomograph for use in sizing retention BMPs in San Diego County.

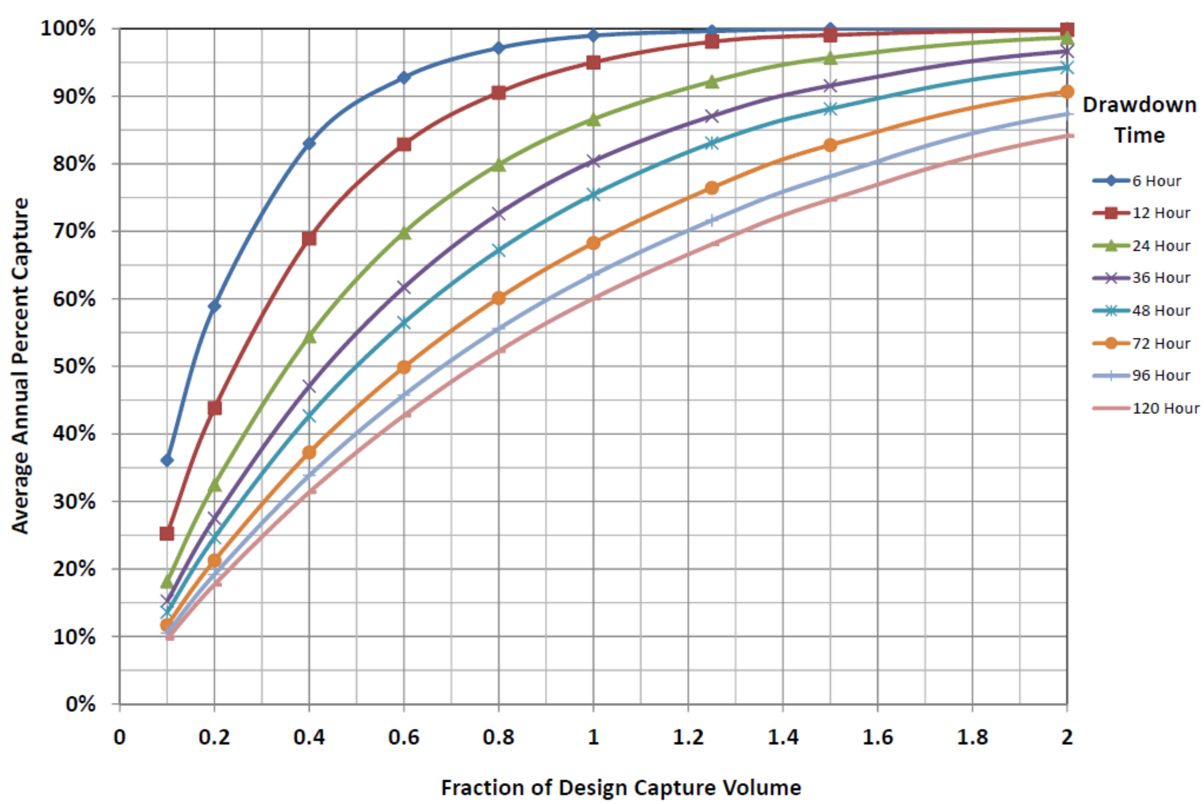


Figure B.4-1: Percent Capture Nomograph

B.4.2.1 Stepwise Instructions for sizing a single BMP:

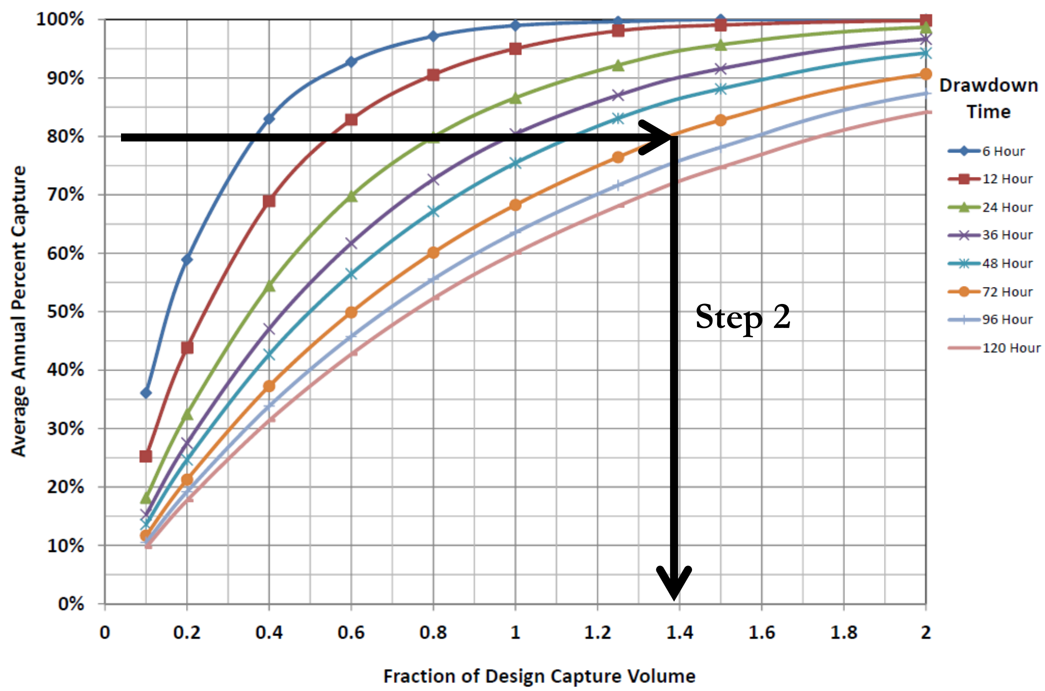
1. Estimate the drawdown time of the proposed BMP by estimating the design infiltration rate (Worksheet D.5-1) and accounting for BMP dimensions/geometry. See the applicable BMP Fact Sheet for specific guidance on how to convert BMP geometry to estimated drawdown time.
2. Using the estimated drawdown time and the nomograph from Figure B.4-1 locate where the line corresponding to the estimated drawdown time intersects with 80 percent capture. Pivot to the X axis and read the fraction of the DCV that needs to be provided in the BMP to achieve this level of capture.
3. Calculate the DCV using Worksheet B.2-1.
4. Multiply the result of Step 2 by the DCV (Step 3). This is the required BMP design volume.
5. Design the BMP to retain the required volume, and confirm that the drawdown time is no more than 25 percent greater than estimated in Step 1. If the computed drawdown time is greater than 125 percent of the estimated drawdown, then return to Step 1 and revise the initial drawdown time assumption.

See the respective BMP facts sheets for BMP-specific instructions for the calculation of volume and drawdown time. The above method can also be used to size and/or evaluate the performance of other retention BMPs (evapotranspiration, harvest and use) that have a drawdown rate that can be approximated as constant throughout the year or over the wet season. In order to use this method for other retention BMPs, drawdown time in Step 1 will need to be evaluated using an applicable method for the type of BMP selected. After completing Step 1 continue to Step 2 listed above.

Example B.4.2.1 Percent Capture Method for Sizing a Single BMP:

Given:
• Estimated drawdown time: 72 Hours • DCV: 3000 ft^3
Required:
• Determine the volume required to achieve 80 percent capture.
Solution:
1. Estimated drawdown time = 72 Hours 2. Fraction of DCV required = 1.35 3. DCV = 3000 ft^3 (Given for this example; To be estimated using Worksheet B.2-1) 4. Required BMP volume = 1.35 x 3000 = 4050 ft^3 5. Design BMP and confirm drawdown Time is $\leq$ 90 Hours (72 Hours +25%)

Example B.4.2.1 Continued:

Graphical Operations Supporting Solution:
 **Percent Capture Nomograph**

B.4.2.2 Stepwise Instructions for sizing BMPs in series:

For projects where BMPs in series have to be implemented to meet the performance standard the following stepwise procedure shall be used to size the downstream BMP to achieve the 80 percent capture performance criterion:

1. Using the upstream BMP parameters (volume and drawdown time) estimate the average annual capture efficiency achieved by the upstream BMP using the nomograph.
2. Estimate the drawdown time of the proposed downstream BMP by estimating the design infiltration rate (Worksheet D.5-1) and accounting for BMP dimensions/geometry. See the applicable BMP Fact Sheet for specific guidance on how to convert BMP geometry to estimated drawdown time. Use the nomograph and locate where the line corresponding to the estimated drawdown time intersects with 80 percent capture. Pivot to the horizontal axis and read the fraction of the DCV that needs to be provided in the BMP. This is referred to as X_1.
3. Trace a horizontal line on the nomograph using the capture efficiency of the upstream BMP estimated in Step 1. Find where the line traced intersects with the drawdown time of the downstream BMP (Step 2). Pivot and read down to the horizontal axis to yield the fraction of the DCV already provided by the upstream BMP. This is referred to as X_2.

4. Subtract X_2 (Step 3) from X_1 (Step 2) to determine the fraction of the design volume that must be provided in the downstream BMP to achieve 80 percent capture to meet the performance standard.
5. Multiply the result of Step 4 by the DCV. This is the required downstream BMP design volume.
6. Design the BMP to retain the required volume, and confirm that the drawdown time is no more than 25 percent greater than estimated in Step 2. If the computed drawdown time is greater than 125 percent of the estimated drawdown, then return to Step 2 and revise the initial drawdown time assumption.

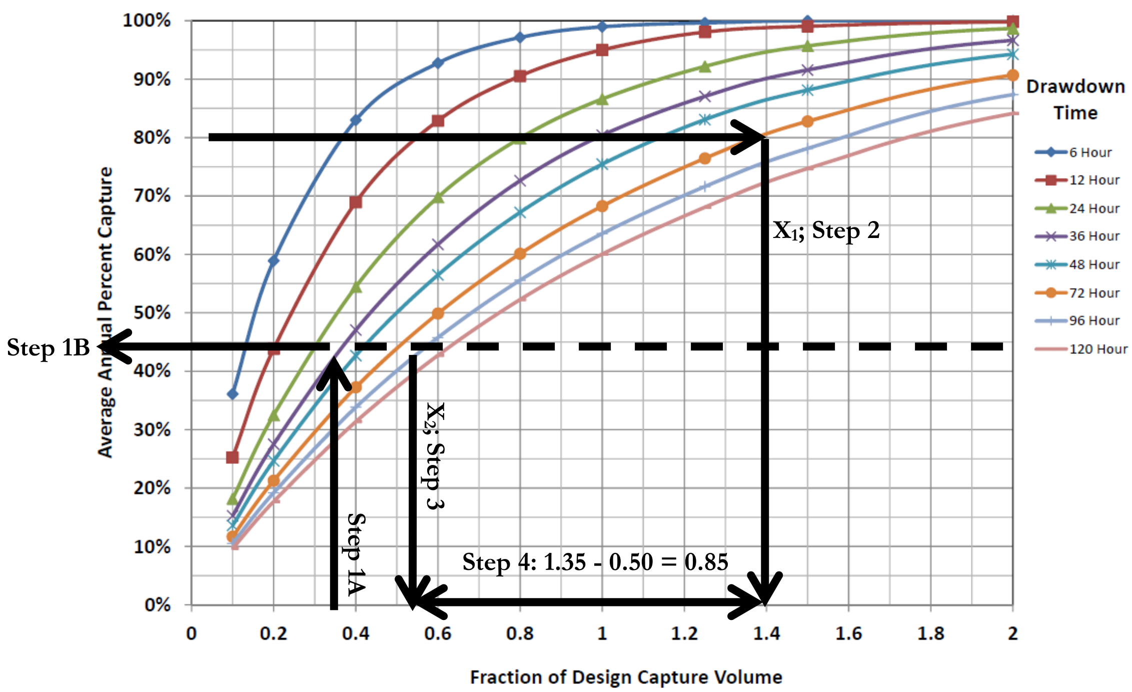
See the respective BMP facts sheets for BMP-specific instructions for the calculation of volume and drawdown time.

Example B.4.2.2 Percent Capture Method for Sizing BMPs in Series:

Given:
• Estimated drawdown time for downstream BMP: 72 Hours • DCV for the area draining to the BMP: 3000 ft^3 • Upstream BMP volume: 900 ft^3 • Upstream BMP drawdown time: 24 Hours
Required:
• Determine the volume required in the downstream BMP to achieve 80 percent capture.
Solution:
1. Step 1A: Upstream BMP Capture Ratio = 900/3000 = 0.3; Step 1B: Average annual capture efficiency achieved by upstream BMP = 44% 2. Downstream BMP drawdown = 72 hours; Fraction of DCV required to achieve 80% capture = 1.35 3. Locate intersection of design capture efficiency and drawdown time for upstream BMP (See Graph); Fraction of DCV already provided (X_2) = 0.50 (See Graph) 4. Fraction of DCV Required by downstream BMP = 1.35-0.50 = 0.85 5. DCV (given) = 3000 ft^3 ; Required downstream BMP volume = 3000 ft^3 x 0.85 = 2,550 ft^3 6. Design BMP and confirm drawdown Time is $\leq$ 90 Hours (72 Hours +25%)

Example B.4.2.2 Continued:

Graphical Operations Supporting Solution:



Percent Capture Nomograph

B.4.3 Technical Basis for Equivalent Sizing Methods

Storm water BMPs can be conceptualized as having a storage volume and a treatment rate, in various proportions. Both are important in the long-term performance of the BMP under a range of actual storm patterns, depths, and inter-event times. Long-term performance is measured by the operation of a BMP over the course of multiple years, and provides a more complete metric than the performance of a BMP during a single event, which does not take into account antecedent conditions, including multiple storms arriving in short timeframes. A BMP that draws down more quickly would be expected to capture a greater fraction of overall runoff (i.e., long-term runoff) than an identically sized BMP that draws down more slowly. This is because storage is made available more quickly, so subsequent storms are more likely to be captured by the BMP. In contrast a BMP with a long drawdown time would stay mostly full, after initial filling, during periods of sequential storms. The volume in the BMP that draws down more quickly is more “valuable” in terms of long term performance than the volume in the one that draws down more slowly. The MS4 permit definition of the DCV does not specify a drawdown time, therefore the definition is not a complete indicator of a

BMP's level of performance. An accompanying performance-based expression of the BMP sizing standard is essential to ensure uniformity of performance across a broad range of BMPs and helps prevents BMP designs from being used that would not be effective.

An evaluation of the relationships between BMP design parameters and expected long term capture efficiency has been conducted to address the needs identified above. Relationships have been developed through a simplified continuous simulation analysis of precipitation, runoff, and routing, that relate BMP design volume and storage recovery rate (i.e., drawdown time) to an estimated long term level of performance using United States Environmental Protection Agency (USEPA) SWMM and parameters listed in Appendix G for Lake Wohlford, Lindbergh, and Oceanside rain gages. Comparison of the relationships developed using the three gages indicated that the differences in relative capture estimates are within the uncertainties in factors used to develop the relationships. For example, the estimated average annual capture for the BMP sized for the DCV and 36 hour drawdown using Lake Wohlford, Lindbergh, and Oceanside are 80%, 76% and 83% respectively. In an effort to reduce the number of curves that are made available, relationships developed using Lake Wohlford are included in this manual for use in the whole San Diego County region.

Figure B.4-1 demonstrated that a BMP sized for the runoff volume from the 85th percentile, 24-hour storm event (i.e., the DCV), which draws down in 36 hours is capable of managing approximately 80 percent of the average annual. There is long precedent for 80 percent capture of average annual runoff as approximately the point at which larger BMPs provide decreasing capture efficiency benefit (also known as the "knee of the curve") for BMP sizing. The characteristic shape of the plot of capture efficiency versus storage volume in Figure B.4-1 illustrates this concept.

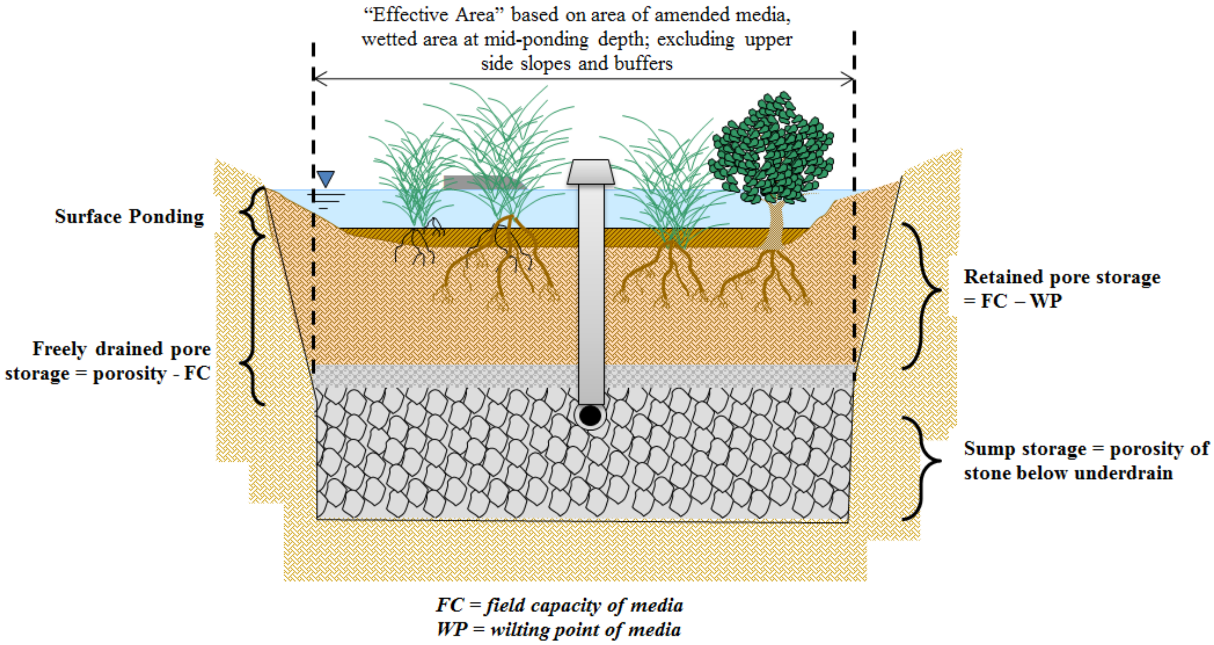
As such, this equivalency (between DCV draw down in 36-hours and 80 percent capture) has been utilized to provide a common currency between volume-based BMPs with a wide range of drawdown rates. This approach allows flexibility in the design of BMPs while ensuring consistent performance.

B.5 Biofiltration BMPs

Biofiltration BMPs shall be sized by one of the following sizing methods:

Option 1: Treat 1.5 times the portion of the DCV not reliably retained onsite, OR

Option 2: Treat 1.0 times the portion of the DCV not reliably retained onsite; and additionally check that the system has a total static (i.e., non-routed) storage volume, including pore spaces and pre-filter detention volume, equal to at least 0.75 times the portion of the DCV not reliably retained onsite.



Explanation of Biofiltration Volume Compartments for Sizing Purposes

Worksheet B.5-1 provides a simple sizing method for sizing biofiltration BMP with partial retention and biofiltration BMP.

When using sizing option 1 a routing period of 6 hours is allowed. The routing period was estimated based on 50th percentile storm duration for storms similar to 85th percentile rainfall depth. It was estimated based on inspection of continuous rainfall data from Lake Wohlford, Lindbergh and Oceanside rain gages.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs		cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible		in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]		inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]		inches
7	Assumed surface area of the biofiltration BMP		sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7		cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]		cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]		inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations		inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area		inches
14	Media available pore space	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]		inches
19	Total Depth Treated [Line 17 + Line 18]		inches

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs			Worksheet B.5-1 (Page 2 of 2)
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]		cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12		sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]		cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12		sq-ft
Footprint of the BMP			
24	Area draining to the BMP		sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)		
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)		unitless
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]		sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)		sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of the DCV retained by the BMP [Line 9/ Line 1]		unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV > 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the Port, if it meets the requirements in Appendix F.

B.5.1 Basis for Minimum Sizing Factor for Biofiltration BMPs

B.5.1.1 Introduction

MS4 Permit Provision E.3.c.(1)(a)(i)

The MS4 Permit describes conceptual performance goals for biofiltration BMPs and specifies numeric criteria for sizing biofiltration BMPs (See Section 2.2.1 of this Manual).

However, the MS4 Permit does not define a specific footprint sizing factor or design profile that must be provided for the BMP to be considered "biofiltration." Rather, the MS4 Permit specifies (Footnote 25):

> **As part of the Copermittee's update to its BMP Design Manual, pursuant to Provision E.3.d, the Copermittee must provide guidance for hydraulic loading rates and other biofiltration design criteria necessary to maximize storm water retention and pollutant removal.**

To meet this provision, this manual includes specific criteria for design of biofiltration BMPs. Among other criteria, a minimum footprint sizing factor of 3 percent (BMP footprint area as percent of contributing area times adjusted runoff factor) is specified. The purpose of this section is to provide the technical rationale for this 3 percent minimum sizing factor.

B.5.1.2 Conceptual Need for Minimum Sizing Factor

Under the 2011 Model SUSMP, a sizing factor of 4 percent was used for sizing biofiltration BMPs. This value was derived based on the goal of treating the runoff from a 0.2 inch per hour uniform precipitation intensity at a constant media flow rate of 5 inches per hour. While this method was simple, it was considered to be conservative as it did not account for significant transient storage present in biofiltration BMPs (i.e., volume in surface storage and subsurface storage that would need to fill before overflow occurred). Under this manual, biofiltration BMPs will typically provide subsurface storage to promote infiltration losses; therefore typical BMP profiles will tend to be somewhat deeper than those provided under the 2011 Model SUSMP. A deeper profile will tend to provide more transient storage and allow smaller footprint sizing factors while still providing similar or better treatment capacity and pollutant removal. Therefore a reduction in the minimum sizing factor from the factor used in the 2011 Model SUSMP is supportable. However, as footprint decreases, issues related to potential performance, operations, and/or maintenance can increase for a number of reasons:

1) As the surface area of the media bed decreases, the sediment loading per unit area increases, increasing the risk of clogging. While vigorous plant growth can help maintain permeability

of soil, there is a conceptual limit above which plants may not be able to mitigate for the sediment loading. Scientific knowledge is not conclusive in this area.

2) With smaller surface areas and greater potential for clogging, water may be more likely to bypass the system via overflow before filling up the profile of the BMP.
3) As the footprint of the system decreases, the amount of water that can be infiltrated from subsurface storage layers and evapotranspire from plants and soils tends to decrease.
4) With smaller sizing factors, the hydraulic loading per unit area increases, potentially reducing the average contact time of water in the soil media and diminishing treatment performance.

The MS4 Permit requires that volume and pollutant retention be maximized. Therefore, a minimum sizing factor was determined to be needed. This minimum sizing factor does not replace the need to conduct sizing calculations as described in this manual; rather it establishes a lower limit on required size of biofiltration BMPs as the last step in these calculations. Additionally, it does not apply to alternative biofiltration designs that utilize the checklist in Appendix F (Biofiltration Standard and Checklist). Acceptable alternative designs (such as proprietary systems meeting Appendix F criteria) typically include design features intended to allow acceptable performance with a smaller footprint and have undergone field scale testing to evaluate performance and required O&M frequency.

B.5.1.3 Lines of Evidence to Select Minimum Sizing Factor

Three primary lines of evidence were used to select the minimum sizing factor of 3 percent (BMP footprint area as percent of contributing area times adjusted runoff factor) in this manual:

1. Typical design calculations.
2. Volume reduction performance.
3. Sediment clogging calculations.

These lines of evidence and associated findings are explained below.

Typical Design Calculations

A range of BMP profiles were evaluated for different design rainfall depths and soil conditions. Worksheet B.5-1 was used for each case to compute the required footprint sizing factor. For these calculations, the amount of water filtered during the storm event was determined based on a media filtration rate of 5 inches per hour and a routing time of 6 hours. These input assumptions are considered to be well-supported and consistent with the intent of the MS4 Permit. These calculations generally yielded footprint factors between 1.5 and 4.9 percent. In the interest of establishing a uniform County-wide minimum sizing factor, a 3 percent sizing factor was selected from this range, consistent with other lines of evidence.

Volume Reduction Performance

Consistent with guidance in Fact Sheet PR-1, the amount of retention storage (in gravel sump below underdrain) that would drain in 36 hours was calculated for a range of soil types. This was used to estimate the volume reduction that would be expected to be achieved. For a sizing factor of 3 percent and a soil filtration rate of 0.20 inches per hour, the average annual volume reduction was estimated to be approximately 40 percent (via percent capture method; see Appendix B.4.2).

In describing the basis for equivalency between retention and biofiltration (1.5 multiplier), the MS4 Permit Fact Sheet referred to analysis prepared in the Ventura County Technical Guidance Manual. The Ventura County analysis considered the pollutant treatment as well as the volume reduction provided by biofiltration in considering equivalency to retention. This analysis assumed an average long term volume reduction of 40 percent based on analysis of data from the International Stormwater BMP Database. The calculations of estimated volume reduction at a 3 percent sizing factor is (previous paragraph) consistent with this value. While estimated volume reduction is sensitive to site-specific factors, this analysis suggests that a sizing factor of approximately 3 percent provides levels of volume reduction that are reasonably consistent with the intent of the MS4 Permit.

Sediment Clogging Calculations

As sediment accumulates in a filter, the permeability of the filter tends to decline. The lifespan of the filter bed can be estimated by determining the rate of sediment loading per unit area of the filter bed. To determine the media bed surface area sizing factor needed to provide a target lifespan, simple sediment loading calculations were conducted based on typical urban conditions. The inputs and results of this calculation are summarized in Table B.5-1.

Table B.5-1: Inputs and Results of Clogging Calculation

Parameter	Value	Source
Representative TSS Event Mean Concentration, mg/L	100	Approximate average of San Diego Land Use Event Mean Concentrations from San Diego River and San Luis Rey River WQIP
Runoff Coefficient of Impervious Surface	0.90	Table B.1-1
Runoff Coefficient of Pervious Surface	0.10	Table B.1-1 for landscape areas
Imperviousness	40% to 90%	Planning level assumption, covers typical range of single family to commercial land uses
Average Annual Precipitation, inches	11 to 13	Typical range for much of urbanized San Diego County
Load to Initial Maintenance, kg/m^2	10	Pitt, R. and S. Clark, 2010. Evaluation of Biofiltration Media for Engineered Natural Treatment Systems.
Allowable period to initial clogging, yr	10	Planning-level assumption
Estimated BMP Footprint Needed for 10-Year Design Life	2.8 to 3.3%	Calculated

This analysis suggests that a 3 percent sizing factor, coupled with sediment source controls and careful system design, should provide reasonable protection against premature clogging. However, there is substantial uncertainty in sediment loading and the actual load to clog that will be observed under field conditions in the San Diego climate. Additionally this analysis did not account for the effect of plants on maintaining soil permeability. Therefore this line of evidence should be considered provisional, subject to refinement based on field scale experience. As field scale experience is gained about the lifespan of biofiltration BMPs in San Diego and the mitigating effects of plants on long term clogging, it may be possible to justify lower factors of safety and therefore smaller design sizes in some cases. If a longer lifespan is desired and/or greater sediment load is expected, then a larger sizing factor may be justified.

B.5.1.4 Discussion

Generally, the purpose of a minimum sizing factor is to help improve the performance and reliability of standard biofiltration systems and limit the use of sizing methods and assumptions that may lead to designs that are less consistent with the intent of the MS4 Permit.

Ultimately, this factor is a surrogate for a variety of design considerations, including clogging and associated hydraulic capacity, volume reduction potential, and treatment contact time. A prudent design approach should consider each of these factors on a project-specific basis and identify whether site conditions warrant a larger or smaller factor. For example a system treating only rooftop runoff in an area without any allowable infiltration may have negligible clogging risk and negligible volume reduction potential – a smaller sizing factor may not substantially reduce performance in either of these areas. Alternatively, for a site with high sediment load and limited pre-treatment potential, a larger sizing factor may be warranted to help mitigate potential clogging risks. The Port has discretion to accept alternative sizing factor(s) based on project-specific or jurisdiction-specific considerations. Additionally, the recommended minimum sizing factor may change over time as more experience with biofiltration is obtained.

The worksheet B.5-2 below shall be used to support a request for an alternative minimum footprint sizing factor. Based on a review of the submitted worksheet and supporting documentation, the use of a smaller footprint sizing factor may be approved at the discretion of the Port. If approved, the estimated footprint from the worksheet below can be used in line 26 of worksheet B.5-1 in lieu of the 3 percent minimum footprint value.

This worksheet includes the following general steps to calculate the minimum footprint sizing factor:

- Select a "load to clog" that is representative of the type of BMP proposed
- Select a target life span (i.e., frequency of major maintenance) that is acceptable to the Port. A default value of 10 years is recommended.
- Compile information about the DMA from other parts of the SWQMP development process.
- Determine the event mean concentration (EMC) of TSS that is appropriate for the DMA
- Perform calculations to determine the minimum footprint to provide the target lifespan.

Worksheet B.5-2: Calculation of Alternative Minimum Footprint Sizing Factor

Alternative Minimum Footprint Sizing Factor		Worksheet B.5-2 (Page 1 of 2)	
1	Area draining to the BMP		sq-ft
2	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)		
3	Load to Clog[1] (See Table B.5-2 for guidance; L_c)	2.0	lb/sq-ft
4	Allowable Period to Accumulate Clogging Load (T_L)	10	years
Volume Weighted EMC Calculation			

Land Use	Fraction of Total DCV	TSS EMC (mg/L)	Product
Single Family Residential		123	
Commercial		128	
Industrial		125	
Education (Municipal)		132	
Transportation		78	
Multi-family Residential		40	
Roof Runoff		14	
Low Traffic Areas		50	
Open Space		216	
Other, specify:			
Other, specify:			
Other, specify:			

5	Volume Weighted EMC (sum of all products)		mg/L
BMP Parameters			
6	If pretreatment measures are included in the design, apply an adjustment of 25%[2] [Line 5 x (1-0.25)]		mg/L
7	Average Annual Precipitation		inches
8	Calculate the Average Annual Runoff (Line 7 x 43,560/12) x Line2	1	cu-ft/yr
9	Calculate the Average Annual TSS Load (Line 8 x 62.4 x Line 6)/10^6		lb/yr
10	Calculate the BMP Footprint Needed (Line 9 x Line 4)/Line 3		sq-ft
11	Calculate the Alternative Minimum Footprint Sizing Factor [Line 10/ (Line 1 x Line 2)]		

[1] Load to clog value should be in the range of 2 – 5 lb/sq-ft per Pitt and Clark (2010). If selecting a value other than 2, a justification for the value selected is required. See guidance in Table B.5-2.

[2] A value of 25 percent is supported by Maniquiz-Redillas et al. (2014) study, which found a pretreatment sediment capture range of 15% - 35%. If using a value outside of this range, documentation of the selected value is required. A value of 50 percent can be claimed for a system with an active Washington State TAPE approval rating for "pre-treatment."

Table B.5-1: Typical land use total suspended solids (TSS) event mean concentration (EMC) values.

Land Use	TSS EMC[3], mg/L
Single Family Residential	123
Commercial	128
Industrial	125
Education (Municipal)	132
Transportation[4]	78
Multi-family Residential	40
Roof Runoff[5]	14
Low Traffic Areas[6]	50
Open Space	216

Table B.5-2: Guidance for Selecting Load to Clog (LC)

BMP Configuration	Load to Clog, L_c, lb/sq-ft
Baseline: Approximately 50 percent vegetative cover; typical fine sand and compost blend	2
Baseline + increase vegetative cover to at least 75 percent	3
Baseline + include coarser sand to increase initial permeability to 20 to 30 in/hr; control flowrate with outlet control	3
Baseline + increase vegetative cover and include more permeable media with outlet control, per above	4

References

Charters, F.J., Cochrane, T.A., and O'Sullivan, A.D., (2015). Particle Size Distribution Variance in Untreated Urban Runoff and its implication on treatment selection. Water Research, 85 (2015), pg. 337-345.

Davis, A.P. and McCuen, R.H., (2005). Stormwater Management for Smart Growth. Springer Science & Business Media, pg. 155.

Maniquiz-Redillas, M.C., Geronimo, F.K.F, and Kim, L-H. Investigation on the Effectiveness of Pretreatment in Stormwater Management Technologies. Journal of Environmental Sciences, 26 (2014), pg. 1824-1830.

Pitt, R. and Clark, S.E., (2010). Evaluation of Biofiltration Media for Engineered Natural Treatment Systems. Geosyntec Consultants and The Boeing Company.

[3] EMCs are from SBPAT datasets for SLR and SDR Watersheds – Arithmetic Estimates of the Lognormal Summary Statistics for San Diego, unless otherwise noted.

[4] EMCs are based on Los Angeles region default SBPAT datasets due to lack of available San Diego data.

[5] Value represents the average first flush concentration for roof runoff (Charters et al., 2015).

[6] Davis and McCuen (2005)

B.5.2 Sizing Biofiltration BMPs Downstream of a Storage Unit

B.5.2.1 Introduction

In scenarios, where the BMP footprint is governed based on Option 1 (Line 21 of Worksheet B.5-1) or the required volume reduction of 40% average annual (long term) runoff capture for partial infiltration conditions (Line 31 of Worksheet B.5.1) the footprint of the biofiltration BMP can be optimized using the sizing calculations in this Appendix B.5.2 when there is an upstream storage unit (e.g. cistern) that can be used to regulate the flows through the biofiltration BMP.

This methodology is **not** applicable when the minimum footprint factor is governed based on the alternative minimum footprint sizing factor calculated using Worksheet B.5-2 (Line 11). Biofiltration BMP smaller than the alternative minimum footprint sizing factor is considered compact biofiltration BMP and may be allowed at the discretion of the Port if the BMP meets the requirements in Appendix F **and** Option 1 or Option 2 sizing in Worksheet B.5-1.

B.5.2.2 Sizing Calculations

Sizing calculations for the biofiltration footprint shall demonstrate that one of two equivalent performance standards is met:

1. Use continuous simulation and demonstrate one of the following is met based on the infiltration condition identified in Chapter 5.4.2:
   a. **No infiltration condition**: The BMP or series of BMPs biofilters at least 92 percent of average annual (long term) runoff volume. This can be demonstrated through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in Appendix G, as acceptable to the Port. The 92 percent of average annual runoff treatment corresponds to the average capture achieved by implementing a BMP with 1.5 times the DCV and a drawdown time of 36 hours (Appendix B.4.2).
   b. **Partial infiltration condition**: The BMP or series of BMPs biofilters at least 92 percent of average annual (long term) runoff volume and achieves a volume reduction of at least 40 percent of average annual (long term) runoff volume. This can be demonstrated through reporting of output from the San Diego Hydrology Model, or through other continuous simulation modeling meeting the criteria in Appendix G, as acceptable to the Port.
2. Use the simple sizing method in Worksheet B.5-3. The applicant is also required to complete Worksheet B.5-1 and B.5-2 when the applicant elects to use Worksheet B.5-3 to optimize the biofiltration BMP footprint. Worksheet B.5-3 was developed to satisfy the following two criteria as applicable:
   a. Greater than 92 percent of the average annual runoff volume from the storage unit is routed to the biofiltration BMP through the low flow orifice and the peak flow from the low flow orifice can instantaneously be filtered through the biofiltration media. If the outlet design includes orifices at different elevations and an overflow structure,

only flows from the overflow structure should be excluded from the calculation (both for 92 percent capture and for peak flow to the biofiltration BMP that needs to be instantaneously filtered), unless the flows from other orifices also bypass the biofiltration BMP, in which case flows from the orifices that bypass should also be excluded.

b. The retention losses from the optimized biofiltration BMP is equal to or greater than the retention losses from the conventional biofiltration BMP. This second criterion is only applicable for partial infiltration condition.

Table B.5-3 Storage required for different drawdown times

Drawdown Time (hours)	Storage requirement (below the overflow elevation, or below outlet elevation that bypass the biofiltration BMP)
12	0.85 DCV
24	1.25 DCV
36	1.50 DCV
48	1.80 DCV
72	2.20 DCV
96	2.60 DCV
120	2.80 DCV

For drawdown times that are outside the range of values presented in Table B.5-4 above the storage unit should be designed to discharge greater than 92% average annual capture to the downstream Biofiltration BMP.

Worksheet B.5-3: Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit

Optimized Biofiltration BMP Footprint when Downstream of a Storage Unit		Worksheet B.5-3	
1	Area draining to the storage unit and biofiltration BMP		sq-ft
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)		
3	Effective impervious area draining to the storage unit and biofiltration BMP [Line 1 x Line 2]		sq-ft
4	Remaining DCV after implementing retention BMPs		cubic-feet
5	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible		ft/hr.
6	Media Thickness [1.5 feet minimum], also add mulch layer thickness to this line for sizing calculations		ft
7	Media filtration rate to be used for sizing (0.42 ft/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate)		ft/hr
8	Media retained pore storage	0.1	ft/ft
Storage Unit Requirement			
9	Drawdown time of the storage unit, minimum(from the elevation that bypasses the biofiltration BMP, overflow elevation)		hours
10	Storage required to achieve greater than 92 percent capture (see Table B.5-4)		fraction
11	Storage required in cubic feet (Line 4 x Line 10)		cubic-feet
12	Storage provided in the design, minimum(from the elevation that bypasses the biofiltration BMP, overflow elevation)		cubic-feet
13	Is Line 12 ≥ Line 11. If no increase storage provided until this criteria is met	☐ Yes	☐ No
Criteria 1: BMP Footprint Biofiltration Capacity			
14	Peak flow from the storage unit to the biofiltration BMP (using the elevation used to evaluate the percent capture)		cfs
15	Required biofiltration footprint [(3,600 x Line 14)/Line 7]		sq-ft
Criteria 2: Alternative Minimum Sizing Factor (Clogging)			
16	Alternative Minimum Footprint Sizing Factor [Line 11 of Worksheet B.5-2]		Fraction
17	Required biofiltration footprint [Line 3 x Line 16]		sq-ft
Criteria 3: Retention requirement [Not applicable for No Infiltration Condition]			
18	Conventional biofiltration footprint Line 28 of Worksheet B.5-1		sq-ft
19	Retention Losses from the conventional footprint (36 x Line 5 + Line 6 x Line 8) x Line 18		cubic-feet
20	Average discharge rate from the storage unit to the biofiltration BMP		cfs
21	Depth retained in the optimized biofiltration BMP {Line 6 x Line 8} + {[(Line 4)/(2400 x Line 20)] x Line 5}		ft
22	Required optimized biofiltration footprint (Line 19/Line 21)		sq-ft
Optimized Biofiltration Footprint			
23	Optimized biofiltration footprint, maximum(Line 15, Line 17, Line 22)		sq-ft

Note: Biofiltration BMP smaller than the alternative minimum footprint sizing (Line 17) is considered compact biofiltration BMP and may be allowed at the discretion of the Port if the BMP meets the requirements in Appendix F and Option 1 or Option 2 sizing in Worksheet B.5-1.

B.6 Flow-Thru Treatment Control BMPs (for use with Alternative Compliance)

The following methodology shall be used for selecting and sizing onsite flow-thru treatment control BMPs. These BMPs are to be used only when the project is participating in an alternative compliance program. This methodology consists of three steps:

1) Determine the PDP most significant pollutants of concern (Appendix B.6.1).
2) Select a flow-thru treatment control BMP that treats the PDP most significant pollutants of concern and meets the pollutant control BMP treatment performance standard (Appendix B.6.2).
3) Size the selected flow-thru treatment control BMP (Appendix B.6.3).

B.6.1 PDP Most Significant Pollutants of Concern

The following steps shall be followed to identify the PDP most significant pollutants of concern:

1) Compile the following information for the PDP and receiving water:
    a. Receiving water quality (including pollutants for which receiving waters are listed as impaired under the Clean Water Act section 303(d) List; refer to Section 1.9);
    b. Pollutants, stressors, and/or receiving water conditions that cause or contribute to the highest priority water quality conditions identified in the WQIP (refer to Section 1.9);
    c. Land use type(s) proposed by the PDP and the storm water pollutants associated with the PDP land use(s) (see Table B.6–1).
2) From the list of pollutants identified in Step 1 identify the most significant PDP pollutants of concern. A PDP could have multiple most significant pollutants of concerns and shall include the highest priority water quality condition identified in the watershed WQIP and pollutants anticipated to be present onsite/generated from land use.

TABLE B.6–1: Anticipated and Potential Pollutants Generated by Land Use Type

Priority Project Categories	General Pollutant Categories								
	Sediment	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development >one acre	P(1)	P(1)	X	P(2)	X	P(5)	X	P(3)	P(5)
Heavy Industry	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	P(1)
Hillside Development >5,000 ft2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X	X	P(1)

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists onsite.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

B.6.2 Selection of Flow-Thru Treatment Control BMPs

The following steps shall be followed to select the appropriate flow-thru treatment control BMPs for the PDP:

1) For each PDP most significant pollutant of concern identify the grouping using Table B.6-2. Table B.6-2 is adopted from the Model SUSMP.
2) Select the flow-thru treatment control BMP based on the grouping of pollutants of concern that are identified to be most significant in Step 1. This section establishes the pollutant control BMP treatment performance standard to be met for each grouping of pollutants in order to meet the standards required by the MS4 permit and how an applicant can select a non-proprietary or a proprietary BMP that meets the established performance standard. The grouping of pollutants of concern are:
    a. Coarse Sediment and Trash (Appendix B.6.2.1)
    b. Pollutants that tend to associate with fine particles during treatment (Appendix B.6.2.2)
    c. Pollutants that tend to be dissolved following treatment (Appendix B.6.2.3)

TABLE B.6–2: Grouping of Potential Pollutants of Concern

Pollutant	Coarse Sediment and Trash	Suspended Sediment and Particulate-bound Pollutants[1]	Soluble-form Dominated Pollutants[2]
Sediment	X	X	
Nutrients			X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

[1] Pollutants in this category can be addressed to Medium or High effectiveness by effectively removing suspended sediments and associated particulate-bound pollutants. Some soluble forms of these pollutants will exist, however treatment mechanisms to address soluble pollutants are not necessary to remove these pollutants to a Medium or High effectiveness.

[2] Pollutants in this category are not typically addressed to a Medium or High level of effectiveness with particle and particulate-bound pollutant removal alone.

One flow-thru BMP can be used to satisfy the required pollutant control BMP treatment performance standard for the PDP most significant pollutants of concern. In some situations it might be necessary to implement multiple flow-thru BMPs to satisfy the pollutant control BMP treatment performance standards. For example, a PDP has trash, nutrients and bacteria as the most significant pollutants of concern. If a vegetated filter strip is selected as a flow-thru BMP then it is anticipated to meet the performance standard in Appendix B.6.2.2 and B.6.2.3 but would need a trash removal BMP to meet the pollutant control BMP treatment performance standard in Appendix B.6.2.1 upstream of the vegetated filter strip. This could be achieved by fitting the inlets and/or outlets with racks or screens on to address trash.

B.6.2.1 Coarse Sediment and Trash

If coarse sediment and/or trash and debris are identified as a pollutant of concern for the PDP, then BMPs must be selected to capture and remove these pollutants from runoff. The BMPs described below can be effective in removing coarse sediment and/or trash. These devices must be sized to treat the flow rate estimated using Worksheet B.6-1. Applicant can only select BMPs that have High or Medium effectiveness.

Trash Racks and Screens [Coarse Sediment: Low effectiveness; Trash: Medium to High effectiveness] are simple devices that can prevent large debris and trash from entering storm drain infrastructure and/or ensure that trash and debris are retained with downstream BMPs. Trash racks and screens can be installed at inlets to the storm drain system, at the inflow line to a BMP, and/or on the outflow structure from the BMP. Trash racks and screens are commercially available in many sizes and configurations or can be designed and fabricated to meet specific project needs.

Hydrodynamic Separation Devices [Coarse Sediment: Medium to High effectiveness; Trash: Medium to High effectiveness] are devices that remove coarse sediment, trash, and other debris from incoming flows through a combination of screening, settlement, and centrifugal forces. The design of hydrodynamic devises varies widely, more specific information can be found by contacting individual vendors. A list of hydrodynamic separator products approved by the Washington State Technology Acceptance Protocol-Ecology protocol can be found at:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html.

Systems should be rated for “pretreatment” with a General Use Level Designation or provide results of field-scale testing indicating an equivalent level of performance.

Catch Basin Insert Baskets [Coarse Sediment: Low effectiveness; Trash: Medium effectiveness, if appropriately maintained] are manufactured filters, fabrics, or screens that are placed in inlets to remove trash and debris. The shape and configuration of catch basin inserts varies based on inlet type and configuration. Inserts are prone to clogging and bypass if large trash items are accumulated, and therefore require frequent observation and maintenance to remain effective. Systems with screen size small enough to retain coarse sediment will tend to clog rapidly and should be avoided.

Other Manufactured Particle Filtration Devices [Coarse Sediment: Medium to High effectiveness; Trash: Medium to High effectiveness] include a range of products such as cartridge filters, bag filters, and other configurations that address medium to coarse particles. Systems should be rated for "pretreatment" with a General Use Level Designation under the Technology Acceptance Protocol-Ecology program or provide results of field-scale testing indicating an equivalent level of performance.

Note, any BMP that achieves Medium or High performance for suspended solids (See Section B.6.2.2) is also considered to address coarse sediments. However, some BMPs that address suspended solids do not retain trash (for example, swales and detention basins). These types of BMPs could be fitted with racks or screens on inlets or outlets to address trash.

BMP Selection for Pretreatment:

Devices that address both coarse sediment and trash can be used as pretreatment devices for other BMPs, such as infiltration BMPs. However, it is recommended that BMPs that meet the performance standard in Appendix B.6.2.2 be used. A device with a "pretreatment" rating and General Use Level Designation under Technology Acceptance Protocol-Ecology is required for pretreatment upstream of infiltration basins and underground galleries. Pretreatment may also be provided as presettling basins or forebays as part of a pollutant control BMP instead of implementing a specific pretreatment device for systems where maintenance access to the facility surface is possible (to address clogging), expected sediment load is not high, and appropriate factors of safety are included in design.

B.6.2.2 Suspended Sediment and Particulate-Bound Pollutants

Performance Standard

The pollutant treatment performance standard is shown in Table B.6-3. This performance standard is consistent with the Washington State Technology Acceptance Protocol-Ecology Basic Treatment Level, and is also met by technologies receiving Phosphorus Treatment or Enhanced Treatment certification. This standard is based on pollutant removal performance for total suspended solids. Systems that provide effective TSS treatment also typically address trash, debris, and particulate bound pollutants and can serve as pre-treatment for offsite mitigation projects or for onsite infiltration BMPs.

Table B.6-3: Performance Standard for Flow-Thru Treatment Control

Influent Range	Criteria
20 – 100 mg/L TSS	Effluent goal ≤ 20 mg/L TSS
100 – 200 mg/L TSS	≥ 80% TSS removal
>200 mg/L TSS	> 80% TSS removal

Selecting Non-Proprietary BMPs

Table B.6-4 identifies the categories of non-proprietary BMPs that are considered to meet the pollutant treatment performance standard if designed to contemporary design standards[7]. BMP types with a "High" ranking should be considered before those with a "Medium" ranking. Statistical analysis by category from the International Stormwater BMP Database (also presented in Table B.6-4) indicates each of these BMP types (as a categorical group) meets or nearly meets the performance standard. The International Stormwater BMP Database includes historic as well as contemporary BMP studies; contemporary BMP designs in these categories are anticipated to meet or exceed this standard on average.

[7] Contemporary design standards refers to design standards that are reasonably consistent with the current state of practice and are based on desired outcomes that are reasonably consistent with the context of the MS4 Permit and this manual. For example, a detention basin that is designed solely to mitigate peak flow rates would not be considered a contemporary water quality BMP design because it is not consistent with the goal of water quality improvement. Current state of the practice recognizes that a drawdown time of 24 to 72 hours is typically needed to promote settling. For practical purposes, design standards can be considered "contemporary" if they have been published within the last 10 years, preferably in California or Washington State, and are specifically intended for storm water quality management.

Table B.6-4: Flow-Thru Treatment Control BMPs Meeting Performance Standard

List of Acceptable Flow-Thru Treatment Control BMPs	Statistical Analysis of International Stormwater BMP Database				Evaluation of Conformance to Performance Standard		
	Count In/Out	TSS Mean Influent, mg/L	TSS Mean Effluent[1], mg/L	Average Category Volume Reduct.	Volume-Adjusted Effluent Conc[2], mg/L	Volume-Adjusted Removal Efficiency[2]	Level of Attainment of Performance Standard (with rationale)
Vegetated Filter Strip	361/ 282	69	31	38%	19	72%	Medium, effluent < 20 mg/L after volume adjustment
Vegetated Swale	399/ 346	45	33	48%	17	61%	Medium, effluent < 20 mg/L after volume adjustment
Detention Basin	321/ 346	125	42	33%	28	77%	Medium, percent removal near 80% after volume adjustment
Sand Filter/ Media Bed Filter	381/ 358	95	19	NA[3]	19	80%	High, effluent and % removal meet criteria without adjustment
Lined Porous Pavement[4]	356/ 220	229	46	NA[3,4]	46	80%	High, % removal meets criteria without adjustment
Wet Pond	923/ 933	119	31	NA[3]	31	74%	Medium, percent removal near 80%

Source: 2014 BMP Performance Summaries and Statistical Appendices; 2010 Volume Performance Summary; available at: www.bmpdatabase.org

1 - A statistically significant difference between influent and effluent was detected at a p value of 0.05 for all categories.

2 - Estimates were adjusted to account for category-average volume reduction.

3 - Not Applicable as these BMPs are not designed for volume reduction and are anticipated to have very small incidental volume reduction.

4 - The category presented in this table represents a lined system for flow-thru treatment purposes. Porous pavement for retention purposes is an infiltration BMP, not a flow-thru BMP. This table should not be consulted for porous pavement for infiltration.

Selecting Proprietary BMPs

Proprietary BMPs can be used if the BMP meets each of the following conditions:

(1) **The proposed BMP meets the performance standard in Appendix B.6.2.2 as certified through third-party, field scale evaluation.** An active General Use Level Designation for Basic Treatment, Phosphorus Treatment or Enhanced Treatment under the Washington State Technology Acceptance Protocol-Ecology program is the preferred method of demonstrating that the performance standard is met. The list of certified technologies is updated as new technologies are approved (link below). Technologies with Pilot Use Level Designation and Conditional Use Level Designations are not acceptable. Refer to:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html. Alternatively, other field scale verification of 80 percent TSS capture, such as through Technology Acceptance Reciprocity Partnership or New Jersey Corporation for Advance Testing may be acceptable. A list of field-scale verified technologies under Technology Acceptance Reciprocity Partnership Tier II and New Jersey Corporation for Advance Testing can be accessed at: http://www.njcat.org/verification-process/technology-verification-database.html (refer to field verified technologies only).

(2) **The proposed BMP is designed and maintained in a manner consistent with its performance certifications (see explanation below).** The applicant must demonstrate conclusively that the proposed application of the BMP is consistent with the basis of its certification/verification. Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the Technology Acceptance Reciprocity Partnership or New Jersey Corporation for Advance Testing programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification. It is common for these approvals to specify the specific model of BMP, design capacity for given unit sizes, type of media that is the basis for approval, and/or other parameters.

(3) **The proposed BMP is acceptable at the discretion of the Port.** The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met. In determining the acceptability of a proprietary flow-thru treatment control BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant

B.6.2.3 Soluble-form dominated Pollutants (Nutrients)

If nutrients are identified as a most significant pollutant of concern for the PDP, then BMPs must be selected to meet the performance standard described in Appendix B.6.2.2 **and** must be selected to provide medium or high level of effectiveness for nutrient treatment as described in this section. The most common nutrient of concern in the San Diego region is nitrogen, therefore total nitrogen (TN) was used as the primary indicator of nutrient performance in storm water BMPs.

Selection of BMPs to address nutrients consists of two steps:

1) Determine if nutrients can be addressed via source control BMPs as described in Appendix E and Chapter 4. After applying source controls, if there are no remaining source areas for soluble nutrients, then this pollutant can be removed from the list of pollutants of concerns for the purpose of selecting flow-thru treatment control BMPs. Particulate nutrients will be addressed by the performance standard in Appendix B.6.2.2.

2) If soluble nutrients cannot be fully addressed with source controls, then select a flow-thru treatment control BMPs that meets the performance criteria in Table B.6-5 or select from the nutrient-specific menu of treatment control BMPs in Table B.6-6.

    a. The performance standard for nitrogen removal (Table B.6-5) has been developed based on evaluation of the relative performance of available categories of non-proprietary BMPs.

    b. For proprietary BMPs, submit third party performance data indicating that the criteria in Table B.6-5 are met. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met. In determining the acceptability of a proprietary flow-thru treatment control BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant

Table B.6-5: Performance Standard for Flow-Thru Treatment Control BMPs for Nutrient Treatment

Basis	Criteria
Treatment Basis	Comparison of mean influent and effluent indicates significant concentration reduction of TN approximately 40 percent or higher based on studies with representative influent concentrations
Combined Treatment and Volume Reduction Basis	Combination of concentration reduction and volume reduction yields TN mass removal of approximately 40 percent or higher based on studies with representative influent concentrations

Table B.6-6: Flow-Thru Treatment Control BMPs Meeting Nutrient Treatment Performance Standard

List of Acceptable Flow-Thru Treatment Control BMPs for Nutrients	Statistical Analysis of International Stormwater BMP Database				Evaluation of Conformance to Performance Standard		
	Count In/Out	TN Mean Influent, mg/L	TN Mean Effluent[1], mg/L	Average Category Volume Reduct.	Volume-Adjusted Effluent Conc[2], mg/L	Volume-Adjusted Removal Efficiency[2]	Level of Attainment of Performance Standard (with rationale)
Vegetated Filter Strip	138/ 122	1.53	1.37	38%	0.85	44%	Medium, if designed to include volume reduction processes
Detention Basin	90/ 89	2.34	2.01	33%	1.35	42%	Medium, if designed to include volume reduction processes
Wet Pond	397/ 425	2.12	1.33	NA	1.33	37%	Medium, best concentration reduction among BMP categories, but limited volume reduction

Source: 2014 BMP Performance Summaries and Statistical Appendices; 2010 Volume Performance Summary; available at: www.bmpdatabase.org

1 - A statistically significant difference between influent and effluent was detected at a p value of 0.05 for all categories included.

2 - Estimates were adjusted to account for category-average volume reduction.

B.6.3 Sizing Flow-Thru Treatment Control BMPs:

Flow-thru treatment control BMPs shall be sized to filter or treat the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of every storm event. The required flow-thru treatment rate should be adjusted for the portion of the DCV already retained or biofiltered onsite as described in Worksheet B.6-1. The following hydrologic method shall be used to calculate the flow rate to be filtered or treated:

$$Q = C \times i \times A$$

Where:

Q = Design flow rate in cubic feet per second

C = Runoff factor, area-weighted estimate using Table B.1-1.

i = Rainfall intensity of 0.2 in/hr.

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingle with project runoff and drain to the BMP. Refer to Section 3.3.3 for additional guidance. Street projects consult Section 1.4.3.

Worksheet B.6-1: Flow-Thru Design Flows

Flow-thru Design Flows		Worksheet B.6-1		
1	DCV	DCV		cubic-feet
2	DCV retained	$DCV_{retained}$		cubic-feet
3	DCV biofiltered	$DCV_{biofiltered}$		cubic-feet
4	DCV requiring flow-thru (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow\text{-}thru}$		cubic-feet
5	Adjustment factor (Line 4 / Line 1)*	AF=		unitless
6	Design rainfall intensity	i=	0.20	in/hr
7	Area tributary to BMP (s)	A=		acres
8	Area-weighted runoff factor (estimate using Appendix B.2)	C=		unitless
9	Calculate Flow Rate = AF x (C x i x A)	Q=		cfs

1) Adjustment factor shall be estimated considering only retention and biofiltration BMPs located upstream of flow-thru BMPs. That is, if the flow-thru BMP is upstream of the project's retention and biofiltration BMPs then the flow-thru BMP shall be sized using an adjustment factor of 1.
2) Volume based (e.g., dry extended detention basin) flow-thru treatment control BMPs shall be sized to the volume in Line 4 and flow based (e.g., vegetated swales) shall be sized to flow rate in Line 9. Sand filter and media filter can be designed either by volume in Line 4 or flow rate in Line 9.
3) Proprietary BMPs, if used, shall provide certified treatment capacity equal to or greater than the calculated flow rate in Line 9; certified treatment capacity per unit shall be consistent with third party certifications.

Appendix

C

BMP DESIGN MANUAL

Geotechnical and Groundwater Investigation Requirements

Appendix C Geotechnical and Groundwater Investigation Requirements

C.1 Purpose and Phasing

Feasibility of storm water infiltration is dependent on the geotechnical and groundwater conditions at the project site.

This appendix provides guidelines for performing and reporting feasibility analysis for infiltration with respect to geotechnical and groundwater conditions. It provides framework for feasibility analysis at two phases of project development:

- ***Planning Phase***: Simpler methods for conducting preliminary screening for feasibility/infeasibility, and
- ***Design Phase***: When infiltration is considered potentially feasible, more rigorous analysis is needed to confirm feasibility and to develop design considerations and mitigation measures if required

Planning Phase At this stage of the project, information about the site may be limited, the proposed design features may be conceptual, and there may be an opportunity to adjust project plans to incorporate infiltration into the project layout as it is developed. At this phase, project geotechnical engineers are typically responsible for conducting explorations of geologic conditions, performing preliminary analyses, and identifying particular aspects of design that require more detailed investigation at later phases. As part of this process, the role of a planning- level infiltration feasibility assessment is to help planners reach early tentative conclusions regarding where infiltration is likely feasible, possibly feasible if done carefully, or clearly infeasible. This determination can help guide the design process by influencing project layout, selection of infiltration BMPs, and identifying if more detailed studies are necessary. The goal of the planning and feasibility phase is to identify potential geotechnical and groundwater impacts and to determine which impacts may be considered fatal flaws and which impacts may be possible to mitigate with design features. Determination of acceptable risks and/or mitigation measures may involve discussions with adjacent land owners and/or utility operators, as well as coordination with other projects under planning or design in the project vicinity. Early involvement of potentially impacted parties is critical to avoid late-stage design changes and schedule delays and to reduce potential future liabilities.

Design Phase During this phase, potential geotechnical and groundwater impacts must be fully considered and evaluated and mitigation measures should be incorporated in the BMP design, as appropriate. Mitigation measures refer to design features or assumptions intended to reduce risks associated with storm water infiltration. While rules of thumb may be useful, if applied carefully, for the planning level phase, the analyses conducted in the detailed design phase require the involvement of a geotechnical professional familiar with the local conditions. One of the first steps in the design phase should be determination if additional field and/or laboratory investigations are required (e.g., borings, test pits, laboratory or field testing) to further assess the geotechnical impacts of storm water infiltration. As the design of infiltration systems are highly dependent on the subsurface conditions, coordination with the storm water design team may be beneficial to limit duplicative efforts and costs.

Worksheet C.4-1 is provided to document infiltration feasibility screening. This worksheet is divided into two parts. Part 1 "Full Infiltration Feasibility Screening Criteria" is used to determine if the full design volume can be infiltrated onsite, whereas Part 2 "Partial Infiltration versus No Infiltration Screening Criteria" is used to determine if any amount of volume can be infiltrated.

Note that it is not necessary to investigate each and every criterion in the worksheet, a single "no" answer in Part 1 and Part 2 controls the feasibility and desirability. If all the answers in Part 1 are "yes" then it is not required to complete Part 2. The same worksheet could be used to document both planning-level categorization and design-level categorization. Note that planning-level categorization, are typically based on initial site assessment results; therefore it is not necessarily conclusive. Categorizations should be confirmed or revised, as necessary, based on more detailed design-level investigation and analysis during BMP design.

C.2 Geotechnical Feasibility Criteria

This section is divided into seven factors that should be considered, as applicable, while assessing the feasibility and desirability of infiltration related to geotechnical conditions. Note that during the planning phase, if one or more of these factors precludes infiltration as an approach, it is not necessary to assess every other factor. However, if proposing infiltration BMPs, then every applicable factor in this section must be addressed.

C.2.1 Soil and Geologic Conditions

Site soils and geologic conditions influence the rate at which water can physically enter the soils. Site assessment approaches for soil and geologic conditions may consist of:

- Review of soil survey maps
- Review of available reports on local geology to identify relevant features, such as depth to bedrock, rock type, lithology, faults, and hydrostratigraphic or confining units
- Review of previous geotechnical investigations of the area
- Site-specific geotechnical and/or geologic investigations (e.g., borings, infiltration tests)

Geologic investigations should also seek to provide an assessment of whether soil infiltration properties are likely to be uniform or variable across the project site. Appendix D provides guidance on determining infiltration rates for planning and design phase.

C.2.2 Settlement and Volume Change

Settlement and volume change limits the amount of infiltration that can be allowed without resulting in adverse impacts that cannot be mitigated. Upon considering the impacts of an infiltration design, the designer must identify areas where soil settlement or heave is likely and whether these conditions would be unfavorable to existing or proposed features. Settlement refers to the condition when soils decrease in volume, and heave refers to expansion of soils or increase in volume.

There are several different mechanisms that can induce volume change due to infiltration that the professional must be aware of and consider while completing the feasibility screening including:

- Hydro collapse and calcareous soils;
- Expansive soils;
- Frost heave;
- Consolidation; and
- Liquefaction.

C.2.3 Slope Stability

Infiltration of water has the potential to result in an increased risk of slope failure of nearby slopes. This should be assessed as part of both the feasibility and design stages of a project. There are many factors that impact the stability of slopes, including, but not limited to, slope inclination, soil and unit weight and seepage forces. Increases in moisture content or rising of the water table in the vicinity of a slope, which may result from storm water infiltration, have the potential to change the soil strength and unit weight and to add seepage forces to the slope, which in turn, may reduce the factor of safety of the stability of the slope. When evaluating the effect of infiltration on the design of a slope, the designer must consider all types of potential slope failures.

C.2.4 Utility Considerations

Utilities are either public or private infrastructure components that include underground pipelines and vaults (e.g., potable water, sewer, storm water, gas pipelines), underground wires/conduit (e.g., telephone, cable, electrical) and above ground wiring and associated structures (e.g., electrical distribution and transmission lines). Utility considerations are typically within the purview of a geotechnical site assessment and should be considered in assessing the feasibility of storm water infiltration. Infiltration has the potential to damage subsurface utilities and/or underground utilities may pose geotechnical hazards in themselves when infiltrated water is introduced. Impacts related to storm water infiltration in the vicinity of underground utilities are not likely to cause a fatal flaw in the design, but the designer must be aware of the potential cost impacts to the design during the planning stage.

C.2.5 Groundwater Mounding

Storm water infiltration and recharge to the underlying groundwater table may create a groundwater mound beneath the infiltration facility. The height and shape of the mound depends on the infiltration system design, the recharge rate, and the hydrogeologic conditions at the site, especially the horizontal hydraulic conductivity and the saturated thickness. Elevated groundwater levels can lead to a number of problems, including flooding and damage to structures and utilities through buoyancy and moisture intrusion, increase in inflow and infiltration into municipal sanitary sewer systems, and flow of water through existing utility trenches, including sewers, potentially leading to formation of sinkholes (Gobel et al. 2004). Mounding shall be considered by the geotechnical professional while performing the infiltration feasibility screening.

C.2.6 Retaining Walls and Foundations

Development projects may include retaining walls or foundations in close proximity to proposed infiltration BMPs. These structures are designed to withstand the forces of the earth they are retaining and other surface loading conditions such as nearby structures. Foundations include shallow foundations (spread and strip footings, mats) and deep foundations (piles, piers) and are designed to support overburden and design loads. All types of retaining walls and foundations can be impacted by increased water infiltration into the subsurface as a result of potential increases in lateral pressures and potential reductions in soil strength. The geotechnical professional should consider these factors while performing the infiltration feasibility screening.

C.2.7 Other Factors

While completing the feasibility screening, other factors determined by the geotechnical professional to influence the feasibility and desirability of infiltration related to geotechnical conditions shall also be considered.

C.3 Groundwater Quality and Water Balance Feasibility Criteria

This section is divided into eight factors that should be considered, to the extent applicable, while assessing the feasibility and desirability of infiltration related to groundwater quality and water balance. Note that during the planning phase, if one or more of these factors precludes infiltration as an approach, it is not necessary to assess every other factor. However, if proposing infiltration BMPs, then every applicable factor in this section must be addressed.

C.3.1 Soil and Groundwater Contamination

Infiltration shall be avoided in areas with:

- Physical and chemical characteristics (e.g., appropriate cation exchange capacity, organic content, clay content and infiltration rate) which are not adequate for proper infiltration durations and treatment of runoff for the protection of groundwater beneficial uses.

- Groundwater contamination and/or soil pollution, if infiltration could contribute to the movement or dispersion of soil or groundwater contamination or adversely affect ongoing clean-up efforts, either onsite or down-gradient of the project.

If infiltration is under consideration for one of the above conditions, a site-specific analysis should be conducted to determine where infiltration-based BMPs can be used without adverse impacts.

C.3.2 Separation to Seasonal High Groundwater

The depth to seasonally high groundwater tables (normal high depth during the wet season) beneath the base of any infiltration BMP must be greater than 10 feet for infiltration BMPs to be allowed. The depth to groundwater requirement can be reduced from 10 feet at the discretion of the approval agency if the underlying groundwater basin does not support beneficial uses and the groundwater quality is maintained at the proposed depth. Depth to seasonally high groundwater levels can be estimated based on well level measurements or redoximorphic methods. For sites with complex groundwater tables, long term studies may be needed to understand how groundwater levels change in wet and dry years.

C.3.3 Wellhead Protection

Wellheads natural and man-made are water resources that may potentially be adversely impacted by storm water infiltration through the introduction of contaminants or alteration in water supply and levels. It is recommended that the locations of wells and springs be identified early in the design process and site design be developed to avoid infiltration in the vicinity of these resources. Infiltration BMPs must be located a minimum of 100 feet horizontally from any water supply well.

C.3.4 Contamination Risks from Land Use Activities

Concentration of storm water pollutants in runoff is highly dependent on the land uses and activities present in the area tributary to an infiltration BMP. Likewise, the potential for groundwater contamination due to the infiltration BMP is a function of pollutant abundance, concentration of pollutants in soluble forms, and the mobility of the pollutant in the subsurface soils. Hence infiltration

BMPs must not be used for areas of industrial or light industrial activity unless source control BMPs to prevent exposure of high threat activities are implemented, or runoff from such activities is first treated or filtered to remove pollutants prior to infiltration.

C.3.5 Consultation with Applicable Groundwater Agencies

Infiltration activities should be coordinated with the applicable groundwater management agency, such as groundwater providers and/or resource protection agencies, to ensure groundwater quality is protected. It is recommended that coordination be initiated as early as possible during the planning process to determine whether specific site assessment activities apply or whether these agencies have data available that may support the planning and design process.

C.3.6 Water Balance Impacts on Stream Flow

Use of infiltration systems to reduce surface water discharge volumes may result in additional volume of deeper infiltration compared to natural conditions, which may result in impacts to receiving channels associated with change in dry weather flow regimes. A relatively simple survey of hydrogeologic data (piezometer measurements, boring logs, regional groundwater maps) and downstream receiving water characteristics is generally adequate to determine whether there is potential for impacts and whether a more rigorous assessment is needed.

Where water balance conditions appear to be sensitive to development impacts and there is an elevated risk of impacts, a computational analysis may be warranted to evaluate the feasibility/desirability of infiltration. Such an analysis should account for precipitation, runoff, irrigation inputs, soil moisture retention, evapotranspiration, baseflow, and change in groundwater recharge on a long term basis. Because water balance calculations are sensitive to the timing of precipitation versus evapotranspiration, it is most appropriate to utilize a continuous model simulation rather than basing calculations on average annual or monthly normal conditions.

C.3.7 Downstream Water Rights

While water rights cases are not believed to be common, there may be cases in which infiltration of water from area that was previously allowed to drain freely to downstream water bodies would not be legal from a water rights perspective. Site-specific evaluation of water rights laws should be conducted if this is believed to be a potential issue in the project location.

C.3.8 Other Factors

While completing the feasibility screening, other factors determined by the geotechnical professional to influence the feasibility and desirability of infiltration related to groundwater quality and water balance shall also be considered.

C.4 Geotechnical and Groundwater Investigation Report Requirements

The geotechnical and groundwater investigation report(s) addressing onsite storm water infiltration shall include the following elements, as applicable. These reports may need to be completed by multiple professional disciplines, depending on the issues that need be addressed for a given site. It may also be necessary to prepare separate report(s) at the planning phase and design phase of a project if the methods and timing of analyses differ.

C.4.1 Site Evaluation

Site evaluation shall identify the following:

- Areas of contaminated soil or contaminated groundwater within the site;
- "Brown fields" adjacent to the site;
- Mapped soil type(s);
- Historic high groundwater level;
- Slopes steeper than 25 percent; and
- Location of water supply wells, septic systems (and expansion area), or underground storage tanks, or permitted gray water systems within 100 feet of a proposed infiltration/ percolation BMP.

C.4.2 Field Investigation

Where the site evaluation indicates potential feasibility for onsite storm water infiltration BMPs, the following field investigations will be necessary to demonstrate suitability and to provide design recommendations.

C.4.2.1 Subsurface Exploration

Subsurface exploration and testing for storm water infiltration BMPs shall include:

- A minimum of two exploratory excavations shall be conducted within 50-feet of each proposed storm water infiltration BMP. The excavations shall extend at least 10 feet below the lowest elevation of the base of the proposed infiltration BMP.
- Soils shall be logged in detail with emphasis on describing the soil profile.
- Identify low permeability or impermeable materials.

- Indicate any evidence of soil contamination.

C.4.2.2 Material Testing and Infiltration/Percolation Testing

Various material testing and in situ infiltration/percolation testing methods and guidance for appropriate factor of safety are discussed in detail in Appendix D. Infiltration testing methods described in Appendix D include surface and shallow excavation methods and deeper subsurface tests.

C.4.2.3 Evaluation of Depth to Groundwater

An evaluation of the depth to groundwater is required to confirm the feasibility of infiltration. Infiltration BMPs may not be feasible in high groundwater conditions (within 10 feet of the base of infiltration/ percolation BMP) unless an exemption is granted by the approval agency.

C.4.3 Reporting Requirements by Geotechnical Engineer

The geotechnical and groundwater investigation report shall address the following key elements, and where appropriate, mitigation recommendations shall be provided.

- Identify areas of the project site where infiltration is likely to be feasible and provide justifications for selection of those areas based on soil types, slopes, proximity to existing features, etc. Include completed and signed Worksheet C.4-1.
- Investigate, evaluate and estimate the vertical infiltration rates and capacities in accordance with the guidance provided in Appendix D which describes infiltration testing and appropriate factor of safety to be applied for infiltration testing results. The site may be broken into sub-basins, each of which has different infiltration rates or capacities.
- Describe the infiltration/ percolation test results and correlation with published infiltration/ percolation rates based on soil parameters or classification. Recommend providing design infiltration/percolation rate(s) at the sub-basins. Use Worksheet D.5-1.
- Investigate the subsurface geological conditions and geotechnical conditions that would affect infiltration or migration of water toward structures, slopes, utilities, or other features. Describe the anticipated flow path of infiltrated water. Indicate if the water will flow into pavement sections, utility trench bedding, wall drains, foundation drains, or other permeable improvements.
- Investigate depth to groundwater and the nature of the groundwater. Include an estimate of the high seasonal groundwater elevations.
- Evaluate proposed use of the site (industrial use, commercial use, etc.), soil and groundwater data and provide a concluding opinion whether proposed storm water infiltration could cause adverse impacts to groundwater quality and if it does cause impacts whether the impacts could be reasonably mitigated or not.

- Estimate the maximum allowable infiltration rates and volumes that could occur at the site that would avoid damage to existing and proposed structures, utilities, slopes, or other features. In addition the report must indicate if the recommended infiltration rate is appropriate based on the conditions exposed during construction.
- Provide a concluding opinion regarding whether or not the proposed onsite storm water infiltration/percolation BMP will result in soil piping, daylight water seepage, slope instability, or ground settlement.
- Recommend measures to substantially mitigate or avoid any potentially detrimental effects of the storm water infiltration BMPs or associated soil response on existing or proposed improvements or structures, utilities, slopes or other features within and adjacent to the site. For example, minimize soil compaction.
- Provide guidance for the selection and location of infiltration BMPs, including the minimum separations between such infiltration BMPs and structures, streets, utilities, manufactured and existing slopes, engineered fills, utilities or other features. Include guidance for measures that could be used to reduce the minimum separations or to mitigate the potential impacts of infiltration BMPs.
- Provide a concluding opinion whether or not proposed infiltration BMPs are in conformance with the following design criteria:
    - Runoff will undergo pretreatment such as sedimentation or filtration prior to infiltration;
    - Pollution prevention and source control BMPs are implemented at a level appropriate to protect groundwater quality for areas draining to infiltration BMPs;
    - The vertical distance from the base of the infiltration BMPs to the seasonal high groundwater mark is greater than 10 feet. This vertical distance may be reduced when the groundwater basin does not support beneficial uses and the groundwater quality is maintained;
    - The soil through which infiltration is to occur has physical and chemical characteristics (e.g., appropriate cation exchange capacity, organic content, clay content, and infiltration rate) which are adequate for proper infiltration durations and treatment of runoff for the protection of groundwater beneficial uses;
    - Infiltration BMPs are not used for areas of industrial or light industrial activity unless source control BMPs to prevent exposure of high threat activities are implemented, or runoff from such activities is first treated or filtered to remove pollutants prior to infiltration; and
    - Infiltration BMPs are located a minimum of 100 feet horizontally from any water supply wells.

C.4.4 Reporting Requirements by the Project Design Engineer

Project design engineer has the following responsibilities:

- Complete criteria 4 and 8 in Worksheet C.4-1; and
- In the SWQMP provide a concluding opinion whether or not proposed infiltration BMPs will affect seasonality of ephemeral streams.

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

<table>
<tr><th colspan="2">Categorization of Infiltration Feasibility Condition</th><th colspan="2">Worksheet C.4-1</th></tr>
<tr><td colspan="4"><u>Part 1 - Full Infiltration Feasibility Screening Criteria</u>
Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>1</td><td>Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td></td><td></td></tr>
</table>

Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		

<table>
<tr><td colspan="3">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>Part 1 Result*</td><td>If all answers to rows 1 - 4 are “Yes” a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is “No”, infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a “full infiltration” design. Proceed to Part 2</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the Port to substantiate findings.

<table>
<tr><th colspan="4">Worksheet C.4-1 Page 3 of 4</th></tr>
<tr><td colspan="4"><u>Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria</u>

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>6</td><td>Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
</table>

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the Port to substantiate findings

C.5 Feasibility Screening Exhibits

Table C.5-1 lists the feasibility screening exhibits that were generated using readily available GIS data sets to assist the project applicant to screen the project site for feasibility.

Table C.5-1: Feasibility Screening Exhibits

Figures	Layer	Intent/Rationale	Data Sources
C.1 Soils[1]	Hydrologic Soil Group – A, B, C, D	Hydrologic Soil Group will aid in determining areas of potential infiltration	SanGIS http://www.sangis.org/
	Hydric Soils	Hydric soils will indicate layers of intermittent saturation that may function like a D soil and should be avoided for infiltration	USDA Web Soil Survey. Hydric soils, (ratings of 100) were classified as hydric. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
C.2: Slopes and Geologic Hazards	Slopes >25%	BMPs are hard to construct on slopes >25% and can potentially cause slope instability	SanGIS http://www.sangis.org/
	Liquefaction Potential	BMPs (particularly infiltration BMPs) must not be sited in areas with high potential for liquefaction or landslides to minimize earthquake/landslide risks	SanGIS http://www.sangis.org/
	Landslide Potential		SanGIS Geologic Hazards layer. Subset of polygons with hazard codes related to landslides was selected. This data is limited to the City of San Diego Boundary. http://www.sangis.org/
C.3: Groundwater Table Elevations	Groundwater Depths	Infiltration BMPs will need to be sited in areas with adequate distance (>10 ft) from the groundwater table	GeoTracker. Data downloaded for San Diego county from 2014 and 2013. In cases where there were multiple measurements made at the same well, the average was taken over that year. http://geotracker.waterboards.ca.gov/data_download_by_county.asp
C.4: Contaminated Sites	Contaminated soils and/or groundwater sites	Infiltration must limited in areas of contaminated soil/groundwater	GeoTracker. Data downloaded for San Diego county and limited to active cleanup sites http://geotracker.waterboards.ca.gov/

[1]In undefined areas it is the responsibility of the project proponent to verify soils conditions and provide geotechnical findings.

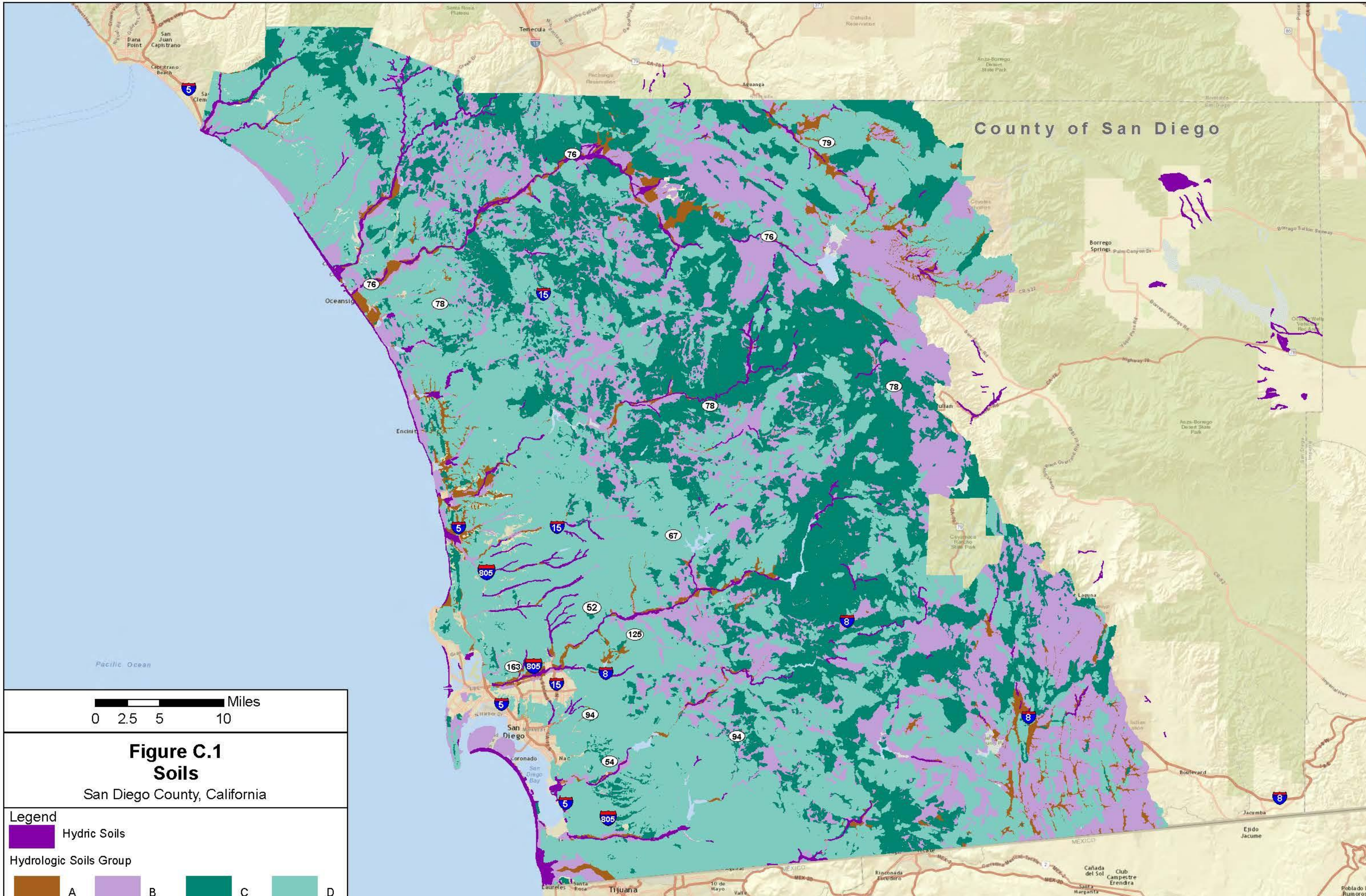


Figure C.1
Soils
San Diego County, California

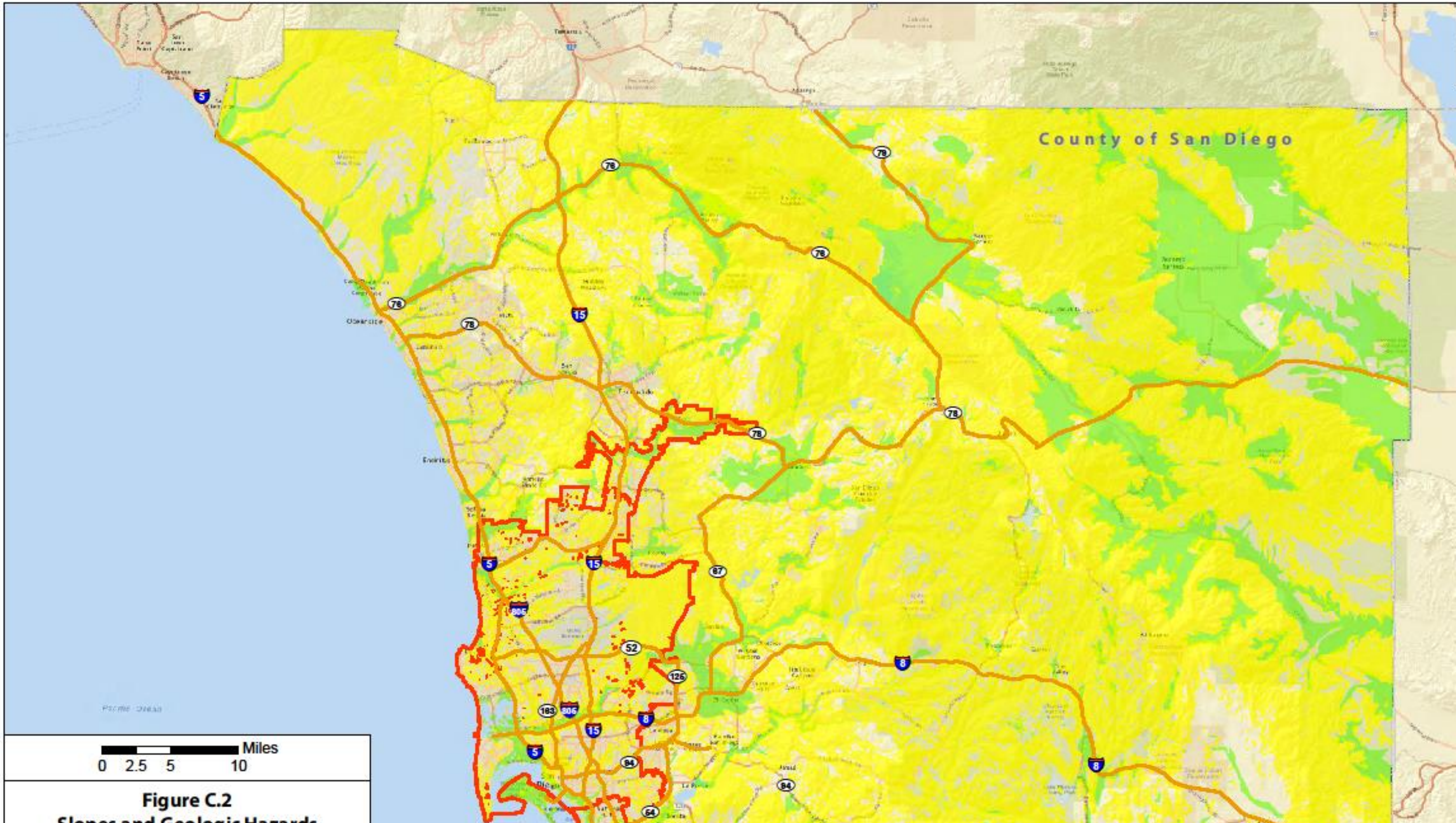


Figure C.2

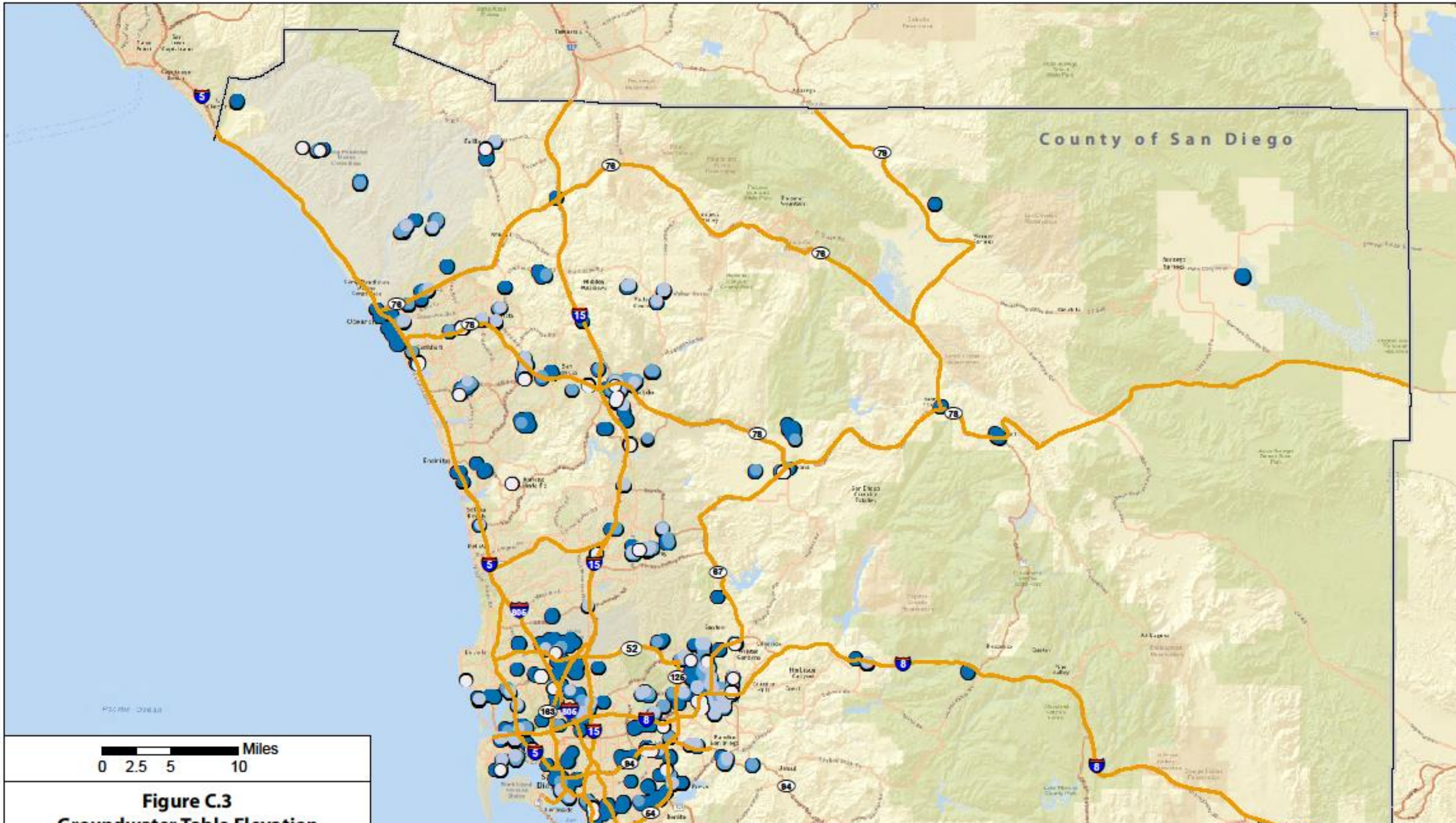


Figure C.3
Groundwater Table Elevation

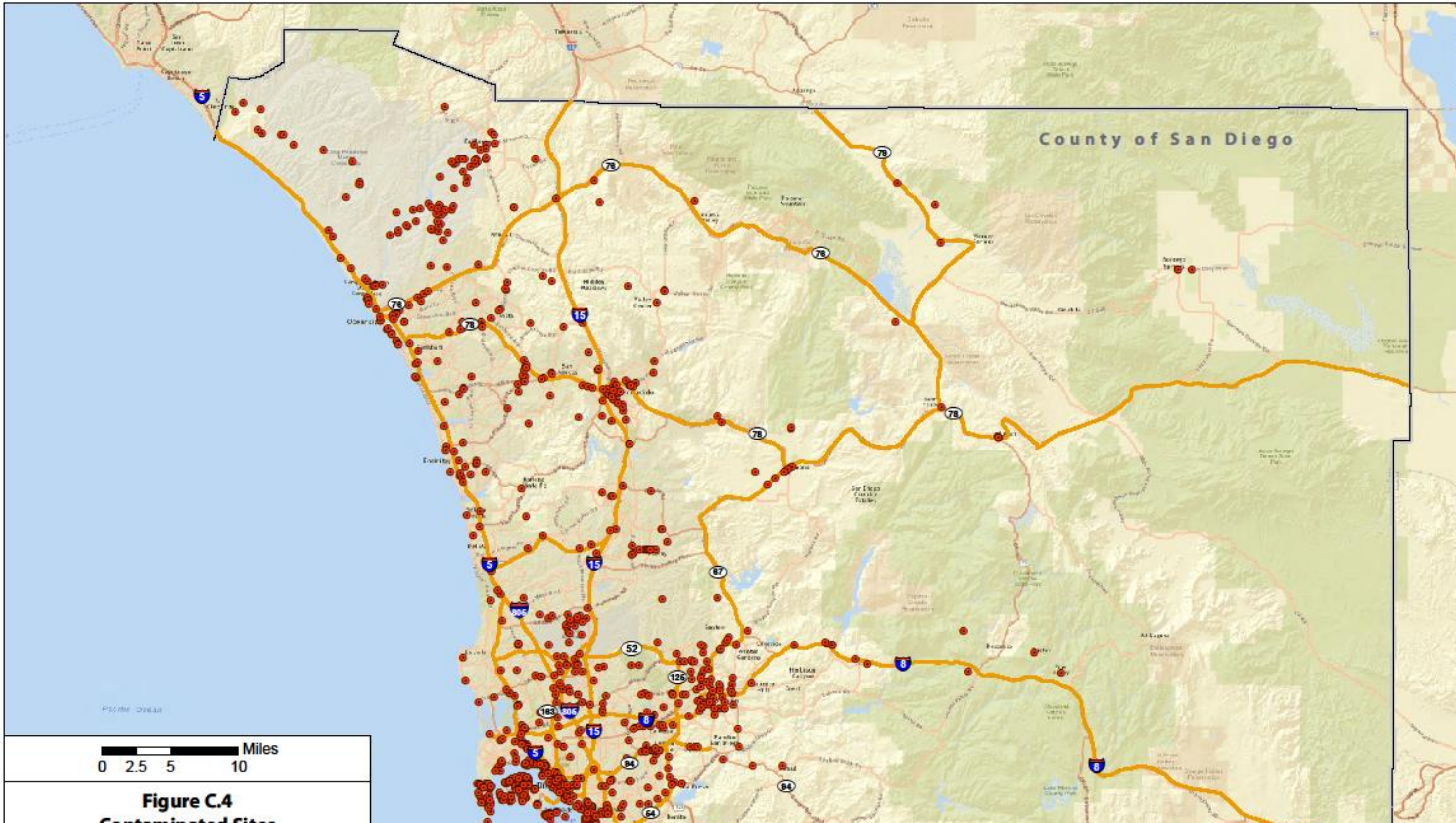


Figure C.4

Appendix

D

Approved Infiltration Rate Assessment Methods for Selection of Storm Water BMPs

Appendix D Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs

D.1 Introduction

Characterization of potential infiltration rates is a critical step in evaluating the degree to which infiltration can be used to reduce storm water runoff volume. This appendix is intended to provide guidance to help answer the following questions:

1. *How and where does infiltration testing fit into the project development process?*

   Section D.2 discusses the role of infiltration testing in different stage of project development and how to plan a phased investigation approach.

2. *What infiltration rate assessment methods are acceptable?*

   Section D.3 describes the infiltration rate assessment methods that are acceptable.

3. *What factors should be considered in selecting the most appropriate testing method for a project?*

   Section D.4 provides guidance on site-specific considerations that influence which assessment methods are most appropriate.

4. *How should factors of safety be selected and applied to, for BMP selection and design?*

   Section D.5 provides guidance for selecting a safety factor.

Note, that this appendix does not consider other feasibility criteria that may make infiltration infeasible, such as groundwater contamination and geotechnical considerations (these are covered in Appendix C). In general, infiltration testing should only be conducted after other feasibility criteria specified in this manual have been evaluated and cleared.

D.2 Role of Infiltration Testing in Different Stages of Project Development

In the process of planning and designing infiltration facilities, there are a number of ways that infiltration testing or estimation factors into project development, as summarized in Table D.2-1. As part of selecting infiltration testing methods, the geotechnical engineer shall select methods that are applicable to the phase of the project and the associated burden of proof.

Table D.2-1: Role of Infiltration Testing

Project Phase	Key Questions/Burden of Proof	General Assessment Strategies
Site Planning Phase	• Where within the project area is infiltration potentially feasible? • What volume reduction approaches are potentially suitable for my project?	• Use existing data and maps to the extent possible • Use less expensive methods to allow a broader area to be investigated more rapidly • Reach tentative conclusions that are subject to confirmation/refinement at the design phase
BMP Design Phase	• What infiltration rates should be used to design infiltration and biofiltration facilities? • What factor of safety should be applied?	• Use more rigorous testing methods at specific BMP locations • Support or modify preliminary feasibility findings • Estimate design infiltration rates with appropriate factors of safety

D.3 Guidance for Selecting Infiltration Testing Methods

The geotechnical engineer shall select appropriate testing methods for the site conditions, subject to the engineer's discretion and approval of the Port, that are adequate to meet the burden of proof that is applicable at each phase of the project design (See Table D.3-1):

- At the planning phase, testing/evaluation method must be selected to provide a reliable estimate of the locations where infiltration is feasible and allow a reasonably confident determination of infiltration feasibilility to support the selection between full infiltration, partial infiltration, and no infiltration BMPs.

- At the design phase, the testing method must be selected to provide a reliable infiltration rate to be used in design. The degree of certainty provided by the selected test should be considered

Table D.3-1 provides a matrix comparison of these methods. Sections D.3.1 to D.3.3 provide a summary of each method. This appendix is not intended to be an exhaustive reference on infiltration testing at this time. It does not attempt to discuss every method for testing, nor is it intended to provide step-by-step procedures for each method. The user is directed to supplemental resources (referenced in this appendix) or other appropriate references for more specific information.

Alternative testing methods are allowed with appropriate rationales, subject to the discretion of the Port.

In order to select an infiltration testing method, it is important to understand how each test is applied and what specific physical properties the test is designed to measure. Infiltration testing methods vary considerably in these regards. For example, a borehole percolation test is conducted by drilling a borehole, filling a portion of the hole with water, and monitoring the rate of fall of the water. This test directly measures the three dimensional flux of water into the walls and bottom of the borehole. An approximate correction is applied to indirectly estimate the vertical hydraulic conductivity from the results of the borehole test. In contrast, a double-ring infiltrometer test is conducted from the ground surface and is intended to provide a direct estimate of vertical (one-dimensional) infiltration rate at this point. Both of these methods are applicable under different conditions.

Table D.3-1: Comparision of Infiltration Rate Estimation and Testing Methods

Test	Suitability at Planning Level Screening Phase	Suitability at BMP Design Phase
NRCS Soil Survey Maps	Yes, but mapped soil types must be confirmed with site observations. Regional soil maps are known to contain inaccuracies at the scale of typical development sites.	No, unless a strong correlation is developed between soil types and infiltration rates in the direct vicinity of the site and an elevated factor of safety is used.
Grain Size Analysis	Not preferred. Should only be used if a strong correlation has been developed between grain size analysis and measured infiltration rates testing results of site soils.	No
Cone Penetrometer Testing	Not preferred. Should only be used if a strong correlation has been developed between CPT results and measured infiltration rates testing results of site soils.	No
Simple Open Pit Test	Yes	Yes, with appropriate correction for infiltration into side walls and elevated factor of safety.
Open Pit Falling Head Test	Yes	Yes, with appropriate correction for infiltration into side walls and elevated factor of safety.
Double Ring Infiltrometer Test (ASTM 3385)	Yes	Yes
Single Ring Infiltrometer Test	Yes	Yes

Test	Suitability at Planning Level Screening Phase	Suitability at BMP Design Phase
Large-scale Pilot Infiltration Test	Yes, but generally cost prohibitive and too water-intensive for preliminary screening of a large area.	Yes, but should consider relatively large water demand associated with this test.
Smaller-scale Pilot Infiltration Test	Yes	Yes
Well Permeameter Method (USBR 7300-89)	Yes; reliability of this test can be improved by obtaining a continuous core where tests are conducted.	Yes in areas of proposed cut where other tests are not possible; a continuous boring log should be recorded and used to interpret test; should be confirmed with a more direct measurement following excavation.
Borehole Percolation Tests (various methods)	Yes; reliability of this test can be improved by obtaining a continuous core where tests are conducted.	Yes in areas of proposed cut where other tests are not possible; a continuous boring log should be recorded and used to interpret test; should be confirmed with a more direct measurement following excavation.
Laboratory Permeability Tests (e.g., ASTM D2434)	Yes, only suitable for evaluating potential infiltration rates in proposed fill areas. For sites with proposed cut, it is preferred to do a borehole percolation test at the proposed grade instead of analyzing samples in the lab. A combination of both tests may improve reliability.	No. However, may be part of a line of evidence for estimating the design infiltration of partial infiltration BMPs constructed in future compacted fill.

D.3.1 Desktop Approaches and Data Correlation Methods

This section reviews common methods used to evaluate infiltration characteristics based on desktop-available information, such as GIS data. This section also introduces methods for estimating infiltration properties via correlations with other measurements.

D.3.1.1 NRCS Soil Survey Maps

NRCS Soil Survey maps (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) can be used to estimate preliminary feasibility conditions, specifically by mapping hydrologic soil groups, soil texture classes, and presence of hydric soils relative to the site layout. For feasibility determinations, mapped conditions must be supplemented with available data from the site (e.g., soil borings, observed soil textures, biological indicators). The presence of D soils, if confirmed by available data, provides a reasonable basis to determine that full infiltration is not feasible for a given DMA.

D.3.1.2 Grain Size Analysis Testing and Correlations to Infiltration Rate

Hydraulic conductivity can be estimated indirectly from correlations with soil grain-size distributions. While this method is approximate, correlations have been relatively well established for some soil conditions. One of the most commonly used correlations between grain size parameters and hydraulic conductivity is the Hazen (1892, 1911) empirical formula (Philips and Kitch, 2011), but a variety of others have been developed. Correlations must be developed based on testing of site-specific soils.

D.3.1.3 Cone Penetrometer Testing and Correlations to Infiltration Rate

Hydraulic conductivity can also be estimated indirectly from cone penetrometer testing (CPT). A cone penetrometer test involves advancing a small probe into the soil and measuring the relative resistance encountered by the probe as it is advanced. The signal returned from this test can be interpreted to yield estimated soil types and the location of key transitions between soil layers. If this method is used, correlations must be developed based on testing of site-specific soils.

D.3.2 Surface and Shallow Excavation Methods

This section describes tests that are conducted at the ground surface or within shallow excavations close to the ground surface. These tests are generally applicable for cases where the bottom of the infiltration system will be near the existing ground surface. They can also be conducted to confirm the results of borehole methods after excavation/site grading has been completed.

D.3.2.1 Simple Open Pit Test

The Simple Open Pit Test is most appropriate for planning level screening of infiltration feasibility. Although it is similar to Open Pit Falling Head tests used for establishing a design infiltration rate (see below), the Simple Open Pit Test is less rigorous and is generally conducted to a lower standard of care. This test can be conducted by a nonprofessional as part of planning level screening phase.

The Simple Open Pit Test is a falling head test in which a hole at least two feet in diameter is filled with water to a level of 6" above the bottom. Water level is checked and recorded regularly until either an hour has passed or the entire volume has infiltrated. The test is repeated two more times in succession and the rate at which the water level falls in the third test is used as the infiltration rate.

This test has the advantage of being inexpensive to conduct. Yet it is believed to be fairly reliable for screening as the dimensions of the test are similar, proportionally, to the dimensions of a typical BMP. The key limitations of this test are that it measures a relatively small area, does not necessarily result in a precise measurement, and may not be uniformly implemented.

Source: City of Portland, 2008. Storm Water Management Manual

D.3.2.2 Open Pit Falling Head Test

This test is similar to the Simple Open Pit Test, but covers a larger footprint, includes more specific instructions, returns more precise measurements, and generally should be overseen by a geotechnical professional. Nonetheless, it remains a relatively simple test.

To perform this test, a hole is excavated at least 2 feet wide by 4 feet long (larger is preferred) and to a depth of at least 12 inches. The bottom of the hole should be approximately at the depth of the proposed infiltrating surface of the BMP. The hole is pre-soaked by filling it with water at least a foot above the soil to be tested and leaving it at least 4 hours (or overnight if clays are present). After pre-soaking, the hole is refilled to a depth of 12 inches and allow it to drain for one hour (2 hours for slower soils), measuring the rate at which the water level drops. The test is then repeated until successive trials yield a result with less than 10 percent change.

In comparison to a double-ring infiltrometer, this test has the advantage of measuring infiltration over a larger area and better resembles the dimensionality of a typical small scale BMP. Because it includes both vertical and lateral infiltration, it should be adjusted to estimate design rates for larger scale BMPs.

D.3.2.3 Double Ring Infiltrometer Test (ASTM 3385)

The Double Ring Infiltrometer was originally developed to estimate the saturated hydraulic conductivity of low permeability materials, such as clay liners for ponds, but has seen significant use in storm water applications. The most recent revision of this method from 2009 is known as ASTM 3385-09. The testing apparatus is designed with concentric rings that form an inner ring and an annulus between the inner and outer rings. Infiltration from the annulus between the two rings is intended to saturate the soil outside of the inner ring such that infiltration from the inner ring is restricted primarily to the vertical direction.

To conduct this test, both the center ring and annulus between the rings are filled with water. There is no pre-wetting of the soil in this test. However, a constant head of 1 to 6 inches is maintained for 6 hours, or until a constant flow rate is established. Both the inner flow rate and annular flow rate are recorded, but if they are different, the inner flow rate should be used. There are a variety of approaches that are used to maintain a constant head on the system, including use of a Mariotte tube, constant level float valves, or manual observation and filling. This test must be conducted at the elevation of the proposed infiltrating surface; therefore application of this test is limited in cases where the infiltration surface is a significant distance below existing grade at the time of testing.

This test is generally considered to provide a direct estimate of vertical infiltration rate for the specific point tested and is highly replicable. However, given the small diameter of the inner ring (standard diameter is 12 inches, but it can be larger), this test only measures infiltration rate in a small area. Additionally, given the small quantity of water used in this test compared to larger scale tests, this test may be biased high in cases where the long term infiltration rate is governed by groundwater mounding and the rate at which mounding dissipates (i.e., the capacity of the infiltration receptor). Finally, the added effort and cost of isolating vertical infiltration rate may not necessarily be warranted considering that BMPs typically have a lateral component of infiltration as well. Therefore, while this method has the advantages of being technical rigorous and well standardized, it should not necessarily be assumed to be the most representative test for estimating full-scale infiltration rates. Source: American Society for Testing and Materials (ASTM) International (2009)

D.3.2.4 Single Ring Infiltrometer Test

The single ring infiltrometer test is not a standardized ASTM test, however it is a relatively well-controlled test and shares many similarities with the ASTM standard double ring infiltrometer test (ASTM 3385-09). This test is a constant head test using a large ring (preferably greater than 40 inches in diameter) usually driven 12 inches into the soil. Water is ponded above the surface. The rate of water addition is recorded and infiltration rate is determined after the flow rate has stabilized. Water can be added either manually or automatically.

The single ring used in this test tends to be larger than the inner ring used in the double ring test. Driving the ring into the ground limits lateral infiltration; however some lateral infiltration is generally considered to occur. Experience in Riverside County (CA) has shown that this test gives results that are close to full-scale infiltration facilities. The primary advantages of this test are that it is relatively simple to conduct and has a larger footprint (compared to the double-ring method) and restricts horizontal infiltration and is more standardized (compared to open pit methods). However, it is still a relatively small scale test and can only be reasonably conducted near the existing ground surface.

D.3.2.5 Large-scale Pilot Infiltration Test

As its name implies, this test is closer in scale to a full-scale infiltration facility. This test was developed by Washington State Department of Ecology specifically for storm water applications.

To perform this test, a test pit is excavated with a horizontal surface area of roughly 100 square feet to a depth that allows 3 to 4 feet of ponding above the expected bottom of the infiltration facility. Water is continually pumped into the system to maintain a constant water level (between 3 and 4 feet about the bottom of the pit, but not more than the estimated water depth in the proposed facility) and the flow rate is recorded. The test is continued until the flow rate stabilizes. Infiltration rate is calculated by dividing the flow rate by the surface area of the pit. Similar to other open pit test, this test is known to result in a slight bias high because infiltration also moves laterally through the walls of the pit during the test. Washington State Department of Ecology requires a correction factor of 0.75 (factor of safety of 1.33) be applied to results.

This test has the advantage of being more resistant to bias from localized soil variability and being more similar to the dimensionality and scale of full scale BMPs. It is also more likely to detect long term decline in infiltration rates associated with groundwater mounding. As such, it remains the preferred test for establishing design infiltration rates in Western Washington (Washington State Department of Ecology, 2012). In a comparative evaluation of test methods, this method was found to provide a more reliable estimate of full-scale infiltration rate than double ring infiltrometer and borehole percolation tests (Philips and Kitch 2011).

The difficulty encountered in this method is that it requires a larger area be excavated than the other methods, and this in turn requires larger equipment for excavation and a greater supply of water. However, this method should be strongly considered when less information is known about spatial variability of soils and/or a higher degree of certainty in estimated infiltration rates is desired.

Source: Washington State Department of Ecology, 2012.

D.3.2.6 Smaller-scale Pilot Infiltration Test

The smaller-scale PIT is conducted similarly to the large-scale PIT but involves a smaller excavation, ranging from 20 to 32 square feet instead of 100 square feet for the large-scale PIT, with similar depths. The primary advantage of this test compared to the full-scale PIT is that it requires less excavation volume and less water. It may be more suitable for small-scale distributed infiltration controls where the need to conduct a greater number of tests outweighs the accuracy that must be obtained in each test, and where groundwater mounding is not as likely to be an issue. Washington State Department of Ecology establishes a correction factor of 0.5 (factor of safety of 2.0) for this test in comparison to 0.75 (factor of safety of 1.33) for the large-scale PIT to account for a greater fraction of water infiltrating through the walls of the excavation and lower degree of certainty related to spatial variability of soils.

D.3.3 Deeper Subsurface Tests

D.3.3.1 Well Permeameter Method (USBR 7300-89)

Well permeameter methods were originally developed for purposes of assessing aquifer permeability and associated yield of drinking water wells. This family of tests is most applicable in situations in which infiltration facilities will be placed substantially below existing grade, which limits the use of surface testing methods.

In general, this test involves drilling a 6 inch to 8 inch test well to the depth of interest and maintaining a constant head until a constant flow rate has been achieved. Water level is maintained with down-hole floats. The Porchet method or the nomographs provided in the USBR Drainage Manual (United States Department of the Interior, Bureau of Reclamation, 1993) are used to convert the measured rate of percolation to an estimate of vertical hydraulic conductivity. A smaller diameter boring may be adequate, however this then requires a different correction factor to account for the increased variability expected.

While these tests have applicability in screening level analysis, considerable uncertainty is introduced in the step of converting direct percolation measurements to estimates of vertical infiltration. Additionally, this testing method is prone to yielding erroneous results cases where the vertical horizon of the test intersects with minor lenses of sandy soils that allow water to dissipate laterally at a much greater rate than would be expected in a full-scale facility. To improve the interpretation of this test method, a continuous bore log should be inspected to determine whether thin lenses of material may be biasing results at the strata where testing is conducted. Consult USBR procedure 7300-89 for more details.

Source: (United States Department of the Interior, Bureau of Reclamation, 1990, 1993)

D.3.3.2 Borehole Percolation Tests (various methods)

Borehole percolation tests were originally developed as empirical tests to estimate the capacity of onsite sewage disposal systems (septic system leach fields), but have more recently been adopted into use for evaluating storm water infiltration. Similar to the well permeameter method, borehole percolation methods primarily measure lateral infiltration into the walls of the boring and are designed for situations in which infiltration facilities will be placed well below current grade. The percolation rate obtained in this test should be converted to an infiltration rate using a technique such as the Porchet method.

This test is generally implemented similarly to the USBR Well Permeameter Method. Per the Riverside County Borehole Percolation method, a hole is bored to a depth at least 5 times the borehole radius. The hole is presoaked for 24 hours (or at least 2 hours if sandy soils with no clay). The hole is filled to approximately the anticipated top of the proposed infiltration basin. Rates of fall are measured for six hours, refilling each half hour (or 10 minutes for sand). Tests are generally repeated until consistent results are obtained.

The same limitations described for the well permeameter method apply to borehole percolation tests, and their applicability is generally limited to initial screening. To improve the interpretation of this test method, a continuous soil core can be extracted from the hole and below the test depth, following testing, to determine whether thin lenses of material may be biasing results at the strata where testing is conducted.

Sources: Riverside County Percolation Test (2011), California Test 750 (Caltrans, 1986), San Bernardino County Percolation Test (1992); USEPA Falling Head Test (USEPA, 1980).

D.4 Specific Considerations for Infiltration Testing

The following subsections are intended to address specific topics that commonly arise in characterizing infiltration rates.

D.4.1 Hydraulic Conductivity versus Infiltration Rate versus Percolation Rate

A common misunderstanding is that the "percolation rate" obtained from a percolation test is equivalent to the "infiltration rate" obtained from tests such as a single or double ring infiltrometer test which is equivalent to the "saturated hydraulic conductivity". In fact, these terms have different meanings. Saturated hydraulic conductivity is an intrinsic property of a specific soil sample under a given degree of compaction. It is a coefficient in Darcy's equation (Darcy 1856) that characterizes the flux of water that will occur under a given gradient. The measurement of saturated hydraulic conductivity in a laboratory test is typically referred to as "permeability", which is a function of the density, structure, stratification, fines, and discontinuities of a given sample under given controlled conditions. In contrast, infiltration rate is an empirical observation of the rate of flux of water into a given soil structure under long term ponding conditions. Similarly to permeability, infiltration rate can be limited by a number of factors including the layering of soil, density, discontinuities, and initial moisture content. These factors control how quickly water can move through a soil. However, infiltration rate can also be influenced by mounding of groundwater, and the rate at which water dissipates horizontally below a BMP – both of which describe the "capacity" of the "infiltration receptor" to accept this water over an extended period. For this reason, an infiltration test should ideally be conducted for a relatively long duration resembling a series of storm events so that the capacity of the infiltration receptor is evaluated as well as the rate at which water can enter the system. Infiltration rates are generally tested with larger diameter holes, pits, or apparatuses intended to enforce a primarily vertical direction of flux.

In contrast, percolation is tested with small diameter holes, and it is mostly a lateral phenomenon. The direct measurement yielded by a percolation test tends to overestimate the infiltration rate, except perhaps in cases in which a BMP has similar dimensionality to the borehole, such as a dry well. Adjustment of percolation rates may be made to an infiltration rate using a technique such as the Porchet Method.

D.4.2 Cut and Fill Conditions

Cut Conditions: Where the proposed infiltration BMP is to be located in a cut condition, the infiltration surface level at the bottom of the BMP might be far below the existing grade. For example, if the infiltration surface of a proposed BMP is to be located at an elevation that is currently beneath 15 feet of planned cut, *how can the proposed infiltration surface be tested to establish a design infiltration rate prior to beginning excavation?* The question can be addressed in two ways: First, one of the deeper subsurface tests described above can be used to provide a planning level screening of potential rates at the elevation of the proposed infiltrating surface. These tests can be conducted at depths exceeding 100 feet, therefore are applicable in most cut conditions. Second, the project can commit to further testing using more reliable methods following bulk excavation to refine or adjust infiltration rates, and/or apply higher factors of safety to borehole methods to account for the inherent uncertainty in these measurements and conversions.

Fill Conditions: There are two types of fills – those that are engineered or documented, and those that are undocumented. Undocumented fills are fills placed without engineering controls or construction quality assurance and are subject to great uncertainty. Engineered fills are generally placed using construction quality assurance procedures and may have criteria for grain-size and fines content, and the properties can be very well understood. However, for engineered fills, infiltration rates may still be quite uncertain due to layering and heterogeneities introduced as part of construction that cannot be precisely controlled.

If the bottom of a BMP (infiltration surface) is proposed to be located in a fill location, the infiltration surface may not exist prior to grading. How then can the infiltration rate be determined? For example, if a proposed infiltration BMP is to be located with its bottom elevation in 10 feet of fill, how could one reasonably establish an infiltration rate prior to the fill being placed?

Where possible, infiltration BMPs on fill material should be designed such that their infiltrating surface extends into native soils. Additionally, for shallow fill depths, fill material can be selectively graded (i.e., high permeability granular material placed below proposed BMPs) to provide reliable infiltration properties until the infiltrating water reaches native soils. In some cases, due to considerable fill depth, the extension of the BMP down to natural soil and/or selective grading of fill material may prove infeasible. In additional, fill material will result in some compaction of now buried native soils potentially reducing their ability to infiltrate. In these cases, because of the uncertainty of fill parameters as described above as well as potential compaction of the native soils, an infiltration BMP may not be feasible.

If the source of fill material is defined and this material is known to be of a granular nature and that the native soils below is permeable and will not be highly compacted, infiltration through compacted fill materials may still be feasible. In this case, a project phasing approach could be used including the following general steps, (1) collect samples from areas expected to be used as borrow sites for fill activities, (2) remold samples to approximately the proposed degree of compaction and measure the saturated hydraulic conductivity of remolded samples using laboratory methods, (3) if infiltration rates appear adequate for infiltration, then apply an appropriate factor of safety and use the initial rates for preliminary design, (4) following placement of fill, conduct in-situ testing to refine design infiltration rates and adjust the design as needed; the infiltration rate of native soil below the fill should also be tested at this time to determine if compaction as a result of fill placement has significantly reduced its infiltration rate. The project geotechnical engineer should be involved in decision making whenever infiltration is proposed in the vicinity of engineered fill structures so that potential impacts of infiltration on the strength and stability of fills and pavement structures can be evaluated.

D.4.3 Effects of Direct and Incidental Compaction

It is widely recognized that compaction of soil has a major influence on infiltration rates (Pitt et al. 2008). However, direct (intentional) compaction is an essential aspect of project construction and indirect compaction (such as by movement of machinery, placement of fill, stockpiling of materials, and foot traffic) can be difficult to avoid in some parts of the project site. Infiltration testing strategies should attempt to measure soils at a degree of compaction that resembles anticipated post-construction conditions.

Ideally, infiltration systems should be located outside of areas where direct compaction will be required and should be staked off to minimize incidental compaction from vehicles and stockpiling. For these conditions, no adjustment of test results is needed.

However, in some cases, infiltration BMPs will be constructed in areas to be compacted. For these areas, it may be appropriate to include field compaction tests or prepare laboratory samples and conducting infiltration testing to approximate the degree of compaction that will occur in post-construction conditions. Alternatively, testing could be conducted on undisturbed soil, and an additional factor of safety could be applied to account for anticipated infiltration after compaction. To develop a factor of safety associated with incidental compaction, samples could compacted to various degrees of compaction, their hydraulic conductivity measured, and a "response curve" developed to relate the degree of compaction to the hydraulic conductivity of the material.

D.4.4 Temperature Effects on Infiltration Rate

The rate of infiltration through soil is affected by the viscosity of water, which in turn is affected by the temperature of water. As such, infiltration rate is strongly dependent on the temperature of the infiltrating water (Cedergren, 1997). For example, Emerson (2008) found that wintertime infiltration rates below a BMP in Pennsylvania were approximately half their peak summertime rates. As such, it is important to consider the effects of temperature when planning tests and interpreting results.

If possible, testing should be conducted at a temperature that approximates the typical runoff temperatures for the site during the times when rainfall occurs. If this is not possible, then the results of infiltration tests should be adjusted to account for the difference between the temperature at the time of testing and the typical temperature of runoff when rainfall occurs. The measured infiltration can be adjusted by the ratio of the viscosity at the test temperature versus the typical temperature when rainfall occurs (Cedergren, 1997), per the following formula:

$$K_{Typical} = K_{Test} \times \left(\frac{\mu_{Test}}{\mu_{Typical}} \right)$$

Where:

$K_{Typical}$ = the typical infiltration rate expected at typical temperatures when rainfall occurs

K_{Test} = the infiltration rate measured or estimated under the conditions of the test
$\mu_{Typical}$ = the viscosity of water at the typical temperature expected when rainfall occurs
μ_{Test} = the viscosity of water at the temperature at which the test was conducted

D.4.5 Number of Infiltration Tests Needed

The heterogeneity inherent in soils implies that all but the smallest proposed infiltration facilities would benefit from infiltration tests in multiple locations. The following requirements apply for in situ infiltration/percolation testing:

- In situ infiltration/ percolation testing shall be conducted at a minimum of two locations within 50-feet of each proposed storm water infiltration/ percolation BMP.
- In situ infiltration/percolation testing shall be conducted using an approved method listed in Table D.3-1
- Testing shall be conducted at approximately the same depth and in the same material as the base of the proposed storm water BMP.

D.5 Selecting a Safety Factor

Monitoring of actual facility performance has shown that the full-scale infiltration rate can be much lower than the rate measured by small-scale testing (King County Department of Natural Resources and Parks, 2009). Factors such as soil variability and groundwater mounding may be responsible for much of this difference. Additionally, the infiltration rate of BMPs naturally declines between maintenance cycles as the BMP surface becomes occluded and particulates accumulate in the infiltrative layer.

In the past, infiltration structures have been shown to have a relatively short lifespan. Over 50 percent of infiltration systems either partially or completely failed within the first 5 years of operation (United States EPA. 1999). In a Maryland study on infiltration trenches (Lindsey et al. 1991), 53 percent were not operating as designed, 36 percent were clogged, and 22 percent showed reduced filtration. In a study of 12 infiltration basins (Galli 1992), none of which had built-in pretreatment systems, all had failed within the first two years of operation.

Given the known potential for infiltration BMPs to degrade or fail over time, an appropriate factor of safety applied to infiltration testing results is strongly recommended. This section presents a recommended thought process for selecting a safety factor. This method considers factor of safety to be a function of:

- Site suitability considerations, and
- Design-related considerations.

These factors and the method for using them to compute a safety factor are discussed below.

Importantly, this method encourages rigorous site investigation, good pretreatment, and commitments to routine maintenance to provide technically-sound justification for using a lower factor of safety.

D.5.1 Determining Factor of Safety

Worksheet D.5-1, at the end of this section can be used in conjunction with Tables D.5-1 and D.5-2 to determine an appropriate safety factor. Tables D.5-1 and D.5-2 assign point values to design considerations; the values are entered into Worksheet D.5-1, which assign a weighting factor for each design consideration.

The following procedure can be used to estimate an appropriate factor of safety to be applied to the infiltration testing results. When assigning a factor of safety, care should be taken to understand what other factors of safety are implicit in other aspects of the design to avoid incorporating compounding factors of safety that may result in significant over-design.

1. For each consideration shown above, determine whether the consideration is a high, medium, or low concern.
2. For all high concerns in Table D.5-1, assign a factor value of 3, for medium concerns, assign a factor value of 2, and for low concerns assign a factor value of 1.
3. Multiply each of the factors in Table D.5-1 by 0.25 and then add them together. This should yield a number between 1 and 3.
4. For all high concerns in Table D.5-2, assign a factor value of 3, for medium concerns, assign a factor value of 2, and for low concerns assign a factor value of 1.
5. Multiply each of the factors in Table D.5-2 by 0.5 and then add them together. This should yield a number between 1 and 3.
6. Multiply the two safety factors together to get the final combined safety factor. If the combined safety factor is less than 2, then 2 should be used as the safety factor.
7. Divide the tested infiltration rate by the combined safety factor to obtain the adjusted design infiltration rate for use in sizing the infiltration facility.

Note: The minimum combined adjustment factor should not be less than 2.0 and the maximum combined adjustment factor should not exceed 9.0.

D.5.2 Site Suitability Considerations for Selection of an Infiltration Factor of Safety

Considerations related to site suitability include:

- Soil assessment methods – the site assessment extent (e.g., number of borings, test pits, etc.) and the measurement method used to estimate the short-term infiltration rate.
- Predominant soil texture/percent fines – soil texture and the percent of fines can influence the potential for clogging. Finer grained soils may be more susceptible to clogging.
- Site soil variability – site with spatially heterogeneous soils (vertically or horizontally) as determined from site investigations are more difficult to estimate average properties for resulting in a higher level of uncertainty associated with initial estimates.
- Depth to seasonal high groundwater/impervious layer – groundwater mounding may become an issue during excessively wet conditions where shallow aquifers or shallow clay lenses are present.

These considerations are summarized in Table D.5-1 below, in addition to presenting classification of concern.

Table D.5-1: Suitability Assessment Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern – 3 points	Medium Concern – 2 points	Low Concern – 1 point
Assessment methods (see explanation below)	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates Use of well permeameter or borehole methods without accompanying continuous boring log Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log Direct measurement of infiltration area with localized infiltration measurement methods (e.g., infiltrometer) Moderate spatial resolution	Direct measurement with localized (i.e., small-scale) infiltration testing methods at relatively high resolution[1] or Use of extensive test pit infiltration measurement methods[2]
Texture Class	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site soil variability	Highly variable soils indicated from site assessment, or Unknown variability	Soil borings/test pits indicate moderately homogeneous soils	Soil borings/test pits indicate relatively homogeneous soils
Depth to groundwater/ impervious layer	<5 ft below facility bottom	5-15 ft below facility bottom	>15 below facility bottom

1 - Localized (i.e., small scale) testing refers to methods such as the double-ring infiltrometer and borehole tests)

2 - Extensive infiltration testing refers to methods that include excavating a significant portion of the proposed infiltration area, filling the excavation with water, and monitoring drawdown. The excavation should be to the depth of the proposed infiltration surface and ideally be at least 30 to 100 square feet.

D.5.3 Design Related Considerations for Selection of an Infiltration Factor of Safety

Design related considerations include:

- Level of pretreatment and expected influent sediment loads – credit should be given for good pretreatment to account for the reduced probability of clogging from high sediment loading. Appendix B.6 describes performance criteria for "flow-thru treatment" based 80 percent capture of total suspended solids, which provides excellent levels of pretreatment. Additionally, the Washington State Technology Acceptance Protocol-Ecology provides a certification for "pre-treatment" based on 50 percent removal of TSS, which provides moderate levels of treatment. Current approved technologies are listed at: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html. Use of certified technologies can allow a lower factor of safety. Also, facilities designed to capture runoff from relatively clean surfaces such as rooftops are likely to see low sediment loads and therefore may be designed with lower safety factors. Finally, the amount of landscaped area and its vegetation coverage characteristics should be considered. For example in arid areas with more soils exposed, open areas draining to infiltration systems may contribute excessive sediments.
- Compaction during construction – proper construction oversight is needed during construction to ensure that the bottoms of infiltration facility are not impacted by significant incidental compaction. Facilities that use proper construction practices and oversight need less restrictive safety factors.

Table D.5-2: Design Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern – 3 points	Medium Concern – 2 points	Low Concern – 1 point
Level of pretreatment/ expected influent sediment loads	Limited pretreatment using gross solids removal devices only, such as hydrodynamic separators, racks and screens AND tributary area includes landscaped areas, steep slopes, high traffic areas, road sanding, or any other areas expected to produce high sediment, trash, or debris loads.	Good pretreatment with BMPs that mitigate coarse sediments such as vegetated swales AND influent sediment loads from the tributary area are expected to be moderate (e.g., low traffic, mild slopes, stabilized pervious areas, etc.). Performance of pretreatment consistent with "pretreatment BMP performance criteria" (50% TSS removal) in Appendix B.6	Excellent pretreatment with BMPs that mitigate fine sediments such as bioretention or media filtration OR sedimentation or facility only treats runoff from relatively clean surfaces, such as rooftops/non-sanded road surfaces. Performance of pretreatment consistent with "flow-thru treatment control BMP performance criteria" (i.e., 80% TSS removal) in Appendix B.6

Consideration	High Concern – 3 points	Medium Concern – 2 points	Low Concern – 1 point
Redundancy/ resiliency	No "backup" system is provided; the system design does not allow infiltration rates to be restored relatively easily with maintenance	The system has a backup pathway for treated water to discharge if clogging occurs or infiltration rates can be restored via maintenance.	The system has a backup pathway for treated water to discharge if clogging occurs and infiltration rates can be relatively easily restored via maintenance.
Compaction during construction	Construction of facility on a compacted site or increased probability of unintended/ indirect compaction.	Medium probability of unintended/ indirect compaction.	Equipment traffic is effectively restricted from infiltration areas during construction and there is low probability of unintended/ indirect compaction.

D.5.4 Implications of a Factor of Safety in BMP Feasibility and Design

The above method will provide safety factors in the range of 2 to 9. From a simplified practical perspective, this means that the size of the facility will need to increase in area from 2 to 9 times relative to that which might be used without a safety factor. Clearly, numbers toward the upper end of this range will make all but the best locations prohibitive in land area and cost.

In order to make BMPs more feasible and cost effective, steps should be taken to plan and execute the implementation of infiltration BMPs in a way that will reduce the safety factors needed for those projects. A commitment to effective site design and source control thorough site investigation, use of effective pretreatment controls, good construction practices, and restoration of the infiltration rates of soils that are damaged by prior compaction should lower the safety factor that should be applied, to help improve the long term reliability of the system and reduce BMP construction cost. While these practices decrease the recommended safety factor, they do not totally mitigate the need to apply a factor of safety. The minimum recommended safety factor of 2.0 is intended to account for the remaining uncertainty and long-term deterioration that cannot be technically mitigated.

Because there is potential for an applicant to "exaggerate" factor of safety to artificially prove infeasibility, an upper cap on the factor of safety is proposed for feasibility screening. A maximum factor of safety of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified. If the site passes the feasibility analysis at a factor of safety of 2.0, then infiltration must investigated, but a higher factor of safety may be selected at the discretion of the design engineer.

Worksheet D.5-1: Factor of Safety and Design Infiltration Rate Worksheet

<table>
<tr><th colspan="3">Factor of Safety and Design Infiltration Rate Worksheet</th><th colspan="3">Worksheet D.5-1</th></tr>
<tr><td colspan="2">Factor Category</td><td>Factor Description</td><td>Assigned Weight (w)</td><td>Factor Value (v)</td><td>Product (p)
p = w x v</td></tr>
<tr><td rowspan="5">A</td><td rowspan="5">Suitability Assessment</td><td>Soil assessment methods</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Predominant soil texture</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Site soil variability</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Depth to groundwater / impervious layer</td><td>0.25</td><td></td><td></td></tr>
<tr><td colspan="3">Suitability Assessment Safety Factor, $S_A = \Sigma p$</td><td></td></tr>
<tr><td rowspan="4">B</td><td rowspan="4">Design</td><td>Level of pretreatment/ expected sediment loads</td><td>0.5</td><td></td><td></td></tr>
<tr><td>Redundancy/resiliency</td><td>0.25</td><td></td><td></td></tr>
<tr><td>Compaction during construction</td><td>0.25</td><td></td><td></td></tr>
<tr><td colspan="3">Design Safety Factor, $S_B = \Sigma p$</td><td></td></tr>
<tr><td colspan="5">Combined Safety Factor, $S_{total} = S_A \times S_B$</td><td></td></tr>
<tr><td colspan="5">Observed Infiltration Rate, inch/hr, $K_{observed}$
(corrected for test-specific bias)</td><td></td></tr>
<tr><td colspan="5">Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$</td><td></td></tr>
<tr><td colspan="6">Supporting Data</td></tr>
<tr><td colspan="6">Briefly describe infiltration test and provide reference to test forms:</td></tr>
</table>

Appendix

E

BMP DESIGN MANUAL

BMP Design Fact Sheets

Appendix E BMP Design Fact Sheets

This appendix presents BMPs for consideration for development and redevelopment projects. All projects must include Site Design and Source Control BMPs to reduce pollutants in runoff to San Diego Bay. The following priority pollutants have been identified in the Water Quality Improvement Plan for San Diego Bay (2015): trash, bacteria, and metals. Therefore, BMPs will be required on a project-specific basis that specifically address controlling those pollutants either through source control or site design features. It is the responsibility of the project applicant to propose BMPs to control these pollutants in addition to any project specific pollutants identified in accordance with the methods required by this design manual. During Port review of the SWQMP, the adequacy of BMPs proposed that target trash, bacteria, and metals will be considered and additional BMPs may be required by the Port if adequate BMPs are not selected by the project.

The following fact sheets were developed to assist the project applicants with designing BMPs to meet the storm water obligations:

MS4 Category	Manual Category	Design Fact Sheet
Source Control	Source Control	SC: Source Control BMP Requirements
Site Design	Site Design	SD-1: Street Trees SD-5: Impervious Area Dispersion SD-6A: Green Roofs SD-6B: Permeable Pavement (Site Design BMP) SD-8: Rain Barrels
Retention	Harvest and Use	HU-1: Cistern
	Infiltration	INF-1: Infiltration Basins INF-2: Bioretention INF-3: Permeable Pavement (Pollutant Control)
	Partial Retention	PR-1: Biofiltration with Partial Retention
Biofiltration	Biofiltration	BF-1: Biofiltration BF-2: Nutrient Sensitive Media Design BF-3: Proprietary Biofiltration
Flow-thru Treatment Control	Flow-thru Treatment Control with Alternative Compliance	FT-1: Vegetated Swales FT-2: Media Filters FT-3: Sand Filters FT-4: Dry Extended Detention Basin FT-5: Proprietary Flow-thru Treatment Control
		PL: Plant List

E.1 Source Control BMP Requirements

Worksheet E.1-1: Source Control BMP Requirements

How to comply: Projects shall comply with this requirement by implementing all source control BMPs listed in this section that are applicable to their project. Applicability shall be determined through consideration of the development project's features and anticipated pollutant sources. Appendix E.1 provides guidance for identifying source control BMPs applicable to a project. Checklist I.4 in Appendix I shall be used to document compliance with source control BMP requirements.

How to use this worksheet:

1. Review Column 1 and identify which of these potential sources of storm water pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your project site plan.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in a table in your project-specific storm water management report. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternatives.

If These Sources Will Be on the Project Site …	… Then Your SWQMP Shall Consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **A.** Onsite storm drain inlets ❑ Not Applicable	❑ Locations of inlets.	❑ Mark all inlets with placards provided by the Port,	❑ Maintain and periodically repaint or replace inlet markings. ❑ Provide storm water pollution prevention information to new site tenants or operators. ❑ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **B.** Interior floor drains and elevator shaft sump pumps ❑ Not Applicable		❑ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **C.** Interior parking garages ❑ Not Applicable		❑ State that parking garage floor drains will be plumbed to the sanitary sewer.	❑ Inspect and maintain drains to prevent blockages and overflow.
❑ **D1.** Need for future indoor & structural pest control ❑ Not Applicable		❑ Note building design features that discourage entry of pests.	❑ Provide Integrated Pest Management information to tenants and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **D2.** Landscape/ Outdoor Pesticide Use ❑ Not Applicable	❑ Show locations of existing trees or areas of shrubs and ground cover to be undisturbed and retained. ❑ Show self-retaining landscape areas, if any. ❑ Show storm water treatment facilities.	State that final landscape plans will accomplish all of the following. ❑ Preserve existing drought tolerant trees, shrubs, and ground cover to the maximum extent possible. ❑ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution. ❑ Where landscaped areas are used to retain or detain storm water, specify plants that are tolerant of periodic saturated soil conditions. ❑ Consider using pest-resistant plants, especially adjacent to hardscape. ❑ To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	❑ Maintain landscaping using minimum or no pesticides. ❑ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ❑ Provide IPM information to new tenants and operators.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **E.** Pools, spas, ponds, decorative fountains, and other water features. ❑ Not Applicable	❑ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	❑ If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	❑ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **F.** Food service ❑ Not Applicable	❑ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ❑ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	❑ Describe the location and features of the designated cleaning area. ❑ Describe the items to be cleaned in this facility and how it has been sized to ensure that the largest items can be accommodated.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **G.** Refuse areas ❑ Not Applicable	❑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ❑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run- on and show locations of berms to prevent runoff from the area. Also show how the designated area will be protected from wind dispersal. ❑ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	❑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ❑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	❑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on- site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative Table and Narrative**
❑ **H.** Industrial processes. ❑ Not Applicable	❑ Show process area.	❑ If industrial processes are to be located onsite, state: “All process activities to be performed indoors. No processes to drain to exterior or to storm drain system.”	❑ See Fact Sheet SC-10, “Non-Stormwater Discharges” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
❑ **I.** Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.) ❑ Not Applicable	❑ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or runoff from area and protected from wind dispersal. ❑ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ❑ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	❑ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for: ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release Prevention Program ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank	❑ See the Fact Sheets SC-31, “Outdoor Liquid Container Storage” and SC-33, “Outdoor Storage of Raw Materials” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

<table>
<tr><th>If These Sources Will Be on the Project Site …</th><th colspan="3">… Then Your SWQMP shall consider These Source Control BMPs</th></tr>
<tr><th>1
Potential Sources of Runoff Pollutants</th><th>2
Permanent Controls—Show on Drawings</th><th>3
Permanent Controls—List in Table and Narrative</th><th>4
Operational BMPs—Include in Table and Narrative</th></tr>
<tr><td>❑ J. Vehicle and Equipment Cleaning
❑ Not Applicable</td><td>❑ Show on drawings as appropriate:

(1) Commercial/industrial facilities having vehicle /equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.
(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited onsite and hoses are provided with an automatic shut- off to discourage such use).
(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.
(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.</td><td>❑ If a car wash area is not provided, describe measures taken to discourage onsite car washing and explain how these will be enforced.</td><td>Describe operational measures to implement the following (if applicable):

❑ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.
❑ Car dealerships and similar may rinse cars with water only.
❑ See Fact Sheet SC-21, “Vehicle and Equipment Cleaning,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com</td></tr>
</table>

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **K.** Vehicle/Equipment Repair and Maintenance ❑ Not Applicable	❑ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to protect from rainfall, run-on runoff, and wind dispersal. ❑ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ❑ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	❑ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ❑ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ❑ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the report, note that all of the following restrictions apply to use the site: ❑ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. ❑ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ❑ No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **L.** Fuel Dispensing Areas ❑ Not Applicable	❑ Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are (1) graded at the minimum slope necessary to prevent ponding; and (2) separated from the rest of the site by a grade break that prevents run-on of storm water to the MEP. ❑ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area1.] The canopy [or cover] shall not drain onto the fueling area.		❑ The tenant or property manager shall dry sweep the fueling area routinely. ❑ See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

1. The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	2 **Permanent Controls—Show on Drawings**	3 **Permanent Controls—List in Table and Narrative**	4 **Operational BMPs—Include in Table and Narrative**
M. Loading Docks ❑ Not Applicable	❑ Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct storm water away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited. ❑ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ❑ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		❑ Move loaded and unloaded items indoors as soon as possible. ❑ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 **Potential Sources of Runoff Pollutants**	**2** **Permanent Controls—Show on Drawings**	**3** **Permanent Controls—List in Table and Narrative**	**4** **Operational BMPs—Include in Table and Narrative**
❑ **N.** Fire Sprinkler Test Water ❑ Not Applicable		❑ Provide a means to drain fire sprinkler test water to the sanitary sewer.	❑ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com.
O. Miscellaneous Drain or Wash Water ❑ Boiler drain lines ❑ Condensate drain lines ❑ Rooftop equipment ❑ Drainage sumps ❑ Roofing, gutters, and trim ❑ Not Applicable		❑ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ❑ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ❑ Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ❑ Any drainage sumps onsite shall feature a sediment sump to reduce the quantity of sediment in pumped water. ❑ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	

If These Sources Will Be on the Project Site …	… Then Your SWQMP shall consider These Source Control BMPs		
1 Potential Sources of Runoff Pollutants	**2 Permanent Controls—Show on Drawings**	**3 Permanent Controls—List in Table and Narrative**	**4 Operational BMPs—Include in Table and Narrative**
❑ **P.** Plazas, sidewalks, and parking lots. ❑ Not Applicable			❑ Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Washwater containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.

E.2 SD-1 Street Trees

MS4 Permit Category
Site Design

Manual Category
Site Design

Applicable Performance Standard
Site Design

Primary Benefits
Volume Reduction

Street Trees (Source: County of San Diego LID Manual – EOA, Inc.)

Description

Trees planted to intercept rainfall and runoff can be used as storm water management measures that provide additional benefits beyond those typically associated with trees, including energy conservation, air quality improvement, and aesthetic enhancement. Typical storm water management benefits associated with trees include:

- **Interception of rainfall** – tree surfaces (roots, foliage, bark, and branches) intercept, evaporate, store, or convey precipitation to the soil before it reaches surrounding impervious surfaces
- **Reduced erosion** – trees protect denuded area by intercepting or reducing the velocity of rain drops as they fall through the tree canopy
- **Increased infiltration** – soil conditions created by roots and fallen leaves promote infiltration
- **Treatment of storm water** – trees provide treatment through uptake of nutrients and other storm water pollutants (phytoremediation) and support of other biological processes that break down pollutants

Typical street tree system components include:

- Trees of the appropriate species for site conditions and constraints
- Available growing space based on tree species, soil type, water availability, surrounding land uses, and project goals
- Optional suspended pavement design to provide structural support for adjacent pavement

without requiring compaction of underlying layers

- Optional root barrier devices as needed; a root barrier is a device installed in the ground, between a tree and the sidewalk, intended to guide roots down and away from the sidewalk in order to prevent sidewalk lifting from tree roots.
- Optional tree grates; to be considered to maximize available space for pedestrian circulation and to protect tree roots from compaction related to pedestrian circulation; tree grates are typically made up of porous material that will allow the runoff to soak through.
- Optional shallow surface depression for ponding of excess runoff
- Optional planter box drain

Design Adaptations for Project Goals

Site design BMP to provide incidental treatment. Street trees primarily functions as site design BMPs for incidental treatment. Benefits from street trees are accounted for by adjustment factors presented in Appendix B.2. This credit can apply to non-street trees as well (that meet the same criteria). Trees as a site design BMP are only credited up to 0.25 times the DCV from the project footprint (with a maximum single tree credit volume of 400 ft^3).

Storm water pollutant control BMP to provide treatment. Applicants are allowed to design trees as a pollutant control BMP and obtain credit greater than 0.25 times the DCV from the project footprint (or a credit greater than 400 ft^3 from a single tree). For this option to be approved by the Port, applicant is required to do infiltration feasibility screening (Appendix C and D) and provide calculations supporting the amount of credit claimed from implementing trees within the project footprint. The Port has the discretion to request additional analysis before approving credits greater than 0.25 times the DCV from the project footprint (or a credit greater than 400 ft^3 from a single tree).

Design Criteria and Considerations

Street Trees must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	**Tree species** is appropriately chosen for the development (tenant or capital). For public rights-of-ways, local planning guidelines and zoning provisions for the permissible species and placement of trees are consulted. A list of trees appropriate for site design that can be	Proper tree placement and species selection minimizes problems such as pavement damage by surface roots and poor growth.

<table>
<tr><th></th><th>Siting and Design</th><th>Intent/Rationale</th></tr>
<tr><td></td><td>used by all county municipalities are provided in Appendix E.20</td><td></td></tr>
<tr><td>☐</td><td>Location of trees planted along public streets follows local requirements and guidelines. Vehicle and pedestrian line of sight are considered in tree selection and placement.

Unless exemption is granted by the Port the following minimum tree separation distance is followed
<table>
<tr><th>Improvement</th><th>Minimum distance to Street Tree</th></tr>
<tr><td>Traffic Signal, Stop sign</td><td>20 feet</td></tr>
<tr><td>Underground Utility lines (except sewer)</td><td>5 feet</td></tr>
<tr><td>Sewer Lines</td><td>10 feet</td></tr>
<tr><td>Above ground utility structures (Transformers, Hydrants, Utility poles, etc.)</td><td>10 feet</td></tr>
<tr><td>Driveways</td><td>10 feet</td></tr>
<tr><td>Intersections (intersecting curb lines of two streets)</td><td>25 feet</td></tr>
</table>
</td><td>Roadway safety for both vehicular and pedestrian traffic is a key consideration for placement along public streets.</td></tr>
<tr><td>☐</td><td>Underground utilities and overhead wires are considered in the design and avoided or circumvented. Underground utilities are routed around or through the planter in suspended pavement applications. All underground utilities are protected from water and root penetration.</td><td>Tree growth can damage utilities and overhead wires resulting in service interruptions. Protecting utilities routed through the planter prevents damage and service interruptions.</td></tr>
</table>

	Siting and Design	*Intent/Rationale*
☐	**Suspended pavement** design was developed where appropriate to minimize soil compaction and improve infiltration and filtration capabilities. Suspended pavement was constructed with an approved structural cell.	Suspended pavement designs provide structural support without compaction of the underlying layers, thereby promoting tree growth. Recommended structural cells include poured in place concrete columns, Silva Cells manufactured by Deeproot Green Infrastructures and Stratacell and Stratavault systems manufactured by Citygreen Systems.
☐	A minimum soil volume of 2 cubic feet per square foot of canopy projection volume is provided for each tree. Canopy projection area is the ground area beneath the tree, measured at the drip line.	The minimum soil volume ensures that there is adequate storage volume to allow for unrestricted evapotranspiration. A lower amount of soil volume may be allowed at the discretion of the Port if certified by a landscape architect or agronomist. The retention credit from the tree is directly proportional to the soil volume provided for the tree.
☐	DCV from the tributary area draining to the tree is equal to or greater than the tree credit volume	The minimum tributary area ensures that the tree receives enough runoff to fully utilize the infiltration and evapotranspiration potential provided. In cases where the minimum tributary area is not provided, the tree credit volume must be reduced proportionately to the actual tributary area.
☐	Inlet opening to the tree that is at least 18 inches wide. A minimum 2 inch drop in grade from the inlet to the finish grade of the tree. Grated inlets are allowed for pedestrian circulation. Grates need to be ADA compliant and have sufficient slip resistance.	Design requirement to ensure that the runoff from the tributary area is not bypassed. Different inlet openings and drops in grade may be allowed at the discretion of the Port if calculations are shown that the diversion flow rate (Appendix B.1.2) from the tributary area can be conveyed to the tree. In cases where the inlet capacity is limiting the amount of runoff draining to the tree, the tree credit

Siting and Design	*Intent/Rationale*
	volume must be reduced proportionately.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where street trees can be used in the site design to achieve incidental treatment. Street trees reduce runoff volumes from the site. Refer to Appendix B. Document the proposed tree locations in the SWQMP.
2. When trees are proposed as a storm water pollutant control BMP, applicant must complete feasibility analysis in Appendix C and D and submit detailed calculations for the DCV treated by trees. Document the proposed tree locations, feasibility analysis and sizing calculations in the SWQMP. The following calculations should be performed and the smallest of the three should be used as the volume treated by trees:
    a. Delineate the DMA (tributary area) to the tree and calculate the associated DCV.
    b. Calculate the required diversion flow rate using Appendix B.1.2 and size the inlet required to covey this flow rate to the tree. If the proposed inlet cannot convey the diversion flow rate for the entire tributary area, then the DCV that enters the tree should be proportionally reduced.
        i. For example, 0.5 acre drains to the tree and the associated DCV is 820 ft^3. The required diversion flow rate is 0.10 ft^3/s, but only an inlet that can divert 0.05 ft^3/s could be installed.
        ii. Then the effective DCV draining to the tree = 820 ft^3 * (0.05/0.10) = 420 ft^3
    c. Estimate the amount of storm water treated by the tree by summing the following:
        i. Evapotranspiration credit of 0.1 * amount of soil volume installed; and
        ii. Infiltration credit calculated using sizing procedures in Appendix B.4.

E.3 SD-5 Impervious Area Dispersion

MS4 Permit Category
Site Design

Manual Category
Site Design

Applicable Performance Criteria
Site Design

Primary Benefits
Volume Reduction
Peak Flow Attenuation

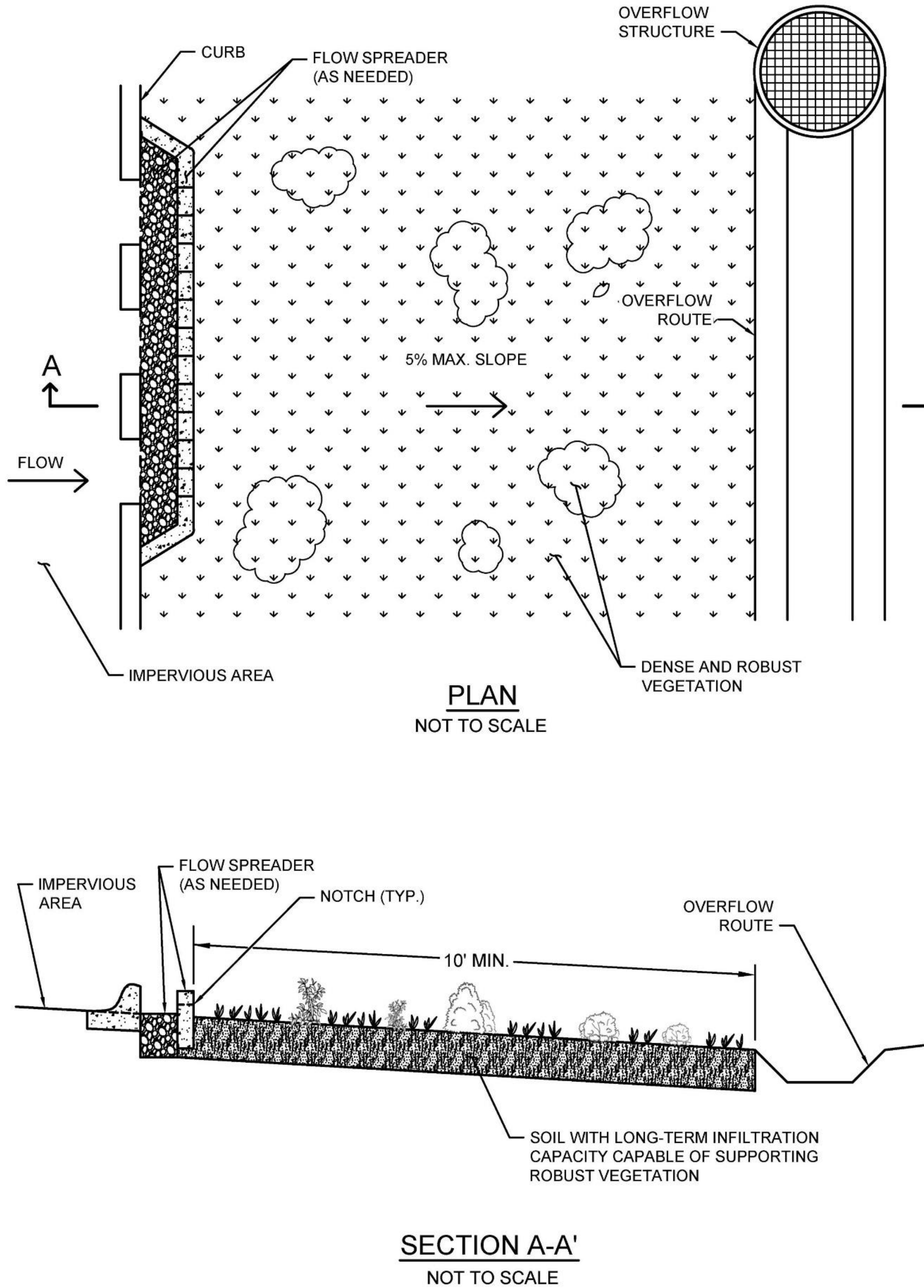
Photo Credit: Orange County Technical Guidance Document

Description

Impervious area dispersion (dispersion) refers to the practice of effectively disconnecting impervious areas from directly draining to the storm drain system by routing runoff from impervious areas such as rooftops (through downspout disconnection), walkways, and driveways onto the surface of adjacent pervious areas. The intent is to slow runoff discharges, and reduce volumes. Dispersion with partial or full infiltration results in significant volume reduction by means of infiltration and evapotranspiration.

Typical dispersion components include:

- An impervious surface from which runoff flows will be routed with minimal piping to limit concentrated inflows
- Splash blocks, flow spreaders, or other means of dispersing concentrated flows and providing energy dissipation as needed
- Dedicated pervious area, typically vegetated, with in-situ soil infiltration capacity for partial or full infiltration
- Optional soil amendments to improve vegetation support, maintain infiltration rates and enhance treatment of routed flows
- Overflow route for excess flows to be conveyed from dispersion area to the storm drain system or discharge point



Typical plan and section view of an Impervious Area Dispersion BMP

Design Adaptations for Project Goals

Site design BMP to reduce impervious area and DCV. Impervious area dispersion primarily functions as a site design BMP for reducing the effective imperviousness of a site by providing partial or full infiltration of the flows that are routed to pervious dispersion areas and otherwise slowing down excess flows that eventually reach the storm drain system. This can significantly reduce the DCV for the site.

Design Criteria and Considerations

Dispersion must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		***Intent/Rationale***
☐	Dispersion is over areas with soil types capable of supporting or being amended (e.g., with sand or compost) to support vegetation. Media amendments must be tested to verify that they are not a source of pollutants.	Soil must have long-term infiltration capacity for partial or full infiltration and be able to support vegetation to provide runoff treatment. Amendments to improve plant growth must not have negative impact on water quality.
☐	Dispersion has vegetated sheet flow over a relatively large distance (minimum 10 feet) from inflow to overflow route.	Full or partial infiltration requires relatively large areas to be effective depending on the permeability of the underlying soils.
☐	Pervious areas should be flat (with less than 5% slopes) and vegetated.	Flat slopes facilitate sheet flows and minimize velocities, thereby improving treatment and reducing the likelihood of erosion.
Inflow velocities		
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
Dedication		
☐	Dispersion areas must be dedicated for the purposes of dispersion to the exclusion of other future uses that might reduce the effectiveness of the dispersion area.	Dedicated dispersion areas prevent future conversion to alternate uses and facilitate continued full and partial infiltration benefits.

Siting and Design		*Intent/Rationale*
Vegetation		
☐	Dispersion typically requires dense and robust vegetation for proper function. Drought tolerant species should be selected to minimize irrigation needs. A plant list to aid in selection can be found in Appendix E.20.	Vegetation improves resistance to erosion and aids in runoff treatment.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where dispersion can be used in the site design to reduce the DCV for pollutant control sizing.
2. Calculate the DCV for storm water pollutant control per Appendix B.2, taking into account reduced runoff from dispersion.
3. Determine if a DMA is considered "Self-retaining" if the impervious to pervious ratio is:
   a. 2:1 when the pervious area is composed of Hydrologic Soil Group A
   b. 1:1 when the pervious area is composed of Hydrologic Soil Group B

E.4 SD-6A: Green Roofs

MS4 Permit Category
Site Design

Manual Category
Site Design

Applicable Performance Standard
Site Design

Primary Benefits
Volume Reduction
Peak Flow Attenuation

Location: County of San Diego Operations Center, San Diego, California

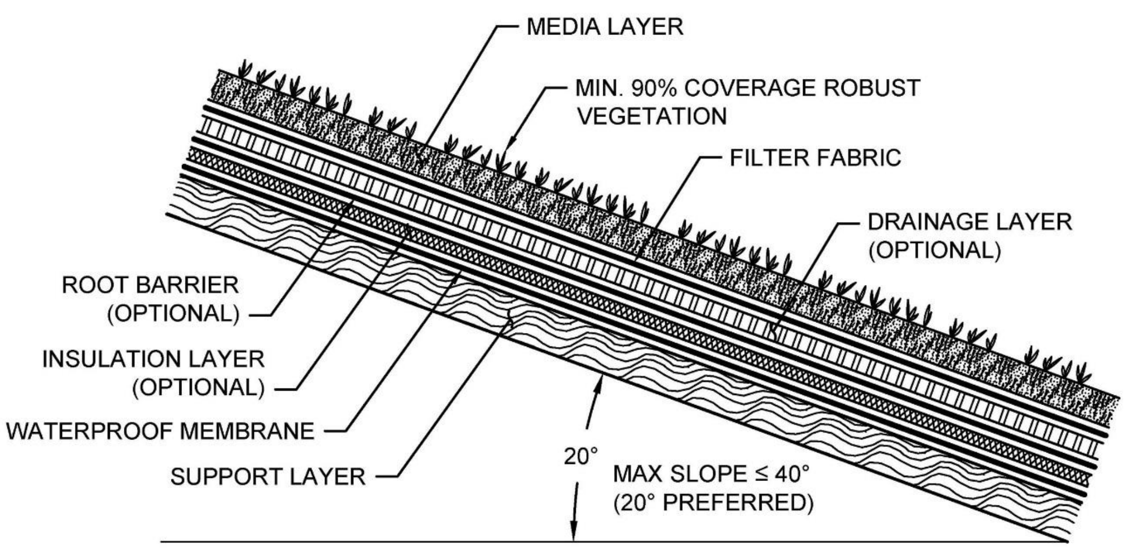
Description

Green roofs are vegetated rooftop systems that reduce runoff volumes and rates, treat storm water pollutants through filtration and plant uptake, provide additional landscape amenity, and create wildlife habitat. Additionally, green roofs reduce the heat island effect and provide acoustical control, air filtration and oxygen production. In terms of building design, they can protect against ultraviolet rays and extend the roof lifetime, as well as increase the building insulation, thereby decreasing heating and cooling costs. There are two primary types of green roofs:

- **Extensive** – lightweight, low maintenance system with low-profile, drought tolerant type groundcover in shallow growing medium (6 inches or less)
- **Intensive** – heavyweight, high maintenance system with a more garden-like configuration and diverse plantings that may include shrubs or trees in a thicker growing medium (greater than 6 inches)

Typical green roof components include, from top to bottom:

- Vegetation that is appropriate to the type of green roof system, climate, and watering conditions
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter fabric to prevent migration of fines (soils) into the drainage layer
- Optional drainage layer to convey excess runoff
- Optional root barrier
- Optional insulation layer
- Waterproof membrane
- Structural roof support capable of withstanding the additional weight of a green roof



PROFILE
NOT TO SCALE

Typical profile of a Green Roof BMP

Design Adaptations for Project Goals

Site design BMP to provide incidental treatment. Green roofs can be used as a site design feature to reduce the impervious area of the site through replacing conventional roofing. This can reduce the DCV and flow control requirements for the site.

Design Criteria and Considerations

Green roofs must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Roof slope is ≤ 40% (Roofs that are ≤ 20% are preferred).	Steep roof slopes increases project complexity and requires supplemental anchoring.
☐	Structural roof capacity design supports the calculated additional load (lbs/sq. ft) of the vegetation growing medium and additional drainage and barrier layers.	Inadequate structural capacity increases the risk for roof failure and harm to the building and occupants.
☐	Design and construction is planned to be completed by an experienced green roof specialist.	A green roof specialist will minimize complications in implementation and potential structural issues that are critical to green roof success.
☐	Green roof location and extent must meet fire safety provisions.	Green roof design must not negatively impact fire safety.
☐	Maintenance access is included in the green roof design.	Maintenance will facilitate proper functioning of drainage and irrigation components and allow for removal of undesirable vegetation and soil testing, as needed.
	Vegetation	
☐	Vegetation is suitable for the green roof type, climate and expected watering conditions. Perennial, self-sowing plants that are drought-tolerant (e.g., sedums, succulents) and require little to no fertilizer, pesticides or herbicides are recommended. Vegetation pre-grown at grade may allow plants to establish prior to facing harsh roof conditions.	Plants suited to the design and expected growing environment are more likely to survive.

	Siting and Design	*Intent/Rationale*
☐	Vegetation is capable of covering ≥ 90% the roof surface.	Benefits of green roofs are greater with more surface vegetation.
☐	Vegetation is robust and erosion-resistant in order to withstand the anticipated rooftop environment (e.g., heat, cold, high winds).	Weak plants will not survive in extreme rooftop environments.
☐	Vegetation is fire resistant.	Vegetation that will not burn easily decreases the chance for fire and harm to the building and occupants.
☐	Vegetation considers roof sun exposure and shaded areas based on roof slope and location.	The amount of sunlight the vegetation receives can inhibit growth therefore the beneficial effects of a vegetated roof.
☐	An irrigation system (e.g., drip irrigation system) is included as necessary to maintain vegetation.	Proper watering will increase plant survival, especially for new plantings.
☐	Media is well-drained and is the appropriate depth required for the green roof type and vegetation supported.	Unnecessary water retention increases structural loading. An adequate media depth increases plant survival.
☐	A filter fabric is used to prevent migration of media fines through the system.	Migration of media can cause clogging of the drainage layer.
☐	A drainage layer is provided if needed to convey runoff safely from the roof. The drainage layer can be comprised of gravel, perforated sheeting, or other drainage materials.	Inadequate drainage increases structural loading and the risk of harm to the building and occupants.
☐	A root barrier comprised of dense material to inhibit root penetration is used if the waterproof membrane will not provide root penetration protection.	Root penetration can decrease the integrity of the underlying structural roof components and increase the risk of harm to the building and occupants.
☐	An insulation layer is included as needed to protect against the water in the drainage layer from extracting building heat in the winter and cool air in the summer.	Regulating thermal impacts of green roofs will aid in controlling building heating and cooling costs.
☐	A waterproof membrane is used to prevent the roof runoff from vertically	Water-damaged roof materials increase the risk of harm to the building and occupants.

Siting and Design	*Intent/Rationale*
migrating and damaging the roofing material. A root barrier may be required to prevent roots from compromising the integrity of the membrane.	

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where green roofs can be used in the site design to replace conventional roofing to reduce the DCV. These green roof areas can be credited toward reducing runoff generated through representation in storm water calculations as pervious, not impervious, areas but are not credited for storm water pollutant control.
2. Calculate the DCV per Appendix B.2.

E.5 SD-6B Permeable Pavement (Site Design BMP)

Photo Credit: San Diego Low Impact Development Design Manual

Description

Permeable pavement is pavement that allows for percolation through void spaces in the pavement surface into subsurface layers. Permeable pavements reduce runoff volumes and rates and can provide pollutant control via infiltration, filtration, sorption, sedimentation, and biodegradation processes. When used as a site design BMP, the subsurface layers are designed to provide storage of storm water runoff so that outflow rates can be controlled via infiltration into subgrade soils. Varying levels of storm water treatment and flow control can be provided depending on the size of the permeable pavement system relative to its drainage area and the underlying infiltration rates. As a site design BMP permeable pavement areas are designed to be self-retaining and are designed primarily for direct rainfall. Self-retaining permeable pavement areas have a ratio of total drainage area (including permeable pavement) to area of permeable pavement of 1.5:1 or less. Permeable pavement surfaces can be constructed from modular paver units or paver blocks, pervious concrete, porous asphalt, and turf pavers. Sites designed with permeable pavements can significantly reduce the impervious area of the project. Reduction in impervious surfaces decreases the DCV and can reduce the footprint of treatment control and flow control BMPs.

Design Adaptations for Project Goals

Site design BMP to reduce impervious area and DCV. Permeable pavement without an underdrain can be used as a site design feature to reduce the impervious area of the site by replacing traditional pavements, including roadways, parking lots, emergency access lanes, sidewalks, trails and driveways.

Typical Permeable Pavement Components (Top to Bottom)
Permeable surface layer
Bedding layer for permeable surface
Aggregate storage layer with optional underdrain(s)
Optional final filter course layer over uncompacted existing subgrade

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where permeable pavements can be used in the site design to replace conventional pavements to reduce the DCV. These areas can be credited toward reducing runoff generated through representation in storm water calculations as pervious, not impervious, areas but are not credited for storm water pollutant control.
2. Calculate the DCV per Appendix B.2, taking into account reduced runoff from permeable pavement areas.

E.6 SD-8 Rain Barrels

Photo Credit: San Diego Low Impact Development Design Manual

Description

Rain barrels are containers that can capture rooftop runoff and store it for future use. With controlled timing and volume release, the captured rainwater can be used for irrigation or alternative grey water between storm events, thereby reducing runoff volumes and associated pollutants to downstream waterbodies. Rain barrels tend to be smaller systems, less than 100 gallons. Treatment can be achieved when rain barrels are used as part of a treatment train along with other BMPs that use captured flows in applications that do not result in discharges into the storm drain system. Rooftops are the ideal tributary areas for rain barrels.

Design Adaptations for Project Goals

Site design BMP to reduce effective impervious area and DCV. Barrels can be used as a site design feature to reduce the effective impervious area of the site by removing roof runoff from the site discharge. This can reduce the DCV and flow control requirements for the site.

Typical Rain Barrel Components
Storage container, barrel or tank for holding captured flows
Inlet and associated valves and piping
Outlet and associated valves and piping
Overflow outlet
Optional pump
Optional first flush diverters
Optional roof, supports, foundation, level indicator, and other accessories

Important Considerations

Maintenance: Rain barrels require regular monitoring and cleaning to ensure that they do not become clogged with leaves or other debris.
Economics: Rain barrels have low installation costs.
Limitations: Due to San Diego's arid climate, some rain barrels may fill only a few times each year.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where rain barrels can be used in the site design to capture roof runoff to reduce the DCV. Rain barrels reduce the effective impervious area of the site by removing roof runoff from the site discharge.

2. Calculate the DCV per Appendix B.2, taking into account reduced runoff from permeable pavement areas.

E.7 HU-1 Cistern

MS4 Permit Category
Retention

Manual Category
Harvest and Use

Applicable Performance Standards
Pollutant Control Flow Control

Primary Benefits
Volume Reduction Peak Flow Attenuation

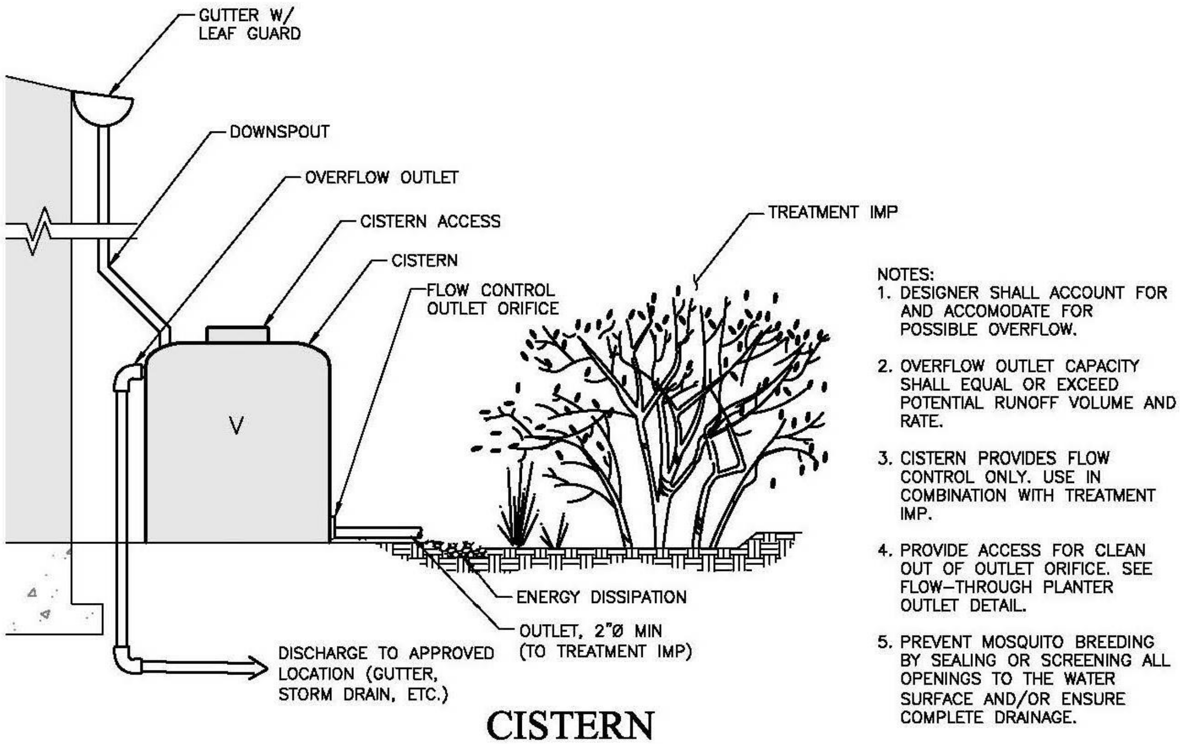
Photo Credit: Water Environment Research Foundation: WERF.org

Description

Cisterns are containers that can capture rooftop runoff and store it for future use. With controlled timing and volume release, the captured rainwater can be used for irrigation or alternative grey water between storm events, thereby reducing runoff volumes and associated pollutants to downstream water bodies. Cisterns are larger systems (generally>100 gallons) that can be self-contained aboveground or below ground systems. Treatment can be achieved when cisterns are used as part of a treatment train along with other BMPs that use captured flows in applications that do not result in discharges into the storm drain system. Rooftops are the ideal tributary areas for cisterns.

Typical cistern components include:

- Storage container, barrel or tank for holding captured flows
- Inlet and associated valves and piping
- Outlet and associated valves and piping
- Overflow outlet
- Optional pump
- Optional first flush diverters
- Optional roof, supports, foundation, level indicator, and other accessories



Source: City of San Diego Storm Water Standards

Design Adaptations for Project Goals

Site design BMP to reduce effective impervious area and DCV. Cisterns can be used as a site design feature to reduce the effective impervious area of the site by removing roof runoff from the site discharge. This can reduce the DCV and flow control requirements for the site.

Harvest and use for storm water pollutant control. Typical uses for captured flows include irrigation, toilet flushing, cooling system makeup, and vehicle and equipment washing.

Integrated storm water flow control and pollutant control configuration. Cisterns provide flow control in the form of volume reduction and/or peak flow attenuation and storm water treatment through elimination of discharges of pollutants. Additional flow control can be achieved by sizing the cistern to include additional detention storage and/or real-time automated flow release controls.

Design Criteria and Considerations

Cisterns must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	***Intent/Rationale***
☐	Cisterns are sized to detain the full DCV of contributing area and empty within 36 hours.	Draining the cistern makes the storage volume available to capture the next storm. The applicant has an option to use a different drawdown time up to 96 hours if the volume of the facility is adjusted using the percent capture method in Appendix B.4.2.
☐	Cisterns are fitted with a flow control device such as an orifice or a valve to limit outflow in accordance with drawdown time requirements.	Flow control provides flow attenuation benefits and limits cistern discharge to downstream facilities during storm events.
☐	Cisterns are designed to drain completely, leaving no standing water, and all entry points are fitted with traps or screens, or sealed.	Complete drainage and restricted entry prevents mosquito habitat.
☐	Leaf guards and/or screens are provided to prevent debris from accumulating in the cistern.	Leaves and organic debris can clog the outlet of the cistern.
☐	Access is provided for maintenance and the cistern outlets are accessible and designed to allow easy cleaning.	Properly functioning outlets are needed to maintain proper flow control in accordance with drawdown time requirements.
☐	Cisterns must be designed and sited such that overflow will be conveyed safely overland to the storm drain system or discharge point.	Safe overflow conveyance prevents flooding and damage of property.

Conceptual Design and Sizing Approach for Site Design and Storm Water Pollutant Control

1. Calculate the DCV for site design per Appendix B.
2. Determine the locations on the site where cisterns can be located to capture and detain the DCV from roof areas without subsequent discharge to the storm drain system. Cisterns are best located in close proximity to building and other roofed structures to minimize piping. Cisterns can also be used as part of a treatment train upstream by increasing pollutant control through delayed runoff to infiltration BMPs such as bioretention without underdrain facilities.
3. Use the sizing worksheet in Appendix B.3 to determine if full or partial capture of the DCV is achievable.

4. The remaining DCV to be treated should be calculated for use in sizing downstream BMP(s).

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or duration will typically require significant cistern volumes, and therefore the following steps should be taken prior to determination of site design and storm water pollutant control. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that cistern siting and design criteria have been met. Design for flow control can be achieved using various design configurations, shapes, and quantities of cisterns.
2. Iteratively determine the cistern storage volume required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control valve operation.
3. Verify that the cistern is drawdown within 36 hours. The drawdown time can be estimated by dividing the storage volume by the rate of use of harvested water.
4. If the cistern cannot fully provide the flow rate and duration control required by this manual, a downstream structure with additional storage volume or infiltration capacity such as a biofiltration can be used to provide remaining flow control.

E.8 INF-1 Infiltration Basin

MS4 Permit Category
Retention

Manual Category
Infiltration

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Volume Reduction
Peak Flow Attenuation

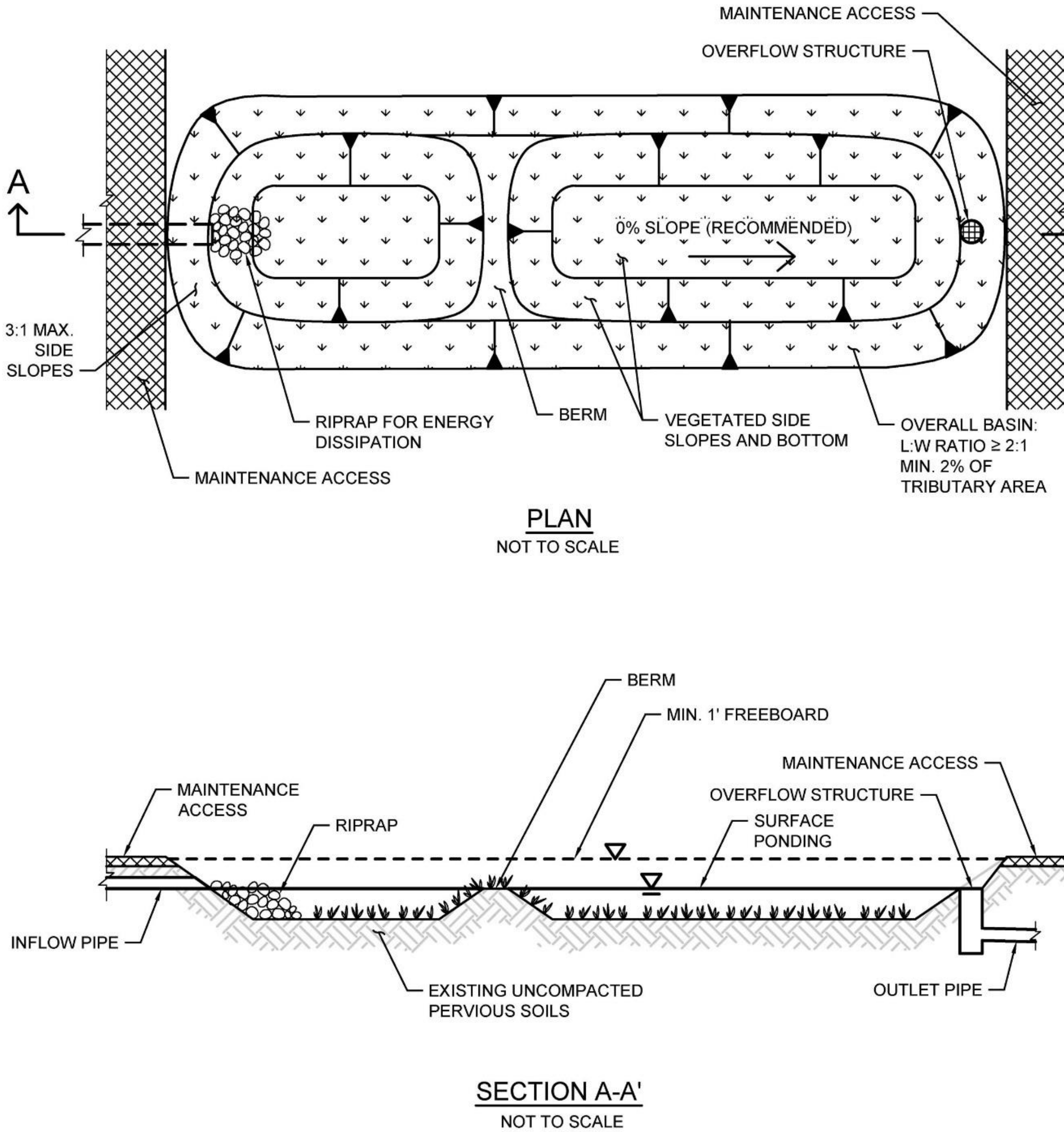
Photo Credit: http://www.stormwaterpartners.com/facilities/basin.html

Description

An infiltration basin typically consists of an earthen basin with a flat bottom constructed in naturally pervious soils. An infiltration basin retains storm water and allows it to evaporate and/or percolate into the underlying soils. The bottom of an infiltration basin is typically vegetated with native grasses or turf grass; however other types of vegetation can be used if they can survive periodic inundation and long inter-event dry periods. Treatment is achieved primarily through infiltration, filtration, sedimentation, biochemical processes and plant uptake. Infiltration basins can be constructed as linear **trenches** or as **underground infiltration galleries**.

Typical infiltration basin components include:

- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Forebay to provide pretreatment surface ponding for captured flows
- Vegetation selected based on basin use, climate, and ponding depth
- Uncompacted native soils at the bottom of the facility
- Overflow structure



Typical plan and section view of an Infiltration BMP

Design Adaptations for Project Goals

Full infiltration BMP for storm water pollutant control. Infiltration basins can be used as a pollutant control BMP, designed to infiltrate runoff from direct rainfall as well as runoff from adjacent areas that are tributary to the BMP. Infiltration basins must be designed with an infiltration storage volume (a function of the surface ponding volume) equal to the full DCV and able to meet drawdown time limitations.

Integrated storm water flow control and pollutant control configuration. Infiltration basins can also be designed for flow rate and duration control by providing additional infiltration storage through increasing the surface ponding volume.

Design Criteria and Considerations

Infiltration basins must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	***Intent/Rationale***
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a full infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
☐	Finish grade of the facility is ≤ 2% (0% recommended).	Flatter surfaces reduce erosion and channelization with the facility.
☐	Settling forebay has a volume ≥ 25% of facility volume below the forebay overflow.	A forebay to trap sediment can decrease frequency of required maintenance.
☐	Infiltration of surface ponding is limited to a 36-hour drawdown time.	Prolonged surface ponding reduce volume available to capture subsequent storms. The applicant has an option to use a different drawdown time up to 96 hours if the volume of the facility is adjusted using the percent capture method in Appendix B.4.2.
☐	Minimum freeboard provided is ≥1 foot.	Freeboard minimizes risk of uncontrolled surface discharge.
☐	Side slopes are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.

	Siting and Design	Intent/Rationale
Inflow and Overflow Structures		
☐	Inflow and outflow structures are accessible by required equipment (e.g., vactor truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control

To design infiltration basins for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement and basin area requirements, forebay volume, and maximum slopes for basin sides and bottom.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet (Appendix B.4) to determine if full infiltration of the DCV is achievable based on the infiltration storage volume calculated from the surface ponding area and depth for a maximum 36-hour drawdown time. The drawdown time can be estimated by dividing the average depth of the basin by the design infiltration rate. Appendix D provides guidance on evaluating a site's infiltration rate.

Conceptual Design and Sizing Approach for Storm Water Pollutant Treatment and Flow Control

Control of flow rates and/or durations will typically require significant surface ponding volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement and basin area

requirements, forebay volume, and maximum slopes for basin sides and bottom.

2. Iteratively determine the surface ponding required to provide infiltration storage to reduce flow rates and durations to allowable limits while adhering to the maximum 36-hour drawdown time. Flow rates and durations can be controlled using flow splitters that route the appropriate inflow amounts to the infiltration basin and bypass excess flows to the downstream storm drain system or discharge point.
3. If an infiltration basin cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide additional control.
4. After the infiltration basin has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.9 INF-2 Bioretention

MS4 Permit Category
Retention

Manual Category
Infiltration

Applicable Performance Standard
Pollutant Control Flow Control

Primary Benefits
Volume Reduction Treatment Peak Flow Attenuation

Photo Credit: Ventura County Technical Guidance Document

Description

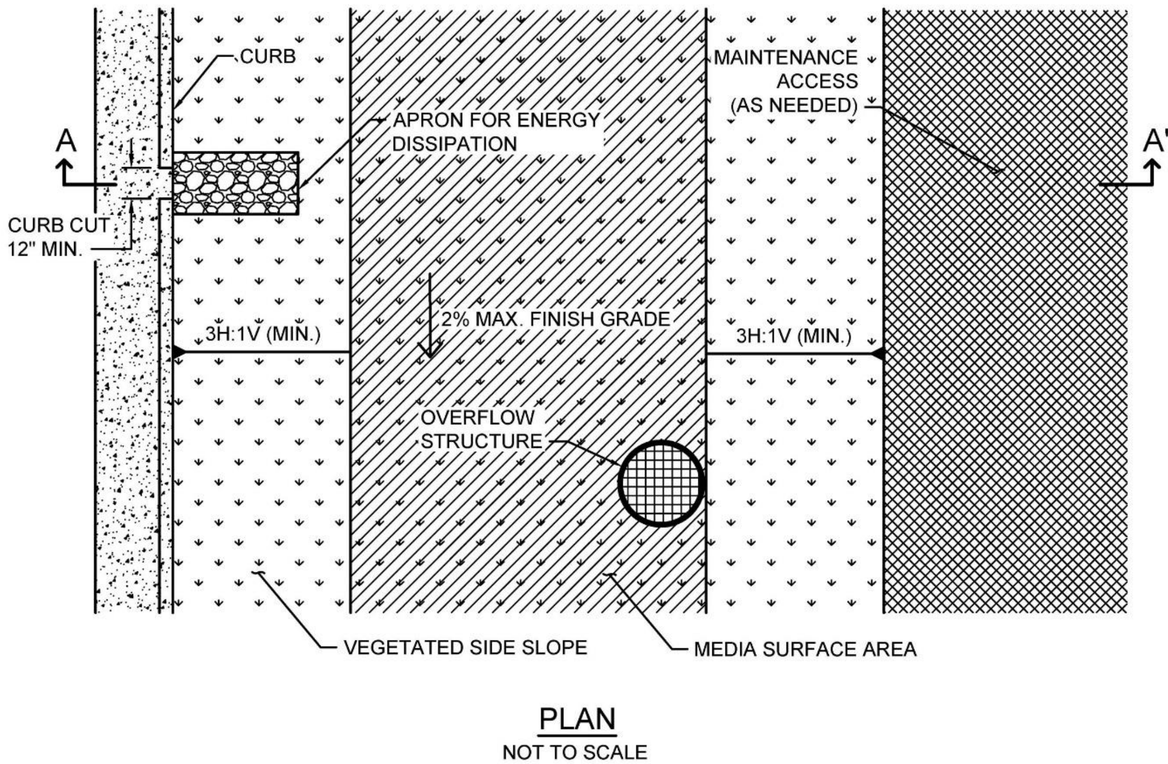
Bioretention (bioretention without underdrain) facilities are vegetated surface water systems that filter water through vegetation and soil, or engineered media prior to infiltrating into native soils. These facilities are designed to infiltrate the full DCV. Bioretention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed inground or partially aboveground, such as planter boxes with open bottoms (no impermeable liner at the bottom) to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

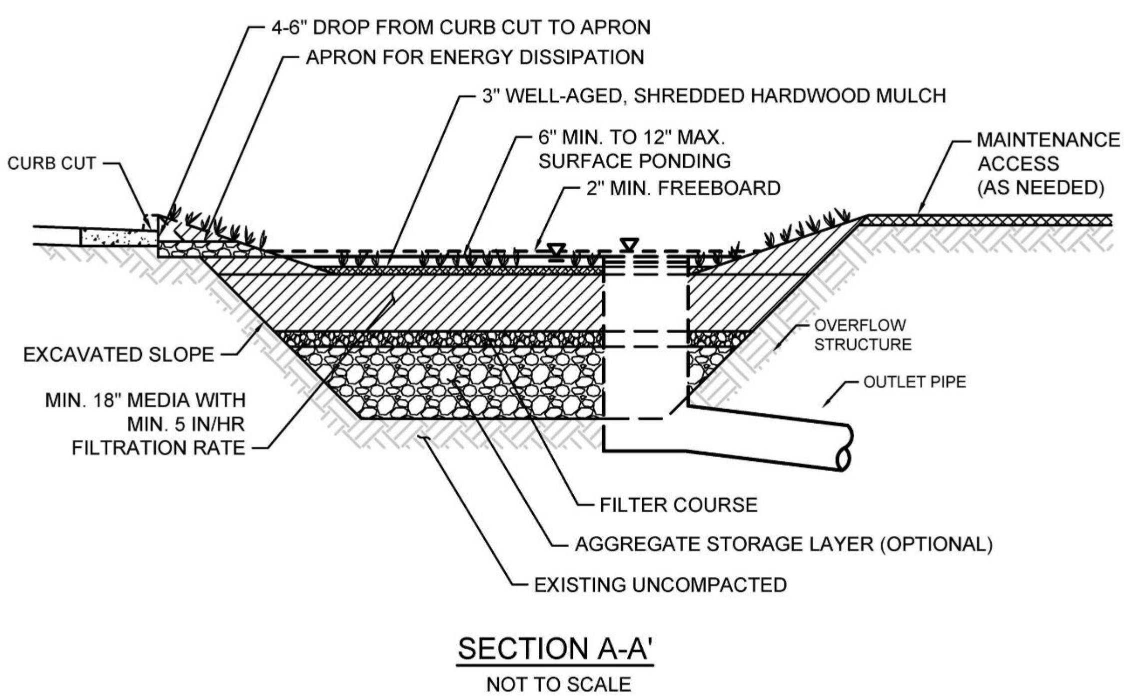
Typical bioretention without underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Optional aggregate storage layer for additional infiltration storage
- Uncompacted native soils at the bottom of the facility
- Overflow structure

Design Adaptations for Project Goals

- **Full infiltration BMP for storm water pollutant control.** Bioretention can be used as a pollutant control BMP designed to infiltrate runoff from direct rainfall as well as runoff from adjacent tributary areas. Bioretention facilities must be designed with an infiltration storage volume (a function of the ponding, media and aggregate storage volumes) equal to the full DCV and able to meet drawdown time limitations.
- **Integrated storm water flow control and pollutant control configuration.** Bioretention facilities can be designed to provide flow rate and duration control. This may be accomplished by providing greater infiltration storage with increased surface ponding and/or aggregate storage volume for storm water flow control.





Typical plan and section view of a Bioretention BMP

Design Criteria and Considerations

Bioretention must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	***Intent/Rationale***
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of BMP is based on infiltration feasibility criteria and appropriate design infiltration rate presented in Appendix C and D.	Must operate as a full infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
☐	Contributing tributary area is ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of the facility is ≤ 2%. In long bioretention facilities where the potential for internal erosion and channelization exists, the use of check dams is required.	Flatter surfaces reduce erosion and channelization within the facility. Internal check dams reduce velocity and dissipate energy.
	Surface Ponding	
☐	Surface ponding is limited to a 24-hour drawdown time.	24-hour drawdown time is recommended for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the Port if certified by a landscape architect or agronomist.

	Siting and Design	*Intent/Rationale*
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the Port if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are ≥ 3H: 1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply is provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows beneficial microbes to multiply.

	Siting and Design	Intent/Rationale
Media Layer		
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. A minimum initial filtration rate of 10 in/hr is recommended.	A high filtration rate through the soil mix minimizes clogging potential and allows flows to quickly enter the aggregate storage layer, thereby minimizing bypass.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards, Appendix F (February 2016, unless superseded by more recent edition) **or** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition).	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed.
☐	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	For proprietary and approved equivalent designs, compliance with F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
Filter Course Layer (Optional)		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.

	Siting and Design	Intent/Rationale
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
Aggregate Storage Layer (Optional)		
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	Maximum aggregate storage layer depth is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time to facilitate provision of adequate storm water storage for the next storm event.
Inflow and Overflow Structures		
☐	Inflow and overflow structures are accessible for inspection and maintenance. Overflow structures must be connected to downstream storm drain system or appropriate discharge point.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement and basin area requirements, maximum side and finish grade slope, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine if full infiltration of the DCV is achievable based on the available infiltration storage volume calculated from the bioretention without underdrain footprint area, effective depths for surface ponding, media and aggregate storage layers, and in-situ soil design infiltration rate for a maximum 36-hour drawdown time for the aggregate storage layer, with surface ponding no greater than a maximum 24-hour drawdown. The drawdown time can be estimated by dividing the average depth of the basin by the design infiltration rate of the underlying soil. Appendix D provides guidance on evaluating a site's infiltration rate. A generic sizing worksheet is provided in Appendix B.4.
4. Where the DCV cannot be fully infiltrated based on the site or bioretention constraints, an underdrain can be added to the design (use biofiltration with partial retention factsheet).

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations shall be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, maximum side and finish grade slopes, and the recommended media surface area tributary area ratio. Design for flow control can be achieved using various design configurations.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide infiltration storage to reduce flow rates and durations to allowable limits while adhering to the maximum drawdown times for surface ponding and aggregate storage. Flow rates and durations can be controlled using flow splitters that route the appropriate inflow amounts to the bioretention facility and bypass excess flows to the downstream storm drain system or discharge point.
3. If bioretention without underdrain facility cannot fully provide the flow rate and duration control required by the MS4 permit, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide additional control.
4. After bioretention without underdrain BMPs have been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.10 INF-3 Permeable Pavement (Pollutant Control)

MS4 Permit Category

Retention
Flow-thru Treatment Control

Manual Category

Infiltration
Flow-thru Treatment Control

Applicable Performance Standard

Pollutant Control
Flow Control

Primary Benefits

Volume Reduction
Peak Flow Attenuation

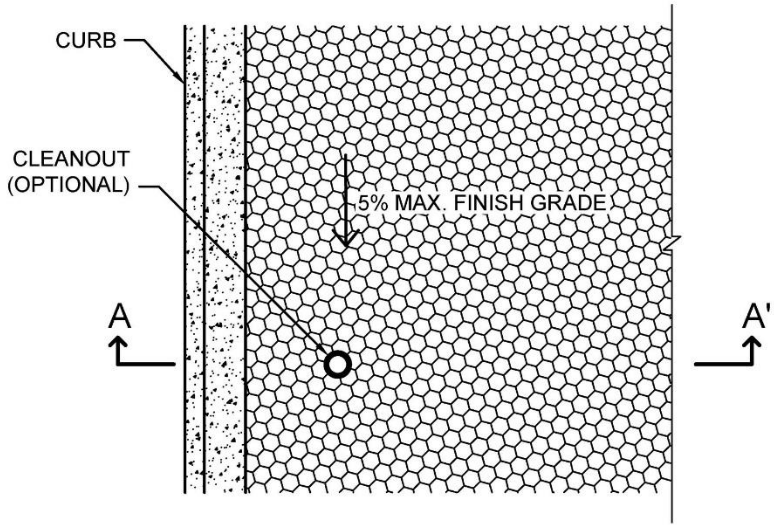
Location: Kellogg Park, San Diego, California

Description

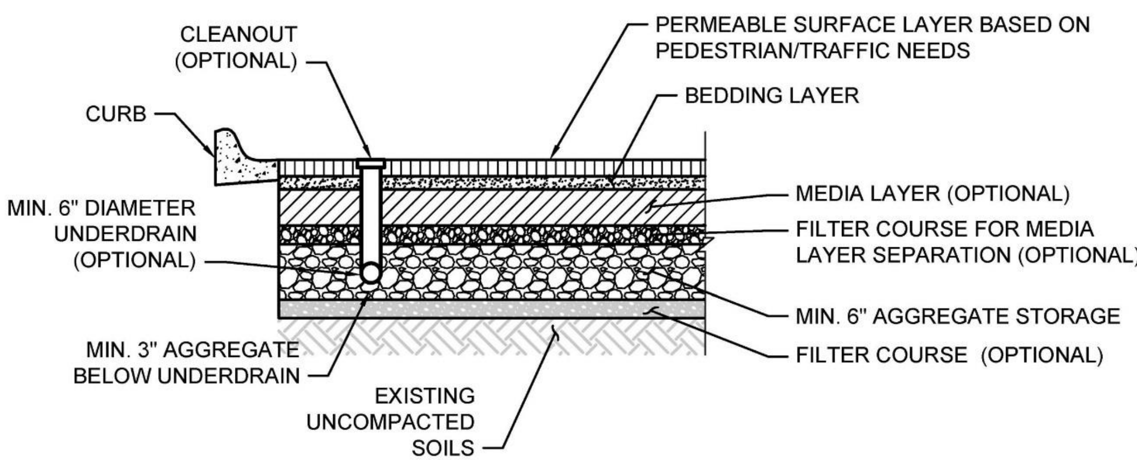
Permeable pavement is pavement that allows for percolation through void spaces in the pavement surface into subsurface layers. The subsurface layers are designed to provide storage of storm water runoff so that outflows, primarily via infiltration into subgrade soils or release to the downstream conveyance system, can be at controlled rates. Varying levels of storm water treatment and flow control can be provided depending on the size of the permeable pavement system relative to its drainage area, the underlying infiltration rates, and the configuration of outflow controls. Pollutant control permeable pavement is designed to receive runoff from a larger tributary area than site design permeable pavement (see SD-6B). Pollutant control is provided via infiltration, filtration, sorption, sedimentation, and biodegradation processes.

Typical permeable pavement components include, from top to bottom:

- Permeable surface layer
- Bedding layer for permeable surface
- Aggregate storage layer with optional underdrain(s)
- Optional final filter course layer over uncompacted existing subgrade



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Permeable Pavement BMP

Subcategories of permeable pavement include modular paver units or paver blocks, pervious concrete, porous asphalt, and turf pavers. These subcategory variations differ in the material used for the permeable surface layer but have similar functions and characteristics below this layer.

Design Adaptations for Project Goals

Site design BMP to reduce impervious area and DCV. See site design option SD-6B.

Full infiltration BMP for storm water pollutant control. Permeable pavement without an underdrain and without impermeable liners can be used as a pollutant control BMP, designed to infiltrate runoff from direct rainfall as well as runoff from adjacent areas that are tributary to the pavement. The system must be designed with an infiltration storage volume (a function of the aggregate storage volume) equal to the full DCV and able to meet drawdown time limitations.

Partial infiltration BMP with flow-thru treatment for storm water pollutant control. Permeable pavement can be designed so that a portion of the DCV is infiltrated by providing an underdrain with infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered flow-thru treatment and is not considered biofiltration treatment. Storage provided above the underdrain invert is included in the flow-thru treatment volume.

Flow-thru treatment BMP for storm water pollutant control. The system may be lined and/or installed over impermeable native soils with an underdrain provided at the bottom to carry away filtered runoff. Water quality treatment is provided via unit treatment processes other than infiltration. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Significant aggregate storage provided above the underdrain invert can provide detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain. **PDPs have the option to add saturated storage to the flow-thru configuration in order to reduce the DCV that the BMP is required to treat.** Saturated storage can be added to this design by including an upturned elbow installed at the downstream end of the underdrain or via an internal weir structure designed to maintain a specific water level elevation. The DCV can be reduced by the amount of saturated storage provided.

Integrated storm water flow control and pollutant control configuration. With any of the above configurations, the system can be designed to provide flow rate and duration control. This may include having a deeper aggregate storage layer that allows for significant detention storage above the underdrain, which can be further controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Permeable pavements must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection must be based on infiltration feasibility criteria.	Full or partial infiltration designs must be supported by drainage area feasibility findings.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Permeable pavement is not placed in an area with significant overhanging trees or other vegetation.	Leaves and organic debris can clog the pavement surface.
☐	For pollutant control permeable pavement, the ratio of the total drainage area (including the permeable pavement) to the permeable pavement should not exceed 4:1.	Higher ratios increase the potential for clogging but may be acceptable for relatively clean tributary areas.
☐	Finish grade of the permeable pavement has a slope ≤ 5%.	Flatter surfaces facilitate increased runoff capture.
☐	Minimum depth to groundwater and bedrock ≥ 10 ft.	A minimum separation facilitates infiltration and lessens the risk of negative groundwater impacts.
☐	Contributing tributary area includes effective sediment source control and/or pretreatment measures such as raised curbed or grass filter strips.	Sediment can clog the pavement surface.

	Siting and Design	*Intent/Rationale*
☐	Direct discharges to permeable pavement are only from downspouts carrying "clean" roof runoff that are equipped with filters to remove gross solids.	Roof runoff typically carries less sediment than runoff from other impervious surfaces and is less likely to clog the pavement surface.
	Permeable Surface Layer	
☐	Permeable surface layer type is appropriately chosen based on pavement use and expected vehicular loading.	Pavement may wear more quickly if not durable for expected loads or frequencies.
☐	Permeable surface layer type is appropriate for expected pedestrian traffic.	Expected demographic and accessibility needs (e.g., adults, children, seniors, runners, high-heeled shoes, wheelchairs, strollers, bikes) requires selection of appropriate surface layer type that will not impede pedestrian needs.
	Bedding Layer for Permeable Surface	
☐	Bedding thickness and material is appropriate for the chosen permeable surface layer type.	Porous asphalt requires a 2- to 4-inch layer of asphalt and a 1- to 2-inch layer of choker course (single-sized crushed aggregate, one-half inch) to stabilize the surface. Pervious concrete also requires an aggregate course of clean gravel or crushed stone with a minimum amount of fines. Permeable Interlocking Concrete Paver requires 1 or 2 inches of sand or No. 8 aggregate to allow for leveling of the paver blocks. Similar to Permeable Interlocking Concrete Paver, plastic grid systems also require a 1- to 2-inch bedding course of either gravel or sand. For Permeable Interlocking Concrete Paver and plastic grid systems, if sand is used, a geotextile should be used between the sand course and the reservoir media to prevent the sand from migrating into the stone media.

	Siting and Design	*Intent/Rationale*
☐	Aggregate used for bedding layer is washed prior to placement.	Washing aggregate will help eliminate fines that could clog the permeable pavement system aggregate storage layer void spaces or underdrain.
Media Layer (Optional) –used between bedding layer and aggregate storage layer to provide pollutant treatment control		
☐	The pollutant removal performance of the media layer is documented by the applicant.	Media used for BMP design should be shown via research or testing to be appropriate for expected pollutants of concern and flow rates.
☐	A filter course is provided to separate the media layer from the aggregate storage layer.	Migration of media can cause clogging of the aggregate storage layer void spaces or underdrain.
☐	If a filter course is used, calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
☐	Consult permeable pavement manufacturer to verify that media layer provides required structural support.	Media must not compromise the structural integrity or intended uses of the permeable pavement surface.
Aggregate Storage Layer		
☐	Aggregate used for the aggregate storage layer is washed and free of fines.	Washing aggregate will help eliminate fines that could clog aggregate storage layer void spaces or underdrain.
☐	Minimum layer depth is 6 inches and for infiltration designs, the maximum depth is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A minimum depth of aggregate provides structural stability for expected pavement loads.
Underdrain and Outflow Structures		
☐	Underdrains and outflow structures, if used, are accessible for inspection and maintenance.	Maintenance will improve the performance and extend the life of the permeable pavement system.

	Siting and Design	*Intent/Rationale*
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
	Filter Course (Optional)	
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog subgrade and impede infiltration.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where permeable pavement can be used in the site design to replace traditional pavement to reduce the impervious area and DCV. These permeable pavement areas can be credited toward reducing runoff generated through representation in storm water calculations as pervious, not impervious, areas but are not credited for storm water pollutant control. These permeable pavement areas should be designed as self-retaining with the appropriate tributary area ratio identified in the design criteria.
2. Calculate the DCV per Appendix B, taking into account reduced runoff from self-retaining permeable pavement areas.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design permeable pavement for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, maximum finish grade slope, and the recommended tributary area ratio for non-self-retaining permeable pavement. If infiltration is infeasible, the permeable pavement can be designed as flow-thru treatment per the sizing worksheet. If infiltration is feasible, calculations should follow the remaining design steps.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.

3. Use the sizing worksheet to determine if full or partial infiltration of the DCV is achievable based on the available infiltration storage volume calculated from the permeable pavement footprint, aggregate storage layer depth, and in-situ soil design infiltration rate for a maximum 36-hour drawdown time. The applicant has an option to use a different drawdown time up to 96 hours if the volume of the facility is adjusted using the percent capture method in Appendix B.4.2.
4. Where the DCV cannot be fully infiltrated based on the site or permeable pavement constraints, an underdrain must be incorporated above the infiltration storage to carry away runoff that exceeds the infiltration storage capacity.
5. The remaining DCV to be treated should be calculated for use in sizing downstream BMP(s).

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, maximum finish grade slope, and the recommended tributary area ratio for non-self-retaining permeable pavement. Design for flow control can be achieving using various design configurations, but a flow-thru treatment design will typically require a greater aggregate storage layer volume than designs which allow for full or partial infiltration of the DCV.
2. Iteratively determine the area and aggregate storage layer depth required to provide infiltration and/or detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If the permeable pavement system cannot fully provide the flow rate and duration control required by this manual, a downstream structure with sufficient storage volume such as an underground vault can be used to provide remaining controls.
4. After permeable pavement has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.11 PR-1 Biofiltration with Partial Retention

Location: 805 and Bonita Road, Chula vista, CA.

MS4 Permit Category
NA

Manual Category
Partial Retention

Applicable Performance Standard
Pollutant Control
Flow Control

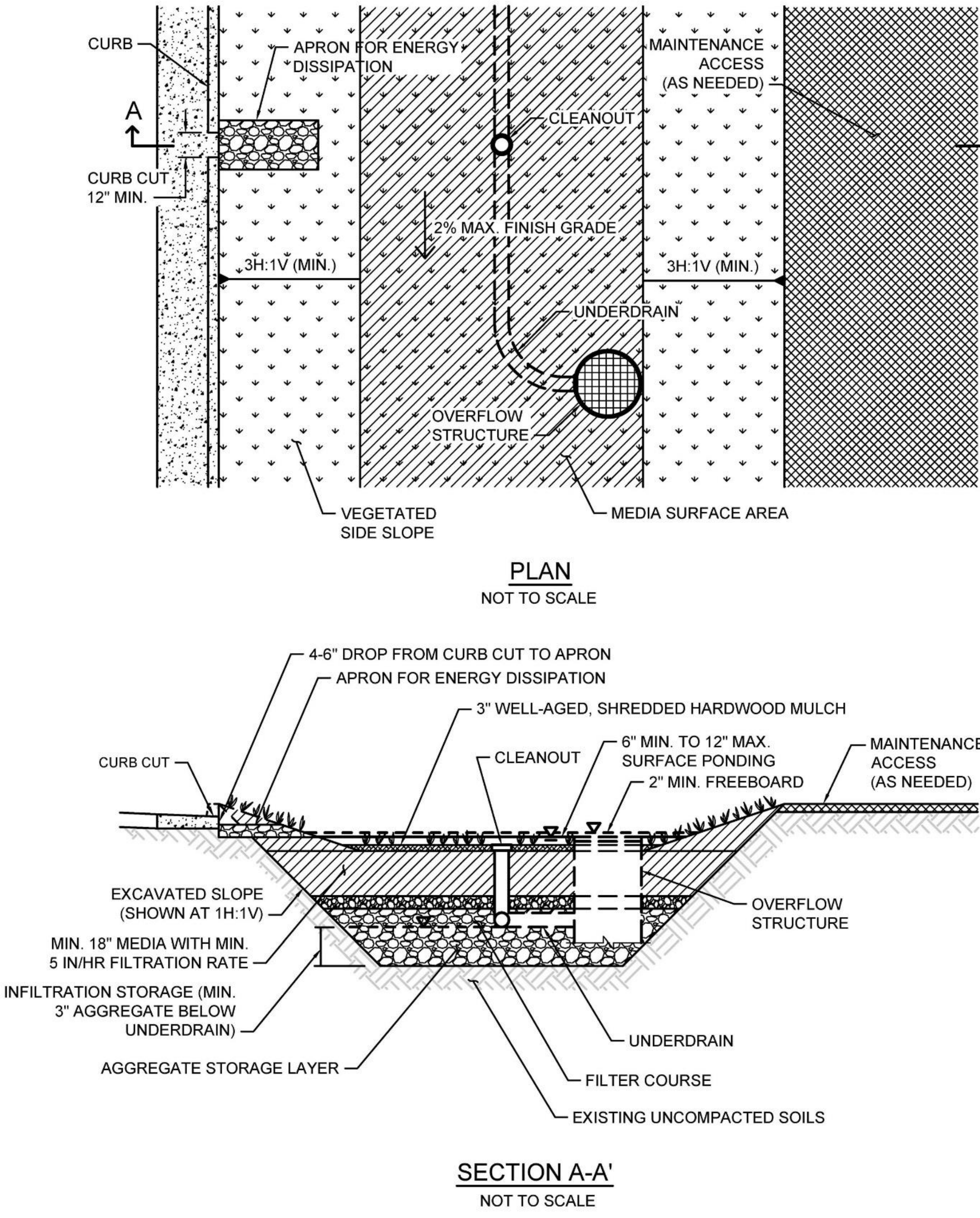
Primary Benefits
Volume Reduction
Treatment
Peak Flow Attenuation

Description

Biofiltration with partial retention (partial infiltration and biofiltration) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to infiltrating into native soils, discharge via underdrain, or overflow to the downstream conveyance system. Where feasible, these BMPs have an elevated underdrain discharge point that creates storage capacity in the aggregate storage layer. Biofiltration with partial retention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed in ground or partially aboveground, such as planter boxes with open bottoms to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

Typical biofiltration with partial retention components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side Slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Uncompacted native soils at the bottom of the facility
- Overflow structure



Typical plan and Section view of a Biofiltration with Partial Retention BMP

Design Adaptations for Project Goals

Partial infiltration BMP with biofiltration treatment for storm water pollutant control. Biofiltration with partial retention can be designed so that a portion of the DCV is infiltrated by providing infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered biofiltration treatment. Storage provided above the underdrain within surface ponding, media, and aggregate storage is included in the biofiltration treatment volume.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer. This will allow for significant detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Biofiltration with partial retention must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a partial infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.

	Siting and Design	Intent/Rationale
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
	Surface Ponding	
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the Port if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the Port if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.

Siting and Design		*Intent/Rationale*
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events, and allows flows to relatively quickly enter the aggregate storage layer, thereby minimizing bypass. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.

	Siting and Design	*Intent/Rationale*
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards Appendix F (February 2016, unless superseded by more recent edition) **or** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary approved equivalent designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.

	Siting and Design	Intent/Rationale
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
Aggregate Storage Layer		
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	Maximum aggregate storage layer depth below the underdrain invert is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time is needed for vector control and to facilitate providing storm water storage for the next storm event.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it

	Siting and Design	Intent/Rationale
		grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Nutrient Sensitive Media Design

To design biofiltration with partial retention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design biofiltration with partial retention and an underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Generalized sizing procedure is presented in Appendix B.5. The surface ponding should be verified to have a maximum 24-hour drawdown time.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention and/or infiltration storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If biofiltration with partial retention cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After biofiltration with partial retention has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.12 BF-1 Biofiltration

MS4 Permit Category
Biofiltration

Manual Category
Biofiltration

Applicable Performance Standard
Pollutant Control Flow Control

Primary Benefits
Treatment Volume Reduction (Incidental) Peak Flow Attenuation (Optional)

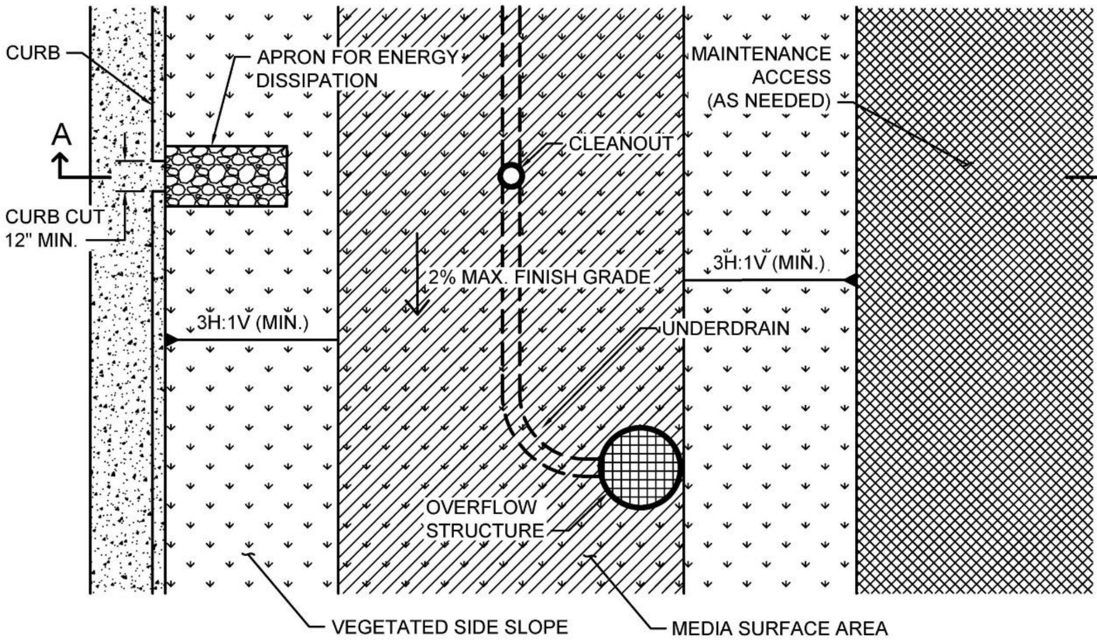
Location: 43rd Street and Logan Avenue, San Diego, California

Description

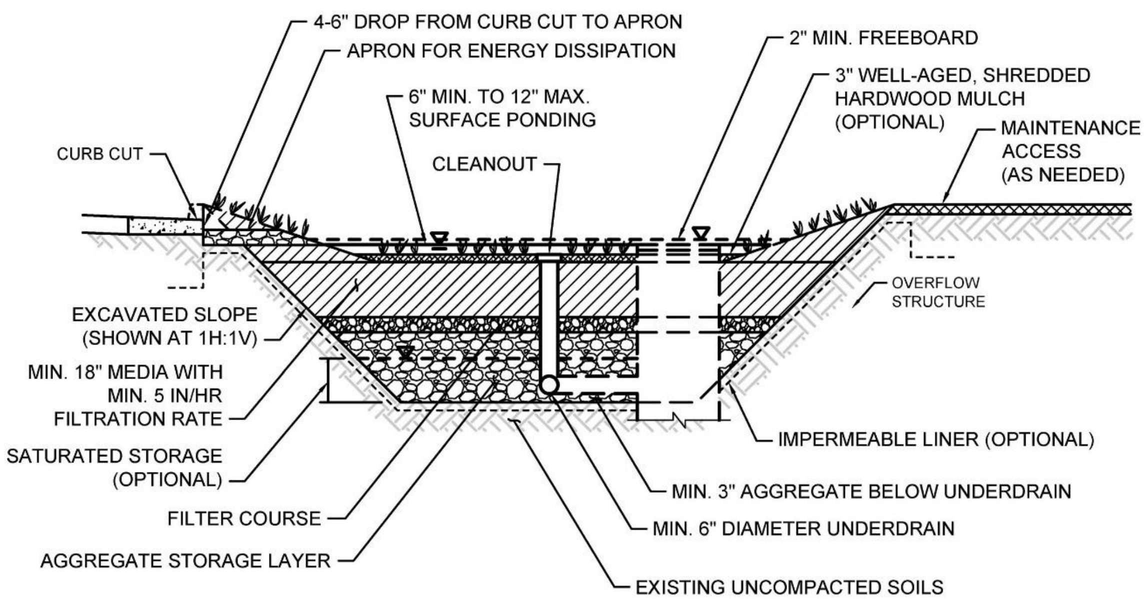
Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.

	Siting and Design	*Intent/Rationale*
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
	Surface Ponding	
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the Port if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the Port if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18” will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.

	Siting and Design	Intent/Rationale
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards Appendix F (February 2016, unless superseded by more recent edition) **or** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed.

	Siting and Design	Intent/Rationale
	(June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	For non-standard or proprietary approved equivalent designs, compliance with F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.

	Siting and Design	Intent/Rationale
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.

Aggregate Storage Layer

☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.

Inflow, Underdrain, and Outflow Structures

☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve

	Siting and Design	*Intent/Rationale*
		hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended

media surface area tributary ratio.

2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.13 BF-2 Nutrient Sensitive Media Design

Some studies of bioretention with underdrains have observed export of nutrients, particularly inorganic nitrogen (nitrate and nitrite) and dissolved phosphorus. This has been observed to be a short-lived phenomenon in some studies or a long term issue in some studies. The composition of the soil media, including the chemistry of individual elements is believed to be an important factor in the potential for nutrient export. Organic amendments, often compost, have been identified as the most likely source of nutrient export. The quality and stability of organic amendments can vary widely.

The biofiltration media specifications contained in the County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition) and the City of San Diego Low Impact Development Design Manual (page B-18) (July 2011, unless superseded by more recent edition) were developed with consideration of the potential for nutrient export. These specifications include criteria for individual component characteristics and quality in order to control the overall quality of the blended mixes. As of the publication of this manual, the June 2014 County of San Diego specifications provide more detail regarding mix design and quality control.

The City and County specifications noted above were developed for general purposes to meet permeability and treatment goals. In cases where the BMP discharges to receiving waters with nutrient impairments or nutrient TMDLs, the biofiltration media should be designed with the specific goal of minimizing the potential for export of nutrients from the media. Therefore, in addition to adhering to the City or County media specifications, the following guidelines should be followed:

1. Select plant palette to minimize plant nutrient needs

A landscape architect or agronomist should be consulted to select a plant palette that minimizes nutrient needs. Utilizing plants with low nutrient needs results in less need to enrich the biofiltration soil mix. If nutrient quantity is then tailored to plants with lower nutrient needs, these plants will generally have less competition from weeds, which typically need higher nutrient content. The following practices are recommended to minimize nutrient needs of the plant palette:

- **Utilize native, drought-tolerant plants and grasses where possible.** Native plants generally have a broader tolerance for nutrient content, and can be longer lived in leaner/lower nutrient soils.

- **Start plants from smaller starts or seed.** Younger plants are generally more tolerant of lower nutrient levels and tend to help develop soil structure as they grow. Given the lower cost of smaller plants, the project should be able to accept a plant mortality rate that is somewhat higher than starting from larger plants and providing high organic content.

2. Minimize excess nutrients in media mix

Once the low-nutrient plant palette is established (item 1), the landscape architect and/or agronomist should be consulted to assist in the design of a biofiltration media to balance the interests of plant establishment, water retention capacity (irrigation demand), and the potential for nutrient export. The following guidelines should be followed:

- **The mix should not exceed the nutrient needs of plants.** In conventional landscape design, the nutrient needs of plants are often exceeded intentionally in order to provide a factor of safety for plant survival. This practice must be avoided in biofiltration media as excess nutrients will increase the chance of export. The mix designer should keep in mind that nutrients can be added later (through mulching, tilling of amendments into the surface), but it is not possible to remove nutrients, once added.

- **The actual nutrient content and organic content of the selected organic amendment source should be determined when specifying mix proportions.** Nutrient content (i.e., C:N ratio; plant extractable nutrients) and organic content (i.e, % organic material) are relatively inexpensive to measure via standard agronomic methods and can provide important information about mix design. If mix design relies on approximate assumption about nutrient/organic content and this is not confirmed with testing (or the results of prior representative testing), it is possible that the mix could contain much more nutrient than intended.

- **Nutrients are better retained in soils with higher cation exchange capacity.** Cation exchange capacity can be increased through selection of organic material with naturally high cation exchange capacity, such as peat or coconut coir pith, and/or selection of inorganic material with high cation exchange capacity such as some sands or engineered minerals (e.g., low P-index sands, zeolites, rhyolites, etc). Including higher cation exchange capacity materials would tend to reduce the net export of nutrients. Natural silty materials also provide cation exchange capacity; however potential impacts to permeability need to be considered.

- **Focus on soil structure as well as nutrient content.** Soil structure is loosely defined as the ability of the soil to conduct and store water and nutrients as well as the degree of aeration of the soil. Soil structure can be more important than nutrient content in plant survival and biologic health of the system. If a good soil structure can be created with very low amounts of organic amendment, plants survivability should still be provided. While soil structure generally develops with time, biofiltration media can be designed to promote earlier development of soil structure. Soil structure is enhanced by the use of amendments with high humus content (as found in well-aged organic material). In addition, soil structure can be enhanced through the use of organic material with a distribution of particle sizes (i.e., a more heterogeneous mix).

- **Consider alternatives to compost.** Compost, by nature, is a material that is continually evolving and decaying. It can be challenging to determine whether tests previously done on a given compost stock are still representative. It can also be challenging to determine how the properties of the compost will change once placed in the media bed. More stable materials such as aged coco coir pith, peat, biochar, shredded bark, and/or other amendments should be considered.

With these considerations, it is anticipated that less than 10 percent organic amendment by volume could be used, while still balancing plant survivability and water retention. If compost is used, designers should strongly consider utilizing less than 10 percent by volume.

3. Design with partial retention and/or internal water storage

An internal water storage zone, as described in Fact Sheet PR-1 is believed to improve retention of nutrients. For lined systems, an internal water storage zone worked by providing a zone that fluctuates between aerobic and anaerobic conditions, resulting in nitrification/denitrification. In soils that will allow infiltration, a partial retention design (PR-1) allows significant volume reduction and can also promote nitrification/denitrification.

Acknowledgment: This fact sheet has been adapted from the Orange County Technical Guidance Document (May 2011). It was originally developed based on input from: Deborah Deets, City of Los Angeles Bureau of Sanitation, Drew Ready, Center for Watershed Health, Rick Fisher, ASLA, City of Los Angeles Bureau of Engineering, Dr. Garn Wallace, Wallace Laboratories, Glen Dake, GDML, and Jason Schmidt, Tree People. The guidance provided herein does not reflect the individual opinions of any individual listed above and should not be cited or otherwise attributed to those listed.

E.14 BF-3 Proprietary Biofiltration Systems

The purpose of this fact sheet is to help explain the potential role of proprietary BMPs in meeting biofiltration requirements, when full retention of the DCV is not feasible. The fact sheet does not describe design criteria like the other fact sheets in this appendix because this information varies by BMP product model.

Criteria for Use of a Proprietary BMP as a Biofiltration BMP

A proprietary BMP may be acceptable as a "biofiltration BMP" under the following conditions:

(1) The BMP meets the minimum design criteria listed in Appendix F, including the pollutant treatment performance standard in Appendix F.1;

(2) The BMP is designed and maintained in a manner consistent with its performance certifications (See explanation in Appendix F.2); <u>and</u>

(3) The BMP is acceptable at the discretion of the Port. In determining the acceptability of a BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant..

Guidance for Sizing a Proprietary BMP as a Biofiltration BMP

Proprietary biofiltration BMPs must meet the same sizing guidance as non-proprietary BMPs. Sizing is typically based on capturing and treating 1.50 times the DCV not reliably retained. Guidance for sizing biofiltration BMPs to comply with requirements of this manual is provided in Appendix F.2.

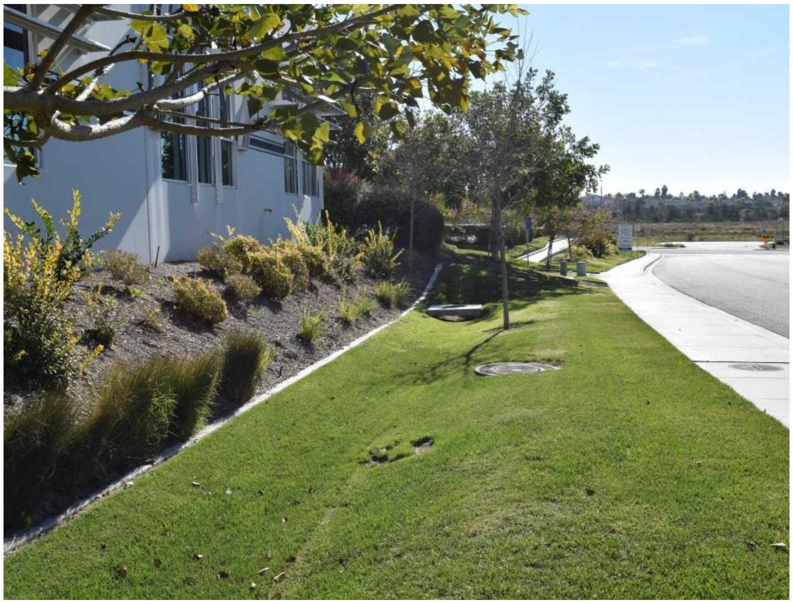
E.15 FT-1 Vegetated Swales

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation



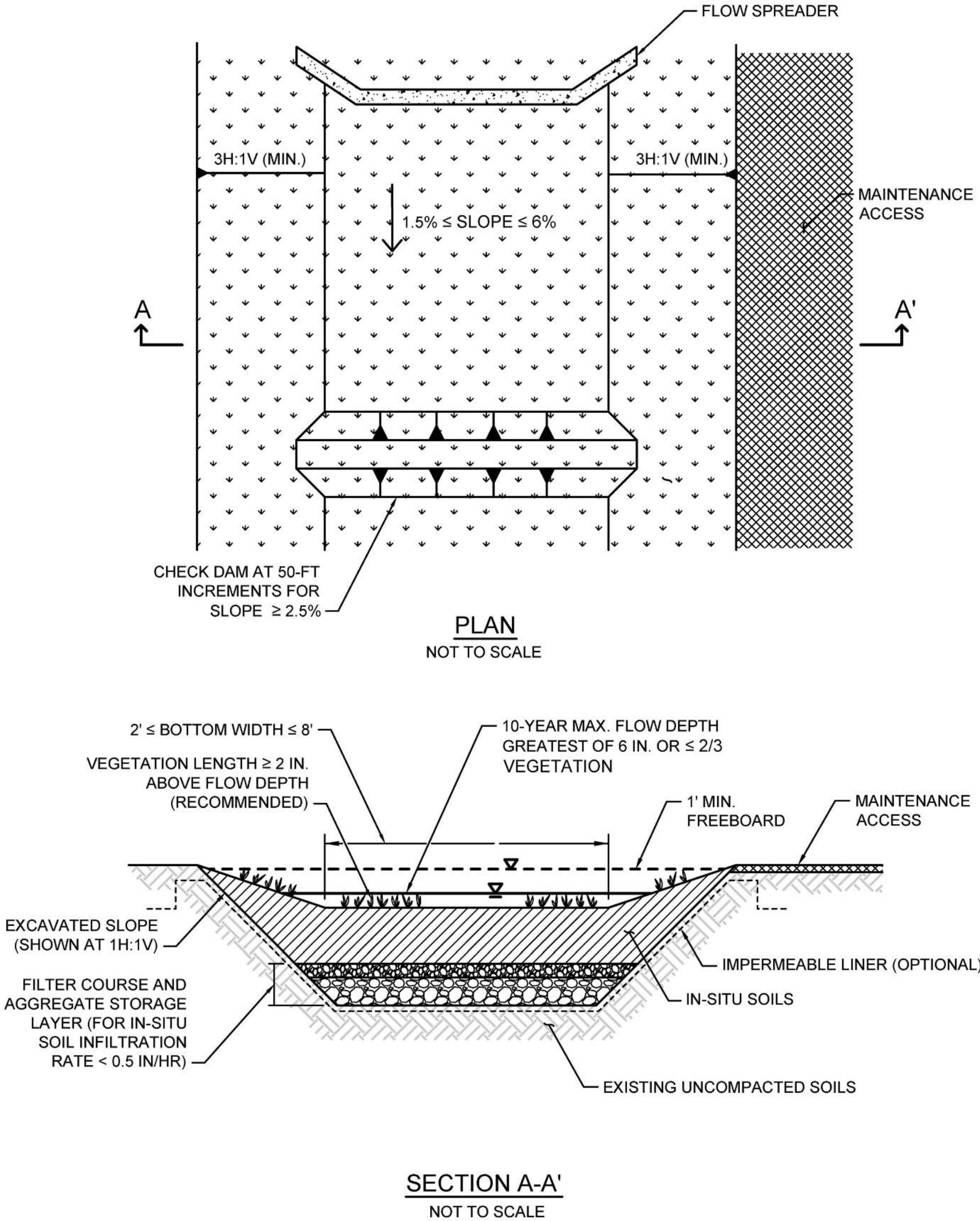
Location: Eastlake Business Center, Chula Vista, California; Photo Credit: Eric Mosolgo

Description

Vegetated swales are shallow, open channels that are designed to remove storm water pollutants by physically straining/filtering runoff through vegetation in the channel. Swales can be used in place of traditional curbs and gutters and are well-suited for use in linear transportation corridors to provide both conveyance and treatment via filtration. An effectively designed vegetated swale achieves uniform sheet flow through densely vegetated areas. When soil conditions allow, infiltration and volume reduction are enhanced by adding a gravel drainage layer underneath the swale. Vegetated swales with a subsurface media layer can provide enhanced infiltration, water retention, and pollutant-removal capabilities. Pollutant removal effectiveness can also be maximized by increasing the hydraulic residence time of water in swale using weirs or check dams.

Typical vegetated swale components include:

- Inflow distribution mechanisms (e.g., flow spreader)
- Surface flow
- Vegetated surface layer
- Check dams (if required)
- Optional aggregate storage layer with underdrain(s)



Typical plan and Section view of a Vegetated Swale BMP

Design Adaptations for Project Goals

Site design BMP to reduce runoff volumes and storm peaks. Swales without underdrains are an alternative to lined channels and pipes and can provide volume reduction through infiltration. Swales can also reduce the peak runoff discharge rate by increasing the time of concentration of the site and decreasing runoff volumes and velocities.

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration with an underdrain and designed to provide pollutant removal through settling and filtration in the channel vegetation (usually grasses). This configuration is considered to provide flow-thru treatment via horizontal surface flow through the swale. Sizing for flow-thru treatment control is based on the surface flow rate through the swale that meets water quality treatment performance objectives.

Design Criteria and Considerations

Vegetated swales must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Contributing tributary area ≤ 2 acres.	Higher ratios increase the potential for clogging but may be acceptable for relatively clean tributary areas.
☐	Longitudinal slope is ≥ 1.5% and ≤ 6%.	Flatter swales facilitate increased water quality treatment while minimum slopes prevent ponding.
☐	For site design goal, in-situ soil infiltration rate ≥ 0.5 in/hr (if < 0.5 in/hr, an underdrain is required and design goal is for pollutant control only).	Well-drained soils provide volume reduction and treatment. An underdrain should only be provided when soil infiltration rates are low or per geotechnical or groundwater concerns.

	Siting and Design	***Intent/Rationale***
Surface Flow		
☐	Maximum flow depth is ≤ 6 inches or ≤ $^{2}/_{3}$ the vegetation length, whichever is greater. Ideally, flow depth will be ≥ 2 inches below shortest plant species.	Flow depth must fall within the height range of the vegetation for effective water quality treatment via filtering.
	A minimum of 1 foot of freeboard is provided.	Freeboard minimizes risk of uncontrolled surface discharge.
☐	Cross sectional shape is trapezoidal or parabolic with side slopes ≥ 3H:1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
☐	Bottom width is ≥ 2 feet and ≤ 8 feet.	A minimum of 2 feet minimizes erosion. A maximum of 8 feet prevents channel braiding.
☐	Minimum hydraulic residence time ≥ 10 minutes.	Longer hydraulic residence time increases pollutant removal.
☐	Swale is designed to safely convey the 10-yr storm event unless a flow splitter is included to allow only the water quality event.	Planning for larger storm events lessens the risk of property damage due to flooding.
☐	Flow velocity is ≤ 1 ft/s for water quality event. Flow velocity for 10-yr storm event is ≤ 3 ft/s.	Lower flow velocities provide increased pollutant removal via filtration and minimize erosion.
Vegetated Surface Layer (amendment with media is Optional)		
☐	Soil is amended with 2 inches of media mixed into the top 6 inches of in-situ soils, as needed, to promote plant growth (optional). For enhanced pollutant control, 2 feet of media can be used in place of in-situ soils. Media meets either of these two media specifications: City of San Diego Storm Water Standards Appendix F, February 2016); Or County of San Diego Low Impact Development Handbook, June 2014: Appendix G -Bioretention Soil Specification.	Amended soils aid in plant establishment and growth. Media replacement for in-situ soils can improve water quality treatment and site design volume reduction.

	Siting and Design	Intent/Rationale
☐	Vegetation is appropriately selected low-growing, erosion-resistant plant species that effectively bind the soil, thrive under site-specific climatic conditions and require little or no irrigation.	Plants suited to the climate and expected flow conditions are more likely to survive.
	Check Dams	
☐	Check dams are provided at 50-foot increments for slopes ≥ 2.5%.	Check dams prevent erosion and increase the hydraulic residence time by lowering flow velocities and providing ponding opportunities.
	Filter Course Layer (For Underdrain Design)	
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
	Aggregate Storage Layer (For Underdrain Design)	
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
☐	Aggregate used for the aggregate storage layer is washed and free of fines.	Washing aggregate will help eliminate fines that could clog aggregate storage layer void spaces or underdrain.
	Inflow and Underdrain Structures	
☐	Inflow and underdrains are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.

	Siting and Design	*Intent/Rationale*
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.

Conceptual Design and Sizing Approach for Site Design

1. Determine the areas where vegetated swales can be used in the site design to replace traditional curb and gutter facilities and provide volume reduction through infiltration.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design vegetated swales for storm water pollutant control only, the following steps should be taken:

1. Verify that siting and design criteria have been met, including bottom width and longitudinal and side slope requirements.
2. Calculate the design flow rate per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine flow-thru treatment sizing of the vegetated swale and if flow velocity, flow depth, and hydraulic residence time meet required criteria. Swale configuration should be adjusted as necessary to meet design requirements.

E.16 FT-2 Media Filters

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Peak Flow Attenuation (Optional)

Photo Credit: Contech Stormwater Solutions

Description

Media filters are manufactured devices that consist of a series of modular filters packed with engineered media that can be contained in a catch basin, manhole, or vault that provide treatment through filtration and sedimentation. The manhole or vault may be divided into multiple chambers where the first chamber acts as a presettling basin for removal of coarse sediment while the next chamber acts as the filter bay and houses the filter cartridges. A variety of media types are available from various manufacturers that can target pollutants of concern via primarily filtration, sorption, ion exchange, and precipitation. **Specific products must be selected to meet the flow-thru BMP selection requirements described in Appendix B.6**. Treatment effectiveness is contingent upon proper maintenance of filter units.

Typical media filter components include:

- Vault for flow storage and media housing
- Inlet and outlet
- Media filters

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. Water quality treatment is provided through filtration. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Storage provided within the vault restricted by an outlet is considered detention storage and is included in calculations for the flow-thru treatment volume.

Integrated storm water flow control and pollutant control configuration. Media filters can also be designed for flow rate and duration control via additional detention storage. The vault storage can be designed to accommodate higher volumes than the storm water pollutant control volume and can utilize multi-stage outlets to mitigate both the duration and rate of flows within a prescribed range.

Design Criteria and Considerations

Media filters must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Recommended for tributary areas with limited available surface area or where surface BMPs would restrict uses.	Maintenance needs may be more labor intensive for media filters than surface BMPs. Lack of surface visibility creates additional risk that maintenance needs may not be completed in a timely manner.
☐	Vault storage drawdown time ≤96 hours.	Provides vector control.
☐	Vault storage drawdown time ≤36 hours if the vault is used for equalization of flows for pollutant treatment.	Provides required capacity to treat back to back storms. Exception to the 36 hour drawdown criteria is allowed if additional vault storage is provided using the curves in Appendix B.4.2.
	Inflow and Outflow Structures	
☐	Inflow and outflow structures are accessible by required equipment (e.g., vactor truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design a media filter for storm water pollutant control only (no flow control required), the following steps should be taken

1. Verify that the selected BMP complies with BMP selection requirements in Appendix B.6.
2. Verify that placement and tributary area requirements have been met.
3. Calculate the required DCV and/or flow rate per Appendix B.6.3 based on expected site design runoff for tributary areas.
4. Media filter can be designed either for DCV or flow rate. To estimate the drawdown time, divide the vault storage by the treatment rate of media filters.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant vault storage volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that placement and tributary area requirements have been met.
2. Iteratively determine the vault storage volume required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows to MS4.
3. If a media filter cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide remaining controls.
4. After the media filter has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.
5. Verify that the vault drawdown time is 96 hours or less. To estimate the drawdown time:
    a. Divide the vault volume by the filter surface area.
    b. Divide the result (a) by the design filter rate.

E.17 FT-3 Sand Filters

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

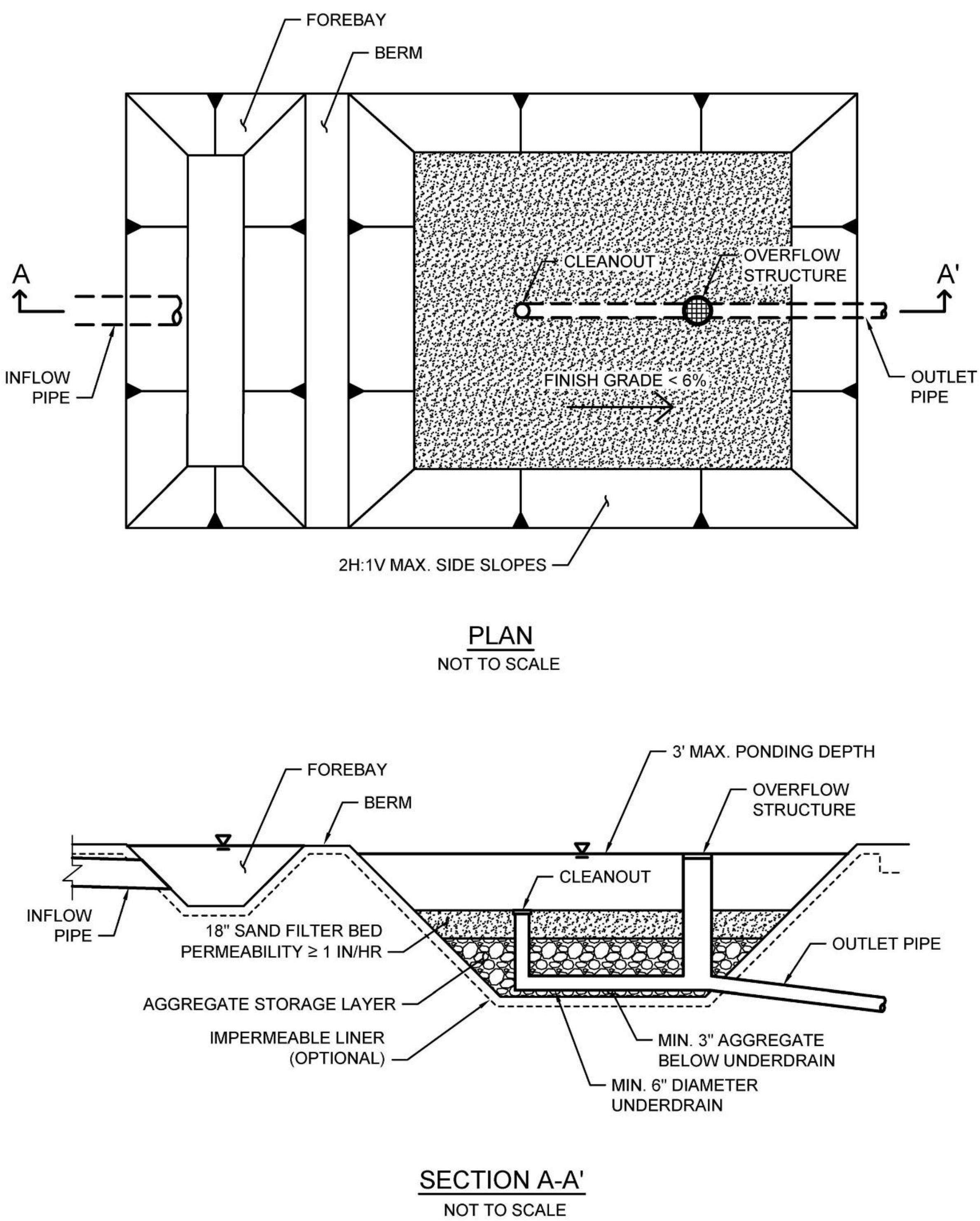
Photo Credit: City of San Diego LID Manual

Description

Sand filters operate by filtering storm water through a constructed sand bed with an underdrain system. Runoff enters the filter and spreads over the surface. Sand filter beds can be enclosed within concrete structures or within earthen containment. As flows increase, water backs up on the surface of the filter where it is held until it can percolate through the sand. The treatment pathway is downward (vertical) through the media to an underdrain system that is connected to the downstream storm drain system. As storm water passes through the sand, pollutants are trapped on the surface of the filter, in the small pore spaces between sand grains or are adsorbed to the sand surface. The high filtration rates of sand filters, which allow a large runoff volume to pass through the media in a short amount of time, can provide efficient treatment for storm water runoff.

Typical sand filter components include:

- Forebay for pretreatment/energy dissipation
- Surface ponding for captured flows
- Sand filter bed
- Aggregate storage layer with underdrain(s)
- Overflow structure



Typical plan and Section view of a Sand Filter BMP

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide flow-thru treatment via vertical flow through the sand filter bed. Storage provided above the underdrain within surface ponding, the sand filter bed, and aggregate storage is considered included in the flow-thru treatment volume. Saturated storage within the aggregate storage layer can be added to this design by including an upturned elbow installed at the downstream end of the underdrain or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Sand filters must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.

	Siting and Design	*Intent/Rationale*
☐	Contributing tributary area (≤ 5 acres).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the Port if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the Port for proper performance of the BMP.
☐	Finish grade of facility is < 6%.	Flatter surfaces reduce erosion and channelization within the facility.
☐	Earthen side slopes are ≥ 3H:1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
☐	Surface ponding is limited to a 36-hour drawdown time.	Provides required capacity to treat back to back storms. Exception to the 36 hour drawdown criteria is allowed if additional surface storage is provided using the curves in Appendix B.4.2.
☐	Surface ponding is limited to a 96-hour drawdown time.	Prolonged surface ponding can create a vector hazard.
☐	Maximum ponding depth does not exceed 3 feet.	Surface ponding capacity lowers subsurface storage requirements and results in lower cost facilities. Deep surface ponding raises safety concerns.
☐	Sand filter bed consists of clean washed concrete or masonry sand (passing ¼ inch sieve) or sand similar to the ASTM C33 gradation.	Washing sand will help eliminate fines that could clog the void spaces of the aggregate storage layer.
☐	Sand filter bed permeability is at least 1 in/hr.	A high filtration rate through the media allows flows to quickly enter the aggregate storage layer, thereby minimizing bypass.

	Siting and Design	*Intent/Rationale*
☐	Sand filter bed depth is at least 18 inches deep.	Different pollutants are removed in various zones of the media using several mechanisms. Some pollutants bound to sediment, such as metals, are typically removed within 18 inches of the media.
☐	Aggregate storage should be washed, bank-run gravel.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow must be non-erosive sheet flow (≤ 3 ft/s) unless an energy-dissipation device, flow diversion/splitter or forebay is installed.	Concentrated flow and/or excessive volumes can cause erosion in a sand filter and can be detrimental to the treatment capacity of the system.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains should be made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design a sand filter for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, and maximum finish grade slope.
2. Calculate the required DCV and/or flow rate per Appendix B.6.3 based on expected site design runoff for tributary areas.
3. Sand filter can be designed either for DCV or flow rate. To estimate the drawdown time, divide the average ponding depth by the permeability of the filter sand.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the Manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, and maximum finish grade slope.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If a sand filter cannot fully provide the flow rate and duration control required by the MS4 permit, an upstream or downstream structure with appropriate storage volume such as an underground vault can be used to provide remaining controls.
4. After the sand filter has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.18 FT-4 Dry Extended Detention Basin

MS4 Permit Category
Flow-thru Treatment Control

Manual Category
Flow-thru Treatment Control

Applicable Performance Standard
Pollutant Control Flow Control

Primary Benefits
Treatment Volume Reduction (Incidental) Peak Flow Attenuation

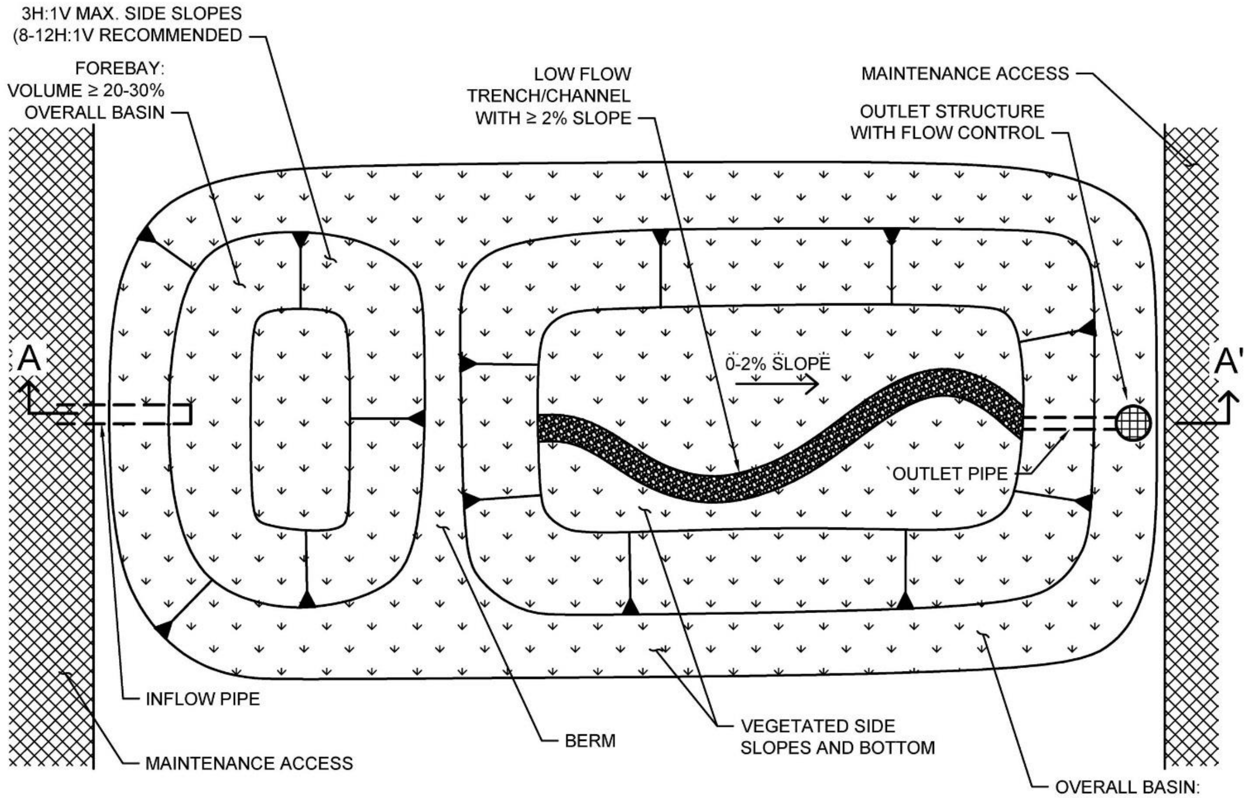
Location: Rolling Hills Ranch, Chula Vista, California; Photo Credit: Eric Mosolgo

Description

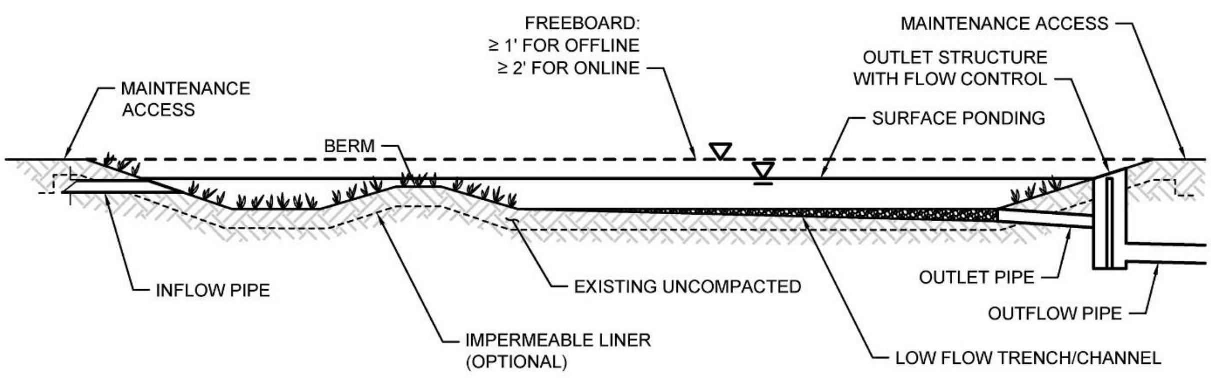
Dry extended detention basins are basins that have been designed to detain storm water for an extended period to allow sedimentation and typically drain completely between storm events. A portion of the dissolved pollutant load may also be removed by filtration, uptake by vegetation, and/or through infiltration. The slopes, bottom, and forebay of dry extended detention basins are typically vegetated. Considerable storm water volume reduction can occur in dry extended detention basins when they are located in permeable soils and are not lined with an impermeable barrier. dry extended detention basins are generally appropriate for developments of ten acres or larger, and have the potential for multiple uses including parks, playing fields, tennis courts, open space, and overflow parking lots. They can also be used to provide flow control by modifying the outlet control structure and providing additional detention storage.

Typical dry extended detention basins components include:

- Forebay for pretreatment
- Surface ponding for captured flows
- Vegetation selected based on basin use, climate, and ponding depth
- Low flow channel, outlet, and overflow device
- Impermeable liner or uncompacted native soils at the bottom of the facility



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Dry Extended Detention Basin BMP

Design Adaptations for Project Goals

Flow-thru treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration and designed to detain storm water to allow particulates and associated pollutants to settle out. This configuration is considered to provide flow-thru treatment, not biofiltration treatment. Storage provided as surface ponding above a restricted outlet invert is considered detention storage and is included in calculations for the flow-thru treatment volume.

Integrated storm water flow control and pollutant control configuration. Dry extended detention basins can also be designed for flow control. The surface ponding can be designed to accommodate higher volumes than the storm water pollutant control volume and can utilize multi-stage outlets to mitigate both the duration and rate of flows within a prescribed range.

Design Criteria and Considerations

Dry extended detention basins must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the Port if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, and liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Contributing tributary area is large (typically ≥ 10 acres).	Dry extended detention basins require significant space and are more cost-effective for treating larger drainage areas.
☐	Longitudinal basin bottom slope is 0 - 2%.	Flatter slopes promote ponding and settling of particles.
☐	Basin length to width ratio is ≥ 2:1 (L:W).	A larger length to width ratio provides a longer flow path to promote settling.
☐	Forebay is included that encompasses 20 - 30% of the basin volume.	A forebay to trap sediment can decrease frequency of required maintenance.

	Siting and Design	*Intent/Rationale*
☐	Side slopes are ≥ 3H:1V.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
☐	Surface ponding drawdown time is between 24 and 96 hours.	Minimum drawdown time of 24 hours allows for adequate settling time and maximizes pollutant removal. Maximum drawdown time of 96 hours provides vector control.
☐	Minimum freeboard provided is ≥1 foot for offline facilities and ≥2 feet for online facilities.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Inflow and outflow structures are accessible by required equipment (e.g., vactor truck) for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	A low flow channel or trench with a ≥ 2% slope is provided. A gravel infiltration trench is provided where infiltration is allowable.	Aids in draining or infiltrating dry weather flows.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow.	Planning for overflow lessens the risk of property damage due to flooding.
☐	The maximum rate at which runoff is discharged is set below the erosive threshold for the site.	Extended low flows can have erosive effects.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design dry extended detention basins for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and criteria have been met, including placement requirements, contributing tributary area, forebay volume, and maximum slopes for basin sides and bottom.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet to determine flow-thru treatment sizing of the surface ponding of the dry extended detention basin, which includes calculations for a maximum 96-hour drawdown time.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding volume, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and criteria have been met, including placement requirements, tributary area, and maximum slopes for basin sides and bottom.
2. Iteratively determine the surface ponding required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If a dry extended detention basin cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with appropriate storage volume such as an additional basin or underground vault can be used to provide remaining controls.
4. After the dry extended detention basin has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.19 FT-5 Proprietary Flow-Thru Treatment Control BMPs

The purpose of this fact sheet is to help explain the potential role of proprietary BMPs in meeting flow thru treatment control BMP requirements. The fact sheet does not describe design criteria like the other fact sheets in this appendix because this information varies by BMP product model.

Criteria for Use of a Proprietary BMP as a Flow-Thru Treatment Control BMP

A proprietary BMP may be acceptable as a "flow-thru treatment control BMP" under the following conditions:

(1) The BMP is selected and sized consistent with the method and criteria described in Appendix B.6;

(2) The BMP is designed and maintained in a manner consistent with its performance certifications (See explanation in Appendix B.6); <u>and</u>

(3) The BMP is acceptable at the discretion of the Port. In determining the acceptability of a BMP, the Port should consider, as applicable, (a) the data submitted; (b) representativeness of the data submitted; (c) consistency of the BMP performance claims with pollutant control objectives; certainty of the BMP performance claims; (d) for projects within the public right of way and/or public projects: maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business; and (e) other relevant factors. If a proposed BMP is not accepted by the Port, a written explanation/reason will be provided to the applicant..

Guidance for Sizing Proprietary BMPs

Proprietary flow-thru BMPs must meet the same sizing guidance as other flow-thru treatment control BMPs. Guidance for sizing flow-thru BMPs to comply with requirements of this manual is provided in Appendix B.6.

E.20 PL Plant List

Plant Name		Irrigation Requirements		Preferred Location in Basin		Applicable Bioretention Sections (Un-Lined Facilities)				Applicability to Flow-Through Planter? (Lined Facility)	
Latin Name	Common Name	Temporary Irrigation during Plant Establishment Period	Permanent Irrigation (Drip / Spray)(1)	Basin Bottom	Basin Side Slopes	Section A Treatment-Only Bioretention in Hydrologic Soil Group A or B Soils	Section B Treatment-Only Bioretention in Hydrologic Soil Group C or D soils	Section C Treatment Plus Flow Control Bioretention in Hydrologic Soil Group A or B Soils	Section D Treatment Plus Flow Control Bioretention in Hydrologic Soil Group C or D Soils	**NO** Applicable to Un-lined Facilities Only (Bioretention Only)	**YES** Can Use in Lined or Un-Lined Facility (Flow-Through Planter OR Bioretention)
TREES(2)											
Alnus rhombifolia	White Alder	X		X	X	X	X	X	X	X	
Platanus racemosa	California Sycamore	X		X	X	X	X	X	X	X	
Salix lasiolepis	Arroyo Willow	X			X	X	X	X	X	X	
Salix lucida	Lance-Leaf Willow	X			X	X	X	X	X	X	
Sambucus mexicana	Blue Elderberry	X			X	X	X	X	X	X	
SHRUBS / GROUNDCOVER											
Achillea millefolium	Yarrow	X			X	X	X				X
Agrostis palens	Thingrass	X			X	X	X	X	X		X
Anemopsis californica	Yerba Manza	X			X	X	X	X	X		X
Baccharis douglasii	Marsh Baccahris	X	X	X		X	X	X	X		X
Carex praegracillis	California Field Sedge	X	X	X		X	X	X	X		X
Carex spissa	San Diego Sedge	X	X	X		X	X	X	X		X
Carex subfusca	Rusty Sedge	X	X	X	X	X	X	X	X		X
Distichlis spicata	Salt Grass	X	X	X		X	X	X	X		X
Eleocharis macrostachya	Pale Spike Rush	X	X	X		X	X	X	X		X
Festuca rubra	Red Fescue	X	X	X	X	X	X				X
Festuca californica	California Fescue	X	X		X	X	X				X
Iva hayesiana	Hayes Iva	X			X	X	X				X
Juncus Mexicana	Mexican Rush	X	X	X	X	X	X	X	X		X
Jucus patens	California Gray Rush	X	X	X	X	X	X	X	X		X
Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	X	X	X	X	X	X	X	X		X
Mahonia nevinii	Nevin's Barberry	X			X	X	X	X	X		X
Muhlenburgia rigens	Deergrass	X	X	X	X	X	X	X	X		X
Mimulus cardinalis	Scarlet Monkeyflower	X		X	X	X	X				X
Ribes speciosum	Fushia Flowering Goose.	X			X	X	X				X
Rosa californica	California Wild Rose	X	X		X	X	X				X
Scirpus cenuus	Low Bullrush	X	X	X		X	X	X	X		X
Sisyrinchium bellum	Blue-eyed Grass	X			X	X	X				X

1. All plants will benefit from some supplemental irrigation during hot dry summer months, particularly those on basin side slopes and further inland.
2. All trees should be planted a min. of 10' away from any drain pipes or structures.

Appendix

F

Biofiltration Standard and Checklist

Appendix F Biofiltration Standard and Checklist

Introduction

The MS4 Permit and this manual define a specific category of storm water pollutant treatment BMPs called "biofiltration BMPs." The MS4 Permit (Section E.3.c.1) states:

Biofiltration BMPs must be designed to have an appropriate hydraulic loading rate to maximize storm water retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP, and must be sized to:

a) Treat 1.5 times the DCV not reliably retained onsite, OR

b) Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite.

A project applicant must be able to affirmatively demonstrate that a given BMP is designed and sized in a manner consistent with this definition to be considered as a "biofiltration BMP" as part of a compliant storm water management plan. Retention is defined in the MS4 Permit as evapotranspiration, infiltration, and harvest and use of storm water vs. discharge to a surface water system.

Contents and Intended Uses

This appendix contains a checklist of the key underlying criteria that must be met for a BMP to be considered a biofiltration BMP. The purpose of this checklist is to facilitate consistent review and approval of biofiltration BMPs that meet the "biofiltration standard" defined by the MS4 Permit.

This checklist includes specific design criteria that are essential to defining a system as a biofiltration BMP; however it does not present a complete design basis. This checklist was used to develop BMP Fact Sheets for PR-1 biofiltration with partial retention and BF-1 biofiltration, which do present a complete design basis. Therefore, biofiltration BMPs that substantially meet all aspects of the Fact sheets PR-1 or BF-1 should be able to complete this checklist without additional documentation beyond what would already be required for a project submittal.

Other biofiltration BMP designs[8] (including both non-proprietary and proprietary designs) may also meet the underlying MS4 Permit requirements to be considered biofiltration BMPs. These BMPs may be classified as biofiltration BMPs if they (1) meet the minimum design criteria listed in this appendix, including the pollutant treatment performance standard in Appendix F.1, (2) are designed and maintained in a manner consistent with their performance certifications (See explanation in Appendix F.2), if applicable, and (3) are acceptable at the discretion of the Port. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to demonstrate that these criteria are met.

Organization

The checklist in this appendix is organized into the seven (7) main objectives associated with biofiltration BMP design. It describes the associated minimum criteria that must be met in order to qualify a biofiltration BMP as meeting the biofiltration standard. The seven main objectives are listed below. Specific design criteria and associated manual references associated with each of these objectives is provided in the checklist in the following section.

1. Biofiltration BMPs shall be allowed only as described in the BMP selection process in this manual (i.e., retention feasibility hierarchy).

2. Biofiltration BMPs must be sized using acceptable sizing methods described in this manual.

3. Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration.

4. Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control/sequestration processes, and minimize potential for pollutant washout.

5. Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes.

6. Biofiltration BMPs must be designed to prevent erosion, scour, and channeling within the BMP.

7. Biofiltration BMP must include operations and maintenance design features and planning

---

[8] Defined as biofiltration designs that do not conform to the specific design criteria described in Fact Sheets PR-1 or BF-1. This category includes proprietary BMPs that are sold by a vendor as well as non-proprietary BMPs that are designed and constructed of primarily of more elementary construction materials.

considerations to provide for continued effectiveness of pollutant and flow control functions.

Biofiltration Criteria Checklist

The applicant shall provide documentation of compliance with each criterion in this checklist as part of the project submittal. The right column of this checklist identifies the submittal information that is recommended to document compliance with each criterion. Biofiltration BMPs that substantially meet all aspects of Fact Sheets PR-1 or BF-1 should still use this checklist; however additional documentation (beyond what is already required for project submittal) should not be required.

	1. Biofiltration BMPs shall be allowed to be used only as described in the BMP selection process based on a documented feasibility analysis. Intent: This manual defines a specific prioritization of pollutant treatment BMPs, where BMPs that retain water (retained includes evapotranspired, infiltrated, and/or harvested and used) must be used before considering BMPs that have a biofiltered discharge to the MS4 or surface waters. Use of a biofiltration BMP in a manner in conflict with this prioritization (i.e., without a feasibility analysis justifying its use) is not permitted, regardless of the adequacy of the sizing and design of the system.	
☐	The project applicant has demonstrated that it is not technically feasible to retain the full DCV onsite.	Document feasibility analysis and findings in SWQMP per Appendix C.
	2. Biofiltration BMPs must be sized using acceptable sizing methods. Intent: The MS4 Permit and this manual defines specific sizing methods that must be used to size biofiltration BMPs. Sizing of biofiltration BMPs is a fundamental factor in the amount of storm water that can be treated and also influences volume and pollutant retention processes.	
☐	The project applicant has demonstrated that biofiltration BMPs are sized to meet one of the biofiltration sizing options available (Appendix B.5).	Submit sizing worksheets (Appendix B.5) or other equivalent documentation with the SWQMP.
	3. Biofiltration BMPs must be sited and designed to achieve maximum feasible infiltration and evapotranspiration. Intent: Various decisions about BMP placement and design influence how much water is retained via infiltration and evapotranspiration. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention (evapotranspiration and infiltration) of storm water volume.	

☐	The biofiltration BMP is sited to allow for maximum infiltration of runoff volume based on the feasibility factors considered in site planning efforts. It is also designed to maximize evapotranspiration through the use of amended media and plants (biofiltration designs without amended media and plants may be permissible; see Item 5).	Document site planning and feasibility analyses in SWQMP per Section 5.4.
☐	For biofiltration BMPs categorized as "Partial Infiltration Condition" the infiltration storage depth in the biofiltration design has been selected to drain in 36 hours (+/-25%) or an alternative value shown to maximize infiltration on the site.	Included documentation of estimated infiltration rate per Appendix D; provide calculations using Appendix B.4 and B.5 to show that the infiltration storage depth meets this criterion. Note, depths that are too shallow or too deep may not be acceptable.
☐	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the infiltration storage is over the entire bottom of the biofiltration BMP footprint.	Document on plans that the infiltration storage covers the entire bottom of the BMP (i.e., not just underdrain trenches); or an equivalent footprint elsewhere on the site.
☐	For biofiltration BMP locations categorized as "Partial Infiltration Condition," the sizing factor used for the infiltration storage area is not less than the minimum biofiltration BMP sizing factors calculated using Worksheet B.5.1 to achieve 40% average annual percent capture within the BMP or downstream of the BMP. .	Provide a table that compares the minimum sizing factor per Appendix B.5 to the provided sizing factor. Note: The infiltration storage area could be a separate storage feature located downstream of the biofiltration BMP, not necessarily within the same footprint.
☐	An impermeable liner or other hydraulic restriction layer is only used when needed to avoid geotechnical and/or subsurface contamination issues in locations identified as "No Infiltration Condition."	If using an impermeable liner or hydraulic restriction layer, provide documentation of feasibility findings per Appendix C that recommend the use of this feature.

☐	The use of "compact" biofiltration BMP design[9] is permitted only in conditions identified as "No Infiltration Condition" and where site-specific documentation demonstrates that the use of larger footprint biofiltration BMPs would be infeasible.	Provide documentation of feasibility findings that recommend no infiltration is feasible. Provide site-specific information to demonstrate that a larger footprint biofiltration BMP would not be feasible.
	4. Biofiltration BMPs must be designed with a hydraulic loading rate to maximize pollutant retention, preserve pollutant control processes, and minimize potential for pollutant washout. Intent: Various decisions about biofiltration BMP design influence the degree to which pollutants are retained. The MS4 Permit requires that biofiltration BMPs achieve maximum feasible retention of storm water pollutants.	
☐	Media selected for the biofiltration BMP meets minimum quality and material specifications per 2016 City Storm Water Standards or County LID Manual, including the maximum allowable design filtration rate and minimum thickness of media. **OR**	Provide documentation that media meets the specifications in 2016 City Storm Water Standards or County LID Manual.
☐	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the 2016 City Storm Water Standards or County LID Manual, field scale testing data are provided to demonstrate that proposed media meets the pollutant treatment performance criteria in Section F.1 below.	Provide documentation of performance information as described in Section F.1.

[9] Compact biofiltration BMPs are defined as features with infiltration storage footprint less than the minimum sizing factors required to achieve 40% volume retention. Note that if a biofiltration BMP is accompanied by an infiltrating area downstream that has a footprint equal to at least the minimum sizing factors calculated using Worksheet B.5.1 assuming a partial infiltration condition, then it is not considered to be a compact biofiltration BMP for the purpose of Item 4 of the checklist. For potential configurations with a higher rate biofiltration BMP upstream of an larger footprint infiltration area, the BMP would still need to comply with Item 5 of this checklist for pollutant treatment effectiveness.

☐	To the extent practicable, filtration rates are outlet controlled (e.g., via an underdrain and orifice/weir) instead of controlled by the infiltration rate of the media.	Include outlet control in designs or provide documentation of why outlet control is not practicable.
☐	The water surface drains to at least 12 inches below the media surface within 24 hours from the end of storm event flow to preserve plant health and promote healthy soil structure.	Include calculations to demonstrate that drawdown rate is adequate. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the [City Engineer] if certified by a landscape architect or agronomist.
☐	If nutrients are a pollutant of concern, design of the biofiltration BMP follows nutrient-sensitive design criteria.	Follow specifications for nutrient sensitive design in Fact Sheet BF-2. Or provide alternative documentation that nutrient treatment is addressed and potential for nutrient release is minimized.
☐	Media gradation calculations or geotextile selection calculations demonstrate that migration of media between layers will be prevented and permeability will be preserved.	Follow specification for choking layer or geotextile in Fact Sheet PR-1 or BF-1. Or include calculations to demonstrate that choking layer is appropriately specified.
	5. Biofiltration BMPs must be designed to promote appropriate biological activity to support and maintain treatment processes. Intent: Biological processes are an important element of biofiltration performance and longevity.	
☐	Plants have been selected to be tolerant of project climate, design ponding depths and the treatment media composition.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.
☐	Plants have been selected to minimize irrigation requirements.	Provide documentation describing irrigation requirements for establishment and long term operation.
☐	Plant location and growth will not impede expected long-term media filtration rates and will enhance long term infiltration rates to the extent possible.	Provide documentation justifying plant selection. Refer to the plant list in Appendix E.20.
☐	If plants are not part of the biofiltration design, other biological processes are supported as needed to sustain treatment processes (e.g., biofilm in a subsurface flow wetland).	For biofiltration designs without plants, describe the biological processes that will support effective treatment and how they will be sustained.

6. Biofiltration BMPs must be designed with a hydraulic loading rate to prevent erosion, scour, and channeling within the BMP.

Intent: Erosion, scour, and/or channeling can disrupt treatment processes and reduce biofiltration effectiveness.

☐	Scour protection has been provided for both sheet flow and pipe inflows to the BMP, where needed.	Provide documentation of scour protection as described in Fact Sheets PR-1 or BF-1 or approved equivalent.
☐	Where scour protection has not been provided, flows into and within the BMP are kept to non-erosive velocities.	Provide documentation of design checks for erosive velocities as described in Fact Sheets PR-1 or BF-1 or approved equivalent.
☐	For proprietary BMPs, the BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification[10] (i.e., maximum tributary area, maximum inflow velocities, etc., as applicable).	Provide copy of manufacturer recommendations and conditions of third-party certification.

7. Biofiltration BMP must include operations and maintenance design features and planning considerations for continued effectiveness of pollutant and flow control functions.

Intent: Biofiltration BMPs require regular maintenance in order provide ongoing function as intended. Additionally, it is not possible to foresee and avoid potential issues as part of design; therefore plans must be in place to correct issues if they arise.

☐	The biofiltration BMP O&M plan describes specific inspection activities, regular/periodic maintenance activities and specific corrective actions relating to scour, erosion, channeling, media clogging, vegetation health, and inflow and outflow structures.	Include O&M plan with project submittal as described in Chapter 7.
☐	Adequate site area and features have been provided for BMP inspection and maintenance access.	Illustrate maintenance access routes, setbacks, maintenance features as needed on project water quality plans.

[10] Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the New Jersey Corporation for Advanced Technology programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification

☐	For proprietary biofiltration BMPs, the BMP maintenance plan is consistent with manufacturer guidelines and conditions of its third-party certification (i.e., maintenance activities, frequencies).	Provide copy of manufacturer recommendations and conditions of third-party certification.

F.1 Pollutant Treatment Performance Standard

Standard biofiltration BMPs that are designed following the criteria in Fact Sheets PR-1 and BF-1 are presumed to the meet the pollutant treatment performance standard associated with biofiltration BMPs. This presumption is based on the MS4 Permit Fact Sheet which cites analyses of standard biofiltration BMPs conducted in the Ventura County Technical Guidance Manual (July 2011).

For BMPs that do not meet the biofiltration media specification and/or the range of acceptable media filtration rates described in Fact Sheet, PR-1 and BF-1, additional documentation must be provided to demonstrate that adequate pollutant treatment performance is provided to be considered a biofiltration BMP. Project applicants have three options for documenting compliance:

1) Project applicants may provide documentation to substantiate that the minor modifications to the design is expected to provide equal or better pollutant removal performance for the project pollutants of concern than would be provided by a biofiltration design that complies with the criteria in Fact Sheets PR-1 and BF-1. Minor modifications are design elements that deviate only slightly from standard design criteria and are expected to either not impact performance or to improve performance compared to standard biofiltration designs. The reviewing agency has the discretion to accept or reject this documentation and/or request additional documentation to substantiate equivalent or better performance to BF-1 or PR-1, as applicable. Examples of minor deviations include:

    - Different particle size distribution of aggregate, with documentation that system filtration rate will meet specifications.

    - Alternative source of organic components, with documentation of material suitability and stability from appropriate testing agency.

    - Specialized amendments to provide additional treatment mechanisms, and which have negligible potential to upset other treatment mechanisms or otherwise deteriorate performances.

2) For approved proprietary BMPs, project applicants may provide evidence that the BMP has been certified for use as part of the Washington State Technology Assessment Protocol-Ecology certification program and meets each of the following requirements:

    a. The applicant must demonstrate (using the checklist in this Appendix) that the BMP meets all other conditions to be considered as a biofiltration BMP. For example, a cartridge media filter or hydrodynamic separator would not meet biofiltration BMP design criteria regardless of Technology Acceptance Protocol-Ecology certification because they do not support effective biological processes.

b. The applicant must select BMPs that have an active Technology Acceptance Protocol-Ecology certification, with General Use Level Designation for the appropriate project pollutants of concern as identified in Table F.1-1. The list of certified technologies is updated as new technologies are approved (link below). Technologies with Pilot Use Level Designation and Conditional Use Level Designations are not acceptable. Refer to:

http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html.

c. The applicant must demonstrate that BMP is being used in a manner consistent with all conditions of the Technology Acceptance Protocol-Ecology certification while meeting the flow rate or volume design criteria that is required for biofiltration BMPs under this manual. Conditions of Technology Acceptance Protocol-Ecology certification are available by clicking on the technology name at the website listed in bullet b. Additional discussion about sizing of proprietary biofiltration BMPs to comply with applicable sizing standards is provided below in Section F.2.

d. For projects within the public right of way and/or public projects: the product must be acceptable to the [City Engineer] with respect to maintainability and long term operation of the product. In determining the acceptability of a product the [City Engineer] should consider, as applicable, maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business, and other relevant factors. If a proposed BMP is not accepted by the [City Engineer], a written explanation/reason will be provided to the applicant.

3) For BMPs that do not fall into options 1 or 2 above, the [City Engineer] may allow the applicant to submit alternative third-party documentation that the pollutant treatment performance of the system is consistent with the performance levels associated with the necessary Technology Acceptance Protocol-Ecology certifications. Table F.1-1 describes the required levels of certification and Table F.l-2 describes the pollutant treatment performance levels associated with each level of certification. Acceptance of this approach is at the sole discretion of the [City Engineer]. If a proposed BMP is not accepted by the [City Engineer], a written explanation/reason will be provided to the applicant. If Technology Acceptance Protocol-Ecology certifications are not available, preference shall be given to:

a. Verified third-party, field-scale testing performance under the Technology Acceptance Reciprocity Partnership Tier II Protocol. This protocol is no longer operated, however this is considered to be a valid protocol and historic verifications are considered to be representative provided that product models being proposed are consistent with those that were tested. Technology Acceptance Reciprocity Partnership verifications were conducted under New Jersey Corporation for Advance Testing and are archived at the website linked below. Note that Technology Acceptance Reciprocity Partnership verifications must be matched to pollutant treatment standards in Table F.1-2 then matched to an equivalent Technology Acceptance Protocol-Ecology certification in Table F.1-1.

b. Verified third-party, field-scale testing performance under the New Jersey Corporation for Advance Testing protocol. Note that New Jersey Corporation for Advance Testing verifications must be matched to pollutant treatment standards in Table F.1-2 then matched to an equivalent Technology Acceptance Protocol-Ecology certification in Table F.1-1.

A list of field-scale verified technologies under Technology Acceptance Reciprocity Partnership Tier II and New Jersey Corporation for Advance Testing can be accessed at: http://www.njcat.org/verification-process/technology-verification-database.html (refer to field verified technologies only).

Table F.1-1: Required Technology Acceptance Protocol-Ecology Certifications for Polltuants of Concern for Biofiltration Performance Standard

Project Pollutant of Concern	Required Technology Acceptance Protocol-Ecology Certification for Biofiltration Performance Standard
Trash	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Sediments	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Oil and Grease	Basic Treatment OR Phosphorus Treatment OR Enhanced Treatment
Nutrients	Phosphorus Treatment[1]
Metals	Enhanced Treatment
Pesticides	Basic Treatment (including filtration)[2] OR Phosphorus Treatment OR Enhanced Treatment
Organics	Basic Treatment (including filtration)[2] OR Phosphorus Treatment OR Enhanced Treatment
Bacteria and Viruses	Basic Treatment (including bacteria removal processes)[3] OR Phosphorus Treatment OR Enhanced Treatment

1 – There is no Technology Acceptance Protocol-Ecology equivalent for nitrogen compounds; however systems that are designed to retain phosphorus (as well as meet basic treatment designation), generally also provide treatment of nitrogen compounds. Where nitrogen is a pollutant of concern, relative performance of available certified systems for nitrogen removal should be considered in BMP selection.

2 – Pesticides, organics, and oxygen demanding substances are typically addressed by particle filtration consistent with the level of treatment required to achieve Basic treatment certification; if a system with Basic treatment certification does not provide filtration, it is not acceptable for pesticides, organics or oxygen demanding substances.

3 – There is no Technology Acceptance Protocol-Ecology equivalent for pathogens (viruses and bacteria), and testing data are limited because of typical sample hold times. Systems with Technology Acceptance Protocol-Ecology Basic Treatment must be include one or more significant bacteria removal process such as media filtration, physical sorption, predation, reduced redox conditions, and/or solar inactivation. Where design options are available to enhance pathogen removal (i.e., pathogen-specific media mix offered by vendor), this design variation should be used.

Table F.1-2: Performance Standards for Technology Acceptance Protocol-Ecology Certification

Performance Goal	Influent Range	Criteria
Basic Treatment	20 – 100 mg/L TSS	Effluent goal ≤ 20 mg/L TSS
	100 – 200 mg/L TSS	≥ 80% TSS removal
	>200 mg/L TSS	> 80% TSS removal
Enhanced (Dissolved Metals) Treatment	Dissolved copper 0.005 – 0.02 mg/L	Must meet basic treatment goal and better than basic treatment currently defined as >30% dissolved copper removal
	Dissolved zinc 0.02 – 0.3 mg/L	Must meet basic treatment goal and better than basic treatment currently defined as >60% dissolved zinc removal
Phosphorous Treatment	Total phosphorous 0.1 – 0.5 mg/L	Must meet basic treatment goal and exhibit ≥50% total phosphorous removal
Oil Treatment	Total petroleum hydrocarbon > 10 mg/L	No ongoing or recurring visible sheen in effluent Daily average effluent Total petroleum hydrocarbon concentration < 10 mg/L Maximum effluent Total petroleum hydrocarbon concentration for a 15 mg/L for a discrete (grab) sample
Pretreatment	50 – 100 mg/L TSS	≤ 50 mg/L TSS
	≥ 200 mg/L TSS	≥ 50% TSS removal

F.2 Guidance on Sizing and Design of Approved Equivalent Proprietary Biofiltration Systems

This section explains the general process for design and sizing of approved equivalent proprietary biofiltration systems. This section assumes that the BMPs have been selected based on the criteria in Section F.1.

F.2.1 Guidance on Design per Conditions of Certification/Verification

The biofiltration standard and checklist in this appendix requires that "the BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification." Practically, what this means is that the BMP is used in the same way in which it was tested and certified. For example, it is not acceptable for a BMP of a given size to be certified/verified with a 100 gallon per minute treatment rate and be applied at a 150 gallon per minute treatment rate in a design.

Certifications or verifications issued by the Washington Technology Acceptance Protocol-Ecology program and the Technology Acceptance Reciprocity Partnership or New Jersey Corporation for Advance Testing programs are typically accompanied by a set of guidelines regarding appropriate design and maintenance conditions that would be consistent with the certification/verification. It is common for these approvals to specify the specific model of BMP, design capacity for given unit sizes, type of media that is the basis for approval, and/or other parameter. The applicant must demonstrate conclusively that the proposed application of the BMP is consistent with these criteria.

For alternate non-proprietary systems that do not have a Technology Acceptance Protocol-Ecology / Technology Acceptance Reciprocity Partnership / New Jersey Corporation for Advance Testing certification (but which still must provide quantitative data per Appendix F.1), it must be demonstrate that the configuration and design proposed for the project is reasonably consistent with the configuration and design under which the BMP was tested to demonstrate compliance with Appendix F.1.

F.2.2 Sizing of Flow-Based Biofiltration BMP

This sizing method is <u>only</u> available when the BMP meets the pollutant treatment performance standard in Appendix F.1.

Approved equivalent proprietary biofiltration systems for meeting PDP standards are typically designed as flow-based BMPs (i.e., a constant treatment capacity with negligible storage volume). Proprietary biofiltration is only acceptable if the sizing criteria in this Appendix and the retention performance standard identified in Appendix B.5 are satisfied. The applicable sizing method for biofiltration for this type of BMP is to <u>treat 1.5 times the flow based DCV</u>. The applicable sizing method for biofiltration is therefore reduced to: <u>Treat 1.5 times the DCV</u>.

The following steps should be followed to demonstrate that the system is sized to treat 1.5 times the DCV.

1. Calculate the flow rate required to meet the pollutant treatment performance standard without scaling for the 1.5 factor. Options include either:
    - o Calculate the runoff flow rate from a 0.2 inch per hour uniform intensity precipitation event (See methodology Appendix B.6.3), or
    - o Conduct a continuous simulation analysis to compute the size required to capture and treat 80 percent of average annual runoff; for small catchments, 5-minute precipitation data should be used to account for short time of concentration. Nearest rain gage with 5-minute precipitation data is allowed for this analysis.
2. Multiply the flow rate from Step 1 by 1.5 to compute the design flow rate for the biofiltration system.
3. Based on the conditions of certification/verification (discussed above), establish the design capacity, as a flow rate, of a given sized unit.
4. Demonstrates that an appropriate unit size and number of units is provided to provide a flow rate that meets the required flow rate from Step 2.
5. Provide a downstream retention BMP that achieves volume reduction equivalent to a non-proprietary BMP sized in accordance with Worksheet B.5-1.

Worksheet F.2-1: Flow Based Sizing for Proprietary Biofiltration

Flow Based Sizing for Proprietary Biofiltration		Worksheet F.2.1	
1	Area draining to the BMP		sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)		
3	85th percentile 24-hour rainfall depth		inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]		cu. ft.
BMP Parameters			
5	Surface ponding [6 inch minimum, 12 inch maximum]		inches
6	Media thickness [18 inches minimum], also add mulch layer and washed ASTM 33 fine aggregate sand thickness to this line for sizing calculations		inches
7	Aggregate storage (also add ASTM No 8 stone) above underdrain invert (12 inches typical) – use 0 inches if the aggregate is not over the entire bottom surface area		inches
8	Aggregate storage below underdrain invert (3 inches minimum) – use 0 inches if the aggregate is not over the entire bottom surface area		inches
9	Freely drained pore storage of the media	0.2	in/in
10	Porosity of aggregate storage	0.4	in/in
11	Media filtration rate to be used for sizing (maximum filtration rate of 5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate (includes infiltration into the soil and flow rate through the outlet structure) which will be less than 5 in/hr.)		in/hr.
Baseline Calculations			
12	Allowable routing time for sizing	6	hours
13	Depth filtered during storm [Line 11 x Line 12]		inches
14	Depth of Detention Storage [Line 5 + (Line 6 x Line 9) + (Line 7 x Line 10) + (Line 8 x Line 10)]		inches
15	Total Depth Treated [Line 13 + Line 14]		inches
Option 1 – Biofilter 1.5 times the DCV			
16	Required biofiltered volume [1.5 x Line 4]		cu. ft.
17	Required Footprint [Line 16/ Line 15] x 12		sq. ft.
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
18	Required Storage (surface + pores) Volume [0.75 x Line 4]		cu. ft.
19	Required Footprint [Line 18/ Line 14] x 12		sq. ft.
Footprint of the BMP			
20	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Line 11 in Worksheet B.5-2)		
21	Minimum BMP Footprint [Line 1 x Line 2 x Line 20]		sq. ft.
22	Footprint of the BMP = Maximum (Minimum (Line 17, Line 19), Line 21)		sq. ft.
23	Provided BMP Footprint		sq. ft.
24	Is Line 23 ≥ Line 22? If Yes, then footprint criterion is met. If No, increase the footprint of the BMP.	☐ Yes	☐ No

Worksheet F.2-2: Target Volume Retention Criteria

Target Volume Retention Criteria			**Worksheet F.2-2**
BMP ID		**DMA(s) Draining to BMP**	
1	Area draining to the BMP		sq. ft.
2	Adjusted runoff factor for drainage area (Refer to Appendix B.1 and B.2)		
3	85th percentile 24-hour rainfall depth		inches
4	Design capture volume [Line 1 x Line 2 x (Line 3/12)]		cu. ft.
Volume Retention Requirement			
5	Measured infiltration rate in the DMA Note: When mapped hydrologic soil groups are used: • Enter 0.10 for NRCS Type D soils. Include a map documenting the NRCS hydrologic soil type in the SWQMP. • Enter 0.30 for NRCS Type C soils. Include a map documenting the NRCS hydrologic soil type in the SWQMP. When the no infiltration condition applies and the actual measured infiltration rate is unknown: • Enter 0.0 in/hr if there are known geotechnical and/or groundwater hazards, and document the source used to identify the hazards in the SWQMP. • Enter 0.05 if there are no documented geotechnical and/or groundwater hazards.		in/hr.
6	Factor of safety	2	
7	Reliable infiltration rate, for biofiltration BMP sizing [Line 5/ Line 6]		in/hr.
8	Average annual volume reduction target When Line 7 > 0.01 in/hr. = Minimum (40, 166.9 x Line 7 +6.62) When Line 7 $\leq$ 0.01 in/hr. = 3.5%		%
9	Fraction of DCV to be retained (Figure B.4-1) When Line 8 > 8% = 0.0000013 x Line 8^3 - 0.000057 x Line 8^2 + 0.0086 x Line 8 - 0.014 When Line 8 $\leq$ 8% = 0.023		
10	Target volume retention [Line 9 x Line 4]		cu. ft.

Worksheet F.2-3: Volume Retention for Site Design BMPs

Volume Retention for Site Design BMPs				Worksheet F.2-3
Category	**#**	**Description**		**Units**
Standard Drainage Basin Inputs	1	Drainage Basin ID or Name		unitless
	2	85th Percentile 24-hr Storm Depth		inches
	3	Impervious Surfaces Not Directed to Dispersion Area (C=0.90)		sq-ft
	4	Semi-Pervious Surfaces Not Serving as Dispersion Area (C=0.30)		sq-ft
	5	Engineered Pervious Surfaces Not Serving as Dispersion Area (C=0.10)		sq-ft
	6	Natural Type A Soil Not Serving as Dispersion Area (C=0.10)		sq-ft
	7	Natural Type B Soil Not Serving as Dispersion Area (C=0.14)		sq-ft
	8	Natural Type C Soil Not Serving as Dispersion Area (C=0.23)		sq-ft
	9	Natural Type D Soil Not Serving as Dispersion Area (C=0.30)		sq-ft
Dispersion Area, Tree Well & Rain Barrel Inputs (Optional)	10	Does Tributary Incorporate Dispersion, Tree Wells, and/or Rain Barrels?		yes/no
	11	Impervious Surfaces **Directed to Dispersion Area** per SD-5 (Ci=0.90)		sq-ft
	12	Semi-Pervious Surfaces **Serving as Dispersion Area** per SD-5 (Ci=0.30)		sq-ft
	13	Engineered Pervious Surfaces **Serving as Dispersion Area** per SD-5 (Ci=0.10)		sq-ft
	14	Natural Type A Soil **Serving as Dispersion Area** per SD-5 (Ci=0.10)		sq-ft
	15	Natural Type B Soil **Serving as Dispersion Area** per SD-5 (Ci=0.14)		sq-ft
	16	Natural Type C Soil **Serving as Dispersion Area** per SD-5 (Ci=0.23)		sq-ft
	17	Natural Type D Soil **Serving as Dispersion Area** per SD-5 (Ci=0.30)		sq-ft
	18	Number of Tree Wells Proposed per SD-1		#
	19	Average Mature Tree Canopy Diameter		ft
	20	Number of Rain Barrels Proposed per SD-8		#
	21	Average Rain Barrel Size		gal
Initial Runoff Factor Calculation	22	Total Tributary Area		sq-ft
	23	Initial Runoff Factor for Standard Drainage Areas		unitless
	24	Initial Runoff Factor for Dispersed & Dispersion Areas		unitless
	25	Initial Weighted Runoff Factor		unitless
	26	Initial Design Capture Volume		cubic-feet
Dispersion Area Adjustments	27	Total Impervious Area Dispersed to Pervious Surface		sq-ft
	28	Total Pervious Dispersion Area		sq-ft
	29	Ratio of Dispersed Impervious Area to Pervious Dispersion Area		ratio
	30	Adjustment Factor for Dispersed & Dispersion Areas		ratio

Volume Retention for Site Design BMPs			Worksheet F.2-3	
Category	**#**	**Description**		**Units**
	31	Runoff Factor After Dispersion Techniques		unitless
	32	Design Capture Volume After Dispersion Techniques		cubic-feet
Tree & Barrel Adjustments	33	Total Tree Well Volume Reduction		cubic-feet
	34	Total Rain Barrel Volume Reduction		cubic-feet
Results	35	Final Adjusted Runoff Factor		unitless
	36	Final Effective Tributary Area		sq-ft
	37	Initial Design Capture Volume Retained by Site Design Elements		cubic-feet
	38	Final Design Capture Volume Tributary to BMP		cubic-feet

Worksheet F.2-3 Line Item Notes

1. User Input from stormwater plans.
2. User input from BMPDM Figure B.1-1.
3. User Input from stormwater plans.
4. User Input from stormwater plans.
5. User Input from stormwater plans.
6. User Input from stormwater plans.
7. User Input from stormwater plans.
8. User Input from stormwater plans.
9. User Input from stormwater plans.
10. User Input. Default is "No". Select Yes if any of the referenced elements are proposed.
11. User Input from stormwater plans. Must satisfy criteria from Fact Sheet SD-5.

13. User Input from stormwater plans. Must satisfy criteria from Fact Sheet SD-5. 14. User Input from stormwater plans. Must satisfy criteria from Fact Sheet SD-5.

15. User Input from stormwater plans. Must satisfy criteria from Fact Sheet SD-5. 16. User Input from stormwater plans. Must satisfy criteria from Fact Sheet SD-5.
17. User Input from stormwater plans. Must satisfy criteria from Fact Sheet SD-5.
18. User Input. Must satisfy criteria from Fact Sheet SD-1.
19. User Input. Must satisfy criteria from Fact Sheet SD-1. Acceptable range from 0-30 feet.
20. User Input. Must satisfy criteria from Fact Sheet SD-8. Cannot provide more than a 25% reduction to initial DCV.
21. User Input. Must satisfy criteria from Fact Sheet SD-8. Acceptable range 0-100 gallons for generic volume reductions.
22. Sum of Lines 3 through 17.
23. [0.9(Line 3) + 0.3(Line 4 + Line 9) + 0.1(Line 5 + Line 6) + 0.14(Line 7) + 0.23(Line 8)] /(Sum of Lines 3 through Line 9)
24. [0.9(Line 11) + 0.3(Line 12 + Line 17) + 0.1(Line 13 + Line 14) + 0.14(Line 15) + 0.23(Line 16)] /(Sum of Lines 11 through Line 17)
25. [(Line 23 x (Sum of Lines 3 through 9) + Line 24 x (Sum of Lines 11 through 17)) / Line 22]
26. (Line 2/12) x Line 22 x Line 25
27. Line 11
28. Summation of Lines 12-17.
29. [Line 27 / Line 28]. If greater than 4.0 dispersion benefits are not quantified.
30. Lookup values from Table B.1-1 weighted with respect to distribution of dispersion areas specified in Lines 12-17.
31. [Line 23 x (Sum of Lines 3 through Line 9) + Line 24 x Line 30 x (Sum of Lines 11 through Line 17)] / Line 22 32. (Line 2/12) x Line 22 x Line 31
33. [Line 18 x Lookup value from Section B.2.2.1 of BMP Design Manual]
34. [Line 20 x Line 21/7.48]. If Line 21>100 or Line 10 is "n/a" or "no", then this value must be zero.
35. Line 31 x [1 - ((Line 33 + Line 34)/(Line 32))]. Value must be between zero and one.
36. Line 22 x Line 35
37. [(Line 26 - Line 32) + Line 33 + Line 34] 38. [Line 26 - Line 37]. Minimum result of 0.

F.3 Biofiltration Soil Media Composition, Testing, and Installation

Biofiltration Soil Media (BSM) is intended to filter storm water and support plant growth while minimizing the leaching of potential pollutants. This specification includes requirements that apply to BSM used in stormwater treatment BMPs, including bioretention and biofiltration. Biofiltration Soil Media is also referred to as Engineered Soil Media and Bioretention Soil Media.

F.3.1 BLENDED BSM CRITERIA AND TESTING REQUIREMENTS

Blended BSM shall consist of 60% to 80% by volume sand, up to 20% by volume topsoil, and up to 20% by volume compost. Sand, Topsoil, and Compost used in BSM shall conform to requirements listed in Sections F.3.2, F.3.3, and F.3.4, respectively. For bioretention/biofiltration with outlet-controlled designs, it is likely that topsoil will need to be omitted or reduced to achieve permeability targets.

Alternative mix components and proportions may be utilized, provided that the whole blended mix conforms to whole BSM criteria, detailed in Section F.3.1.2 through F.3.1.4. Alternative mix designs may include alternative proportions and/or alternative organic amendments. Alternative mixes are subject to approval by the Port. Alternative mixes that use an alternative organic component (rather than compost) may be necessary when BMPs are installed in areas with nitrogen or phosphorus impaired receiving waters in order to meet more stringent BSM quality requirements as detailed in Section F.3.1.4.

F.3.1.1 Testing and Submittals

At least 30 days prior to ordering materials, the Contractor shall submit the following to the Port reviewer (upon request): source/supplier of BSM, location of source/supplier, a physical sample of the BSM, whole BSM test results from a third-party independent laboratory, test results for individual component materials as required, and description of proposed methods and schedule for mixing, delivery, and placement of BSM. The test results shall be no older than 120 days and shall accurately represent the materials and feed stocks that are currently available from the supplier.

Test results shall demonstrate conformance to agronomic suitability and hydraulic suitability criteria listed in Sections F.3.1.2 and F.3.1.3, respectively. BSM for use in BMPs in areas with water quality impairments in receiving waters shall also comply with applicable Chemical Suitability criteria in Section F.3.1.4. No delivery, placement, or planting of BSM shall begin until test results confirm the suitability of the BSM. The Contractor shall submit a written request for approval which shall be accompanied by written analysis results from a written report of a testing agency. The testing agency must be registered by the State for agronomic soil evaluation laboratory test fees shall be paid for by the Contractor. BSM criteria may also be modified at the discretion of the Port if the contractor demonstrates that suitable BSM materials cannot be feasibly sourced within a 50-mile radius of the project site and a good faith effort has been undertaken to investigate available materials. BSM that meets other specifications approved for use by the County of San Diego or other local agencies may be accepted as meeting the “good faith effort” standard at the discretion of the Port.

F.3.1.2 Agronomic Suitability

The BSM shall conform to the requirements herein to support plant growth. BSM which requires amending to comply with the below specifications shall be uniformly blended and tested in its blended state prior to testing and delivery.

a) pH range shall be between 6.0-8.5.

b) Salinity shall be between 0.5 and 3.0 millimho/cm (as measure by electrical conductivity)

c) Sodium absorption ratio (SAR) shall be less than 5.0

d) Chloride shall be less than 800 ppm.

e) Cation exchange capacity shall be greater than 10 meq/100 g.

f) Organic matter shall be between 2 and 5%.

g) Carbon:Nitrogen ratio shall be between 12 and 40 (15 to 40 preferred).

Textural class fraction shall adhere to limits in Table F.3.1.2, as determined by ASTM Method D422 or an approved alternative method:

TABLE F.3.1.2

Textural Class (ASTM D422)	Size Range	Mass Fraction (percent)
Gravel	Larger than 2 mm	0 to 25 of total sample
Clay	Smaller than 0.005 mm	0 to 5 of non-gravel fraction

Test results shall show the following information:

a) Date of testing

b) Project name, contractor name, and source of materials and supplier name

c) Copies of all testing reports including, at a minimum, analytical results sufficient to confirm compliance with all requirements listed in this section.

F.3.1.3 Hydraulic Suitability

BSM shall meet the have appropriate hydraulic properties for filtering stormwater. The BSM shall conform to the requirements herein to support plant growth. BSM which requires amending, shall be uniformly blended and tested in its blended state prior to testing and delivery.

F.3.1.3.1 Testing

The saturated hydraulic conductivity of the whole BSM shall be measured according to the method detailed in the measurement of hydraulic conductivity (USDA Handbook 60, method 34b), commonly available as part of standard agronomic soil evaluation, or ASTM D24234 Permeability of Granular Soils (at approximately 85% relative compaction Standard Proctor, ASTM D698). BSM shall conform to hydraulic criteria associated with the BMP design configuration that best applies to the facility where the BSM will be installed (Section F.3.1.3.2 or F.3.1.3.3).

F.3.1.3.2 Systems with Unrestricted Underdrain System (i.e., media control)

For systems with underdrains that are not restricted, the BSM shall meet the minimum and maximum measured hydraulic conductivity found in Table F.3.1.3 to ensure adequate flow rate through the BMP and longevity of the system but reduce excessive velocities through the media. In all cases, an upturned elbow system on the underdrain, measuring 9 to 12 inches above the invert of the underdrain, should be used to control velocities in the underdrain pipe and reduce potential for solid migration through the system.

F.3.1.3.3 Systems with Restricted Underdrain System (i.e., outlet control)

For systems in which the flow rate of water through the media is controlled via an outlet control device (e.g., orifice or valve) affixed to the outlet of the underdrain system, the hydraulic conductivity of the media should meet the requirements in Table F.3.1.3 and the outlet control device should control the flow rate to between 5 and 12 inches per hour. This configuration reduces the sensitivity of system performance to the hydraulic conductivity, compaction, and clogging of the material, reduces the likelihood of preferential flow through media, and allows more precise design and control of system flow rates. For these reasons, outlet control should be considered the preferred design option over unrestricted underdrain systems.

F.3.1.3.3 Systems without Underdrains

For systems without underdrains, the BSM shall have a hydraulic conductivity of at least 5 inches per hour, or at least 2 times higher than the design infiltration rate of the underlying soil, whichever is greater.

TABLE F.3.1.3

	Hydraulic Conductivity Requirements	
Underdrain System	**Minimum (in/hr)**	**Maximum (in/hr)**
Unrestricted (media control)	8	24
Restricted (outlet control) Preferred Design Option.	20	80

F.3.1.4 Chemical Suitability for Areas Draining to Impaired Receiving Waters

The chemical suitability criteria listed in this section do not apply to systems without underdrains, unless groundwater is impaired or susceptible to nutrient contamination. Limits for a given parameter only apply if that parameter is associated with a water quality impairment, priority water quality condition, and/or TMDL in the receiving water. Limits may be waived at the discretion of the Port if it is determined that it is unreasonable to meet the specification using locally-available materials (available within 100 miles).

F.3.1.4.1 Testing

Potential for pollutant leaching shall be assessed using either the Saturated Media Extract Method (aka, Saturation Extract) that is commonly performed by agronomic laboratories or the Synthetic Precipitation Leaching Procedure (SPLP) (EPA SW-846, Method 1312). If the saturation extract method is used, samples may be rinsed with up to five pore volumes before collecting extract for analysis.

F.3.1.4.1 BSM Limits in Areas Draining to Impaired Receiving Waters

The limits in this section are in terms of the concentration of a parameter in water that has been contacted with the BSM.

TABLE F.3.1.4.2

Applicable Pollutant(s)	Saturation Extract or SPLP Criteria
Phosphorus*	< 1 mg/L
Zinc	< 1 mg/L
Copper	< 0.04 mg/L
Lead	< 0.025 mg/L
Arsenic	< 0.02 mg/L
Cadmium	< 0.01 mg/L

Mercury	< 0.01 mg/L
Selenium	< 0.01 mg/L

F.3.1.4.3 Alternative BSM for Reduced Phosphorus Leaching

In areas with impaired receiving waters, alternative BSM should be considered, especially if receiving waters are phosphorus impaired. BSM with 20% compost may result in phosphorus leaching and soluble phosphorus test results in excess of the 1 mg/L limit presented in Table F.3.1.4.2. Alternative organic amendments, such as coco coir pith and/or composted wood products, in place of compost should be considered in these areas. Sand and soil components with higher levels of iron and aluminum should also be considered to limit the solubility of phosphorus.

F.3.1.4.4 Nitrogen Impaired Receiving Waters

In areas with a downstream water quality impairment or TMDL for nitrogen, a combination of BSM composition and BMP design shall be used to reduce the potential for nitrate leaching from BMPs.

- BSM: The C:N ratio of BSM shall be between 15 and 40 to reduce the potential for nitrate leaching.

- BMP design: BMPs shall be designed to either enhance infiltration into underlying soils or with internal water storage to promote reduction of nitrogen:

    - If a BMP is installed with a liner, the BMP must include an internal saturated zone, consisting of at least an 18-inch thick layer of gravel, to enhance denitrification.

    - If a BMP does not include a liner, it must be installed with a retention zone below the underdrain discharge elevation, consisting of at least an 18-inch thick layer of gravel, to enhance infiltration into underlying soils.

F.3.2 SAND FOR BSM

Sand used in BSM should preferably be washed prior to delivery. If sand is not washed it must still meet sieve analysis requirements in Table F.3.2.1.

F.3.2.1 Gradation Limits

A sieve analysis shall be performed in accordance with California Test 202, ASTM D 422, or approved equivalent method to demonstrate compliance with the gradation limits shown in Table F.3.2.1. Fines passing the No. 200 sieve shall be non-plastic.

TABLE F.3.2.1

	Percentage Passing Sieve (by weight)	
Sieve Size (ASTM D422)	**Minimum**	**Maximum**
3/8 inch	100	100
#4	90	100
#8	70	100
#16	40	95
#30	15	70
#40	5	55
#100	0	15
#200	0	5

F.3.3 TOPSOIL FOR BSM

Topsoil shall be free of hazardous materials and shall be consistent with a common definition of topsoil. Decomposed granite and derivatives of decomposed granite are not considered to be topsoil for the purpose of this specification.

F.3.3.1 Textural Class

Topsoil shall be classified as a sandy loam or a loamy sand according to the US Department of Agriculture soil classification system. In addition, a textural class analysis shall be performed in accordance with ASTM D422, or an approved alternative method to demonstrate compliance with the gradation limits in Table F.3.3.1.

TABLE F.3.3.1

Textural Class (ASTM D422)	Size Range	Mass Fraction (percent)
Gravel	Larger than 2 mm	0 to 25 of total sample
Clay	Smaller than 0.005 mm	0 to 15 of non-gravel fraction

F.3.4 803-5 COMPOST FOR BSM

Compost shall be produced at a facility inspected and regulated by the local enforcement agency for CalRecycle. Compost should also preferably be certified by the U.S. Composting Council's Seal of Testing Assurance Program (USCC STA) or an approved equivalent program. Compost shall not be produced from biosolids feedstock.

F.3.4.1 Gradation Limits

A sieve analysis shall be performed in accordance with ASTM D 422 or approved equivalent method to demonstrate compliance with the gradation limits show in Table F.3.4.1.

TABLE F.3.4.1

Sieve Size (ASTM D422)	Percent Passing Sieve (by weight)
1/2"	97 to 100
2 mm	40 to 90

F.3.4.2 Material Content

Organic Material Content shall be 35% to 100% by dry weight and moisture shall be 25% to 60% wet weight basis. Physical contaminants (manmade inert materials) shall not exceed 1% by dry weight.

F.3.4.3 Compost Testing

Compost shall meet the following requirements as demonstrated through standard agronomic testing methods:

a) **Carbon to nitrogen (C:N) ratio.** C:N shall be between 15:1 and 40:1, preferably above 20:1 to reduce the potential for nitrogen leaching/washout.

b) **pH.** pH shall be between 6.0 and 8.5.

c) **Soluble Salt Concentration.** Soluble Salt Concentration shall be less than 10 dS/m. (Method TMECC 4.10-A, USDA and U.S. Composting Council).

d) **Stability.** Carbon Dioxide evolution rate shall be less than 3.0 mg CO2-C per g compost organic matter (OM) per day or less than 6 mg CO2-C per g compost carbon per day, whichever unit is reported. (Method TMECC 5.08-B, USDA and U.S. Composting
Council). Alternatively, a Solvita rating of 5.5 or higher is acceptable.

F.3.4.3.1 Pathogens and Pollutant Limits

Select pathogens shall pass US EPA Class A standard, 40 CFR Section 503.32(a). Trace Metals shall pass US EPA Class A standard, 40 CFR Section 503.13, Table 1 for Ceiling Concentrations.

F.3.5 803-6 DELIVERY, STORAGE, HANDLING, AND PAYMENT

BSM shall be thoroughly mixed prior to delivery using mechanical mixing methods such as a drum mixer. The Contractor shall protect soils and mixes from absorbing excess water and from erosion at all times.

F.3.5.1 Delivery

The Contractor shall not deliver or place soils in wet or muddy conditions.

F.3.5.2 Storage

The Contractor shall not store materials unprotected during large rainfall events (>0.25 inches). If water is introduced into the material while it is stockpiled, the Contractor shall allow the material to drain to the acceptance of the Port before placement.

F.3.5.3 Handling and Placement

BSM shall be lightly compacted and placed in loose lifts approximately 12 inches (300 mm) to ensure reasonable settlement without excessive compaction. Compaction within the BSM area should not exceed 75 to 85% standard proctor within the BSM. Machinery shall not be used in the bioretention facility to place the BSM. A conveyor or spray system shall be used for media placement in large facilities. Low ground pressure equipment may be authorized for large facilities at the discretion of the Port. Placement methods and BSM quantities shall account for approximately 10% loss of volume due to settling. Planting methods and timing shall account for settling of media without exposing plant root systems.

F.3.5.4 Hydraulic Suitability

The Port may request up to three double ring infiltrometer tests (ASTM D3385) or approved alternative tests to confirm that the placed material meets applicable hydraulic suitability criteria. In the event that the infiltration rate of placed material does not meet applicable criteria, the Port may require replacement and/or de-compaction of materials.

F.3.5.5 Quality Control and Acceptance

Close adherence to the material quality controls herein is necessary in order to support healthy vegetation, minimize pollutant leaching, and assure sufficient permeability to infiltrate/filter runoff during the life of the facility. Amendments may be included to adjust agronomic properties. Acceptance of the material will be based on test results certified to be representative. Test results shall be conducted no more than 120 days prior to delivery of the blended BSM to the project site. For projects installing more than 100 cubic yards of BSM, batch specific tests of the blended mix shall be provided to the Port for every 100 cubic yards of BSM along with a site plan showing the placement locations of each BSM batch within the facility.

F.3.5.6 Measurement and Payment

Quantities of mixed BSM will be measured as shown in the Bid. The volumetric quantity of mixed BSM to be paid for shall be the volume of BSM placed within the limits of the dimensions shown on the Plans.

F.3.6 AGGREGATE MATERIALS FOR BIORETENTION AND BIOFILTRATION DRAINAGE LAYERS

This section provides material specifications for drainage layers below BSM in bioretention BMPs. This consists of a two-layer filter course placed below the BSM and above an open-graded aggregate stone reservoir.

F.3.6.1 Rock and Sand Materials for Drainage Layers

All sand and stone products used in BSM drainage layers shall be clean and thoroughly washed.

F.3.6.1.1 Filter Course

Graded aggregate choker material is installed as a filter course to separate BSM from the drainage rock reservoir layer. The purpose of this layer is to limit migration of sand or other fines from the BSM. The filter course consists of two layers of choking material increasing in particle size. The top layer (closets to the BSM) of the filter course shall be constructed of thoroughly washed ASTMC33 Choker Sand as detailed in Table 200-1.5.5 of the WHITEBOOK. The bottom layer of the filter course shall be constructed of thoroughly washed ASTM No. 8 aggregate material conforming to gradation limits contained in Table 200-1.2.1 the WHITEBOOK.

F.3.6.1.2 Open-Graded Aggregate Stone

Open-graded aggregate material is installed below filter course layers to provide additional storm water storage capacity and contain the underdrain pipe(s). This layer shall be constructed of thoroughly washed AASHTO No. 57 open graded aggregate material conforming to gradation limits contained in Table 200-1.2.1 the WHITEBOOK.

F.3.6.2 Layer Thicknesses and Construction

Aggregate shall be deposited on underlying layers at a uniform quantity per linear foot (meter), which quantity will provide the required compacted thickness within the tolerances specified herein without resorting to spotting, picking up, or otherwise shifting the aggregate material.

F.3.6.2.1 Filter Course Layers

Each of the two filter course layers (top layer of ASTM C33 Choker Sand and bottom layer of ASTM No. 8) shall be installed to a thickness of 3 inches (75 mm). Both layers shall be spread in single layers. Marker stakes should be used to ensure uniform lift thickness.

F.3.6.2.2 Aggregate Drainage and Storage Layer

The thickness of the aggregate drainage and storage layer (AASHTO No. 57) will depend on site specific design and shall be detailed in contract documents.

F.3.6.2.3 Spreading

Drainage layers shall be as delivered as uniform mixtures and each layer shall be spread in one operation. Segregation within each aggregate layer shall be avoided and the layers shall be free from pockets of coarse or fine material.

F.3.6.2.4 Compacting

Filter course material and aggregate storage material shall be lightly compacted to approximately 80% standard proctor without the use of vibratory compaction.

F.3.6.3 Measurement and Payment

Quantities of graded aggregate choker material and opengraded aggregate storage material will be measured as shown in the Bid. The volumetric quantities of graded aggregate choker stone material and open-graded storage material shall be those placed within the limits of the dimensions shown on the Plans. The weight of material to be paid for will be determined by deducting (from the weight of material delivered to the Work) the weight of water in the material (at the time of weighing) in excess of 1% more than the optimum moisture content. No payment will be made for the weight of water deducted as provided in this subsection.

F.3.7 SUMMARY

Summary of BSM specification requirements for the City of San Diego and County of San Diego included in Table F.3.7.

TABLE F.3.7

Component	Requirement
BSM Material Composition	Sand: 60-80% by volume Topsoil: 0-20% by volume Compost: 20% by volume

Alternative Blends Acceptable?	Yes, but they must meet performance-based specifications.
Sand Type	Washed sand conforming to particle size distribution
Topsoil Type	Sandy loam or loamy sand with clay < 15% and gravel < 25%
Compost Type	From a CalRecycle permitted facility. Biosolids derived materials are not acceptable
BSM Permeability	8-24 inches/hour for BMPs without outlet control; 15-80 inches/hour for BMPs with outlet control; testing is required to demonstrate.
Agronomic Suitability Requirements	Limits for salts and potential toxins. C:N ratio between 12 and 40.
Water Quality Related Limits?	Requirements related to specific pollutants when water quality of receiving waters is impaired for those pollutants.

Appendix G

BMP DESIGN MANUAL

Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

Appendix G Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

G.1 Guidance for Continuous Simulation Hydrologic Modeling for Hydromodification Management Studies in San Diego County Region 9

G.1.1 Introduction

Continuous simulation hydrologic modeling is used to demonstrate compliance with the performance standards for hydromodification management in San Diego. There are several available hydrologic models that can perform continuous simulation analyses. Each has different methods and parameters for determining the amount of rainfall that becomes runoff, and for representing the hydraulic operations of certain structural BMPs such as biofiltration with partial retention or biofiltration. This Appendix is intended to:

- Identify acceptable models for continuous simulation hydrologic analyses for hydromodification management;
- Provide guidance for selecting climatology input to the models;
- Provide standards for rainfall loss parameters to be used in the models;
- Provide standards for defining physical characteristics of LID components; and
- Provide guidance for demonstrating compliance with performance standards for hydromodification management.

This Appendix is not a user's manual for any of the acceptable models, nor a comprehensive manual for preparing a hydrologic model. This Appendix provides guidance for selecting model input parameters for the specific purpose of hydromodification management studies. The model preparer must be familiar with the user's manual for the selected software to determine how the parameters are entered to the model.

G.1.2 Software for Continuous Simulation Hydrologic Modeling

The following software models may be used for hydromodification management studies in San Diego:

- HSPF – Hydrologic Simulation Program-FORTRAN, distributed by USEPA, public domain.
- SDHM – San Diego Hydrology Model, distributed by Clear Creek Solutions, Inc. This is an HSPF-based model with a proprietary interface that has been customized for use in San Diego for hydromodification management studies.
- SWMM – Storm Water Management Model, distributed by USEPA, public domain.

Third-party and proprietary software, such as XPSWMM or PCSWMM, may be used for hydromodification management studies in San Diego, provided that:

- Input and output data from the software can interface with public domain software such as SWMM. In other words, input files from the third party software should have sufficient functionality to allow export to public domain software for independent validation.
- The software's hydromodification control processes are substantiated.

G.1.3 Climatology Parameters

G.1.3.1 Rainfall

In all software applications for preparation of hydromodification management studies in San Diego, rainfall data must be selected from approved data sets that have been prepared for this purpose. As part of the development of the March 2011 Final HMP, long-term hourly rainfall records were prepared for public use. The rainfall record files are provided on the Project Clean Water website. The rainfall station map is provided in the March 2011 Final HMP and is included in this Appendix as Figure G.1-1.

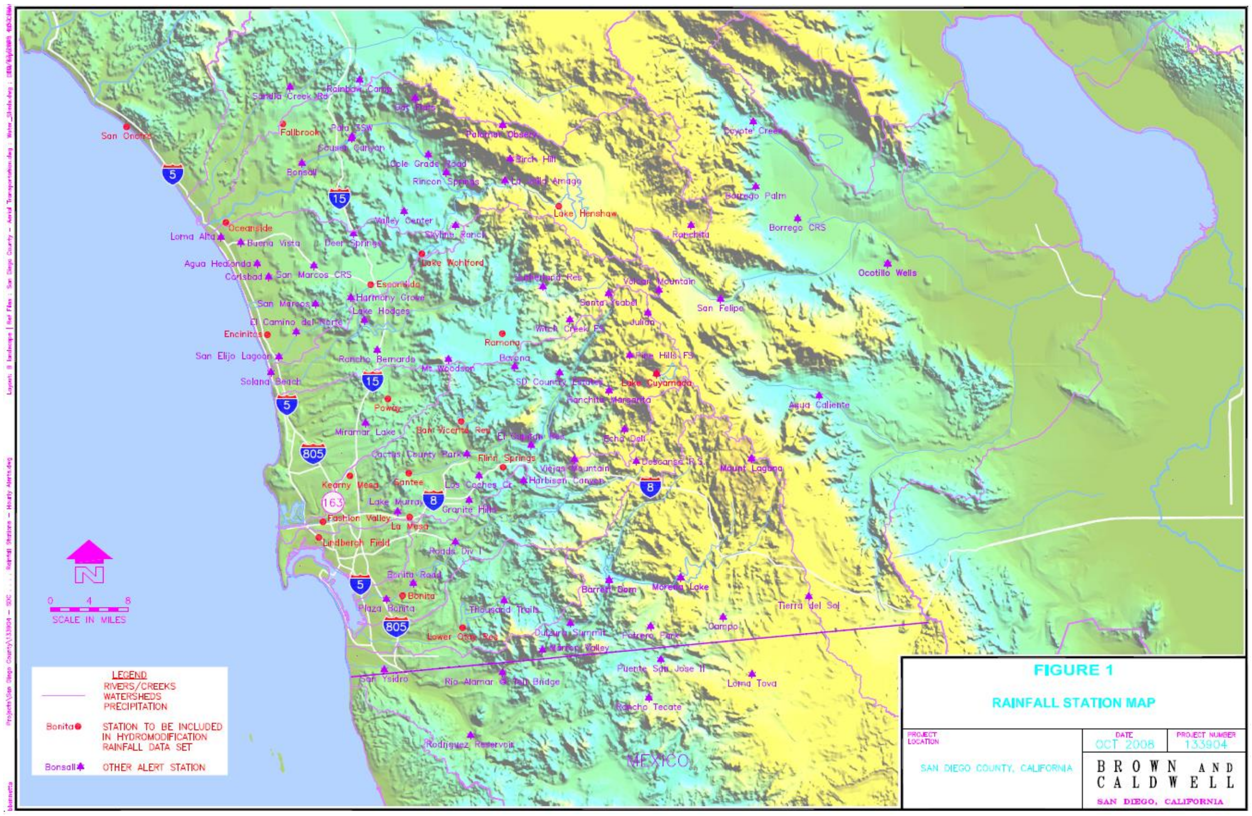


Figure G.1-1: Rainfall Station Map

Project applicants preparing continuous simulation models shall select the most appropriate rainfall data set from the rainfall record files provided on the Project Clean Water website. For a given project location, the following factors should be considered in the selection of the appropriate rainfall data set:

- In most cases, the rainfall data set in closest proximity to the project site will be the appropriate choice (refer to the rainfall station map).
- In some cases, the rainfall data set in closest proximity to the project site may not be the most applicable data set. Such a scenario could involve a data set with an elevation significantly different from the project site. In addition to a simple elevation comparison, the project proponent may also consult with the San Diego County's average annual precipitation isopluvial map, which is provided in the San Diego County Hydrology Manual (2003). Review of this map could provide an initial estimate as to whether the project site is in a similar rainfall zone as compared to the rainfall stations. Generally, precipitation totals in San Diego County increase with increasing elevation.
- Where possible, rainfall data sets should be chosen so that the data set and the project location are both located in the same topographic zone (coastal, foothill, mountain) and major

watershed unit (Upper San Luis Rey, Lower San Luis Rey, Upper San Diego River, Lower San Diego River, etc.).

For SDHM users, the approved rainfall data sets are pre-loaded into the software package. SDHM users may select the appropriate rainfall gage within the SDHM program. HSPF or SWMM users shall download the appropriate rainfall record from the Project Clean Water website and load it into the software program.

Both the pre-development and post-project model simulation period shall encompass the entire rainfall record provided in the approved rainfall data set. Scaling the rainfall data is not permitted.

G.1.3.2 Potential Evapotranspiration

Project applicants preparing continuous simulation models shall select a data set from the sources described below to represent potential evapotranspiration.

For HSPF users, this parameter may be entered as an hourly time series. The hourly time series that was used to develop the BMP Sizing Calculator parameters is provided on the project clean water website and may be used for hydromodification management studies in San Diego. For SDHM users, the hourly evaporation data set is pre-loaded into the program. HSPF users may download the evaporation record from the Project Clean Water website and load it into the software program.

For HSPF or SWMM users, this parameter may be entered as monthly values in inches per month or inches per day. Monthly values may be obtained from the California Irrigation Management Information System "Reference Evapotranspiration Zones" brochure and map (herein "CIMIS ETo Zone Map"), prepared by California Department of Water Resources, dated January 2012. The CIMIS ETo Zone Map is available from www.cimis.gov, and is provided in this Appendix as Figure G.1-2. Determine the appropriate reference evapotranspiration zone for the project from the CIMIS ETo Zone Map. The monthly average reference evapotranspiration values are provided below in Table G.1-1.

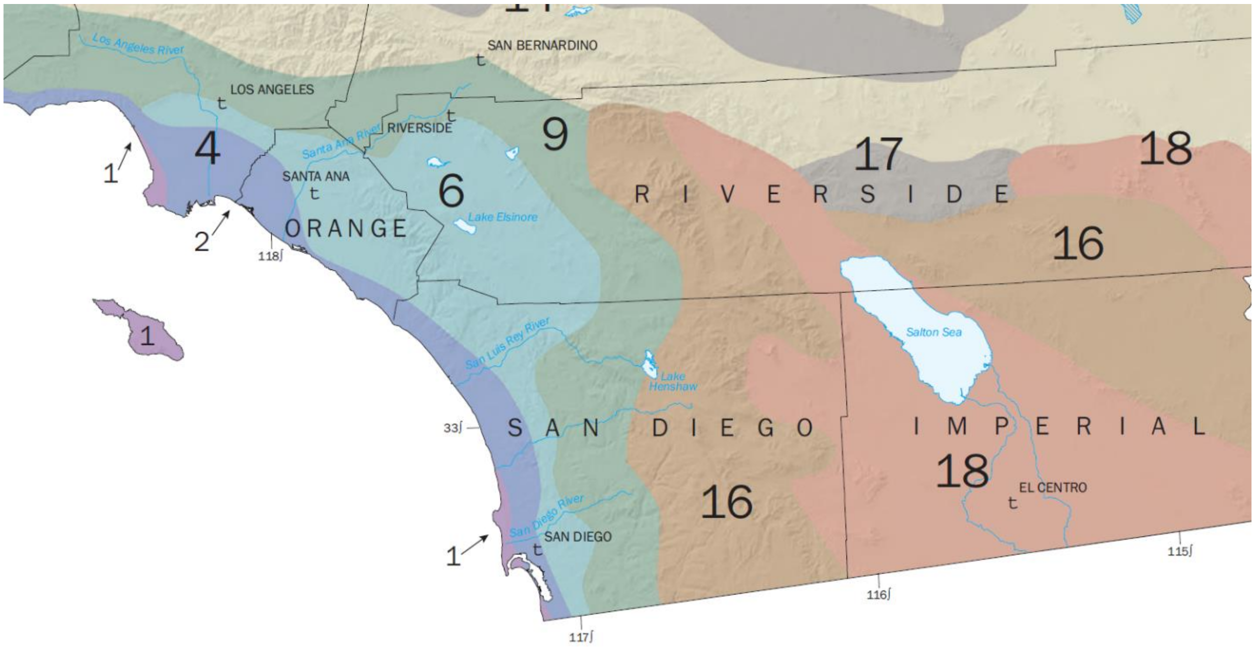


Figure G.1-2: California Irrigation Management Information System "Reference Evapotranspiration Zones"

Table G.1-1: Monthly Average Reference Evapotranspiration by ETo Zone (inches/month and inches/day) for use in SWMM Models for Hydromodification Management Studies in San Diego County CIMIS Zones 1, 4, 6, 9, and 16 (See CIMIS ETo Zone Map)

	January	February	March	April	May	June	July	August	September	October	November	December
Zone	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month	in/month
1	0.93	1.4	2.48	3.3	4.03	4.5	4.65	4.03	3.3	2.48	1.2	0.62
4	1.86	2.24	3.41	4.5	5.27	5.7	5.89	5.58	4.5	3.41	2.4	1.86
6	1.86	2.24	3.41	4.8	5.58	6.3	6.51	6.2	4.8	3.72	2.4	1.86
9	2.17	2.8	4.03	5.1	5.89	6.6	7.44	6.82	5.7	4.03	2.7	1.86
16	1.55	2.52	4.03	5.7	7.75	8.7	9.3	8.37	6.3	4.34	2.4	1.55
	January	February	March	April	May	June	July	August	September	October	November	December
Days	31	28	31	30	31	30	31	31	30	31	30	31
Zone	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day	in/day
1	0.030	0.050	0.080	0.110	0.130	0.150	0.150	0.130	0.110	0.080	0.040	0.020
4	0.060	0.080	0.110	0.150	0.170	0.190	0.190	0.180	0.150	0.110	0.080	0.060
6	0.060	0.080	0.110	0.160	0.180	0.210	0.210	0.200	0.160	0.120	0.080	0.060
9	0.070	0.100	0.130	0.170	0.190	0.220	0.240	0.220	0.190	0.130	0.090	0.060
16	0.050	0.090	0.130	0.190	0.250	0.290	0.300	0.270	0.210	0.140	0.080	0.050

G.1.4 Land Characteristics and Loss

In all software applications for preparation of hydromodification management studies in San Diego, rainfall loss parameters must be consistent with this Appendix unless the preparer can provide documentation to substantiate use of other parameters, subject to local jurisdiction approval. HSPF and SWMM use different processes and different sets of parameters. SDHM is based on HSPF, therefore parameters for SDHM and HSPF are presented together in Section G.1.4.1. Parameters that have been pre-loaded into SDHM may be used for other HSPF hydromodification management studies outside of SDHM. Parameters for SWMM are presented separately in Section G.1.4.2.

G.1.4.1 Rainfall Loss Parameters for HSPF and SDHM

Rainfall losses in HSPF are characterized by PERLND/PWATER parameters and IMPLND parameters, which describe processes occurring when rainfall lands on pervious lands and impervious lands, respectively. "BASINS Technical Notice 6, Estimating Hydrology and Hydraulic Parameters for HSPF," prepared by the USEPA, dated July 2000, provides details regarding these parameters and summary tables of possible ranges of these parameters. Table G.1-2, excerpted from the above-mentioned document, presents the ranges of these parameters.

For HSPF studies for hydromodification management in San Diego, PERLND/PWATER parameters and IMPLND parameters shall fall within the "possible" range provided in EPA Technical Note 6. To select specific parameters, HSPF users may use the parameters established for development of the San Diego BMP Sizing Calculator, and/or the parameters that have been established for SDHM. Parameters for the San Diego BMP Sizing Calculator and SDHM are based on research conducted specifically for HSPF modeling in San Diego.

Documentation of parameters selected for the San Diego BMP Sizing Calculator is presented in the document titled, San Diego BMP Sizing Calculator Methodology, prepared by Brown and Caldwell, dated January 2012 (herein "BMP Sizing Calculator Methodology"). The PERLND/PWATER parameters selected for development of the San Diego BMP Sizing Calculator represent a single composite pervious land cover that is representative of most pre-development conditions for sites that would commonly be managed by the BMP Sizing Calculator. The parameters shown below in Table G.1-3 are excerpted from the BMP Sizing Calculator Methodology.

Table G.1-2: HSPF PERLND/PWATER and IMPLND Parameters from EPA Technical Note 6

Name	Definition	Units	Range of Values				Function of ...	Comment
			Typical		Possible			
			Min	Max	Min	Max		
PWAT – PARM2								
FOREST	Fraction forest cover	none	0.0	0.50	0.0	0.95	Forest cover	Only impact when SNOW is active
LZSN	Lower Zone Nominal Soil Moisture Storage	inches	3.0	8.0	2.0	15.0	Soils, climate	**Calibration**
INFILT	Index to Infiltration Capacity	in/hr	0.01	0.25	0.001	0.50	Soils, land use	**Calibration**, divides surface and subsurface flow
LSUR	Length of overland flow	feet	200	500	100	700	Topography	Estimate from high resolution topo maps or GIS
SLSUR	Slope of overland flow plane	ft/ft	0.01	0.15	0.001	0.30	Topography	Estimate from high resolution topo maps or GIS
KVARY	Variable groundwater recession	1/inches	0.0	3.0	0.0	5.0	Baseflow recession variation	Used when recession rate varies with GW levels
AGWRC	Base groundwater recession	none	0.92	0.99	0.85	0.999	Baseflow recession	**Calibration**
PWAT – PARM3								
PETMAX	Temp below which ET is reduced	deg. F	35.0	45.0	32.0	48.0	Climate, vegetation	Reduces ET near freezing, when SNOW is active
PETMIN	Temp below which ET is set to zero	deg. F	30.0	35.0	30.0	40.0	Climate, vegetation	Reduces ET near freezing, when SNOW is active
INFEXP	Exponent in infiltration equation	none	2.0	2.0	1.0	3.0	Soils variability	Usually default to 2.0
INFILD	Ratio of max/mean infiltration capacities	none	2.0	2.0	1.0	3.0	Soils variability	Usually default to 2.0
DEEPFR	Fraction of GW inflow to deep recharge	none	0.0	0.20	0.0	0.50	Geology, GW recharge	Accounts for subsurface losses
BASETP	Fraction of remaining ET from baseflow	none	0.0	0.05	0.0	0.20	Riparian vegetation	Direct ET from riparian vegetation
AGWETP	Fraction of remaining ET from active GW	none	0.0	0.05	0.0	0.20	Marsh/wetlands extent	Direct ET from shallow GW
PWAT – PARM4								
CEPSC	Interception storage capacity	inches	0.03	0.20	0.01	0.40	Vegetation type/density, land use	Monthly values usually used
UZSN	Upper zone nominal soil moisture storage	inches	0.10	1.0	0.05	2.0	Surface soil conditions, land use	Accounts for near surface retention
NSUR	Manning's n (roughness) for overland flow	none	0.15	0.35	0.05	0.50	Surface conditions, residue, etc.	Monthly values often used for croplands
INTFW	Interflow inflow parameter	none	1.0	3.0	1.0	10.0	Soils, topography, land use	**Calibration**, based on hydrograph separation
IRC	Interflow recession parameter	none	0.5	0.70	0.30	0.85	Soils, topography, land use	Often start with a value of 0.7, and then adjust
LZETP	Lower zone ET parameter	none	0.2	0.70	0.1	0.9	Vegetation type/density, root depth	**Calibration**
IWAT – PARM2								
LSUR	Length of overland flow	feet	50	150	50	250	Topography, drainage system	Estimate from maps, GIS, or field survey
SLSUR	Slope of overland flow plane	ft/ft	0.01	0.05	0.001	0.15	Topography, drainage	Estimate from maps, GIS, or field survey
NSUR	Manning's n (roughness) for overland flow	none	0.03	0.10	0.01	0.15	Impervious surface conditions	Typical range is 0.05 to 0.10 for roads/parking lots
RETSC	Retention storage capacity	inches	0.03	0.10	0.01	0.30	Impervious surface conditions	Typical range is 0.03 to 0.10 for roads/parking lots
IWAT – PARM3 (PETMAX and PETMIN, same values as shown for PWAT – PARM3)								

Table G.1-3: HSPF PERLND/PWATER Parameters from BMP Sizing Calculator Methodology

		Hydrologic Soil Group A			Hydrologic Soil Group B			Hydrologic Soil Group C			Hydrologic Soil Group D		
	Slope	5%	10%	15%	5%	10%	15%	5%	10%	15%	5%	10%	15%
PWAT_PARM2	Units												
FOREST	None	0	0	0	0	0	0	0	0	0	0	0	0
LZSN	inches	5.2	4.8	4.5	5.0	4.7	4.4	4.8	4.5	4.2	4.8	4.5	4.2
INFILT	in/hr	0.090	0.070	0.045	0.070	0.055	0.040	0.050	0.040	0.032	0.040	0.030	0.020
LSUR	Feet	200	200	200	200	200	200	200	200	200	200	200	200
SLSUR	ft/ft	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15	0.05	0.1	0.15
KVARY	1/inches	3	3	3	3	3	3	3	3	3	3	3	3
AGWRC	None	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
PWAT_PARM3													
PETMAX (F)	F	35	35	35	35	35	35	35	35	35	35	35	35
PETMIN (F)	F	30	30	30	30	30	30	30	30	30	30	30	30
INFEXP	None	2	2	2	2	2	2	2	2	2	2	2	2
INFILD	None	2	2	2	2	2	2	2	2	2	2	2	2
DEEPFR	None	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
BASETP	None	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
AGEWTP	None	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PWAT_PARM4													
CEPSC	inches	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
UZSN	inches	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
NSUR	None	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
INTFW	None	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
IRC	None	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
LZETP	None	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Parameters within SDHM are documented in "San Diego Hydrology Model User Manual," prepared by Clear Creek Solutions, Inc. (as of the development of the Manual, the current version of the SDHM User Manual is dated January 2012). Parameters established for SDHM represent "grass" (non-turf grasslands), "dirt," "gravel," and "urban" cover. The documented PERLND and IMPLND parameters for the various land covers and soil types have been pre-loaded into SDHM. SDHM users shall use the parameters that have been pre-loaded into the program without modification unless the preparer can provide documentation to substantiate use of other parameters.

G.1.4.2 Rainfall Loss Parameters for SWMM

In SWMM, rainfall loss parameters (parameters that describe processes occurring when rainfall lands on pervious lands and impervious lands) are entered in the "subcatchment" module. In addition to specifying parameters, the SWMM user must also select an infiltration model.

The SWMM Manual provides details regarding the subcatchment parameters and summary tables of possible ranges of these parameters. For SWMM studies for hydromodification management in San Diego, subcatchment parameters shall fall within the range provided in the SWMM Manual. Some of the parameters depend on the selection of the infiltration model. For consistency across the San Diego region, SWMM users shall use the Green-Ampt infiltration model for hydromodification management studies. Table G.1-4 presents SWMM subcatchment parameters for use in hydromodification management studies in the San Diego region.

Table G.1-4: Subcatchment Parameters for SWMM Studies for Hydromodification Management in San Diego

SWMM Parameter Name	Unit	Range	Use in San Diego
Name X-Coordinate Y-Coordinate Description Tag Rain Gage Outlet	N/A	N/A – project-specific	Project-specific
Area	acres (ac)	Project-specific	Project-specific
Width	feet (ft)	Project-specific	Project-specific
% Slope	percent (%)	Project-specific	Project-specific
% Imperv	percent (%)	Project-specific	Project-specific
N-imperv	--	0.011 – 0.024 presented in Table A.6 of SWMM Manual	default use 0.012 for smooth concrete, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
N-Perv	--	0.05 – 0.80 presented in Table A.6 of SWMM Manual	default use 0.15 for short prairie grass, otherwise provide documentation of other surface consistent with Table A.6 of SWMM Manual
Dstore-Imperv	inches	0.05 – 0.10 inches presented in Table A.5 of SWMM Manual	0.05
Dstore-Perv	inches	0.10 – 0.30 inches presented in Table A.5 of SWMM Manual	0.10
%ZeroImperv	percent (%)	0% – 100%	25%
Subarea routing	--	OUTLET IMPERVIOUS PERVIOUS	Project-specific, typically OUTLET
Percent Routed	%	0% – 100%	Project-specific, typically 100%
Infiltration	Method	HORTON GREEN_AMPT CURVE_NUMBER	GREEN_AMPT

SWMM Parameter Name	Unit	Range	Use in San Diego
Suction Head (Green-Ampt)	Inches	1.93 – 12.60 presented in Table A.2 of SWMM Manual	Hydrologic Soil Group A: 1.5 Hydrologic Soil Group B: 3.0 Hydrologic Soil Group C: 6.0 Hydrologic Soil Group D: 9.0
Conductivity (Green-Ampt)	Inches per hour	0.01 – 4.74 presented in Table A.2 of SWMM Manual by soil texture class 0.00 – ≥0.45 presented in Table A.3 of SWMM Manual by hydrologic soil group	Hydrologic Soil Group A: 0.3 Hydrologic Soil Group B: 0.2 Hydrologic Soil Group C: 0.1 Hydrologic Soil Group D: 0.025 Note: reduce conductivity by 25% in the post-project condition when native soils will be compacted. Conductivity may also be reduced by 25% in the pre-development condition model for redevelopment areas that are currently concrete or asphalt but must be modeled according to their underlying soil characteristics. For fill soils in post-project condition, see Section G.1.4.3.
Initial Deficit (Green-Ampt)		The difference between soil porosity and initial moisture content. Based on the values provided in Table A.2 of SWMM Manual, the range for completely dry soil would be 0.097 to 0.375	Hydrologic Soil Group A: 0.30 Hydrologic Soil Group B: 0.31 Hydrologic Soil Group C: 0.32 Hydrologic Soil Group D: 0.33 Note: in long-term continuous simulation, this value is not important as the soil will reach equilibrium after a few storm events regardless of the initial moisture content specified.
Groundwater	yes/no	yes/no	NO
LID Controls			Project Specific

SWMM Parameter Name	Unit	Range	Use in San Diego
Snow Pack Land Uses Initial Buildup Curb Length			Not applicable to hydromodification management studies

G.1.4.3 Pervious Area Rainfall Loss Parameters in Post-Project Condition (HSPF, SDHM, and SWMM)

The following guidance applies to HSPF, SDHM, and SWMM. When modeling pervious areas in the post-project condition, fill soils shall be modeled as hydrologic soil group Type D soils, or the project applicant may provide an actual expected infiltration rate for the fill soil based on testing (must be approved by the Port for use in the model). Where landscaped areas on fill soils will be re-tilled and/or amended in the post-project condition, the landscaped areas may be modeled as Type C soils. Areas to be re-tilled and/or amended in the post-project condition must be shown on the project plans. For undisturbed pervious areas (i.e., native soils, no fill), use the actual hydrologic soil group, the same as in the pre-development condition.

G.1.5 Modeling Structural BMPS (Ponds AND LID Features)

There are many ways to model structural BMPs. There are standard modules for several pond or LID elements included in SDHM and SWMM. Users may also set up project-specific stage-storage-discharge relationships representing structural BMPs. Regardless of the modeling method, certain characteristics of the structural BMP, including infiltration of water from the bottom of the structural BMP into native soils, porosity of bioretention soils and/or gravel sublayers, and other program-specific parameters must be consistent with those presented below, unless the preparer can provide documentation to substantiate use of other parameters, subject to local jurisdiction approval. The geometry of structural BMPs is project-specific and shall match the project plans.

G.1.5.1 Infiltration into Native Soils Below Structural BMPs

Infiltration into native soils below structural BMPs may be modeled as a constant outflow rate equal to the project site-specific design infiltration rate (Worksheet D.5-1) multiplied by the area of the infiltrating surface (and converted to cubic feet per second). This infiltration rate is not the same as an infiltration parameter used in the calculation of rainfall losses, such as the HSPF INFILT parameter or the Green-Ampt conductivity parameter in the SWMM subcatchment module. It must be site-specific and must be determined based on the methods presented in Appendix D of this manual.

For preliminary analysis when site-specific geotechnical investigation has not been completed, project applicants proposing infiltration into native soils as part of the structural BMP design shall prepare a sensitivity analysis to determine a potential range for the structural BMP size based on a range of potential infiltration rates. As shown in Appendices C and D of this manual, many factors influence the ability to infiltrate storm water. Therefore even when soils types A and B are present, which are generally expected to infiltrate storm water, the possibility that a very low infiltration rate could be determined at design level must be considered. The range of potential infiltration rates for preliminary analysis is shown below in Table G.1-5.

Table G.1-5: Range of Potential Infiltration Rates to be Studied for Sensitivity Analysis when Native Infiltration is Proposed but Site-Specific Geotechnical Investigation has not been Completed

Hydrologic Soil Group at Location of Proposed Structural BMP	Low Infiltration Rate for Preliminary Study (inches/hour)	High Infiltration Rate for Preliminary Study (inches/hour)
A	0.02	2.4
B	0.02	0.52
C	0	0.08
D	0	0.02

The infiltration rates shown above are for preliminary investigation only. Final design of a structural BMP must be based on the project site-specific design infiltration rate (Worksheet D.5-1).

G.1.5.2 Structural BMPs That Do Not Include Sub-Layers (Ponds)

To model a pond, basin, or other depressed area that does not include processing runoff through sublayers of amended soil and/or gravel, create a stage storage discharge relationship for the pond, and supply the information to the model according to the program requirements. For HSPF users, the stage-storage-discharge relationship is provided in FTABLES. SDHM users may use the TRAPEZOIDAL POND element for a trapezoidal pond or IRREGULAR POND element to request the program to create the stage-storage-discharge relationship, use the SSD TABLE element to supply a user-created stage-storage-discharge relationship, or use other available modules such as TANK or VAULT. For SWMM users, the stage-storage relationship is supplied in the storage unit module, and the stage-discharge relationship may be represented by various other modules such as the orifice, weir, or outlet modules. Stage-storage and stage-discharge curves for structural BMPs must be fully documented in the project-specific HMP report and must be consistent with the structural BMP(s) shown on project plans.

For user-created stage-discharge relationships, refer to local drainage manual criteria for equations representing hydraulic behavior of outlet structures. Users relying on the software to develop the stage-discharge relationship may use the equations built into the program. This manual does not recommend that all program modules calculating stage-discharge relationships must be uniform because the flows to be controlled for hydromodification management are low flows, calculated differently from the single-storm event peak flows studied for flood control purposes, and hydromodification management performance standards do not represent any performance standard for flood control drainage design. Note that for design of emergency outlet structures, and any calculations related to single-storm event routing for flood control drainage design, stage-discharge calculations must be consistent with the local drainage design requirements. This may require separate calculations for stage-discharge relationship pursuant to local manuals. The HMP flow rates shall not be used for flood control calculations.

G.1.5.3 Structural BMPs That Include Sub-Layers (Bioretention and Other LID)

G.1.5.3.1 Characteristics of Engineered Soil Media

The engineered soil media used in bioretention, biofiltration with partial retention, and biofiltration structural BMPs is a sandy loam. The following parameters presented in Table G.1-6 are characteristics of a sandy loam for use in continuous simulation models.

Table G.1-6: Characteristics of Sandy Loam to Represent Engineered Soil Media in Continuous Simulation for Hydromodification Management Studies in San Diego

Soil Texture	Porosity	Field Capacity	Wilting Point	Conductivity	Suction Head
Sandy Loam	0.4	0.2	0.1	5 inches/hour	1.5 inches

- Porosity is the volume of pore space (voids) relative to the total volume of soil (as a fraction).
- Field Capacity is the volume of pore water relative to total volume after the soil has been allowed to drain fully (as a fraction). Below this level, vertical drainage of water through the soil layer does not occur.
- Wilting point is the volume of pore water relative to total volume for a well dried soil where only bound water remains (as a fraction). The moisture content of the soil cannot fall below this limit.
- Conductivity is the hydraulic conductivity for the fully saturated soil (in/hr or mm/hr).
- Suction head is the average value of soil capillary suction along the wetting front (inches or mm).

Figures G.1-3 and G.1-4, from http://www.stevenswater.com/articles/irrigationscheduling.aspx, illustrate unsaturated soil and soil saturation, field capacity, and wilting point.

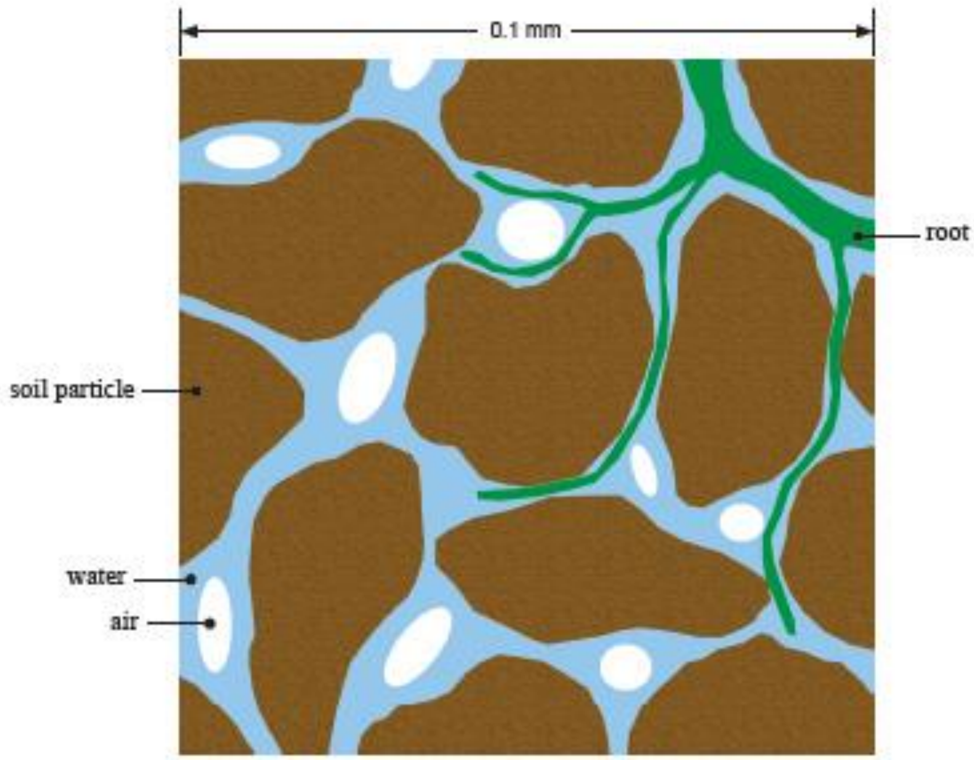


Figure G.1-3: Unsaturated Soil Composition

Unsaturated soil is composed of solid particles, organic material and pores. The pore space will contain air and water.

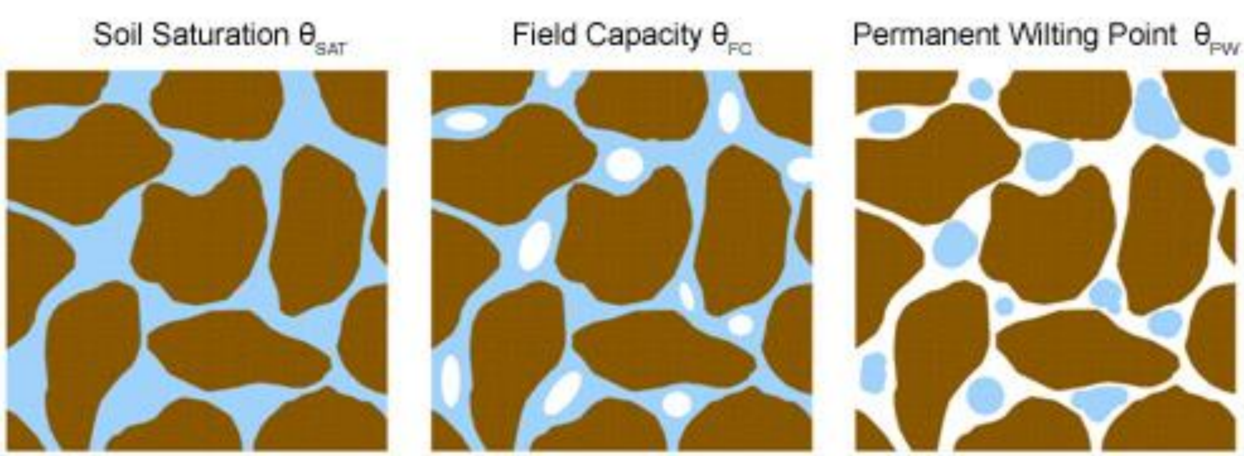


Figure G.1-4: Soil saturation, field capacity, and wilting point

G.1.5.3.2 Characteristics of Gravel

For the purpose of hydromodification management studies, it may be assumed that water moves freely through gravel, not limited by hydraulic properties of the gravel. For the purpose of calculating available volume, use porosity of 0.4, or void ratio of 0.67. Porosity is equal to void ratio divided by (1 + void ratio).

G.1.5.3.3 Additional Guidance for SDHM Users

The module titled "bioretention/rain garden element" may be used to represent bioretention or biofiltration BMPs. SDHM users using the available "bioretention/rain garden element" shall customize the soil media characteristics to use the parameters from Table G.1-6 above, and select "gravel" for gravel sublayers. All other input variables are project-specific. "Native infiltration" refers to infiltration from the bottom of the structural BMP into the native soil. This variable is project-specific, see Section G.1.5.1.

G.1.5.3.4 Additional Guidance for SWMM Users

The "bio-retention cell" LID control may be used to represent bioretention or biofiltration BMPs. Table G.1-7 provides parameters required for the standard "bio-retention cell" available in SWMM. The parameters are entered in the LID Control Editor.

Table G.1-7: Parameters for SWMM "Bio-Retention Cell" Module for Hydromodification Management Studies in San Diego

SWMM Parameter Name	Unit	Use in San Diego
Surface		
Berm Height also known as Storage Depth	inches	Project-specific
Vegetative Volume Fraction also known as Vegetative Cover Fraction	---	0
Surface Roughness	---	0 (this parameter is not applicable to bio-retention cell)
Surface Slope	---	0 (this parameter is not applicable to bio-retention cell)
Soil		
Thickness	inches	project-specific
Porosity	---	0.40
Field Capacity	---	0.2

SWMM Parameter Name	Unit	Use in San Diego
Wilting Point	---	0.1
Conductivity	Inches/hour	5
Conductivity Slope	---	5
Suction Head	inches	1.5
Storage		
Thickness also known as Height	inches	Project-specific
Void Ratio	---	0.67
Seepage Rate also known as Conductivity	Inches/hour	Conductivity from the storage layer refers to infiltration from the bottom of the structural BMP into the native soil. This variable is project-specific, see Section G.5.1. Use 0 if the bio-retention cell includes an impermeable liner
Clogging Factor	---	0
Underdrain		
Flow Coefficient Also known as Drain Coefficient	---	Project-specific
Flow Exponent Also known as Drain Exponent	---	Project-specific, typically 0.5
Offset Height Also known as Drain Offset Height	Inches	Project-specific

G.1.6 Flow Frequency and Duration

The continuous simulation model will generate a flow record corresponding to the frequency of the rainfall data input as its output. This flow record must then be processed to determine pre-development and post-project flow rates and durations. Compliance with hydromodification management requirements of this manual is achieved when results for flow duration meet the performance standards. The performance standard is as follows (also presented in Chapter 6 of this manual):

1. For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-development 2-year runoff event ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-development 10-year runoff event (Q_{10}), the post-project discharge rates and durations must not exceed the pre-development rates and

durations by more than 10 percent. The specific lower flow threshold will depend on the erosion susceptibility of the receiving stream for the project site (see Section 6.3.4).

To demonstrate that a flow control facility meets the hydromodification management performance standard, a flow duration summary must be generated and compared for pre-development and post-project conditions. The following guidelines shall be used for determining flow rates and durations.

G.1.6.1 Determining Flow Rates from Continuous Hourly Flow Output

Flow rates for hydromodification management studies in San Diego must be based on partial duration series analysis of the continuous hourly flow output. Partial duration series frequency calculations consider multiple storm events in a given year. To construct the partial duration series:

1. Parse the continuous hourly flow data into discrete runoff events. The following separation criteria may be used for separation of flow events: a new discrete event is designated when the flow falls below an artificially low flow value based on a fraction of the contributing watershed area (e.g., 0.002 to 0.005 cfs/acre) for a time period of 24 hours. Project applicants may consider other separation criteria provided the separation interval is not more than 24 hours and the criteria is clearly described in the submittal document.
2. Rank the peak flows from each discrete flow event, and compute the return interval or plotting position for each event.

Readers who are unfamiliar with how to compute the partial-duration series should consult reference books or online resources for additional information. For example, Hydrology for Engineers, by Linsley et all, 1982, discusses partial-duration series on pages 373-374 and computing recurrence intervals or plotting positions on page 359. Handbook of Applied Hydrology, by Chow, 1964, contains a detailed discussion of flow frequency analysis, including Annual Exceedance, Partial-Duration and Extreme Value series methods, in Chapter 8. The US Geological Survey (USGS) has several hydrologic study reports available online that use partial duration series statistics (see http://water.usgs.gov/ and http://water.usgs.gov/osw/bulletin17b/AGU_Langbein_1949.pdf).

Pre-development Q_2 and Q_{10} shall be determined from the partial duration analysis for the pre-development hourly flow record. Pre-development Q_{10} is the upper threshold of flow rates to be controlled in the post-project condition. The lower flow threshold is a fraction of the pre-development Q_2 determined based on the erosion susceptibility of the receiving stream. Simply multiply the pre-development Q_2 by the appropriate fraction (e.g., $0.1Q_2$) to determine the lower flow threshold.

G.1.6.2 Determining Flow Durations from Continuous Hourly Flow Output

Flow durations must be summarized within the range of flows to control. Flow duration statistics provide a simple summary of how often a particular flow rate is exceeded. To prepare this summary:

1. Rank the entire hourly runoff time series output.

2. Extract the portion of the ranked hourly time series output from the lower flow threshold to the upper flow threshold – this is the portion of the record to be summarized.
3. Divide the applicable portion of the record into 100 equal flow bins (compute the difference between the upper flow threshold (cfs) and lower flow threshold (cfs) and divide this value by 99 to establish the flow bin size).
4. Count the number of hours of flow that fall into each flow bin.

Both pre-development and post-project flow duration summary must be based on the entire length of the flow record. Compare the post-project flow duration summary to the pre-development flow duration summary to determine if it meets performance criteria for post-project flow rates and durations (criteria presented under Section G.1.6).

G.2 Sizing Factors for Hydromodification Management BMPs

This section presents sizing factors for design of flow control structural BMPs based on the sizing factor method identified in Chapter 6.3.5.1. The sizing factors are re-printed from the "San Diego BMP Sizing Calculator Methodology," dated January 2012, prepared by Brown and Caldwell (herein "BMP Sizing Calculator Methodology"). The sizing factors are linked to the specific details and descriptions that were presented in the BMP Sizing Calculator Methodology, with limited options for modifications. The sizing factors were developed based on the 2007 MS4 Permit. Although the sizing factors were developed under the 2007 MS4 Permit, the unit runoff ratios and some sizing factors developed for flow control facility sizing may still be applied at the discretion of the [City Engineer]. Some of the original sizing factors developed based on the 2007 MS4 Permit and presented in the BMP Sizing Calculator Methodology are not compatible with new requirements of the 2013 MS4 Permit, and therefore are not included in this manual. The sizing factor method is intended for simple studies that do not include diversion, do not include significant offsite area draining through the project from upstream, and do not include offsite area downstream of the project area. Use of the sizing factors is limited to the specific structural BMPs described in this Appendix. Sizing factors are available for the following specific structural BMPs:

- Full infiltration condition:
  - **Infiltration**: sizing factors available for A and B soils represent a below-ground structure (dry well)
  - **Bioretention**: sizing factors available for A and B soils represent a bioretention area with engineered soil media and gravel storage layer, with no underdrain and no impermeable liner
- Partial infiltration condition:
  - **Biofiltration with partial retention**: sizing factors available for C and D soils represent a bioretention area with engineered soil media and gravel storage layer, with an underdrain, with gravel storage below the underdrain, with no impermeable liner
- No infiltration condition:
  - **Biofiltration**: sizing factors available for C and D soils represent a bioretention area with engineered soil media and gravel storage layer, with an underdrain, without gravel storage below the underdrain, with no impermeable liner
  - **Biofiltration (formerly known as "flow-through planter") with impermeable liner**: sizing factors available for C and D soils represent a biofiltration system with engineered soil media and gravel storage layer, with an underdrain, with or without

gravel storage below the underdrain, with an impermeable liner

- Other:
  - **Cistern**: sizing factors available for A, B, C, or D soils represent a vessel with a low flow orifice outlet to meet the hydromodification management performance standard.

Sizing factors were created based on three rainfall basins: Lindbergh Field, Oceanside, and Lake Wohlford.

The following information is needed to use the sizing factors:

- Determine the appropriate rainfall basin for the project site from Figure G.2-1, Rainfall Basin Map
- Hydrologic soil group at the project site (use available information pertaining to existing underlying soil type such as soil maps published by the Natural Resources Conservation Service)
- Pre-development and post-project slope categories (low = 0% – 5%, moderate = 5% – 15%, steep = >15%)
- Area tributary to the structural BMP
- Area weighted runoff factor (C) for the area draining to the BMP from Table G.2-1. Note: runoff coefficients and adjustments presented in Appendices B.1 and B.2 are for pollutant control only and are not applicable for hydromodification management studies
- Fraction of Q2 to control (see Chapter 6.3.4)

When using the sizing factor method, Worksheet G.2-1 may be used to present the calculations of the required minimum areas and/or volumes of BMPs as applicable.

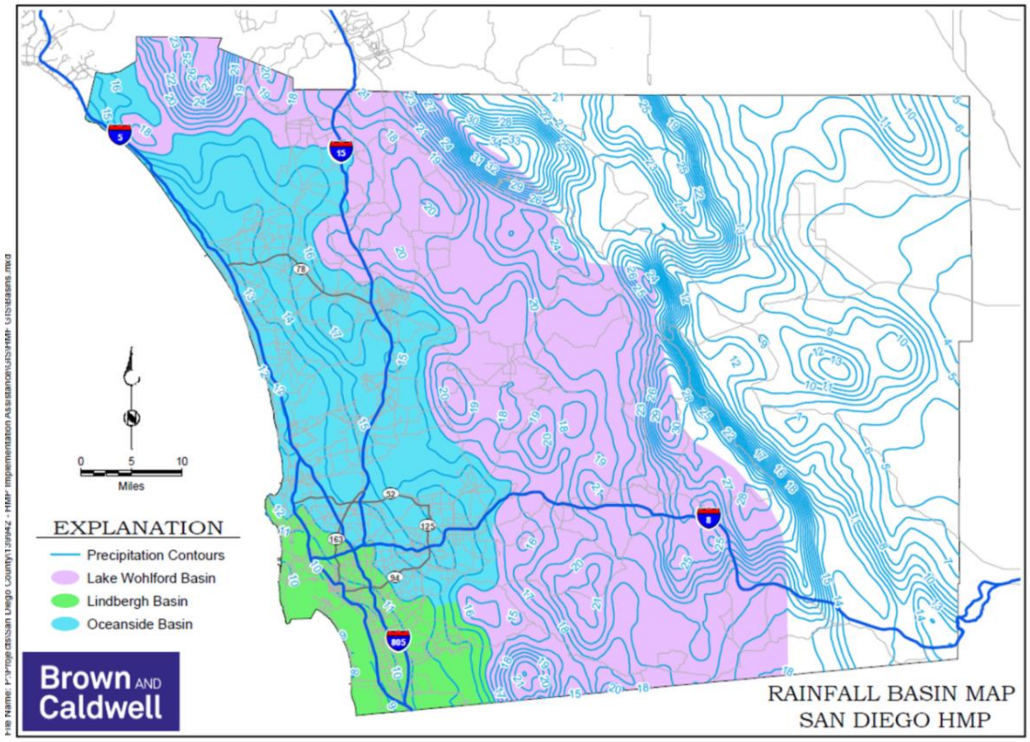


Figure G.2-1: Appropriate Rain Gauge for Project Sites

Table G.2-1: Runoff factors for surfaces draining to BMPs for Hydromodification Sizing Factor Method

Surface	Runoff Factor
Roofs	1.0
Concrete	1.0
Pervious Concrete	0.10
Porous Asphalt	0.10
Grouted Unit Pavers	1.0
Solid Unit Pavers on granular base, min. 3/16 inch joint space	0.20
Crushed Aggregate	0.10
Turf block	0.10
Amended, mulched soils	0.10
Landscape	0.10

Worksheet G.2-1: Sizing Factor Worksheet

Site Information			
Project Name:		Hydrologic Unit	
Project Applicant:		Rain: Gauge:	
Jurisdiction:		Total Project Area:	
Assessor's Parcel Number :		Low Flow Threshold:	
BMP Name:		BMP Type:	

Areas Draining to BMP						Sizing Factors			Minimum BMP Size		
DMA Name	Area (sf)	Soil Type	Pre-Project Slope	Post Project Surface Type	Runoff Factor (From Table G.2-1)	Surface Area	Surface Volume	Subsurface Volume	Surface Area (sf)	Surface Volume (cf)	Subsurface Volume (cf)
Total DMA Area								Minimum BMP Size*			
								Proposed BMP Size*			

*Minimum BMP Size = Total of rows above.

*Proposed BMP Size $\geq$ Minimum BMP size.

G.2.1 Unit Runoff Ratios

Table G.2-2 presents unit runoff ratios for calculating pre-development Q_2, to be used when applicable to determine the lower flow threshold for low flow orifice sizing for biofiltration with partial retention, biofiltration, biofiltration with impermeable liner, or cistern BMPs. There is no low flow orifice in the infiltration BMP or bioretention BMP. The unit runoff ratios are re-printed from the BMP Sizing Calculator methodology. Unit runoff ratios for "urban" and "impervious" cover categories were not transferred to this manual due to the requirement to control runoff to pre-development condition (see Chapter 6.3.3).

How to use the unit runoff ratios:

Obtain unit runoff ratio from Table G.2-2 based on the project's rainfall basin, hydrologic soil group, and pre-development slope (for redevelopment projects, pre-development slope may be considered if historic topographic information is available, otherwise use pre-project slope). Multiply the area tributary to the structural BMP (A, acres) by the unit runoff ratio (Q2, cfs/acre) to determine the pre-development Q2 to determine the lower flow threshold, to use for low flow orifice sizing.

Table G.2-2: Unit Runoff Ratios for Sizing Factor Method

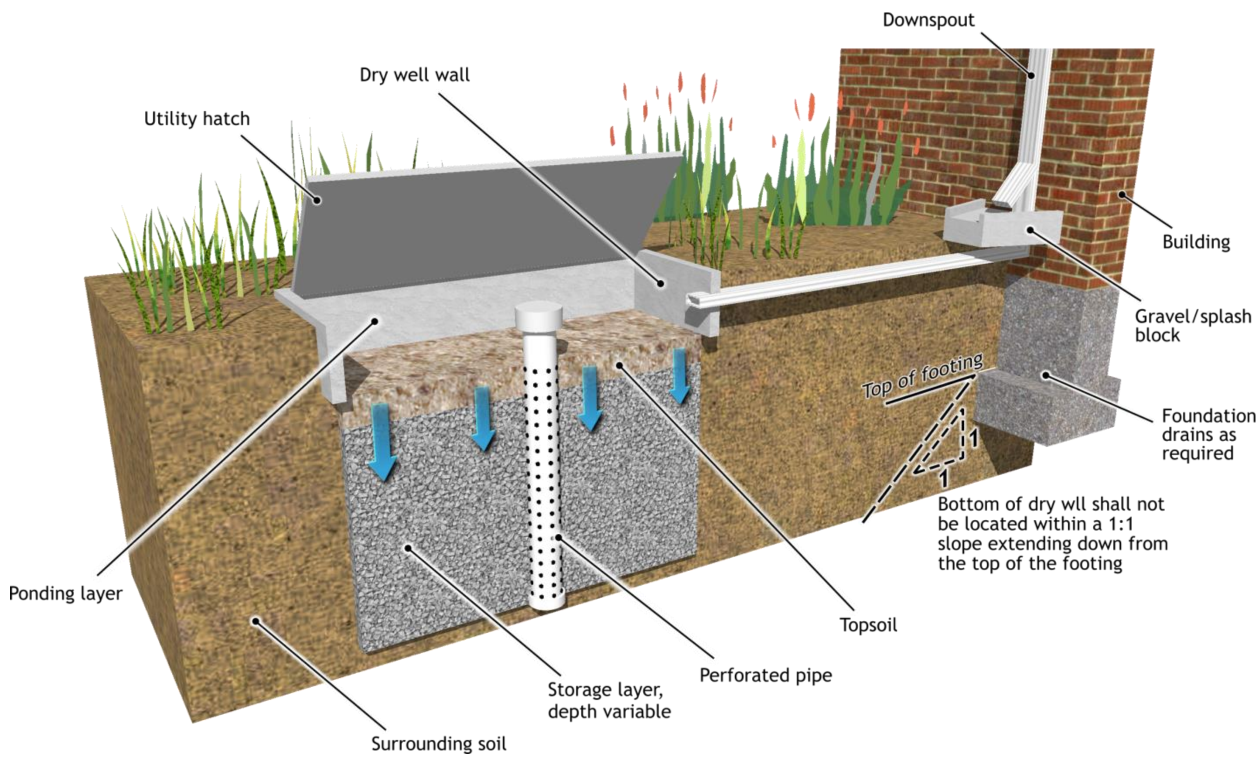
Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Lake Wohlford	A	Scrub	Low	0.136	0.369
Lake Wohlford	A	Scrub	Moderate	0.207	0.416
Lake Wohlford	A	Scrub	Steep	0.244	0.47
Lake Wohlford	B	Scrub	Low	0.208	0.414
Lake Wohlford	B	Scrub	Moderate	0.227	0.448
Lake Wohlford	B	Scrub	Steep	0.253	0.482
Lake Wohlford	C	Scrub	Low	0.245	0.458
Lake Wohlford	C	Scrub	Moderate	0.253	0.481
Lake Wohlford	C	Scrub	Steep	0.302	0.517
Lake Wohlford	D	Scrub	Low	0.253	0.48
Lake Wohlford	D	Scrub	Moderate	0.292	0.516
Lake Wohlford	D	Scrub	Steep	0.351	0.538

Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	Soil	Cover	Slope	Q_2 (cfs/acre)	Q_{10} (cfs/ac)
Oceanside	A	Scrub	Low	0.035	0.32
Oceanside	A	Scrub	Moderate	0.093	0.367
Oceanside	A	Scrub	Steep	0.163	0.42
Oceanside	B	Scrub	Low	0.08	0.365
Oceanside	B	Scrub	Moderate	0.134	0.4
Oceanside	B	Scrub	Steep	0.181	0.433
Oceanside	C	Scrub	Low	0.146	0.411
Oceanside	C	Scrub	Moderate	0.185	0.433
Oceanside	C	Scrub	Steep	0.217	0.458
Oceanside	D	Scrub	Low	0.175	0.434
Oceanside	D	Scrub	Moderate	0.212	0.455
Oceanside	D	Scrub	Steep	0.244	0.571
Lindbergh	A	Scrub	Low	0.003	0.081
Lindbergh	A	Scrub	Moderate	0.018	0.137
Lindbergh	A	Scrub	Steep	0.061	0.211
Lindbergh	B	Scrub	Low	0.011	0.134
Lindbergh	B	Scrub	Moderate	0.033	0.174
Lindbergh	B	Scrub	Steep	0.077	0.23
Lindbergh	C	Scrub	Low	0.028	0.19
Lindbergh	C	Scrub	Moderate	0.075	0.232
Lindbergh	C	Scrub	Steep	0.108	0.274
Lindbergh	D	Scrub	Low	0.05	0.228
Lindbergh	D	Scrub	Moderate	0.104	0.266
Lindbergh	D	Scrub	Steep	0.143	0.319

G.2.2 Sizing Factors for "Infiltration" BMP

Table G.2-3 presents sizing factors for calculating the required surface area (A) and volume (V1) for an infiltration BMP. There is no underdrain and therefore no low flow orifice in the infiltration BMP. Sizing factors were developed for hydrologic soil groups A and B only. This BMP is not applicable in hydrologic soil groups C and D. The infiltration BMP is a below-ground structure (dry well) that consists of three layers:

- Ponding layer: a nominal 6-inch ponding layer should be included below the access hatch to allow for water spreading and infiltration during intense storms.
- Soil layer [topsoil layer]: 12 inches of soil should be included to remove pollutants.
- Free draining layer [storage layer]: The drywell is sized assuming a 6-foot deep free draining layer. However, designers could use shallower facility depths [provided the minimum volume and surface area are met].



Infiltration Facility BMP Example Illustration

Reference: "San Diego BMP Sizing Calculator Methodology," prepared by Brown and Caldwell, dated January 2012

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-3 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet) and volume (V1, cubic feet) for the infiltration BMP. The civil engineer shall provide the necessary volume and surface area of the BMP on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size of the BMP using the sizing factors, then refer to Appendix B.4 to check whether the BMP meets performance standards for infiltration for pollutant control. If necessary, increase the surface area to meet the drawdown requirement for pollutant control.

Table G.2-3: Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	0.040	0.1040	N/A
$0.5Q_2$	A	Moderate	Lindbergh	0.040	0.1040	N/A
$0.5Q_2$	A	Steep	Lindbergh	0.035	0.0910	N/A
$0.5Q_2$	B	Flat	Lindbergh	0.058	0.1495	N/A
$0.5Q_2$	B	Moderate	Lindbergh	0.055	0.1430	N/A
$0.5Q_2$	B	Steep	Lindbergh	0.050	0.1300	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Flat	Oceanside	0.045	0.1170	N/A
$0.5Q_2$	A	Moderate	Oceanside	0.045	0.1170	N/A
$0.5Q_2$	A	Steep	Oceanside	0.040	0.1040	N/A
$0.5Q_2$	B	Flat	Oceanside	0.065	0.1690	N/A
$0.5Q_2$	B	Moderate	Oceanside	0.065	0.1690	N/A
$0.5Q_2$	B	Steep	Oceanside	0.060	0.1560	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Flat	L Wohlford	0.050	0.1300	N/A
$0.5Q_2$	A	Moderate	L Wohlford	0.050	0.1300	N/A
$0.5Q_2$	A	Steep	L Wohlford	0.040	0.1040	N/A
$0.5Q_2$	B	Flat	L Wohlford	0.078	0.2015	N/A
$0.5Q_2$	B	Moderate	L Wohlford	0.075	0.1950	N/A
$0.5Q_2$	B	Steep	L Wohlford	0.065	0.1690	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Flat	Lindbergh	0.040	0.1040	N/A
$0.3Q_2$	A	Moderate	Lindbergh	0.040	0.1040	N/A
$0.3Q_2$	A	Steep	Lindbergh	0.035	0.0910	N/A
$0.3Q_2$	B	Flat	Lindbergh	0.058	0.1495	N/A
$0.3Q_2$	B	Moderate	Lindbergh	0.055	0.1430	N/A
$0.3Q_2$	B	Steep	Lindbergh	0.050	0.1300	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Flat	Oceanside	0.045	0.1170	N/A
$0.3Q_2$	A	Moderate	Oceanside	0.045	0.1170	N/A
$0.3Q_2$	A	Steep	Oceanside	0.040	0.1040	N/A
$0.3Q_2$	B	Flat	Oceanside	0.065	0.1690	N/A
$0.3Q_2$	B	Moderate	Oceanside	0.065	0.1690	N/A
$0.3Q_2$	B	Steep	Oceanside	0.060	0.1560	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Flat	L Wohlford	0.050	0.1300	N/A
$0.3Q_2$	A	Moderate	L Wohlford	0.050	0.1300	N/A
$0.3Q_2$	A	Steep	L Wohlford	0.040	0.1040	N/A
$0.3Q_2$	B	Flat	L Wohlford	0.078	0.2015	N/A
$0.3Q_2$	B	Moderate	L Wohlford	0.075	0.1950	N/A
$0.3Q_2$	B	Steep	L Wohlford	0.065	0.1690	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Lindbergh	0.040	0.1040	N/A
$0.1Q_2$	A	Moderate	Lindbergh	0.040	0.1040	N/A
$0.1Q_2$	A	Steep	Lindbergh	0.035	0.0910	N/A
$0.1Q_2$	B	Flat	Lindbergh	0.058	0.1495	N/A
$0.1Q_2$	B	Moderate	Lindbergh	0.055	0.1430	N/A
$0.1Q_2$	B	Steep	Lindbergh	0.050	0.1300	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Oceanside	0.045	0.1170	N/A
$0.1Q_2$	A	Moderate	Oceanside	0.045	0.1170	N/A
$0.1Q_2$	A	Steep	Oceanside	0.040	0.1040	N/A
$0.1Q_2$	B	Flat	Oceanside	0.065	0.1690	N/A
$0.1Q_2$	B	Moderate	Oceanside	0.065	0.1690	N/A
$0.1Q_2$	B	Steep	Oceanside	0.060	0.1560	N/A

Sizing Factors for Hydromodification Flow Control Infiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Flat	L Wohlford	0.050	0.1300	N/A
$0.1Q_2$	A	Moderate	L Wohlford	0.050	0.1300	N/A
$0.1Q_2$	A	Steep	L Wohlford	0.040	0.1040	N/A
$0.1Q_2$	B	Flat	L Wohlford	0.078	0.2015	N/A
$0.1Q_2$	B	Moderate	L Wohlford	0.075	0.1950	N/A
$0.1Q_2$	B	Steep	L Wohlford	0.065	0.1690	N/A
$0.1Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Infiltration volume sizing factor for flow control

Definitions for "N/A"

- Soil groups A and B: N/A in column V2 means there is no V2 element in this infiltration BMP for soil groups A and B
- Soil groups C and D: N/A across all elements (A, V1, V2) means sizing factors were not developed for an infiltration BMP for soil groups C and D

G.2.3 Sizing Factors for Bioretention

Table G.2-4 presents sizing factors for calculating the required surface area (A) and surface volume (V1) for the bioretention BMP. The bioretention BMP consists of two layers:

- Ponding layer: 10-inches active storage, [minimum] 2-inches of freeboard above overflow relief
- Growing medium: 18-inches of soil [bioretention soil media]

This BMP is applicable in soil groups A and B. This BMP does not include an underdrain or a low flow orifice. This BMP does not include an impermeable layer at the bottom of the facility to prevent infiltration into underlying soils, regardless of hydrologic soil group. If a facility is to be lined, the designer must use the sizing factors for biofiltration with impermeable layer (formerly known as "flow-through planter").

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-4 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet) and surface volume (V1, cubic feet). Note the surface volume is the ponding layer. The BMP must also include 18 inches of bioretention soil media which does not contribute to V1. The civil engineer shall provide the necessary volume and surface area of the BMP on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size of the BMP using the sizing factors, then refer to Appendix B.4 to check whether the BMP meets performance standards for infiltration for pollutant control. If necessary, adjust the surface area, depth of storage layer, or depth of growing medium as needed to meet pollutant control standards.

Table G.2-4: Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	0.060	0.0500	N/A
$0.5Q_2$	A	Moderate	Lindbergh	0.055	0.0458	N/A
$0.5Q_2$	A	Steep	Lindbergh	0.045	0.0375	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Flat	Lindbergh	0.093	0.0771	N/A
$0.5Q_2$	B	Moderate	Lindbergh	0.085	0.0708	N/A
$0.5Q_2$	B	Steep	Lindbergh	0.065	0.0542	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Flat	Oceanside	0.070	0.0583	N/A
$0.5Q_2$	A	Moderate	Oceanside	0.065	0.0542	N/A
$0.5Q_2$	A	Steep	Oceanside	0.060	0.0500	N/A
$0.5Q_2$	B	Flat	Oceanside	0.098	0.0813	N/A
$0.5Q_2$	B	Moderate	Oceanside	0.090	0.0750	N/A
$0.5Q_2$	B	Steep	Oceanside	0.075	0.0625	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Flat	L Wohlford	0.050	0.0417	N/A
$0.5Q_2$	A	Moderate	L Wohlford	0.045	0.0375	N/A
$0.5Q_2$	A	Steep	L Wohlford	0.040	0.0333	N/A
$0.5Q_2$	B	Flat	L Wohlford	0.048	0.0396	N/A
$0.5Q_2$	B	Moderate	L Wohlford	0.045	0.0375	N/A
$0.5Q_2$	B	Steep	L Wohlford	0.040	0.0333	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	A	Flat	Lindbergh	0.060	0.0500	N/A
$0.3Q_2$	A	Moderate	Lindbergh	0.055	0.0458	N/A
$0.3Q_2$	A	Steep	Lindbergh	0.045	0.0375	N/A
$0.3Q_2$	B	Flat	Lindbergh	0.098	0.0813	N/A
$0.3Q_2$	B	Moderate	Lindbergh	0.090	0.0750	N/A
$0.3Q_2$	B	Steep	Lindbergh	0.070	0.0583	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Flat	Oceanside	0.070	0.0583	N/A
$0.3Q_2$	A	Moderate	Oceanside	0.065	0.0542	N/A
$0.3Q_2$	A	Steep	Oceanside	0.060	0.0500	N/A
$0.3Q_2$	B	Flat	Oceanside	0.098	0.0813	N/A
$0.3Q_2$	B	Moderate	Oceanside	0.090	0.0750	N/A
$0.3Q_2$	B	Steep	Oceanside	0.075	0.0625	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Flat	L Wohlford	0.050	0.0417	N/A
$0.3Q_2$	A	Moderate	L Wohlford	0.045	0.0375	N/A
$0.3Q_2$	A	Steep	L Wohlford	0.040	0.0333	N/A
$0.3Q_2$	B	Flat	L Wohlford	0.060	0.0500	N/A
$0.3Q_2$	B	Moderate	L Wohlford	0.055	0.0458	N/A
$0.3Q_2$	B	Steep	L Wohlford	0.045	0.0375	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Lindbergh	0.060	0.0500	N/A
$0.1Q_2$	A	Moderate	Lindbergh	0.055	0.0458	N/A
$0.1Q_2$	A	Steep	Lindbergh	0.045	0.0375	N/A
$0.1Q_2$	B	Flat	Lindbergh	0.100	0.0833	N/A
$0.1Q_2$	B	Moderate	Lindbergh	0.095	0.0792	N/A
$0.1Q_2$	B	Steep	Lindbergh	0.080	0.0667	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Flat	Oceanside	0.070	0.0583	N/A
$0.1Q_2$	A	Moderate	Oceanside	0.065	0.0542	N/A
$0.1Q_2$	A	Steep	Oceanside	0.060	0.0500	N/A
$0.1Q_2$	B	Flat	Oceanside	0.103	0.0854	N/A
$0.1Q_2$	B	Moderate	Oceanside	0.090	0.0750	N/A
$0.1Q_2$	B	Steep	Oceanside	0.075	0.0625	N/A
$0.1Q_2$	C	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Flat	L Wohlford	0.050	0.0417	N/A
$0.1Q_2$	A	Moderate	L Wohlford	0.045	0.0375	N/A
$0.1Q_2$	A	Steep	L Wohlford	0.040	0.0333	N/A
$0.1Q_2$	B	Flat	L Wohlford	0.090	0.0750	N/A
$0.1Q_2$	B	Moderate	L Wohlford	0.085	0.0708	N/A
$0.1Q_2$	B	Steep	L Wohlford	0.065	0.0542	N/A

Sizing Factors for Hydromodification Flow Control Bioretention BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	C	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	N/A	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Surface volume sizing factor for flow control

Definitions for "N/A"

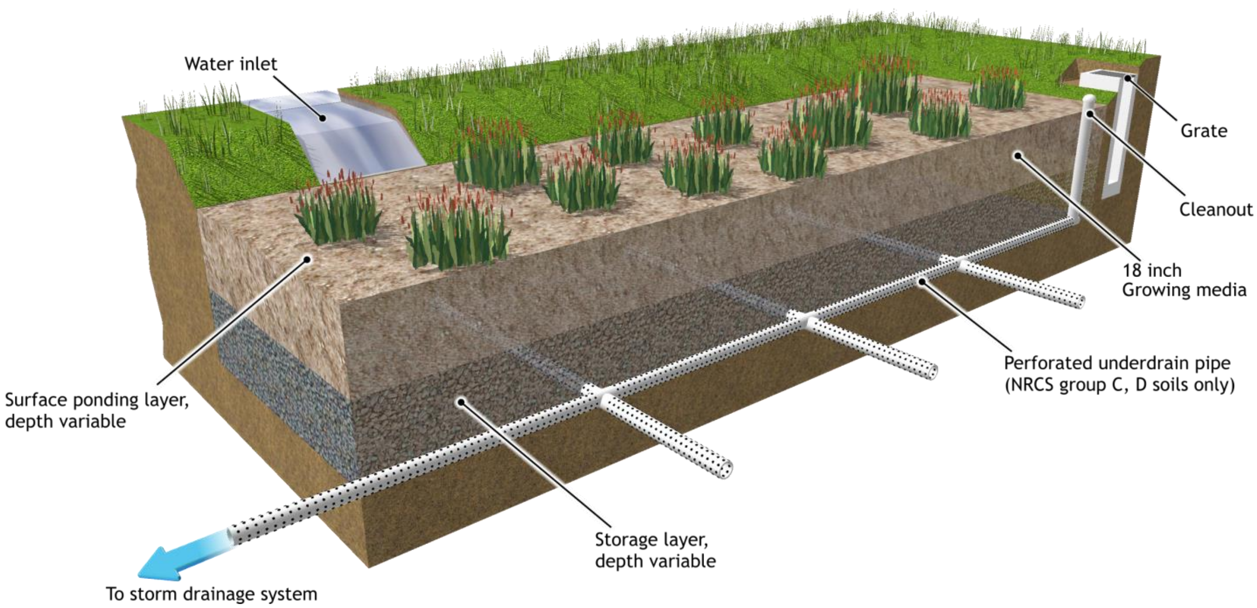
- Soil groups A and B: N/A in column V2 means there is no V2 element in this bioretention BMP for soil groups A and B
- Soil groups C and D: N/A in all elements (A, V1, V2) for soil groups C and D means sizing factors developed for "bioretention" in soil groups C and D under the 2007 MS4 Permit are not applicable in the "bioretention" category under the 2013 MS4 Permit because they were developed with the assumption that an underdrain is operating. Refer to Appendix G.2.4, Sizing Factors for Biofiltration with Partial Retention and Biofiltration

G.2.4 Sizing Factors for Biofiltration with Partial Retention and Biofiltration

Table G.2-5 presents sizing factors for calculating the required surface area (A), surface volume (V1), and sub-surface volume (V2) for a biofiltration with partial retention and biofiltration BMP. The BMPs consist of three layers:

- Ponding layer: 10-inches active storage, [minimum] 2-inches of freeboard above overflow relief
- Growing medium: 18-inches of soil [bioretention soil media]
- Storage layer: 30-inches of gravel at 40 percent porosity [18 inches active storage above underdrain is required, additional dead storage depth below underdrain is optional and can vary]

This BMP is applicable in soil groups C and D. This BMP includes an underdrain with a low flow orifice 18 inches (1.5 feet) below the bottom of the growing medium. This BMP can include additional dead storage below the underdrain. This BMP does not include an impermeable layer at the bottom of the facility to prevent infiltration into underlying soils, regardless of hydrologic soil group. If a facility is to be lined, the designer must use the sizing factors for biofiltration with impermeable liner (formerly known as "flow-through planter").



Biofiltration BMP Example Illustration

Reference: "San Diego BMP Sizing Calculator Methodology," prepared by Brown and Caldwell, dated January 2012

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-5 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet), surface volume (V1, cubic feet), and sub-surface volume (V2, cubic feet). Select a low flow orifice for the underdrain that will discharge the lower flow threshold flow when there is 1.5 feet of head over the underdrain orifice. The civil engineer shall provide the necessary volume and surface area of the BMP and the underdrain and orifice detail on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size of the BMP using the sizing factors. For BMPs without dead storage below the underdrain, then refer to Appendix B.5 and Appendix F to check whether the BMP meets performance standards for biofiltration for pollutant control. If necessary, adjust the surface area, depth of storage layer, or depth of growing medium as needed to meet pollutant control standards. For BMPs with dead storage below the underdrain, refer to Appendix B.4 to determine the portion of the DCV to be infiltrated for pollutant control, then Appendix B.5 and Appendix F to check whether the BMP meets performance standards for biofiltration for pollutant control for the balance of the DCV. If necessary, adjust the surface area, depth of storage layer, or depth of growing medium as needed to meet pollutant control standards.

Table G.2-5: Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Lindbergh	0.100	0.0833	0.0600
$0.5Q_2$	C	Moderate	Lindbergh	0.100	0.0833	0.0600
$0.5Q_2$	C	Steep	Lindbergh	0.075	0.0625	0.0450
$0.5Q_2$	D	Flat	Lindbergh	0.080	0.0667	0.0480

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	D	Moderate	Lindbergh	0.080	0.0667	0.0480
$0.5Q_2$	D	Steep	Lindbergh	0.060	0.0500	0.0360
$0.5Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Moderate	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Steep	Oceanside	0.060	0.0500	0.0360
$0.5Q_2$	D	Flat	Oceanside	0.065	0.0542	0.0390
$0.5Q_2$	D	Moderate	Oceanside	0.065	0.0542	0.0390
$0.5Q_2$	D	Steep	Oceanside	0.050	0.0417	0.0300
$0.5Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Flat	L Wohlford	0.065	0.0542	0.0390
$0.5Q_2$	C	Moderate	L Wohlford	0.065	0.0542	0.0390
$0.5Q_2$	C	Steep	L Wohlford	0.050	0.0417	0.0300
$0.5Q_2$	D	Flat	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Moderate	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Steep	L Wohlford	0.045	0.0375	0.0270
$0.3Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Lindbergh	0.110	0.0917	0.0660

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	C	Moderate	Lindbergh	0.110	0.0917	0.0660
$0.3Q_2$	C	Steep	Lindbergh	0.085	0.0708	0.0510
$0.3Q_2$	D	Flat	Lindbergh	0.100	0.0833	0.0600
$0.3Q_2$	D	Moderate	Lindbergh	0.100	0.0833	0.0600
$0.3Q_2$	D	Steep	Lindbergh	0.070	0.0583	0.0420
$0.3Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Oceanside	0.100	0.0833	0.0600
$0.3Q_2$	C	Moderate	Oceanside	0.100	0.0833	0.0600
$0.3Q_2$	C	Steep	Oceanside	0.080	0.0667	0.0480
$0.3Q_2$	D	Flat	Oceanside	0.085	0.0708	0.0510
$0.3Q_2$	D	Moderate	Oceanside	0.085	0.0708	0.0510
$0.3Q_2$	D	Steep	Oceanside	0.065	0.0542	0.0390
$0.3Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Flat	L Wohlford	0.075	0.0625	0.0450
$0.3Q_2$	C	Moderate	L Wohlford	0.075	0.0625	0.0450
$0.3Q_2$	C	Steep	L Wohlford	0.060	0.0500	0.0360
$0.3Q_2$	D	Flat	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Moderate	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Steep	L Wohlford	0.050	0.0417	0.0300
$0.1Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Biofiltration with Partial Retention and Biofiltration BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Lindbergh	0.145	0.1208	0.0870
$0.1Q_2$	C	Moderate	Lindbergh	0.145	0.1208	0.0870
$0.1Q_2$	C	Steep	Lindbergh	0.120	0.1000	0.0720
$0.1Q_2$	D	Flat	Lindbergh	0.160	0.1333	0.0960
$0.1Q_2$	D	Moderate	Lindbergh	0.160	0.1333	0.0960
$0.1Q_2$	D	Steep	Lindbergh	0.115	0.0958	0.0690
$0.1Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	C	Moderate	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	C	Steep	Oceanside	0.110	0.0917	0.0660
$0.1Q_2$	D	Flat	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	D	Moderate	Oceanside	0.130	0.1083	0.0780
$0.1Q_2$	D	Steep	Oceanside	0.065	0.0542	0.0390
$0.1Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Flat	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	C	Moderate	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	C	Steep	L Wohlford	0.090	0.0750	0.0540
$0.1Q_2$	D	Flat	L Wohlford	0.100	0.0833	0.0600
$0.1Q_2$	D	Moderate	L Wohlford	0.100	0.0833	0.0600
$0.1Q_2$	D	Steep	L Wohlford	0.075	0.0625	0.0450

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records

A = Surface area sizing factor for flow control

V_1 = Surface volume sizing factor for flow control

V_2 = Subsurface volume sizing factor for flow control

Definitions for "N/A"

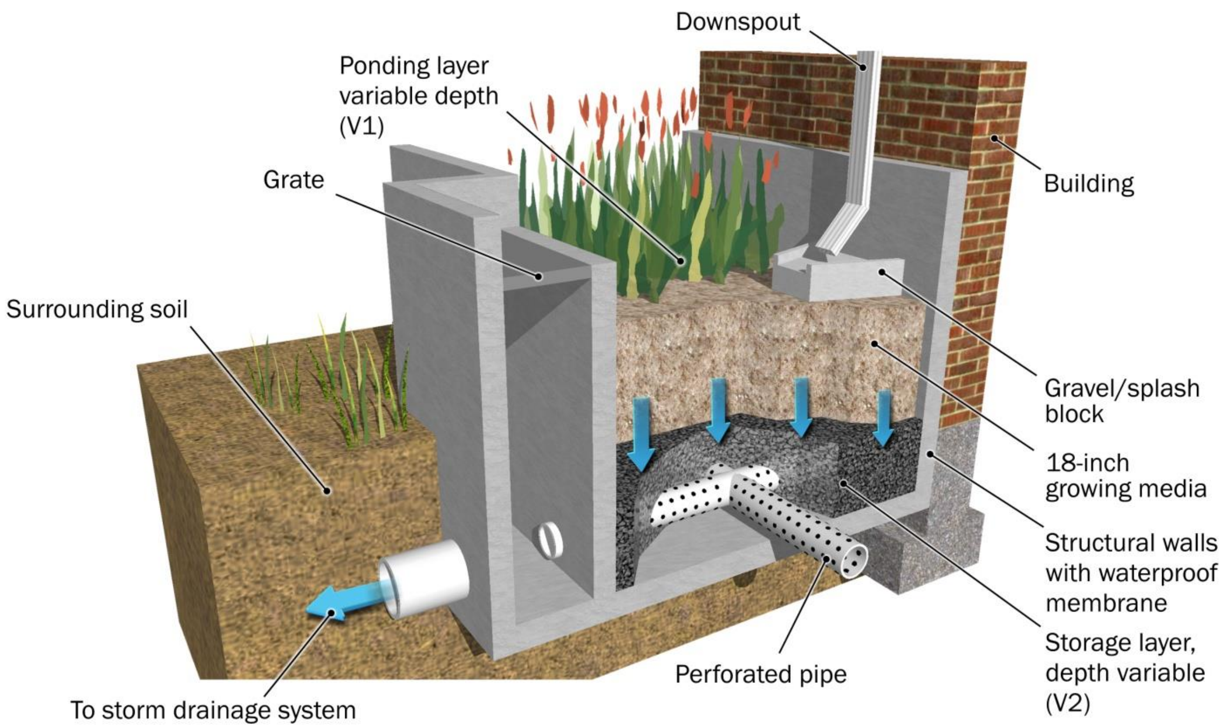
- Soil groups A and B: N/A in all elements (A, V1, V2) for soil groups A and B means sizing factors were not developed for biofiltration (i.e., with an underdrain) for soil groups A and B. If no underdrain is proposed, refer to Appendix G.2.3, Sizing Factors for Bioretention. If an underdrain is proposed, use project-specific continuous simulation modeling.

G.2.5 Sizing Factors for Biofiltration with Impermeable Liner

Table G.2-6 presents sizing factors for calculating the required surface area (A), surface volume (V1), and sub-surface volume (V2) for a biofiltration BMP with impermeable liner (formerly known as flow-through planter). The BMP consists of three layers:

- Ponding layer: 10-inches active storage, [minimum] 2-inches of freeboard above overflow relief
- Growing medium: 18-inches of soil [bioretention soil media]
- Storage layer: 30-inches of gravel at 40 percent porosity [18 inches active storage above underdrain is required, additional dead storage depth below underdrain is optional and can vary]

This BMP includes an underdrain with a low flow orifice 18 inches (1.5 feet) below the bottom of the growing medium. This BMP includes an impermeable liner to prevent infiltration into underlying soils.



Biofiltration with impermeable liner BMP Example Illustration

Reference: "San Diego BMP Sizing Calculator Methodology," prepared by Brown and Caldwell, dated January 2012

How to use the sizing factors for flow control BMP Sizing:

Obtain sizing factors from Table G.2-6 based on the project's lower flow threshold fraction of Q2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required surface area (A, square feet), surface volume (V1, cubic feet), and sub-surface volume (V2, cubic feet). Select a low flow orifice for the underdrain that will discharge the lower flow threshold flow when there is 1.5 feet of head over the underdrain orifice. The civil engineer shall provide the necessary volume and surface area of the BMP and the underdrain and orifice detail on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

To use this BMP as a combined pollutant control and flow control BMP, determine the size using the sizing factors, then refer to Appendix B.5 and Appendix F to check whether the BMP meets performance standards for biofiltration for pollutant control. If necessary, adjust the surface area, depth of growing medium, or depth of storage layer as needed to meet pollutant control standards.

Table G.2-6: Sizing Factors for Hydromodification Flow Control Biofiltration BMPs (formerly known as Flow-Through Planters) Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Lindbergh	0.115	0.0958	0.0690
$0.5Q_2$	C	Moderate	Lindbergh	0.115	0.0958	0.0690
$0.5Q_2$	C	Steep	Lindbergh	0.080	0.0667	0.0480
$0.5Q_2$	D	Flat	Lindbergh	0.085	0.0708	0.0510
$0.5Q_2$	D	Moderate	Lindbergh	0.085	0.0708	0.0510
$0.5Q_2$	D	Steep	Lindbergh	0.065	0.0542	0.0390
$0.5Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	N/A	N/A

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.5Q_2$	C	Flat	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Moderate	Oceanside	0.075	0.0625	0.0450
$0.5Q_2$	C	Steep	Oceanside	0.065	0.0542	0.0390
$0.5Q_2$	D	Flat	Oceanside	0.070	0.0583	0.0420
$0.5Q_2$	D	Moderate	Oceanside	0.070	0.0583	0.0420
$0.5Q_2$	D	Steep	Oceanside	0.050	0.0417	0.0300
$0.5Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.5Q_2$	C	Flat	L Wohlford	0.070	0.0583	0.0420
$0.5Q_2$	C	Moderate	L Wohlford	0.070	0.0583	0.0420
$0.5Q_2$	C	Steep	L Wohlford	0.050	0.0417	0.0300
$0.5Q_2$	D	Flat	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Moderate	L Wohlford	0.055	0.0458	0.0330
$0.5Q_2$	D	Steep	L Wohlford	0.045	0.0375	0.0270
$0.3Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Lindbergh	0.130	0.1083	0.0780
$0.3Q_2$	C	Moderate	Lindbergh	0.130	0.1083	0.0780
$0.3Q_2$	C	Steep	Lindbergh	0.100	0.0833	0.0600
$0.3Q_2$	D	Flat	Lindbergh	0.105	0.0875	0.0630
$0.3Q_2$	D	Moderate	Lindbergh	0.105	0.0875	0.0630
$0.3Q_2$	D	Steep	Lindbergh	0.075	0.0625	0.0450

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.3Q_2$	C	Flat	Oceanside	0.105	0.0875	0.0630
$0.3Q_2$	C	Moderate	Oceanside	0.105	0.0875	0.0630
$0.3Q_2$	C	Steep	Oceanside	0.085	0.0708	0.0510
$0.3Q_2$	D	Flat	Oceanside	0.090	0.0750	0.0540
$0.3Q_2$	D	Moderate	Oceanside	0.090	0.0750	0.0540
$0.3Q_2$	D	Steep	Oceanside	0.070	0.0583	0.0420
$0.3Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.3Q_2$	C	Flat	L Wohlford	0.085	0.0708	0.0510
$0.3Q_2$	C	Moderate	L Wohlford	0.085	0.0708	0.0510
$0.3Q_2$	C	Steep	L Wohlford	0.060	0.0500	0.0360
$0.3Q_2$	D	Flat	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Moderate	L Wohlford	0.065	0.0542	0.0390
$0.3Q_2$	D	Steep	L Wohlford	0.050	0.0417	0.0300
$0.1Q_2$	A	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Lindbergh	0.250	0.2083	0.1500
$0.1Q_2$	C	Moderate	Lindbergh	0.250	0.2083	0.1500
$0.1Q_2$	C	Steep	Lindbergh	0.185	0.1542	0.1110

Sizing Factors for Hydromodification Flow Control Biofiltration with Impermeable Liner BMPs Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	D	Flat	Lindbergh	0.200	0.1667	0.1200
$0.1Q_2$	D	Moderate	Lindbergh	0.200	0.1667	0.1200
$0.1Q_2$	D	Steep	Lindbergh	0.130	0.1083	0.0780
$0.1Q_2$	A	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	N/A	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	N/A	N/A
$0.1Q_2$	C	Flat	Oceanside	0.190	0.1583	0.1140
$0.1Q_2$	C	Moderate	Oceanside	0.190	0.1583	0.1140
$0.1Q_2$	C	Steep	Oceanside	0.140	0.1167	0.0840
$0.1Q_2$	D	Flat	Oceanside	0.160	0.1333	0.0960
$0.1Q_2$	D	Moderate	Oceanside	0.160	0.1333	0.0960
$0.1Q_2$	D	Steep	Oceanside	0.105	0.0875	0.0630
$0.1Q_2$	A	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	N/A	N/A
$0.1Q_2$	C	Flat	L Wohlford	0.135	0.1125	0.0810
$0.1Q_2$	C	Moderate	L Wohlford	0.135	0.1125	0.0810
$0.1Q_2$	C	Steep	L Wohlford	0.105	0.0875	0.0630
$0.1Q_2$	D	Flat	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	D	Moderate	L Wohlford	0.110	0.0917	0.0660
$0.1Q_2$	D	Steep	L Wohlford	0.080	0.0667	0.0480

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Surface area sizing factor for flow control
V_1 = Surface volume sizing factor for flow control
V_2 = Subsurface volume sizing factor for flow control

Definitions for "N/A"

- Soil groups A and B: N/A in all elements (A, V1, V2) for soil groups A and B means sizing factors were not developed for biofiltration (i.e., with an underdrain) for soil groups A and B. If no underdrain is proposed, refer to Appendix G.2.3, Sizing Factors for Bioretention. If an underdrain is proposed, use project-specific continuous simulation modeling.

G.2.6 Sizing Factors for "Cistern" BMP

Table G.2-7 presents sizing factors for calculating the required volume (V1) for a cistern BMP. In this context, a "cistern" is a detention facility that stores runoff and releases it at a controlled rate. A cistern can be a component of a harvest and use system, however the sizing factor method will not account for any retention occurring in the system. The sizing factors were developed assuming runoff is released from the cistern. The sizing factors presented in this section are to meet the hydromodification management performance standard only. The cistern BMP is based on the following assumptions:

- Cistern configuration: The cistern is modeled as a 4-foot tall vessel. However, designers could use other configurations (different cistern heights), as long as the lower outlet orifice is sized to properly restrict outflows and the minimum required volume is provided.
- Cistern upper outlet: The upper outlet from the cistern would consist of a weir or other flow control structure with the overflow invert set at an elevation of 7/8 of the water height associated with the required volume of the cistern – V1. For the assumed 4-foot water depth in the cistern associated with the sizing factor analysis, the overflow invert is assumed to be located at an elevation of 3.5 feet above the bottom of the cistern. The overflow weir would be sized to pass the peak design flow based on the tributary drainage area.

How to use the sizing factors:

Obtain sizing factors from Table G.2-7 based on the project's lower flow threshold fraction of Q_2, hydrologic soil group, pre-development slope, and rain gauge (rainfall basin). Multiply the area tributary to the structural BMP (A, square feet) by the area weighted runoff factor (C, unitless) (see Table G.2-1) by the sizing factors to determine the required volume (V_1, cubic feet). Select a low flow orifice that will discharge the lower flow threshold flow when there is 4 feet of head over the lower outlet orifice (or adjusted head as appropriate if the cistern configuration is not 4 feet tall). The civil engineer shall provide the necessary volume of the BMP and the lower outlet orifice detail on the plans.

Additional steps to use this BMP as a combined pollutant control and flow control BMP:

A cistern could be a component of a full retention, partial retention, or no retention BMP depending on how the outflow is disposed. However use of the sizing factor method for design of the cistern in a combined pollutant control and flow control system is not recommended. The sizing factor method for designing a cistern does not account for any retention or storage occurring in BMPs combined with the cistern (i.e., cistern sized using sizing factors may be larger than necessary because sizing factor method does not recognize volume losses occurring in other elements of a combined system). Furthermore when the cistern is designed using the sizing factor method, the cistern outflow must be set to the low flow threshold flow for the drainage area, which may be inconsistent with requirements for other elements of a combined system. To optimize a system in which a cistern provides temporary storage for runoff to be either used onsite (harvest and use), infiltrated, or biofiltered, project-specific continuous simulation modeling is recommended. Refer to Sections 5.6 and 6.3.6.

Table G.2-7: Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	B	Flat	Lindbergh	N/A	0.3900	N/A
$0.5Q_2$	B	Moderate	Lindbergh	N/A	0.2000	N/A
$0.5Q_2$	B	Steep	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Flat	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Moderate	Lindbergh	N/A	0.1200	N/A
$0.5Q_2$	C	Steep	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	Lindbergh	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.5Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	B	Flat	Oceanside	N/A	0.1900	N/A
$0.5Q_2$	B	Moderate	Oceanside	N/A	0.1600	N/A
$0.5Q_2$	B	Steep	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	Oceanside	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Flat	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Moderate	Oceanside	N/A	0.1200	N/A
$0.5Q_2$	D	Steep	Oceanside	N/A	0.1000	N/A
$0.5Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.5Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.5Q_2$	B	Flat	L Wohlford	N/A	0.2100	N/A
$0.5Q_2$	B	Moderate	L Wohlford	N/A	0.2000	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.5Q_2$	B	Steep	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Flat	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Moderate	L Wohlford	N/A	0.1400	N/A
$0.5Q_2$	C	Steep	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Flat	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Moderate	L Wohlford	N/A	0.1000	N/A
$0.5Q_2$	D	Steep	L Wohlford	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.3Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.3Q_2$	B	Flat	Lindbergh	N/A	0.5900	N/A
$0.3Q_2$	B	Moderate	Lindbergh	N/A	0.3600	N/A
$0.3Q_2$	B	Steep	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	Lindbergh	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Lindbergh	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Lindbergh	N/A	0.0800	N/A
$0.3Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	B	Flat	Oceanside	N/A	0.2200	N/A
$0.3Q_2$	B	Moderate	Oceanside	N/A	0.1800	N/A
$0.3Q_2$	B	Steep	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Flat	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Moderate	Oceanside	N/A	0.1600	N/A
$0.3Q_2$	C	Steep	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	Oceanside	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	Oceanside	N/A	0.1200	N/A
$0.3Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.3Q_2$	B	Flat	L Wohlford	N/A	0.2600	N/A
$0.3Q_2$	B	Moderate	L Wohlford	N/A	0.2400	N/A
$0.3Q_2$	B	Steep	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Flat	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Moderate	L Wohlford	N/A	0.1800	N/A
$0.3Q_2$	C	Steep	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Flat	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Moderate	L Wohlford	N/A	0.1400	N/A
$0.3Q_2$	D	Steep	L Wohlford	N/A	0.1000	N/A
$0.1Q_2$	A	Flat	Lindbergh	N/A	0.1200	N/A
$0.1Q_2$	A	Moderate	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	A	Steep	Lindbergh	N/A	0.1000	N/A
$0.1Q_2$	B	Flat	Lindbergh	N/A	0.5400	N/A
$0.1Q_2$	B	Moderate	Lindbergh	N/A	0.7800	N/A
$0.1Q_2$	B	Steep	Lindbergh	N/A	0.3400	N/A
$0.1Q_2$	C	Flat	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Moderate	Lindbergh	N/A	0.3600	N/A
$0.1Q_2$	C	Steep	Lindbergh	N/A	0.2400	N/A
$0.1Q_2$	D	Flat	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Moderate	Lindbergh	N/A	0.2600	N/A
$0.1Q_2$	D	Steep	Lindbergh	N/A	0.1600	N/A
$0.1Q_2$	A	Flat	Oceanside	N/A	0.1600	N/A
$0.1Q_2$	A	Moderate	Oceanside	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	Oceanside	N/A	0.1200	N/A
$0.1Q_2$	B	Flat	Oceanside	N/A	0.5100	N/A
$0.1Q_2$	B	Moderate	Oceanside	N/A	0.3400	N/A
$0.1Q_2$	B	Steep	Oceanside	N/A	0.2400	N/A
$0.1Q_2$	C	Flat	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Moderate	Oceanside	N/A	0.2600	N/A
$0.1Q_2$	C	Steep	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Flat	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Moderate	Oceanside	N/A	0.2000	N/A
$0.1Q_2$	D	Steep	Oceanside	N/A	0.1800	N/A
$0.1Q_2$	A	Flat	L Wohlford	N/A	0.1800	N/A

Sizing Factors for Hydromodification Flow Control Cistern Facilities Designed Using Sizing Factor Method						
Lower Flow Threshold	Soil Group	Slope	Rain Gauge	A	V_1	V_2
$0.1Q_2$	A	Moderate	L Wohlford	N/A	0.1400	N/A
$0.1Q_2$	A	Steep	L Wohlford	N/A	0.0800	N/A
$0.1Q_2$	B	Flat	L Wohlford	N/A	0.4400	N/A
$0.1Q_2$	B	Moderate	L Wohlford	N/A	0.4000	N/A
$0.1Q_2$	B	Steep	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Flat	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Moderate	L Wohlford	N/A	0.3200	N/A
$0.1Q_2$	C	Steep	L Wohlford	N/A	0.2200	N/A
$0.1Q_2$	D	Flat	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Moderate	L Wohlford	N/A	0.2400	N/A
$0.1Q_2$	D	Steep	L Wohlford	N/A	0.1800	N/A

Q_2 = 2-year pre-project flow rate based upon partial duration analysis of long-term hourly rainfall records
A = Bioretention surface area sizing factor (not applicable under this manual standards – use methods presented in Chapter 5 and Appendix B or Appendix F to size bioretention or biofiltration facility for pollutant control)
V_1 = Cistern volume sizing factor

Definitions for "N/A"

- Column V2: N/A in column V2 means there is no V2 element in the cistern BMP
- Column A: N/A in column A means there is no A element in the cistern BMP. Note sizing factors previously created for sizing a bioretention or biofiltration facility downstream of a cistern under the 2007 MS4 Permit are not applicable under the MS4 Permit.

Appendix

H

BMP DESIGN MANUAL

Guidance for Investigating Potential Critical Coarse Sediment Yield Areas

Appendix H Guidance for Investigating Potential Critical Coarse Sediment Yield Areas

Introduction

Identification of potential critical coarse sediment yield areas for San Diego County has been prepared based on GLU analysis. Criteria for the GLU analysis were developed and documented in the "San Diego County Regional WMAA" (herein "Regional WMAA"). Regional-level mapping of potential critical coarse sediment yield areas was prepared using regional data sets and included in the Regional WMAA. The original Regional WMAA document can be found on the Project Clean Water website at the following address:

http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=75&Itemid=99

The regional-level mapping was distributed to WQIP preparers to incorporate into the WMAA attachment to the WQIP for all watersheds in San Diego County. The regional-level mapping is based on the following sources:

Dataset	Source	Year	Description
Elevation	USGS	2013	1/3rd Arc Second (~10 meter cells) digital elevation model for San Diego County
Land Cover	SanGIS	2013	Ecology-Vegetation layer for San Diego County downloaded from SanGIS
Geology	Kennedy, M.P., and Tan, S.S.	2002	Geologic Map of the Oceanside 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 2, 1:100,000 scale.
	Kennedy, M.P., and Tan, S.S.	2008	Geologic Map of the San Diego 30'x60' Quadrangle, California, California Geological Survey, Regional Geologic Map No. 3, 1:100,000 scale.
	Todd, V.R.	2004	Preliminary Geologic Map of the El Cajon 30'x60' Quadrangle, Southern California, United States Geological Survey, Southern California Areal Mapping Project, Open File Report 2004-1361, 1:100,000 scale.
	Jennings et al.	2010	"Geologic Map of California," California Geological Survey, Map No. 2 – Geologic Map of California, 1:750,000 scale

The regional data set is a function of the inherent data resolution of the macro-level data sets and may not conform to all site conditions, or does not reflect changes to particular areas that have occurred since the underlying data was developed. This means slopes, geology, or land cover at the project site can be mischaracterized in the regional data set. This Appendix presents criteria for the GLU analysis, excerpted from the Regional WMAA, to be used when detailed project-level investigation of GLUs onsite is needed.

A project applicant should first check the map included in the WMAA for the watershed in which the project resides to determine if potential critical coarse sediment yield areas may exist within the project drainage boundaries (i.e., within or draining through the project). Generally, if the WMAA map does not indicate potential critical coarse sediment yield areas may exist within the project drainage boundaries, no further analysis is necessary. However, the Port has the discretion to require additional project-level investigation even when the WMAA map does not indicate the presence of potential critical coarse sediment yield areas within the project site.

If the project is shown to impact potential critical coarse sediment yield areas based on the WMAA map, or if the Port requires, project-level GLU analysis can be performed (see Section 6.2.1). Project-level GLU analysis will either confirm or invalidate the finding of the Regional WMAA maps. For project-level GLU analysis, the civil engineer shall determine slopes, geology, and land cover categories existing at the project site, and intersect this data to determine GLUs existing at the project site. The data provided in H.1 will assist the civil engineer to characterize the site.

When it has been determined based on the GLU analysis that potential critical coarse sediment yield areas are present within the project boundary, and it has been determined that downstream systems require protection (see Section 6.2.2), additional analysis may be performed that may refine the extents of actual critical coarse sediment yield areas to be protected onsite (see Section 6.2.3). Procedures for additional analysis are provided in H.2.

H.1 Criteria for GLU Analysis

There are four slope categories in the GLU analysis. Category numbers shown (1 to 4) were assigned for the purpose of GIS processing.

- 0% to 10% (1)
- 10% to 20% (2)
- 20% to 40% (3)
- >40% (4)

There are seven geology categories in the GLU analysis:

- Coarse bedrock (CB)
- Coarse sedimentary impermeable (CSI)
- Coarse sedimentary permeable (CSP)
- Fine bedrock (FB)
- Fine sedimentary impermeable (FSI)
- Fine sedimentary permeable (FSP)
- Other (O)

There are six land cover categories in the GLU analysis:

- Agriculture/grass
- Forest
- Developed
- Scrub/shrub
- Other
- Unknown

Project site slopes shall be classified into the categories based on project-level topography. Project site geology may be determined from geologic maps (may be the same as regional-level information) or classified in the field by a qualified geologist. Table H-1.1 provides information to classify geologic map units into each geology category. Project site land cover shall be determined from aerial photography and/or field visit. For reference, Table H-1.2 provides information to classify land cover categories from the SanGIS Ecology-Vegetation data set into land cover categories. The civil engineer shall not rely on the SanGIS Ecology-Vegetation data set to identify actual land cover at the project site (for project-level investigation land cover must be confirmed by aerial photo or field visit). Intersect the geologic categories, land cover categories, and slope categories within the project boundary to create GLUs. The GLUs listed in Table H-1.3 (also shown in Table 6-1) are considered to be potential critical coarse sediment yield areas. Note the GLU nomenclature is presented in the following format: Geology – Land Cover – Slope Category (e.g., "CB-Agricultural/Grass-3" for a GLU consisting of coarse bedrock geology, agricultural/grass land cover, and 20% to 40% slope).

Table H.1-1: Geologic Grouping for Different Map Units

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
gr-m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
grMz	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Jcr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jhc	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Jsp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ka	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kbp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kcp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kdl	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgbf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgd	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgdf	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgh	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm1	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm2	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm3	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgm4	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgr	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kgu	San Diego 30' x 60'	Coarse	Bedrock	Impermeable	CB
Khg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ki	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kis	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kjd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJem	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
KJld	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Kjv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klb	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klh	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Klp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Km	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmgp	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kmm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpa	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kpv	El Cajon 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kqbd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Krr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kt	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ktr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kvc	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwm	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwp	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Kwsr	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
m	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Mzd	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzg	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzq	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Mzs	Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
sch	Jennings; CA	Coarse	Bedrock	Impermeable	CB
Kp	San Diego & Oceanside 30' x 60'	Coarse	Bedrock	Impermeable	CB
Ql	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
QTf	El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ec	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
K	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Kccg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Kcs	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Kl	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Ku	Jennings; CA	Coarse	Sedimentary	Impermeable	CSI
Qvof	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tp	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tpm	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsc	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tscu	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsd	San Diego & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdcg	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsdss	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsm	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tso	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tst	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tt	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tta	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tmv	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsi	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa11	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa12	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoa13	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvoc	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop1	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qvop10	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop10a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop11a	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop12	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop13	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop2	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop3	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop4	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop5	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop6	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop8	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qvop9	San Diego 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Tsa	Oceanside 30' x 60'	Coarse	Sedimentary	Impermeable	CSI
Qof	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qof2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Q	Jennings; CA	Coarse	Sedimentary	Permeable	CSP
Qa	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qd	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qmb	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Qw	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyf	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qt	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa1-2	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa2-6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa5	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa6	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa7	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoc	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop1	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qc	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qu	El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qoa	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop2-4	San Diego 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop3	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop4	Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop6	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qop7	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qya	San Diego, Oceanside & El Cajon 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Qyc	San Diego & Oceanside 30' x 60'	Coarse	Sedimentary	Permeable	CSP
Mzu	San Diego & Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
gb	Jennings; CA	Fine	Bedrock	Impermeable	FB
JTRm	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kat	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kc	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgb	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
KJvs	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Kmv	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB
Ksp	El Cajon 30' x 60'	Fine	Bedrock	Impermeable	FB

Map Unit	Map Name	Anticipated Grain size of Weathered Material	Bedrock or Sedimentary	Impermeable/ Permeable	Geology Grouping
Kvsp	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kwmt	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Qv	Jennings; CA	Fine	Bedrock	Impermeable	FB
Tba	San Diego 30' x 60'	Fine	Bedrock	Impermeable	FB
Tda	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tv	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Tvsr	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Kgdfg	Oceanside 30' x 60'	Fine	Bedrock	Impermeable	FB
Ta	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tcs	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Td+Tf	San Diego 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qls	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tm	Oceanside 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tf	San Diego, Oceanside & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Tfr	El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
To	San Diego & El Cajon 30' x 60'	Fine	Sedimentary	Impermeable	FSI
Qpe	San Diego & Oceanside 30' x 60'	Fine	Sedimentary	Permeable	FSP
Mexico	San Diego 30' x 60'	NA	NA	Permeable	Other
Kuo	San Diego 30' x 60'	NA (Offshore)	NA	Permeable	Other
Teo	San Diego & Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Tmo	Oceanside 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
Qmo	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
QTso	San Diego 30' x 60'	NA (Offshore)	Sedimentary	Permeable	Other
af	San Diego & Oceanside 30' x 60'	Variable, dependent on source material	Sedimentary		Other

Table H.1-2: Land Cover Grouping for SanGIS Ecology-Vegetation Data Set

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
1	42000 Valley and Foothill Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
2	42100 Native Grassland		Agricultural/Grass
3	42110 Valley Needlegrass Grassland		Agricultural/Grass
4	42120 Valley Sacaton Grassland		Agricultural/Grass
5	42200 Non-Native Grassland	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Agricultural/Grass
6	42300 Wildflower Field		Agriculture/Grass
7	42400 Foothill/Mountain Perennial Grassland		Agriculture/Grass
8	42470 Transmontane Dropseed Grassland		Agriculture/Grass
9	45000 Meadow and Seep		Agriculture/Grass
10	45100 Montane Meadow		Agriculture/Grass
11	45110 Wet Montane Meadow		Agriculture/Grass
12	45120 Dry Montane Meadows		Agriculture/Grass
13	45300 Alkali Meadows and Seeps		Agriculture/Grass
14	45320 Alkali Seep		Agriculture/Grass
15	45400 Freshwater Seep		Agriculture/Grass
16	46000 Alkali Playa Community		Agriculture/Grass
17	46100 Badlands/Mudhill Forbs		Agriculture/Grass
18	Non-Native Grassland		Agriculture/Grass
19	18000 General Agriculture	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Agriculture/Grass
20	18100 Orchards and Vineyards		Agriculture/Grass
21	18200 Intensive Agriculture		Agriculture/Grass
22	18200 Intensive Agriculture - Dairies, Nurseries, Chicken Ranches		Agriculture/Grass
23	18300 Extensive Agriculture - Field/Pasture, Row Crops		Agriculture/Grass
24	18310 Field/Pasture		Agriculture/Grass
25	18310 Pasture		Agriculture/Grass
26	18320 Row Crops		Agriculture/Grass
27	12000 Urban/Developed		Developed
28	12000 Urban/Developed		Developed
29	81100 Mixed Evergreen Forest	Forest	Forest
30	81300 Oak Forest		Forest
31	81310 Coast Live Oak Forest		Forest
32	81320 Canyon Live Oak Forest		Forest
33	81340 Black Oak Forest		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
34	83140 Torrey Pine Forest	Forest	Forest
35	83230 Southern Interior Cypress Forest		Forest
36	84000 Lower Montane Coniferous Forest		Forest
37	84100 Coast Range, Klamath and Peninsular Coniferous Forest		Forest
38	84140 Coulter Pine Forest		Forest
39	84150 Bigcone Spruce (Bigcone Douglas Fir)-Canyon Oak Forest		Forest
40	84230 Sierran Mixed Coniferous Forest		Forest
41	84500 Mixed Oak/Coniferous/Bigcone/Coulter		Forest
42	85100 Jeffrey Pine Forest		Forest
43	11100 Eucalyptus Woodland	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Forest
44	60000 RIPARIAN AND BOTTOMLAND HABITAT	Riparian and Bottomland Habitat	Forest
45	61000 Riparian Forests		Forest
46	61300 Southern Riparian Forest		Forest
47	61310 Southern Coast Live Oak Riparian Forest		Forest
48	61320 Southern Arroyo Willow Riparian Forest		Forest
49	61330 Southern Cottonwood-willow Riparian Forest		Forest
50	61510 White Alder Riparian Forest		Forest
51	61810 Sonoran Cottonwood-willow Riparian Forest		Forest
52	61820 Mesquite Bosque		Forest
53	62000 Riparian Woodlands		Forest
54	62200 Desert Dry Wash Woodland		Forest
55	62300 Desert Fan Palm Oasis Woodland		Forest
56	62400 Southern Sycamore-alder Riparian Woodland		Forest
57	70000 WOODLAND	Woodland	Forest
58	71000 Cismontane Woodland		Forest

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
59	71100 Oak Woodland		Forest
60	71120 Black Oak Woodland		Forest
61	71160 Coast Live Oak Woodland		Forest
62	71161 Open Coast Live Oak Woodland		Forest
63	71162 Dense Coast Live Oak Woodland		Forest
64	71162 Dense Coast Love Oak Woodland		Forest
65	71180 Engelmann Oak Woodland	Woodland	Forest
66	71181 Open Engelmann Oak Woodland		Forest
67	71182 Dense Engelmann Oak Woodland		Forest
68	72300 Peninsular Pinon and Juniper Woodlands		Forest
69	72310 Peninsular Pinon Woodland		Forest
70	72320 Peninsular Juniper Woodland and Scrub		Forest
71	75100 Elephant Tree Woodland		Forest
72	77000 Mixed Oak Woodland		Forest
73	78000 Undifferentiated Open Woodland		Forest
74	79000 Undifferentiated Dense Woodland		Forest
75	Engelmann Oak Woodland		Forest
76	52120 Southern Coastal Salt Marsh	Bog and Marsh	Other
77	52300 Alkali Marsh		Other
78	52310 Cismontane Alkali Marsh		Other
79	52400 Freshwater Marsh		Other
80	52410 Coastal and Valley Freshwater Marsh		Other
81	52420 Transmontane Freshwater Marsh		Other
82	52440 Emergent Wetland		Other
83	44000 Vernal Pool	Grasslands, Vernal Pools, Meadows, and Other Herb Communities	Other
84	44320 San Diego Mesa Vernal Pool		Other
85	44322 San Diego Mesa Claypan Vernal Pool (southern mesas)		Other
86	13100 Open Water		Other

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
87	13110 Marine	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
88	13111 Subtidal		Other
89	13112 Intertidal		Other
90	13121 Deep Bay		Other
91	13122 Intermediate Bay		Other
92	13123 Shallow Bay		Other
93	13130 Estuarine		Other
94	13131 Subtidal		Other
95	13133 Brackishwater		Other
96	13140 Freshwater	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Other
97	13200 Non-Vegetated Channel, Floodway, Lakeshore Fringe		Other
98	13300 Saltpan/Mudflats		Other
99	13400 Beach		Other
100	21230 Southern Foredunes	Dune Community	Scrub/Shrub
101	22100 Active Desert Dunes		Scrub/Shrub
102	22300 Stabilized and Partially-Stabilized Desert Sand Field		Scrub/Shrub
103	24000 Stabilized Alkaline Dunes		Scrub/Shrub
104	29000 ACACIA SCRUB		Scrub/Shrub
105	63000 Riparian Scrubs	Riparian and Bottomland Habitat	Scrub/Shrub
106	63300 Southern Riparian Scrub		Scrub/Shrub
107	63310 Mule Fat Scrub		Scrub/Shrub
108	63310 Mulefat Scrub		Scrub/Shrub
109	63320 Southern Willow Scrub		Scrub/Shrub
110	63321 Arundo donnax Dominant/Southern Willow Scrub		Scrub/Shrub
111	63330 Southern Riparian Scrub		Scrub/Shrub
112	63400 Great Valley Scrub		Scrub/Shrub
113	63410 Great Valley Willow Scrub		Scrub/Shrub
114	63800 Colorado Riparian Scrub		Scrub/Shrub
115	63810 Tamarisk Scrub		Scrub/Shrub
116	63820 Arrowweed Scrub		Scrub/Shrub
117	31200 Southern Coastal Bluff Scrub	Scrub and Chaparral	Scrub/Shrub
118	32000 Coastal Scrub		Scrub/Shrub
119	32400 Maritime Succulent Scrub		Scrub/Shrub
120	32500 Diegan Coastal Sage Scrub		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
121	32510 Coastal form		Scrub/Shrub
122	32520 Inland form (> 1,000 ft. elevation)		Scrub/Shrub
123	32700 Riversidian Sage Scrub		Scrub/Shrub
124	32710 Riversidian Upland Sage Scrub		Scrub/Shrub
125	32720 Alluvial Fan Scrub		Scrub/Shrub
126	33000 Sonoran Desert Scrub		Scrub/Shrub
127	33100 Sonoran Creosote Bush Scrub		Scrub/Shrub
128	33200 Sonoran Desert Mixed Scrub		Scrub/Shrub
129	33210 Sonoran Mixed Woody Scrub		Scrub/Shrub
130	33220 Sonoran Mixed Woody and Succulent Scrub	Scrub and Chaparral	Scrub/Shrub
131	33230 Sonoran Wash Scrub		Scrub/Shrub
132	33300 Colorado Desert Wash Scrub		Scrub/Shrub
133	33600 Encelia Scrub		Scrub/Shrub
134	34000 Mojavean Desert Scrub		Scrub/Shrub
135	34300 Blackbush Scrub		Scrub/Shrub
136	35000 Great Basin Scrub		Scrub/Shrub
137	35200 Sagebrush Scrub		Scrub/Shrub
138	35210 Big Sagebrush Scrub		Scrub/Shrub
139	35210 Sagebrush Scrub		Scrub/Shrub
140	36110 Desert Saltbush Scrub		Scrub/Shrub
141	36120 Desert Sink Scrub		Scrub/Shrub
142	37000 Chaparral		Scrub/Shrub
143	37120 Southern Mixed Chaparral		Scrub/Shrub
144	37120 Southern Mixed Chapparal		Scrub/Shrub
145	37121 Granitic Southern Mixed Chaparral		Scrub/Shrub
146	37121 Southern Mixed Chaparral		Scrub/Shrub
147	37122 Mafic Southern Mixed Chaparral		Scrub/Shrub
148	37130 Northern Mixed Chaparral		Scrub/Shrub
149	37131 Granitic Northern Mixed Chaparral		Scrub/Shrub
150	37132 Mafic Northern Mixed Chaparral		Scrub/Shrub
151	37200 Chamise Chaparral		Scrub/Shrub
152	37210 Granitic Chamise Chaparral		Scrub/Shrub
153	37220 Mafic Chamise Chaparral		Scrub/Shrub
154	37300 Red Shank Chaparral		Scrub/Shrub

Id	SanGIS Legend	SanGIS Grouping	Land Cover Grouping
155	37400 Semi-Desert Chaparral		Scrub/Shrub
156	37500 Montane Chaparral		Scrub/Shrub
157	37510 Mixed Montane Chaparral		Scrub/Shrub
158	37520 Montane Manzanita Chaparral		Scrub/Shrub
159	37530 Montane Ceanothus Chaparral		Scrub/Shrub
160	37540 Montane Scrub Oak Chaparral		Scrub/Shrub
161	37800 Upper Sonoran Ceanothus Chaparral		Scrub/Shrub
162	37830 Ceanothus crassifolius Chaparral		Scrub/Shrub
163	37900 Scrub Oak Chaparral		Scrub/Shrub
164	37A00 Interior Live Oak Chaparral		Scrub/Shrub
165	37C30 Southern Maritime Chaparral	Scrub and Chaparral	Scrub/Shrub
166	37G00 Coastal Sage-Chaparral Scrub		Scrub/Shrub
167	37K00 Flat-topped Buckwheat		Scrub/Shrub
168	39000 Upper Sonoran Subshrub Scrub		Scrub/Shrub
169	Diegan Coastal Sage Scrub		Scrub/Shrub
170	Granitic Northern Mixed Chaparral		Scrub/Shrub
171	Southern Mixed Chaparral		Scrub/Shrub
172	11000 Non-Native Vegetation	Non-Native Vegetation, Developed Areas, or Unvegetated Habitat	Unknown
173	11000 Non-Native VegetionVegetation		Unknown
174	11200 Disturbed Wetland		Unknown
175	11300 Disturbed Habitat		Unknown
176	13000 Unvegetated Habitat		Unknown
177	Disturbed Habitat		Unknown

Table H.1-3: Potential Critical Coarse Sediment Yield Areas

GLU	Geology	Land Cover	Slope (%)
CB-Agricultural/Grass-3	Coarse Bedrock	Agricultural/Grass	20% - 40%
CB-Agricultural/Grass-4	Coarse Bedrock	Agricultural/Grass	>40%
CB-Forest-2	Coarse Bedrock	Forest	10 – 20%
CB-Forest-3	Coarse Bedrock	Forest	20% - 40%
CB-Forest-4	Coarse Bedrock	Forest	>40%
CB-Scrub/Shrub-4	Coarse Bedrock	Scrub/Shrub	>40%
CB-Unknown-4	Coarse Bedrock	Unknown	>40%
CSI-Agricultural/Grass-2	Coarse Sedimentary Impermeable	Agricultural/Grass	10 – 20%
CSI-Agricultural/Grass-3	Coarse Sedimentary Impermeable	Agricultural/Grass	20% - 40%
CSI-Agricultural/Grass-4	Coarse Sedimentary Impermeable	Agricultural/Grass	>40%
CSP-Agricultural/Grass-4	Coarse Sedimentary Permeable	Agricultural/Grass	>40%
CSP-Forest-3	Coarse Sedimentary Permeable	Forest	20% - 40%
CSP-Forest-4	Coarse Sedimentary Permeable	Forest	>40%
CSP-Scrub/Shrub-4	Coarse Sedimentary Permeable	Scrub/Shrub	>40%

H.2 Optional Additional Analysis When Potential Critical Coarse Sediment Yield Areas are Present Onsite

(Adapted from "Step 1" of Section 2.3.i of "Santa Margarita Region HMP," dated May 2014)

As stated in Chapter 6.2.3 of this manual, when it has been determined based on a GLU analysis that potential critical coarse sediment yield areas are present within the project boundary, and it has been determined that downstream systems require protection, additional analysis may be performed that may refine the extents of actual critical coarse sediment yield areas to be protected onsite. The following text, adapted from Chapter 2 of the Santa Margarita Region HMP dated May 2014, describes the process.

Step 1: Determine whether the Portion of the Project Site is a Significant Source of Bed Sediment Supply to the Channel Receiving Runoff

A triad approach will be completed to determine whether the project site is a Significant Source of Bed Sediment Supply to the channel receiving runoff and includes the following components:

A. Site soil assessment, including an analysis and comparison of the Bed Sediment in the receiving channel and the onsite channel;

B. Determination of the capability of the channels on the project site to deliver the site Bed Sediment (if present) to the receiving channel; and

C. Present and potential future condition of the receiving channel.

A. Site soil assessment, including an analysis and comparison of the Bed Sediment in the channel receiving runoff and the onsite channels

A geotechnical and sieve analysis is the first piece of information to be used in a triad approach to determine if the project site is a Significant Source of Bed Sediment Supply to the assessment channel. An investigation must be completed of the assessment channel to complete a sieve analysis of the Bed Sediment. Two samples will be taken of the assessment channel using the "reach" approach (TS13A, 2007 [United States Army Corps of Engineers. 2007. Guidelines for Sampling Bed Material, Technical Supplement 13A, Part 654 of National Engineering Handbook, New England District. August]). Samples in each of the two locations should be taken using the surface and subsurface bulk sample technique (TS13A, 2007) for a total of four samples. Pebble counts may be required for some channels.

A similar sampling assessment should be conducted on the project site. First-order and greater channels that may be impacted by the PDP (drainage area changed, stabilized, lined or replaced with underground conduits) will be analyzed in each subwatershed. First-order channels are identified as the unbranched channels that drain from headwater areas and develop in the uppermost topographic depressions, where two or more contour crenulations (notches or indentations) align and point upslope (National Engineering Handbook, 2007). First-order channels may, in fact, be field ditches, gullies, or ephemeral gullies (National Engineering Handbook, 2007). One channel per subwatershed that may be impacted on the project site must be assessed. A subwatershed is defined as tributary to a single discharge point at the project site boundary.

The sieve analysis should report the coarsest 90% (by weight) of the sediment for comparison between the site and the assessment channel. The User should render an opinion if the Bed Sediment found on the site is of similar gradation to the Bed Sediment found in the receiving channel. The opinion will be based on the following information:

- Sieve analysis results
- Soil erodibility (K) factor
- Topographic relief of the project area
- Lithology of the soils on the project site

The User should rate the similarity of onsite Bed Sediment and Bed Sediment collected in the receiving channel as high, medium, or low.

This site soil assessment serves as the first piece of information for the triad approach.

B. Determination of the capability of the onsite channels to deliver Bed Sediment Supply (if present) to the channel receiving runoff from the project site.

The second piece of information is to qualitatively assess the sediment delivery potential of the channels on the project site to deliver the Bed Sediment Supply to the channel receiving runoff from the project site, or the Bed Sediment delivery potential or ratio. There are few documented procedures to estimate the Bed Sediment delivery ratio (see: Williams, J. R., 1977: Sediment delivery ratios determined with sediment and runoff models. IAHS Publication (122): 168-179, as an example); it is affected by a number of factors, including the sediment source, proximity to the receiving channel, onsite channel density, project sub-watershed area, slope, length, land use and land cover, and rainfall intensity. The User will qualitatively assess the Bed Sediment delivery potential and rate the potential as high, medium, or low.

C. Present and potential future condition of the channel receiving runoff from the project site.

The final piece of information is the present and potential future condition of the channel receiving runoff from the project site. The User should assess the receiving channel for the following:

- Bank stability – Receiving channels with unstable banks may be more sensitive to changes in Bed Sediment Load.
- Degree of incision – Receiving channels with moderate to high incision may be more sensitive to changes in Bed Sediment Load.
- Bed Sediment gradation – Receiving channels with more coarse Bed Sediment (such as gravel) are better able to buffer change in Bed Sediment Load as compared to beds with finer gradation of Bed Sediment (sand).
- Transport vs. supply limited channels. Receiving channels that are transport limited may be better able to buffer changes in Bed Sediment Load as compared to channels that are supply limited.

The User will qualitatively assess the channel receiving runoff from the project site using the gathered observations and rate the potential for adverse response based on a change in Bed Sediment Load as high, medium, or low.

[Interpreting the results of A, B, and C]

The User should use the triad assessment approach, weighting each of the components based on professional judgment to determine if the project site provides a Significant Source of Bed Sediment Supply to the receiving channel, and the impact the PDP would have on the receiving channel. The final assessment and recommendation must be documented in the HMP portion of the [SWQMP].

The recommendation may be any of the following:

- Site is a Significant Source of Bed Sediment Supply – all channels on the project site must be preserved or by-passed within the site plan.
- Site is a source of Bed Sediment Supply – some of the channels on the project site must be preserved (with identified channels noted).
- Site is not a Significant Source of Bed Sediment Supply.

The final recommendation will be guided by the triad assessment. Projects with predominantly "high" values for each of the three assessment areas would indicate preservation of channels on the project site. Sites with predominantly "medium" values may warrant preservation of some of the channels on the project site, and sites with generally "low" values would not require site design considerations for Bed Sediment Load.

Appendix

I

Forms and Checklists

Appendix I Forms and Checklists

1) For projects that will start construction prior to the effective date of Order No. R9-2013-0001, project applicants should use the current Port Storm Water Requirements Applicability Checklist. The current checklist for tenant projects is available at:

   https://www.portofsandiego.org/environment/stormwater/stormwater-development.html

   For capital projects, please contact the Port Environmental and Land Use Management Department for a copy of the current applicability checklist.

2) For projects that will start construction after the effective date of Order No. R9-2013-0001, projects should use the forms included with Appendix I to document whether the project is a standard or priority development project and to document selection of applicable Source Control and Site Design (Both Standard and PDPs) and Storm Water Pollutant Control BMPs (PDPs only). In addition, Section 2 of the Port Storm Water Requirements Applicability Checklist should be used to determine Construction Phase BMP requirements for the Project.

   The Port Storm Water Requirements Applicability Checklist is in the process of being tailored to meet the procedures and requirements of the BMP Design Manual and the forms in Appendix I will be updated / amended once the forms are tailored.

The following Forms/Checklists/Worksheets were developed for use by the project applicant to document the storm water management design:

- I-3A: Site Information Checklist for Standard Projects
- I-3B: Site Information Checklist for PDPs
- I-4: Source Control BMP Checklist for All Development Projects
- I-5: Site Design BMP Checklist for All Development Projects
- I-6: Summary of PDP Structural BMPs
- I-7: Harvest and Use Feasibility Screening Checklist
- I-8: Categorization of Infiltration Feasibility Condition
- I-9: Factor of Safety and Design Infiltration Rate
- I-10: Determination of Downstream Systems Requirements for Preservation of Coarse Sediment Supply
- I-1: Applicability of Permanent, Post-Construction Storm Water BMP Requirements
- I-2: Project Type Determination Checklist (Standard Project or PDP)

Form I-1 and Form I-2 were included in previous versions of this manual, and used to determine stormwater requirements. The stormwater requirements applicability checklist, available online, has replaced forms I-1 and I-2, and takes precedence over aforementioned forms. The applicability checklist can be found on the Port's stormwater management website: https://www.portofsandiego.org/stormwater-management

Site Information Checklist For Standard Projects	Form I-3A (Standard Projects)
Project Summary Information	
Project Name	
Project Address	
Assessor's Parcel Number(s)	
Permit Application Number	
Project Watershed (Hydrologic Unit)	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ☐ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906 ☐ San Diego 907 ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☐ Otay 910 ☐ Tijuana 911
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	_________ Acres (_____________ Square Feet)
Area to be disturbed by the project (Project Area)	_________ Acres (_____________ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	_________ Acres (_____________ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	_________ Acres (_____________ Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form I-3A Page 2 of 4
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply) ☐ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Description / Additional Information
Existing Land Cover Includes (select all that apply) ☐ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Description / Additional Information
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☐ NRCS Type D
Existing Natural Hydrologic Features (select all that apply) ☐ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information
Description of Existing Site Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? If so, describe.]

Form I-3A Page 3 of 4
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities
List proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features)
List proposed pervious features of the project (e.g., landscape areas)
Does the project include grading and changes to site topography? ☐ Yes ☐ No Description / Additional Information
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? ☐ Yes ☐ No Description / Additional Information

Form I-3A Page 4 of 4
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply) ☐ Onsite storm drain inlets ☐ Interior floor drains and elevator shaft sump pumps ☐ Interior parking garages ☐ Need for future indoor & structural pest control ☐ Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, and other water features ☐ Food service ☐ Refuse areas ☐ Industrial processes ☐ Outdoor storage of equipment or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☐ Loading docks ☐ Fire sprinkler test water ☐ Miscellaneous drain or wash water ☐ Plazas, sidewalks, and parking lots

Site Information Checklist For PDPs	Form I-3B (PDPs)
Project Summary Information	
Project Name	
Project Address	
Assessor's Parcel Number(s)	
Permit Application Number	
Project Watershed (Hydrologic Unit)	Select One: ☐ Santa Margarita 902 ☐ San Luis Rey 903 ☐ Carlsbad 904 ☐ San Dieguito 905 ☐ Penasquitos 906 ☐ San Diego 907 ☐ Pueblo San Diego 908 ☐ Sweetwater 909 ☐ Otay 910 ☐ Tijuana 911
Parcel Area (total area of Assessor's Parcel(s) associated with the project)	________ Acres (____________ Square Feet)
Area to be disturbed by the project (Project Area)	________ Acres (____________ Square Feet)
Project Proposed Impervious Area (subset of Project Area)	________ Acres (____________ Square Feet)
Project Proposed Pervious Area (subset of Project Area)	________ Acres (____________ Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Parcel Area.	

Form I-3B Page 2 of 9
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☐ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Description / Additional Information:
Existing Land Cover Includes (select all that apply): ☐ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Description / Additional Information:
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☐ NRCS Type D
Approximate Depth to Groundwater: ☐ Groundwater Depth < 5 feet ☐ 5 feet < Groundwater Depth < 10 feet ☐ 10 feet < Groundwater Depth < 20 feet ☐ Groundwater Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☐ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information:

Form I-3B Page 3 of 9
Description of Existing Site Topography and Drainage [How is storm water runoff conveyed from the site? At a minimum, this description should answer (1) whether existing drainage conveyance is natural or urban; (2) describe existing constructed storm water conveyance systems, if applicable; and (3) is runoff from offsite conveyed through the site? If so, describe]:

Form I-3B Page 4 of 9
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities:
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):
List/describe proposed pervious features of the project (e.g., landscape areas):
Does the project include grading and changes to site topography? ☐ Yes ☐ No Description / Additional Information:
Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)? ☐ Yes ☐ No Description / Additional Information:

Form I-3B Page 5 of 9
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply): ☐ Onsite storm drain inlets ☐ Interior floor drains and elevator shaft sump pumps ☐ Interior parking garages ☐ Need for future indoor & structural pest control ☐ Landscape/outdoor pesticide use ☐ Pools, spas, ponds, decorative fountains, and other water features ☐ Food service ☐ Refuse areas ☐ Industrial processes ☐ Outdoor storage of equipment or materials ☐ Vehicle and equipment cleaning ☐ Vehicle/equipment repair and maintenance ☐ Fuel dispensing areas ☐ Loading docks ☐ Fire sprinkler test water ☐ Miscellaneous drain or wash water ☐ Plazas, sidewalks, and parking lots

Form I-3B Page 6 of 9		
Identification of Receiving Water Pollutants of Concern		
Describe path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable):		
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs for the impaired water bodies:		
303(d) Impaired Water Body	**Pollutant(s)/Stressor(s)**	**TMDLs**

Identification of Project Site Pollutants*			
***Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)**			
Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see manual Appendix B.6):			
Pollutant	**Not Applicable to the Project Site**	**Anticipated from the Project Site**	**Also a Receiving Water Pollutant of Concern**
Sediment			
Nutrients			
Heavy Metals			
Organic Compounds			
Trash & Debris			
Oxygen Demanding Substances			
Oil & Grease			
Bacteria & Viruses			
Pesticides			

Form I-3B Page 7 of 9
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the manual)? ☐ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above):
Critical Coarse Sediment Yield Areas* ***This Section only required if hydromodification management requirements apply**
Based on the maps provided within the WMAA, do potential critical coarse sediment yield areas exist within the project drainage boundaries? ☐ Yes ☐ No, no critical coarse sediment yield areas to be protected based on WMAA maps If yes, have any of the optional analyses presented in Section 6.2 of the manual been performed? ☐ 6.2.1 Verification of GLUs Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite ☐ No optional analyses performed, the project will avoid critical coarse sediment yield areas identified based on WMAA maps If optional analyses were performed, what is the final result? ☐ No critical coarse sediment yield areas to be protected based on verification of GLUs onsite. ☐ Critical coarse sediment yield areas exist but additional analysis has determined that protection is not required. Documentation attached in Attachment 8 of the SWQMP. ☐ Critical coarse sediment yield areas exist and require protection. The project will implement management measures described in Sections 6.2.4 and 6.2.5 as applicable, and the areas are identified on the SWQMP Exhibit. Discussion / Additional Information:

Form I-3B Page 8 of 9
Flow Control for Post-Project Runoff* ***This Section only required if hydromodification management requirements apply**
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit.
Has a geomorphic assessment been performed for the receiving channel(s)? ☐ No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: Discussion / Additional Information: (optional)

Form I-3B Page 9 of 9
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed.

<table>
<tr><th colspan="4">Source Control BMP Checklist
for All Development Projects
(Standard Projects and PDPs)</th><th>Form I-4</th></tr>
<tr><td colspan="5">Project Identification</td></tr>
<tr><td colspan="5">Project Name</td></tr>
<tr><td colspan="5">Permit Application Number</td></tr>
<tr><td colspan="5">Source Control BMPs</td></tr>
<tr><td colspan="5">All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.
"Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required.
"No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
"N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.</td></tr>
<tr><td colspan="2">Source Control Requirement</td><td colspan="3">Applied?</td></tr>
<tr><td colspan="2">SC-1 Prevention of Illicit Discharges into the MS4</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="5">Discussion / justification if SC-1 not implemented:</td></tr>
<tr><td colspan="2">SC-2 Storm Drain Stenciling or Signage</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="5">Discussion / justification if SC-2 not implemented:</td></tr>
<tr><td colspan="2">SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="5">Discussion / justification if SC-3 not implemented:</td></tr>
<tr><td colspan="2">SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal</td><td>☐ Yes</td><td>☐ No</td><td>☐ N/A</td></tr>
<tr><td colspan="5">Discussion / justification if SC-4 not implemented:</td></tr>
</table>

Form I-4 Page 2 of 2			
Source Control Requirement	**Applied?**		
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
☐ Onsite storm drain inlets	☐ Yes	☐ No	☐ N/A
☐ Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☐ N/A
☐ Interior parking garages	☐ Yes	☐ No	☐ N/A
☐ Need for future indoor & structural pest control	☐ Yes	☐ No	☐ N/A
☐ Landscape/outdoor pesticide use	☐ Yes	☐ No	☐ N/A
☐ Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	☐ N/A
☐ Food service	☐ Yes	☐ No	☐ N/A
☐ Refuse areas	☐ Yes	☐ No	☐ N/A
☐ Industrial processes	☐ Yes	☐ No	☐ N/A
☐ Outdoor storage of equipment or materials	☐ Yes	☐ No	☐ N/A
☐ Vehicle and equipment cleaning	☐ Yes	☐ No	☐ N/A
☐ Vehicle/equipment repair and maintenance	☐ Yes	☐ No	☐ N/A
☐ Fuel dispensing areas	☐ Yes	☐ No	☐ N/A
☐ Loading docks	☐ Yes	☐ No	☐ N/A
☐ Fire sprinkler test water	☐ Yes	☐ No	☐ N/A
☐ Miscellaneous drain or wash water	☐ Yes	☐ No	☐ N/A
☐ Plazas, sidewalks, and parking lots	☐ Yes	☐ No	☐ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Site Design BMP Checklist for All Development Projects (Standard Projects and PDPs)			Form I-5
Project Identification			
Project Name			
Permit Application Number			
Site Design BMPs			
All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the manual for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.			
Site Design Requirement	**Applied?**		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-1 not implemented:			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-2 not implemented:			
SD-3 Minimize Impervious Area	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented:			
SD-4 Minimize Soil Compaction	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-4 not implemented:			

Form I-5 Page 2 of 2			
Site Design Requirement	**Applied?**		
SD-5 Impervious Area Dispersion	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented:			
SD-6 Runoff Collection	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-6 not implemented:			
SD-7 Landscaping with Native or Drought Tolerant Species	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☐ N/A
Discussion / justification if SD-8 not implemented:			

Summary of PDP Structural BMPs	Form I-6 (PDPs)
Project Identification	
Project Name	
Permit Application Number	
PDP Structural BMPs	
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the manual). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the local jurisdiction at the completion of construction. This may include requiring the project owner or project owner's representative to certify construction of the structural BMPs (see Section 1.12 of the manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the manual). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).	
Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate. (Continue on page 2 as necessary.)	

Form I-6 Page 2 of 3
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information **(Copy this page as needed to provide information for each individual proposed structural BMP)**	
Structural BMP ID No.	
Construction Plan Sheet No.	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☐ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification forms if required by the Port (See Section 1.12 of the manual)	
Who will be the final owner of this BMP?	
Who will maintain this BMP into perpetuity?	
What is the funding mechanism for maintenance?	
Discussion (as needed):	

Harvest and Use Feasibility Checklist		Form I-7
1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season? ☐ Toilet and urinal flushing ☐ Landscape irrigation ☐ Other:_______________		
2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2. [Provide a summary of calculations here]		
3. Calculate the DCV using worksheet B-2.1. DCV = ___________ (cubic feet)		
3a. Is the 36 hour demand greater than or equal to the DCV? ☐ Yes / ☐ No ⇨ ⇩	3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV? ☐ Yes / ☐ No ⇨ ⇩	3c. Is the 36 hour demand less than 0.25DCV? ☐ Yes ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	Harvest and use is considered to be infeasible.
Is harvest and use feasible based on further evaluation? ☐ Yes, refer to Appendix E to select and size harvest and use BMPs. ☐ No, select alternate BMPs.		

<table>
<tr><td colspan="2">Categorization of Infiltration Feasibility Condition</td><td colspan="2">Form I-8</td></tr>
<tr><td colspan="4"><u>Part 1 - Full Infiltration Feasibility Screening Criteria</u>
Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>1</td><td>Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>2</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
</table>

<table>
<tr><th colspan="4">Form I-8 Page 2 of 4</th></tr>
<tr><th>Criteria</th><th>Screening Question</th><th>Yes</th><th>No</th></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.</td></tr>
<tr><td>Part 1 Result *</td><td colspan="2">If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Form I-8 Page 3 of 4

<table>
<tr><td colspan="4">

<u>Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria</u>

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?
</td></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>5</td><td>Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>6</td><td>Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
</table>

<table>
<tr><th colspan="4">Form I-8 Page 4 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td></td><td></td></tr>
<tr><td colspan="4">Provide basis:

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 5-8 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.

If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td></td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Factor of Safety and Design Infiltration Rate Worksheet				Form I-9	
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25		
		Predominant soil texture	0.25		
		Site soil variability	0.25		
		Depth to groundwater / impervious layer	0.25		
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Level of pretreatment/ expected sediment loads	0.5		
		Redundancy/resiliency	0.25		
		Compaction during construction	0.25		
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{total} = S_A \times S_B$					
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					
Design Infiltration Rate, in/hr, $K_{design} = K_{observed} / S_{total}$					
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					

<table>
<tr><th colspan="2">Downstream Systems Requirements for Preservation of Coarse Sediment Supply</th><th colspan="2">Form I-10</th></tr>
<tr><td colspan="4">When it has been determined that potential critical coarse sediment yield areas exist within the project site, the next step is to determine whether downstream systems would be sensitive to reduction of coarse sediment yield from the project site. Use this form to document the evaluation of downstream systems requirements for preservation of coarse sediment supply.</td></tr>
<tr><td colspan="4">Project Name:</td></tr>
<tr><td colspan="4">Project Tracking Number / Permit Application Number:</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Will the project discharge runoff to a hardened MS4 system (pipe or lined channel) or an un-lined channel?</td><td>☐ Hardened MS4 system</td><td>Go to 2</td></tr>
<tr><td>☐ Un-lined channel</td><td>Go to 4</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Will the hardened MS4 system convey sediment (e.g., a concrete-lined channel with steep slope and cleansing velocity) or sink sediment (e.g., flat slopes, constrictions, treatment BMPs, or ponds with restricted outlets within the system will trap sediment and not allow conveyance of coarse sediment from the project site to an un-lined system).</td><td>☐ Convey</td><td>Go to 3</td></tr>
<tr><td>☐ Sink</td><td>Go to 7</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">What kind of receiving water will the hardened MS4 system convey the sediment to?</td><td>☐ Un-lined channel</td><td>Go to 4</td></tr>
<tr><td>☐ Lake
☐ Reservoir
☐ Bay</td><td>Go to 7</td></tr>
<tr><td>☐ Lagoon
☐ Ocean</td><td>Go to 6</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Is the un-lined channel impacted by deposition of sediment? This condition must be documented by the local agency.</td><td>☐ Yes</td><td>Go to 7</td></tr>
<tr><td>☐ No</td><td>Go to 5</td></tr>
</table>

Form I-10 Page 2 of 2	
5	End – Preserve coarse sediment supply to protect un-lined channels from accelerated erosion due to reduction of coarse sediment yield from the project site unless further investigation determines the sediment is not critical to the receiving stream. Sediment that is critical to receiving streams is the sediment that is a significant source of bed material to the receiving stream (bed sediment supply) (see Section 6.2.3 and Appendix H.2 of the manual).
6	End – Provide management measures for preservation of coarse sediment supply (protect beach sand supply).
7	End – Downstream system does not warrant preservation of coarse sediment supply, no measures for protection of critical coarse sediment yield areas onsite are necessary. Use the space below to describe the basis for this finding for the project.

Appendix

J

Appendix J Tidal Influence Study

BMP TIDAL ANALYSIS
FOR
TENTH AVENUE MARINE TERMINAL

Job Number 17765-H

August 4, 2017

RICK ENGINEERING COMPANY

BMP TIDAL ANALYSIS
FOR
TENTH AVENUE MARINE TERMINAL

Job Number: 17765-H

REGISTERED PROFESSIONAL ENGINEER
BRENDAN CRAIG HASTIE
NO. 65809
EXP. 9/30/17
CIVIL
STATE OF CALIFORNIA

Brendan Hastie
R.C.E #65809
Exp. 09/17

Prepared For:

San Diego Unified Port District
3165 Pacific Highway
San Diego, California 92101

Prepared By:

Rick Engineering Company
Water Resources Division
5620 Friars Road
San Diego, California 92110-2596
(619) 291-0707

August 4, 2017

TABLE OF CONTENTS

APPENDICES:

1.0 INTRODUCTION

This study was performed for the San Diego Unified Port District (District) to evaluate the performance of flow-based water quality best management practices (BMPs) proposed for implementation along the waterfront at elevations where tide levels may influence hydraulic function, in support of the structural BMP design for the Tenth Avenue Marine Terminal (TAMT) Tiger Grant Project. The study effort included a review and statistical analysis of historical rain and tidal data, preparation and execution of storm water models, evaluation of results, and the preparation of this report.

This report presents a summary of the data collected, methodologies, and results related to the following tasks:

1. A comparison of historical tidal and rainfall data to show the distribution of rainfall associated with tide levels.
2. An analysis of average treatment volumes, in terms of percentage, associated with various BMP design capacities, in terms of rainfall intensity, set at various elevations relative to the Mean Lower Low Water (MLLW) datum.
3. Evaluation of the water quality treatment capacity of the BMP design shown on the TAMT Tiger Grant Project (100 percent design submittal).
4. Evaluation of the water quality treatment capacity of the BMP with the potential design modification of raising the upstream diversion weir to 6.5 feet MLLW.

1.1 Study Vertical Datum

The Mean Lower Low Water (MLLW) was selected as the vertical datum for this study. For projects that may be tidally influenced, it is critical that a consistent vertical datum be used when comparing key project elevations to key tidal elevations. Key elevations associated with projects that are proposing flow based BMPs may include the invert elevation of the BMP outlet and the BMP maximum operating water surface elevation. San Diego Region Standard Drawing (SDRSD) M-12 provides a summary of the various tide elevation for the MLLW datum as well as other vertical datums. Key tidal elevations, based on SDRSD M-12, are shown in Table 1-1.

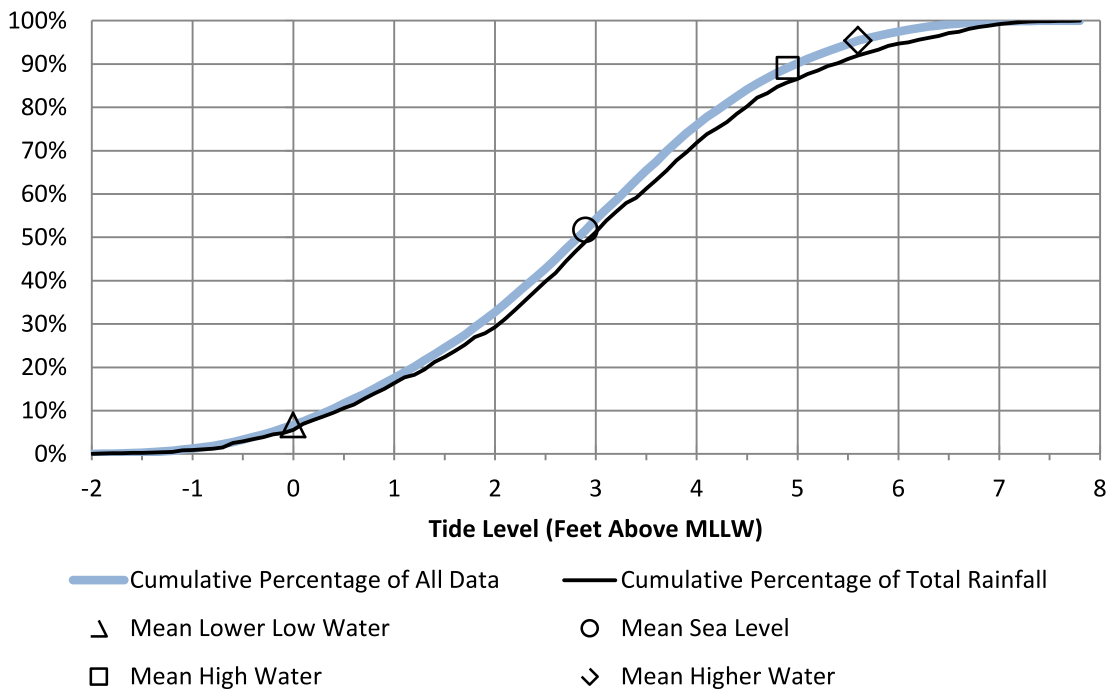
Table 1-1. Mean Lower Low Water Datum

Description	Elevation (feet MLLW)
Highest Tide	7.79
Mean Higher Water	5.61
Mean High Water	4.89
Mean Sea Level	2.88
Mean Lower Low Water	0
Lowest Tide	-2.18

2.0 HISTORICAL TIDAL AND RAINFALL COMPARISON

A statistical comparison of tidal data to rainfall data was performed in order to show the distribution of tide levels and the corresponding rainfall amounts. Rainfall data was obtained from the County of San Diego's Onerain Website (https://sandiego.onerain.com/home.php) for the Fashion Valley Gage for the period of July 1, 1998 through June 10, 2017. Data of higher resolution than hourly Gage is not readily available for Lindbergh Field, and thus the next closest gage with incremental data (i.e., actual time to the minute recorded with each gage bucket tip) was selected. Hourly Tidal data was obtained for the same period for Broadway Pier from the National Oceanic and Atmospheric Website (https://tidesandcurrents.noaa.gov). The timeframe of 19 years was selected based on the Metonic cycle of 19 years, in which the Earth, moon, and sun's relative positions repeat. For each rainfall record value the tidal level, rounded to the nearest tenth of a foot, was estimated using the method of linear interpretation between the hourly tidal data points. The results of this analysis are provided in Figure 1. The thick blue represents all data, irrespective of rainfall, whereas the black line corresponds to amount of rainfall, as a percentage of total rainfall that occurred at or below the corresponding tide level indicated by the x-axis.

Figure 2-1. Comparison of Rainfall Versus Tide Levels



The results indicate that the rainfall distribution generally follows the same distribution as tide levels. Based on this analysis, above and below the Mean Sea Level the curve is approximately linear for about a foot. The Mean High Water corresponds approximately with the 85 percent precipitation (i.e., 85 percent of precipitation occurs when tide is at or below Mean High Water), and the Mean Higher Water corresponds with slightly more than the 90 percent precipitation.

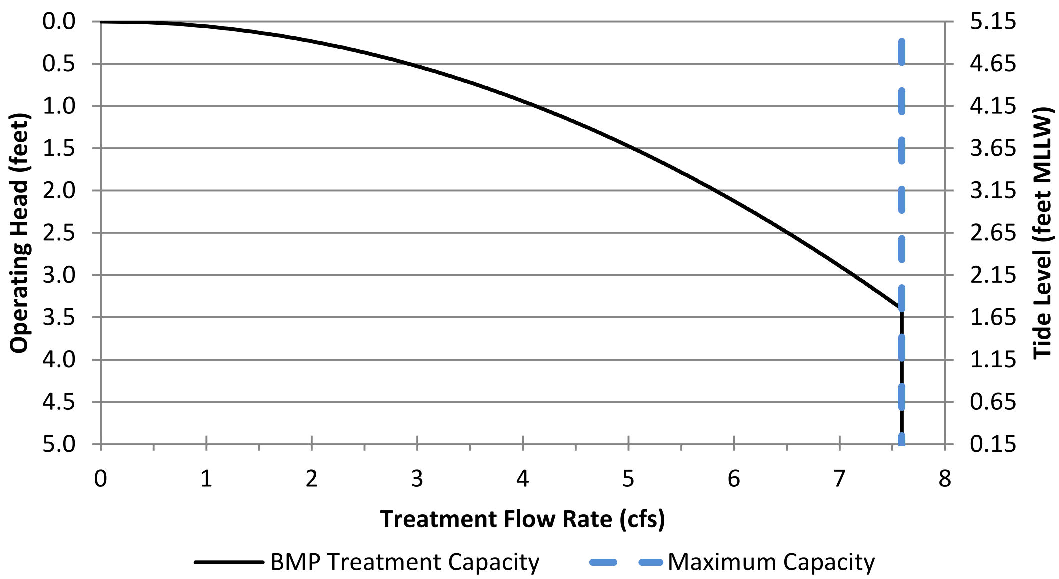
3.0 GENERAL ANALYSIS OF TIDALLY INFLUENCED BMP PERFORMANCE

An analysis was performed to estimate the performance of tidally influenced BMPs. Appendix F of the District's *BMP Design Manual*, dated February 2016, details two options for determining the pollutant treatment performance of flow-based BMPs that includes (Option 1) using a 0.2 inch per hour uniform intensity or (Option 2) conducting a continuous simulation analysis to compute the treatment flow rate (i.e., BMP size) required to capture and treat 80 percent of the average annual runoff. Both Options 1 and 2 require that a 1.5 factor be applied to the flow rate if BMPs do not have a total volume to capture 75 percent of the Design Capture Volume (DCV). Flow based BMPs do not typically meet the 75 percent of DCV requirement and thus must apply the 1.5 factor. The Option 2 analysis was performed as part of this study for several scenarios, each having a different treatment flow rate in terms of constant rainfall intensity (i.e., rainfall intensity was varied for each scenario). For each treatment flow rate scenario, several secondary scenarios were evaluated by varying the BMP height above the MLLW elevation. For each secondary scenario for the average annual runoff treatment value was determined.

A continuous simulation model was prepared to analyze the storm water runoff, tide level, BMP capacity (considering tide level), and average annual storm water runoff treated. The US Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) software was utilized. The SWMM software allows the user to provide incremental rainfall data and site specific information, such as soil parameters and subcatchment lengths, widths, and slopes. These data allow the program to simulate the storm event rainfall and the hydrologic processes across the site in order to calculate storm event runoff values. A rainfall data set was collected, as described in Section 2.0, and incorporated into the model. A SWMM analysis was performed for each scenario (i.e., BMP treatment capacity remained unchanged between scenarios and drainage area was varied to achieve different BMP capacities in terms of uniform rainfall intensity). Using a constant BMP capacity while varying other parameters (e.g., area) allows for a single BMP, such as the BMP currently proposed at TAMT, to be incorporated into each scenario. The SWMM analyses provided output data that included the total storm water runoff flow rates in 5-minute time steps for the period of July 1, 2003 through June 10, 2017 (a simulation of approximately 14 years). The timeframe for continuous simulation modeling was selected based on the availability of good quality, higher resolution rain gage data. Extending beyond 14 years, the data has periods of hourly reading. The 14-year time frame does include both wet, dry, and near average years, and thus is considered to provide an adequately representation of the average annual rainfall. Key SWMM parameters were selected in accordance with guidance from the District's BMP Design Manual, dated February 2016.

A typical flow-based BMP was incorporated into the continuous simulation model. The selected BMP has a maximum operating head of 3.4 feet. That is, with storm water runoff within the BMP at a depth of 3.4 feet above the BMP outlet invert, the BMP is designed to be at peak capacity. The flow rate is regulated through an orifice located at each outlet. When the tide level is above the outlet elevation, the difference in water surface elevations, or head, across the orifice is reduced resulting in less flow rate through the BMP. When the tide level is above the maximum operating water surface of the BMP, corresponding to a depth of 3.4 feet above the BMP flowline, the flow rate through the BMP is reduced to zero. Figure 2-1 shows a graphical representation of the relationship between the operating head and treatment capacity of the typical flow-based BMP incorporated into the continuous simulation modeling. For this example, the BMP outlet invert is assumed to be at 1.75 feet MLLW, and thus the maximum treatment flow rate capacity of 7.59 cfs occurs for tide levels at or below 1.75 feet MLLW. For this example, tide levels of 5.15 feet MLLW or above result in zero head and thus zero treatment flow rate.

Figure 3-1. Head versus Treatment Capacity for Typical Flow-Based BMP



The data obtained from the SWMM analyses were exported to Microsoft Excel post-processing worksheets and were evaluated with tidal data and BMP treatment parameters in order to calculate the average annual runoff capture and treatment volumes. Tidal data was collected, as described in Section 2.0, and incorporated into the post-processing worksheet calculations. The post-processing worksheets included 5-minute time step calculations to compare the tide level to the BMP maximum operation level, determine the BMP treatment capacity associated with the tide level, and determine the volume of runoff treated and bypassed. The post-processing worksheets were prepared to allow the user to change the height of the BMP relative to the MLLW elevation thereby providing calculations and results for each secondary scenario (i.e., for each assumed BMP elevation). The results of the general analysis of tidally influenced BMP performance are summarized in the Table 3-1.

Table 3-1. Summary of the General Analysis of Tidally Influenced BMP Performance

BMP Outlet Elevation (ft MLLW)	Max. BMP Operating Level (ft MLLW)	*Unfactored BMP Rainfall Intensity Treatment Capacity (inches per hour)							
		0.15	0.2	0.25	0.3	0.4	0.5	0.75	1
0	3.4	29.0%	32.0%	34.4%	37.1%	39.8%	41.8%	45.2%	47.5%
0.5	3.9	36.6%	40.2%	43.1%	46.3%	49.5%	51.9%	56.1%	58.7%
1	4.4	43.9%	48.1%	51.4%	55.1%	58.8%	61.5%	66.1%	68.9%
1.5	4.9	50.5%	55.2%	58.8%	58.7%	67.0%	69.9%	74.6%	77.4%
2	5.4	56.0%	61.1%	65.0%	69.4%	70.3%	76.6%	81.2%	83.8%
2.5	5.9	60.5%	65.8%	70.0%	76.7%	78.8%	81.6%	86.0%	88.4%
3	6.4	64.2%	69.7%	74.1%	78.7%	82.9%	83.6%	89.8%	92.1%
3.5	6.9	66.9%	72.6%	77.0%	81.6%	85.7%	88.4%	92.4%	94.6%
4	7.4	68.8%	74.6%	79.0%	82.5%	87.6%	90.1%	94.1%	96.3%
4.5	7.9	70.0%	75.8%	80.2%	83.5%	88.5%	91.0%	94.8%	97.0%
5	8.4	70.3%	76.5%	80.8%	84.6%	89.1%	91.5%	95.1%	97.2%
5.5	8.9	71.1%	76.9%	81.2%	85.3%	89.3%	91.7%	95.2%	97.3%
6	9.4	71.3%	77.1%	81.4%	85.6%	89.5%	91.7%	95.3%	97.3%
6.5	9.9	71.5%	77.2%	81.6%	85.8%	89.5%	91.8%	95.3%	97.3%
7	10.4	71.5%	77.3%	81.6%	85.9%	89.6%	91.8%	95.3%	97.4%
7.5	10.9	71.5%	77.3%	81.6%	85.9%	89.6%	91.8%	95.3%	97.4%
8	11.4	71.5%	77.3%	81.6%	85.9%	89.6%	91.8%	95.3%	97.4%

*Design capacities shown are unfactored. If using this table for design purposes, the final capacity of proposed BMPs shall the based on the intensity listed here multiplied by 1.5.

The results shown in Table 3-1 indicate that as tidally influenced BMPs are proposed at lower elevations, the capacities of these BMPs must be increased in order to capture and treat 80 percent of the average annual runoff. The thick line represents the approximate delineation between the ranges of acceptable and unacceptable BMP design capacities. BMPs with outlet elevations at or below 4.5 feet MLLW have a decrease in average annual treatment capacities. BMPs with outlets at 5.0 feet MLLW or above have no significant decrease in average annual treatment capacities (i.e., act like non-tidally influenced BMPs). At the other end of spectrum, BMPs with outlet elevations below approximately 2.5 feet MLLW may be not be feasible for typical site layouts.

It is noted that the District's BMP Design Manual, dated February 2016, allows for the use of 0.2 inches per hour to determine the unfactored BMP treatment capacity (Option 1 analysis), whereas the results of the Option 2 analysis indicates that a design rainfall intensity of approximately 0.23 inches per hour is required to capture and treat 80 percent of the average annual runoff (assuming 100 percent impervious cover in the drainage areas to the BMPs). Modeling that incorporates pervious areas may result in less runoff and thus result in BMPs requiring less capacity (i.e., capacity closer to and possibly lower than the design intensity of 0.2 inches per hour).

Both Options 1 and 2 detailed in Section F.2.2 of the District's BMP Design Manual require that the determined BMP capacity be factored by 1.5 (i.e., increased in size by a factor of 1.5), and both options are valid for the design of BMPs that are not significantly influenced by tide levels. For BMPs that are influenced by tide levels, and that have the same general characteristics as the example flow-based BMP analyzed, the following general guidelines may be implemented:

- The performance of BMPs with outlet elevations at or above 5.0 feet MLLW are not significantly affected, and thus either the Option 1 or 2 analysis may be performed in support of BMP design.
- For BMPs with an outlet elevation below 5.0 feet MLLW, the Option 2 analysis should be used to demonstrate that proposed BMPs meet the applicable pollutant control obligations.

4.0 SPECIFIC TIDAL ANALYSIS FOR TAMT PROJECT

A detailed analysis was performed to evaluate the performance of the BMP proposed as part of the TAMT Tiger Project. The analysis was based on data extracted from the 100 percent submittal drawings obtained on July 6, 2017. The potential design modification of raising the upstream weir elevation to 6.5 feet MLLW was discussed at coordination meetings and this change was also incorporated into analysis. The models and post-processing calculations, described in Section 3.0, were enhanced to incorporate project specific drainage area and BMP parameters. In particular, the hydraulic function of the BMP and downstream system was evaluated to identify potential system limitations or restrictions, which were incorporated into the post-processing worksheet calculations. Additionally, the required 1.5 factor was incorporated into the post-processing worksheet calculations.

The following summarizes key characteristics of the proposed structural BMP:

<u>100% Design Submittal</u>

- BMP outlet elevation of 1.75 feet MLLW.
- BMP maximum operation depth of 3.4 feet (elevation of 5.15 feet MLLW).
- Upstream bypass weir elevation of 5.23 feet MLLW.
- BMP system maximum treatment capacity of 7.59 cfs.

<u>As Discussed at Coordination Meetings</u>

- BMP outlet elevation of 1.75 feet MLLW.
- BMP maximum operation depth of 4.58 feet (elevation of 6.33 feet MLLW).
- Upstream bypass weir elevation of 6.5 feet MLLW.
- BMP system maximum treatment capacity of 7.59 cfs.

Hydraulic calculations of the storm drain system downstream of the proposed BMP were performed using Water Surface Pressure Gradient for Windows (WSPGW) modeling software. The results of these calculations indicate that the peak flow rate of 7.59 cubic feet per second through the BMP results in a downstream water surface elevation, at the BMP outlet, of approximately 2.85 feet MLLW during periods when the system is not influenced by tide levels (i.e., when tide levels are below 1.75 feet MLLW). This means that as designed, at a water surface elevation of 5.15 feet MLLW in the treatment chamber of the BMP, the system would have an operating head of 2.3 feet not 3.4 feet, and this would result in a reduced flow through the system (see Figure 3-1 in Section 3.0) (or with a water surface elevation of 6.33 feet MLLW in the treatment chamber of the BMP, the system would have an operating head of 3.48 feet not 4.58 feet). A reduced flow would in turn would result in a lower downstream water surface elevation, and performing the necessary iterations indicates that as currently designed the BMP has a peak pollutant control capacity 6.89 cubic feet per second, which results in a downstream water surface elevation of approximately 2.73 feet MLLW. The hydraulic calculations also indicate that when the system bypasses flows of approximately 30 cubic feet per second or more, the resulting water surface elevations downstream of the BMP are above 5.15 feet MLLW, and thus no flow is treated through the BMP when this occurs. Both of these hydraulic limitations were incorporated into the post-processing worksheet calculations.

A total of four scenarios were analyzed in order to evaluate BMP performance and to incorporate and evaluate design considerations. The first two scenarios evaluated the BMP effectiveness considering a reduced drainage area of 8.8 acres, which corresponds to the area where site improvements are proposed (i.e., area required to be treated). Scenario 1 assumed the BMP is designed as shown on the 100 percent design drawings. Scenario 2 assumed modifications that included raising the upstream diversion weir to 6.5 feet MLLW and increasing the diameter of BMP orifices in order to achieve the optimal treatment capacity flow rate of 7.59 cubic feet considering a downstream water surface elevation of 2.85 feet MLLW.

Scenarios 3 and 4 assumed similar BMP configurations as Scenarios 1 and 2, respectively. However, Scenarios 3 and 4 assumed that the drainage area is a total of 40.3 acres as shown on the 100 percent submittal documents. Scenario 3 results indicate how the system will function in the current design (i.e., BMP outlet at 1.75 feet MLLW and orifice diameter based on 3.4 feet operating head). Scenario 4 results indicate how the system will function if the upstream weir is raised to 6.5 feet MLLW and if the diameters of the BMP orifices are modified to maximize treatment flow rate provided. The summary of the analysis performed for each scenario is shown in Table 4-1. The "Equivalent Area Treated" column provides the correlation between the total volumes treated for each scenario and the total volume required to be treated, which is 80 percent of the runoff from the 8.8 acres, multiplied by 8.8 acres (i.e., correlated to the area of the project that the project is obligated to treat through a pollutant control BMP). The "Net Additional Area Treated" column provides the additional equivalent area, beyond the 8.8 acres required by the project, that the project is estimated to treat on an average annually basis. Please note that the results presented in Table 4-1 include the 1.5 scaling factor that is required by BMP Design Manual criteria.

Table 4-1. Summary of TMAT BMP Performance Analysis

Scenario	Modeled Drainage Area (acres)	Upstream Weir Elevation (ft MLLW)	Orifice Diameters (inches)	Average Annual Runoff Treated*	Average Annual Runoff Treated (cf)	Equivalent Area Treated (acres)	Net Additional Area Treated (acres)
1	8.8	5.23	2.67	74.7%	210,487	8.2	-0.6
2	8.8	6.5	2.65	86.7%	244,334	9.5	0.7
3	40.3	5.23	2.67	*43.6%	558,119	21.8	13.0
4	40.3	6.5	2.65	*54.6%	699,115	27.3	18.5

*Please note that average annual runoff treated values shown in this table were computed utilizing a reduced BMP treatment capacity (i.e., reduced by 1 / 1.5). The proposed BMP was designed to treat approximately 80% of the average annual runoff without the consideration of tidal influence or the 1.5 scaling factor. When performing the simulation to consider tidal influence but without the applying the 1.5 scaling reduction, such as if considering the Industrial General Permit treatment volumes treated, the overall average annual runoff treated values are 58.5% and 70.3% for Scenarios 3 and 4, respectively.

The refinement of raising the upstream diversion weir elevation, if implemented, shall be coordinated with BMP manufacturer. This refinement may be more complicated than merely proposing a raised weir elevation as it may require that the BMP manufacturer ensure that depths above 3.4 feet will not simply overflow into the discharge chamber (i.e., bypass the BMP at the downstream BMP wall). Additionally, this sort of refinement may require modification to the media configuration, such as making the media area taller or placing a barrier over the media to prevent short circuiting. Additionally, future refinements to the proposed BMP, beyond those mentioned here, if proposed should be evaluated using the described methodologies and continuous simulation model prepared for this study.

5.0 SUMMARY

Data collection, compilation, and various analyses were performed in order to evaluate the performance of tidally influenced BMPs. Based on the SDRSD M-12, the Highest Tide elevation is 7.79 feet MLLW, the Mean Higher Water elevation is 5.61 feet MLLW, the Mean High Water elevation is 4.89 feet MLLW, the Mean Sea Level is 2.88 feet MLLW, and MLLW is the datum with an elevation of zero feet MLLW. This study included a general analysis of BMP performance, which indicates typical BMPs with outlet elevations at 5.0 feet MLLW or above have no significant decrease in average annual treatment capacities (i.e., act like non-tidally influenced BMPs). BMPs with outlet elevations below approximately 2.5 feet MLLW may not be feasible for implementation for typical site layouts. BMPs with outlet elevations below 5.0 feet MLLW should require continuous simulation modeling to demonstrate that the unfactored BMP capacity will be adequate to capture and treat 80 percent of the average annual runoff (i.e., determine the flow rate capacity required to treat 80 percent of the average annual runoff and then multiple that value by the 1.5 scaling factor). BMP Tidal Analysis key findings for flow-based BMPs include the following:

- BMP outlet elevation ≥ 7.8 feet MLLW: no special requirements, no flap valve.
- BMP outlet elevation ≤ 7.8 feet and ≥ 5.0 feet MLLW: flap valve required, no other special design or analysis required.
- BMP outlet elevation < 5.0 feet MLLW: flap valve required, *BMP Design Manual* Appendix F Option 2 analysis required to demonstrate project will capture and treat 80 percent of the average annual runoff.

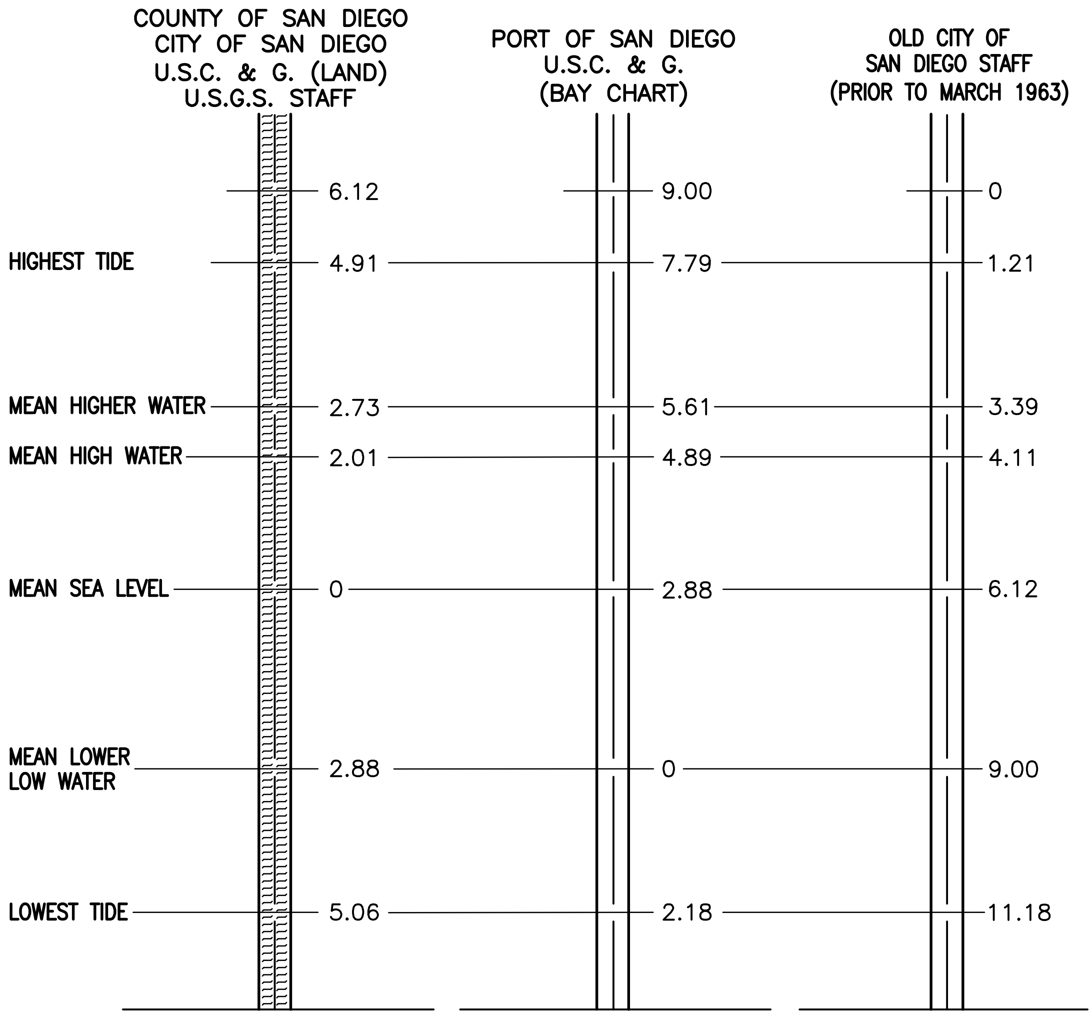
A project-specific continuous simulation modeling analysis was prepared to evaluate the BMP performance of the proposed TAMT Tiger Demolition Project. The results of the analysis indicate that the proposed BMP will capture and treat an average annual runoff volume in excess of the annual runoff volume associated with the project area of 8.8 acres. The site location, project scope, and BMP system combine to create a very unique situation, and the approach to quantify pollutant control capture and treatment for this type of unique situation is not clearly described in current guidance documents, such as the District's *BMP Design Manual*. The approach and results described in this study seem to meet the intent of the current regulatory permit, which is understood as priority development projects (PDPs) must reduce project pollutant loading in storm water runoff from project areas by at least 80 percent. Based on the analysis described hereon, the TAMT Tiger Project exceeds this requirement by capturing and treating runoff from an area that is larger than what is required. The analysis results are summarized in Table 4-1 in Section 4.0.

The potential design modification of raising the upstream diversion weir to 6.5 feet MLLW was evaluated. According to the assumptions and analysis described in this study, the modification would result in the BMP system having the capacity to treat well over the 80 percent of the average annual runoff specific to 8.8 acres associated with project site. The increased pollutant removal provided by the modification provides additional confidence in meeting current regulatory requirements. Furthermore, by voluntarily directing runoff from the entire drainage area of 40.3 acres, the project will provide significantly better water quality, and thus generate additional earned credits for pollutant control in support of the District's Alternative Compliance Program (ACP).

APPENDIX A

San Diego Regional Standard Drawing

M-12 – Datums



LEGEND

U.S.C. & G.	=	United States Coast and Geodetic Survey.
U.S.G.S.	=	United States Geological Survey.
MEAN HIGH WATER	=	Mean of all high water in San Diego Bay.
MEAN HIGHER WATER	=	Mean of all higher water in San Diego Bay. Bay charts and topography up to the mean high tide based on zero at the mean lower low water.

SOURCE

Data based on U.S.C. & G. "Sea level Datum of 1929".

Revision	By	Approved	Date
TEXT	BUSS		2/11
REVISED		D. Gerschoffer	9/15

SAN DIEGO REGIONAL STANDARD DRAWING

DATUMS

RECOMMENDED BY THE SAN DIEGO REGIONAL STANDARDS COMMITTEE

12/17/2015

Chairperson R.C.E. 19246 Date

DRAWING NUMBER **M-12**

APPENDIX B

Continuous Simulation Model

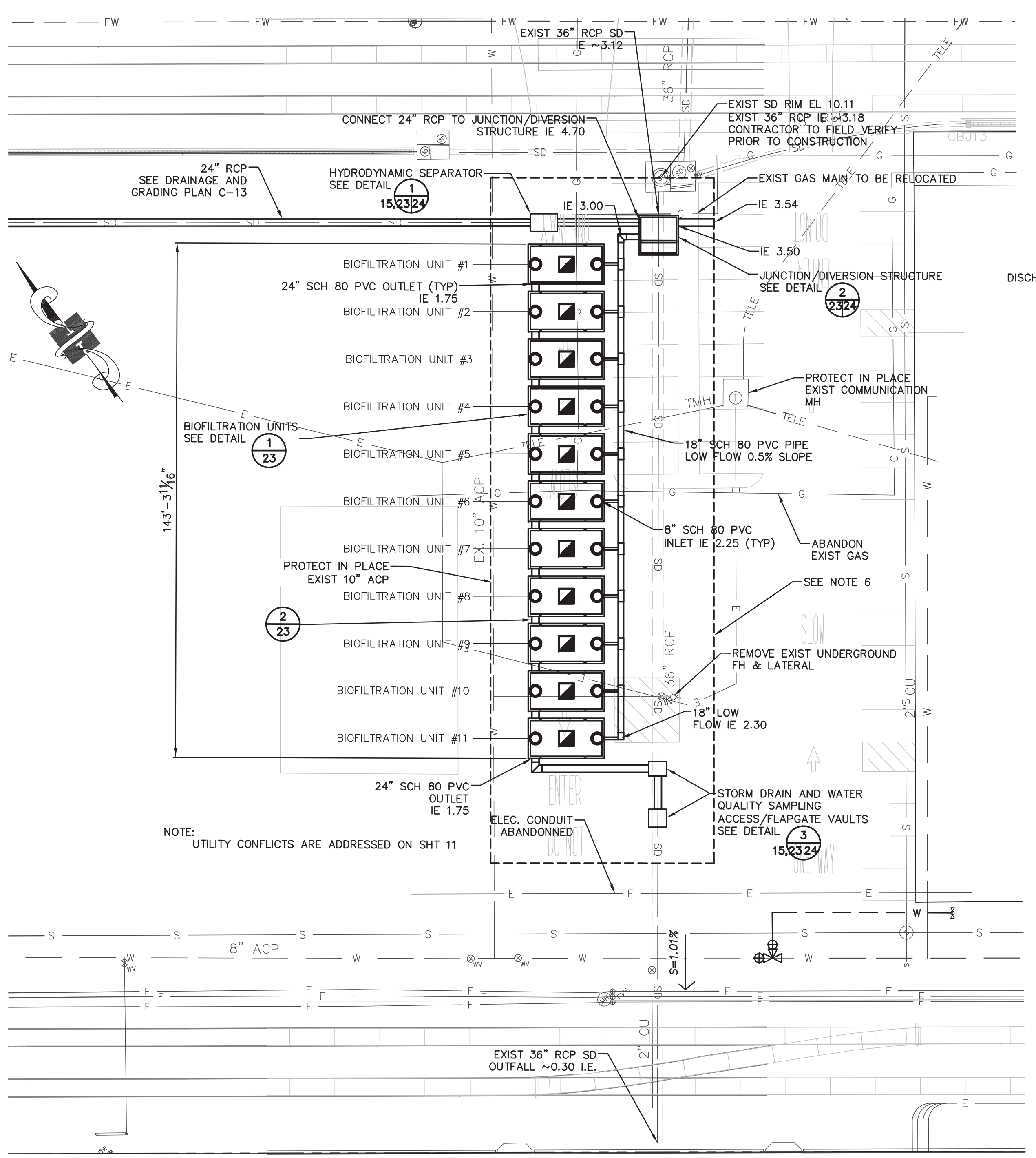
Summary of Annual Rainfall

Fashion Valley Rain Gage Data, Summary of Annual Rainfall for Model Period

Rainfall Year	Rain (inches)
2003 - 2004	6.16
2004 - 2005	25.51
2005 - 2006	7.04
2006 - 2007	4.72
2007 - 2008	10.16
2008 - 2009	8.04
2009 - 2010	12.31
2010 - 2011	15.34
2011 - 2012	8.75
2012 - 2013	7.79
2013 - 2014	4.85
2014 - 2015	8.19
2015 - 2016	11.80
2016 - 2017	14.87
Average =	**10.39**

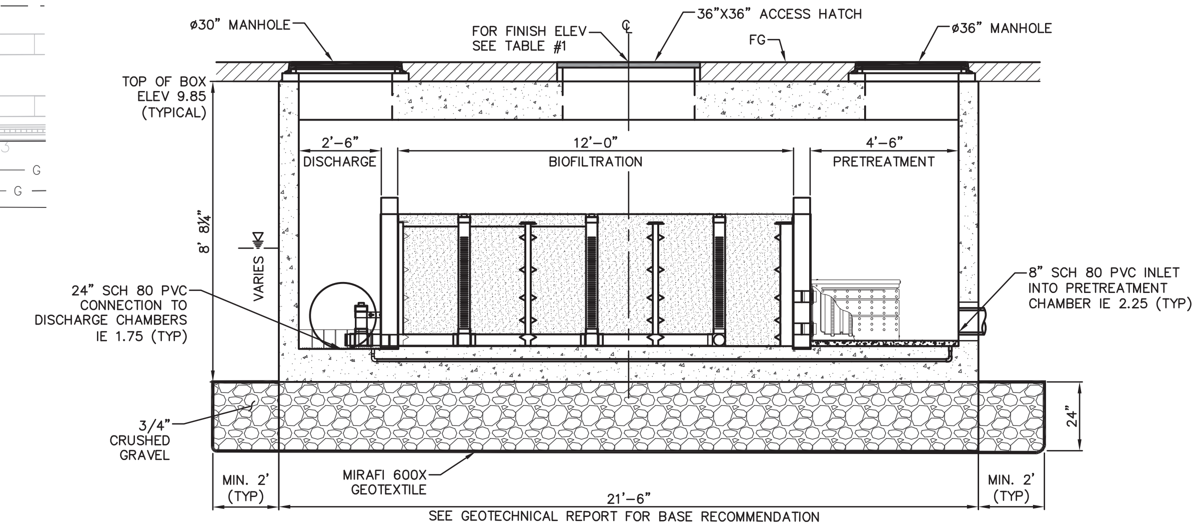
APPENDIX C

Copy of Plan Sheets Relevant to Structural BMP



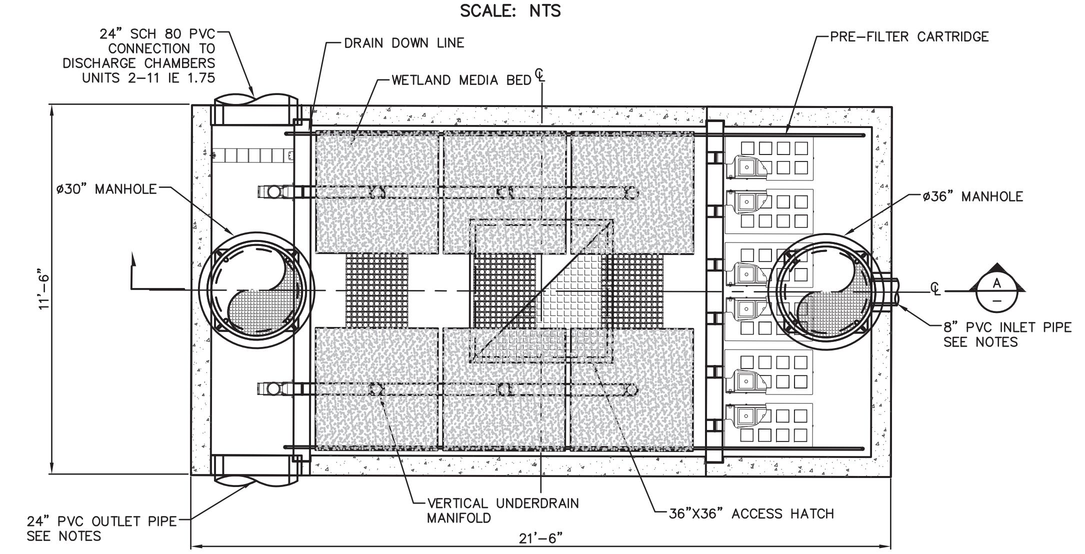
NOTE:

1. IN ORDER TO MINIMIZE IMPACT TO PORT OPERATIONS, THE CONSTRUCTION OF BIOFILTRATION UNITS AND STORM DRAIN SYSTEM AT THIS LOCATION, MUST NOT OCCUR CONCURRENT WITH DEMOLITION AND PAVEMENT ACTIVITIES AT TRANSIT SHED NO. 1. AS A MINIMUM, CONTRACTOR MUST COMPLETE THE PAVEMENT WORK ON BAYS A AND B BEFORE STARTING CONSTRUCTION ACTIVITIES AT THE BIOFILTRATION SITE. COORDINATE WORK WITH THE ENGINEER. ALSO, A WORKPLAN IS REQUIRED FOR CONSTRUCTION OF THE BIOFILTRATION UNITS AND STORM DRAIN SYSTEM SHOWN ABOVE. SEE SPECIFICATIONS FOR MORE DETAILS.
2. DIMENSIONS PROVIDED ARE DIAGRAMMATIC AND APPROXIMATE. SEE SPECIFICATIONS FOR THE SPECIFIED PERFORMANCE AND REQUIREMENTS OF THE BIOFILTRATION UNITS. DIMENSIONS AND LAYOUT DETAILS PER THE MANUFACTURER.
3. CONTRACTOR IS REQUIRED TO DESIGN AND CONSTRUCT THE STORM DRAIN STRUCTURES ON THIS SHEET FOR H20 LOADING.
4. CONTRACTOR TO SUBMIT DESIGN CALCULATIONS (BY A CIVIL OR STRUCTURAL ENGINEER REGISTERED IN THE STATE OF CALIFORNIA) TO THE ENGINEER FOR APPROVAL.
5. SEE GEOTECHNICAL REPORT BY NINYO AND MOORE FOR BASE RECOMMENDATIONS FOR BIOFILTRATION UNITS. ALTERNATIVE BASE RECOMMENDATION IS PROVIDED FOR STABILIZING THE BIOFILTRATION UNITS.
6. PROVIDE RED DIAGONAL STRIPING A MINIMUM OF 10' FROM STORM DRAIN SYSTEM VAULTS AS SHOWN. STRIPES AT EVERY 10' OC, WIDTH OF STRIPE 12". PROVIDE THE FOLLOWING TEXT: "NO GOTTWALD CRANE IN THIS AREA" ALONG BOTH LENGTHS OF STRIPE BOUNDARY. LETTERING SHALL BE A MINIMUM OF 1' HEIGHT.



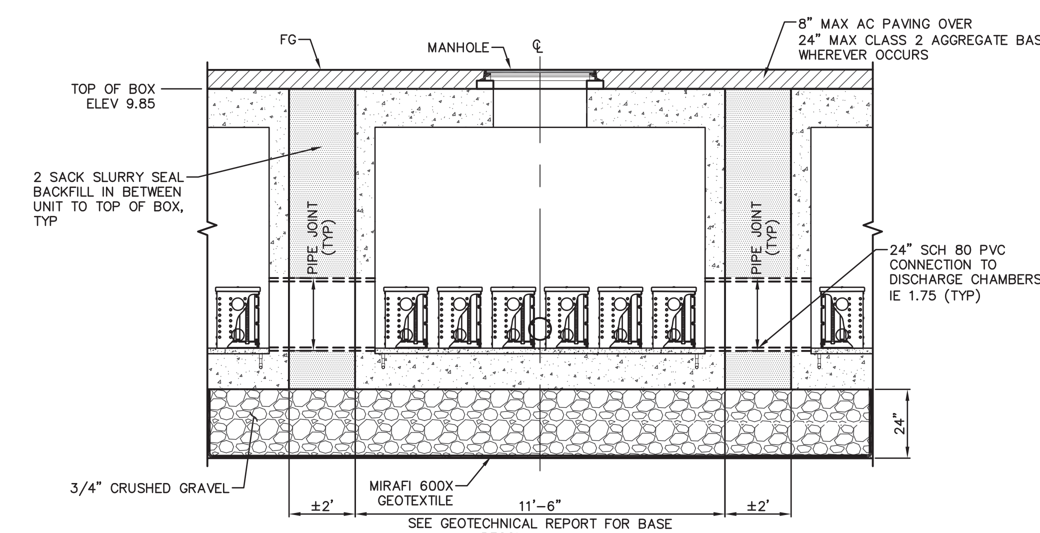
SECTION A–A

SCALE: NTS



1/23 BIOFILTRATION UNIT DETAIL

SCALE: NTS



2/23 TYPICAL ELEVATION BETWEEN BIOFILTRATION UNIT PRETREATMENT CHAMBER

SCALE: NTS

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS.
2. UNIT MUST BE INSTALLED ON LEVEL BASE.
3. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL GAPS AROUND PIPES SHALL BE SEALED WATER TIGHT WITH A NON-SHRINK GROUT PER MANUFACTURERS STANDARD CONNECTION DETAIL AND SHALL MEET OR EXCEED REGIONAL PIPE CONNECTION STANDARDS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE.
6. SEE DETAIL 4 ON SHT 22 FOR PIPE PENETRATION TO CONCRETE STRUCTURES.
7. SAW CUT PAVEMENT FOR EXCAVATION TO CONSTRUCT BIOFILTRATION STRUCTURES. PAVEMENT SECTION BETWEEN THE BIOFILTRATION UNITS AND THE EDGE OF THE EXCAVATION PIT SHALL BE PER DETAIL 1 ON SHT 20, MATCHING BAY C PAVEMENT SECTION.

TABLE #1

BIOFILTRATION UNIT #	FINISH GRADE SURFACE ELEVATION	FLOW (CFS)
1	10.60	0.69
2	10.70	0.69
3	10.80	0.69
4	10.90	0.69
5	11.00	0.69
6	11.10	0.69
7	11.20	0.69
8	11.30	0.69
9	11.50	0.69
10	11.50	0.69
11	11.60	0.69

NOTE: TOP OF BOX ELEVATION IS 9.85 (TYP)
FINISH GRADE SURFACE ELEVATIONS ARE APPROXIMATE. MATCH EXISTING GRADE

GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

REGISTERED PROFESSIONAL ENGINEER JAVIER A. ... NO. C71481 EXP. 12-31-17 CIVIL STATE OF CALIFORNIA

HARRIS & ASSOCIATES
600 B Street, Suite 2000
San Diego, CA 92101
(619) 236-1778 ● (619) 236-1179

SPEC NO. 2017-03	WBS NO. CP-0016-1
REFERENCES	
PROJECT ENGINEER	MARK MCINTIRE
CONTRACTOR	
CONSTRUCTION STARTED	
CONSTRUCTION COMPLETED	
COST	INSPECTOR

REVISIONS | DATE | APPROVED

San Diego Unified Port District
San Diego • California

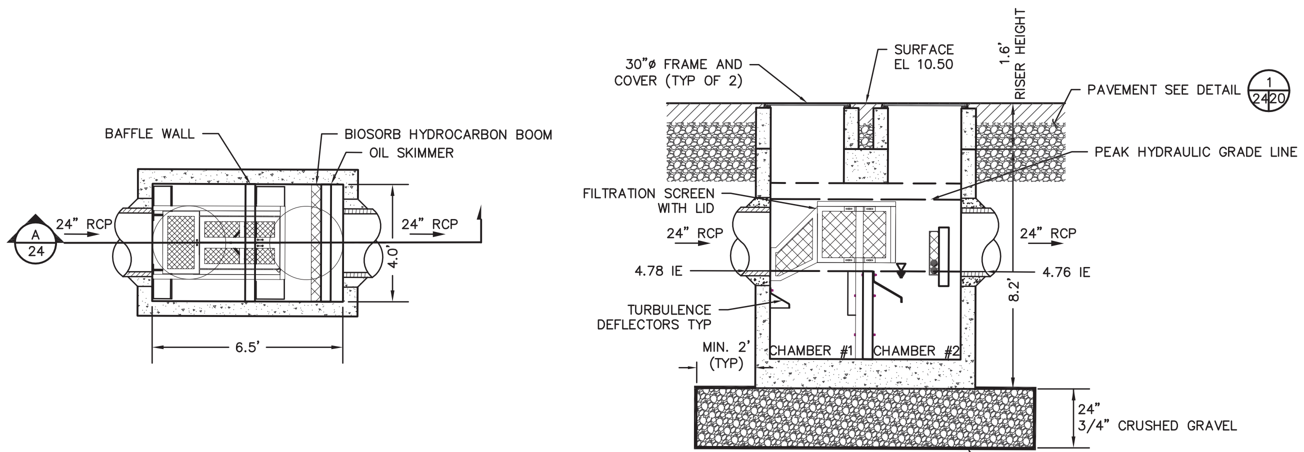
DESIGNED JAY | DRAWN OJ | CHECKED GKM
APPROVAL RECOMMENDED | APPROVED

SAN DIEGO, CALIFORNIA

DEMOLITION AND SITE IMPROVEMENTS OF TRANSIT SHED 1 AT TENTH AVENUE MARINE TERMINAL

STORM WATER TS1 BMP SITE MAP & DETAILS

C20
* DATUM * MEAN LOWER LOW WATER
DATE 3/30/2017
SHEET 23 OF 88
DRAWING NO. TA-2017-01 REV.



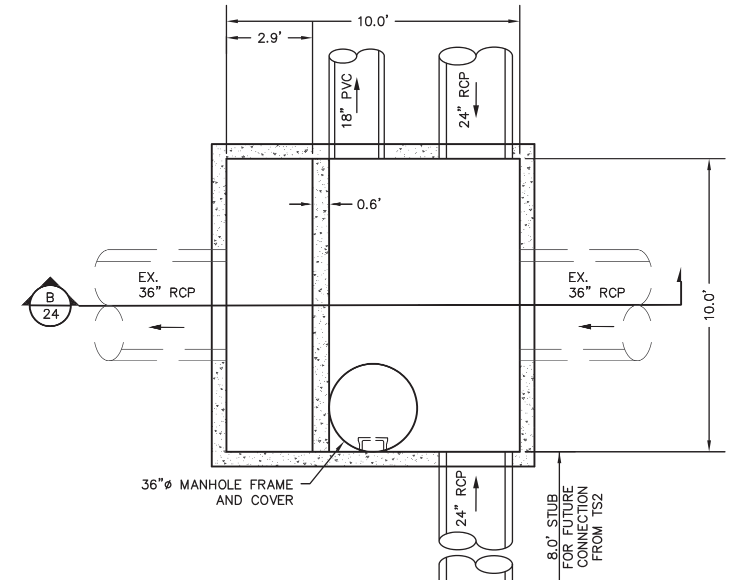
SECTION A–A

SCALE: NTS

NOTE:
1. HYDRODYNAMIC SEPARATOR STRUCTURE, MANHOLE RISER, MANHOLE FRAME, AND COVER SHALL BE RATED FOR H20 LOADING.
2. CONTRACTOR TO PROVIDE DESIGN AND STRUCTURAL CALCULATIONS. SEE GENERAL NOTE 4.

1 — 15,23|24 HYDRODYNAMIC SEPARATOR

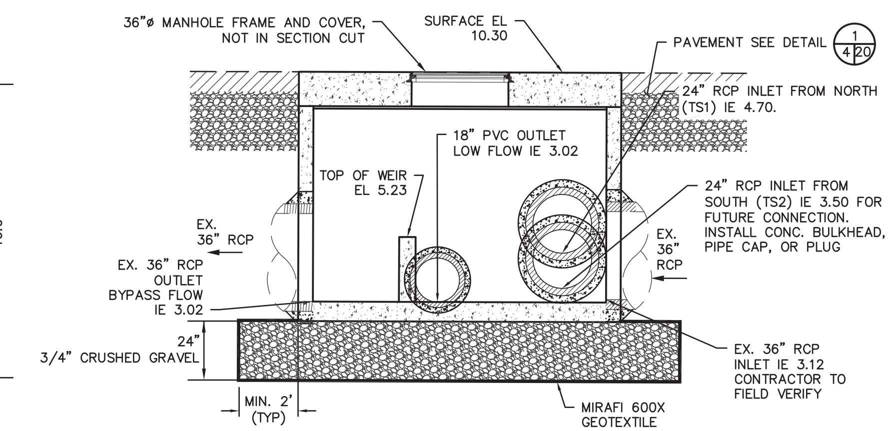
SCALE: NTS



NOTE:
1. JUNCTION/DIVERSION STRUCTURE, MANHOLE RISER, MANHOLE FRAME, AND COVER SHALL BE RATED FOR H20 LOADING.
2. CONTRACTOR TO PROVIDE DESIGN AND STRUCTURAL CALCULATIONS. SEE GENERAL NOTE 4.

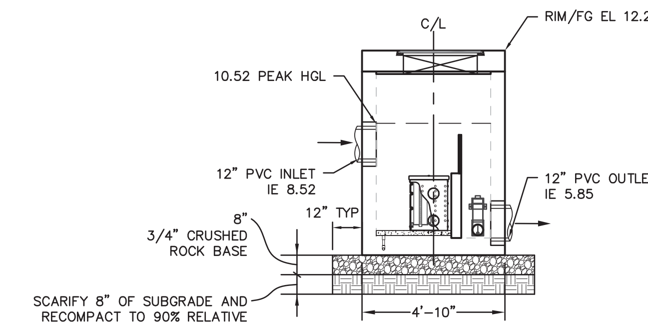
2 — 15,23|24 JUNCTION/DIVERSION STRUCTURE

SCALE: NTS



SECTION B–B

SCALE: NTS

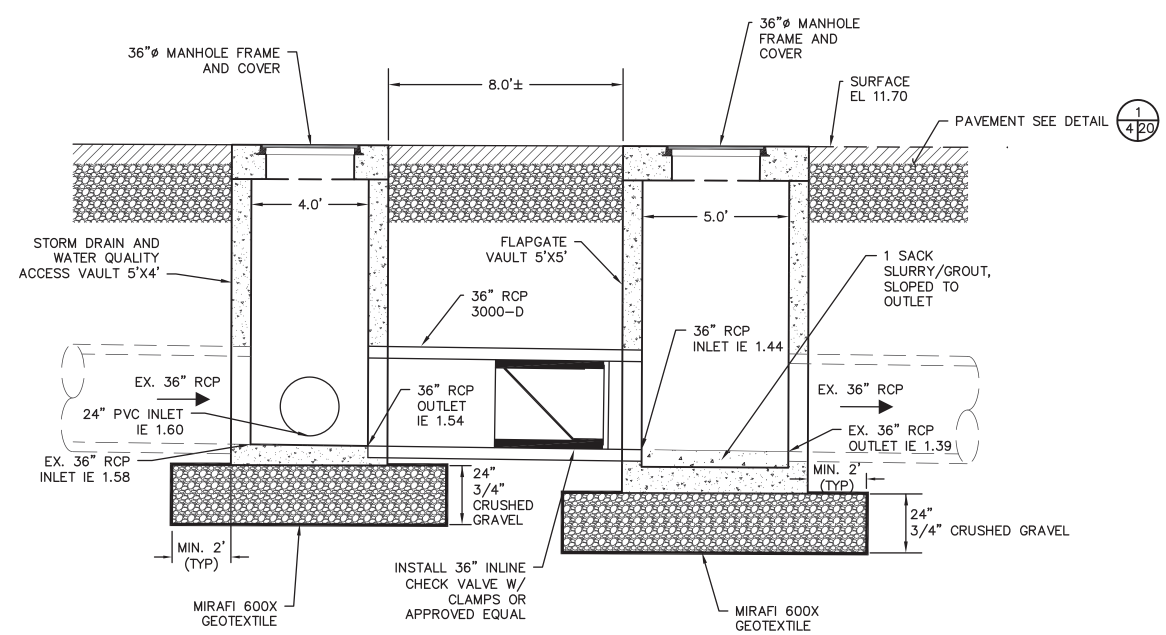


SECTION C–C

SCALE: NTS

GENERAL NOTES:

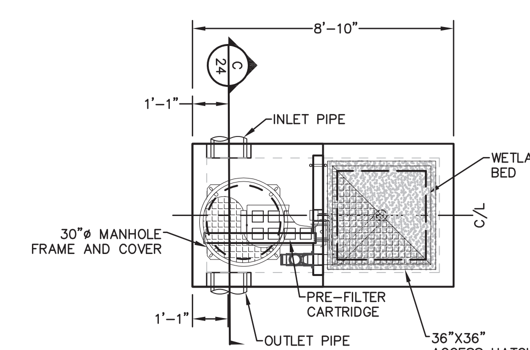
1. IN ORDER TO MINIMIZE IMPACT TO PORT OPERATIONS, THE CONSTRUCTION OF BIOFILTRATION UNITS AND STORM DRAIN SYSTEM AT THIS LOCATION, MUST NOT OCCUR CONCURRENT WITH DEMOLITION AND PAVEMENT ACTIVITIES AT TRANSIT SHED NO. 1. AS A MINIMUM, CONTRACTOR MUST COMPLETE THE PAVEMENT WORK ON BAYS A AND B BEFORE STARTING CONSTRUCTION ACTIVITIES AT THE BIOFILTRATION SITE. COORDINATE WORK WITH THE ENGINEER. ALSO, A WORKPLAN IS REQUIRED FOR CONSTRUCTION OF THE BIOFILTRATION UNITS AND STORM DRAIN SYSTEM SHOWN ABOVE. SEE SPECIFICATIONS FOR MORE DETAILS.
2. DIMENSIONS PROVIDED ARE DIAGRAMMATIC AND APPROXIMATE. SEE SPECIFICATIONS FOR THE SPECIFIED PERFORMANCE AND REQUIREMENTS OF THE BIOFILTRATION UNITS. DIMENSIONS AND LAYOUT DETAILS PER THE MANUFACTURER.
3. CONTRACTOR IS REQUIRED TO DESIGN AND CONSTRUCT STORM DRAIN STRUCTURES ON THIS SHEET FOR H20 LOADING.
4. CONTRACTOR TO SUBMIT DESIGN CALCULATIONS (BY A REGISTERED CIVIL OR STRUCTURAL ENGINEER REGISTERED IN THE STATE OF CALIFORNIA) TO THE ENGINEER FOR APPROVAL.
5. SEE GEOTECHNICAL REPORT BY NINYO AND MOORE FOR BASE RECOMMENDATIONS FOR BIOFILTRATION UNITS. ALTERNATIVE BASE RECOMMENDATION IS PROVIDED FOR STABILIZING THE BIOFILTRATION UNITS.



NOTE:
1. STORM DRAIN AND WATER QUALITY ACCESS / FLAPGATE VAULTS, MANHOLE RISER, MANHOLE FRAME, AND COVER SHALL BE RATED FOR H20 LOADING.
2. CONTRACTOR TO PROVIDE DESIGN AND STRUCTURAL CALCULATIONS, SEE GENERAL NOTE 4.

3 — 15,23|24 STORM DRAIN AND WATER QUALITY ACCESS / FLAPGATE VAULTS

SCALE: NTS



NOTE:
1. THIS BIOFILTRATION UNIT SHALL BE RATED FOR H20 LOADING, INCLUDING VAULT, FRAME AND COVER, RISER AND HATCH.
2. SEE GENERAL NOTE 4 THIS SHEET.
3. FLOW RATE THROUGHOUT THIS BIOFILTRATION UNIT IS 0.11 CFS

4 — 19|24 BIOFILTRATION UNIT FOR MODULAR OFFICE SITE

SCALE: NTS

HARRIS & ASSOCIATES
600 B Street, Suite 2000
San Diego, CA 92101
(619) 236–1778 • (619) 236–1179

REGISTERED PROFESSIONAL ENGINEER JAVIER A. YESCAS NO. C71481 EXP. 12–31–17 CIVIL STATE OF CALIFORNIA

SPEC NO. 2017-03	WBS NO. CP-0016-1		
REFERENCES			
PROJECT ENGINEER MARK MCINTIRE			
CONTRACTOR			
CONSTRUCTION STARTED			
CONSTRUCTION COMPLETED			
COST	INSPECTOR	REVISIONS	DATE / APPROVED

San Diego Unified Port District
San Diego • California

DESIGNED	JAY
DRAWN	OJ
CHECKED	GKM
APPROVAL RECOMMENDED	
APPROVED	

SAN DIEGO, CALIFORNIA

DEMOLITION AND SITE IMPROVEMENTS OF TRANSIT SHED 1 AT TENTH AVENUE MARINE TERMINAL

STORM WATER BMP DETAILS

C21	
* DATUM * MEAN LOWER LOW WATER	
DATE	3/30/2017
SHEET 24 OF 88	
DRAWING NO.	REV.
TA-2017-01	

Appendix

K

BMP DESIGN MANUAL

PDP Exemption Guidance

Appendix K PDP Exemption Guidance

There are two categories of PDP exemptions, each with its own requirements for runoff treatment.

- Walkways Exemption: New or retrofit paved sidewalks, bicycle lanes, or trails that meet certain criteria (Appendix K.1)

- Green Street Exemption: Retrofitting or redevelopment of existing paved alleys, streets or roads that meet certain criteria (Appendix K.2)

Technical guidance related to both exemption categories are provided in this appendix.

K.1 Walkways Exemption

The Walkways Exemption is defined in Section 1.4.3. This section provides technical guidance related to this exemption category, including sidewalks, bicycle lanes or paths that are:

1. Designed and constructed to direct stormwater runoff to adjacent vegetated areas, or other non-erodible permeable areas (Appendix K.1.1); OR

2. Designed and constructed to be hydraulically disconnected from paved streets or roads (Appendix K.1.2); OR

3. Designed and constructed with permeable pavements or surfaces (Appendix K.1.3).

Where a project or portion of a project meets the criteria for the Walkways Exemption, then pollutant control and hydromodification controls are not required. Additionally, this area should not be included in tabulation of the created, added, or replaced impervious surface.

Form K-1 is used to document how a project meets the requirements of the Walkways Exemption. A PDF version of Form K-1 can be found on the Port of San Diego Stormwater Management website: https://www.portofsandiego.org/stormwater-management

K.1.1 Guidance for Directing Stormwater into Vegetated or Non-Erodible Permeable Areas

Routing stormwater onto vegetated and non-erodible permeable areas can provide an opportunity for infiltration and/or evaporation to occur, particularly in smaller storms. However, the effectiveness of this approach is dependent on the loading ratio (i.e., how much area is routed onto a given permeable area) and whether the surface is resistant to erosion (i.e. shear stress). If loading ratios are too high and/or permeable surfaces are too unstable, this approach can create additional problems relative to erosion and sedimentation.

For the purpose of meeting the criteria of this exemption, one of two options, or equivalent, may be used:

1. Satisfy the specifications outlined within the impervious dispersion factsheet (SD-B in Appendix E), OR

2. Route water into an open-graded gravel area with a gravel diameter greater than or equal to 1-inch diameter, or other surface with similar permeability and resistance to shear stress (Figure K.1-1). For this option, the loading ratio must be less or equal to 5:1 and the contributing path length of the impervious surface must have a maximum length of 20 feet. The sidewalk or other paved pathway must be designed with the standard cross slope.

Intent: A vegetated or non-erodible pervious surface must allow water to permeate into the subsurface layers and not be susceptible to erosion at the maximum hydraulic load rates and velocities expected to occur under large storm events, such as the 10-year storm event.

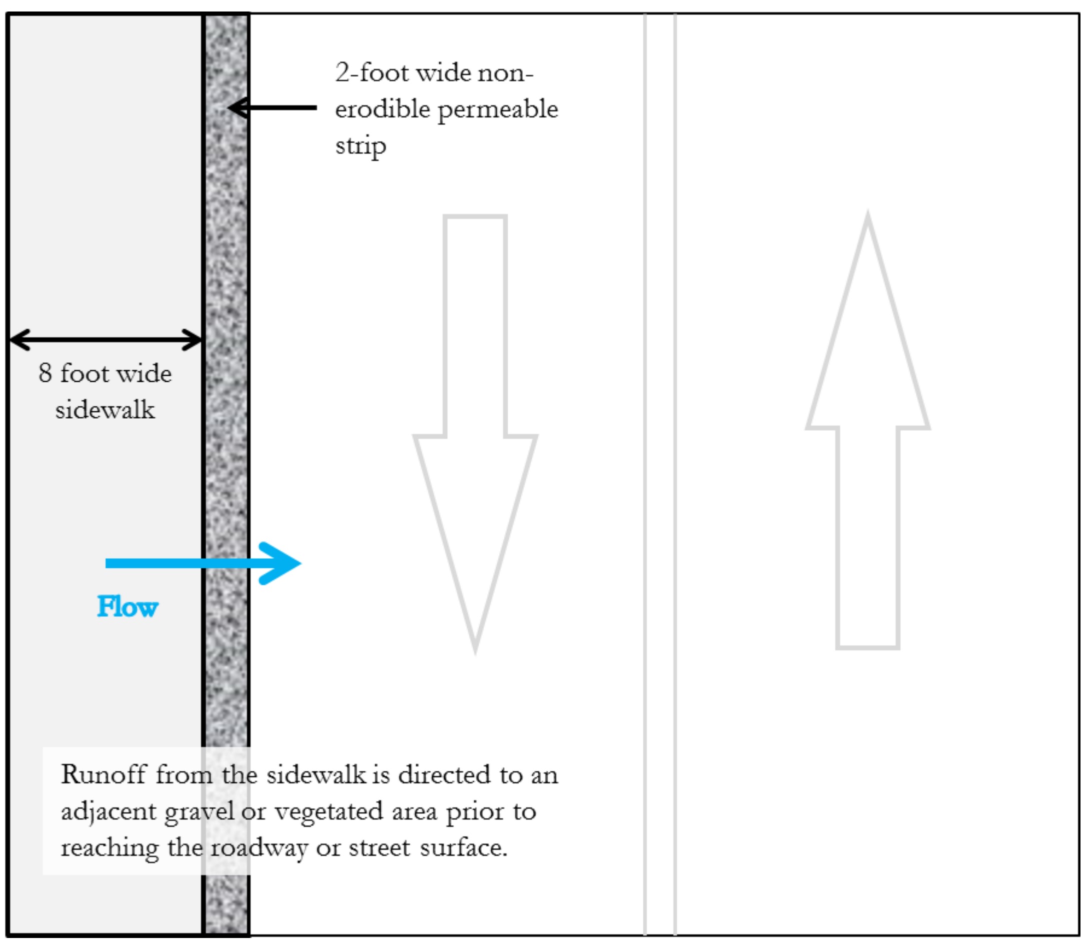


Figure K.1-1 : Schematic of an all gravel non-erodible permeable area configuration (not to scale)

K.1.2 Guidance for Hydraulic Disconnection

Hydraulic disconnection involves separating the stormwater collected from the sidewalk, bicycle lane, and/or trail surface from the runoff collected form an adjacent paved street or roadway. If the surface runoff from the sidewalk, bicycle lane, and/or trail surfaces does not comingle with street runoff on the ground surface and does not enter the same inlet as the street or roadway runoff, then this area can be considered exempt from PDP requirements. Figure K.1-2 and Figure K.1-3 provide examples of how this exemption could be achieved. Water is allowed to comingle once it is in the storm drain pipe.

Intent: This exemption seeks to isolate the runoff generated from sidewalks, bicycle lanes, and trails that tend to be cleaner (i.e., less floatables and lower contaminant concentrations) as compared to their street and roadway counterparts. The exemption allows surface runoff from these surfaces to discharge untreated, as long as it does not comingle with street or roadway surface water. In a case when the sidewalk, bicycle lane, or trail is expected to generate runoff with similar contaminant profiles as the adjacent street or roadway, the Stormwater Construction and Redevelopment Program Manager may determine that it is not appropriate to grant this exemption.

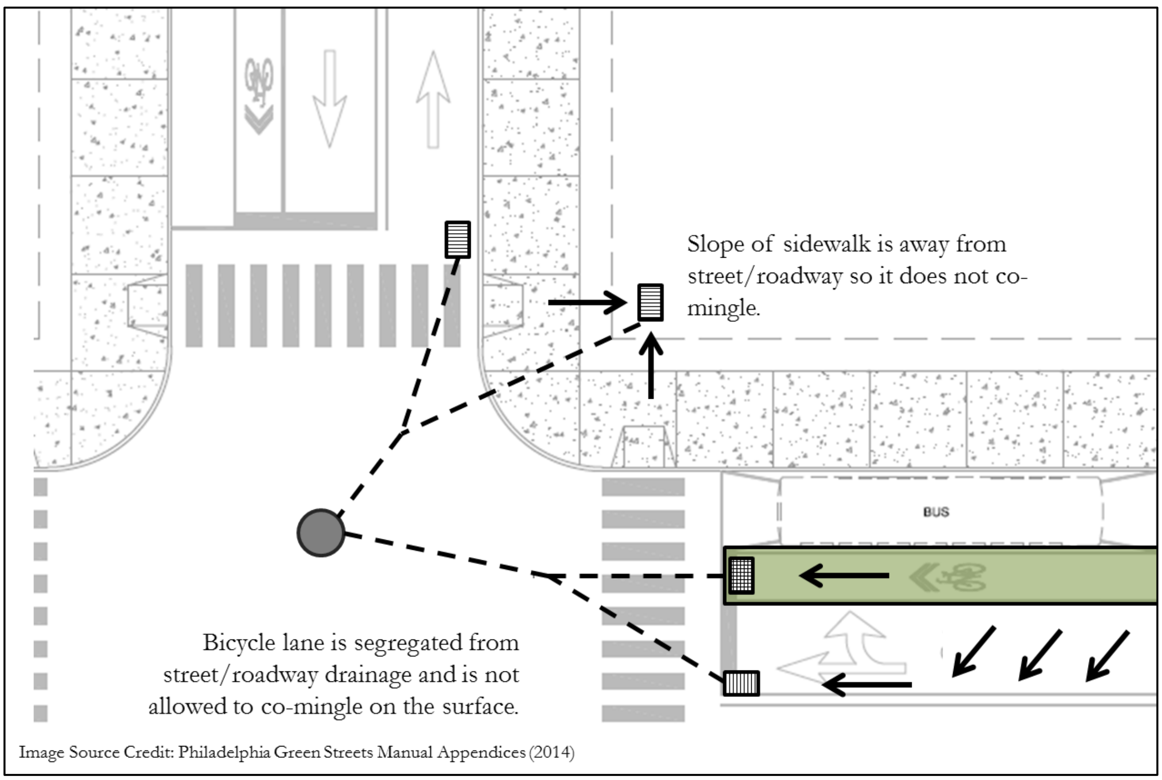


Figure K.1-2 : Schematic showing hydraulic disconnection of sidewalks and bicycle lanes in a typical intersection.

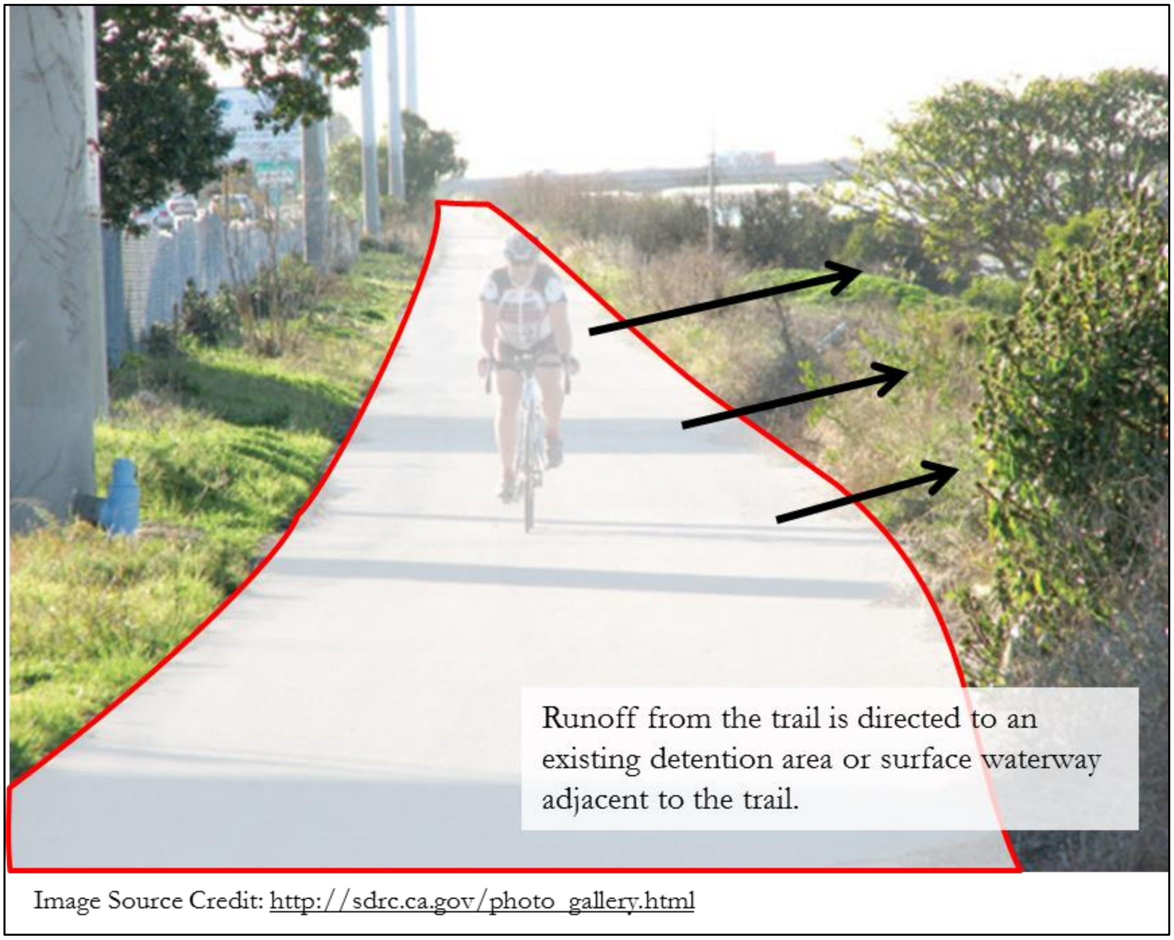
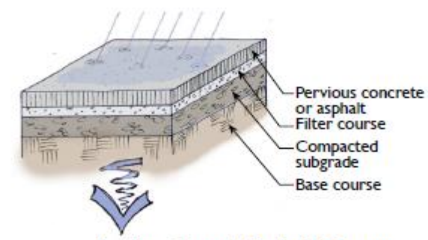


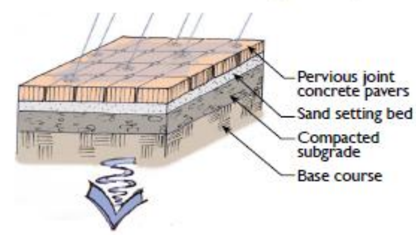
Figure K.1-3 : Schematic of a trail where the runoff does not comingle with street or road runoff

K.1.3 Permeable Pavements/Surfaces Guidance

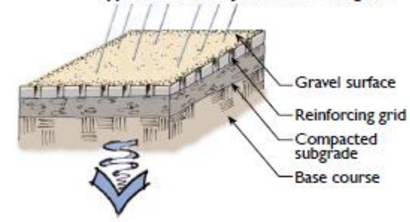
Permeable pavements or surfaces allow rainwater to pass through the surface and soak into the underlying ground. These help in reducing the amount of stormwater runoff generated. These surfaces should not be used where infiltration of stormwater runoff causes geotechnical or groundwater concerns, including in areas with shallow groundwater (refer to Appendix C). However, it should be noted that where permeable surfaces receive only direct rainfall, the total water loading per area is not typically higher than other pervious areas of the site and should generally pose limited risk associated with stormwater infiltration. No exemption is granted if the permeable pavement is lined with an impermeable liner. The following provides general guidelines for implementation of permeable pavements/surfaces:



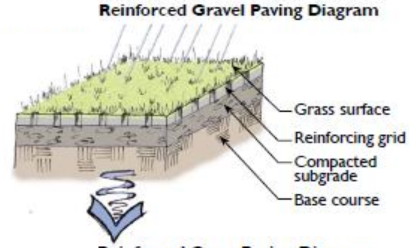
Pervious Concrete/Asphalt Diagram



Typical Pervious Joint Paver Diagram



Reinforced Gravel Paving Diagram



Reinforced Grass Paving Diagram

Source Credit: San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook (adapted)

Pervious Asphalt and Concrete: Pervious asphalt and concrete production is similar to that of standard asphalt and concrete. The main difference is that the fines are left out of the aggregate added to the mixture. This results in small holes within the paving that allows water to drain through the surface. Unlike traditional asphalt surfaces, pervious asphalt surfaces are not sealed. Regular maintenance of pervious asphalt and concrete is required for the long-term viability of the paving system.

Pervious Joint Pavers: Any type of paver can create a pervious surface if there are spaces between them and those spaces are filled with sand or other porous aggregate. Many interlocking concrete unit pavers are designed specifically for stormwater management applications. They allow water to pass through joint gaps that are filled with sand or gravel and infiltrate into a thick gravel subgrade. It is important to note that selected pervious joint pavers along pedestrian walkways must be ADA-compliant and not cause tripping hazards. Regular vacuum cleaning of the paver joints will help prevent clogging and extend the longevity of the system.

Reinforced Gravel Paving: A gravel paving system uses small, angular gravel without the fines and a structure that helps provide support to create a rigid surface. Gravel can be a viable alternative to a traditional paved surface in areas of low use that still require a rigid surface.

Reinforced Grass Paving: In the right situations, grass paving, or other hybrids between paving and planting, can be used to provide structural support while also allowing for some plant growth and stormwater infiltration. These systems may be appropriate in areas of low use and where soil, drainage, sunlight, and other conditions are conducive to plant growth.

K.2 Green Streets Exemption

As provided by MS4 Permit Provision E.3.b.(3), certain projects may be exempted from being defined as PDPs provided that they are designed and constructed in accordance with USEPA Green Streets Guidance.[11] The USEPA Green Streets Guidance provides direction on types of BMPs to be included in projects, but it does not provide direction on numeric sizing of BMPs or some other practical implementation aspects of designing green street projects. This appendix provides additional direction for the design of green street projects so that project proponents may incorporate features consistent with the USEPA Green Streets Guidance in accordance with the maximum extent practicable (MEP) standard.

This appendix is applicable only to projects that meet the criteria in Section 1.4.3 of the Port of San Diego BMP Design Manual.. These projects are referred to in this appendix as "applicable Green Streets projects." Generally the entire project must qualify as a green street in order to use the Green Street Exemption. When a private PDP is conditioned to complete improvements in the public right-of-way (e.g., street or sidewalk improvements), the public improvements may be considered a separate project that is eligible to use the Green Street Exemption provided that the public improvements meet the criteria in Section 1.4.3. The private improvements would need to meet PDP standards.

K.2.1 Site Assessment Considerations

Site assessment, including conceptual site layout, for applicable Green Streets projects includes many of the same considerations as described in Sections 3 and 5 of the Port BMP Design Manual. In addition to those factors, specific elements which should be given special consideration in the site assessment process for applicable Green Streets include the following:

- **Ownership of land adjacent to right of ways.** The opportunity to provide storm water treatment may depend on the ownership of land adjacent to the right-of-way. Acquisition of additional right-of-way and/or access easements may be more feasible if land bordering the project is owned by relatively few land owners.
- **Location of existing utilities.** The location of existing storm drainage utilities can influence the opportunities for Green Streets infrastructure. For example, storm water planters can be designed to overflow along the curb-line to an existing storm drain inlet, thereby avoiding the infrastructure costs associated with an additional inlet. The location of other utilities will

[11] USEPA, 2008. "Managing Wet Weather with Green Infrastructure – Municipal Handbook: Green Streets". http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_green_streets.pdf

influence the ability plumb BMPs to storm drains, therefore, may limit the allowable placement of BMPs to only those areas where a clear pathway to the storm drain exists.

- **Grade differential between road surface and storm drain system.** Some BMPs require more head from inlet to outlet than others; therefore, allowable head drop may be an important consideration in BMP selection. Storm drain elevations may be constrained by a variety of factors in a roadway project (utility crossings, outfall elevations, sites located over or on water, etc.) that cannot be overcome and may override storm water management considerations.
- **Longitudinal slope.** The suite of LID BMPs which may be installed on steeper road sections is more limited. Specifically, permeable pavement and swales are more suitable for gentle grades. Other BMPs may be more readily terraced to be used on steeper slopes.
- **Potential access opportunities.** A significant concern with installation of BMPs in major rights-of-way is the ability to access the BMPs safely for maintenance considering traffic hazards. The site assessment should identify vehicle travel lanes and areas of specific safety hazards for maintenance crews, and subsequent steps of the SWQMP preparation process should attempt avoid placing BMPs in these areas.
- **Suitability for infiltration and geotechnical considerations.** Infiltration may be considered for applicable Green Streets projects provided that infeasibility screening criteria are observed, with specific attention to protection of groundwater quality as discussed in Appendices C and E and to the structural integrity of adjacent road bed. Impermeable liners and/or root barriers may need to be included in the design of LID BMPs to protect surrounding utilities and infrastructure.
- **Street Category.** As listed in Table K-1, suitability of different BMPs for green street design varies depending on the category of street. For example, infiltration BMPs are generally not suitable for high traffic roadways.
- **Traffic Safety and Emergency Vehicle Access.** LID BMPs for green street design should not be selected and sited where they would compromise traffic safety or emergency access.

K.2.2 BMP Selection and Site Design for Applicable Green Streets Projects

The fundamental tenets of the approach described by the USEPA Green Streets Guidance include:

- Selecting LID BMPs to the opportunities of the site and to attempt to address pollutants of concern and HCOCs,
- Developing innovative storm water management configurations integrating "green" with "grey" infrastructure,
- Sizing BMPs opportunistically to provide storm water pollution reduction to the MEP, accounting for the many competing considerations in rights of way.

Applicable Green Streets projects should apply the following LID site design measures to the MEP and as specified in the local permitting agency's codes, where feasible:

- Minimize street width to the appropriate minimum width for maintaining traffic flow and public safety.
- Add tree canopy by planting or preserving trees/shrubs.

Applicable Green Streets projects should select BMPs consistent with the USEPA Green Streets Guidance. Table K-1 provides an inventory of LID BMPs which may be appropriate for applicable Green Streets projects. The performance criteria for applicable Green Streets projects do not require retention BMPs to be considered to the MEP before considering biotreatment and treatment control BMPs. A formal process of BMP prioritization and selection is not required for applicable Green Streets projects. However, if retention BMPs are selected, geotechnical and groundwater information must be provided to confirm that the BMPs are feasible. See geotechnical and groundwater investigation requirements in Appendix C and BMP fact sheets in Appendix E for additional details.

BMPs should be prioritized based on a comparison of drainage area characteristics to the opportunity criteria listed in Table K-1. The USEPA Green Streets Guidance describes how some of these BMPs may be used in combination to achieve optimal benefits in runoff reduction and water quality improvement. Specific examples and applications for residential streets, commercial streets, arterials streets, and alleys are provided in the USEPA guidance.

The drainage patterns of the project should be developed so that drainage can be routed to areas with BMP opportunities before entering storm drains. For example, if a median strip is present, a reverse crown should be considered, where allowed, so that storm water can drain to a storm water treatment feature in the median. Likewise, standard peak-flow curb inlets should be located downstream of areas with potential for storm water planters so that water can first flow into the planter, and then overflow to the downstream inlet if capacity of the planter is exceeded. It is more difficult to apply green infrastructure after water has entered the storm drain.

Conceptual drainage plans for redevelopment projects should identify tributary areas outside of the project site generates runoff that comingles with on-site runoff. The project is not required to treat off-site runoff; however treatment of comingled off-site runoff may be used to off-set the inability to treat areas within the project for which significant constraints prevent the ability to provide treatment.

Table K-1: Potential BMPs for Applicable Green Streets Projects

BMP Type[1]	Fact Sheet(s)[1]	Opportunity Criteria for Applicable Green Streets Projects
Tree wells, Canopy Interception	SD-1	• Access roads, residential streets, local roads and minor arterials • Drainage infrastructure, sea walls/break waters • Effective for projects with any slope • Trees may be prohibited along high speed roads for safety reasons or must be setback behind the clear zone or protected with guard rails and barriers
Permeable Pavement	SD-D (Site Design), INF-3 (Sized for Pollution Control)	• Parking and sidewalk areas of residential streets, and local roads • Should not receive significant run-on from major roads • Should not receive significant run-on from areas anticipated to have high sediment loads in runoff (e.g., sparsely vegetated steep slopes). • Should not be subject to heavy truck/ equipment traffic • Light vehicle access roads • Vacuum street sweepers typically required for maintenance
Infiltration Basin or Trench[2]	INF-1[2]	• Constrained ROWs • Can require small footprint where soils are suitable • Low to moderate traffic roadways • Not suitable for high traffic roadways • Requires robust pretreatment • May be designed with decorative rock surface layer that requires no landscaping or irrigation
Bioretention Curb Extensions / Storm Water Planters	INF-2 (Bioretention), PR-1 (Biofiltration with Partial Retention), BF-1 (Biofiltration)	• Access roads, residential streets, and local roads with parallel or angle parking and sidewalks • Can be designed to overflow back to curbline and to standard inlet • Shape is not important and can be integrated wherever unused space exists • Can be installed on relatively steep grades with terracing • Curb extensions are beneficial where traffic calming is a desired project objective • Parkways or medians are potential locations for storm water planters, provided adequate space is available • Features typically require landscaping and irrigation

Table K-1: Potential BMPs for Applicable Green Streets Projects

BMP Type[1]	Fact Sheet(s)[1]	Opportunity Criteria for Applicable Green Streets Projects
Vegetated Swales	FT-1	• Roadways with low to moderate slope • Residential streets with minimal driveway access • Minor to major arterials with medians or mandatory sidewalk set-back • Access roads • Swales running parallel to storm drain can have intermittent discharge points to reduce required flow capacity • Use of media in place of native soil is suggested where it will improve pollutant removal, where feasible • Features require landscaping and irrigation
Proprietary Biotreatment[3]	BF-3; FT-5 (guidance provided by manufacturer)	• Constrained ROWs • Typically have small footprint to tributary area ratio • Simple installation and maintenance • Can be installed on roadways of any slope • Can be designed to overflow back to curb line and to standard inlet

Notes:

1. Other BMPs not listed in this table, or BMPs in this table designed in accordance with other green street or LID design manuals, may also be approved at the discretion of the Port.
2. Fact sheet INF-1 provides direction for the design of infiltration basins. For more information on the design of infiltration trenches, see CASQA fact sheet TC-10 (https://www.casqa.org/sites/default/files/BMPHandbooks/TC-10.pdf).
3. This category includes proprietary BMPs that have a similar appearance to or treatment mechanism as tree wells or storm water planters. Proprietary BMPs that use soil media to filter runoff but do not include plants may be used. However, this category does not include proprietary BMPs that do not use vegetation or soil media to provide treatment, such as underground cartridge filter systems.

K.2.3 BMP Sizing for Applicable Green Streets Projects

The following steps are used to size BMPs for applicable Green Streets projects:

1. Delineate drainage management areas (DMA) tributary to BMP locations.
2. Based on project area characteristics, including those listed in Section K.1 above, select one or more BMPs that may be feasible for the proposed project.
   a. Tree wells (SD-1) and permeable pavement (SD-D) may be used as site design measures to reduce the amount of runoff to be treated by other BMPs.

3. Look up the recommended sizing method for the BMP(s) selected in each DMA based on the appropriate BMP fact sheet(s) from Appendix E, and calculate the target capacity for each BMP as directed in Appendix B, and/or F, as needed. Although the use of green street elements also typically results in flow control benefits, sizing calculations are based on providing storm water pollutant control only.
    a. For most BMPs, the target capacity is the design capture volume (DCV). Applicable Green Streets projects that incorporate biofiltration should be sized at 1.5 times the DCV, consistent with PDP sizing requirements.
    b. Flow-thru BMPs must be sized using the flow-thru BMP sizing method described in Appendix B.
4. Design BMPs per the guidance provided in the BMP fact sheets (Appendix E).
5. Attempt to provide the target capacity calculated based on the appropriate sizing criteria for each selected BMP.
    a. Often it may be difficult to locate BMPs onsite (within the project area) in a manner that treats runoff from the entire project area. In these cases, it is acceptable to use onsite BMPs to treat run-on from offsite area of similar land use to the project such that the entire target capacity, as calculated in Step 3, is treated. This approach is consistent with MS4 Permit requirements because it results in implementing BMPs listed in the USEPA Green Streets Guidance as part of the project.
6. If the target capacity cannot be fully provided, document the constraints that override the application of BMPs, and proceed through the steps listed below, documenting additional constraints where necessary. Applicable Green Streets projects are not required to meet alternative compliance options if storm water management controls described in this section, or equivalent, are installed in a manner consistent with the MEP standard.
    a. Use offsite BMPs to treat the portion of the target capacity that cannot be treated onsite. The offsite BMPs must receive runoff from offsite area of similar land use to the project and should be located as close to the project site as possible, as described in item 5.a above.

    <u>*OR*</u>

    If "a" is not feasible, proceed to item "b" below.

    b. Provide onsite and/or offsite BMPs listed in Table K-1 sized to provide treatment for the largest portion of the target capacity that can be reasonably provided given constraints.

In some cases the required amount of treatment needed to meet the Green Streets standard may be less than the DCV associated with the entire tributary area to a BMP location. In these cases, the BMP must also be designed to avoid flooding and scour when considering the entire tributary area, and the designer must provide appropriate supporting calculations to demonstrate that any BMP sized for an area smaller than the entire upstream tributary area will not result in flooding or scour and that BMP effectiveness will not be compromised.

For example, a BMP may be required to treat 15,000 square feet within the right-of-way but be installed at location that receives runoff from both that 15,000 square feet plus an additional 25,000 square feet of development outside the right-of-way. In this type of scenario, the BMP treatment capacity may be designed only for the 15,000 square feet of project area in the tributary area. The designer would also need to show that when considering the runoff from the entire drainage area of 40,000 square feet, the BMP does not cause flooding for high peak flows (as required by flood control sizing standards), scour does not occur within the BMP, and higher flow rates, volumes, or velocities associated with the entire tributary area to the BMP do not result in decreased BMP effectiveness for the design treatment flow rate or volume.

Glossary of Key Terms

50% Rule Refers to an MS4 Permit standard for redevelopment PDPs (PDPs on previously developed sites) that defines whether the redevelopment PDP must meet storm water management requirements for the entire development or only for the newly created or replaced impervious surface. Refer to **Section 1.7**.

Aggregate Hard, durable material of mineral origin typically consisting of gravel, crushed stone, crushed quarry or mine rock. Gradation varies depending on application within a BMP as bedding, filter course, or storage.

Aggregate Storage Layer Layer within a BMP that serves to provide a conduit for conveyance, detention storage, infiltration storage, saturated storage, or a combination thereof.

Alternative Compliance Programs A program that allows PDPs to participate in an offsite mitigation project in lieu of implementing the onsite structural BMP performance requirements required under the MS4 Permit. Refer to **Section 1.8** for more information on alternative compliance programs.

Bed Sediment The part of the sediment load in channel flow that moves along the bed by sliding or saltation, and part of the suspended sediment load, that principally constitutes the channel bed.

Bedding Aggregate used to establish a foundation for structures such as pipes, manholes, and pavement.

Biodegradation Decomposition of pollutants by biological means.

Biofiltration BMPs Biofiltration BMPs are shallow basins filled with treatment media and drainage rock that treat storm water runoff by capturing and detaining inflows prior to controlled release through minimal incidental infiltration, evapotranspiration, or discharge via underdrain or surface outlet structure. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and/or vegetative uptake. These BMPs must be sized to:[a] Treat 1.5 times the DCV not reliably retained onsite, OR[b] Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite. (See **Section 5.5.3** and **Appendix B.5** for illustration and additional information).

Biofiltration Treatment	Treatment from a BMP meeting the biofiltration standard.
Biofiltration with Partial Retention BMPs	Biofiltration with partial retention BMPs are shallow basins filled with treatment media and drainage rock that manage storm water runoff through infiltration, evapotranspiration, and biofiltration. Partial retention is characterized by a subsurface stone infiltration storage zone in the bottom of the BMP below the elevation of the discharge from the underdrains. The discharge of biofiltered water from the underdrain occurs when the water level in the infiltration storage zone exceeds the elevation of the underdrain outlet. (See **Section 5.5.2.1** for illustration and additional information).
Bioretention BMPs	Vegetated surface water systems that filter water through vegetation and soil, or engineered media prior to infiltrating into native soils. Bioretention BMPs in this manual retain the entire DCV prior to overflow to the downstream conveyance system. (See **Section 5.5.1.2** for illustration and additional information).
BMP	A procedure or device designed to minimize the quantity of runoff pollutants and / or volumes that flow to downstream receiving water bodies. Refer to **Section 2.2.2.1**.
BMP Sizing Calculator	An on-line tool that was developed under the 2007 MS4 Permit to facilitate the sizing factor method for designing flow control BMPs for hydromodification management. The BMP Sizing Calculator has been discontinued as of June 30, 2014.
Cistern	A vessel for storing water. In this manual, a cistern is typically a rain barrel, tank, vault, or other artificial reservoir.
Coarse Sediment Yield Area	A GLU with coarse-grained geologic material (material that is expected to produce greater than 50% sand when weathered). See the following terms modifying coarse sediment yield area: critical, potential critical.

Compact Biofiltration BMP
A biofiltration BMP, either proprietary or non-proprietary in origin, that is designed to provide storm water pollutant control within a smaller footprint than a typical biofiltration BMP, usually through use of specialized media that is able to efficiently treat high storm water inflow rates.

Conditions of Approval
Requirements a jurisdiction may adopt for a project in connection with a discretionary action (e.g., issuance of a use permit). COAs may include features to be incorporated into the final plans for the project and may also specify uses, activities, and operational measures that must be observed over the life of the project.

Contemporary Design Standards
This term refers to design standards that are reasonably consistent with the current state of practice and are based on desired outcomes that are reasonably consistent with the context of the MS4 Permit and Model BMP Design Manual. For example, a detention basin that is designed solely to mitigate peak flow rates would not be considered a contemporary water quality BMP design because it is not consistent with the goal of water quality improvement. Current state of the practice recognizes that a drawdown time of 24 to 72 hour is typically needed to promote settling. For practical purposes, design standards can be considered "contemporary" if they have been published within the last 10 years, preferably in California or Washington State, and are specifically intended for storm water quality management.

Continuous Simulation Modeling
A method of hydrological analysis in which a set of rainfall data (typically hourly for 30 years or more) is used as input, and a continuous runoff hydrograph is calculated over the same time period. Continuous simulation models typical track dynamic soil and storage conditions during and between storm events. The output is then analyzed statistically for the purposes of comparing runoff patterns under different conditions (for example, pre- and post-development-project).

Copermittees
See Jurisdiction.

Critical Channel Flow (Qc)
The channel flow that produces the critical shear stress that initiates bed movement or that erodes the toe of channel banks. When measuring Qc, it should be based on the weakest boundary material – either bed or bank.

Critical Coarse Sediment Yield Areas	A GLU with coarse-grained geologic material and high relative sediment production, where the sediment produced is critical to the receiving stream (a source of bed material to the receiving stream). See also: potential critical coarse sediment yield area.
Critical Shear Stress	The shear stress that initiates channel bed movement or that erodes the toe of channel banks. See also critical channel flow.
DCV	A volume of storm water runoff produced from the 85th percentile, 24-hour storm event. See **Section 2.2.2.2**.
De Minimis DMA	De minimis DMAs are very small areas that are not considered to be significant contributors of pollutants, and are considered not practicable to drain to a BMP. See **Section 5.2.2**.
Depth	The distance from the top, or surface, to the bottom of a BMP component.
Detention	Temporarily holding back storm water runoff via a designed outlet (e.g., underdrain, orifice) to provide flow rate and duration control.
Detention Storage	Storage that provides detention as the outflow mechanism.
Development Footprint	The limits of all grading and ground disturbance, including landscaping, associated with a project.
Development Project	Construction, rehabilitation, redevelopment, or reconstruction of any capital or tenant projects. Includes both new development and redevelopment. Also includes whole of the action as defined by CEQA. See **Section 1.3.**
Direct Discharge	The connection of project site runoff to an exempt receiving water body, which could include an exempt river reach, reservoir or lagoon. To qualify as a direct discharge, the discharge elevation from the project site outfall must be at or below either the normal operating water surface elevation or the reservoir spillway elevation, and properly designed energy dissipation must be provided. "Direct discharge" may be more specifically defined by each municipality.

Direct Infiltration Infiltration via methods or devices, such as dry wells or infiltration trenches, designed to bypass the mantle of surface soils that is unsaturated and more organically active and transmit runoff directly to deeper subsurface soils.

DMAs See **Section 3.3.3**.

Drawdown Time The time required for a storm water detention or infiltration facility to drain and return to the dry-weather condition. For detention facilities, drawdown time is a function of basin volume and outlet orifice size. For infiltration facilities, drawdown time is a function of basin volume and infiltration rate.

Enclosed Embayments (Enclosed Bays) Enclosed bays are indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost bay works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays do not include inland surface waters or ocean waters. In San Diego: Mission Bay and San Diego Bay.

Environmentally Sensitive Areas (ESAs) Areas that include but are not limited to all Clean Water Act Section 303(d) impaired water bodies; areas designated as Areas of Special Biological Significance by the State Water Board and San Diego Water Board; State Water Quality Protected Areas; water bodies designated with the RARE beneficial use by the State Water Board and San Diego Water Board; and any other equivalent environmentally sensitive areas which have been identified by the Copermittees.

Filter Course Aggregate used to prevent particle migration between two different materials when storm water runoff passes through.

Filter Fabric A permeable textile material, also termed a non-woven geotextile, that prevents particle migration between two different materials when storm water runoff passes through.

Filtration Controlled seepage of storm water runoff through media, vegetation, or aggregate to reduce pollutants via physical separation.

Flow Control Control of runoff rates and durations as required by the HMP.

Flow Control BMP	A structural BMP designed to provide control of post-project runoff flow rates and durations for the purpose of hydromodification management.
Flow-thru Treatment	Treatment from a BMP meeting the flow-thru treatment control standard.
Flow-Thru Treatment BMPs	Flow-thru treatment control BMPs are structural, engineered facilities that are designed to remove pollutants from storm water runoff using treatment processes that do not incorporate significant biological methods. Flow-thru BMPs include vegetated swales, media filters, sand filters, and dry extended detention basins. (See **Section 5.5.4** for illustration and additional information).
Forebay	An initial storage area at the entrance to a structural BMP designed to trap and settle out solid pollutants such as sediment in a concentrated location, to provide pre-treatment within the structural BMP and facilitate removal of solid pollutants during maintenance operations.
Full Infiltration	Infiltration of a storm water runoff volume equal to the DCV.
Geomorphic Assessment	A quantification or measure of the changing properties of a stream channel.
Geomorphically Significant Flows	Flows that have the potential to cause, or accelerate, stream channel erosion or other adverse impacts to beneficial stream uses. The range of geomorphically significant flows was determined as part of the development of the March 2011 Final HMP, and has not changed under the 2013 MS4 Permit. However, under the 2013 MS4 Permit, Q2 and Q10 must be based on the pre-development condition rather than the pre-project condition, meaning that no pre-project impervious area may be considered in the computation of pre-development Q2 and Q10.
GLUs	Classifications that provide an estimate of sediment yield based upon three factors: geology, hillslope, and land cover. GLUs are developed based on the methodology presented in the SCCWRP Technical Report 605 titled "Hydromodification Screening Tools: GIS-Based Catchment Analyses of Potential Changes in Runoff and Sediment Discharge" (SCCWRP, 2010).

Gross Pollutants — In storm water, generally litter (trash), organic debris (leaves, branches, seeds, twigs, grass clippings), and coarse sediments (inorganic breakdown products from soils, pavement, or building materials).

Harvest and Use BMP — Harvest and use (aka rainwater harvesting) BMPs capture and store storm water runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. (See **Section 5.5.1.1** for illustration and additional information).

HMP — A plan implemented by the Copermittees so that post-project runoff shall not exceed estimated pre-development rates and/or durations by more than 10%, where increased runoff would result in increased potential for erosion or other adverse impacts to beneficial uses. The March 2011 Final HMP and the updated MS4 Permit are the basis of the flow control requirements of this manual.

Hungry Water — Also known as "sediment-starved" water, "hungry" water refers to channel flow that is hungry for sediment from the channel bed or banks because it currently contains less bed material sediment than it is capable of conveying. The "hungry water" phenomenon occurs when the natural sediment load decreases and the erosive force of the runoff increases as a natural counterbalance, as described by Lane's Equation.

Hydraulic Head — Energy represented as a difference in elevation, typically as the difference between the inlet and outlet water surface elevation for a BMP.

Hydraulic Residence Time — The length of time between inflow and outflow that runoff remains in a BMP.

Hydrologic Soil Group — Classification of soils by the Natural Resources Conservation Service (NRCS) into A, B, C, and D groups according to infiltration capacity.

Hydromodification	The change in the natural watershed hydrologic processes and runoff characteristics (i.e., interception, infiltration, overland flow, interflow and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport. In addition, alteration of stream and river channels, installation of dams and water impoundments, and excessive stream-bank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.
Hydromodification Management BMP	A structural BMP for the purpose of hydromodification management, either for protection of critical coarse sediment yield areas or for flow control. See also flow control BMP.
Impervious Surface	Any material that prevents or substantially reduces infiltration of water into the soil.
Infeasible	As applied to BMPs, refers to condition in which a BMP approach is not practicable based on technical constraints specific to the site, including by not limited to physical constraints, risks of impacts to environmental resources, risks of harm to human health, or risk of loss or damage to property. Feasibility criteria are provided in this manual.
Infiltration	In the context of LID, infiltration is defined as the percolation of water into the ground. Infiltration is often expressed as a rate (inches per hour), which is determined through an infiltration test. In the context of non-storm water, infiltration is water other than wastewater that enters a sewer system (including sewer service connections and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes. Infiltration does not include, and is distinguished from, inflow [40 CFR 35.2005(20)].
Infiltration BMP	Infiltration BMPs are structural measures that capture, store and infiltrate storm water runoff. These BMPs are engineered to store a specified volume of water and have no design surface discharge (underdrain or outlet structure) until this volume is exceeded. These types of BMPs may also support evapotranspiration processes, but are characterized by having their most dominant volume losses due to infiltration. (See **Section 5.5.1.2** for illustration and additional information).

Jurisdiction The term "jurisdiction" is used in this manual to refer to individual copermittees who have independent responsibility for implementing the requirements of the MS4 Permit.

LID A storm water management and land development strategy that emphasizes conservation and the use of onsite natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions. See **Site Design**.

Lower Flow Threshold The lower limit of the range of flows to be controlled for hydromodification management. The lower flow threshold is the flow at which erosion of sediment from the stream bed or banks begins to occur. See also critical channel flow. For the San Diego region, the lower flow threshold shall be a fraction (0.1, 0.3, or 0.5) of the pre-development 2-year flow rate based on continuous simulation modeling (0.1Q2, 0.3Q2, or 0.5Q2).

Media Storm water runoff pollutant treatment material, typically included as a permeable constructed bed or container (cartridge) within a BMP.

MEP Refer to the definition in the MS4 Permit. [Appendix C, Definitions, Page C-6]

National Pollutant Discharge Elimination System The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of the Clean Water Act.

New Development Land disturbing activities; structural development, including construction or installation of a building or structure, the creation of impervious surfaces; and land subdivision.

O&M Requirements in the MS4 Permit to inspect structural BMPs and verify the implementation of operational practices and preventative and corrective maintenance in perpetuity.

Partial Infiltration Infiltration of a storm water runoff volume less than the DCV.

Partial Retention Partial retention category is defined by structural measures that incorporate both infiltration (in the lower treatment zone) and biofiltration (in the upper treatment zone).

PDPs

As defined by the MS4 Permit provision E.3.b, land development projects that fall under the planning and building authority of the Copermittee for which the Copermittee must impose specific requirements in addition to those required of Standard Projects. Refer to **Section 1.4** to determine if your project is a PDP.

PDPs with only Pollutant Control Requirements

PDPs that need to meet Source Control, Site Design and Pollutant Control Requirements (but are exempt from Hydromodification Management Requirements).

PDPs with Pollutant Control and Hydromodification Management Requirements

PDPs that need to meet Source Control, Site Design, Pollutant Control and Hydromodification Management Requirements.

Point of Compliance

1. For channel screening and determination of low flow threshold: the point at which collected storm water from a development is delivered from a constructed or modified drainage system into a natural or un-lined channel. POC for channel screening may be located onsite or offsite, depending on where runoff from the project meets a natural or un-lined channel. 2. For flow control: the point at which pre-development and post-development flow rates and durations will be compared. POC for flow control is typically onsite. A project may have a different POC for channel screening vs. POC for flow control if runoff from the project site is conveyed in hardened systems from the project site boundary to the natural or un-lined channel.

Pollutant Control

Control of pollutants via physical, chemical or biological processes

Pollution Prevention

Pollution prevention is defined as practices and processes that reduce or eliminate the generation of pollutants, in contrast to source control BMPs, treatment control BMPs, or disposal.

Post-Project Hydrology Flows, Volumes

The peak runoff flows and runoff volume anticipated after the project has been constructed taking into account all permeable and impermeable surfaces, soil and vegetation types and conditions after landscaping is complete, detention or retention basins or other water storage elements incorporated into the site design, and any other site features that would affect runoff volumes and peak flows.

Potential Critical Coarse Sediment Yield Area — A GLU with coarse-grained geologic material and high relative sediment production, as defined in the Regional WMAA. The Regional WMAA identified GLUs as potential critical coarse sediment yield areas based on slope, geology, and land cover. GLU analysis does not determine whether the sediment produced is critical to the receiving stream (a source of bed material to the receiving stream) therefore the areas are designated as potential.

Pre-Development Runoff Conditions — Approximate flow rates and durations that exist or existed onsite before land development occurs. For new development projects, this equates to runoff conditions immediately before any new project disturbance or grading. For redevelopment projects, this equates to runoff conditions from the project footprint assuming infiltration characteristics of the underlying soil, and existing grade. Runoff coefficients of concrete or asphalt must not be used. A redevelopment PDP must use available information pertaining to existing underlying soil type and onsite existing grade to estimate pre-development runoff conditions.

Pre-Project Condition — The condition prior to any project work or the existing condition. Note that pre-project condition and pre-development condition will not be the same for redevelopment projects.

Pretreatment — Removal of gross solids, including organic debris and coarse sediment, from runoff to minimize clogging and increase the effectiveness of BMPs.

Project Area — All areas proposed by an applicant to be altered or developed, plus any additional areas that drain on to areas to be altered or developed. Also see **Section 1.3**.

Project Submittal — Documents submitted to a jurisdiction or Copermittee in connection with an application for development approval and demonstrating compliance with MS4 Permit requirements for the project. Specific requirements vary from municipality to municipality.

Proprietary BMP — BMP designed and marketed by private business for treatment of storm water. Check with Port prior to proposing to use a proprietary BMP.

Receiving Waters — See **Waters of the United States**.

Redevelopment The creation and/or replacement of impervious surface on an already developed site. Examples include the expansion of a building footprint, road widening, and the addition to or replacement of a structure. Replacement of impervious surfaces includes any activity where impervious material(s) are removed, exposing underlying soil during construction. Redevelopment does not include routine maintenance activities, such as trenching and resurfacing associated with utility work; pavement grinding; resurfacing existing roadways, sidewalks, pedestrian ramps, or bike lanes on existing roads; and routine replacement of damaged pavement, such as pothole repair.

Retrofitting Storm water management practice put into place after development has occurred in watersheds where the practices previously did not exist or are ineffective. Retrofitting of developed areas is intended to improve water quality, protect downstream channels, reduce flooding, or meet other specific objectives. Retrofitting developed areas may include, but is not limited to replacing roofs with green roofs, disconnecting downspouts or impervious surfaces to drain to pervious surfaces, replacing impervious surfaces with pervious surfaces, installing rain barrels, installing rain gardens, and trash area enclosures.

Regional Water Quality Control Board (San Diego Water Board) California Water Boards are responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within their jurisdiction. There are nine California Water Boards.

Retention (Retention BMPs) A category of BMP that does not have any service outlets that discharge to surface water or to a conveyance system that drains to surface waters for the design event (i.e. 85th percentile 24-hour). Mechanisms used for storm water retention include infiltration, evapotranspiration, and use of retained water for non-potable or potable purposes.

Saturated Storage Storage that provides a permanent volume of water at the bottom of the BMP as an anaerobic zone to promote denitrification and/or thermal pollution control. Also known as internal water storage or a saturation zone.

Self-mitigating Areas A natural, landscaped, or turf area that does not generate significant pollutants and drains directly offsite or to the public storm drain system without being treated by a structural BMP. See **Section 5.2.1**.

Self-retaining DMA via Qualifying Site Design BMPs An area designed to retain runoff to fully eliminate storm water runoff from the 85th percentile 24 hours storm event; See **Section 5.2.3**.

SIC A Federal government system for classifying industries by 4-digit code. It is being supplanted by the North American Industrial Classification System but SIC codes are still referenced by the Regional Water Board in identifying development sites subject to regulation under the National Pollutant Discharge Elimination System permit. Information and an SIC search function are available at https://www.osha.gov/pls/imis/sicsearch.html

Significant Redevelopment Redevelopment that meets the definition of a "PDP" in this manual. See **Section 1.4**.

Site Design A storm water management and land development strategy that emphasizes conservation of natural features and the use of onsite natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions.

Sizing Factor Method A method for designing flow control BMPs for hydromodification management using sizing factors developed from unit area continuous simulation models.

Sorption Physical and/or chemical process where pollutants are taken out of runoff through attachment to another substance.

Source Control Land use or site planning practices, or structures that aim to prevent runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimizes the contact between pollutants and storm water runoff. Examples include roof structures over trash or material storage areas, and berms around fuel dispensing areas. Source control BMPs are described within this manual.

Standard Project Any development project that is not defined as a PDP by the MS4 Permit.

Storm Water Conveyance System: A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or designated and approved management agency under section 208 of the Clean Water Act that discharges to waters of the United States; (ii) Designated or used for collecting or conveying storm water; (iii) Which is not a combined sewer; (iv) Which is not part of the Publicly Owned Treatment Works as defined at 40 CFR 122.26.

Storm Water Pollutant Control BMP: A category of storm water management requirements that includes treatment of storm water to remove pollutants by measures such as retention, biofiltration, and/or flow-thru treatment control, as specified in this manual. Also called a Pollutant Control BMP.

Structural BMP: Throughout the manual, the term "structural BMP" is a general term that encompasses the pollutant control BMPs and hydromodification BMPs required for PDPs under the MS4 Permit. A structural BMP may be a pollutant control BMP, a hydromodification management BMP, or an integrated pollutant control and hydromodification management BMP. Structural BMPs as defined in the MS4 Permit are: a subset of BMPs which detains, retains, filters, removes, or prevents the release of pollutants to surface waters from development projects in perpetuity, after construction of a project is completed.

Subgrade: In-situ soil that lies underneath a BMP.

Tributary Area: The total surface area of land or hardscape that contributes runoff to the BMP; including any offsite or onsite areas that comingles with project runoff and drains to the BMP. Refer to **Section 3.3.3** for additional guidance Also termed the drainage area or catchment area.

Unified BMP Design Approach

This term refers to the standardized process for site and watershed investigation, BMP selection, BMP sizing, and BMP design that is outlined and described in this manual with associated appendices and templates. This approach is considered to be "unified" because it represents a pathway for compliance with MS4 Permit requirements that is anticipated to be reasonably consistent across the local jurisdictions in San Diego County. In contrast, applicants may choose to take an alternative approach where they demonstrate to the satisfaction of the Port, in their submittal, compliance with applicable performance standards without necessarily following the process identified in this manual.

Upper Flow Threshold

The upper limit of the range of flows to be controlled for hydromodification management. For the San Diego region, the upper flow threshold shall be the pre-development 10-year flow rate (Q10) based on continuous simulation modeling.

Vactor

Refers to a sewer or storm drain cleaning truck equipped to remove materials from sewer or storm drain pipes or structures, including some storm water BMPs.

Vector

An animal or insect capable of transmitting the causative agent of human disease. An example of a vector in San Diego County that is of concern in storm water management is a mosquito.

Water Quality Improvement Plan

Copermittees are required to develop a Water Quality Improvement Plan for each Watershed Management Area in the San Diego Region. The purpose of the Water Quality Improvement Plans is to guide the Copermittees' jurisdictional runoff management programs towards achieving the outcome of improved water quality in MS4 discharges and receiving waters. WQIPs requirements are defined in the MS4 Permit provision B.

Waters of the United States

Surface bodies of water, including naturally occurring wetlands, streams (perennial, intermittent, and ephemeral (exhibiting bed, bank, and ordinary high water mark)), creeks, rivers, reservoirs, lakes, lagoons, estuaries, harbors, bays and the Pacific Ocean which directly or indirectly receive discharges from storm water conveyance systems. The Port shall determine the definition for wetlands and the limits thereof for the purposes of this definition, which shall be as protective as the Federal definition utilized by the United States Army Corps of Engineers and the United States Environmental Protection Agency. Constructed wetlands are not considered wetlands under this definition, unless the wetlands were constructed as mitigation for habitat loss. Other constructed BMPs are not considered receiving waters under this definition, unless the BMP was originally constructed within the boundaries of the receiving waters. Also see MS4 permit definition.

Watershed Management Area

The ten areas defined by the San Diego Water Board in Regional MS4 Permit provision B.1, Table B-1. Each Watershed Management Area is defined by one or more Hydrologic Unit, major surface water body, and responsible Copermittee.

Watershed Management Area Analysis

For each Watershed Management Area, the Copermittees have the option to perform a WMAA for the purpose of developing watershed-specific requirements for structural BMP implementation. Each WMAA includes: GIS layers developed to provide physical characteristics of the watershed management area, a list of potential offsite alternative compliance projects, and areas exempt from hydromodification management requirements.

Appendix E
SWPPP Templates

CONSTRUCTION BEST MANAGEMENT PRACTICES (BMP) PLAN

(FOR SOIL DISTURBANCES OF LESS THAN ONE ACRE OR NO SOIL DISTURBANCE)

PROJECT NAME:____
CONTRACTOR NAME:____________________________________

DATE: ____

Prepared for:

Port of San Diego
3165 Pacific Highway
San Diego, CA 92101-1128

Note: This Construction BMP Plan must be maintained at the site and available for review upon request by the Port of San Diego and the Regional Water Quality Control Board.

Page intentionally left blank.

PORT OF SAN DIEGO CONSTRUCTION BMP PLAN
PROJECT INFORMATION AND SIGNATURE PAGE

This Construction BMP Plan shall be effective immediately upon approval of the Port of San Diego (Port) and signature of the Water Pollution Control Manager (WPCM). The person listed as the WPCM shall be responsible for ensuring that the elements of this plan are implemented.

Work Location/Address:

Project Size (including staging area):

Total Area of Disturbed Soil:

Estimated Project Start Date:

Estimated Project Duration:

Detailed Work Description (include any/all work that will be necessary to complete the project):

Project Owner:

Address:

Phone:

Contractor Name:

Address:

Phone:

Email*:

Water Pollution Control Manager (WPCM)[1]:

Signature:

Phone:

Email*:

Preparer of Construction BMP Plan:

Signature:

Phone:

Email*:

* Email address may be used to send notice of an upcoming rain event and/or inspection results.

[1]Refer to page 21 of this document regarding the role and responsibilities of the WPCM.

Location Map and Water Pollution Control Drawings

Project Location and Water Pollution Control Drawings (WPCDs) are required to include the following elements:

Location Map

- Vicinity map showing major roadways.
- Boundaries of proposed construction activity.
- Construction area shaded.
- Label project site.
- General topography.
- North arrow and scale.

Project Site Map(s)

- Existing and proposed buildings, lots, and roadways.
- An area extending 50’ beyond the perimeter of the work area.
- Boundaries of the actual construction site.
- Storm water collection and discharge points.
- Vehicle and equipment parking areas.
- Areas to be used to store soils, construction materials, and wastes, including loading and unloading areas.
- Areas of non-soil disturbing activities with the potential to impact water quality (painting, abrasive blasting, etc.).
- Areas of cut and fill.
- Outlines of all areas of soil disturbance that will be stabilized during the rainy season[1].
- Outlines of all areas of soil disturbance that will not be stabilized during the rainy season.
- Locations of storm water run-on and discharge from the construction site.
- Locations of non-storm water discharge (if recurring and if known).
- Existing graded condition and final graded condition (if the work will alter the existing landform).
- Drainage patterns and slopes of the existing and ultimate graded condition, as appropriate.
- Existing and proposed relevant drainage areas.
- Areas of existing vegetation to be preserved.
- Location of primary site vehicle and equipment entrance and exit points.
- Area(s) to be used for vehicle and equipment fueling and service/maintenance.
- Proposed construction BMPs and where they will be installed.

If one of the above items is not applicable to the project describe below:

____
____
____
____
____
____
____

[1] The rainy season is defined as October 1 through April 30.

THE CONSTRUCTION BMP PLAN DOCUMENT

The Construction BMP Plan must be retained at the construction site from the date of project initiation to the date of project termination. The Construction BMP Plan should be available at all times to site employees, and to representatives of the San Diego Region Water Quality Control Board (RWQCB), State Water Quality Control Board (SWQCB), United States Environmental Protection Agency (EPA), the Port, and/or local jurisdictional municipality or storm water management agency.

This Construction BMP Plan document is a requirement of the Order No R9-2013-0001 Municipal Stormwater Permit (Municipal Permit), the Port's Jurisdictional Runoff Management Program (JRMP)[1]. **Failure to comply with the conditions of the JRMP or failure to implement and maintain the approved Construction BMP Plan or the BMPs described in the approved plan is a violation of the Port's stormwater ordinance; Article 10.**

The contractor is required to maintain a paper or electronic copy of all required records for three years from the date generated or after project completion. These records must be available at the construction site until construction is completed. Any additional permits (e.g., 404 Permit, 401 Certification, Dewatering Permit) obtained by the project are to be attached to this document and available at all times on site.

The contractor is required to amend the Construction BMP Plan and make notes or changes to the water pollution control drawings(s) (WPCD) whenever there is a change in project design, construction, or operations that may have an effect on the potential for discharge of pollutants to surface waters, groundwater, or municipal separate storm sewer systems (MS4). The Construction BMP Plan shall also be amended if the discharger violates any condition of the Municipal Permit or JRMP or has not achieved the general objective of eliminating or minimizing pollutants in storm water discharges. If the contractor is in violation, the Construction BMP Plan should be amended and implemented in a timely manner, but in no case more than 14 calendar days after notification. In addition, the plan must be amended to identify any new contractor and/or subcontractor that will implement a measure of the Construction BMP Plan. All amendments shall be dated and directly attached to the Construction BMP Plan. Each amendment shall be signed by the contractor and logged on Table 1.

Contractor Acknowledgment: ____

[1] The Port of San Diego Jurisdictional Runoff Management Program Document is located on the Port's website at https://www.portofsandiego.org/

Table 1
SUMMARY OF CONSTRUCTION BMP PLAN AMENDMENTS OR REVISIONS

Section and Page	Summary of Revision	Date	Name/Title

BEST MANAGEMENT PRACTICES (BMPs)

This section contains a series of BMPs to eliminate or reduce pollutants in storm water runoff and authorized non-storm water discharges from the project site during construction. The Municipal Permit and Article 10 prohibit the discharge of storm water that causes or threatens to cause pollution, contamination or nuisance. It also allows the developer/owner to choose the most economical, effective, and possibly innovative BMPs to reduce or eliminate pollutants in runoff. The BMPs described in this section are designed to meet the Port's JRMP minimum BMP requirements for construction.

BMPs used for this project are indicated by checked boxes (☒). BMPs are shown on the WPCD where possible.

Erosion and Sediment Control

The project will implement and maintain an effective combination of erosion and sediment control BMPs. The following principles will be followed to the maximum extent practicable to control erosion and sedimentation in disturbed areas at the site:

- Fit grading to the surrounding terrain.
- Time grading operations to minimize soil exposure.
- Retain existing vegetation whenever feasible.
- Vegetate and mulch or otherwise stabilize disturbed areas.
- Minimize the length and steepness of slopes.
- Keep runoff velocities low.
- Prepare drainage ways and outlets to handle concentrated runoff until permanent drainage structures are constructed.
- Trap sediment onsite.
- Inspect and maintain control measures frequently.

Note: Erosion control is a required minimum BMP that must be implemented at all inactive areas of a construction site. An area is considered "inactive" if no construction activity including soil disturbing activities such as clearing, grading, disturbances to ground such as stockpiling and excavation is occurring. An area is also considered inactive if soil disturbing activities had previously occurred but are not scheduled or planned to be re-disturbed for at least 14 days. Disturbed areas of the construction site that will not be re-disturbed will be stabilized by the day after the last disturbance.

Soil Stabilization (Erosion Control)

Soil stabilization, also referred to as erosion control, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in storm water runoff. Soil stabilization BMPs protects the soil surface by covering and/or binding soil particles. Soil stabilization or erosion control measures are required for projects that anticipate the disturbance of soil on site. If no soil disturbance is anticipated during the project, then these measures are not required.

☐ No soil will be disturbed as a part of this project, therefore soil stabilization or erosion control measures are not required for this project.

This project will incorporate minimum temporary soil stabilization requirements, temporary soil stabilization measures required by the contract documents, and other measures selected by the Contractor. This project will implement the following practices for effective temporary and final soil stabilization during construction:

- Preserve existing vegetation and hydologic features where required and when feasible.
- Apply temporary soil stabilization (erosion control) to remaining active and non-active areas. Reapply as necessary to maintain effectiveness.
- Implement temporary soil stabilization measures at regular intervals throughout the defined rainy season to achieve and maintain the contract's disturbed soil area requirements.
- Control erosion in concentrated flow paths by applying erosion control blankets, check dams, erosion control seeding, and lining swales as shown on plans.
- Apply seed to areas deemed substantially complete during the defined rainy season.
- At completion of construction, apply permanent erosion control to all remaining disturbed soil areas as early as feasible and as shown on plans.

Sufficient soil stabilization materials will be maintained onsite to allow implementation in conformance with this Construction BMP Plan. This includes implementation requirements for active and non-active areas that require deployment before the onset of rain.

The following soil stabilization BMP consideration checklist indicates the BMPs that will be implemented to control erosion on the construction site.

Table A-1
TEMPORARY EROSION CONTROL BMPs

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE(2)
EC-1	Scheduling	✓	☐		
EC-2	Preservation of Existing Vegetation	✓	☐		
None	Minimize exposure time of DSA	✓ (1)			
EC-3	Hydraulic Mulch	✓ (1)	☐		
SS-4	Hydroseeding	✓ (1)	☐		
EC-5	Soil Binder	✓ (1)	☐		
EC-6	Straw Mulch	✓ (1)	☐		
EC-7	Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats	✓ (1)	☐		
EC-8	Wood Mulching	✓ (1)	☐		
EC-15	Soil Preparation/ Roughening	✓ (1)	☐		
	Other		☐		
	Other		☐		

(1) The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's disturbed soil area (DSA) protection requirements.
(2) Provide the phase of construction (e.g., demo, grading) for which the BMP will be implemented. Dates the BMP will be implemented can also be used.

Implementation of Soil Stabilization BMPs

BMPs will be deployed in a sequence to follow the progress of grading and construction. As the locations of soil disturbance change, erosion and sedimentation controls will be adjusted accordingly to control storm water runoff at the downgrade perimeter and drain inlets. BMPs will be mobilized as follows:

Year-round:

- The WPCM will monitor weather using National Weather Service reports to track conditions and alert crews to the onset of rainfall events.

During the rainy season:

- Disturbed soil areas (DSAs) will be stabilized with temporary or permanent soil stabilization (erosion control) before rain events.
- Disturbed soil areas that are substantially complete will be stabilized with permanent soil stabilization (erosion control) and vegetation (if within seeding window for seed establishment).
- Prior to forecasted storm events, temporary soil stabilization BMPs will be deployed and inspected.

During the non-rainy season:

- The project schedule will sequence construction activities with the installation of both soil stabilization and sediment control measures. The construction schedule will be arranged as much as practicable to leave existing vegetation undisturbed until immediately prior to grading.

Sediment Control

Sediment controls are structural measures that are intended to complement and enhance the soil stabilization (erosion control) measures and reduce sediment discharges from construction areas. Sediment controls are designed to intercept and settle soil particles that have been detached and transported by the force of water. This project will incorporate minimum temporary sediment control requirements, temporary sediment control measures required by the contract documents, and other measures selected by the Contractor.

☐ No soil will be disturbed as a part of this project, therefore sediment control measures are not required for this project.

Sediment control BMPs will be installed at all appropriate locations along the site perimeter and at all operational internal inlets to the storm drain system at all times during the rainy season. During the nonrainy season, adequate sediment control materials will be available to control sediment discharges at the downgrade perimeter and operational inlets in the event of a predicted storm.

Temporary sediment control materials, equivalent to 10% of the installed quantities on the site during the rainy and non-rainy seasons will be maintained onsite throughout the duration of the project to allow implementation of temporary sediment controls in event of predicted rain, rapid response to failures or emergencies, and as described in the Construction BMP Plan. This includes implementation requirements for active areas and non-active areas before the onset of rain.

Prior to the opening of new DSA in the rainy season, additional temporary sediment control materials necessary to protect this DSA will be stored onsite.

The following sediment control BMP consideration checklist indicates the BMPs that will be implemented to control sediment on the construction site.

Table A-2
TEMPORARY SEDIMENT CONTROL BMPs

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE(2)
SE-1	Silt Fence	✓ (1)	☐		
SE-2	Sediment Basin	✓ (1)	☐		
SE-3	Sediment Trap	✓ (1)	☐		
SE-4	Check Dam	✓ (1)	☐		
SE-5	Fiber Rolls	✓ (1)	☐		
SE-6	Gravel Bag Berm	✓ (1)	☐		
SE-7	Street Sweeping and Vacuuming	✓	☐		
SE-8	Sandbag Barrier	✓ (1)	☐		
SE-13	Compost socks and Berms	✓ (1)	☐		
SE-10	Storm Drain Inlet Protection	✓	☐		

(1) The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's disturbed soil area (DSA) protection requirements.
(2) Provide the phase of construction (e.g., demo, grading) for which the BMP will be implemented. Dates the BMP will be implemented can also be used.

Implementation of Temporary Sediment Controls

- During the rainy season, temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas, at the toe of slopes, at storm drain inlets and at outfall areas at all times.
- During the non-rainy season, temporary sediment controls will be implemented at the draining perimeter of disturbed soil areas and at the storm drain downstream from disturbed areas before rain events.
- Sediment controls will be deployed along the toe of exterior slopes to settle out sediment from storm water runoff.
- Storm drain inlet protection will be used at all operational internal inlets to the storm drain system during the rainy season.
- During the non-rainy season, in the event of a predicted storm, temporary sediment control materials will be maintained onsite.

Tracking Control

The following tracking control BMP consideration checklist indicates the BMPs that will be implemented to reduce sediment tracking from the construction site onto private or public roads.

Table A-3
TEMPORARY TRACKING CONTROL BMPs

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE(2)
TC-1	Stabilized Construction Entrance/Exit	✓ (1)	☐		
TC-2	Stabilized Construction Roadway	✓ (1)	☐		
TC-3	Entrance/Outlet Tire Wash	✓ (1)	☐		
SC-7	Street Sweeping and Vacuuming	✓	☐		

(1) The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's disturbed soil area (DSA) protection requirements.
(2) Provide the phase of construction (e.g., demo, grading) for which the BMP will be implemented. Dates the BMP will be implemented can also be used.

Wind Erosion Control BMPs

The following wind erosion control BMP consideration checklist indicates the BMPs that will be implemented to control wind erosion on the construction site.

Table A-4 TEMPORARY WIND EROSION CONTROL BMPs					
BMP No.	**BMP**	**BMP MINIMUM REQUIREMENT**	**CHECK IF USED**	**DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED**	**CONSTRUCTION PHASE(2)**
WE-1	Wind Erosion Control	✓	☐		
TC-1	Stabilized Construction Entrance/Exit	✓ (1)	☐		
TC-2	Stabilized Construction Roadway	✓ (1)	☐		
SE-7	Street Sweeping and Vacuuming	✓	☐		
EC-3	Hydraulic Mulch		☐		
EC-5	Soil Binder		☐		
EC-6	Straw Mulch		☐		
EC-7	Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats		☐		
EC-8	Wood Mulch		☐		
WM-3	Stockpile Management(3)		☐		

(1) The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's disturbed soil area (DSA) protection requirements.
(2) Provide the phase of construction (e.g., demo, grading) for which the BMP will be implemented. Dates the BMP will be implemented can also be used.
(3) See additional BMP requirements for stockpile management under Waste Management and Materials Pollution Control BMPs below.

(4) Non-Storm Water Management BMPs

The following BMP consideration checklist indicates the BMPs that have been selected to control non-storm water pollution on the construction site.

Table A-5 NON-STORM WATER MANAGEMENT BMPs					
BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE(2)
NS-1	Water Conservation Practices	✓ (1)	☐		
NS-2	Dewatering Operations		☐		
NS-3	Paving and Grinding Operations	✓ (1)	☐		
NS-5	Clear Water Diversion		☐		
NS-6	Illicit Discharge/Illegal Dumping Reporting	✓ (3)	☐		
NS-7	Potable Water/Irrigation	✓ (1)	☐		
NS-8	Vehicle and Equipment Cleaning	✓ (3)	☐		
NS-9	Vehicle and Equipment Fueling	✓	☐		
NS-10	Vehicle and Equipment Maintenance	✓	☐		
NS-11	Pile Driving Operations		☐		
NS-12	Concrete Curing		☐		
NS-13	Material and Equipment Use Over Water		☐		
NS-14	Concrete Finishing		☐		
NS-15	Structure Demolition/Removal Over or Adjacent to Water		☐		
	other				

(1) The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's disturbed soil area (DSA) protection requirements.
(2) Provide the phase of construction (e.g., demo, grading) for which the BMP will be implemented. Dates the BMP will be implemented can also be used.
(3) Failure to implement WQIP BMPs which target priority pollutants including metals, trash and bacteria will result in an automatic administrative citation.

Over Water Work

Tarps or other containment will be used by the Contractor for any work conducted over water with the potential to impact water quality (painting, blasting, construction, maintenance, etc.). Refer to BMPs NS-13 and NS-15 in Table A-5.

Waste Management and Materials Pollution Control BMPs

The following BMP consideration checklist indicates the BMPs that have been selected to control construction site wastes and materials.

Table A-6
WASTE MANAGEMENT AND MATERIALS POLLUTION CONTROL BMPs

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE(3)
WM-1	Material Delivery and Storage In addition, all stockpiles of treated lumber must be covered during the rainy season	✓	☐		
WM-2	Material Use	✓ (4)	☐		
WM-3	Stockpile Management(5)	✓	☐		
WM-4	Spill Prevention and Control	✓ (4)	☐		
WM-5[1]	Solid Waste Management	✓ (4)	☐		
WM-6[1]	Hazardous Waste Management	✓ (2) (4)	☐		
WM-7[1]	Contaminated Soil Management	✓ (2) (4)	☐		
WM-8[1]	Concrete Waste Management	✓ (2)	☐		
WM-9[1]	Sanitary/Septic Waste Management	✓ (4)	☐		
WM-10[1]	Liquid Waste Management		☐		
PO-18	Cover stockpiles of treated lumber during wet weather	✓ (4)	☐		

(1) In the narrative description of Waste Management BMPs (WM-5 through WM-10), a list of waste disposal facilities and type of waste to be disposed at each facility should be provided.
(2) The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's disturbed soil area (DSA) protection requirements.
(3) Provide the phase of construction (e.g., demo, grading) for which the BMP will be implemented. Dates the BMP will be implemented can also be used.

(4) Failure to implement WQIP BMPs which target priority pollutants including metals, trash and bacteria will result in an automatic administrative citation.
(5) The following BMPs are required when implementing stockpiles during construction:
- Stockpiles must be protected to prevent discharge of sediment or other pollutants beyond the immediate area of the stockpile and offsite either by transport via wind or water.
- All stockpiles must be stabilized at the end of each day. In addition, all stockpiles must be bermed (i.e. perimeter controls) at the end of each day.
- Stockpiles in the right-of-way must be stabilized with an erosion control product and bermed (i.e. perimeter control) at the end of each day.
- All stockpiles must be stabilized with an erosion control product and bermed (i.e. perimeter control) prior to rain.
- For stockpiles where only a portion (or "face") is actively being used, the remaining inactive portion (or faces) must be designated on the site map and stabilized with an erosion control product and bermed at all times. Active faces must be bermed and stabilized at the end of each day and prior to rain as described above in notes 3 and 4.
- Stockpile perimeter controls must be inspected on a daily basis by the Contractor for sediment accumulation. Sediment accumulation must be removed when sediment reaches 1/3 of BMP height and prior to a rain event. For perimeter controls within the right-of-way, sediment accumulation must be removed daily and prior to rain event.
- All stockpiles must be placed at least 18 inches from the curb face and are prohibited where they obstruct flow including storm drain inlets and drainage ditches.

Spill Prevention and Control

All sewage or petroleum spills that enter a storm drain and are not fully contained, and/or reach San Diego Bay, or spills 5 gallons or greater of potentially hazardous materials, and/or any spill of hazardous material of Federal Reportable Quantity (as established under 40 CFR Parts 110, 117, or 302), shall be documented in Table A-7 and the WPCM shall notify Port Planning and Green Port Department (619-686-6254) within 48 hours who will notify the National Response Center by telephone at (800) 424-8802, if appropriate. Additionally, the WPCM will notify the Coast Guard (619-295-3121) of any petroleum spill that reaches San Diego Bay, or the County of San Diego Department of Environmental Health (619-338-2222) of any sewage spill that reaches San Diego Bay or any waters of the state.

Table A-7
CONSTRUCTION BMP PLAN REPORTABLE QUANTITY RELEASES

This table will be completed for any release of petroleum products or sewage that enters a storm drain and are not fully contained and/or reach a receiving water body; any release 5 gallons or greater of potentially hazardous material, and/or any Reportable Quantity spill of hazardous materials (as established under 40 CFR Part 110[1], 40 CFR Part 117[2], or 40 CFR 302[3]) that occurs on site.

1. 40 CFR Part 110 addresses the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Clean Water Act.
2. 40 CFR Part 117 addresses the determination of such quantities of hazardous substances that may be harmful pursuant to Section 311(b)(3) of the Clean Water Act.
3. 40 CFR Part 302 addresses the designation, reportable quantities, and notification requirements for the release of substances designated under Section 311(b)(2)(A) of the Clean Water Act.
4. Copies of the above regulations are available by contacting the Port of San Diego (619-686-6254).

Date of Spill	Material Spilled	Approximate Quantity	Agencies Notified	Date Notified

Non-Compliance

The minimum BMPs are required to ensure a reduction of potential pollutants from the project site to the MEP. These BMPs also ensure that all construction and grading activities are in compliance with applicable Port ordinances and other environmental laws.

Sites are considered non-compliant if one or more violations are discovered at a site. If an incident or practice of non-compliance occurs, Port Planning and Green Port staff will then determine if the incident poses a threat to human or environmental health by considering the following criteria:

- Characteristics, quantity, and toxicity of substances/materials involved;
- Proximity of site to a sensitive water body (San Diego Bay or its tributaries);
- Proximity of site to a 303(d) listed impaired water body (San Diego Bay, Chollas Creek);
- Proximity of site to a sensitive habitat/endangered species;
- Estimated volume of actual and/or potential discharge; and
- Discharges to storm drain and condition of storm drain (clog, etc.).

Reporting of any non-compliance issues are required to be documented in the project Construction BMP Plan. An example non-compliance documentation form is located in Appendix B of this Construction BMP Plan.

1

BEST MANAGEMENT PRACTICE (BMP)

IMPLEMENTATION RECORD

The dates that selected BMPs are implemented, along with the contractor or other party responsible for installation, are listed below.

CONSTRUCTION START DATE: ________________________
(Rainy season is October 1 to May 30)

Best Management Practices Implemented	Responsible Party	Date Implemented	Installed Prior to Construction Start (1)
Erosion And Sediment Controls			
Drainage Controls			
Wind Erosion Controls			
Tracking Controls			
Non-Storm Water Controls			

(1) Place a check in the right-hand column to indicate which BMPs will be implemented prior to the start of construction (e.g. perimeter sediment controls)

INSTRUCTIONS FOR COMPLETION OF THE BMP INSPECTION AND REPORTING (FORM 2)

The following BMP inspection and reporting procedures shall be followed:

1. The WPCM shall inspect BMPs implemented under the Port Construction BMP Plan at varying intervals based upon the likelihood of precipitation. During the rainy season, the Contractor shall conduct weekly BMP inspections. During the dry season[2], the Contractor shall conduct monthly BMP inspections. When precipitation is eminent, the Contractor shall inspect BMPs just prior to, during and after storms. Care should be taken during inclement weather to ensure the safety of inspection personnel.
2. Only the WPCM or qualified persons may conduct the inspections. The inspections are intended to ensure the proper installation of BMPs and identify the effectiveness of the BMPs in minimizing the effects of storm water runoff. The inspections are also intended to indicate repairs, maintenance requirements, or design changes that need to be implemented as soon as field conditions permit.
3. As part of the inspections, the WPCM shall note and make recommendations to eliminate or control non-storm water flows from irrigation, construction water application or other uses of water on the site.
4. The Contractor shall include a copy of the WPCD which is included as part of the Construction BMP Plan. The manager shall make notes and sketches on this copy that indicate any required changes to BMPs, failures of BMPs, locations of soil erosion, changes in drainage patterns and locations, and sites for additional BMPs.
5. Contractor shall file BMP Inspection Records and maps on site during the length of the construction project. The Contractor shall make available the BMP Inspection Records and maps for review by the Port staff upon request.

[2] The dry season is defined as May 1 through September 30.

2

BEST MANAGEMENT PRACTICE (BMP) INSPECTION REPORT

INSPECTION TYPE: ☐ Routine Weekly/Monthly ☐ Pre-Rain ☐ During Rain ☐ Post Rain

DATE: ____________________ FOR WEEK ENDING: ________________________

WEATHER: STORM START TIME: ____________ STORM DURATION: _____________

TIME ELAPSED SINCE LAST STORM: ____

INSPECTED BY: __________________________ ____________________________
(print name) *(title)*

____
(signature)

Check "Yes," "No" or "N/A" if not applicable.

NO.	DESCRIPTION	YES	NO*	N/A
1	Are sediment controls in place at site perimeter and storm drain inlets, including offsite tracking controls?			
2	Are all discharge points free of any noticeable pollutant discharges?			
3	Is sediment, debris, or mud being cleaned from public roads where they intersect with site access roads?			
4	Are all temporary stockpiles or construction materials located in approved areas and protected from erosion?			
5	Are dust control measures being appropriately implemented?			
6	Are all materials and equipment properly covered?			
7	Are all material handling and storage areas clean and free of spills, leaks, or other deleterious materials?			
8	Are all hazardous materials properly stored in bermed, covered area, and free of spills, leaks, or other deleterious materials?			
9	Are all equipment storage and maintenance areas clean and free of spills, leaks, or any other deleterious materials?			
10	Are all on-site traffic routes, parking, and storage of equipment and supplies restricted to designated areas?			
11	Are all sediment traps, barriers, and basins clean and functioning properly?			
12	Are all erosion control devices in-place and functioning in accordance with the erosion control plan?			
13	Are all exposed slopes protected from erosion through the implementation of acceptable soil stabilization practices?			
14	Are stockpiles of treated lumber protected from wet weather?			
15	Other? (explain below)			

** If any answer is "no," describe needed correction(s) below. Indicate the location of needed correction(s), along with the date corrections are made, on attached maps.*

____

____

Training and WPCM Responsibilities

The Construction BMP Plan must include procedures to ensure that all personnel implement the Construction BMP Plan and that trained personnel perform the inspections. When properly trained, site personnel are more capable of managing materials properly, preventing spills, and implementing BMPs efficiently and correctly.

The Contractor shall designate a WPCM who shall be the primary contact for issues related to the Construction BMP Plan or its implementation. The WPCM is responsible for Construction BMP Plan modifications and amendments, and is responsible for the implementation and adequate functioning of various water pollution control practices employed. Specifically, the WPCM is responsible for the following tasks unless his/her designee is approved by the Port:

- Responsible for overall Construction BMP Plan implementation, ensuring that materials and manpower are made available for the successful maintenance of all erosion and sediment control and other BMPs specified in the Construction BMP Plan.
- Responsible for maintaining an up-to-date copy of this Construction BMP Plan onsite at all times, from commencement of construction to final site stabilization.
- Responsible for making a copy of the Construction BMP Plan available for inspection by outside authorized regulatory authorities upon request.
- Ensuring the new Contractors/subcontractors are made aware of their responsibilities in this Construction BMP Plan.
- Responsible for ensuring that field engineering activities are planned and conducted in accordance with the Construction BMP Plan.
- Responsible for directing ongoing regular BMP maintenance activities (e.g., silt fence repair, damaged gravel bag replacement, sediment removal in retention basin, timely waste disposal, etc.).
- Responsible for implementing and overseeing necessary corrective actions to the erosion/sediment control devices and other BMPs.
- Responsible for maintaining all site records pertaining to inspection and maintenance of erosion and sediment controls and other BMPs as well as records detailing the dates on which major construction activities began and were completed.
- Responsible for conducting Environmental Awareness Training for site personnel (including subcontractor personnel). This involves increasing awareness of the need to comply with Construction BMP Plan which includes: minimizing sediment in storm water discharges off-site as well as keeping a clean site and minimizing the potential for construction materials and wastes from entering storm water discharges. Required documentation of training will be recorded on Form 3 of this Construction BMP Plan and kept on site.
- Responsible for conducting regular documented inspections of erosion and sediment control devices and other BMPs contained in this Construction BMP Plan. Required documentation of the inspections will be kept on site.

- Responsible for conducting regular site environmental inspections and noting the conditions of those areas onsite that have the potential to result in pollution of storm water. Required documentation of the inspections and any corrective actions will be kept on site.
- Responsible for acting as the site spill coordinator to document spills, direct clean-up activities, minimize impact to storm water, and ensure that the proper reporting, if necessary, is completed.
- Responsible for ensuring that all subcontractors involved with construction activities, which may potentially affect storm water quality at the site, are made aware of, and their contracts reflect that they must comply with the applicable provisions of this Construction BMP Plan.

It is recommended that the WPCM have certified formal storm water management training, certification as a certified erosion, sediment and storm water inspector, or certification as a Certified Professional in Erosion and Sediment Control (CPESC). Credentials of the WPCM shall be included in the CONSTRUCTION BMP PLAN. WPCMs that have not received formal training must arrange for a tailgate meeting with the Port stormwater inspector to be held within the first 5 days of the project start, to go over expectations and requirements for implementing the SWPPP.

Personnel shall be trained in the components and goals of the Construction BMP Plan. Specifically, employees of the Contractor and any subcontractors working on the construction site shall be informed of the goals of the storm water pollution prevention plan at a training meeting prior to commencing construction activities. The training meeting shall cover basic storm water information as well as the specific requirements of the General Construction Permit. Specifically, the meeting will focus on implementation, inspection, and maintenance of storm water BMPs.

Employees responsible for implementing, inspecting, maintaining, or repairing storm water BMPs will receive copies of relevant portions of the Construction BMP Plan. The Contractor shall train all new employees and subcontractors before they will be permitted to work on the site. For projects that start during the dry season, refresher sessions on storm water pollution control will be conducted prior to the wet season. Additional training will be provided as necessary based on site inspections and evidence of storm water quality problems.

All training must be documented in the Construction BMP Plan document (Form 3) and documentation records should be kept for at least three years from the date generated or after project completion.

3 CONSTRUCTION BMP PLAN TRAINING DOCUMENTATION FORM

Record of CONSTRUCTION BMP PLAN Training Session

Training Date:	
Instructor:	
Topics Covered:	☐ Inspections ☐ BMP Maintenance/Repair ☐ Planned BMPs ☐ Non-Storm Water Discharges ☐ Other (e.g., workshops offered by agencies, SWRCB/RWQCB, or professional organizations)

Name	Company	Telephone Number	CONSTRUCTION BMP PLAN Responsibilities[(a)]	Received Complete BMP Plan or Excerpt (Yes/No)

(a) CONSTRUCTION BMP PLAN responsibilities may include one or more of the following: BMP Installation, Inspection, Maintenance; Training; Plan Revisions, Non-Storm Water Discharges, Storm Water Sampling

Appendix A BMPs Selected for Project

Appendix B Non-Compliance Form

NON-COMPLIANCE REPORT

Dischargers who cannot certify compliance with the permit and/or who have had other instances of non-compliance, excluding exceedances of water quality standards, shall notify the Port within 30 days.

Inspector Name:	
Inspector Phone Number:	
Non-Compliance Identification Date:	

Description of Non-Compliance:
Initial assessment of any impact caused by the non-compliance:
Actions required to achieve compliance:
Time schedule of remediation activities:
When compliance will be achieved:

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

(FOR LAND DISTURBANCES OF GREATER THAN ONE ACRE OR EQUAL TO ONE ACRE)

PROJECT NAME: ______________________________

CONTRACTOR NAME: ______________________________

RISK LEVEL: ______________________________

WDID NO.: ______________________________

DATE OF SWPPP PREPARATION: ______________________________

Prepared for:

Port of San Diego
3165 Pacific Highway
San Diego, CA 92101-1128

Note: This Construction SWPPP must be maintained at the site and available for review upon request by the Port of San Diego and the Regional Water Quality Control Board.

Disclaimer

The Template Construction Activities Stormwater Pollution Prevention Plan (SWPPP Template) was prepared by the San Diego Unified Port District (District) to assist in complying with the Order No. R9-2013-0001 Municipal Stormwater Permit for the San Diego Region (Municipal Permit) and the District's Jurisdictional Runoff Management Program (JRMP) requirements. Minimum best management practices (BMPs) required by the District for construction activities have been incorporated into the template. Refer to Chapter 5 of the District JRMP located on the District's website at www.portofsandiego.org for further information regarding BMPs and the management of construction activities on District tidelands.

The SWPPP Template has been prepared to comply with State Water Resources Control Board (SWRCB), Order WQ 2022-0057-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit For Stormwater Discharges Associated With Construction and Land Disturbances Activities (General Permit) No. CAS000002. General Permit No. CAS000002 also identified as the Construction General Permit (CGP) was adopted by the State Water Resources Control Board (SWRCB) on September 8, 2022 and became effective on September 1, 2023.

The template herein is provided for informational purposes to assist the Qualified SWPPP Developer (QSD) in preparing a Risk Level 1 or Risk Level 2 SWPPP. The San Diego Bay is currently not listed for sediment impairment and does not satisfy the criteria for beneficial uses as defined by the CGP; therefore Receiving Water Risk for all District projects is currently considered LOW.

Due to the multitude of applications of BMPs, the SWPPP template does not address site-specific applications. Users of this template should use their professional judgment and seek advice from appropriately qualified professionals to determine the applicability of the information provided for general use or site-specific application. Users of this template assume all liability directly or indirectly arising from the use of the template.

GENERAL INSTRUCTIONS AND CAVEATS

THIS TEMPLATE PRESENTS A RECOMMENDED STRUCTURE AND CONTENT FOR PREPARATION OF A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) INCLUDING A CONSTRUCTION SITE MONITORING PROGRAM (CSMP). THE STRUCTURE AND CONTENT IS BASED ON A COMBINATION OF SPECIFIC DISTRICT JRMP AND CGP REQUIREMENTS AND OTHER SUGGESTED CONTENT TO MEET THE OVERALL CGP REQUIREMENTS.

- This template has been prepared to address traditional Risk Level 1 and 2 projects and does not address the specific requirements of Linear Underground/Overhead Projects.
- Instructions are identified in blue and red and should be deleted upon SWPPP completion.
- Delete Disclaimer and General Instructions and Caveats upon SWPPP completion.
- Project specific text is identified with gray highlight and should be replaced to reflect the actual project condition. Remove highlighting upon SWPPP completion.
- References within the SWPPP template to other sections of the SWPPP are yellow highlighted to facilitate update by the Qualified SWPPP Developer (QSD) during the SWPPP development process. Remove highlighting upon SWPPP completion.
- Periodically you will be prompted to select text for an appropriate risk level or other scenario, delete all text that does not pertain to your project.
- The QSD should remove any text that is not applicable to the specific project (e.g., Port as discharger versus the Port not being the discharger, Risk Level, etc.).

Table of Contents

Qualified SWPPP Developer

Approval and Certification of the Stormwater Pollution Prevention Plan

"This stormwater Pollution Prevention Plan and its appendices were prepared under my direction to meet the requirements of the California Construction Stormwater General Permit (Order No. 2022-0057-DWQ) and applicable elements of the City of San Diego's Storm Water Standards Manual. I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below and will maintain up to date credentials for the duration for the project."

QSD Signature	Date
QSD Name	QSD Certificate Number include certificate in Appendix M
Title and Affiliation	
Email	Telephone Number

Table 1 Basic Project Information Summary

LRP: Discharger: Address: Phone Number: Email:	
Project Risk Level	
Total Site Size	
Total Planned Disturbed Acreage	
Construction Start Date	
Construction End Date	
Receiving Water Body	
Site Operating Hours	
QSP	
QSP Trained Delegate	
QSP Trained Delegate	
QSD	

(Add additional rows if necessary)

Amendment Log

Project Name/WDID ______________________________

Include references to section of SWPPP that has been amended, add additional pages as needed.

Amendment No.	**Date**	**Brief Description of Amendment, include section and page number**	**Prepared and Approved By**
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#
			Name: QSD#

Section 1 SWPPP Requirements

1.1 INTRODUCTION

RECOMMENDED TEXT

This Stormwater Pollution Prevention Plan (SWPPP) was prepared for construction activities within the San Diego Unified Port District (District) tidelands within the County of San Diego, CA (project). The project location is shown on the Site Map included in Appendix B.

This SWPPP is designed to assist the project's compliance with the District's Jurisdictional Runoff Management Program (JRMP), Order No. R9-2013-0001 Municipal Stormwater Permit and with the State Water Resources Control Board (SWRCB), Order WQ 2022-0057-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit For Stormwater Discharges Associated With Construction and Land Disturbances Activities (General Permit) No. CAS000002. General Permit No. CAS000002, also identified as the Construction General Permit (CGP).

This SWPPP has been prepared following the SWPPP Template prepared by the District and designed to comply with the conditions listed below:

- A site-specific SWPPP is developed, and amended as necessary, by a QSD. The discharger is responsible for keeping the SWPPP and associated documents updated in SMARTS to reflect current site conditions and construction activities.
- Trained personnel and BMP materials are available at the site as required by the CGP.
- The SWPPP includes the implementation of BMPs that comply with BAT, BCT, and ensure compliance with water quality standards; additional BMPs based on input from the QSP to address numeric action level and numeric effluent limitation exceedances; and additional training needed for the QSP, Legally Responsible Person, or designated persons on-site.
- The SWPPP is available at the site and made available upon request by a federal, State, or municipal inspector. A current copy of the site-specific SWPPP and any site inspection reports required by the CGP may be kept in electronic format at the site so long as the information requested by a federal, State, or municipal inspector can be made available during an inspection. All maps are legible and available in hard copy at the site.

Calculations and design details for BMP controls applicable to this project are included in, Appendix A.

1.2 CGP COVERAGE

The Discharger, (name), has submitted the Permit Registration Documents (PRDs) to the SWRCB Stormwater Multi-Application and Report tracking system (SMARTS). The SWRCB has issued a Waste Discharge Identification (WDID) number as indicated below:

WDID: ______________________________

1.3 SWPPP AVAILABILITY AND IMPLEMENTATION

RECOMMENDED TEXT

The SWPPP must be made available during working hours (see Table 1 for working hours) while construction is occurring and shall be made available upon request by a State, Municipal or Port inspector. The SWPPP can be kept in hardcopy or electronic form. When the original SWPPP is retained by a crewmember in a construction vehicle and is not currently at the construction site, current copies of the BMPs and map/drawing will be left with the field crew and the implemented SWPPP shall be made available via a request by radio/telephone.

The SWPPP shall be Implemented concurrently with the start of ground disturbing activities.

The CGP requires a Qualified SWPPP Practitioner (QSP) to be appointed for each project to implement the approved SWPPP.

A QSP must be appointed throughout the duration of the project, the project cannot operate under the CGP without a QSP. The QSP's certification must be inserted in Appendix K of this SWPPP.

The Contractor is responsible for implementing the SWPPP and CGP requirements. If a third party contracted QSP is appointed, all the CGP QSP responsibilities must be met. The Contractor should refer to this section of the SWPPP when devising an agreement with a third party contracted QSP to ensure all CGP QSP responsibilities are being met.

The QSP must perform the following minimum on-site visual inspections:

a. Once every calendar month;

b. Within 72 hours prior to a forecasted Qualifying Precipitation Event to inspect areas of concern to verify the status of any deficiencies, BMPs, or other identified issues at the site. If extended forecast precipitation data (greater than 72 hours) is available from the National Weather Service, the pre-precipitation event inspection may be done up to 120 hours in advance;

c. Within 14 days after a numeric action level exceedance the QSP shall visually inspect the drainage area of exceedance and document any areas of concern; and

Prior to the submittal of Notice of Termination or Change of Information (for acreage changes) of all or part of a site.

The QSP must verify the following:

a. All BMPs required in the SWPPP are implemented, correctly installed, inspected, and maintained;

b. Track out of construction related material at site entrances and exits is controlled;

c. The SMARTS generated WDID number notification form is in a site location viewable by the public or readily available upon request, kept up to date, and the start and end dates are correct and match the dates listed in SMARTS for the project;

d. Sampling protocols for stormwater and non-stormwater discharges are correctly performed as described in the SWPPP by on-site trained personnel delegated by a QSP (including, but not limited to, taking representative samples of the runoff);

e. Contact information including, name, phone number, and email address for the discharger, Legally Responsible Person, QSD(s), and QSP(s) is correct and updated in SMARTS within 90 days of a change); and

f. Photo documentation of problem areas of erosion, new sediment deposition, unauthorized non-stormwater discharges, and/or failed BMPs is included in the SWPPP and are made available upon a regulatory inspector's request.

Contractors working on this project must be trained in SWPPP implementation. The QSP should perform this training and document the training using training forms included in the SWPPP.

The CGP also requires that a Qualified SWPPP Developer (QSD) be retained from the beginning of a project through the Notice of Termination (NOT). The initial QSD who develops the SWPPP may not be the same QSD that performs the required QSD site inspections.

The QSD is required to assess how construction activities will affect sediment transport, erosion, and other discharges of pollutants in stormwater runoff in the SWPPP design and implementation. The QSD is required to revise the SWPPP to address potential problems identified by visual inspections, sampling data, comments from a QSP, or their own site observations.

The QSD must perform the following on-site visual inspections:

a. Within 30 days of construction activities commencing on a site;

b. Within 30 days of a discharger replacing the QSD;

c. Twice annually, once August through October and once January through March;

d. Within 14 calendar days after a numeric action level exceedance; and

e. Within the time period requested in writing from Water Board staff.

A QSD may perform the work of a QSP but the QSP may not perform the work of a QSD.

1.4 SWPPP AMENDMENTS

INSTRUCTIONS

This section provides direction regarding when SWPPP amendments are required, and when deemed necessary by the QSD. Table 2 includes typical construction site changes that the QSD can choose to allow field determination by QSP.

The following text should be modified accordingly

RECOMMENDED TEXT

Amendments and revisions to the SWPPP must be prepared by a QSD. SWPPP changes and amendments shall be uploaded through SMARTS within 30 calendar days. Amendments and revisions shall be dated and directly attached to the SWPPP. Each amendment shall be logged in the Amendment Log of the SWPPP. Additionally, a SWPPP Amendment Certification shall be completed by the QSD and maintained in Appendix D, for each amendment.

The CGP requires the SWPPP to be revised when:

- If there is a CGP violation. *"Upon exceedance of a numeric action level, the discharger must take necessary corrective actions, including but not limited to maintenance, replacement, and/or installation of new best management practices. This General Permit relies on dischargers to implement an iterative process for best management practices to protect water quality. Failure to implement corrective actions in response to a numeric action level exceedance is a violation of this General Permit." (CGP – Order, Section 1.28)*
- When there is a change to the construction start or end date. *"The discharger shall electronically certify and submit a revised Notice of Intent through a Change of Information in SMARTS, when the construction start or end date changes, recalculating sediment risk and revising the SWPPP as appropriate. The Change of Information shall be submitted at least 14 days prior to the date that was modified, unless infeasible due to unforeseen circumstances." "If the discharger is revising the construction start date to a later date than preciously submitted, the Change of Information shall contain time-stamped photo documentation depicting that construction activities have not commenced for the entirety of the site." (CGP – Order, Section III.F.1.a.)*
- When there is a reduction in total disturbed acreage. *"The Discharger reducing disturbed acreage shall electronically certify and submit the following Permit Registration Document revisions in SMARTS, through a Change of Information, within 30 days of the reduction in acreage…" (CGP – Order, Section III.F.2.)*
- When there is an increase in total disturbed acreage. *"If the disturbed acreage of the site will increase, the discharger shall certify and submit the following Permit Registration Documents revisions in SMARTS, through a Change of Information, prior to the increase in disturbed acreage." (CGP – Order, Section III.F.4.)*

Additionally, the SWPPP shall be revised when:

- When the QSD or QSP for the project change;
- There is a change in construction or operations which may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4);
- To identify any new contractor and or subcontractor that will implement a measure of the SWPPP; or
- When deemed necessary by the QSD. The QSD has determined that the changes listed in Table 2 can be field determined by the QSP. All other changes shall be made by the QSD as formal amendments to the SWPPP.

The following items shall be included in the amendment:

- Who requested the amendment;
- The location of proposed change;
- The reason for change;
- The original BMP proposed, if any; and
- The new BMP proposed.

The following changes listed in Table 2 have been designated by the QSD“as "to be field determined” and constitute minor changes that the QSP may implement based on field conditions, and do not require a SWPPP amendment. The SWPPP progress map shall be updated to reflect field changes.

The QSD shall expand or reduce table as needed for construction site.

Table 2 List of Changes to be Field Determined

Changes for field location or determination by QSP(1)	Check changes that can be field located or field determined by QSP
Increase quantity of an erosion or sediment control measure	
Relocate/Add stockpiles or stored materials	
Relocate or add toilets	
Relocate vehicle storage and/or fueling locations	
Relocate areas for waste storage	
Relocate water storage and/or water transfer location	
Changes to access points (entrance/exits)	
Change type of erosion or sediment control measure	
Changes to location of erosion or sediment control	
Minor changes to schedule or phases	
Changes in construction materials	
(1) Any field changes not identified for field location or field determination by QSP must be approved by QSD	

1.5 RETENTION OF RECORDS

The contractor must provide the implemented SWPPP, all required PRDs, inspection reports, compliance certifications and Annual Reports, non-compliance reports, and training records to the Discharger upon project completion. These documents may be kept in hard copy or electronica form. The Discharger will retain this information for at least 3 years from the date that the Notice of Termination (NOT) has been approved. The contractor must retain a copy of the SWPPP and inspection reports at the project site from the date of project initiation until the NOT has been approved. The Regional Water Board may request retention of records for a period longer than 3 years.

1.6 REQUIRED NON-COMPLIANCE REPORTING

INSTRUCTIONS

Select text for project Risk Level and modify accordingly.

RECOMMENDED TEXT

All projects

Corrective measures will be implemented immediately following pollutant laden discharges (e.g. sediment, concrete, non-visible pollutants, etc.) or following written notice of non-compliance from the San Diego Regional Water Quality Control Board (RWQCB). The District's Environmental Protection

Department requires that any instances of non-compliance with the requirements of the CGP must be reported to them within 24 hours of detection of the non-compliance via a SWPPP Non-Compliance Report. Discharges and corrective actions will be documented on the Discharge Form, Effluent Sampling Form, and Site Visual Inspection Form located in Appendix H. The SWPPP Non-Compliance Report Form is located in Appendix H.

The SWPPP Non-Compliance Report to the District must contain the following items:

- The date, time, location, nature of operation and type of discharge.
- The cause or nature of the instance of non-compliance.
- The control measures (BMPs) deployed before the discharge, or prior to the instance of non-compliance.
- The date of deployment and type of control measures (BMPs) deployed after the discharge event, or after receiving a notice or order, including additional measures installed or planned to reduce or prevent re-occurrence.
- [Include the San Diego RWQCB requirements if any]

Risk Level 2 Only

Reporting requirements for Numeric Action Levels (NALs) exceedances are discussed in Section 7.7.2.4.

1.7 ANNUAL REPORTING

INSTRUCTIONS

Select appropriate scenario

RECOMMENDED TEXT

District Capital Improvement Projects

The CGP requires all projects to submit information and annually certify that their site is in compliance with the CGP. The primary purpose of this requirement is to provide information needed for overall program evaluation and pubic information.

An Annual Report must be certified and submitted by September 1 of each year until an NOT has been approved in the SWRCB's SMARTS database. The contractor is responsible for submitting the Annual Report information to the District by August 1 of each year. The District will review the report information for completeness and accuracy and certify and submit the Annual Report to the SWRCB's SMARTS database by September 1 of each year. Use the Annual Report form in Appendix E to prepare the Annual Report submittal to the District.

For projects where District is not the Discharger

The CGP requires all projects to submit information and annually certify that their site is in compliance with the CGP. The primary purpose of this requirement is to provide information needed for overall program evaluation and pubic information.

An Annual Report, for the reporting year of July 1 – June 30, must be certified and submitted by September 1 of each year until an NOT has been approved in the SWRCB's SMARTS database.

1.8 NOTICE OF TERMINATION

RECOMMENDED TEXT

To terminate coverage under the CGP, a Notice of Termination (NOT) must be submitted through SMARTS and approved by the Regional Water Board. The NOT shall be prepared by the QSP after the required QSP prepared final NOT inspection has been conducted and documented. The NOT will be reviewed prior to approval by the Discharger and will be electronically submitted via SMARTS when the construction project is complete, and the site meets the NOT requirements of Section III.H of the General Permit. A project is considered complete when all portions of the site meet the following conditions:

a. The discharger has completed all construction activity;

b. There is no greater potential for construction-related stormwater pollutants to be discharged into site runoff than prior to the construction activity;

c. Construction-related equipment and temporary BMPs have been removed from the site, except as set forth in Section III.F.2.b of the CGP;

d. Construction materials and wastes have been disposed of properly;

e. Soils disturbed by construction activities have been permanently stabilized (final stabilization), except as set forth in Section III.F.2.b of the CGP, using materials that:

    i. Have a product life that support the full and continued stabilization of the site;

    ii. Achieve stabilization without becoming trash or debris; and

    iii. Minimize the risk of wildlife entrapment;

a. The discharger has ensured the QSP completed on-site visual inspections and verified the site complies with all Notice of Termination requirements, including installation of post-construction stormwater runoff BMPs and/or low impact development features;

b. The Legally Responsible Person has submitted the information in the Notice of Termination and has certified and submitted through SMARTS; and

c. The discharger has demonstrated that the site complies with all Notice of Termination conditions above (Section III.H) and all final stabilization conditions by one of the following methods:

70 percent final cover method. No computational proof required. Requires permanent vegetative cover to be evenly established over 70 percent of all disturbed and exposed areas of soil (non-paved or non-built).
OR
Revised Universal Soil Loss Equation (RUSLE or RUSLE2) method. Computational proof required.
OR
Custom method. The discharger may request approval from the Regional Water Board to use a method or analytical model other than Section III.H.4.h.i and 4.h.ii above to demonstrate that the site complies

with the “final stabilization” requirements. Photos of all site areas are required to verify the custom method used.

The QSP will prepare the following on SMARTS:

a. A complete Notice of Termination;
b. QSP-prepared final Notice of Termination inspection with the QSP name and valid QSP certificate number;
c. A final site map; and
d. Photos demonstrating final stabilization and the implementation of applicable post-construction BMPs and/or low impact development.

At a minimum the final site map must include the following:

a. Project boundaries and adjacent lands with labeled key features, such as roadways and waterbodies;
b. Developed drainage basin boundaries and discharge location points;
c. Site entrances and exits, lot boundaries, roads, structures, and features related to the project that may be used as a reference;
d. Specific permanent erosion control BMPs, post-construction BMPs, and low impact development features;
e. Individual erosion control BMPs (including final landscaping) identified using hatch patterns, symbols, or shading unique to each BMP;
f. Location and orientation of all photos used to document final site conditions and demonstrate compliance with post-construction requirements of this General Permit; and
g. If applicable, areas of the site being transferred to new ownership, and the name and contact information of the owner.

The photo documentation must include photos of the following:

a. The site’s final conditions;
b. Post-construction BMPs and /or low impact development features;
c. A description of the corresponding location;
d. The orientation of photos as indicated on the final site map.

The NOT must include a long-term maintenance plan for the post-construction stormwater runoff BMPs and/or low impact development features. If a SWQMP is not required to be prepared for a project a separate long-term maintenance plan will be required for the post-construction BMPs or site stabilization features.

All CGP requirements remain in effect until the NOT is approved. The Contractor’s QSP will be responsible for implementing all aspects of the SWPPP until the NOT is approved, unless the District formally assigns an interim QSP until the NOT is approved.

Section 2 Project Information

2.1 PROJECT AND SITE DESCRIPTION

RECOMMENDED TEXT

2.1.1 Site Description

The [name] project site comprises approximately [acres] The project site is located approximately [distance and direction] of [describe nearby water bodies (e.g., San Diego Bay)]. The project is located at [Lat/Long] and is identified on the Site Maps in Appendix B.

The 2022 CGP defines a project as; “the area that includes sites where land is disturbed and also includes the areas of activities that do not disturb land.”

The 2022 CGP defines a site as; “the area disturbed where the construction activity is physically located or conducted, including staging, storage, and access areas.”

The SWPPP must include the all the disturbed area, including the contractor staging and storage areas as part of the Disturbed Soil Area (DSA). The DSA is also referred to as the Total Disturbed Area.

2.1.2 Existing Conditions

As of the initial date of this SWPPP, the project site is [describe if site is undeveloped or describe existing development; include description of vegetated areas; or impervious areas such as parking lots]. The project site was previously developed with [describe previous land use]. Any historic sources of contamination are descibed in Section 2.1.4.

2.1.3 Existing Drainage

The project site is [describe topography (e.g., relatively level, slopes to the west, etc (msl). Surface drainage at the site currently flows to the [direction], towards [describe discharge locations [storm drain inlet, bay, ocean, etc.)]. Stormwater is conveyed through [surface runoff, storm drain systems, etc.]. Stormwater discharges, from the site, [are/are not] considered direct discharges, as defined by the SWRCB into [(list water body)]. Existing site topography, drainage patterns, and stormwater conveyance systems are shown on [names of drawings or plans].

2.1.4 Historic Sources of Contamination

No historic sources of contamination

This site has no historical sources of contamination.

Site has historic sources of contamination

The Site was historically used for [describe activities] that could potentially contribute pollutants to stormwater. [Describe locations and sources of contaminates]

[Include recent investigations and findings] Potential pollutants from these former land use activities include [list contaminates]. Sampling for non-visible pollutants is described in Section 7.

2.1.5 Project Description

Approximately [acres/square-feet] of the project will be distrubed, which comprises approximately [number] percent of the total area. The limits of grading are shown on the Site Maps in Appendix B. Soil will be stockpiled [describe locations] as shown on the Site Maps in Appendix B.

2.1.6 Developed Condition

Post construction surface drainage will be directed to the [direction] as surface flow through stormwater conveyance systems [and/or sheet flow] and will discharge [describe discharge points – If project discharges directly to a public storm drain system, state so and state owner of storm drain (e.g., city or District)].

Post construction drainage patterns and conveyance systems are presented on the Site Maps in Appendix B.

[Describe the work that will occur to complete this project. (e.g., A new three story building will be built, proejct phases include grading and land development, streets and utilities, vertical construction and final site satbilization.)].

2.2 PERMITS AND GOVERNING DOCUMENTS

RECOMMENDED TEXT

In addition to the General Permit, the following documents have been taken into account while preparing this SWPPP. Delete any documents that are not applicable.

Regional Water Quality Control Board requirements

San Diego Unified Port District SWQMP

San Diego Unified P18istricttric Stormwater Management and Discharge Control (Article –0) - https://pantheonstorage.blob.core.windows.net/administration/Ordinance-2815.pdf

San Diego Unified Port District JRMP

Basin Plan Requirements

Contract Documents

Air Quality Regulations and Permits

Federal Endangered Species Act

National Historic Preservation Act/Requirements of the State Historic Preservation Office

State of California Endangered Species Act

Clean Water Act Section 401 Water Quality Certifications

US Army Corps of Engingers 404 Permits

CA Department of Fish and Game 1600 Streambed Alteration Agreement

2.3 STORMWATER RUN-ON FROM OFFSITE AREAS

INSTRUCTIONS

Select appropriate scenario and modify accordingly

RECOMMENDED TEXT

No anticipated offsite run-on

There is no anticipated offsite run-on to this construction site because [Describe reasons for no offsite run-on [e.g., existing BMPs or stormwater conveyance system to prevent on-site flow, no up-gradient drainage area, etc.)].

Anticipated offsite run-on

Run-on to the site is generated by [describe sources of offsite run-on to the project, such sources may include one or more of the following: "point source discharges from upgradient developed land uses, creeks; streams or other water bodies that run through or discharge from the site; and upgradient non-point source discharges (dry weather and stormwater runoff)"].

If feasible, divert up gradient run-on water from contacting areas of exposed soils disturbed by construction activities or convey run-on through the site in a manner that prevents erosion from areas of construction and does not compromise the effectiveness of erosion, sediment, and perimeter controls.

Run-on water flowing onto the site from off-site areas may be separated from the site's stormwater discharge to eliminate commingled contribution. Run-on diversion shall occur prior to entering an area affected by construction activity. Run-on flow diversion shall be conveyed through or around the construction activity in plastic pipe or an engineered conveyance channel in a manner that will not cause erosion due to flow diversion. Run-on combined with a site's stormwater discharge is considered a stormwater discharge and must be in compliance with the site NALs/NELs.

BMPs to be implemented to direct offsite run-on are described in Table 3.

Table 3 Temporary Diversion BMPs

BMP No.	BMP	MINIMUM BMP REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED
EC-9	Earth Dikes/Drainage Swales & Lined Ditches	✓	☐	
EC-10	Outlet Protection/ Velocity Dissipation Devices	✓	☐	
EC-11	Slope Drains	✓	☐	

Table 3 Temporary Diversion BMPs

BMP No.	BMP	MINIMUM BMP REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED
	Other		☐	
	Other		☐	

2.4 SEDIMENT AND RECEIVING WATER RISK DETERMINATION

INSTRUCTIONS

Part A should be completed for all SWPPPs, and Part B is an optional summary of risk level assessment

RECOMMENDED TEXT

Part A

A construction site risk assessment has been performed and the proejct is a Risk Level [1, 2].

A copy of the Risk Level determination submitted on SMARTS with the PRDs is included in Appendix C.

The San Diego Bay is currently not listed for sediment impairment and does not have combinded benificial uses of “Cold”, “Spawn” and “Migratory” therefore Receiving Water Risk for all District projects is currently considered LOW.

For all SWPPPs select the appropriate Risk Level and modify accordingly

Risk Level 1

Risk Level 1 sites are subject to the narrative effluent limitations specified in the General Permit. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in stormwater and authorized non-stormwater through the use of controls, structures, and best management practices. This SWPPP has been prepared to address Risk Level 1 requirements (GCP Attachment D).

Risk Level 2

Risk Level 2 sites are subject to both the narrative effluent limitations and numeric effluent standards. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in stormwater and authorized non-stormwater through the use of controls, structures and best management practices. Discharges from Risk Level 2 sites are subject to Numeric Action Levels (NAL) for pH and turbidity. This SWPPP has been prepared to address Risk Level 2 requirements (CGP Attachment D).

2.5 CONSTRUCTION SCHEDULE

RECOMMENDED TEXT

The contractor shall contact the (District or Discharger) immediately if the schedule changes and the (District or Discharger) and its QSD will assess potential impacts to the SWPPP. The estimated schedule for planned work can be found in Appendix G. Table 2.4 below must be filled out by the QSP as work progresses on the project.

Table 4 Construction Activity Milestones

Milestone	Start Date	End Date
Demolition		
Initial ground-breaking		
Mass clearing and grubbing/roadside clearing		
Grading/excavation/trenching activities		
BMP Implementation schedule		
• Deployment of temporary soil stabilization*		
• Deployment of temporary sediment control BMPs		
• Deployment of wind erosion control BMPs		
• Deployment of tracking control BMPs		
• Deployment of non-stormwater BMPs		
Deployment of waste management and materials pollution control BMPs		
Paving, saw cutting, and any other pavement related activities		
Major planned stockpiling operations		
Construction of structures and paved surfaces		
Installation of LID and post-construction BMPs		
Site clean-up		
Anticipated final stabilization (erosion control) date		
Anticipated construction completion date		
Anticipated filing of Notice of Termination (NOT) to RWQCB.		
QSP to insert information as work progresses.		

*Per the District's JRMP, erosion control measures are a required minimum BMP that must be implemented at all inactive areas of a construction site. An area is considered "inactive" if no construction activity, including soil disturbing activities, such as clearing, grading, disturbances to ground such as stockpiling and excavation, is occurring. An area is also considered inactive if soil disturbing activities had previously occurred but are not scheduled or planned to be re-disturbed for at least 14 days. Disturbed areas of the construction site that will not be re-disturbed will be stabilized by the day after the last disturbance

2.6 POTENTIAL CONSTRUCTION ACTIVITY AND POLLUTANT SOURCES

RECOMMENDED TEXT

Appendix G includes a list of construction activities and associated materials that are anticipated to be used onsite. These activities and associated materials will or could potentially contribute pollutants, other than sediment, to stormwater runoff.

The anticipated activities and associated pollutants were used in Section 3 to select the appropriate BMPs for the project. Locations of anticipated pollutants and associated BMPs are shown on the Site Map in Appendix B.

For sampling requirements for non-visible pollutants associated with construction activity refer to Section 7.7.1. For a full and complete list of onsite pollutants, refer to the Material Safety Data Sheets (MSDS), which are retained onsite at the construction trailer.

2.7 IDENTIFICATION OF NON-STORMWATER DISCHARGES

RECOMMENDED TEXT

Non-stormwater discharges consist of discharges which do not originate from precipitation events. Per the District's stormwater ordinance, Article 10 and the JRMP, non-stormwater discharges to the stormwater conveyance system that do not have coverage under a separate NPDES permit are considered illicit discharges and subject to enforcement.

Discharges from potable water sources are allowable provided the discharge does not cause erosion or carry other pollutants. Building fire suppression systems maintenance discharges will be addressed as an illicit discharge unless BMPs are implemented to prevent pollutants associated with such discharges to the storm water conveyance system. Refer to Section 10.04 of Article 10 for a complete list of illicit discharges.

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under Article 10 or the JRMP, or authorized under a separate NPDES permit, are prohibited.

Non-stormwater discharges from the following categories are conditionally allowed if they are addressed with BMPs. Otherwise, non-stormwater discharges from the following categories are illicit discharges.

a. Air conditioning condensation.
b. Individual residential vehicle washing.
c. Dechlorinated water from swimming pools.

Non-stormwater discharges to the MS4 from firefighting activities are conditionally allowed if they are addressed as follows:

a. Non-emergency firefighting discharges – Non-emergency firefighting discharges, including building fire suppression system maintenance discharges (e.g. sprinkler line flushing), controlled or practice blazes, training, and maintenance activities shall be addressed by BMPs to prevent the discharge of pollutants to the MS4.

b. Emergency firefighting discharges – BMPs are encouraged to prevent pollutants from entering the MS4. During emergencies, priority of efforts should be directed toward life, property, and the environment (in descending order). BMPs shall not interfere with emergency response operations or impact public health and safety.

Furthermore, the authorized non-stormwater discharges must also:

a. Comply with BMPs as described in the SWPPP;

b. Filter or treat, using appropriate technology, all dewatering discharges from sedimentation basins; in compliance with Attachment J of the CGP;

c. Evidence of non-stormwater discharges will be documented in the Site Visual Inspection Form located in Appendix H.

d. If authorized non-stormwater discharges are observed the Discharge Form in Appendix H must be completed along with the Non-Compliance Report Form located in Appendix H.

e. Documentation of observed non-stormwater discharges will include presence or absence of floating and suspended materials, sheen on the surface, discolorations, turbidity, odors, and source(s) of any observed pollutants as indicated on the Discharge Form in Appendix H.

f. Further assessment for the presence of non-visible pollutants, and subsequent requirements for sampling and analysis for non-visible pollutants should be conducted.

g. For Risk Level 2 projects, observed non-stormwater discharges will also require sampling and analysis for pH and turbidity.

Non-stormwater discharges may occur on various types of construction projects. Landscape projects may involve irrigation overspray that may discharge and require documentation in the Discharge Form and Non-Stormwater Discharge Log located in Appendix H. Irrigation overspray in an area where soil amendments have been used will need to be sampled for non-visible pollutants. Related irrigation overspray discharge on Risk Level 2 projects will require discharges to be sampled for pH and turbidity. Irrigation overspray is prohibited under Section 10.05 – Prohibitions of Article 10 of Ordinance 2815.

Required line flushing often involves discharges, which will require discharge documentation and analysis for free chlorine, if the discharge is not dechlorinated. Attempts should be made to prevent all non-stormwater discharges.

Weekly site visual inspections shall include observations of, or evidence of, non-stormwater discharges in each drainage area of the project and document:

- The presence or evidence of any non-stormwater discharge (authorized or unauthorized) and their sources;
- Pollutant characteristics of the non-stormwater discharge (floating and suspended material, sheen, discoloration, turbidity, odor, etc.);
- The person performing the visual observations;
- The dates and approximate times each drainage area and non-stormwater discharge was observed; and
- The response taken to eliminate unauthorized non-stormwater discharges and to reduce or prevent pollutants from contacting authorized non-stormwater discharges.

These authorized non-stormwater discharges will be managed with the stormwater and non-stormwater BMPs described in Section 3 of this SWPPP and will be minimized by the QSP.

Steps will be taken, including the implementation of appropriate BMPs, to ensure that unauthorized discharges are eliminated, controlled, disposed, or treated on-site.

Discharges of construction materials and wastes, such as fuel or paint, resulting from dumping, spills, or direct contact with rainwater or stormwater runoff, are also prohibited.

2.8 REQUIRED SITE MAP INFORMATION

RECOMMENDED TEXT

The construction project's Site Map(s) shows the project location, surface water boundaries, geographic features, construction site perimeter, general topography and other requirements identified in Section IV.O.2. of the CGP, are located in Appendix B. Site Maps must depict the required information listed in the CGP, and site maps are required for each relevant phase in which the BMP configuration may change of construction. For example, a project may require a separate site map for Demolition, Grading and Land Development, Streets and Utilities, Vertical Construction, Final Landscaping and Site Stabilization.

Section 3 Best Management Practices

3.1 BMP IMPLEMENTATION

Implementation and location of BMPs are shown on the Site Map(s) in Appendix B. Separate Site Maps should be prepared for each of the major construction phases. Site Map(s) should be developed and provided for construction phases including:

- Demolition
- Grading and Land Development
- Streets and Utilities
- Vertical Construction
- Final Landscaping and Site Stabilization

Each phase has activities that can result in different water quality effects from different water quality pollutants. BMPs for the site are to be implemented and maintained throughout the year on an as-needed basis. BMPs should be implemented in a proactive manner, as appropriate, to protect water quality.

The San Diego Bay Water Quality Improvement Plan (WQIP) requires the District to implement a Construction Management program in accordance with the strategies in the WQIP in addition to core CGP requirements. To assist in meeting the water quality goals identified in the WQIP, the District requires Construction BMPs to be implemented which target WQIP priority pollutants including sediment, metals, trash, and bacteria. Applicable BMPs are identified in this section to target WQIP priority pollutants.

WQIP BMPs include non-stormwater management, good housekeeping and waste management BMPs. Failure to implement the BMPs in this section will result in an automatic administrative citation.

Specific Water Quality Improvement Plan BMPs to be implemented and maintained at the project site are denoted with an "✓" and described below. BMPs shall be installed and maintained in accordance with the BMP Fact Sheets provided in Appendix M. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP and over guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the BMP Fact Sheets. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

3.1.1 Disturbed Soil Area (DSA) Temporary Waiver

A project's total disturbed soil area (DSA) shall not exceed 5 acres during the rainy season (October 1-April 30) and 17 acres during the non-rainy (May 1- September 30) season. The District may temporarily increase these limits if the individual site is in compliance with applicable stormwater regulations and the site has adequate control practices implemented to prevent stormwater pollution. The Contractor must provide a BMP mobilization plan which is termed a *Disturbed Soil Area (DSA) Temporary Waiver*, including a description of the delivery and deployment of appropriate BMP material to the jobsite prior to all predicted rain events, to the District for approval prior to increasing the DSA. To request a *DSA Temporary Waiver*, please have the project QSD provide the following information:

1. The duration that the Temporary Approval is requested needs to be provided.
2. The description of BMPs to be used for erosion and sediment controls should be included.
3. Provide a description of delivery and deployment of BMP materials to be used prior to all predicted rain events.
4. Verification that adequate BMP materials will be on site.
5. Site maps will need to be updated to track disturbed soil areas and stabilized areas.
6. Upon approval of the Temporary Approval the SWPPP will need to be amended.

The following template is to be used for requesting a DSA Temporary Waiver.

https://pantheonstorage.blob.core.windows.net/environment/DSA-waiver-request-form-port-of-san-diego.docx

3.2 EROSION AND SEDIMENT CONTROL

RECOMMENDED TEXT

Erosion and sediment controls are required by the General Permit to provide effective reduction or elimination of sediment related pollutants in stormwater discharges and authorized non-stormwater discharges from the Site. Applicable BMPs are identified in this section for erosion control, sediment control, tracking control, and wind erosion control.

3.2.1 Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles.

Erosion Control BMPs are the most effective type of BMP for minimizing sediment runoff from construction sites. All projects, regardless of risk level, are required to install and maintain effective temporary erosion controls throughout the entirety of construction. Attachment D Section II.D of the CGP describes the requirements for erosion control for traditional risk level projects. All projects must implement the following minimum practices for effective temporary soil stabilization during construction:

a. Implement effective wind erosion control;
b. Preserve existing vegetation;
c. Minimize the amount of soil exposed during construction activity;
d. Minimize the disturbance of steep slopes;
e. Schedule earthwork to minimize the amount of disturbed area when feasible;
f. Immediately initiate stabilization for disturbed areas whenever earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days;
g. Minimize soil compaction in areas other than where the intended function of a specific area dictates that it be compacted;
h. Reestablish vegetation or non-vegetative erosion controls as soon as practicable;
i. If feasible, divert up gradient run-on water from contacting areas of exposed soils disturbed by construction activities or convey run-on through the site in a manner that prevents erosion from areas of construction and does not compromise the effectiveness of erosion, sediment, and perimeter controls;
j. Run-on water flowing onto a site from off-site areas may be separated from a site's stormwater discharge to eliminate commingled contribution. Run-on diversion shall occur prior to entering an area affected by construction activity. Run-on flow diversion shall be conveyed through or around the construction activity in plastic pipe or an engineered conveyance channel in a manner that will not cause erosion due to flow diversion. Run-on combined with a site's stormwater discharge is considered a stormwater discharge.
k. Limit the use of plastic materials when more sustainable, environmentally friendly alternatives exist. Where plastic materials are deemed necessary, the discharger shall consider the use of plastic materials resistant to solar degradation;

l. Control stormwater and non-stormwater discharges to minimize downstream channel and bank erosion; and

m. Control peak flowrates and total volume of stormwater and authorized non-stormwater discharges to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points.

Sufficient erosion control BMPs, (except from sprayed products) must be available on-site, or at a nearby location (e.g., common laydown yard) year-round with trained persons able to deploy the products under the direction of the QSP. This includes implementation requirements for active and non-active areas that require deployment before the onset of rain.

Implementation and locations of temporary erosion control BMPs are shown on the Site Maps in Appendix B and described in this section. The following erosion control BMP consideration checklist indicates the BMPs that will be implemented to control erosion on the construction site. The following list of BMPs also includes narrative explaining how the selected BMPs will be incorporated into the project:

Table 5 Temporary Erosion Control BMPs[1]

BMP No.	BMP	MINIMUM BMP REQUIREMENT	CHECK IF USED	DESCRIBE SPECIFICALLY WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE
N/A	Soil cover for inactive areas (minimum BMP for all projects)	✓(2)	☐		
N/A	Runoff control and soil stabilization for active areas (Risk Level 2)	✓(2)	☐		
N/A	Limit use of plastic erosion control materials (minimum BMP for all projects)	✓(2)	☐		
N/A	Minimize exposure time of DSA	✓(2)	☐		
WE-1	Wind Erosion Control		☐		
EC-1	Scheduling	✓	☐		
EC-2	Preservation of Existing Vegetation	✓	☐		
EC-3	Hydraulic Mulch	✓(2)	☐		
EC-4	Hydroseeding		☐		
EC-5	Soil Binder	✓(2)	☐		
EC-6	Straw Mulch	✓(2)	☐		
EC-7	Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats	✓(2)	☐		
EC-8	Wood Mulching	✓(2)	☐		
EC-9	Earth Dikes/Drainage Swales & Lined Ditches		☐		
EC-10	Outlet Protection/ Velocity Dissipation Devices		☐		
EC-11	Slope Drains		☐		
EC-12	Streambank Stabilization		☐		
EC-14	Compost Blanket		☐		
EC-15	Soil Preparation/Roughening		☐		

EC-16	Non-Vegetative Stabilization		☐		

1 – The QSD must specify and QSP must implement an effective form of erosion control during all phases of construction including demolition, grading, utilities, and vertical construction.
2 - The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's DSA protection requirements.

Implementation of Erosion Control BMPs

- All inactive areas are required to have temporary erosion control BMPs implemented and maintained througout the year. The QSP must monitor the weather using National Weather Service reports (https://www.weather.gov/) to track conditions and alert crews to the onset of precipitation events.
- Disturbed soil areas must be stabilized with temporary or permanent erosion control before precipitation events.
- Prior to forecasted precipitation events, temporary erosion control BMPs msut be deployed and inspected.
- The project schedule should sequence construction activities with the installation of erosion control measures. The construction schedule will be arranged as much as practicable to leave existing vegetation undisturbed until immediately prior to grading.

Grading activities are anticipated to occur between (insert dates). Insert description of construction scheduling activities (e.g., all BMPs shall be in place year-round). Construction activities shall be scheduled and performed to minimize the area and duration of exposure of soil to erosion by wind, rain, runoff and vehicle tracking. The area that can be cleared or graded and left exposed at one time is limited to the amount of acreage that the Contractor can adequately protect prior to a predicted Qualifying Precipitation Event. A Qualifying precipitation event is any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a Quantitative Precipitation Forecast (QPF) of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast. The timing of construction shall be considered when scheduling work to minimize soil-disturbing activities and major grading operations during the rainy season.

The erosion controls described in Table 5 will be implemented at the project construction site. Only areas necessary for construction should be disturbed, cleared, or graded. Areas of vegetation to be protected will be clearly designated as no disturbance areas on the plans and flagged in the field to exclude construction vehicles. Specific shrubs and trees to be preserved should be clearly marked.

Disturbed areas on the site are shown on the Site Maps in Appendix B. Land grading will be performed to minimize erosion and protect vegetation. Disturbed areas of the construction site that will not be re-disturbed will be stabilized within 14 days after the last disturbance.

Wind Erosion Control measures (WE-1) will be used to stabilize soil from wind erosion, and reduce dust generated by construction activities including grading, demolition and travel on unpaved temporary roads. Dust control shall be provided daily or more often by the application of water. Care shall be taken to prevent over-watering, which may result in runoff or erosion.

Heavily traveled earthen roads will be stabilized utilizing BMP TC-2 (Stabilized Construction Roadway) and/or sprayed daily by a water truck for dust suppression. Care will be taken to spray additional areas of exposed soil as necessary during windy periods. Only the minimum amount of water will be used; no runoff will result from this practice.

3.2.2 Sediment Controls

Sediment controls are structural measures that are intended to complement and enhance the erosion control BMPs and reduce sediment discharges from construction sites. A site cannot rely solely on sediment control BMPs to meet the NALs/NELs listed in the CGP. All projects must use sediment control BMPs in conjunction with erosion control BMPs BMPs on exposed soils, especially prior to rain events.

Specific sediment control measures to be implemented and maintained at the project site are selected and described below. BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix M. If there is a conflict between documents, the Site Map(s) will prevail over narrative in the body of the SWPPP and over guidance in the BMP Fact Sheets. Site specific details in the Site Map(s) prevail over standard details included in the BMP Fact Sheets. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Table 6 Temporary Sediment Control BMPs[1]

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE
SE-1	Silt Fence	✓(3)	☐		
SE-2	Desilting Basin	✓(3)	☐		
SE-3	Sediment Trap	✓(3)	☐		
SE-4	Check Dam	✓(3)	☐		
SE-5	Fiber Rolls[2]	✓(3)	☐		
SE-6	Gravel Bag Berm	✓(3)	☐		
SE-7	Street Sweeping and Vacuuming	✓	☐		
SE-10	Storm Drain Inlet Protection	✓	☐		
SE-12	Manufactured Linear Sediment Controls	✓(3)	☐		
SE-13	Compost Socks and Berms	✓(3)	☐		
SE-14	Biofilter Bags		☐		
TC-1	Stabilized Construction Entrance/Exit	✓(3)	☐		

TC-2	Stabilized Construction Roadway		☐		
TC-3	Entrance/Exit Tire Wash		☐		
1 – The QSD must specify and QSP must implement an effective form of erosion control during all phases of construction including demolition, grading, utilities, and vertical construction. 2 – See Table 7 for fiber roll installation specific to the face of slopes. 3 – The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's DSA protection requirements.					

Prior to any ground-disturbing activities, including grading, demolition, or vegetation removal, sediment controls will be placed around the site perimeter. Vegetative buffers will be maintained wherever possible. Construction entrances and exits will be stabilized and inlet protection will be placed at all storm drain inlets that could receive runoff from the construction site.

If sediment basins are constructed, they must be designed according to the CASQA BMP Handbook. In general sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. For drainage locations with 5 or fewer disturbed acres, temporary sediment traps, silt fences or equivalent measures will be installed along the downhill boundary of the construction site.

Perimeter sediment controls, including controls along the physical site perimeter and at active storm drain inlets, and sediment traps, shall be implemented prior to the start of construction and maintained throughout the duration of construction activities.

Locations for specific sediment control measures for the project are included on the Site Maps located in Appendix B of this SWPPP.

The construction site will be managed to minimize the amount of dirt, mud, or dust that is generated and can thus be tracked or blown off the site. The Contractor shall provide a stabilized construction entrance (TC-1) to reduce offsite tracking. A wheel wash (TC-3) shall be used in problem areas with fine grain soils or where offsite tracking cannot be controlled by a stabilized construction entrance and sweeping. All dirt and/or debris tracked or transported to offsite paved surfaces shall be removed at the end of each workday by hand sweeping or mechanized sweeper. Washing of sediment from the right-or-way shall be prohibited.

Additional Sediment Controls for Risk Level 2 Projects (should be reflected in Table 7)

☐ Applicable ☐ Not Applicable

Additional Risk Level 2 Requirements

Aside from the erosion and sediment control BMPs described above in Tables 5 and 6, all Risk Level 2 projects must also implement additional BMPs. Those additional BMPs are listed in the CGP as such:

1. Design and construct cut and fill slopes in a manner to ensure slope stability and to minimize erosion including, but not limited to, these practices:
   - Reduce continuous slope length using terracing and diversions;
   - Reduce slope steepness; and
   - Roughen slope surfaces with large cobble or track walking.

2. Install linear sediment controls along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes according to sheet flow lengths as shown in Table 7 until the slope has reached Notice of Termination conditions for erosion protection. When infeasible to comply with Table 7 due to site-specific geology or topography, the QSD shall include in the SWPPP a justification for the use of an alternative method to protect slopes from erosion and sediment loss.

Table 7 Critical Slope And Sheet Flow Length Combinations For Linear Sediment Reduction Barrier

Slope Ratio (Vertical to Horizontal)	Sheet flow length not to exceed
≤ 1:20	Per QSD's specification
>1:20 to ≤ 1:4	35 feet
> 1:4 to ≤ 1:3	20 feet
> 1:3 to ≤ 1:2	15 feet
> 1:2	10 feet

1. Limit construction activity traffic to and from the project to entrances and exits that employ effective controls to prevent off-site tracking of sediment.
2. Maintain and protect all storm drain inlets, perimeter controls, and BMPs at entrances and exits (e.g., tire wash off locations).
3. Remove any excess sediment or other construction activity-related materials that are deposited on the impervious roads by vacuuming or sweeping prior to any precipitation event.
4. Implement additional site-specific sediment controls upon written request by the Regional Water Boards when the implementation of the other requirements in this Section are determined to inadequately protect the site's receiving water(s).

Implementation of Temporary Sediment Controls

- Temporary sediment control BMPs must be deployed througout the year.
- Temporary sediment controls will be implemented year round at the downgradient perimeter of disturbed soil areas and at the storm drain downstream from disturbed areas before rain events.
- Storm drain inlet protection will be used at all operational internal inlets to the storm drain system during the project as shown on the WPCDs.
- As shown on the WPCDs, sediment contols will be deployed along the toe of exterior slopes to improve settling of sediment in stormwater runoff.

3.3 NON-STORMWATER CONTROLS AND WASTE AND MATERIALS MANAGEMENT

RECOMMENDED TEXT

3.3.1 Non-Stormwater Controls

Non-stormwater management BMPs involve good housekeeping practices to prevent non-stormwater discharges from entering the storm drain and source control of potential pollutants to prevent them from coming into contact with runoff. Categories of non-stormwater management include paving operations management, pesticide and fertilizer management, vehicle and equipment cleaning, fueling, and maintenance, and painting controls. The following considerations should be taken into account when determining the type or BMPs selected in Table 8. The selection of non-stormwater BMPs is based on the list of construction activities with a potential for non-stormwater discharges identified in Section 2.6 of this SWPPP.

Paving and Grinding Operations
In order to reduce the potential for the transport of pollutants in stormwater runoff from paving operations, paving shall be rescheduled if rain is forecasted. If paving does occur within 72 hours of a precipitation event, catch basin filters, or other appropriate BMPs will be utilized to trap hydrocarbons.

Any pavement cutting waste, generated by pavement cutting activities, shall be vacuumed up and disposed of immediately (NS-3)

Pesticide and Fertilizer Use
Apply pesticides only as specified on the “Pesticide Use Recommendation” on the label. The pesticide label is considered the law. Use of a pesticide inconsistent with the label is considered a violation. Minimize the use of pesticides in and near the storm drainage system or watercourses. Record the use of all pesticides. Avoid applying pesticides before a predicted rain event. Only pesticides that have been authorized for use through the California Department of Pesticide Regulation.

Apply only the type and quantity of fertilizer needed, based on the fertility of the soil and the type of vegetation. Do not over-irrigate following fertilizer application. Do not apply fertilizer before a predicted rain event.

Vehicle and Equipment Cleaning, Fueling and Maintenance

Vehicles and heavy machinery are a potential source of pollutants such as petroleum products, antifreeze, and exhaust and waste oil containing heavy metals. Pollutants may enter stormwater runoff by means of direct contact with machine parts and by contact with spills on surfaces and the ground. On-site vehicle and equipment fueling and maintenance are prohibited unless specific provisions to contain and dispose of fluid drips and spills are implemented and approved by District in the SWPPP.

Table 8 Non-Stormwater Management BMPs

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE
NS-1	Water Conservation Practices	✓(1)	☐		
NS-2	Dewatering Operations	✓	☐		
NS-3	Paving and Grinding Operations	✓(1)	☐		
NS-4	Temporary Stream Crossing		☐		
NS-5	Clear Water Diversion		☐		
NS-6	Illicit Discharge/Illegal Dumping Reporting	✓(2)	☐		
NS-7	Potable Water/Irrigation	✓(1)	☐		
NS-8	Vehicle and Equipment Cleaning	✓(2)	☐		
NS-9	Vehicle and Equipment Fueling	✓	☐		
NS-10	Vehicle and Equipment Maintenance	✓	☐		
NS-11	Pile Driving Operations		☐		
NS-12	Concrete Curing		☐		
NS-13	Concrete Finishing		☐		

NS-14	Material and Equipment Use Over Water		☐		
NS-15	Structure Demolition/Removal Over or Adjacent to Water		☐		
NS-16	Temporary Batch Plants		☐		
1 – The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's DSA protection requirements. 2 – Failure to implement WQIP BMPs which target priority pollutants including metals, trash and bacteria will result in an automatic administrative citation.					

RECOMMENDED TEXT

3.3.2 Materials Management and Waste Management

Materials management control practices consist of implementing procedural and structural BMPs for handling, storing and using construction materials to prevent the release of those materials into stormwater discharges. The amount and type of construction materials to be utilized at the site will depend upon the type of construction and the length of the construction period. The materials may be used continuously, such as fuel for vehicles and equipment, or the materials may be used for a discrete period, such as soil binders for temporary stabilization.

Waste management consist of implementing procedural and structural BMPs for handling, storing and ensuring proper disposal of wastes to prevent the release of those wastes into stormwater discharges. [If applicable to the project site, waste management should be conducted in accordance with the Project's Construction Waste Management Plan.]

Materials and waste management pollution control BMPs shall be implemented to minimize stormwater contact with construction materials, wastes and service areas; and to prevent materials and wastes from being discharged offsite. The primary mechanisms for stormwater contact that shall be addressed include:

- Direct contact with precipitation.
- Contact with stormwater run-on and runoff.
- Wind dispersion of loose materials.
- Direct discharge to the storm drain system through spills or dumping.
- Extended contact with some materials and wastes, such as asphalt cold mix and treated wood products, which can leach pollutants into stormwater.

Specific material management and waste management control measures to be implemented and maintained at the project site are described in Table 9 below. BMPs shall be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix M. If there is a conflict between documents, the Site Maps will prevail over narrative in the body of the SWPPP and over guidance in the BMP

Fact Sheets. Site specific details in the Site Maps prevail over standard details included in the BMP Fact Sheets. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Table 9 Waste Management and Materials Pollution Control BMPs

BMP No.	BMP	BMP MINIMUM REQUIREMENT	CHECK IF USED	DESCRIBE WHERE AND HOW THE BMP WILL BE USED OR DESCRIBE WHY BMP WAS NOT SELECTED	CONSTRUCTION PHASE
WM-1	Material Delivery and Storage	✓(2)	☐		
WM-2	Material Use	✓(2)	☐		
WM-3	Stockpile Management	✓(3)	☐		
WM-4	Spill Prevention and Control	✓(2)	☐		
WM-5	Solid Waste Management	✓(2)	☐		
WM-6	Hazardous Waste Management	✓(1)(2)	☐		
WM-7	Contaminated Soil Management	✓(1)(2)	☐		
WM-8	Concrete Waste Management	✓(1)	☐		
WM-9	Sanitary/Septic Waste Management	✓(1)(2)	☐		
WM-10	Liquid Waste Management		☐		
PO-18	Cover Stockpiles of Treated Lumber During Wet Weather	✓(2)	☐		

1 – The Contractor shall select one of the measures listed or a combination thereof to achieve and maintain the contract's DSA protection requirements.
2 – Failure to implement WQIP BMPs which target priority pollutants including metals, trash and bacteria will result in an automatic administrative citation.
3 – The following BMPs are required when implementing stockpiles during construction:

- Stockpiles must be protected to prevent discharge of sediment or other pollutants beyond the immediate area of the stockpile and offsite either by transport via wind or water.
- All stockpiles must be stabilized at the end of each day. In addition, all stockpiles must be bermed (i.e. perimeter controls) at the end of each day.
- Stockpiles in the right-of-way must be stabilized with an erosion control product and bermed (i.e. perimeter control) at the end of each day.

- All stockpiles must be stabilized with an erosion control product and bermed (i.e. perimeter control) prior to rain.
- For stockpiles where only a portion (or "face") is actively being used, the remaining inactive portion (or faces) must be designated on the site map and always stabilized with an erosion control product and bermed. Active faces must be bermed and stabilized at the end of each day and prior to rain as described above.
- Stockpile perimeter controls must be inspected daily by the Contractor for sediment accumulation. Sediment accumulation must be removed when sediment reaches 1/3 of BMP height and prior to a rain event. For perimeter controls within the right-of-way, sediment accumulation must be removed daily and prior to rain event.
- All stockpiles must be placed at least 18 inches from the curb face and are prohibited where they obstruct flow including storm drain inlets and drainage ditches.

Many materials used in construction can contribute pollutants to stormwater runoff. Examples of such materials include vehicle fuels, oils, and antifreeze. Any materials being stored which could release constituents by wind or runoff transport shall be protected by overhead cover, secondary containment, tarpaulins, or other methods approved by the QSD. All construction materials will be delivered to and stored in designated areas at the construction site (WM-1). The main loading, unloading, and access areas should be located away from storm drain inlets and channels. The Contractor will construct enclosures or flow barriers (berms) around these areas to prevent stormwater flows from entering storm drains or receiving waters, and to control the discharge of sediments and other pollutants.

Material Use

All hazardous material will be stored in covered, sealed containers, within a bermed area. The bermed storage area will be covered to prevent contact with stormwater.

Stockpiles

Stockpiles will be covered or protected by soil stabilization measures when not in use and at the end of each day throughout the term of the contract (WM-3). Stockpiles shall be protected with temporary perimeter sediment barriers as berms at the end of each day.

Spill Prevention and Control

The following measures will be undertaken at the site to prevent or reduce the discharge of pollutants to stormwater from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees (describe BMP measures):

The spill equipment will be located in the following areas: (QSP to list areas)

In the event of a spill, follow reporting procedures presented in Section 3.3.3.

Waste Management

There will be designated temporary waste storage areas on the site. When practical, waste will be stored within covered dumpsters. All waste materials will be removed by the Contractor or a licensed subcontractor. The disposal of excess material offsite must comply with all Federal, State, and local regulations.

Compliance with State/Local Sanitary Waste Regulations

The following measures will be implemented to ensure compliance with local, State and Federal waste disposal, sanitary sewer or septic system regulations:

- Portable sanitary facilities will be transported to and from the site by a licensed contractor, placed in a convenient location and maintained in good working order by a licensed service.
- Untreated wastewater will never be discharged to surface waters or on-site storm drains and will never be buried.

Hazardous Materials and Waste Management

The following BMPs will be implemented to minimize or eliminate the discharge of pollutants from construction site hazardous waste and materials to the storm drain system or to watercourses (insert BMPs e.g. store within bermed and covered area).

Contaminated Soil Management

A number of practices occurring during construction may lead to contamination of soils. For example, leaks and spills of petroleum products from leaking vehicles and routine vehicle and equipment maintenance can cause soil contamination or areas of historic contamination may be encountered. All contaminated soils resulting from vehicle leaks or maintenance must be removed and disposed of correctly (WM-7). No contaminated soils shall be buried or otherwise disposed on site.

Concrete Waste Management

Whenever possible, concrete trucks will be washed-out offsite in designated areas. If washout must occur on site, concrete washout facilities shall be provided and properly maintained by the Contractor. Facilities shall be maintained with a minimum 12” freeboard and cleaned or replaced when the washout is 75% full. No overflow from concrete washouts is permitted to runoff the site. Upon completion of the concrete work, the concrete will be broken up, removed, and reused on site or hauled away (WM-8). Washing of fresh concrete will be avoided, unless runoff can be drained to a bermed or level area, away from storm drain inlets and channels.

3.3.3 District Spill Reponses and Reporting Procedures

Proper disposal of all spill cleanup material will be done within 24 hours of the incident.

Non-Stormwater Discharges

All non-stormwater discharges that enter a storm drain and/or enter San Diego Bay shall be immediately abated and cleaned. Notification of the spill is to be made to the District Environmental Protection Department at 619-686-6254 or at swpollutionprevention@portofsandiego.org Sampling of non-stormwater shall be in accordance with the CSMP Section 7.7.3. Documentation of the non-stormwater release and response activities will be recorded on Site Visual Inspection Form and Discharge Form located in Appendix H.

Sewage and Petroleum Discharges

All sewage or petroleum spills that enter a storm drain and are not fully contained, and/or reach San Diego Bay, or spills 5 gallons or greater of potentially hazardous materials, and/or any spill of hazardous material of Federal Reportable Quantity (as established under 40 CFR Parts 110, 117, or 302), shall be documented in the Spill Log located in Appendix H and the Project Superintendent shall notify the San

Diego Harbor Police Department (619-686-6272) who will notify the National Response Center by telephone at (800) 424-8802, for any petroleum spill that reaches San Diego Bay, if appropriate. The National Response Center will then notify the Coast Guard. The Project Superintendent shall notify the County of San Diego Department of Environmental Health (619-338-2222) for any sewage spill that reaches San Diego Bay or any waters of the state. The Project Superintendent will submit a written description of the release to EPA Region 9, including the date, circumstances of the incident, and steps taken to prevent another release within 14 days, if a Federal Reportable Release occurred. A copy of this report is to be submitted to the District Environmental Protection Department.

SWPPP Reportable Quantity Releases

This table will be completed for any release of petroleum products or sewage that enters a storm drain and are not fully contained and/or reach San Diego Bay; any release 5 gallons or greater of potentially hazardous material, and/or any Reportable Quantity spill of hazardous materials (as established under 40 CFR Part 110[1], 40 CFR Part 117[2], or 40 CFR 302[3]) that occurs on site.

1. 40 CFR Part 110 addresses the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Clean Water Act.
2. 40 CFR Part 117 addresses the determination of such quantities of hazardous substances that may be harmful pursuant to Section 311(b)(3) of the Clean Water Act.
3. 40 CFR Part 302 addresses the designation, reportable quantities, and notification requirements for the release of substances designated under Section 311(b)(2)(A) of the Clean Water Act.

3.4 POST CONSTRUCTION STORMWATER MANAGEMENT MEASURES

INSTRUCTIONS

Select Appropriate Scenario and modify text accordingly

RECOMENDED TEXT

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate pollutant discharges from the site after construction is completed.

The following text is for all projects and should be modified accordingly

Proper operation and maintenance will be implemented by the (District or tenant) for permanent structural BMPs so that they continue to function as designed. This is especially important for treatment controls (e.g., on-site retention or detention basins, vegetated swales, catch basin filters or inserts), since their routine maintenance involves activities such as sediment removal, vegetation management, and replacement of filters or inserts.

A plan for post construction BMP funding and maintenance has been developed to address at a minimum, five years following construction. The post construction BMPs that are described in (SWQMP Reference or below in Tables 10 and 11) shall be funded and maintained by the (District or tenant). The SWQMP must be submitted with the NOI as one of the required Permit Registration Documents (PRDs).

For projects with a site specific SWQMP

This site is subject to a Phase I MS4 permit. Post construction runoff reduction requirements have been satisfied through the MS4 program; this project is exempt from the post-construction requirements of the General Permit. All required treatment BMPs have been designed to meet the Stormwater Quality

Management Plan (SWQMP) numerical sizing requirements and are described in the project SWQMP (SWQMP reference).

For project without a site specific SWQMP

This site is subject to a Phase I MS4 permit, and post construction runoff reduction requirements have been satisfied through the MS4 program, this project is exempt from the post-construction requirements of the CGP. This project does not have a site specific SWQMP, the post construction BMPs that will be implemented are described below.

Table 10 Post-Construction Site Design BMP

(Double click the check boxes to edit)

Minimizing Impervious Areas ☐ Reduce sidewalk widths ☐ Incorporate landscaped buffer areas between sidewalks and streets. ☐ Design residential streets for the minimum required pavement widths. ☐ Minimize the number of residential street cul-de-sacs and incorporate landscaped areas to reduce their impervious cover. ☐ Use open space development that incorporates smaller lot sizes. ☐ Increase building density while decreasing the building footprint. ☐ Reduce overall lot imperviousness by promoting alternative driveway surfaces and shared driveways that connect two or more homes together. ☐ Reduce overall imperviousness associated with parking lots by providing compact car spaces, minimizing stall dimensions, incorporating efficient parking lanes, and using pervious materials in spillover parking areas.
Increase Rainfall Infiltration ☐ Use permeable materials for private sidewalks, driveways, parking lots, and interior roadway surfaces (examples: hybrid lots, parking groves, permeable overflow parking, etc.). ☐ Direct rooftop runoff to pervious areas such as yards, open channels, or vegetated areas, and avoid routing rooftop runoff to the roadway or the urban runoff conveyance system.
Maximize Rainfall Interception ☐ Maximizing canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs.
Minimize Directly Connected Impervious Areas (DCIAs) ☐ Draining rooftops into adjacent landscaping prior to discharging to the storm drain. ☐ Draining parking lots into landscape areas co-designed as biofiltration areas. ☐ Draining roads, sidewalks, and impervious trails into adjacent landscaping.
Slope and Channel Protection ☐ Use of natural drainage systems to the maximum extent practicable. ☐ Stabilized permanent channel crossings. ☐ Planting native or drought tolerant vegetation on slopes. ☐ Energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels.
Maximize Rainfall Interception ☐ Cisterns. ☐ Foundation planting.
Increase Rainfall Infiltration ☐ Dry wells.
Other BMPs (describe and add lines as necessary)

The following source control post-construction BMPs to comply with CGP Section IV.N and local requirements have been identified for the site:

Table 11 Post-Construction Source Control BMPs

☐ Storm drain system stenciling and signage.
☐ Outdoor material and trash storage area designed to reduce or control rainfall runoff.
☐ Landscape Irrigation Controls.
☐ Street Sweeping and Catch Basin Cleaning.
☐ Other BMPs (describe/ add lines as necessary).
Public Education ☐ Training for building owners/managers. ☐ Brochures/flyers on stormwater pollution control. ☐ Good housekeeping practices (proper waste disposal, etc.).
☐ Hazardous Waste Collection.
☐ Landscape Irrigation Controls.
☐ Reduction of Vehicle Use Impacts.
☐ Storage and Application of Fertilizers, Pesticides and Other Landscape Management Products.

Section 4 BMP Inspection and Maintenance

4.1 BMP INSPECTION AND MAINTENANCE

RECOMMENDED TEXT

The General Permit requires routine weekly inspections of BMPs, along with inspections before, during, and after Qualifying Precipitation Events. The CGP defines a Qualifying Precipitation Event as any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a Quantitative Precipitation Forecast (QPF) of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast.A BMP inspection checklist must be filled out for inspections and maintained on-site with the SWPPP. Refer to Construction Site Monitoring Plan (CSMP) (Section 7) for rain event inspection information. The inspection checklist includes the necessary information covered in Section 7.6. Inspection and monitoring records shall be kept in Appendix H.

BMPs shall be maintained regularly to ensure proper and effective functionality. If necessary, corrective actions shall be begin within 72 hours of identified deficiencies and associated amendments to the SWPPP shall be prepared by the QSD.

Specific details for maintenance, inspection, and repair of BMPs selected for this site can be found in the BMP Factsheets in Appendix M.

Section 5 Training

RECOMMENDED TEXT

Appendix K identifies the QSP(s) for the project. To promote stormwater management awareness specific for this project, periodic training of job-site personnel shall be included as part of routine project meetings (e.g. daily/weekly tailgate safety meetings), or task specific trainings as needed.

The QSP shall be responsible for providing this information at the meetings, and subsequently completing the training logs shown in Appendix J, which identifies the site-specific stormwater topics covered as well as the names of site personnel who attended the meeting. Tasks may be delegated to trained employees by the QSP provided adequate supervision and oversight is provided. Training shall correspond to the specific task delegated including: SWPPP implementation; BMP inspection and maintenance; and record keeping.

Documentation of training activities (formal and informal) is retained in SWPPP Appendix J.

Section 6 Responsible Parties and Operators

6.1 RESPONSIBLE PARTIES

RECOMMENDED TEXT

Discharger

The discharger is a person as defined in Water Code, § 13050(c), which includes companies and governmental bodies, subject to this General Permit. The discharger is responsible for compliance with this Permit, including work done by QSDs, QSPs, and QSP delegates. The following persons may serve as the discharger:

1. A person, company, agency, or other entity that possesses a real property interest (including, but not limited to, fee simple ownership, easement, leasehold, or other rights of way) in the land upon which the construction or land disturbance activities will occur for the regulated site.
2. For linear underground and overhead projects, the utility company, municipality, or other public or private company or agency that owns or operates the linear underground or overhead project.
3. For land controlled by an estate or similar entity, the person who has day-to-day control over the land (including, but not limited to, a bankruptcy trustee, receiver, or conservator).
4. For pollution investigation and remediation projects, any potentially responsible party that has received permission to conduct the project from the holder of a real property interest in the land.
5. For U.S. Army Corps of Engineers projects, the U.S. Army Corps of Engineers may provide written authorization to its bonded contractor to serve as the discharger, provided the U.S. Army Corps of Engineers is also responsible for compliance with the General Permit, as authorized by the Clean Water Act or the Federal Facilities Compliance Act.
6. For projects on public lands, a public agency with a real property interest in the land may provide written authorization via an encroachment permit to another public agency to serve as the discharger, provided that both public agencies remain responsible for compliance with this General Permit.

A contractor is qualified to be a discharger if the contractor satisfies one of the requirements above.

Duly Authorized Representative (DAR)

A Duly Authorized Representative is a named individual or position that has responsibility for the overall operation of the regulated construction project or activities including, but not limited to, a superintendent, project manager, or other positions of equivalent or higher responsibility. Additionally, an individual or position that has overall responsibility for environmental matters for the owner or company may be designated as a Duly Authorized Representative. The Legally Responsible Person designates the Duly Authorized Representative through SMARTS, authorizing the Duly Authorized Representative to sign, certify, and electronically submit Permit Registration Documents, Notices of Termination, and any other supporting documents, reports, or information required by this General Permit, the State or Regional Water Boards, or U.S. EPA. A Duly Authorized Representative cannot be a contractor, consultant, or other third party.

Legally Responsible Person

The Legally Responsible Person is a representative of a permittee and signatory that is legally designated to sign, certify, and electronically submit any documents required by the General Permit, the State or Regional Water Board, or U.S. EPA. An LRP must meet one of the descriptions set forth in the CGP.

Qualified SWPPP Practitioner:

The QSP shall ensure that all BMPs required by the General Permit and this SWPPP are implemented. In general the QSP is responsible for non-stormwater and stormwater visual observations, sampling and analysis. The QSP contact information and responsibilities for this project are listed below. Note: A QSD can serve the role of the QSP also. The QSP(s) are indentified in Appendix K.

Qualified SWPPP Designer

The discharger shall retain a QSD from the beginning of the project through the Notice of Termination approval.

A QSD is required to assess how construction activities will affect sediment transport, erosion, and other discharges of pollutants in stormwater runoff in the SWPPP design and implementation.

The QSD is required to revise the SWPPP to address potential problems identified by visual inspections, sampling data, comments from a QSP, or their own site observations. All SWPPP revisions must be completed by a QSD.

The QSD is required to include in the SWPPP the name, email, and phone number of all the QSP-trained delegate(s) (if applicable).

6.2 CONTRACTOR LIST

INSTRUCTIONS

The General Permit requires that the SWPPP include a list of names of all contractors, subcontractors and individuals who will be directed by the QSP.

Include this list in Appendix L.

RECOMMENDED TEXT

Appendix L includes a list of all contractors, subcontractors and individuals that will be directed by the QSP for actives covered under this SWPPP. At a minimum the following information shall be included:

- Name
- Title
- Company
- Address
- Phone Number
- Number (24/7)

Section 7 Construction Site Monitoring Program

7.1 Purpose

To ensure the BMPs, described in Section 3 and detailed on the multiple construction phased WPCDs in Appendix B, are effective and adequate to meet the discharge prohibitions outlined in the CGP, a Construction Site Monitoring Program (CSMP) is required. This CSMP will be amended, if necessary, as risk level requirements, or site conditions change.

The techniques and methodologies for collection of stormwater and analyses of water quality constituents are briefly described in this CSMP; other specific details should be referred to sampling and analysis guidance developed by the U.S. Environmental Protection Agency (EPA), and the Surface Water Ambient Monitoring Program's (SWAMP) information on sample collection and analysis and Standard Methods for Examination of Water and Wastewater, available at http://www.waterboards.ca.gov/water_issues/programs/swamp/.

In general, the CSMP should not include details of ATS monitoring; however, it should provide reference to those monitoring documents.

Risk Level 1 Projects may delete text related to NALs.

RECOMMENDED TEXT FOR ALL PROJECTS

This CSMP has been prepared to meet the requirements of the CGP and including the following:

- Visual inspection locations, inspection procedures, and follow-up tracking procedures.
- Applicable sampling locations, collection, and handling procedures shall include detailed procedures for field analysis, sample collection, storage, preservation, and shipping to the laboratory to ensure consistent quality assurance and control is maintained.
- A copy of the Chain of Custody form used when handling and shipping samples to a laboratory.
- Identification of the analytical methods and related method detection limits (if applicable) for each parameter.

7.2 Applicability of Permit Requirements

INSTRUCTIONS

Select text for appropriate risk level and delete other text

RECOMMENDED TEXT FOR ALL PROJECTS

This project has been determined to be a Risk Level (Enter Number) project. The CGP identifies the following types of monitoring as being applicable for a Risk Level (Enter Number) project.

Risk Level 1

- Visual inspections of BMPs;
- Visual monitoring of the site related to qualifying storm events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for non-visible pollutants when applicable; and
- Sampling and analysis of construction site runoff as required by the RWQCB when applicable.

Risk Level 2

- Visual inspections of BMPs;
- Visual monitoring of the site related to Qualifying Precipitation Events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for pH and turbidity related to Qualifying Precipitation Events ;
- Sampling and analysis of construction site runoff for non-visible pollutants when applicable; and
- Sampling and analysis of non-stormwater discharges when applicable.

7.3 Weather and Precipitation Event Tracking

Weather triggered visual monitoring, sampling and inspection requirements of the General Permit are triggered by a Qualifying Precipitation Event. The General Permit defines a Qualifying Precipitation Event as any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a Quantitative Precipitation Forecast (QPF) of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast. Precipitation forecast information shall be obtained from the National Weather Service Forecast Office by entering the zip code of the project's location at https://www.weather.gov/ and shall be included as part of the inspection checklist weather information section.

7.3.1 Weather Tracking

The QSP must consult the National Oceanographic and Atmospheric Administration (NOAA) for the weather forecasts. These forecasts must be obtained at https://www.weather.gov/ .

7.3.2 Rain Gauges

The QSP shall install a rain gauge(s) on the project site. Locate the gauge in an open area away from obstructions such as trees or overhangs. Mount the gauge on a post at a height of 3 to 5 feet with the gauge extending several inches beyond the post. Make sure that the top of the gauge is level. Make sure the post is not in an area where rainwater can indirectly splash from sheds, equipment, trailers, etc.

Record the rain gauge reading for each 24-hour period of a QPE. The rain gauge should be read daily at approximately the same time. Once the rain gauge reading has been recorded accumulated rain shall be emptied and the gauge reset. If total rainfall is greater than 0.5 inches the QSP shall prepare a Post-Qualifying Precipitation Event inspection Site Visual Inspection Form within 96 hours of the conclusion of the Qualifying Precipitation Event. If an electronic rain gauge is used the manufacturer's instructions for reading and resetting the rain gauge shall be followed.

For comparison with the site rain gauge, the nearest appropriate governmental rain gauge(s) is located at [Insert location and web site of the applicable governmental rain gauge(s)].

7.4 Monitoring Location and Personnel

INSTRUCTIONS

Select appropriate scenario and delete other

RECOMMENDED TEXT FOR ALL PROJECTS

Monitoring locations are shown on the Site Maps located in Appendix B. Monitoring locations are described in Sections 7.6 and 7.7.

Whenever changes in the construction site might affect the appropriateness of sampling locations, the sampling locations shall be revised accordingly. All such revisions shall be implemented as soon as feasible and the SWPPP amended. Temporary changes that result in a one-time additional sampling locations do not require a SWPPP amendment.

Samples will be collected and analyzed by:

Contractor	☐ Yes	☐ No
Consultant	☐ Yes	☐ No
Laboratory	☐ Yes	☐ No

Include the following text if samples will be collected by contractor and modify accordingly

Samples on the project site will be collected by the following contractor sampling personnel:

Name/Telephone Number:

Alternate(s)/Telephone Number:

Include the following text if samples will be collected by consultant or laboratory and modify accordingly

Samples on the project site will be collected by the following (specify name of laboratory or environmental consultant)

Company Name:

Street Address:

City, State, Zip:

Telephone Number:

Point of Contact:

Name of Sampler(s):

7.5 Safety and Monitoring Exemptions

This project is not required to collect samples or conduct visual observations (inspections) under the following conditions:

- During dangerous weather conditions such as electrical storms, flooding, and high winds above 40 miles per hour;
- Outside of scheduled site business hours.
- When the site is not accesible to personnel.

Scheduled site business hours are located in Table 1

If monitoring (visual monitoring or sample collection) of the site is unsafe because of the dangerous conditions noted above, then the QSP shall document the conditions for why an exception to performing the monitoring was necessary. The exemption documentation shall be filed in Appendix H.

7.6 Visual Inspections

Visual inspections must be conducted in compliance with the CGP and CSMP. Visual inspections are required to confirm that appropriately selected BMPs have been implemented, are being maintained, and are effective.

Copies of the completed visual inspection checklists must be kept with the SWPPP in Appendix H. A tracking or follow-up procedure shall follow any inspection that identifies deficiencies in BMPs and requires corrective actions. If deficiencies are identified during a BMP inspection, maintenance, repairs, and/or design changes to the BMPs and the SWPPP, if applicable, shall be initiated within 72 hours of identification and need to be completed as soon as possible. If BMP repairs or maintenance are indicated in pre-storm or during storm inspections, repairs should be made as soon as possible to deter potential unauthorized discharges, discharges that may trigger non-visible pollutant sampling, or discharges that may exceed pH and turbidity NALs. BMP deficiencies will require documentation in the corrective action section of the Site Visual Inspection Form located in Appendix H. Table 13 identifies the required visual inspection schedule for all project Risk Level types.

Table 12 Visual Inspection Schedule

Risk Level	Weekly	Pre-Qualifying Precipitation Event	During Qualifying Precipitation Event	Post-Qualifying Precipitation Event1
1	X	X	X	X
2	X	X	X	X
3	X	X	X	X

1 – Reference Section 7.6.2

7.6.1 Routine Observations and Inspections

RECOMMENDED TEXT FOR ALL PROJECTS

Routine site inspections and visual monitoring are necessary to ensure that the project is in compliance with the requirements of the CGP.

7.6.1.1 Routine BMP Inspections

The CGP requires that BMPs be inspected:

- Weekly (Routine);
- Prior to a Qualifying Precipitation Event (Pre-Qualifying Precipitation Event);
- Once each 24-hour period during extended storm events (During Qualifying Precipitation Event);
- After each Qualifying Precipitation Event that produces 0.5 inch or greater of precipitation as measured by the on-site rain gauge (Post-Qualifying Precipitation Event);
- During discharge sampling and/or observations (use of Discharge Form located in Appendix H); and

The purpose of these inspections is to:

- Identify if BMPs were adequately designed, implemented, and effective;
- Identify BMPs that require repair or replacement due to damage; and
- Identify additional BMPs that need to be implemented and revise the SWPPP accordingly

7.6.1.2 Non-Stormwater Discharge Observations

Each drainage area will be inspected for the presence of or indications of prior unauthorized and authorized non-stormwater discharges. Inspections will record:

- Presence or evidence of any non-stormwater discharge (authorized or unauthorized);
- Pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc); and
- Source of discharge.

7.6.2 Visual Observation Inspections of Qualifying Precipitation Events

RECOMMENDED TEXT FOR ALL PROJECTS

This section describes the CGP requirements for Qualifying Precipitation Event visual inspections.

- Pre-Qualifying Precipitation Event inspection within 72 hours prior to any weather pattern that is forecasted to have a 50 percent or greater chance of 0.5 inches or more in a 24-hour period. Precipitation forecast information shall be obtained from the National Weather Service Forecast Office (e.g., by entering the zip code of the project's location at https://www.weather.gov/) and must be included as part of the inspection checklist. If extended forecast precipitation data (greater than three days) is available from the National Weather Service, the pre-precipitation event inspection may be done up to 120 hours in advance. The pre-Qualifying Precipitation Event inspection shall include an inspection of the following:
    - All stormwater drainage areas to identify leaks, spills, or uncontrolled pollutant sources and when necessary, implement appropriate corrective actions to control pollutant sources.
    - All BMPs identify whether they have been properly implemented in accordance with the SWPPP, and when necessary, implement appropriate corrective actions to control pollutant sources.
    - All stormwater storage and containment areas to detect leaks and check for available capacity to prevent overflow.
- Within 14 days after a NAL exceedance the QSP shall visually inspect the drainage area of exceedance and document any areas of concern
- Dischargers shall conduct visual inspections at least once every 24-hour period during Qualifying Precipitation Events. Qualifying Precipitation Events are extended for each subsequent 24-hour period forecast to have at least 0.25 inches of precipitation.
- Post-Qualifying Precipitation Event visual inspections within 96 hours after each Qualifying Precipitation Event if 0.5 inches or more precipitation is measured during the duration of the Qualifying Precipitation Event using the onsite rain gauge.
- The purpose of the During Qualifying Precipitation Event and Post-Qualifying Precipitation Event inspections is to observe and record the following:
    - Identify if BMPs were adequately designed, implemented, and effective;
    - Identify BMPs that require repair or replacement due to damage; and
    - Identify additional BMPs that need to be implemented and revise the SWPPP accordingly.

The results of all storm-related inspections and assessments will be documented and copies of the completed inspection checklists will be maintained within the SWPPP in Appendix H, or electronically in a manner which would allow the inspection checklists to be made available at the request of a federal, State, Regional Water Board, or the Port's 3rd party inspector (if applicable).

7.6.3 Visual Monitoring Procedures

RECOMMENDED TEXT FOR ALL PROJECTS

Visual monitoring shall be conducted by the QSP or staff trained by and under the supervision of the QSP. The name(s) and contact number(s) of the site visual monitoring personnel are provided in Appendix K and Table 1.

Stormwater observations shall be documented on the Site Visual Inspection Form located in Appendix H.

The QSP shall within (Enter Number) days of the inspection submit copies of the completed inspection report to (Name).

7.6.4 Visual Monitoring Follow-Up and Reporting

RECOMMENDED TEXT FOR ALL PROJECTS

Correction of deficiencies identified by the observations or inspections, including required repairs or maintenance of BMPs, shall be initiated and completed as soon as possible.

If identified deficiencies require design changes, including additional BMPs, the implementation of changes will be initiated within 72 hours of identification and be completed as soon as possible. When design changes to BMPs are required, the SWPPP shall be amended to reflect the changes.

Deficiencies identified during site visual inspections and correction of deficiencies will be tracked on the Site Visual Inspection Form kept in Appendix H.

The QSP shall, within (Enter Number) days of the inspection submit copies of the completed Site Visual Inspection Form with the corrective actions to (Name).

Results of visual monitoring must be summarized and reported in the Annual Report.

7.7 Water Quality Sampling and Analysis

INSTRUCTIONS

Select appropriate scenario and modify accordingly

RECOMMENDED TEXT FOR ALL PROJECTS

Risk Level 1

Water quality sampling and analysis serves to demonstrate the project is in compliance with discharge prohibitions. This project is classified as Risk Level 1 and shall perform water quality sampling and analysis for non-visible pollutants.

Risk Level 2

Water quality sampling and analysis serves to demonstrate the project is in compliance with discharge prohibitions. This project is classified as Risk Level 2 and shall perform water quality sampling and analysis for non-visible pollutants, pH and turbidity during Qualifying Precipitation Events, and for non-stormwater discharges.

7.7.1 Non-Visible Pollutants in Stormwater Runoff Discharges

Select appropriate scenario and modify accordingly

RECOMMENDED TEXT FOR ALL PROJECTS

All projects

All projects under the CGP are required to conduct non-visible pollutant monitoring, sampling, and analysis. Sampling of non-visible pollutants identified in the pollutant source assessment is required when the materials or chemicals have the potential to cause or contribute to an exceedance of a water quality standard. A BMP breach, failure, malfunction, as well as a leak or spill of a pollutant of concern, observed during a visual inspection would require non-visible sampling/analysis.

Dischargers shall implement sampling and analysis requirements to monitor non-visible pollutants when there is:

1. Evidence of pollutant releases that are not visually detectable in stormwater discharges; and

2. Releases of substances which could cause or contribute to an exceedance of water quality objectives in the receiving waters.

Dischargers are required to conduct sampling and analysis for non-visible pollutants (including those associated with TMDLs) identified in the SWPPP or otherwise known to be on-site, only when the pollutants may be discharged due to failure to implement BMPs, a container spill or leak, or a BMP breach, failure, or malfunction.

Non-visible pollutant sampling is not required if one of the conditions described above (e.g., breach, spill, leak, failure or malfunction) occurs and, prior to discharge, the material containing the pollutant is fully remediated or removed; and BMPs to control the pollutant are implemented, maintained, or replaced as necessary.

Potential sources of non-visible pollutants are identified in Appendix G, Storage, use, and operational locations are shown on the Site Maps in Appendix B.

Risk Level 2

The project has the potential to receive stormwater run-on with the potential to contribute non-visible pollutants to stormwater discharges from the project. Locations of such run-on to the project site are shown on the Site Maps in Appendix B.

7.7.1.1 Non-Visible Pollutants Sampling Schedule

Samples for the potential non-visible pollutant(s) and a sufficiently large unaffected background sample shall be collected during the first eight hours of discharge from rain events that result in discharge. Samples shall be collected during the site’s scheduled hours and shall be collected regardless of the time of year and phase of the construction.

At least one sample must be collected per the applicable discharge location for each 24-hour period in which discharge occurs until corrective actions are completed to eliminate further discharge of the pollutants.

Samples will be analyzed in the field or submitted to the ELAP accredited laboratory, as identified in Section 7.9, for analysis of all non-visible pollutants, including applicable TMDL-specific pollutants.

7.7.1.2 Non-Visible Pollutants Sampling Locations, Collection and Analysis

INSTRUCTIONS

Use Table 7.2 -7.6 to identify sampling locations, delete tables that do not apply to Project

Select appropriate scenario and modify accordingly

RECOMMENDED TEXT FOR ALL PROJECTS

Include the following text for all projects

The locations of potential pollutant storage and use may change as work progresses. Any potential non-visible sampling locations that are not listed in Tables 13 through 17 should be added to the tables by the QSP using the same rationale as that used to identify planned locations. These locations must be updated on the Site Maps in Appendix B and documented on the hardcopy Site Wall Map to be kept in the trailer. Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use; accessibility for sampling, and personnel safety. Planned non-visible pollutant sampling locations are shown on the Site Maps in Appendix B and include the locations identified in Tables 13 through 17.

Samples of discharge shall be collected at the designated non-visible pollutant sampling locations shown on the Site Maps in Appendix B and listed in Tables 13 through 17. Samples shall be collected in the locations determined by observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historically contaminated soil areas, which triggered the need for sampling.

Grab samples shall be collected and preserved in accordance with the methods identified in Table 20, "Table 7.8 List of Non-Visible Laboratory Analytical Constituents" provided in Section 7.7.1.4. Only the QSP, or personnel trained in water quality sampling under the direction of the QSP shall collect samples.

Sample collection and handling requirements are described in Section 7.10.

Samples shall be analyzed using the analytical methods identified in Table 20, and samples will be analyzed by the laboratory identified in Appendix K.

(Enter Number) sampling location(s) on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Table 13 Non-Visible Pollutant Sample Locations – Contractors' Yard

Sample Location Number	Sample Location Description	Sample Location Latitude and Longitude (Decimal Degrees)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)

(Enter Number) sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Table 14 Non-Visible Pollutant Sample Locations – Soil Amendment Areas

Sample Location Number	**Sample Location**	**Sample Location Latitude and Longitude** (Decimal Degrees)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)

(Enter Number) sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Table 15 Non-Visible Pollutant Sample Locations – Areas of Historical Contamination

Sample Location Number	**Sample Location**	**Sample Location Latitude and Longitude** (Decimal Degrees)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)

(Enter Number) sampling location(s) has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. This location(s) was selected such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

Table 16 Non-Visible Pollutant Sample Locations – Background (Unaffected Sample)

Sample Location Number	**Sample Location**	**Sample Location Latitude and Longitude** (Decimal Degrees)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)

Include for Risk Level 2 projects

(Enter Number) sampling locations have been identified for the collection of samples of run-on to the project site. Run-on from these locations has the potential to combine with discharges from the site being sampled for non-visible pollutants. These samples are intended to identify potential sources of non-visible pollutants that originate off the project site.

Table 17 Non-Visible Pollutant Sample Locations – Site Run-On

Sample Location Number	Sample Location	Sample Location Latitude and Longitude (Decimal Degrees)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)
(Enter Number)	(Enter Location)	(Enter Latitude/Longitude)

7.7.1.3 Analytical Constituents

INSTRUCTIONS

Table 18 can be used as a guide for determining the type of analysis to be performed based on possible pollutant sources. Not all pollutant sources are applicable to the all project site. Analysis for non-visible pollutants will be performed based the site inspection and direction from the appropriate representative.

RECOMMENDED TEXT FOR ALL PROJECTS

Table 18 lists pollutant sources associated with different construction phases, associated field test and water quality indicator constituent(s) for that pollutant.

Table 18 Pollutant Sources, Field Test and Indicator Constituents

Pollutant Source	Field Test	Water Quality Indicator Constituent
Demolition		
Sediment	(visible)	
Paint Strippers	N/A	Volatile Organics
Solvents	N/A	Volatile Organics
Adhesives	N/A	Semi-Volatile Organics
Vehicle Fuels	(visible)	Oil and Grease or TPH
Metals	N/A	Total/Dissolved Metals
Bacteria	N/A	Total/Fecal Coliform
Litter	(visible)	
Utility Installation		
Sediment	(visible)	
Fuels/Lubricants	N/A	Oil and Grease/TPH
Chlorinated Water	Colorimetric	
Concrete	pH	Lab pH
Pesticides/Herbicides	N/A	Pesticide Scan/Semi-Volatile Organics
Fertilizers	N/A	$NO_3/NH_3/P$
Bacteria	N/A	Total/Fecal Coliform
Vertical Construction		

Sediment	(visible)	
Paint Strippers	N/A	Volatile Organics
Solvents, Thinners	N/A	Volatile Organics
Detergents	Colorimetric	MBAS
Adhesives, Sealants, Resins	N/A	Semi-Volatile Organics
Fuels, Lubricants, Hydraulic Fluid	N/A	Oil and Grease or TPH
Concrete	pH	Lab pH
Litter	(visible)	
Bacteria	N/A	Total/Fecal Coliform
Organics	N/A	Semi-Volatile Organics
Paint	(visible)	
Wood (sawdust)	(visible)	
Acid Wash	pH	Lab pH
Asphalt (liquid)	N/A	TPH
Habitat Conservation		
Sediment	(visible)	
Nutrients (Fertilizers)	N/A	$NO_3/NH_3/P$
Bacteria	N/A	Total/Fecal Coliform
Based on consultation with SWPPP preparer or monitoring specialist.		

7.7.1.4 Non-Visible Pollutants Data Evaluation and Reporting

RECOMMENDED TEXT FOR ALL PROJECTS

The QSP shall complete an evaluation of the water quality sample analytical results.

Runoff/downgradient results shall be compared with the associated upgradient/unaffected results and any associated run-on results. Should the runoff/downgradient sample show an increased level of the tested analyte relative to the unaffected background sample, which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences shall be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs shall be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs shall be recorded as an amendment to the SWPPP.

The CGP prohibits stormwater discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. Parts 110, 117 and 302.

The results of any non-visible pollutant discharges that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the District and other agencies as required by 40 C.F.R. Parts 110, 117 and 302.

Results of non-visible pollutant monitoring shall be reported in the Annual Report.

Table 19 List of Non-Visible Laboratory Analytical Constituents

Constituent/ Parameter Name	Constituent Abbreviation	Bottle Type	Volume Required (mL)	Preservation	Method Type	EPA Method Number	Holding Time	Units	Target Reporting Limit
Conventional									
Specific Conductance	EC	Poly-Propylene	50	N/A	N/A	120.1	ASAP	umhos/cm	1
pH[(2)]	pH		50	N/A	Electrometric	150.1	ASAP	pH unit	+/- 0.1
Hydrocarbons									
Total Recoverable Petroleum Hydrocarbons	TRPH	Glass	1000	4 degrees Celsius	Gas chromatography	8015b	14 days	µg/L	50
Oil and Grease (HEM/SGT)	O&G		1000	H_2SO_4 to pH<2	Gravimetric	1664	28 days	mg/L	5
Nutrients									
Nitrate-Nitrogen	NO_3-N	Poly-Propylene	100	4 degrees Celsius	Ion chromatography	300.0	48 hours	mg/L	0.1
Ammonia-Nitrogen	NH_3-N		100	None	Titrimetric	350.2	28 days	mg/L	0.1
Total Phosphorus	Total P		100	HNO_3 or H_2SO_4 to pH<2	Colorimetric	365.2	28 days	mg/L	0.03
Detergents	MBAS		500	4 degrees Celsius	Colorimetric	425.1	48 hours	mg/L	0.1
Bacteriological									
Coliform (Fecal)	FC	Poly-Propylene	50	$Na_2S_2O_3$	Multiple-tube fermentation	9211E	6 hours	MPN/100 ml	1
Coliform (Total)	TC		50	$Na_2S_2O_3$	Multiple-tube fermentation	9221B	6 hours	MPN/100 ml	1
Metals									
Total Recoverable	TR	Poly-Propylene	250	HNO_3 or H_2SO_4 to pH<2	GFAA; ICP-MS	200.8	Filter for dissolved fraction and preserve within 48 hours; analyze within 6 months.	µg/L	0.2-5[(4)]
Dissolved [(3)]	Diss		250	HNO_3 or H_2SO_4 to pH <2[(1)]	GFAA; ICP-MS	200.8		µg/L	0.2-5[(4)]
Organics									
Volatile Organics	VOCs	Glass	2 x 40 vials	4 degrees Celsius	GC-MS	8020	14 days	µg/L	0.5-50
Semi-Volatile Organics	SVOCs		1000	4 degrees Celsius	GC-MS	8270	Extract in 7 days, analyze within 40 days	µg/L	0.05-0.25
Pesticides	Pest		1000	4 degrees Celsius	Gas chromatography	8141, 8081		µg/L	0.5-1

Notes:
(1) Dissolved metals preserved after filtration.
(2) Report pH to nearest 0.1 std. pH unit. Also report temperature at time of measurement.
(3) Filter dissolved samples prior to analysis.
(4) Target reporting limit varies by metal.

7.7.2 pH and Turbidity in Stormwater Runoff Discharges

INSTRUCTIONS

Risk Level 1 project should include the first statement below and delete the rest of Section 7.7.2. Risk Level 2 projects should delete the first statement below and include all of Section 7.7.2.

RECOMMENDED TEXT

For Risk Level 1 Projects

Sampling and analysis of runoff for pH and turbidity is not required for Risk Level 1 projects.

For Risk Level 2 Projects

Risk Level 2 projects shall collect stormwater grab samples during a Qualifying Precipitation Event, from all discharge locations incorporating runoff from the project construction sites, during discharge and within site operating hours. The grab samples shall be representative of the discharge flow and characteristics.

Samples for pH and turbidity will be collected from all drainage areas with disturbed soil areas.

7.7.2.1 pH and Turbidity Sampling Schedule

Risk Level 2 dischargers shall obtain one sample from each discharge location per 24-hour period of each Qualifying Precipitation Event, during active discharge.

Risk Level 2 and 3 dischargers shall collect samples of stored or contained stormwater during discharge from the impoundment, in accordance with Attachment J of the CGP.

Run-on samples shall be collected whenever the QSP identifies that run-on has the potential to contribute to an exceedance of a NAL.

7.7.2.2 pH and Turbidity Sampling Locations and Collection

Sampling locations are based on the site runoff discharge locations and locations where run-on enters the site; accessibility for sampling; and personnel safety. Planned pH and turbidity sampling locations are shown on the Site Maps in Appendix B and include the locations identified in Table 20.

Samples of discharge shall be collected at the designated runoff and run-on sampling locations shown on the Site Maps in Appendix B. Run-on samples shall be collected within close proximity of the point of run-on to the project.

Only personnel trained in water quality sampling and field measurements working under the direction of the QSP shall collect samples.

Sample collection and handling requirements are described in Section 7.9.

(Enter Number) sampling location(s) on the project site and the contractor's yard have been identified for the collection of runoff samples. Table 20 also provides an estimate of the site's area that drains to each location.

Table 20 Turbidity and pH Runoff Sample Locations

Sample Location Name or Number	Sample Location Latitude and Longitude(1) (Decimal Degrees)	Estimate of Site Drainage Factor (2) (%)
(Name or Number)	(Latitude, Longitude)	(%)
(Name or Number)	(Latitude, Longitude)	(%)
(Name or Number)	(Latitude, Longitude)	(%)
(Name or Number)	(Latitude, Longitude)	(%)
(Name or Number)	(Latitude, Longitude)	(%)
(Name or Number)	(Latitude, Longitude)	Run-on

(1)SMARTS requires location in decimal degree to 5 decimal places

(2) Area or flow-based percentage

RECOMMENDED TEXT FOR RISK LEVEL 2 PROJECTS THAT RECEIVE RUN-ON

(Enter Number) sampling locations have been identified for the collection of run-on samples where the run-on has the potential to contribute to an exceedance of a NAL. (Describe locations)

RECOMMENDED TEXT FOR RISK LEVEL 2 THAT DO NOT RECEIVE RUN-ON

The project does not receive run-on with the potential to exceed NALs.

7.7.2.3 Field Parameters and Measurements

Samples shall be analyzed for the constituents indicated in Table 21 below "Sample Collection, and Analysis for Monitoring Turbidity and pH."

Table 21 Sample Collection and Analysis for Monitoring Turbidity and pH

Parameter	Test Method	Minimum Sample Volume(1)	Sample Collection Container Type	Detection Limit (minimum)
Turbidity	Field meter/probe with calibrated portable instrument	50 mL	Polypropylene or Glass (Do not collect in meter sample cells)	1 NTU
pH	Field meter/probe with calibrated portable instrument or calibrated pH test kit	100 mL	Polypropylene	0.2 pH units

Table 21 Sample Collection and Analysis for Monitoring Turbidity and pH

Parameter	Test Method	Minimum Sample Volume(1)	Sample Collection Container Type	Detection Limit (minimum)
Notes: [1] Minimum sample volume recommended. Specific volume requirements will vary by instrument; check instrument manufacturer instructions. L – Liter mL – Milliliter NTU – Nephelometric Turbidity Unit				

Samples collected for field analysis, collection, analysis and equipment calibration shall be in accordance with the field instrument manufacturer's specifications.

Immediately following collection, samples for field analysis shall be tested in accordance with the field instrument manufacturer's instructions and results recorded on the *Effluent Sampling Field Log Sheet*.

The field instrument(s) listed in Table 22 will be used to analyze the following constituents:

Table 22 Field Instruments

Field Instrument (Manufacturer and Model)	Constituent
	pH
	Turbidity

The manufacturers' instructions are included in CSMP Attachment 2 "Field Meter Instructions". Field sampling staff shall review the instructions prior to each sampling event and follow the instructions in completing measurement of the samples.

- The instrument(s) shall be maintained in accordance with manufacturer's instructions.
- The instrument(s) shall be calibrated before each sampling and analysis event.
- Maintenance and calibration records shall be maintained with the SWPPP.

The QSD may authorize alternate equipment provided that the equipment meets the CGPs requirements and the manufacturers' instructions for calibration and use are added to CSMP Attachment 2 "Field Meter Instructions".

7.7.2.4 Data Evaluation and Reporting

Numeric Action Levels

This project is subject to NALs for pH and turbidity shown in Table 23.

Table 23 Numeric Action Levels

Parameter	Unit	Daily Average
pH	pH units	Lower NAL = 6.5 Upper NAL = 8.5
Turbidity	NTU	250 NTU

Within (enter number) days of the sample collection, the QSP shall submit copies of the completed *Effluent Sampling Form* to (District Environmental Protection Department or LRP).

In the event that the pH or turbidity NAL is exceeded, the QSP shall immediately notify (District Environmental Protection Department at 619-686-6254, the District 's 3rd party SWPPP Inspector (if applicable), the QSD and the LRP) and investigate the cause of the exceedance and identify corrective actions.

All field sampling results must be submitted through SMARTS within 30 days of the completion of the Qualifying Precipitation Event.

Exceedances of NALs shall be electronically submitted to SMARTS within 10 days of the NAL exceedance.

If requested by the RWQCB, a NAL Exceedance Report must be submitted. The NAL Exceedance Report must contain the following information:

- Analytical method(s), method reporting unit(s), and MDL(s) of each parameter;
- Date, place, time of sampling, visual observation, and/or measurements, including precipitation; and
- An assessment of the existing BMPs associated with the sample that exceeded the NAL(s), a description of each corrective action taken including photographs, and date of implementation.

7.7.3 Non-Stormwater Discharges

INSTRUCTIONS

Risk Level 1 project should include the first statement below and delete the rest of Section 7.7.3. Risk Level 2 projects should delete the first statement below and include all of Section 7.7.3.

RECOMMENDED TEXT FOR RISK LEVEL 2 PROJECTS

For Risk Level 1 Projects

Sampling and analysis of non-stormwater discharges is not required for Risk Level 1 projects.

For Risk Level 2 Projects

This CSMP for non-stormwater discharges describes the sampling and analysis strategy and schedule for monitoring pollutants in authorized and unauthorized non-stormwater discharges from the project site in accordance with the requirements of the CGP.

Sampling of non-stormwater discharges will be conducted when an authorized or unauthorized non-stormwater discharge is observed discharging from the project site. In the event that non-stormwater discharges run-on to the project site from offsite locations, and this run-on has the potential to contribute to a violation of a NAL, the run-on will also be sampled.

7.7.3.1 Non-Stormwater Sampling Locations, Collection and Analysis

Samples shall be collected from the discharge point of the construction site where the non-stormwater discharge is running off the project site. Site discharge locations are shown on the Site Maps in Appendix B and include the locations identified below.

Grab samples shall be collected and preserved in accordance with the methods identified in Table 19. Only personnel trained in water quality sampling under the direction of the QSP shall collect samples. Sample collection and handling requirements are described in Section 7.9.

Samples shall be analyzed for turbidity and pH as described in 7.7.2.6. For non-visible constituents using the analytical methods identified in Table 19, and samples will be analyzed by laboratory identified in Section 7.9.

(Enter Number) sampling location(s) on the project site and the contractor's yard have been identified where non-stormwater discharges may runoff from the project site.

(Enter Number) sampling locations have been identified for the collection of non-stormwater discharges that run-on to the project site.

Table 24 Sample Collection and Analysis for Monitoring Non-Stormwater Discharges

Sample Location Name or Number	**Sample Location Latitude and Longitude**[(1)] (Decimal Degrees)

(1)SMARTS requires location in decimal degree to 5 decimal places

7.7.3.3 Analytical Constituents

All non-stormwater discharges must be sampled for pH and turbidity.

The QSP shall identify additional pollutants to be monitored for each non-stormwater discharge incident based on the source of the non-stormwater discharge. If the source of an unauthorized non-stormwater discharge is not known, monitoring for pH, turbidity, MBAS, TOC, and residual chlorine or chloramines is recommended to help identify the source of the discharge.

Non-stormwater discharge run-on shall be monitored, at minimum, for pH and turbidity. The QSP shall identify additional pollutants to be monitored for each non-stormwater discharge incident based on the source of the non-stormwater discharge. If the source of an unauthorized non-stormwater discharge is not known, monitoring for pH, turbidity, methyl blue active substances (MBAS), total organic carbons (TOC), and residual chlorine or chloramines is recommended to help identify the source of the discharge.

Table 25 lists the specific sources and types of potential non-visible pollutants on the project site and the water quality indicator constituent(s) for that pollutant.

Table 25 Potential Non-Stormwater Discharge Pollutants and Water Quality Indicator Constituents

Pollutant Source	Pollutant	Water Quality Indicator Constituent
Disturbed Areas	Sediment	Turbidity
Concrete Work	pH	pH

7.7.3.4 Data Evaluation and Reporting

The QSP shall complete an evaluation of the water quality sample analytical results.

Turbidity and pH results shall be evaluated for compliance with NALs as identified in Section 7.7.2.4.

Should the runoff sample indicate the discharge of a pollutant which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences shall be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs shall be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs shall be recorded as an amendment to the SWPPP.

Non-stormwater discharge results shall be submitted with the Annual Report.

The CGP prohibits the discharge of non-stormwater discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. Parts 110, 117 and 302. The results of any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the District, the District's 3rd Party SWPPP Inspector (if applicable), and the LRP

7.7.4 Other Pollutants Required by the Regional Water Quality Control Board

INSTRUCTIONS

Delete this sub-section (7.7.4) if RWQCB is not requiring additional monitoring.

RECOMMENDED TEXT

The RWQCB has specified monitoring for the following additional pollutants:

- ❑
- ❑

This CSMP describes the sampling and analysis strategy and schedule for monitoring additional pollutants as specified in the communication from the RWQCB dated (Enter Date). This communication is included in CSMP Attachment 3 "Supplemental Information".

7.7.4.1 RWQCB Required Sampling Schedule

Runoff samples shall be collected for (list pollutants) from all Qualifying Precipitation Events that result in a discharge from the project site.

Grab samples shall be collected from all discharge locations incorporating runoff from the project construction sites, during discharge and within site operating hours. The grab samples shall be representative of the discharge flow and characteristics.

7.7.4.2 RWQCB Required Sampling Locations, Collection and Analysis

Sampling locations are based on the site discharge locations; accessibility for sampling; and personnel safety. Planned sample locations are shown on the Site Maps in Appendix B and include the locations identified below.

Grab samples shall be collected and preserved in accordance with the methods identified in Table 19. Only personnel trained in water quality sampling under the direction of the QSP shall collect samples. Sample collection and handling requirements are described in Section 7.9.

Samples shall be analyzed using the analytical methods and laboratory identified in Table 19.

(Enter Number) sampling location(s) on the project site and the contractor's yard have been identified for the collection of runoff samples.

Table 26 Runoff Sample Locations for Other Pollutants Required by the RWQCB

Sample Location Name or Number	**Sample Location Latitude and Longitude**(1) (Decimal Degrees)

(1)SMARTS requires location in decimal degree to 5 decimal places

7.7.4.3 RWQCB Required Data Evaluation and Reporting

[Discuss the data evaluation (e.g., effluent limits, numeric or narrative objectives, basin plan limitations, waste load allocations) established by the RWQCB.]

[Identify the RWQCB specified reporting, and at minimum identify that the data will be reported in the Annual Report.]

7.7.5 Active Treatment System

INSTRUCTIONS

This sub-section (7.7.5) applies to projects for which ATS will be used. Delete section if ATS is not used, and re-number following sub-sections

RECOMMENDED TEXT FOR PROJECTS WTIH AN ATS

The project specific CSMP for the ATS is provided in the ATS Monitoring and Sampling Plan (MSRP). The ATS MSRP is located (Location of MSRP)

7.7.6 Passive Treatment Plan

INSTRUCTIONS

The CGP allows for the use of passive treatment on projects that cannot meet the required NALs/NELs. Attachment G of the CGP describes the requirements for the use of passive treatment on projects.

If a project will use passive treatment the Passive Treatment Plan should be placed in this section of the SWPPP.

The QSD will prepare the Passive Treatment Plan if one has not been prepared during the design phase of the project.

The QSP must communicate any NAL/NEL exceedances to the QSD. The QSD will discuss the option of preparing a Passive Treatment Plan with the District, the District's 3rd Party SWPPP Inspector (if applicable), and the LRP.

Passive Treatment Plan requirements are described in Attachment G of the CGP.

7.8 Training of Sampling Personnel

RECOMMENDED TEXT FOR ALL PROJECTS

Sampling personnel shall be trained to collect, maintain, and ship samples in accordance with the Surface Water Ambient Monitoring program (SWAMP) 2022 Quality Assurance Program Plan (QAPrP). Training records of designated contractor sampling personnel are provided in Appendix K.

The stormwater sampler(s) and alternate(s) have received the following stormwater sampling training:

Name	Training
	(List Training Courses)
	(List Training Courses)

The stormwater sampler(s) and alternates have the following stormwater sampling experience:

Name	Experience
	(List stormwater sampling experience)
	(List stormwater sampling experience)

7.9 Sample Collection, Preservation and Delivery

RECOMMENDED TEXT FOR ALL PROJECTS

Samples will be analyzed by:

Laboratory Name:	
Street Address:	
City, State Zip:	
Telephone Number:	
Point of Contact:	
ELAP Certification Number:	

Samples will be delivered to the laboratory by:

Driven by Contractor	☐	Yes	☐	No
Picked up by Laboratory Courier	☐	Yes	☐	No
Shipped	☐	Yes	☐	No

An adequate stock of monitoring supplies and equipment for monitoring potential pollutants will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with rain or direct sunlight. Sampling personnel will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, field meters, extra batteries; clean powder-free nitrile gloves, sample collection equipment, appropriate sample containers, paper towels, personal rain gear, and Effluent Sampling Form located in Appendix H and Chain of Custody (CoC) forms provided in CSMP Attachment 1 "Chain of Custody Forms".

7.9.1 Sample Collection Methods

If possible, field teams will consist of two persons. Because of the unpredictability of storm events, field crews may arrive at the monitoring sites before any significant stormwater runoff has been observed.

7.9.1.1 Detailed Grab Sample Collection Procedures for Each Monitoring Site

Inspect general conditions of the site. Note the conditions of the site at the time of sampling.

Once runoff is observed in the area to be sampled (sheet flow, drainpipe, or other stormwater conveyance), manually collect a water sample with a clean polypropylene collection device, or directly into sample container provided by laboratory.

Once sufficient water has been collected in the collection device, carefully pour the water into each of the laboratory sample bottles using a polypropylene funnel. Note: For collection of the oil and grease sample, a glass or metal funnel must be used.

After all water samples have been collected, clean equipment with a 2% Contrad (or equivalent) detergent solution, rinse off the polypropylene collection device and funnels with distilled water and towel dry to prepare for the next sampling event.

7.9.2 Field Measurement Methods

Certain grab samples will require field measurement of certain parameters. To accomplish this, pour a subsample of stormwater into a clean plastic cup for field measurements. pH and electrical conductivity can be measured using hand-held devices. The devices will be calibrated prior to mobilization at the monitoring site. At some locations, colorimetric field test kits (e.g., HACH field kits) may be used to test for the presence of chlorine or detergents. Follow manufacturers' instructions on proper use of the test kits. The measurements will be recorded in field notes and on the chain-of-custody forms. The sub-sample will then be discarded following recording of the field measurements.

7.9.3 Sample Containers and Handling

Sampling procedures involving handling items that have direct contact with the samples (i.e., sampling container, container lid, etc.) will be performed in accordance with proper sample handling techniques designed to minimize contamination of the sample. Sampling personnel are required to wear clean powder-free nitrile gloves. If sampling with a two member team, one member of the field team shall be responsible for sample collection and will change gloves between sample collections, or when the gloves have come in contact with any potential source of contamination. The other field team member will be responsible for cleaning of sampling equipment and all other activities that do not involve handling items that have direct contact with the sample. If one person is collecting and documenting all samples, care shall be taken to not cross-contaminate or introduce contaminates to samples.

7.9.4 Laboratory Communication Procedures

Sampling personnel will contact the analytical laboratory 24 hours before the anticipated beginning of the precipitation event. The laboratory will be instructed to prepare sample bottles for use at the monitoring sites and to prepare for receipt of samples during and following the precipitation event.

7.9.5 Sample Shipping/Delivery and Chain of Custody

After grab samples are collected they must be delivered to the analytical laboratory as soon as possible to meet sample holding time requirements. If samples are to be analyzed for bacteria, they must be delivered to the laboratory within six hours of sample collection. Samples for all other analyses should be delivered within 24 hours of collection. The laboratory should be notified of the estimated time of delivery and be alerted when weekend delivery is required. The following list outlines the packaging and shipping procedures for pick-up:

- Assemble and package all sample bottles in an orderly and secure manner for delivery to the laboratory.
- Verify information on the chain-of-custody form completed by the field crew on a cooler-by-cooler basis.

- If multiple coolers contain bottles from the same station, indicate this on all related forms.
- Use military time (i.e., 2 p.m. = 1400 hours) for all entries.
- If necessary, re-pack coolers with ice to keep samples cool and to prevent breakage.
- Place the completed chain-of-custody form in a re-sealable bag and place the form in the cooler with the bottles.
- Pack any sampler bottles to be cleaned for delivery to lab.

7.9.6 Sample Preservation and Filtration

During collection of grab samples, the field teams will:

- Seal sample bottles in re-sealable plastic bags.
- Place them in a cooler.
- Pack the cooler with ice in order to preserve the samples below 4 degrees Celsius (39.2 degrees Farenheit).
- Once samples are at the laboratory, they will be refrigerated until analysis.

Sample filtration and/or preservative may be required for some analyses, including dissolved metals. Because of contamination concerns, this will be performed in the laboratory in accordance with procedures specified by the appropriate analytical method.

7.10 Quality Assurance and Quality Control

RECOMMENDED TEXT FOR ALL PROJECTS

An effective Quality Assurance and Quality Control (QA/QC) plan shall be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- CoCs;
- QA/QC Samples; and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

7.10.1 Field Logs

The purpose of field logs is to record sampling information and field observations during monitoring that may explain any uncharacteristic analytical results. Sampling information to be included in the field log include the date and time of water quality sample collection, sampling personnel, sample container identification numbers, and types of samples that were collected. Field observations should be noted in the field log for any abnormalities at the sampling location (color, odor, BMPs, etc.). Field measurements for pH and turbidity should also be recorded in the "Effluent Sampling Form". A Site Visual Inspection Form and "Effluent Sampling Form", are included in Appendix H.

7.10.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. Adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

7.10.3 Chain of Custody

The sample CoC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample CoC procedures include the following:

- Proper labeling of samples;
- Use of CoC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide CoC forms to be filled out for sample containers. An example CoC is included in CSMP Attachment 1 "Chain of Custody Forms".

7.10.4 QA/QC Samples

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods. The following types of QA/QC will be conducted for this project:

Table 27 QA/QC Sample Frequency

QA/QC Sample Type	Sampling Frequency
Equipment Blanks	Will be collected from polypropylene grab sampling equipment prior to the sampling season.
Field Duplicates	Will be collected for 10% of the total number of samples collected.
Laboratory Duplicates	Will be collected for 10% of the total number of samples collected.
Matrix Spike/ Matrix Spike Duplicates	Will be collected for 10% of the total number of samples collected.
Method Blanks	Will be run with each QC batch analyzed by the laboratory.

7.10.4.1 Field Duplicates

Field duplicates will collected and analyzed for 10% or the total number of grab samples collected. Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples shall be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected shall be randomly selected from the discharge locations. Duplicate samples shall be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time as possible to the original sample. Duplicate samples shall not influence any evaluations or conclusion.

7.10.4.2 Equipment Blanks

Equipment blanks provide verification that equipment has not introduced a pollutant into the sample. Equipment blanks are typically collected when:

- New equipment is used;
- Equipment that has been cleaned after use at a contaminated site;
- Equipment that is not dedicated for surface water sampling is used; or
- Whenever a new lot of filters is used when sampling metals.

7.10.4.3 Field Blanks

Field blanks assess potential sample contamination levels that occur during field sampling activities. De-ionized water field blanks are taken to the field, transferred to the appropriate container, and treated the same as the corresponding sample type during the course of a sampling event.

7.10.4.4 Travel Blanks

Travel blanks assess the potential for cross-contamination of volatile constituents between sample containers during shipment from the field to the laboratory. De-ionized water blanks are taken along for the trip and held unopened in the same cooler with the VOC samples.

7.10.5 Data Verification

After results are received from the analytical laboratory, the QSP shall verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Data verification shall include:

- Check the CoC and laboratory reports.
  Make sure all requested analyses were performed and all samples are accounted for in the reports.
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values and follow up with the laboratory.
  Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. The QSP should especially note data that is an order of magnitude or more different than

similar locations, or is inconsistent with previous data from the same location.

- Check laboratory QA/QC results.
  EPA establishes QA/QC checks and acceptable criteria for laboratory analyses. These data are typically reported along with the sample results. The QSP shall evaluate the reported QA/QC data to check for contamination (method, field, and equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.
- Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate.
  Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met and confirms this in writing.

Field data including inspections and observations must be verified as soon as the field logs are received, typically at the end of the sampling event. Field data verification shall include:

- Check field logs to make sure all required measurements were completed and appropriately documented;
- Check reported values that appear out of the typical range or inconsistent; Follow-up immediately to identify potential reporting or equipment problems, if appropriate, recalibrate equipment after sampling;
- Verify equipment calibrations;
- Review observations noted on the field logs; and
- Review notations of any errors and actions taken to correct the equipment or recording errors.

7.11 Data Management and Reporting

RECOMMENDED TEXT FOR ALL PROJECTS

7.11.1 Analytical Data Validation

Results of precision and accuracy and contamination checks will be reviewed after each storm event. In the event that data quality objectives are not met, data will be qualified and documented as necessary.

- Data collected from the laboratory will be validated through the following procedures:
- Review hard copy data package;
- Compare chain-of-custody forms to logbooks and laboratory data reports to ensure successful data transfer;

- Ensure that laboratory reports are complete;
- Ensure that there are no typographical errors or incongruities in the data;
- Compare QA/QC results with data quality objective criteria;
- Tabulate and analyze the success rate of each QA/QC parameter; and
- Document and report out-of-range values.

7.11.2 Electronic Data Transfer

Data from the laboratory will be delivered in hard copy and electronic format. Both data packages will include:

- A narrative of any problems, corrections, anomalies, and conclusions; and
- Results/summary of QA/QC elements, including:
    1. sample extract and analysis dates
    2. method blanks, laboratory control spikes, and matrix spikes
    3. analytical accuracy
    4. analytical precision
    5. reporting limits

Section 8 References

Project Plans and Specifications No. [Insert Number] dated [insert date], prepared by [entity preparing plans and specifications]

Port of San Diego Jurisdictional Runoff Management Program, June 2023 (or most current version). https://www.portofsandiego.org/environment/environmental-protection/stormwater

San Diego Unified Port District Stormwater Management and Discharge Control Ordinance (Article 10) https://pantheonstorage.blob.core.windows.net/administration/Ordinance-2815.pdf

State Water Resources Control Board (SWRCB), Order WQ 2022-0057-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit For Stormwater Discharges Associated With Construction and Land Disturbances Activities (General Permit) No. CAS000002. General Permit No. CAS000002 also identified as the 2022 Construction General Permit (CGP)
Available online at:
https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2022/wqo_2022-0057-dwq.pdf

California Regional Water Quality Control Board – San Diego Region – Order No. R9-2013-001, As Amended By Order Nos. R9-2015-001 And R9-2015-0100 – NPDES No. CAS0109266 National Pollutant Discharge Elimination System (NPDES) Permit And Waste Discharge Requirements For Discharges From the Municipal Separate Storm Sewer Systems (MS4s) Draining The Watersheds Within The San Diego Region – also identified as the MS4 Permit, Municipal Permit, San Diego MS4 Permit, etc.

CASQA 2023, *Stormwater BMP Handbook Portal: Construction*, December 2023, www.casqa.org

[Include additional references as needed]

Appendix A: Calculations

INSTRUCTIONS

- ❑ *Include calculations here*

Appendix B: Site Maps

INSTRUCTIONS

- ❑ *Include maps here*

Appendix C: Permit Registration Documents and Discharger Certification

INSTRUCTIONS

- *The QSP must include Copies of Permit Registration Documents submitted to SMARTS, other than the SWPPP itself*
  - Notice Of Intent (NOI)
  - Risk Assessment
  - Signed Certification Statement
  - Post Construction Water Balance
  - Post Construction BMP Operations and Maintenance Plan
  - Copy of Annual Fee Receipt
  - ATS Design Documents (if applicable)
  - Passive Treatment Plan (if applicable)
  - Site Map, see Appendix B

RECOMMENDED TEXT

Permit Registration Documents included in this Appendix

Y/N	Permit Registration Document
	Notice of Intent
	Risk Assessment
	Certification
	Post Construction Water Balance
	Copy of Annual Fee Receipt
	ATS Design Documents
	Passive Treatment Plan
	Site Map, see Appendix B

Appendix D: SWPPP Amendment Certifications

INSTRUCTIONS

- ❑ *Include certification statements for each SWPPP amendment.*

SWPPP Amendment No. ______________________________

Project Name: ______________________________

WDID #: ______________________________

Qualified SWPPP Developer's Certification of the Stormwater Pollution Prevention Plan Amendment

"This Stormwater Pollution Prevention Plan and attachments were prepared under my direction to meet the requirements of the California Construction General Permit (State Water Resources Control Board (SWRCB), Order WQ 2022-0057-DWQ, No. CAS000002).). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below."

QSD's Signature	Date
QSD Name	QSD Certificate Number
Title and Affiliation	Telephone
Address	Email

Appendix E: Submitted Changes to PRDs

Log of Updated PRDs

The General Permit allows for the reduction or increase of the total acreage covered under the General Permit when a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

Modified PRDs shall be filed electronically within 30 days of a reduction or increase in total disturbed area if a change in permit covered acreage is to be sought. The SWPPP shall be modified appropriately, with revisions and amendments recorded in Appendix C. Updated PRDs submitted electronically via SMARTS can be found in this Appendix.

This appendix includes all of the following updated PRDs (check all that apply):

☐ Revised Notice of Intent (NOI);

☐ Revised Site Map;

☐ Revised Risk Assessment;

☐ New landowner's information (name, address, phone number, email address); and

☐ New signed certification statement.

Legally Responsible Person [if organization]

Signature of [Authorized Representative of] Legally Responsible Person or Approved Signatory	Date
Name of [Authorized Representative of] Legally Responsible Person or Approved Signatory	Telephone Number

Appendix F: Construction Schedule

INSTRUCTIONS

- ❑ *Include a copy of construction schedule*

Appendix G: Construction Activities, Materials Used, and Associated Pollutants, and Pollutant Source Assessment

INSTRUCTIONS

❑ List construction materials that will be used and construction activities that will have the potential to contribute to the discharge of pollutants to stormwater.

❑ List construction activities (i.e., construction or demolition activity, including, but not limited to, clearing, grading, grubbing, or excavation) that have the potential to contribute sediment or other pollutants to stormwater discharges.

❑ Delete phases that are not applicable to Project

❑ Insert as many lines to Table G.a as necessary to complete the list.

❑ Pollutant Categories identified are consistent with the *CASQA BMP Handbook Portal*: *Construction*: Sediment, Nutrients, Bacteria and Viruses, Oil and Grease, Metals, Synthetic Organics, Pesticides, Gross Pollutants, and Vector Production

❑ For sampling requirements for non-visible pollutants associated with construction site activity please refer to Section 7.7.1.

❑ The QSP must complete Table G.b. Pollutant Source Assessment and update it regularly.

Table G.a POLLUTANTS ASSOCIATED WITH CONSTRUCTION ACTIVITIES

Construction Phase	Associated Activity/Products With Potential To Cause Stormwater Pollution	Associated Potential Pollutants	BMPs
☐ Demolition	☐ Building Demolition (HVAC, insulation, concrete, metals, etc.) ☐ Asphalt/Paving Demolition	Sediment, concrete particles, wood debris, asbestos, freon, aluminum, zinc	Sediment control, erosion control, good housekeeping, wind erosion control, solid waste management
☐ Grading, Land Development and Utilities	☐ Clearing and grubbing ☐ Grading activities ☐ Stockpiling ☐ Disturbance of contaminated soil ☐ Dewatering ☐ Drainage Construction ☐ Pile Driving ☐ Utility installation ☐ Line Flushing (hydrostatic test water, pipe flushing) ☐ Fire Line and Temporary Water (bacteria testing)	Sediment, List identified soil and dredged contaminants, Chlorine, Bacteria, BOD, fertilizers, herbicides, nutrients (nitrogen, phosphorous, and potassium) acidity/ alkalinity, metals, aluminum sulfate, sulfur	Sediment control, erosion control, good housekeeping, dewatering BMPs, stockpile management, contaminated soil management, pile driving operations
☐ Masonry, Concrete, Asphalt Work	☐ Saw Cutting (cement and brick dust, saw cut slurries) ☐ Paving and Grinding ☐ Concrete Placement ☐ Concrete Curing (curing and glazing compounds ☐ Concrete Finishing (surface cleaners) ☐Concrete Waste Management	Concrete, sediments, acidity, metals, asbestos, particulates, cold mix, asphalt emulsion, liquid asphalt	Sediment control, erosion control, good housekeeping, liquid waste management, concrete waste management
☐ Building Construction	☐ Painting (paint thinners, acetone, methyl ethyl ketone, stripper paints, lacquers, varnish, enamels, turpentine, gum spirit, solvents, dyes, stripping pigments and sanding) ☐ Staging ☐ Fire Proofing ☐ Adhesives (glues, resins, epoxy synthetics, caulks, sealers, putty, sealing agents and coal tars)	VOCs, metals, phenolics and mineral spirits, BOD, formaldehyde, copper and creosote Phenolics, formaldehydes, asbestos, benzene, phenols and naphthalene Metals, acidity/alkalinity, chromium Lead, zinc and tin	Material Use, Material Delivery and Storage, liquid waste management, spill prevention and control, solid waste management, hazardous waste management, sanitary and septic waste management

	☐ Cleaners (polishes (metal, ceramic, tile), etching agents, cleaners, ammonia, lye, caustic, sodas, bleaching agents and chromate salts) ☐ Plumbing (solder (lead, tin), flux (zinc chloride), pipe fitting) ☐ Wood Products (sawdust, particle board dust and treated woods) ☐ Exterior Construction (stucco and finishing materials) ☐ Interior Construction (tile cutting, flashing, saw-cutting drywall, galvanized metal in nails and fences, and electric wiring) ☐ Sanitary and septic waste ☐ Landscaping (vegetation control, (herbicides) planting and plant maintenance; use of soil additives, production of solid waste such as trees, shrubs green waste and mulch)	Copper, aluminum, sediments, minerals, and asbestos	
☐ Equipment Use	☐ Vehicle and Equipment Cleaning ☐ Vehicle and Equipment Fueling ☐ Vehicle and Equipment Maintenance	Total petroleum hydrocarbons, oils and grease, coolants, benzene and derivatives	Vehicle and equipment fueling, vehicle and equipment maintenance, vehicle and equipment cleaning
☐ Other			

Table G.b. Pollutant Source Assessment

Pollutant Source Assessment (Chemicals, Materials, And Equipment) Used Or Stored On Site			
Date	Product/Source/Contractor	Quantity	Location

Appendix H: Site Visual Inspection Forms, Discharge Forms, Effluent Sampling Forms, Non-Compliance Report Form and Spill Log

Site Visual Inspection Form

1. SITE INFORMATION

Site Name:	QSP Name:	QSP Phone:
WDID #:	QSP Email:	QSP Signature:
Inspection Date:	QSD Name:	QSD Phone:
Inspection Time:	QSD Email:	QSD Signature
Approximate Area Disturbed:		

2. INSPECTION INFORMATION

Inspection Type: ☐ Weekly ☐ Pre-QPE ☐ Post-QPE ☐ During QPE

Construction Phase: ☐ Demolition ☐ Grading and Land Development ☐ Streets and Utilities

☐ Vertical Construction ☐ Final Landscaping and Site Stabilization ☐ Other

3. WEATHER INFORMATION

Weather Information	
Is precipitation currently present:	☐ Yes ☐ No
Date of Most Recent Qualifying Precipitation Event: (Assuming one is not currently occurring)	
Beginning Date of Current QPE:	
End Date of Current QPE:	
Current Site Rain Gauge Accumulated Rainfall (inch)	
Nearest NWS Rain Gauge Name and Accumulated Rainfall (inch)	

4. SITE CONDITIONS

Current Project Size	Total Project Area		Acre
	Disturbed Area[1]		Acre
	Approximate Inactive Disturbed Area[2]		Acre
1 – Based on estimations at time of inspection. 2 – Inactive areas that has been stabilized.			

SWPPP Documentation	Adequate		Notes/Corrective Actions Required
Visual Inspection/Monitoring Records	☐ Yes	☐ No	
Weather Information	☐ Yes	☐ No	
WPCD w/BMP	☐ Yes	☐ No	
Current Amendment Log	☐ Yes	☐ No	
Significant Spills/Leaks Log	☐ Yes	☐ No	
Current/Relevant Construction Schedule	☐ Yes	☐ No	
Sampling and Analysis Plan/CSMP	☐ Yes	☐ No	
QSP Training Records	☐ Yes	☐ No	
Contractor Training Records	☐ Yes	☐ No	
Subcontractor List/ Notification Letter	☐ Yes	☐ No	
pH/Turbidity Sampling Results	☐ Yes	☐ No	
Non-Visible Pollutant Sampling Results	☐ Yes	☐ No	

5. OBSERVATIONS

Discharge observed from site: ☐ Yes ☐ No **IF DISCHARGE WAS OBSERVED COMPLETE THE DISCHARGE FORM IN APPENDIX H**

6. BMP ASSESSMENT

BMP	Adequate			Notes (If N/A state why)	Corrective Actions Required
	Yes	No	N/A		
Soil Stabilization and Erosion Prevention					
Preservation of existing vegetation	☐	☐	☐		☐
Cover: Hydraulic Mulch, Hydroseeding, Soil Binders, Straw Mulch, Wood Mulch; Rock/Gravel	☐	☐	☐		☐
Cover: Geotextiles, plastic covers, erosion prevention blankets	☐	☐	☐		☐
Outlet Protection/ Velocity Dissipation Device	☐	☐	☐		☐
Slope Drains	☐	☐	☐		☐
Site Drainage: earth dikes, drainage swales, ditches	☐	☐	☐		☐
Runoff containment/traps	☐	☐	☐		☐

BMP	Adequate			Notes (If N/A state why)	Corrective Actions Required
	Yes	No	N/A		
Other BMPs; Innovative BMPs;	☐	☐	☐		☐
Are all inactive disturbed areas provided with cover?	☐	☐	☐		☐
Do all active areas have an effective combination of erosion and sediment controls (Risk Level 2&3)?	☐	☐	☐		☐
Sediment Control/Containment					
Perimeter Protection	☐	☐	☐		☐
Storm Drain Inlet Protection	☐	☐	☐		☐
Street Sweeping/ Vacuuming	☐	☐	☐		☐
Tracking Controls	☐	☐	☐		☐
Is offsite tracking monitored daily (Risk Level 2 and 3)?	☐	☐	☐		☐
Appropriate sediment controls are applied to slopes to comply with sheet flow lengths (Risk Level 2 and 3)?	☐	☐	☐		☐
Materials, Waste, and Equipment					
Material Storage with BMPs	☐	☐	☐		☐
Are all chemicals stored within secondary containment or otherwise completely contained?	☐	☐	☐		☐
Stockpile Management BMPs	☐	☐	☐		☐
Are stockpiles covered and bermed when not actively being used?	☐	☐	☐		☐
Equipment Storage with BMPs	☐	☐	☐		☐
Sanitary/Septic Waste Management	☐	☐	☐		☐
Concrete Waste Management	☐	☐	☐		☐
Are any cementitious wastes or wash waters observed on ground, paved or unpaved?	☐	☐	☐		☐
Hazardous Waste Management	☐	☐	☐		☐
Liquid Waste Management	☐	☐	☐		☐
Spill Prevention and Control	☐	☐	☐		☐
Are any spills observed that require immediate clean up?	☐	☐	☐		☐

BMP	Adequate			Notes (If N/A state why)	Corrective Actions Required
	Yes	No	N/A		
Waste Removal Schedule	☐	☐	☐		☐
Dumpsters covered at end of day and during rain?	☐	☐	☐		☐
Non-Storm Water Management					
Water Conservation Practices	☐	☐	☐		☐
Potable Water/Irrigation	☐	☐	☐		☐
Illegal Connections and Illicit Discharges	☐	☐	☐		☐
Dewatering Operations	☐	☐	☐		☐
Are any rinse or wash waters observed on the ground or in underlying soil?	☐	☐	☐		☐
Vehicle and Equipment Cleaning	☐	☐	☐		☐
Vehicle and Equipment Fueling	☐	☐	☐		☐
Are Equipment parked and fueled in designated areas?	☐	☐	☐		☐
Are drip pans or other drip protection under parked equipment?	☐	☐	☐		☐
Vehicle and Equipment Maintenance	☐	☐	☐		☐
Concrete Curing and Finishing	☐	☐	☐		☐
Landscape Materials	☐	☐	☐		☐
Are landscape materials contained?	☐	☐	☐		☐
Have landscape materials been applied prior to a forecasted storm?	☐	☐	☐		☐
Discharge Locations					
Are the discharge locations free of significant erosion or sediment transport?	☐	☐	☐		☐
Is the site free of observed discharges?	☐	☐	☐		☐
If discharges or offsite runoff is observed, complete the Discharge Form					
Wind Erosion					
Wind Erosion Control	☐	☐	☐		☐
Are stockpiles protected from wind erosion?	☐	☐	☐		☐

BMP	Adequate			Notes (If N/A state why)	Corrective Actions Required
	Yes	No	N/A		
Are inactive areas protected from wind erosion?	☐	☐	☐		☐
Is blowing dust observed on site?	☐	☐	☐		☐
Other/Site Specific/new CGP Specific					
Are there any other potential stormwater pollution issues or concerns? If yes, explain below:	☐	☐	☐		☐
Potential Pollutant Inventory	☐	☐	☐		☐
Corrective Action Log	☐	☐	☐		☐

Corrective Action Log

Insert photo here	Photo #	Photo Date:
	Required Corrective Action: *Date Corrective Action Completed:*	

Insert photo here	Photo #	Photo Date:
	Required Corrective Action: *Date Corrective Action Completed:*	

Insert photo here	Photo #	Photo Date:
	Required Corrective Action: *Date Corrective Action Completed:*	

Insert photo here	Photo #	Photo Date:
	Required Corrective Action: *Date Corrective Action Completed:*	

Insert photo here	Photo #	Photo Date:
	Required Corrective Action: *Date Corrective Action Completed:*	

Insert photo here	Photo #	Photo Date:
	Required Corrective Action: *Date Corrective Action Completed:*	

<table>
<tr><td rowspan="2">Insert photo here</td><td>Photo #</td><td>Photo Date:</td></tr>
<tr><td colspan="2"><u>Required Corrective Action</u>:

<u>Date Corrective Action Completed:</u></td></tr>
</table>

<table>
<tr><td rowspan="2">Insert photo here</td><td>Photo #</td><td>Photo Date:</td></tr>
<tr><td colspan="2"><u>Required Corrective Action</u>:

<u>Date Corrective Action Completed:</u></td></tr>
</table>

Discharge Form

Date and Time of Inspection:			Date Report was Prepared:		
QSP Name:			QSP Signature:		
Type of Discharge					
☐ Stormwater	☐ Authorized Non-Stormwater		☐ Unauthorized Non-Stormwater	☐Contained Stormwater	
*****If discharge is unauthorized, a <u>SWPPP NON-COMPLIANCE REPORT</u> must be completed and attached to this form and submitted to the District. *****					
Site Information					
Project Name:			WDID#:		
Construction Phase:			Current Acres Disturbed:		
Discharge Observations					
Discharge Start Time:			Discharge End Time:		
Discharge Locations					
1.			2.		
3.			4.		
5.			6.		
Were Samples Collected:		☐ Yes		☐ No	
Odors:		☐ Yes		☐ No	
Type of Odor:					
Floating Materials:		☐ Yes		☐ No	
Type of Materials:					
Sheen:		☐ Yes		☐ No	
Discolorations:		☐ Yes		☐ No	
Color:	☐ clear	☐ brown	☐ gray	☐ red	☐ green
☐ Other:					
Turbidity:		☐ Yes		☐ No	
Actions Attach Related Site Visual Inspection Form with Deficiencies and Corrective Listed					

Effluent Sampling Form

Construction Site Name:	Date:	Time Start:
Sampler:		

Type of Discharge			
□ Stormwater	□ Authorized Non-stormwater	□ Unauthorized Non-stormwater	□ Non-visible pollutant

Field Meter Calibration	
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements

Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected

Discharge Location Description	Sample Type	Time

Non-Compliance Report Form

Site Information	
Construction Site Name:	
Construction Phase (grading, utilities, vertical, etc.):	Approximate area of site that is exposed:
Was an Order or Notice Received From the RWQCB: ☐ Yes ☐ No	
Details of Order or Notice:	

Discharge Information	
Estimated Time Discharge Began:	Estimated Time Discharge Ended:
Cause of Instance of Non-Compliance:	
BMPs Deployed Prior to Instance of Non-Compliance:	
BMPs Deployed After Instance of Non-Compliance:	
Date and Time BMPs Deployed:	

Inspector Information	
Inspector Name:	Inspector Title:
Signature:	Date:

Spill Log[1]

Minor				
Date	**Material Spilled/Location/Source**	**Approximate Quantity**	**First Response Team Members**	**Disposal Date**
Significant				
Date	**Material Spilled/Location/Source**	**Approximate Quantity**	**First Response Team Members/Contracted Offsite Response Team**	**Disposal Date**
Reportable				
Date of Spill	**Material Spilled/Location/Source**	**Approximate Quantity**	**Agencies Notified**	**Date Notified**
1 See Discussion in SWPPP Section 3.3.3. for completing table.				

Appendix I: Rain Gauge Log

INSTRUCTIONS

- ❑ *Complete the Rain Gauge Log and store it in this Appendix*

Rain Gauge Log Sheet

Construction Site Name:				
WDID #:				
Date (mm/dd/yy)	Time (24-hr)	Initials	Rainfall Depth (Inches)	Notes:

Appendix J: Training Reporting Form

Trained Contractor Personnel Log

Stormwater Management Training Log and Documentation

Project Name: ____

WDID #: ____

Stormwater Management Topic: (check as appropriate)

☐ Erosion Control ☐ Sediment Control

☐ Wind Erosion Control ☐ Tracking Control

☐ Non-Stormwater Management ☐ Waste Management and Materials Pollution Control

☐ Stormwater Sampling

Specific Training Objective: ____

Location: ___________________________ Date: _______________________________

Instructor:___________________________ Telephone: _________________________

Course Length (hours): _______________

Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

As needed, add proof of external training (e.g., course completion certificates, credentials for QSP, QSD).

Appendix K: Responsible Parties and ELAP Laboratory

Include copy of QSD Certification

Insert copy of QSP certification for QSPs associated with this project

Identification of QSP

Project Name:

WDID #:

The following are QSPs associated with this project

Name of Personnel(1)	Company	Date

(1) If additional QSPs are required on the job site add additional lines and include information here

Appendix L: Contractors and Subcontractors

Appendix M: CASQA BMP Factsheets and Construction General Permit

INSTRUCTIONS

- ❑ Include a copy of the General Permit, or link to CGP

INSTRUCTIONS

- ❑ *Include Fact Sheets for BMPs identified in Section 3 of this SWPPP*

CSMP Attachment 1: Chain of Custody Form

CHAIN-OF-CUSTODY **DATE:** **Lab ID:**

DESTINATION LAB:							REQUESTED ANALYSIS				Notes:
	ATTN:										
ADDRESS:											
Office Phone:											
Cell Phone:											
SAMPLED BY:											
Contact:											
Project Name											
Client Sample ID	**Sample Date**	**Sample Time**	**Sample Matrix**	**Container #**	**Type**	**Pres.**					

SENDER COMMENTS:	**RELINQUISHED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:
LABORATORY COMMENTS:	**RECEIVED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:

CSMP Attachment 2: Field Meter Instructions

INSTRUCTIONS

Place instructions for field meters that will be used by contractor personnel in this Attachment.

CSMP Attachment 3: Supplemental Information

Appendix F
MS4 Maps and Inventory

Figure 1. MS4 and Existing Development Inventory - Port Overview

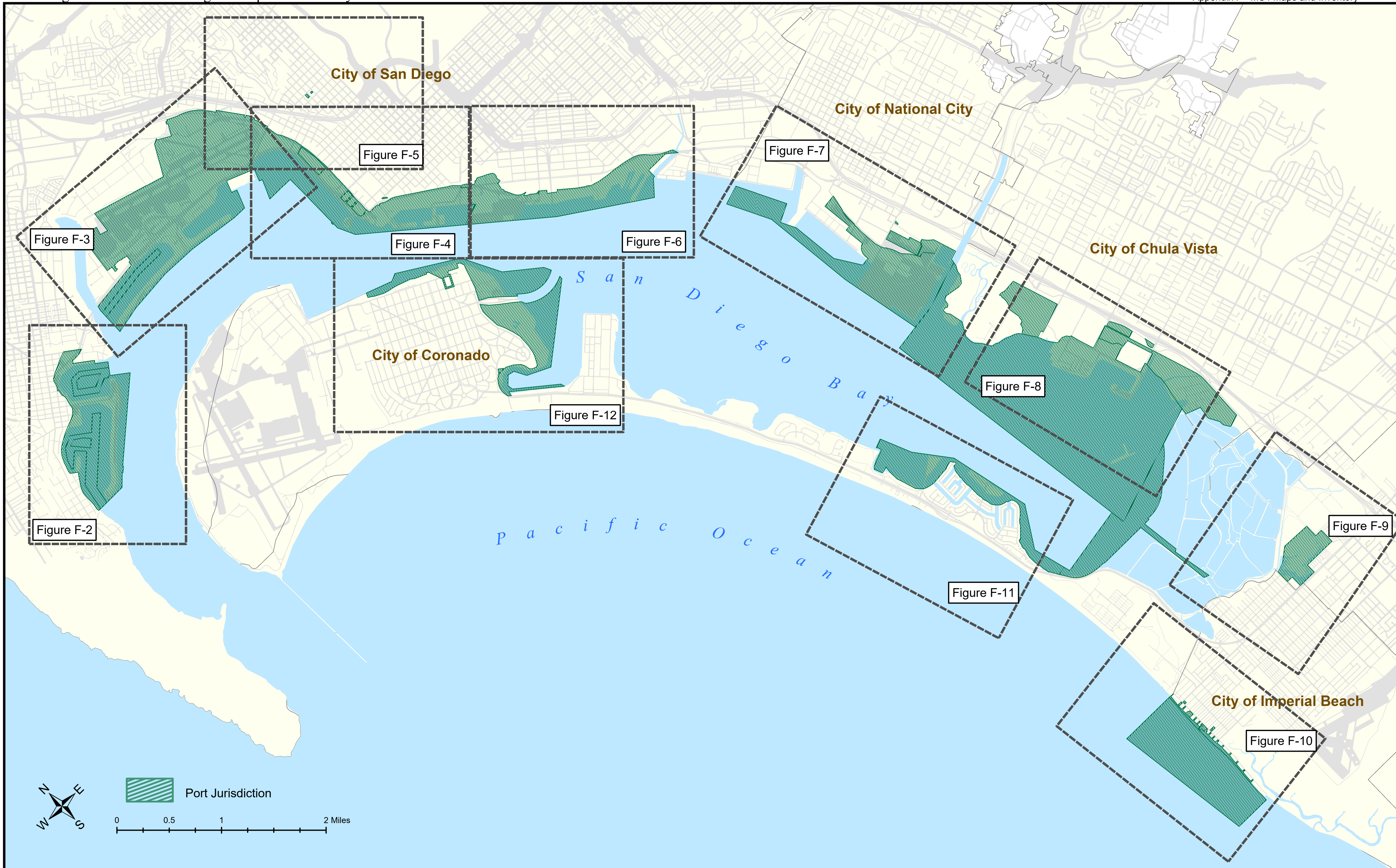


Figure 2. MS4 and Existing Development Inventory - Shelter Island

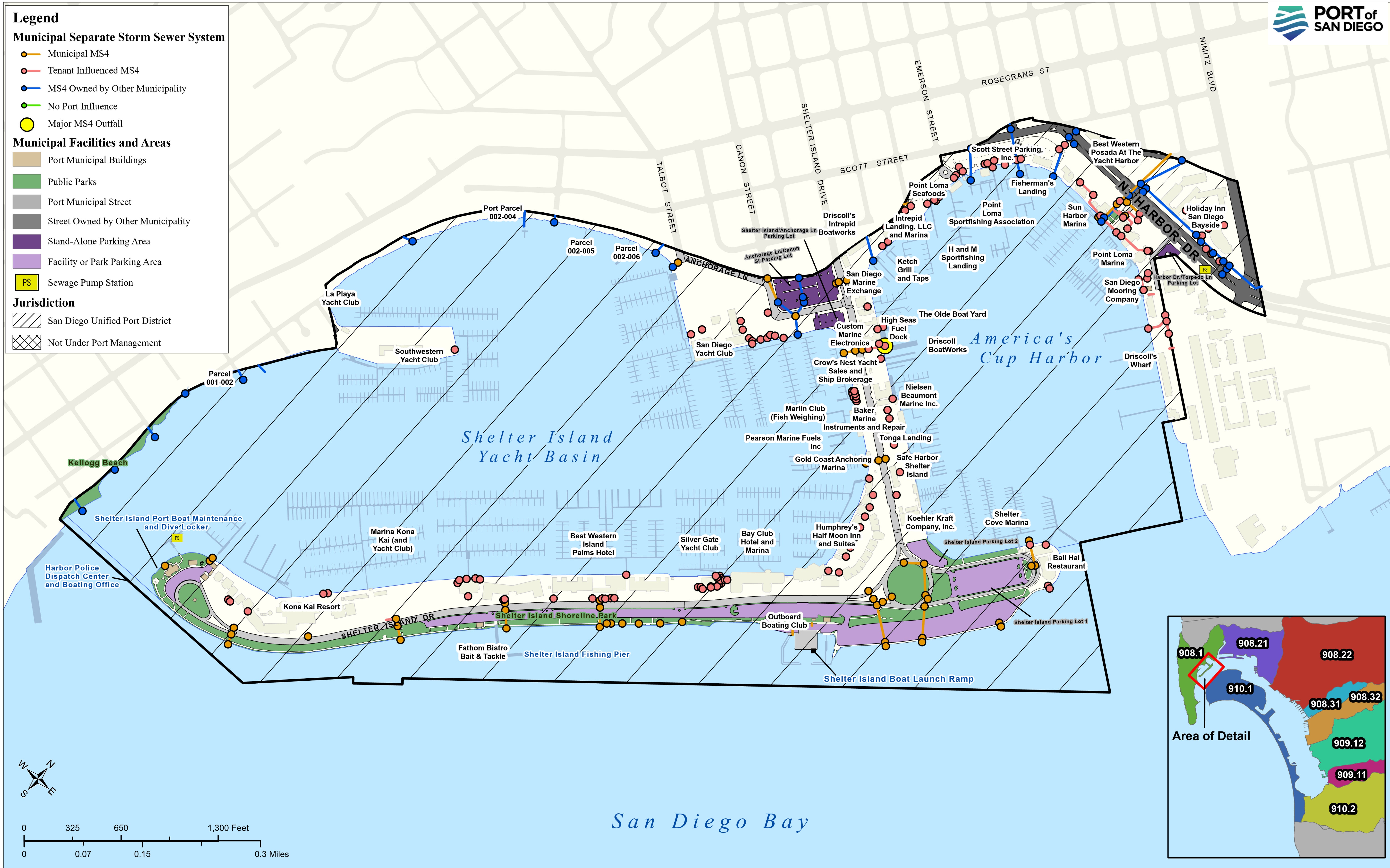


Figure 3. MS4 and Existing Development Inventory - Harbor Island

Figure 4. MS4 and Existing Development Inventory - Embarcadero

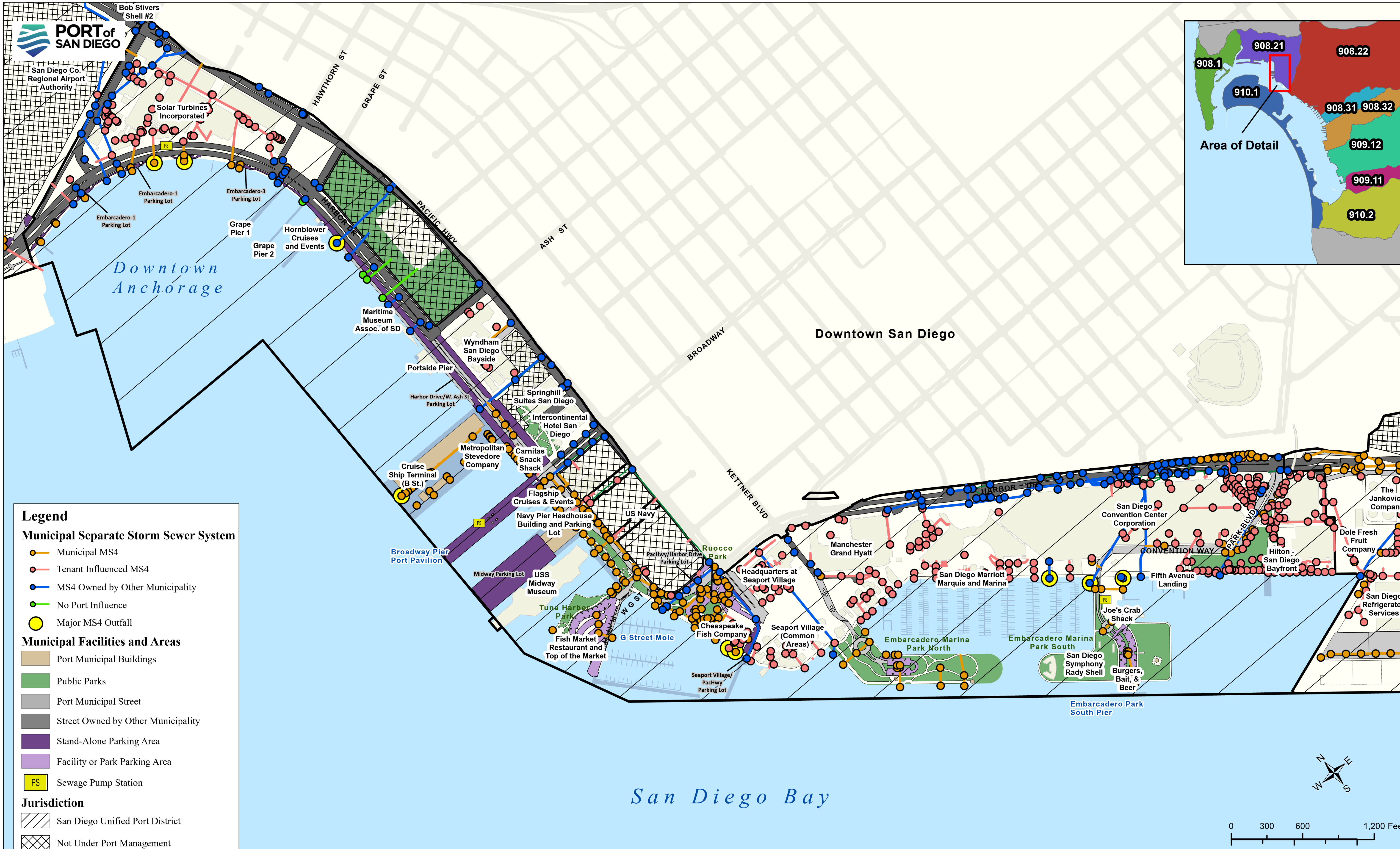


Figure 5. MS4 and Existing Development Inventory - Parcel 016-021

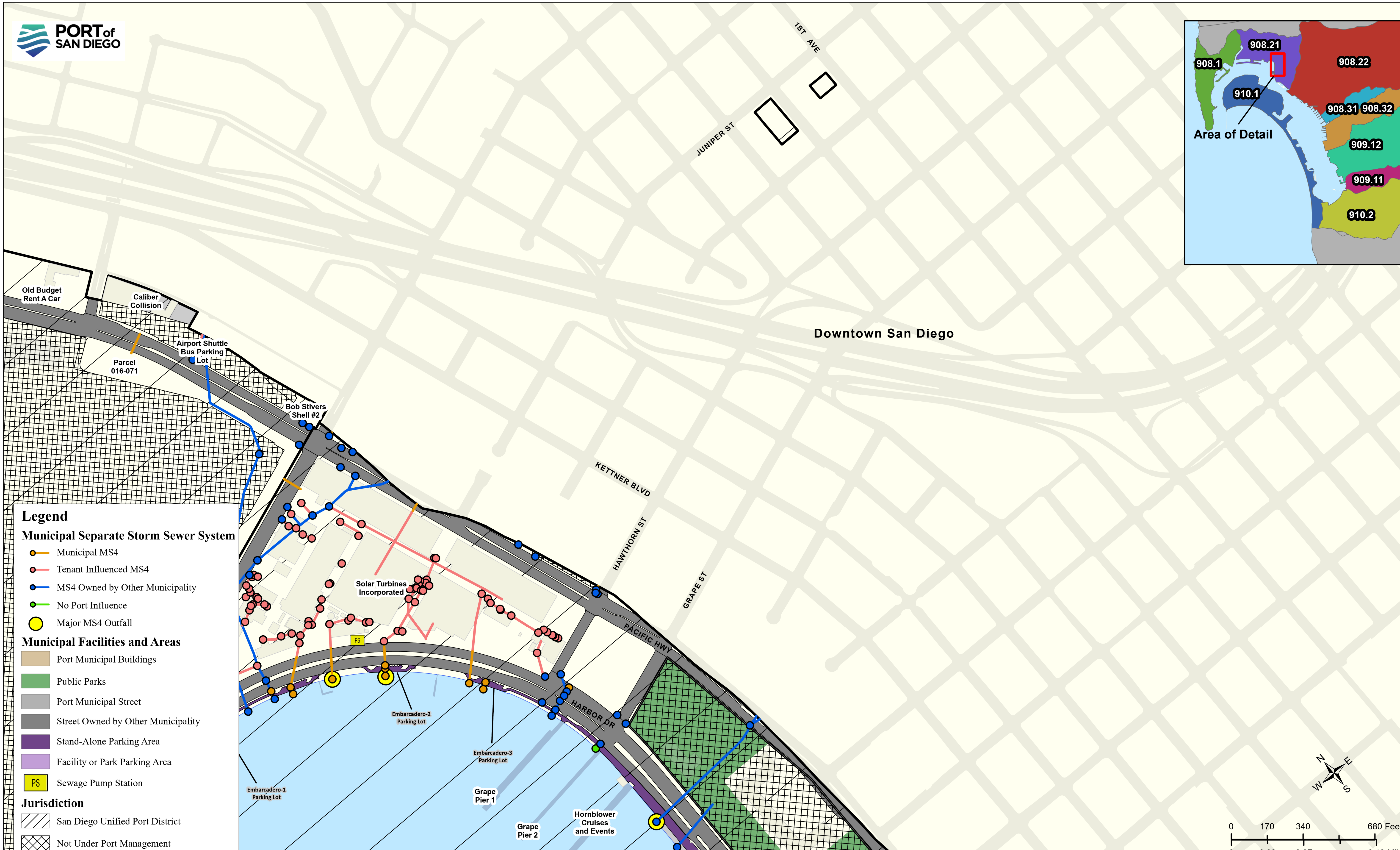


Figure 6. MS4 and Existing Development Inventory - Tenth Avenue Marine Terminal

Figure 7. MS4 and Existing Development Inventory - National City

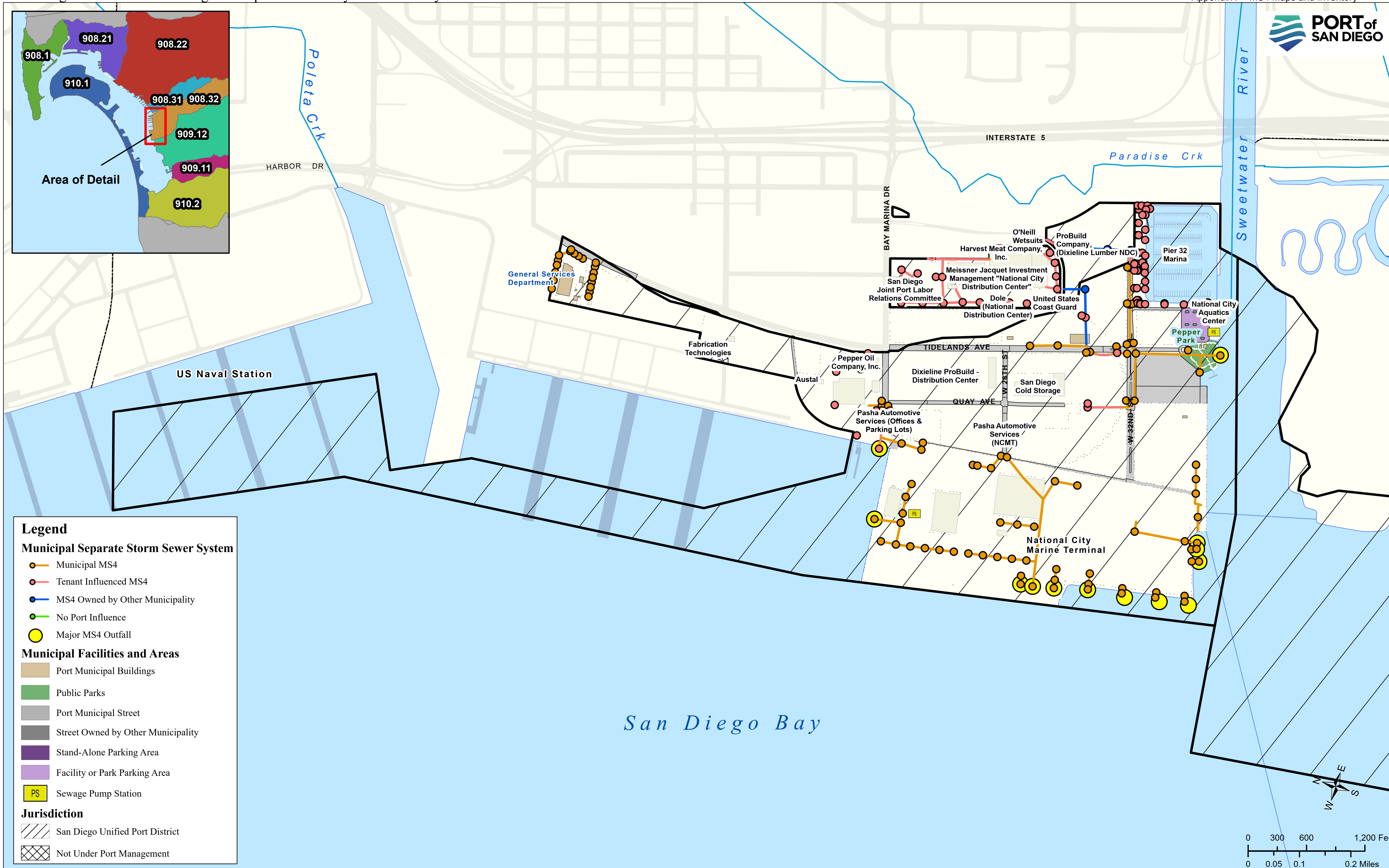


Figure 8. MS4 and Existing Development Inventory - Chula Vista

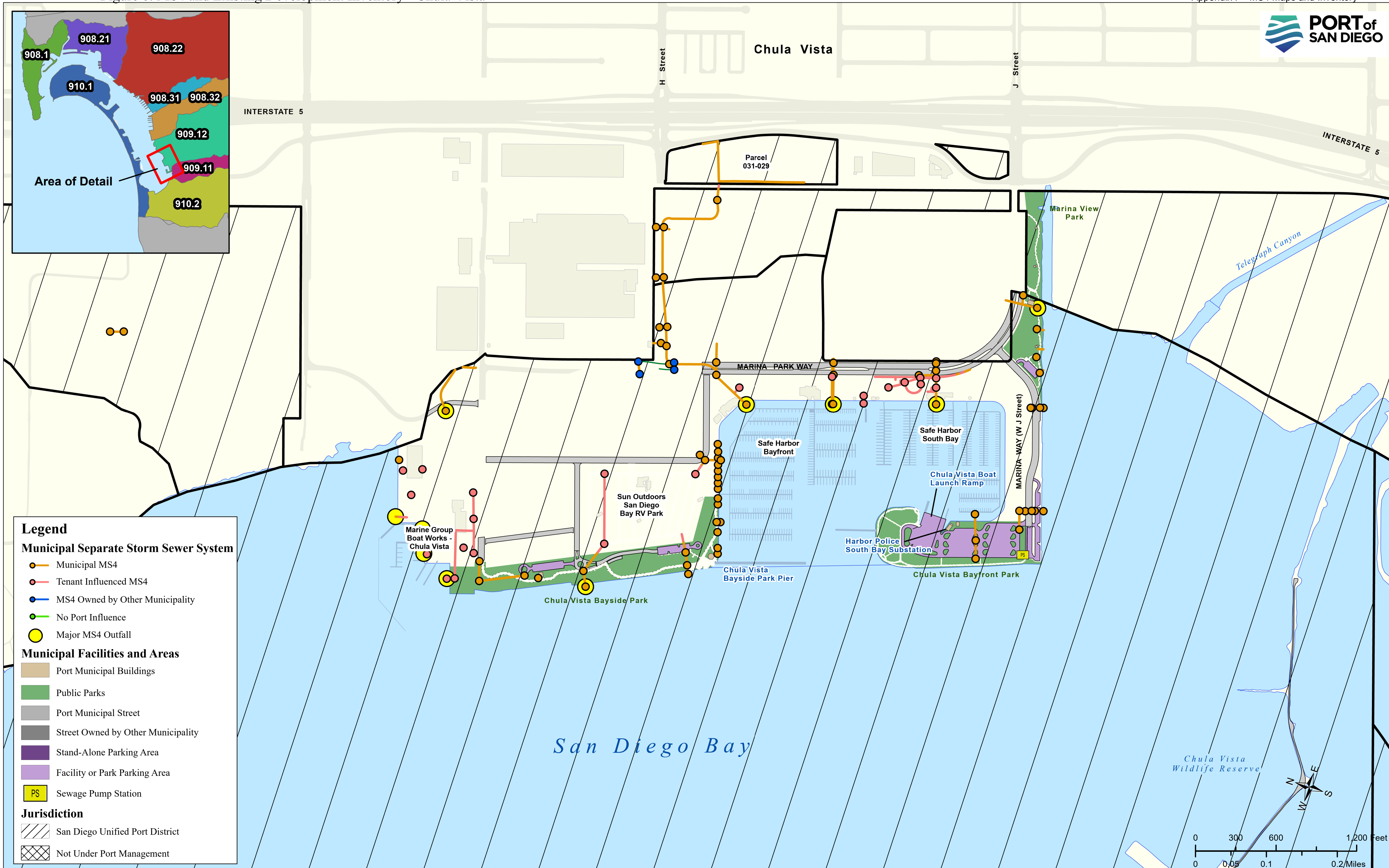


Figure 9. MS4 and Existing Development Inventory - Salt Works

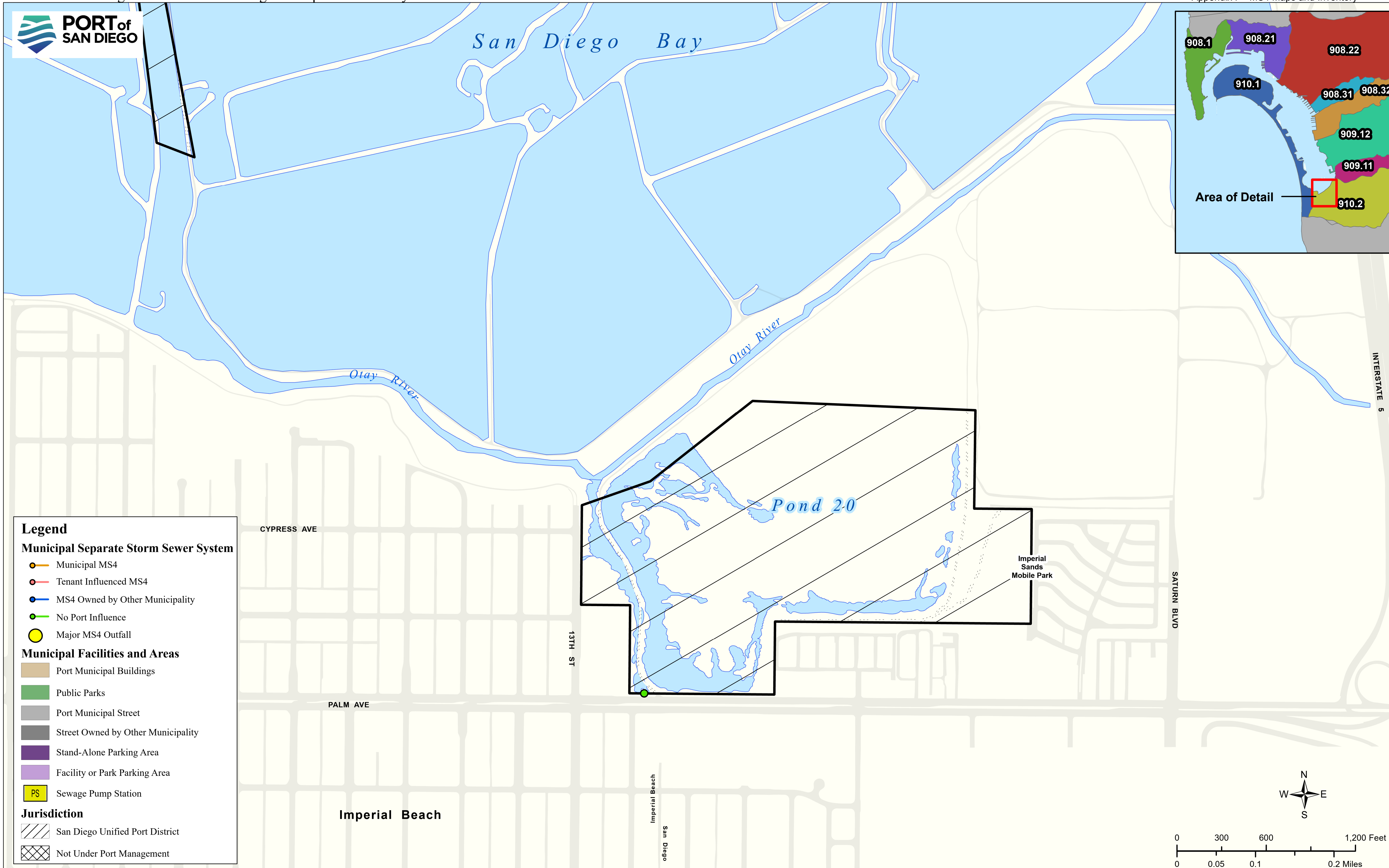


Figure 10. MS4 and Existing Development Inventory - Imperial Beach

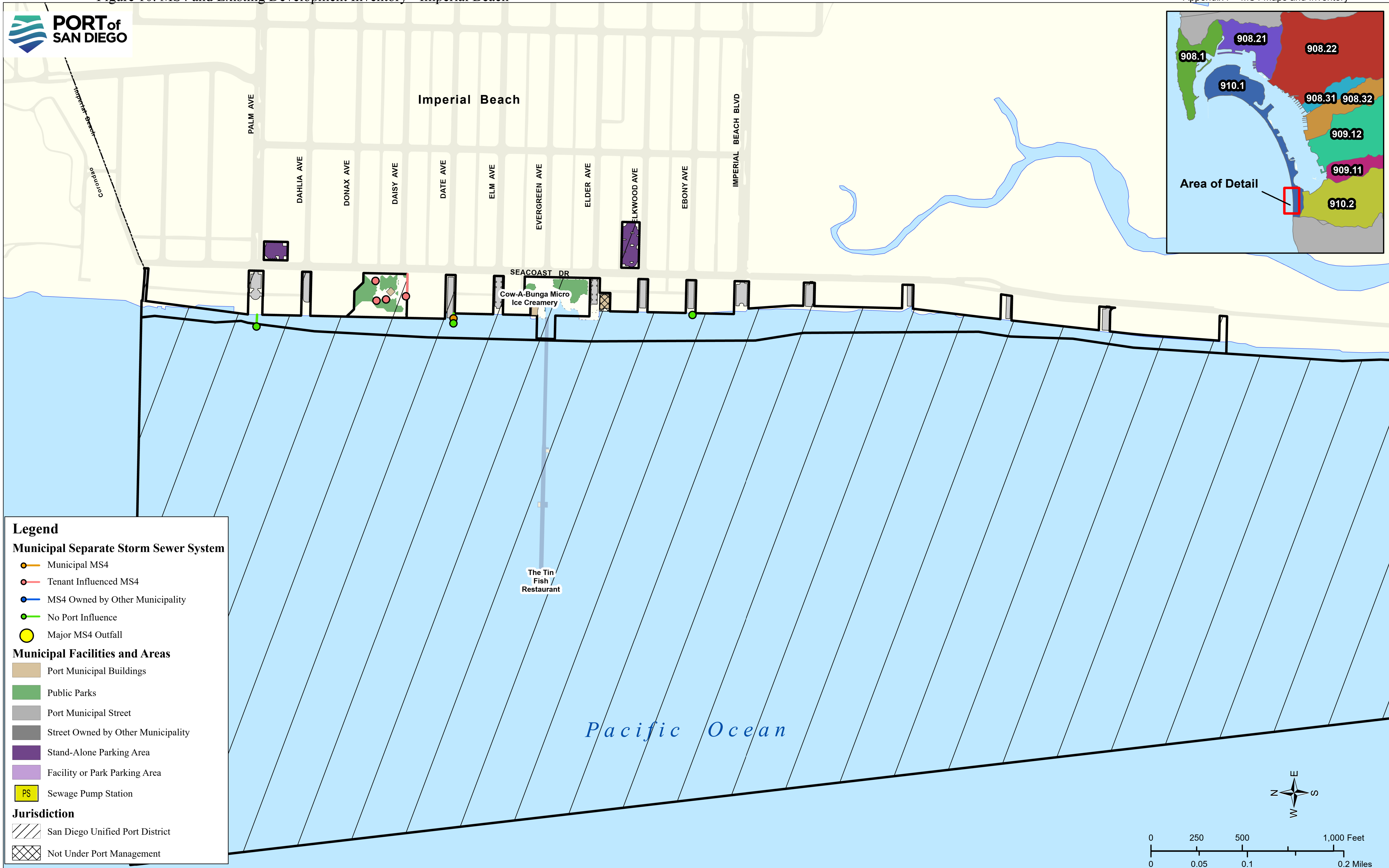


Figure 11. MS4 and Existing Development Inventory - Silver Strand

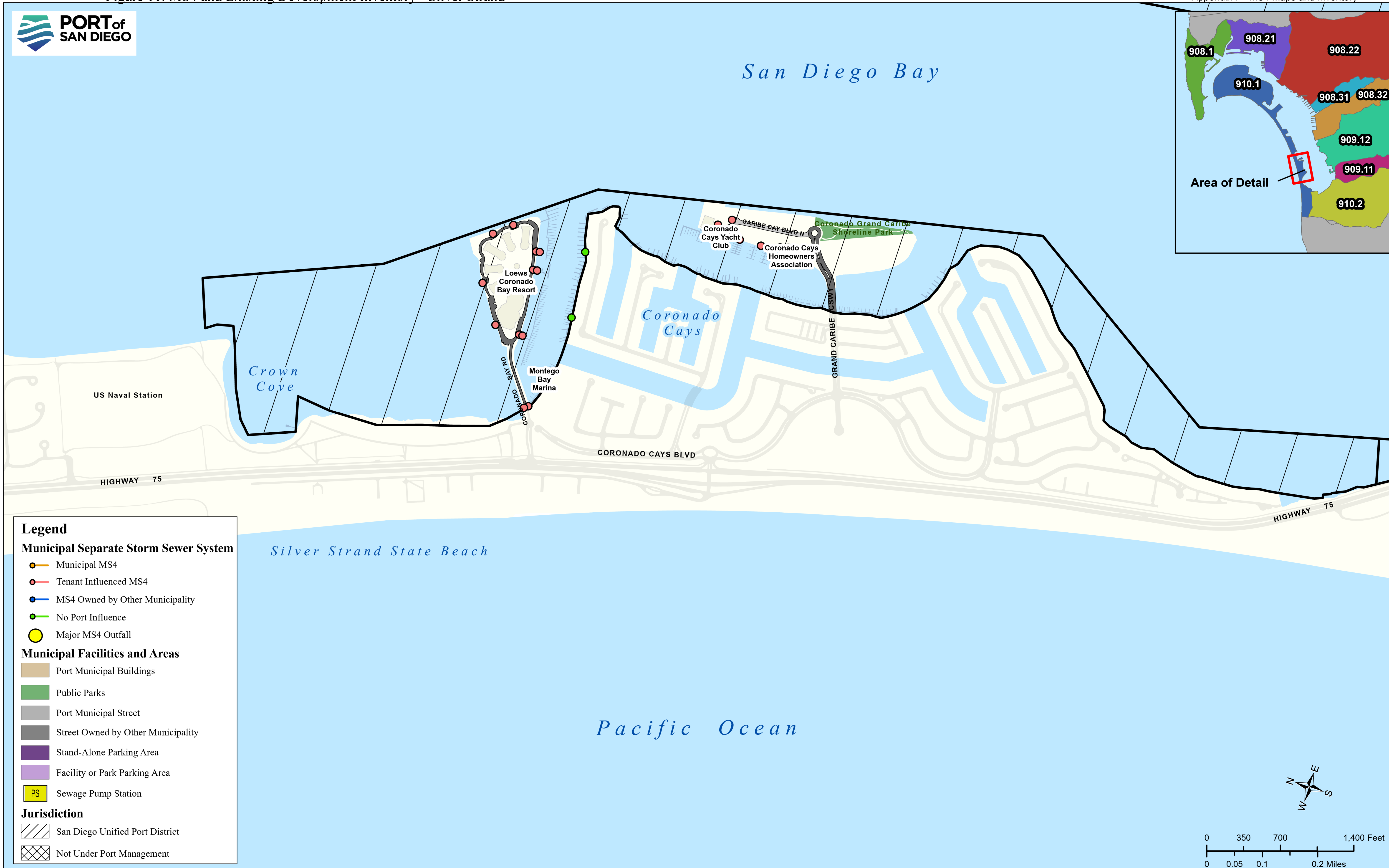


Figure 12. MS4 and Existing Development Inventory - Coronado

Appendix G
Municipal/Commercial/Industrial Inventory

Facilities Inventory Report

Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Potential Pollutants								Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
											Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash			
Municipal Facilities																					
Cruise Ship Terminal (B St.)	1150 North Harbor Drive	San Diego	CA	92101	908.21	N/A	4489, 4491	Active	Water Transportation Services, Passengers	Provides water-based excursions to visitors. Changed to Industrial component and low priority w/JRMP 2015	No	No	No	Yes	No	No	No	Yes	Yes	Yes	High
G Street Mole	Tuna Lane at the Foot of G Street	San Diego	CA	92101	908.21	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
General Services Department	1400 Tidelands Avenue	National City	CA	91950	908.32	N/A	9199	Active	Corporate Yard, Equipment, Storage and Repair	Facilities maintenance yard	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Harbor Police Dispatch Center and Boating Office	1401 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
Harbor Police Headquarters	3380 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
Harbor Police South Bay Substation	950 Marina Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	High
National City Marine Terminal - PDP BMPs	1400 West 24th Street	National City	CA	91950	908.32	N/A	N/A	Active	Marine Cargo Handling	Port Maintained PDP BMPs located at National City Marine Terminal	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Low
Parcel 001-002	Dock Near 2900 Nichols Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Port District Administration Building and Annex	3165 Pacific Highway	San Diego	CA	92101	908.21	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	High
Port Parcel 002-004	Dock adjacent to 873 San Antonio Place	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	recreational pier	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Shelter Island Port Boat Maintenance and Dive Locker	1401 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Corporate Yard, Equipment, Storage and Repair	Provides storage of vessels, equipment, and supplies/chemicals used during routine maintenance and repair.	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Tenth Avenue Marine Terminal	687 Switzer Street	San Diego	CA	92101	908.22	N/A	4491, 4412, 4225	Active	Marine Cargo Handling	Conducts marine cargo offloading activities. May include storage of vehicles, equipment, products for ongoing activites and offsite transportation.	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
Total Municipal Facilities: 12																					
Municipal Parks																					
Broadway Pier Port Pavilion	1198 W. Broadway	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides water access for the general public.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Cancer Survivor's Park (SDUPD)	North Harbor Drive, Adjacent to Spanish Landing Park	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes seating areas and grassy open space.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Cesar Chavez Park	Foot of Cesar E Chavez Parkway	San Diego	CA	92101	908.22	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public parking, restrooms, playgrounds, a fishing pier and grassy open areas.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Chula Vista Bayfront Park	980 Marina Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. May include public parking, restrooms, playgrounds, sporting areas (tennis, basketball, etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Chula Vista Bayside Park	999 Bayside Parkway	San Diego	CA	91910	909.12	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. May include public parking, restrooms, playgrounds, sporting areas (tennis, basketball, etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Chula Vista Bayside Park Pier	496 Bayside Parkway	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides fishing and water access for the general public. May include fish cleaning areas, restrooms, or parking areas.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Low
Chula Vista Boat Launch Ramp	Adjacent to 950 Marina Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides fishing and water access for the general public. May include fish cleaning areas, restrooms, or parking areas.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Low
Coronado Boat Launch Ramp	Adjacent to 1715 Strand Way	Coronado	CA	92118	910.10	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides fishing and water access for the general public. May include fish cleaning areas, restrooms, or parking areas.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Low

											Potential Pollutants										
Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash	Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
Coronado Grand Caribe Shoreline Park	598 Grand Caribe Cswy.	Coronado	CA	92118	910.10	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes open spaces and seating areas.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Coronado Landing Park	1201 1st Street	Coronado	CA	92118	910.10	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes open grassy areas, seating areas and trash receptacles.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Coronado Tidelands Park	2000 Mullinex Dr	Coronado	CA	92118	910.10	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public parking, restrooms, playgrounds, open grassy areas, and baseball fields.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Embarcadero Marina Park, North	400 Kettner Blvd	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public parking, restrooms, playgrounds, sporting areas (basketball, circuit training etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Embarcadero Marina Park, South	200 Marina Park Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public parking, restrooms, playgrounds, and sporting areas (basketball, circuit training, etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Embarcadero Park South Pier	200 Marina Park Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides fishing and water access for the general public. May include fish cleaning areas, restrooms, or parking areas.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Low
Grape Pier 1	1810 N Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides dock slips for boaters	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Grape Pier 2	N Harbor Drive and W Grape Street	San Diego	CA	92101	908.21	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides dock slips for boaters	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Low
Harbor Island Park	1875 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. May include public parking, restrooms, playgrounds, sporting areas (tennis, basketball, etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Kellogg Beach	at the end of Kellogg St.	San Diego	CA	92106	908.10	N/A	9199	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Marina View Park	900 Marina Park Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. May include public parking, restrooms, playgrounds, sporting areas (tennis, basketball, etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
National City Aquatics Center	3300 Goesno Place	National City	CA	91950	908.32	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Recreation and educational space.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Pepper Park	1200 West 32nd St	National City	CA	91950	908.32	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. May include public parking, restrooms, playgrounds, sporting areas (tennis, basketball, etc.).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Ruocco Park	585 Harbor Lane	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public restrooms, seating areas and open grassy areas.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Shelter Island Boat Launch Ramp	Adjacent to 2210 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides fishing and water access for the general public. May include fish cleaning areas, restrooms, or parking areas.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Low
Shelter Island Fishing Pier	1776 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Piers and Boat Launch Ramps	Provides fishing and water access for the general public. May include fish cleaning areas, restrooms, or parking areas.	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Low
Shelter Island Shoreline Park	Southerly of Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public parking, restrooms and playgrounds.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Spanish Landing Park	4200 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Provides outdoor open space for use by the general public. Includes public parking, restrooms, and grassy open space areas.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Tuna Harbor Park	Tuna Lane at the Foot of G Street	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	This facility provides outdoor open space for use by the general public. It includes public parking, restrooms, seating areas and open grassy areas. There are also tourist and sight seeing areas.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Total Municipal Parks: 27																					
Roads/Streets																					
Anchorage Lane	Anchorage Lane	San Diego	CA	92106	908.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low

Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Potential Pollutants								Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
											Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash			
Bay Marina Drive	Bay Marina Drive	National City	CA	91950	908.32	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Belt Street	Belt Street	San Diego	CA	92101	908.22	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Canon Street	Canon Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Caribe Cay Boulevard North	Caribe Cay Boulevard North	Coronado	CA	92118	910.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles	No	No	No	No	No	No	No	No	No	Yes	Low
Cesar E. Chavez Parkway	1449 Cesar E. Chavez Parkway	San Diego	CA	92101	908.22	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Convention Way	Convention Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Crosby Road	Crosby Road	San Diego	CA	92101	908.22	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Emerson Street	Emerson Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Glorietta Blvd.	Glorietta Blvd.	Coronado	CA	92118	910.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	Low
H Street	H Street between Marina Parkway and Walnut Avenue	Chula Vista	CA	91910	909.11	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	High
Harbor Island Drive	Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	Low
Kettner Boulevard	Kettner Boulevard	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	Low
Liberator Way	Liberator Way (from Harbor Island Drive to the edge of Enterprise)	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Marina Park Way	Marina Park Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Marina Way (W J Street)	W J Street	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
N Harbor Drive	N Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Pacific Highway	Pacific Highway	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	Low
Park Blvd.	800 Blk of Harbor Drive. Street turns into Convention Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Quay Avenue	Quay Avenue	National City	CA	91950	908.32	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	Low
Shelter Island Drive	Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Spanish Landing East Road	Spanish Landing East Road	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Switzer Street	Switzer Street	San Diego	CA	92101	908.22	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Talbot Street	Talbot Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Tidelands Avenue	Tidelands Avenue	National City	CA	91950	908.32	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	High

Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Potential Pollutants								Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
											Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash			
W 28th Street	W 28th Street	National City	CA	91950	908.32	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	High
W 32nd Street	W 32nd Street	National City	CA	91950	908.32	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	No	High
W G Street	W G Street	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Water Street	Water Street	San Diego	CA	92101	908.22	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	Low
Total Roads/Streets: 29																					
Municipal Parking Areas																					
Anchorage Ln/Canon St Parking Lot	1100 Anchorage Lane	San Diego	CA	92106	908.10	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	High
Coast Guard Parking Lot	2750 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Embarcadero-1 Parking Lot	2500 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	High
Embarcadero-2 Parking Lot	2340 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	High
Embarcadero-3 Parking Lot	1600 N. Harbor Drive	San Diego	CA	92106	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	High
Harbor Dr./Torpedo Ln Parking Lot	N. Harbor Drive and Torpedo Ln	San Diego	CA	92106	908.10	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Harbor Drive/W. Ash St. Parking Lot	Harbor Drive and West Ash St.	San Diego	CA	92102	908.21	N/A	N/A	Active	Parking Lot/Storage	Short Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Harbor/Laurel Parking Lot	2548 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Midway Parking Lot	950 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Navy Pier Headhouse Building and Parking Lot	960 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Parking Lot	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Old Budget Rent A Car	3125 Pacific Highway	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Empty lot	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	High
PacHwy/Harbor Drive Parking Lot	Northwest Corner of Pacific Hwy and Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking - Permit Required	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Parcel 007-011	Adjacent to the parking lot at 851 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Inactive tree farm	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Parcel 008-003	Corner of N Harbor Drive and Seaplane Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	empty lot used to store GS dumpsters	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Parcel 016-071	1500 W Palm Street	San Diego	California	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Unused Lot	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	High
Parcel 031-029	H street and Bay Blvd	Chula Vista	CA	91910	909.11	N/A	N/A	Active	Parking Lot/Storage	empty lot	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
Seaport Village/PacHwy Parking Lot	End of Pacific Coast Hwy	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	High
Shelter Island Parking Lot 1	Shelter Island Drive (parking lot on far east end of Shelter Island)	San Diego	CA	92106	908.10	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	High
Shelter Island Parking Lot 2	Shelter Island Drive (parking lot on the north end of the traffic circle)	San Diego	CA	92106	908.10	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	High

Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Potential Pollutants: Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash	Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
Shelter Island/Anchorage Ln Parking Lot	1100 Anchorage Ln	San Diego	CA	92101	908.10	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Total Municipal Parking Areas: 20																					
Municipal Sewer Collection Structures (indicated on maps as "PS" for sewage pump structure)																					
America's Cup Harbor Restroom- Sewage Pump Station	4900 N. Harbor Drive	San Diego	CA	92101	908.10	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Broadway Pavilion - Sewage Pump Station	1000 W. Broadway	San Diego	CA	92101	908.21	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Embarcadero Marina Park South - Sewage Pump Station	200 Marina Parkway	San Diego	CA	92101	908.21	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Laurel Hawthorn - Sewage Pump Station	2300 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
National City Marine Terminal - Sewage Pump Station	1400 W. 24th Street	National City	CA	91950	908.32	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Spanish Landing North - Sewage Pump Station	3900-4300 N. Harbor Drive	San Diego	CA	92101	908.10	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Spanish Landing South - Sewage Pump Station	3900-4300 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Tenth Avenue Marine Terminal - Sewage Pump Station	Foot of Crosby Street	San Diego	CA	92101	908.22	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Vessel Pump-out Bayfront Park Boat Launch	Foot of Marina Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Vessel Pump-out Pepper Park Boat Launch	3299 Tidelands Avenue	National City	CA	91950	908.32	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Vessel Pump-out Shelter Island Transient Dock	1403 Shelter Island Drive	San Diego	CA	92016	908.10	N/A	N/A	Active	Sewage Pump Station	Sewage pump-station used to pump waste location to another	Yes	No	No	No	No	No	No	No	Yes	Yes	Low
Total Sewer Collection Structures: 11																					
Total Municipal Facilities: 99																					
Commercial Facilities																					
Airport Parking Lot Parcel 007-048 and 007-025	Easterly Adj. 1380 Harbor Island Dr	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	parking lot	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Airport Shuttle Bus Parking Lot	2535 Pacific Highway	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Airport Shuttle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
Avis Rent A Car	3180 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Temporary storage and/or parking of vehicles or equipment. May include temporary storage containers.	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Baker Marine Instruments and Repair	2425 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marine Services and Supplies	Provides indoor offices for the sales and/or distribution of maritime equipment. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
Bali Hai Restaurant	2230 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Bay Club Hotel and Marina	2131 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	7211, 71390, 7224, 7225	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Best Western Island Palms Hotel	2051 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	High
Best Western Posada At The Yacht Harbor	5005 North Harbor Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low

												Potential Pollutants										
Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash	Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
Bob Stivers Shell #2	2521 Pacific Highway	San Diego	CA	92101	908.21	N/A	N/A	Active	Retail or Wholesale Fueling	Provides retail or wholesale fueling services and may provide auto maintenance services	No	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Low
Burgers, Bait & Beer	200 Marina Parkway	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in the kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Cabrillo Isle Marina	1450 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Caliber Collision	1411 West Palm Street	San Diego	CA	92101	908.21	N/A	7539	Active	Auto Repair, Maintenance, Fueling, Cleaning	Auto body repair.	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Carnitas Snack Shack	1004 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Coasterra	880 Harbor Island Dr,	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Coronado Cays Homeowners Association	505 Grande Caribe Causeway	Coronado	CA	92118	910.10	N/A	N/A	Active	Marina/Yacht Club	Provides marketing, management, dock space and residential sales services.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Coronado Cays Yacht Club	30 Caribe Cay Boulevard North	Coronado	CA	92118	910.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Coronado Ferry Landing Management	1201 First Street	Coronado	CA	92118	910.10	N/A	N/A	Active	Offices, Administrative Uses	Provides water-based excursions and/or transportation primarily aimed at providing entertainment to visitors.	No	No	No	No	No	No	No	No	No	No	Low
Coronado Island Marriott Resort	2000 Second Street	Coronado	CA	92118	910.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	High
Coronado Yacht Club	1631 Strand Way	Coronado	CA	92118	910.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Cow-A-Bunga Micro Ice Creamery	10 Evergreen Ave, Suite E	Imperial Beach	CA	91932	910.10	N/A	N/A	Active	Specialty Food and Beverage Shop	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Crow's Nest Yacht Sales and Ship Brokerage	2515 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Realty, Including Boat and Automobile Sales	Indoor sales offices and/or showrooms for boats and automobiles.	No	No	No	No	No	No	No	No	No	No	Low
Custom Marine Electronics	2525 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marine Services and Supplies	Provides indoor offices for the sales and/or distribution of maritime equipment. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
Driscoll's Wharf	4900-4930 North Harbor Drive	San Diego	CA	92101	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for sportfishing vessels, both public and private. May also provide restrooms, trash containers, fish cleaning areas, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Fathom Bistro Bait & Tackle	1776 Shelter Island Dr,	San Diego	CA	92106	908.10	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also provides fishing gear and kayak rental.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Ferry Landing Associates, LLC	1311 First Ave,	Coronado	CA	92118	910.10	N/A	N/A	Active	Eating or Drinking Establishment	Retail sales and restaurants	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Fifth Avenue Landing	600 Convention Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Fish Market Restaurant and Top of the Market	750 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Fisherman's Landing	2838 Garrison Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Sportfishing	Provides dock slips for sportfishing vessels, both public and private. May also provide restrooms, trash containers, fish cleaning areas, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Flagship Cruises & Events	1050 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Water Transportation Services, Passengers	Provides water-based excursions and/or transportation primarily aimed at providing entertainment to visitors.	No	No	No	Yes	No	No	No	Yes	Yes	Yes	Low
Glorietta Bay Marina	1715 Strand Way	Coronado	CA	92118	910.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low

Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Potential Pollutants								Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
											Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash			
Gold Coast Anchoring Marina	2353 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
H and M Sportfishing Landing	2803 Emerson Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Sportfishing	Provides dock slips for sportfishing vessels, both public and private. May also provide restrooms, trash containers, fish cleaning areas, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Harbor Island West Marina	2040 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Headquarters at Seaport Village	849 West Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	High
Hertz Rental Car	3202 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Establishments primarily engaged in short-term rental of passenger cars without drivers (SIC 7514).	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
High Seas Fuel Dock	2540 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Retail or Wholesale Fueling	Provides retail or wholesale fueling services and may provide boat maintenance services.	No	Yes	No	Yes	Yes	No	No	Yes	Yes	No	Low
Hilton - San Diego Bayfront	1 Park Boulevard	San Diego	CA	92101	908.21	N/A	7011	Active	Hotel/Motel	Provides temporary lodging of visitors, may include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Holiday Inn San Diego Bayside	4875 North Harbor Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Hornblower Cruises and Events	1800 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Water Transportation Services, Passengers	Provides water-based excursions and/or transportation primarily aimed at providing entertainment to visitors.	No	No	No	Yes	No	No	No	Yes	Yes	Yes	Low
Humphrey's Half Moon Inn and Suites	2303 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Imperial Sands Mobile Park	N of Palm Ave, W of Saturn Blvd	San Diego	CA	92154	910.20	N/A	N/A	Active	Parking Lot/Storage	Parking lot for the mobile home park	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	High
Intercontinental Hotel San Diego	901 Bayfront Ct.	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities. Also includes Lanefield Park (with PDP BMPs)	No	No	No	Yes	No	Yes	No	Yes	Yes	No	High
Intrepid Landing, LLC and Marina	2805 Dickens Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Specialty Retail Services	Eating or Drinking Establishment, Marine Services and Supplies, Offices Administrative Uses, Specialty Food and Beverage Shop, Specialty Gift Shop. Facility also operates a commercial marina.	No	No	No	No	No	No	No	No	No	No	Low
Island Prime	880 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer (s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Joe's Crab Shack	525 Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Ketch Grill & Taps	2614 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Kona Kai Resort	1551 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	No	Low
La Playa Yacht Club	Dock adjacent to 2849 Qualtrough Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Loews Coronado Bay Resort	4000 Coronado Bay Road	Coronado	CA	92118	910.10	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Manchester Grand Hyatt	One Market Place	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Marina Cortez, Inc.	1880 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Marina Kona Kai (and Yacht Club)	1551 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Potential Pollutants								Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
											Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash			
Maritime Museum Assoc. of SD	1492 North Harbor Dr.	San Diego	CA	92101	908.21	N/A	N/A	Active	Museum	Provides tourist attractions of various historic artifacts, vehicles, and equipment.	Yes	No	No	Yes	No	Yes	No	Yes	Yes	No	Low
Marlin Club (Fish Weighing)	2445 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Sportfishing	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Meissner Jacquet Investment Management "National City Distribution Center"	1000 Bay Marina Drive	National City	CA	91950	908.32	N/A	N/A	Active	Offices, Administrative Uses	Property management of the National City Distribution Center.	No	No	No	No	No	No	No	No	No	No	High
Montego Bay Marina	12 Sandpiper Strand	Coronado	CA	92118	910.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
National Oceanographic & Atmospheric Administration (NOAA)	1800 Crosby Rd	San Diego	CA	92101	908.22	N/A	N/A	Active	Industrial Uses Not Elsewhere Classified	Scientific research agency	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
National Rental Car	3280 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Parking Lot/Storage	Establishments primarily engaged in short-term rental of passenger cars without drivers (SIC Code: 7514).	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
O'Neill Wetsuits	1022 Bay Marina Drive Suite 140	National City	CA	91950	908.32	N/A	N/A	Active	Wholesale Distributors	Wetsuits	No	No	No	Yes	No	No	No	Yes	Yes	No	Low
Outboard Boating Club	2210 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
Parcel 002-005	Dock bayside of 939 Scott Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides Dock Slips for Boaters	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Parcel 002-006	Dock Bayside of 979 Scott Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Park, Shuttle, & Fly Airport Parking	3405 Pacific Highway (Lot 4) and 3275 Pacific Highway (Lot 5)	San Diego	CA	92101	908.21	N/A	7521	Active	Parking Lot/Storage	Vechile long and short term parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
Pasha Automotive Services (Offices & Parking Lots)	1309 Bay Marina Dr	National City	CA	91950	908.32	N/A	8741 & 7521	Active	Parking Lot/Storage	Short-term vehicle parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Pearson Marine Fuels Inc	2435 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Retail or Wholesale Fueling	Provides retail or wholesale fueling services and may provide maintenance services	No	Yes	No	Yes	Yes	No	No	Yes	Yes	Yes	Low
Pier 32 Marina	3201 Marina Way	National City	CA	91950	908.32	N/A	N/A	Active	Marina/Yacht Club	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Point Loma Marina	4960 North Harbor Drive	San Diego	CA	San Diego	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Point Loma Seafoods	2805 Emerson Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Point Loma Sportfishing Association	1403 Scott Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Sportfishing	Provides dock slips for sportfishing vessels, both public and private. May also provide restrooms, trash containers, fish cleaning areas, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Portside Pier	1360 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen. Formerly Anthony's Star of the Sea Room.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Probuild Company (Dixieline Lumber NDC)	1022 Bay Marina Drive	National City	CA	92150	908.32	N/A	N/A	Active	Wholesale Distributors	Warehouse	No	No	No	Yes	No	No	No	Yes	Yes	No	Low
Rent A Car Access	Liberator Way (After Harbor Police Headquarters, that section inspected under Liberator Way)	San Diego	CA	92101	908.21	N/A	N/A	Active	Roads and Streets	Transportation thoroughfare and parking surfaces primarily intended for automobiles.	No	No	No	No	No	No	No	No	No	Yes	High
Safe Harbor Bayfront	550 Marina Parkway	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Safe Harbor South Bay	640 Marina Parkway	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

											Potential Pollutants										
Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash	Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
Safe Harbor Sunroad	955 Harbor Island Dr	San Diego	CA	92101	908.21	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
San Diego Airport Hilton	1960 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
San Diego Convention Center Corporation	111 West Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
San Diego Joint Port Labor Relations Committee	1000 Bay Marina Drive	National City	CA	91950	908.32	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
San Diego Marine Exchange	2636 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marine Services and Supplies	Provides indoor offices for the sales and/or distribution of maritime equipment. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
San Diego Marriott Marquis and Marina	333 West Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities. Facility also operates a commercial marina and sub-leases a restaurant.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
San Diego Mooring Company	4980 N. Harbor Drive #201	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides moorings for boaters.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
San Diego Symphony Rady Shell	222 Marina Park Way	San Diego	CA	92101	908.21	N/A	N/A	Active	Parks, or Other Recreational Areas/Facilities	Event space for the San Diego Symphony	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
San Diego Yacht Club	1011 Anchorage Lane	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Scott Street Parking, Inc.	2838 Garrison Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Parking Lot/Storage	Short-Term Vehicle Parking	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Seaport Village (Common Areas)	849 West Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating areas, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Shelter Cove Marina	2240 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Sheraton San Diego Hotel & Marina	1380 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Silver Gate Yacht Club	2091 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Southwestern Yacht Club	2702 Qualtrough Street	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
SpringHill Suites San Diego	900 Bayfront Ct	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	High
Sun Harbor Marina	5000 N Harbor Drive	San Diego	CA	92101	908.10	N/A	N/A	Active	Marina/Yacht Club	Provides dock slips for boaters. May also provide restrooms, trash containers, and storage for employees and tenants.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Sun Outdoors San Diego Bay RV Park	460 Sandpiper Way	Chula Vista	CA	91910	909.12	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
The Olde Boat Yard	2608 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	N/A	Active	Marine Services and Supplies	Provides indoor offices for the sales and/or distribution of maritime equipment. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	High
The Tin Fish Restaurant	910 Seacoast Drive	Imperial Beach	CA	91932	910.10	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Tom Ham's Lighthouse	2150 Harbor Island Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Eating or Drinking Establishment	Provides food services for the general public. Typically includes seating area, restrooms, product storage, and indoor cleaning areas. Also may include fryer(s) in kitchen.	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Tonga Landing	2420 Shelter Island Dr	San Diego	CA	92106	908.10	N/A	N/A	Active	Marina/Yacht Club	ship chandlery, marine hardware and electronic sales, boat sales, offices for marine-related professional services, dockside boat repairs.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low

											Potential Pollutants										
Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash	Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
United States Coast Guard	1022 Bay Marina Drive, Suite 125/150	National City	CA	91950	908.32	N/A	N/A	Active	Offices, Administrative Uses	Indoor office space for various non-manufacturing activities. Little to no potential for pollutant generating activities.	No	No	No	No	No	No	No	No	No	No	Low
USS Midway Museum	910 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Museum	Provides tourist attractions of various historic artifacts, vehicles, and equipment.	Yes	No	No	Yes	No	Yes	No	Yes	Yes	No	Low
Wyndham San Diego Bayside	1355 North Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Hotel/Motel	Provides temporary lodging of visitors. May also include parking, restrooms, and laundry facilities.	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Low
Total Commercial Facilities: 99																					
Industrial Facilities																					
Austal	1313 Bay Marina Drive	National City	CA	91950	908.32	N/A	N/A	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
BAE Systems San Diego Ship Repair	2205 Belt Street	San Diego	CA	92113	908.22	N/A	3731	Active	Shipyards: Shipbuilding, Maintenance and Repair	Conducts shipbuilding, maintenance, and repair of large vessels. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
Chesapeake Fish Company	535 Harbor Lane	San Diego	CA	92101	908.21	N/A	5146	Active	Wholesale Distributors	Establishments primarily engaged in preparing fresh and raw or cooked frozen fish and other seafoods and seafood preparations (SIC Code 2092)	No	No	No	Yes	No	No	No	Yes	Yes	Yes	High
Continental Maritime of San Diego, LLC (CMSD)	1995 Bay Front Street	San Diego	CA	92113	908.22	N/A	N/A	Active	Shipyards: Shipbuilding, Maintenance and Repair	Conducts shipbuilding, maintenance, and repair of large vessels. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
CP Kelco	2025 E Harbor Drive	San Diego	CA	92101	908.22	N/A	2099	Active	Industrial Uses Not Elsewhere Classified	Establishments primarily engaged in manufacturing prepared foods and miscellaneous food specialties, not elsewhere classified.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Crowley Marine Services	1800 Crosby Street	San Diego	CA	92101	908.22	N/A	4492	Active	Marine Cargo Handling	Tugboat water transportation services.	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Low
Dixieline ProBuild - Distribution Center	2740 Tidelands Avenue	National City	CA	91950	908.32	9 37S015366	2439, 7538	Active	Industrial Uses Not Elsewhere Classified	Warehouse	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Dole (National Distribution Center)	1022 Bay Marina Drive	National City	CA	91950	908.32	N/A	N/A	Active	Parking Lot/Storage	Parking for Dole trucks	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	High
Dole Fresh Fruit Company	850 Water Street	San Diego	CA	92101	908.22	N/A	4491	Active	Marine Cargo Handling	Marine cargo handling of fruit.	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
Driscoll BoatWorks	2500 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	3732	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Driscoll's Intrepid Boatworks	2702 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	3732	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	Low
Fabrication Technologies	1850 Tidelands Avenue	National City	CA	91950	908.32	N/A	3441	Active	Industrial Uses Not Elsewhere Classified	Establishments primarily engaged in fabricating iron and steel or other metal for structural purposes, such as bridges, buildings, and sections for ships, boats, and barges.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Harvest Meat Company, Inc.	1022 Bay Marina Drive	National City	CA	91950	908.32	N/A	5421	Active	Industrial Uses Not Elsewhere Classified	Establishments primarily engaged in the retail sale of fresh, frozen, or cured meats, fish, shellfish, and other seafoods (SIC Code: 5421).	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
International Materials, Inc.	1090 Water St.	San Diego	CA	92101	908.22	N/A	4491	Active	Marine Cargo Handling	Handling of marine cargo	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
Koehler Kraft Company, Inc.	2302 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	3732	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Lockheed Martin Facility	1160 Harbor Island Dr,	San Diego	CA	92101	908.21	N/A	N/A	Active	Industrial Uses Not Elsewhere Classified	Former industrial facility used for aerospace manufacturing.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
Marine Group Boat Works - Chula Vista	997 G Street	Chula Vista	CA	91910	909.12	N/A	3732	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Metropolitan Stevedore Company	1140 N. Harbor Drive	San Diego	CA	92101	908.21	N/A	N/A	Active	Marine Cargo Handling	Marine Cargo Handling	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
National Steel and Shipbuilding Company	2798 Harbor Drive	San Diego	CA	92113	908.22	N/A	3731	Active	Shipyards: Shipbuilding, Maintenance and Repair	Conducts shipbuilding, maintenance, and repair of large vessels. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	High

											Potential Pollutants										
Facility Name	Address	City	State	Zip Code	Hydrologic Sub-Area	WDID/NOI Number	SIC Code	Status	Facility Type(s)	Principal Activity	Bacteria	Metals	Nutrients	Oil & Grease	Organics	Pesticides	Sediment	Trash	Potential to discharge WQIP priority pollutants	Tributary to 303(d) Listed	Threat to Water Quality
Nielsen Beaumont Marine Inc.	2420 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	3732	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Pacific Tugboat Service	1444 Cesar E. Chavez Parkway	San Diego	CA	92113	908.22	N/A	4492	Active	Water Transportation Services, Passengers	Establishments primarily engaged in furnishing marine towing and tugboat services in the performance of auxiliary or terminal services in harbor areas	No	No	No	Yes	No	No	No	Yes	Yes	Yes	Low
Pasha Automotive Services (NCMT)	1400 W.Bay Marina Dr	National City	CA	91950	908.32	N/A	4491, 4412	Active	Marine Cargo Handling	Automobile transport	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
Pepper Oil Company, Inc.	2300 Tidelands Avenue	National City	CA	91950	908.32	N/A	5172	Active	Industrial Uses Not Elsewhere Classified	Establishment primarily engaged in the wholesale distribution of petroleum and petroleum products.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
Safe Harbor Shelter Island	2330 Shelter Island Drive	San Diego	CA	92106	908.10	N/A	3732	Active	Boatyards: Maintenance, Repair, Cleaning	Conducts maintenance, repair, cleaning, and/or painting of private boats. Includes overhauling and dry docking facilities.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
San Diego Cold Storage	1240 West 28th Street	National City	CA	91950	908.32	N/A	4222	Active	Industrial Uses Not Elsewhere Classified	Establishments primarily engaged in the warehousing and storage of perishable goods under refrigeration.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
San Diego Metropolitan Transit System	1255 Imperial Ave, Suite 1000	San Diego	CA	92101	908.22	N/A	N/A	Active	Industrial Uses Not Elsewhere Classified	Rail yard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	High
San Diego Refrigerated Services	1800 Crosby St	San Diego	CA	92101	908.22	N/A	4222	Active	Wholesale Distributors	Establishments primarily engaged in the warehousing and storage of perishable goods under refrigeration.	No	No	No	Yes	No	No	No	Yes	Yes	Yes	High
Searles Valley Minerals Operations	1800 Crosby St	San Diego	CA	92101	908.22	N/A	4491	Active	Marine Cargo Handling	Bulk material storage and material handling	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
Solar Turbines Incorporated	2200 Pacific Highway	San Diego	CA	92101	908.21	9 37S001827	3511	Active	Industrial Uses Not Elsewhere Classified	Establishments primarily engaged in manufacturing steam turbines; hydraulic turbines; gas turbines, except aircraft; and complete steam, gas, and hydraulic turbine generator set units.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Low
SSA Marine	1090 Water street	San Diego	CA	92101	908.22	N/A	4491	Active	Marine Cargo Handling	Marine cargo loading and unloading	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
Terminalift	1800 Crosby St	San Diego	CA	92101	908.22	N/A	4491	Active	Marine Cargo Handling	Cargo loading and unloading	No	Yes	No	Yes	No	No	No	Yes	Yes	No	High
The Jankovich Company	961 E Harbor Dr,	San Diego	CA	92101	908.22	N/A	4498	Active	Retail or Wholesale Fueling	Establishment primarliy engaged in the wholesale distribution of petroleum and petroleum products	No	Yes	No	Yes	Yes	No	No	Yes	Yes	No	High
Total Industrial Facilities: 32																					
Total Commercial/Industrial Facilities: 131																					

Appendix H
Retrofit and Rehabilitation of Existing Developments

Appendix H Retrofit & Rehabilitation Program

1.0 Introduction

The Regional Water Quality Control Board, San Diego Region (RWQCB) Order No. R9-2013-0001 (Municipal Permit or Permit) requires the 18 municipalities in San Diego County, the County of San Diego, the San Diego County Regional Airport Authority, and the Port of San Diego (Port) to develop a program that will retrofit areas of existing development and a program to rehabilitate streams, channels, and/or habitats within the Port's jurisdiction. Addressing the highest priority water quality conditions of the representative watershed management area(s) is a key goal of this effort.

The Port has developed an overarching strategy to address both the retrofit and rehabilitation requirements set forth in the Permit, as discussed in this program document. The Port's retrofit and rehabilitation program is focused on meeting the highest priority water quality conditions of the San Diego Bay Water Quality Improvement Plan (WQIP). The program is intended to be dynamic and flexible to allow the Port to maximize retrofit and rehabilitation opportunities that may arise. The program may be modified through an adaptive management process over the course of the Permit term. Any updates to the program will be identified during the submittal of JRMP and WQIP annual reports.

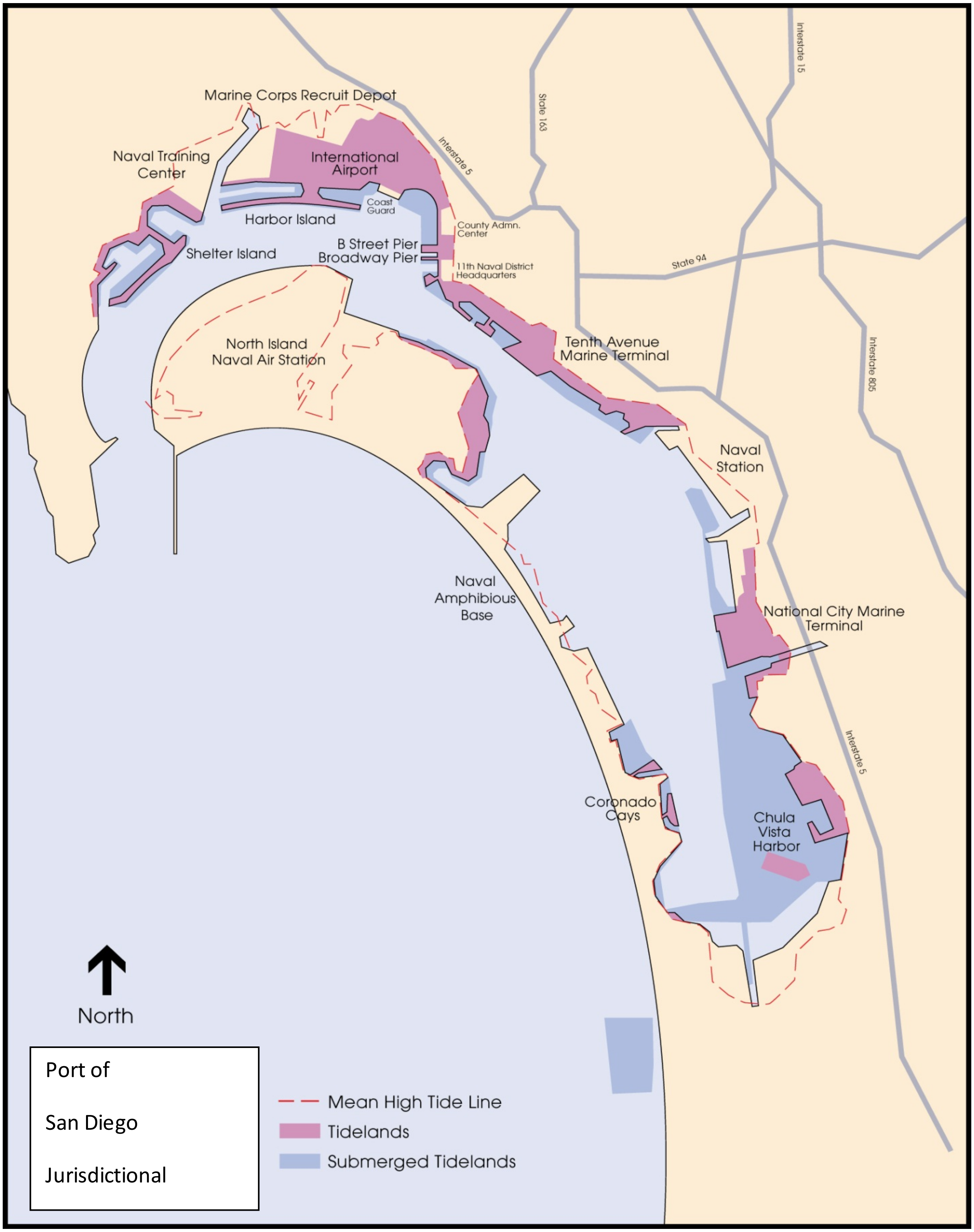
2.0 Background

As discussed in Chapter 1 of the Port JRMP Document, the Port is a special district, created in 1962 by an act of the California legislature. The legislature passed the San Diego Unified Port District Act to create an entity to manage San Diego Harbor and administer approximately 5,483 acres of public lands along San Diego Bay. As environmental steward and manager of State lands surrounding San Diego Bay, the Port works to improve and protect the bay.

The Port's jurisdictional boundary is limited to a portion of San Diego Bay and the San Diego Bay tidelands1 (Figure H-1). The Port controls approximately 33 miles, or 61% of the total bay shoreline. The remaining tidelands around the Bay is either owned or controlled by the Federal Government, the State of California, the County of San Diego, or the cities of San Diego and Coronado. The Port's jurisdiction also overlays portions of the cities of Chula Vista, Coronado, National City, and Imperial Beach (collectively referred to as "member cities"). Because of the manner in which the Port was created, the member cities have retained ownership for portions of the MS4 that existed prior to the formation of the Port which cross the Port tidelands and discharge into San Diego Bay.

"Tidelands", properly speaking, are lands between the lines of mean high tide and mean low tide. By contrast, "submerged lands" are those lands seaward of the low tide and not uncovered in the ordinary ebb and flow of the tide. The area of San Diego Bay encompassed by the historic mean high tide line is approximately 15,000 acres of filled and submerged lands and with an existing shoreline of approximately 54.01 miles in length. [1]

Figure H-1. Port Of San Diego Jurisdictional Boundaries.



3.0 Implementation Strategy

The Permit requires the Port to develop a strategy to facilitate the implementation of retrofit and rehabilitation projects in candidate areas. Given the unique nature of the Port's jurisdictional boundaries and the close proximity to the Bay, the Port places a high priority on ensuring the bay waters are healthy and support beneficial uses. Several Port policies, programs and initiatives are directed toward environmental stewardship, protection of natural resources, climate change, and long-term sustainability as well as water quality protection. Built into these programs are implementation strategies, schedules, and actions that lend themselves to supporting the Permit's retrofit and rehabilitation requirements. As a result, the Port has the opportunity to leverage both the aforementioned Permit requirements and other long-term environmental initiatives to create solutions that have long lasting multi-program benefits.

3.1 Use of Existing Plans/Programs

The Port's strategy to address the Permit's retrofit and rehabilitation requirements seeks to build upon existing Port programs and leverage their project lists. Environmental initiatives such as shoreline enhancement and restoration, energy efficiency projects, water conservation, reduction of greenhouse gas emissions and planning for sea level rise provide a dual benefit in that they can address WQIP pollutants while concurrently addressing the bay's other high priority environmental needs. The key environmental programs currently in place and in progress are summarized below.

- Integrated Natural Resources Management Program (INRMP): The INRMP is a long-term, collaborative strategy for managing the bay's natural resources, and the primary means by which the U.S. Navy and the Port jointly plan natural resources work in San Diego Bay. The goal of this program is to ensure the long-term health, restoration, and protection of San Diego Bay's ecosystem in concert with the bay's economic, Naval, navigational, recreational, and fisheries needs. This document contains a list of projects and initiatives that support the restoration and enhancement of the bay. Such efforts include improving water quality, planning for sea level rise, and enhancing/restoring habitats and shorelines which are applicable to the Permit-required retrofit and rehabilitation program.

- Climate Action Plan (CAP): As a trustee of public lands surrounding San Diego Bay, the Port is responsible for planning and preparing for future impacts of climate change on its environment. The CAP adopted by the Port in 2013 provides the framework for achieving its goals for the reduction of greenhouse gas (GHG) emissions. The CAP identifies policies and measures to reduce GHG emissions through a variety of means. The CAP unifies the Port's environmental sustainability goals into six key areas, three of which have direct relevance to the JRMP program and WQIP priorities. These include (1) waste management, (2) water recycling/conservation, and (3) sustainable business practices. Several measures have been identified in the CAP under each key area. Implementation of such may be ideal for consideration as retrofit and/or rehabilitation projects.

- Capital Improvement Program (CIP): The Port's capital improvement program (CIP) sets aside funds for new facilities, road upgrades, parks or other improvements on Port tidelands. The program is governed by Port Board Policy No.120, which outlines the process for developing, administering, and ranking projects. Each year the Port holds a public CIP workshop to ensure that the project selection and priority are consistent with the Port's strategic goals and the current business and operations needs are met in light of changing circumstances. This provides an opportunity to hear project updates and discuss future schedules and budgets. Because this process is reviewed annually, there is an opportunity to identify candidate projects or modify existing projects to meet the Permit's retrofit requirements.

- Alternative compliance: The Port's JRMP Document (Chapter 4, Development Planning) includes alternative compliance provisions for development projects that allow offsite retrofit or rehabilitation projects in lieu of meeting implementing onsite structural best management practice (BMP) performance requirements. Because this effort is currently under development, the process and potential projects selected as candidates will be identified in the future.

- Sustainable Leasing: The Sustainable Leasing Policy currently under development will serve as a framework for the implementation of future actions through the District's leases and development guidelines. The sustainable leasing concept seeks to incentivize tenants (including industrial and commercial facilities) who wish to modify their leases to (1) renovate existing development with sustainability improvements above regulatory requirements, or (2) go above standard development requirements when proposing new or re-development (i.e. priority development projects) on their leasehold. Such actions may include inclusion of GHG reduction measures, BMPs, or pollution prevention strategies (including water conservation, energy reduction, etc.) that could address sources of pollutants that may contribute to the WQIP priority conditions. Because this policy is currently under development, the manner in which it will address retrofit efforts will be identified in the future.

3.2 Collaboration with Other Jurisdictions

The Permit requires the Port to collaborate with other Copermittees or entities in the watershed when retrofitting and/or rehabilitation within specific areas is determined to be infeasible to address the highest priority water quality problems identified in the WQIP. Given the nature of the Port's jurisdictional boundaries, and because the Port is at the "end of the pipe", in many instances there is little opportunity to implement projects within its jurisdictional boundary. As such, the need to collaborate with other upstream jurisdictions will be necessary to fulfill this Permit requirement. In particular, two distinct areas lend themselves to this opportunity, as discussed herein.

- Large creek/river channels (i.e. Chollas Creek & Sweetwater River) The Port has limited land and/or jurisdictional authority on the areas that discharge into the Chollas Creek and Sweetwater River channels. In addition, the Port's jurisdictional authority at the Chollas Creek mouth is limited to the Nassco parcel of which the Port acts as a non-operating landlord for the Nassco parcel. Because Nassco currently collects all stormwater and does not discharge to the bay, the opportunity to retrofit the parcel is limited. The Port currently participates in workgroups focused on restoring Chollas Creek through natural enhancements and stream rehabilitations. Potential projects identified within this workgroup may be applicable to the Permit's retrofit and rehabilitation requirements.

  Similar to Chollas Creek, the Port's jurisdictional authority along the Sweetwater River mouth is also limited. Because the river mouth is currently a concrete channel, natural enhancement opportunities for this river mouth segment have been identified in the INRMP. In addition, this area is adjacent to parts of the Sweetwater National Wildlife Refuge. As such, there is a potential for large scale enhancement grants and partnering with multiple jurisdictions and resource agencies that may be applicable to the Permit's rehabilitation requirements.

- Non-Port owned MS4 segments/lines discharging directly to San Diego Bay. As mentioned earlier and in Chapters 1 (Introduction) and 6 (Existing Development – Municipal) of the JRMP, there are several instances in which the Port does not own, operate, or maintain, the MS4 segments that discharge directly to the bay. Nonetheless, these outfalls have the potential to discharge pollutants into the bay and potentially on to Port-managed tidelands. The Port may seek to work with the upstream jurisdictions to identify potential MS4 retrofit opportunities that will reduce pollutants in the discharges emanating from upstream.

  Areas such as those mentioned above, lend themselves to collaborative opportunities. Details of potential project concepts are discussed further in the project list (Table I-1)

3.3 Potential Funding Mechanisms

Identifying and securing funding is a critical part of any sound implementation strategy. The Port's approach to identifying funding mechanisms for potential retrofit and rehabilitation projects seeks to ensure that funding mechanisms exist and are available for near-term and long-term candidate projects. Longstanding funding sources, such as the Port's operational and capital improvement budgets are reviewed annually. As such, projects may be planned proactively so that budgets incorporate the retrofit cost into the future project timelines. Other opportunities lend themselves well to grants which require upfront planning to secure grant funds. The candidate project list will be evaluated annually and projects will be initiated when resources to complete a retrofit or stream restoration project become available. Listed below are some potential funding mechanisms and a description of how they may be implemented over time.

- Securing grants or outside funding: Leveraging resources through grants or collaborations with outside entities is a mechanism to complete retrofit or rehabilitation projects. Oftentimes grants can be used to secure funding if agencies are willing to go above standard regulatory requirements or agree to improve existing areas in advance of forthcoming regulations. Obtaining grants requires some upfront preparation and (most likely) a commitment for matching a percentage of the grant funds. However, when used in conjunction with a candidate list of potential projects, the Port may be able to plan in advance for upcoming grant announcements.

- Leveraging existing planned projects and/or adding enhancements to long term schedules/budgets: Projects identified in the Port's CIP may be ideal candidates for retrofitting. During the annual CIP review, the Port may seek to identify candidate projects and put funds into the CIP budget for consideration.

- Use of the Port's environmental fund: The Port's Environmental Fund was established to fund projects that address air, water and sediment quality, sustainability, natural resources management, habitat creation or protection, reclaiming natural shoreline conditions, and/or other issues in the Bay and/or the tidelands. Each year, the Board sets aside ½ of 1% of the Port's projected gross revenues for that year for the Environmental Fund. These monies may be accumulated for more than one year, but their use, from year-to-year, will be subject to the discretion of the Board. Port staff provides recommendations to the Board to approve funding for projects that (1) seek funding from sources other than the Environmental Fund, and/or (2) seek matching funds from other sources. This funding source may be applicable for retrofit or rehabilitation projects.

- Sustainable leasing: Once the sustainable leasing policy has been adopted, it will establish a structure from which to incentivize tenants through lease negotiations for upfront efforts to improve environmental conditions on leasehold. Such efforts may include water conservation or other energy efficiency improvements that lend themselves to the Permit's retrofit requirements.

- Other funding mechanisms: The Port may, at its discretion, identify funding opportunities such as tenant loan programs, maritime impact programs or other loan-based programs to fund tenant projects that improve the tidelands. Retrofits to existing leaseholds may qualify tenants for these programs.

4.0 Identification of Candidate Projects

The Municipal Permit requires the Port to identify candidate retrofit and stream rehabilitation projects. Within the framework of this program, evaluating sites for retrofit or rehabilitation efforts requires consideration of a number of factors including maintenance practices, environmental resource avoidance and minimization measures, adjacent infrastructure, and project alternatives. The Port will consider the following factors when identifying candidate projects:

- WQIP Goals: Whether the project directly targets and helps make progress toward Water Quality WQIP numeric goals.
- Feasibility of project: The feasibility of the project is an important consideration that takes into account a project's likelihood of obtaining funding, constructability, ease of implementation and operation, and any potential impediments. The project's viability takes into account the amount of resources Port staff are able to commit to the project. Candidates that may place a considerable administrative burden on Port staff, or that may require significant Port resources to maintain and operate are generally less desirable projects and may be entirely infeasible.
- Dual Program Benefits: Candidate projects that are included in the INRMP, CAP or part of a sustainable leasing policy have the potential to result in long-term environmental enhancements. These projects are preferred and provide the Port a greater return on investment than a project completed solely for water quality improvement.
- Land use: Land use of the area tributary to a potential retrofit project is an important consideration when selecting retrofit project candidates. Land uses commonly associated with the WQIP priorities will be considered before other land uses.
- Total area of high threat to water quality (TTWQ) properties: The total area of inventoried existing development (industrial, commercial, municipal, and residential) classified as having a high TTWQ draining to a candidate project will be considered. The facility's or area's TTWQ is based on the prioritization processes discussed in the JRMP document which takes into account the facility's or area's pollutant discharge potential and proximity to and sensitivity of the water body to which the area drains.
- Multiple benefits of project: Candidate projects with the potential to contribute to the overall enhancement of the local environment are preferred. Other benefits of retrofit/rehabilitation projects can include, but are not limited to, the following:
    - Improved access to green spaces or recreational opportunities
    - Enhanced walkability or pedestrian safety and access
    - Community beautification, such as streetscape aesthetics or incorporating murals other features with significant artistic value
    - Improved flood protection
    - Environmental justice

- Land availability: If there is development bordering a potential stream segment on both sides of the stream, it would be difficult to complete a retrofit project. Similarly, land ownership is another factor to consider when identifying areas for potential projects. If the Port owns the property where a project is being considered, that is the best case scenario. If another public agency, like a school district, owns the property, then that is second best, whereas, if the land is privately owned, especially if there are many land owners, the project could become more complicated to execute.

- Amount of impervious area: Impervious surfaces are generally recognized as sources of common storm water pollutants such as oil and grease, heavy metals, and sediment (California Stormwater Quality Association, 2003). Projects that have the potential to treat a large area of impervious surfaces are ideal project candidates.

- Cost effectiveness: Projects that are able to remove the greatest unit of pollution for the lowest cost are preferred. Long term structural best management practice (BMP) maintenance cost also need to be considered.

- Opportunities for infiltration or retention (Retrofit): Ideal candidates will incorporate structural BMPs suitable for infiltration or retention. Infiltration is the most effective BMP, since it has close to 100 percent pollutant removal efficiency and also reduces runoff volume, and requires relatively low maintenance (California Stormwater Quality Association, 2003). Feasibility for infiltration BMPs should be conducted in accordance with the BMP Design Manual. Since there are few areas within San Diego County where infiltration is feasible, other types of structural BMPs should be considered.

- Beneficial uses: Stream or channel segments with multiple beneficial uses, are desirable candidates. Areas with the following beneficial uses designated by the Basin Plan should be considered for rehabilitation before others:

    - Preservation of Biological Habitats of Special Significance (BIOL) – Includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance), where the preservation or enhancement of natural resources requires special protection.

    - Estuarine Habitat (EST) – Includes uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

    - Rare, Threatened or Endangered Species (RARE) – Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.

- Contact Water Recreation (REC-1) – includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible.
- Non-contact Water Recreation (REC-2) – Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible.
- Spawning, Reproduction, and/or Early Development (SPWN) – Includes uses of water that support high quality habitats suitable for reproduction, early development, and sustenance of marine fish and/or cold freshwater fish.
- Warm Freshwater Habitat (WARM) – Includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

- <u>Stream Geomorphic Conditions (Rehabilitation)</u>: Streams that are susceptible to hydromodification due to increased runoff in the watershed are ideal for rehabilitation/restoration to mitigate for hydromodification impact. Stream rehabilitation/restoration may provide a greater water quality benefit for the overall watershed in mitigating hydromodification impact compared to hydromodification controls at the site level.

4.1 Identifying Retrofit Candidate Projects

As defined by the Municipal Permit, a retrofit is a "storm water management practice put into place after development has occurred in watersheds where the practices previously did not exist or are ineffective." Potential projects can include, for example, disconnecting roof downspouts and impervious surfaces and redirecting them to pervious areas, installing rain barrels, or implementing green streets.

4.2 Identifying Stream, Channel, and/or Habitat Rehabilitation Candidate Areas

The Municipal Permit states that rehabilitation methods may include in-stream restoration, offline storm water management practices installed in the system corridor or upland areas, or a combination of in-stream and out-of-stream techniques. Some of these techniques may include riparian zone restoration, constructed wetlands, channel modifications, and daylighting of drainage systems.

4.3 List of Candidate Projects or Areas for Retrofit / Rehabilitation

The Port has developed an initial candidate project list (Table H-1) that incorporates projects identified in previous planning efforts (such as the INRMP, CAP and Capital Improvement Program) that could be potential candidates for retrofit or rehabilitation. The purpose of the candidate project list is to identify potential projects. It is important to note that most candidate projects have been identified only at a basic conceptual stage, and more detailed investigation may find that they are not feasible. Implementation of projects on the candidate project list is also contingent upon funding availability. Retrofit or rehabilitation projects that are not on the candidate project list may also be implemented; the presence of the candidate project list does not preclude projects that are not included on the list from being pursued. Projects may be added to or removed from the candidate project list as additional data becomes available in the future.

Table H-1. Retrofit/Rehabilitation Candidate Project List.

Focus Area	Project Type	Coordinating Program
Parks	Xeriscaping	CAP; CIP; INRMP
	Water collection systems	CAP; CIP; Alternative Compliance Program
Parking Lots	Drainage to landscape	CIP; Sustainable Leasing
	Water collection systems	CAP; CIP; Alternative Compliance Program
	Parking Lot Retrofits to include PDP BMPs above permit requirements	CAP; CIP; Alternative Compliance Program
Streets	Green Streets	CAP; CIP; Alternative Compliance Program
	Median retrofits (xeriscape, etc.)	CAP; CIP; Alternative Compliance Program
Trash Collection Areas	PDPs encouraged in existing development for improved trash collection at Port facilities	CIP; Alternative Compliance Program
	PDPs encouraged in existing development for improved trash collection at tenant facilities	Sustainable Leasing
Bay Shoreline Segments	Living Shoreline Project	INRMP; CAP
	Pond 20 Wetlands Mitigation Bank	INRMP; CAP; CIP
Chollas Creek	Stream/River bank enhancements	INRMP; Collaboration with City of San Diego, Navy, others
Sweetwater River	Stream/River bank enhancements	INRMP; Collaboration with City of National City, Chula Vista, others
Marine Terminals	PDPs that address retrofits, increased trash collection, and water quality impacts	CIP; Alternative Compliance Program

4.4 List of Completed Projects since JRMP Development

The Port has been designing and constructing retrofit/rehabilitation projects that address WQIP and Municipal Permit prioritized pollutants since JRMP development in June of 2015. These are retrofit/rehabilitation projects that meet the candidate project framework and were implemented in watersheds with existing development where the practices previously did not exist or were ineffective.

Table H-2. Retrofit/Rehabilitation Projects that have been completed since 2015.

Location	Project	BMP	Factor(s) used to Determine if Project is Retrofit/Rehabilitation
National City Marine Terminal	Parking and Berth Upgrades and Additional Treatment BMP Installation	Modular Wetland and Cistern Installation	WQIP Goals; Feasibility of project; TTWQ; Amount of impervious area; Land availability
Shelter Island Boat Launch	Boat Launch Upgrade and Additional Treatment BMP Installation	Modular Wetland Installation	WQIP Goals; Feasibility of project; TTWQ; Multiple benefits of project; Amount of impervious area; Land availability
Chula Vista Parks	Install Additional Trash Cans	Additional Trash Cans	WQIP Goals; Feasibility of project; Cost effectiveness
Tenth Avenue Marine Terminal, National City Marine Terminal, B Street Pier	Inlet Filter Installation at Various Locations Across the Three Terminals	Catch Basin Inlet Filters	WQIP Goals; Feasibility of project; Cost effectiveness; Amount of impervious area; Land use; TTWQ
Tenth Avenue Marine Terminal	Demolition of Transit Shed on Terminal and Installation of Modular Wetland System	Modular Wetland	WQIP Goals; Feasibility of project; Cost effectiveness; Amount of impervious area; Land use; TTWQ

5.0 References

California Regional Water Quality Control Board, San Diego Region, 2013. Order No. R9-2013-0001. Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority.

California Storm Water Quality Association, 2003. California Storm Water BMP Handbook – New Development &Redevelopment.

California Regional Water Quality Control Board, San Diego Region, 1994. Water Quality Control Plan for the San Diego Basin.

Port of San Diego, 2013 Climate Action Plan.

U.S. Department of the Navy, Naval Facilities Engineering Command Southwest and Port of San Diego. 2013. San Diego Bay Integrated Natural Resources Management Plan.

Appendix I
Pollution Prevention Outreach Campaign

Appendix I Pollution Prevention Outreach Campaign

1.0 Introduction

The Port's education and public outreach expanded significantly in FY 2018. During this timeframe, a new pollution prevention outreach campaign was developed and launched. The focus of the Pollution Prevention Outreach campaign is reducing trash and other pollutants while promoting the general public to practice environmental stewardship through a series of videos and other media featuring specific behaviors individuals could practice helping keep trash out of the bay.

The #ThatsMyBay campaign is a collaborative effort between Port staff from Marketing and Environmental Protection departments. The campaign was developed to encourage a sense of ownership over protecting the environmental health of San Diego Bay.

2.0 Campaign Objectives

Keeping waste out of our bay is a critical step in ensuring the wildlife, plant life and people of San Diego Bay can continue to enjoy our region's most precious natural resource. The Port's goal is to make sure everyone who depends on, enjoys and loves the bay becomes just as much a champion of the San Diego Bay as the Port is.

Operational Objectives:

- Improve the quality of water and land health through pollution prevention measures over a ten-year period
- Engage the public in participating in pollution prevention
- Engage staff in creating ownership of pollution prevention
- Utilize best management practice compliance
- Implement the Water Quality Improvement Plan (WQIP) and Jurisdictional Runoff Management Program (JRMP) strategies and initiatives

Campaign Outreach Objectives:

- Encourage users of the waterfront to protect it as an environmental resource by keeping trash and other pollutants out of the bay
- Build pride in and ownership of the bay so environmental messages are more likely to resonate

The messaging related to the #ThatsMyBay campaign is presented in a whimsical and humorous approach to engage the public in a fun and relatable manner. The campaign targets any visitors to San Diego Bay that want to enjoy the waterfront, but don't necessarily think of it as an environmental resource.

3.0 Target Audience

The campaign targets park users, picnickers, highly outdoor lifestyle leaders, bicyclists, joggers, water sports enthusiasts, or other outdoors exercisers, birdwatchers, pet owners, yoga in the park guests, park moms, fishermen, people who work in restaurants, hotels or other locations nearby the waterfront that may take breaks in the parks or on piers and other San Diego Bay visitors. In other words – general people, who love the waterfront, but don't necessarily think of it as an environmental resource. For this reason, the Port decided on a whimsical campaign that both educates and engages people to feel ownership in a fun and humorous way, rather than anything that makes people feel sad or guilty.

4.0 Campaign Concept - #ThatsMyBay

The campaign concept is #ThatsMyBay – a fun play on words designed specifically for social media and to build love for San Diego Bay. The campaign's name (#That'sMyBay) doubles as a metadata tag to increase awareness and recognition of the campaign overtime and to link each video back to the overall message of environmental stewardship.

The outreach campaign revolves around a series of "tips" on how to keep the bay clean, each featuring a very specific behavior change based on information to help people keep waste out of San Diego Bay. Each tip is featured in a short social media video of approximately thirty seconds, or an animated gif focused on the idea that people love, cherish and want to protect the bay.

These short, easy to understand videos are carefully crafted to be as memorable as the bay itself. The Port's in-house marketing team developed a funny set of lovable characters that love San Diego Bay so much, they can't stop telling the world how to take care of it with #ThatsMyBay.

Positioning Piece

This is the language used to introduce the feel of the campaign:

> "No one wants to be seen with a trashy bay…
>
> We know you love your bay, you own it, you want to take care of it, it's your number one priority; you are ready to change your relationship status to make it official. Okay, maybe that's a bit much, but we all love San Diego Bay and want to be sure it stays the pristine natural resource it is for generations to come. When you visit, we want you to say to yourself, #ThatsMyBay! And sometimes, it just takes a simple reminder not to take your bay for granted. So, the Port of San Diego is here with helpful tips and suggestions on how we can all do our part to keep our bay looking classy, not trashy!
>
> We can do this, San Diego. Think: "Trash can!", not "Trash can't!" If we each do our part, at each and every visit, you can look wistfully into those deep blue waves you love, embrace the hot sand under your toes, feel the gentle kiss of the breeze … smile and quietly say to yourself, #ThatsMyBay."

5.0 Marketing and Media Plan

In order to distribute the videos to the target audience, the Port put together a strategic media plan designed to optimize views of each video and create online engagement. The videos are distributed via the Port's multiple social media accounts (Twitter, YouTube, Facebook, LinkedIn, and Instagram), advertisements through social media, television advertisements, and radio advertisements.

Website – A campaign landing page was created for all social media and other media call-to-actions and digital click-through traffic[1]. The site hosts a page for each video along with additional information on how to keep the bay clean and why it is important to do so.

Social Media - A very strategic social media strategy was designed to build engagement with the target audience by encouraging people to watch and share the videos. A comprehensive social media plan is running throughout the year utilizing different themes, fun contests, video shorts, and campaign hashtags to encourage engagement and drive traffic to the website.

- Facebook – A combination of organic posts, boosted ads, promoted events and pay-per-click ad campaigns are running utilizing videos, photos, animated gifs, and links.
- Instagram – All videos in the series are running on Instagram, with all Facebook ad content linking to the Port's Instagram account.

[1] https://www.portofsandiego.org/thatsmybay

- Twitter – The videos and GIFs are running on Twitter, using all organic content.
- LinkedIn – Each video is also being posted to the Port's LinkedIn page to spread engagement using all organic content.
- YouTube – Each video is posted on the Port's YouTube channel with links to the website for more information.

Mobile Display Ads

- Geo-Fencing - iHeartMedia ran a series of mobile ads targeting specific geographic boundaries within five miles of the bay using behavioral filters matching the audience profile. The mobile ads will run within the boundaries exclusively on mobile devices and include static banners, animated GIFs and videos.

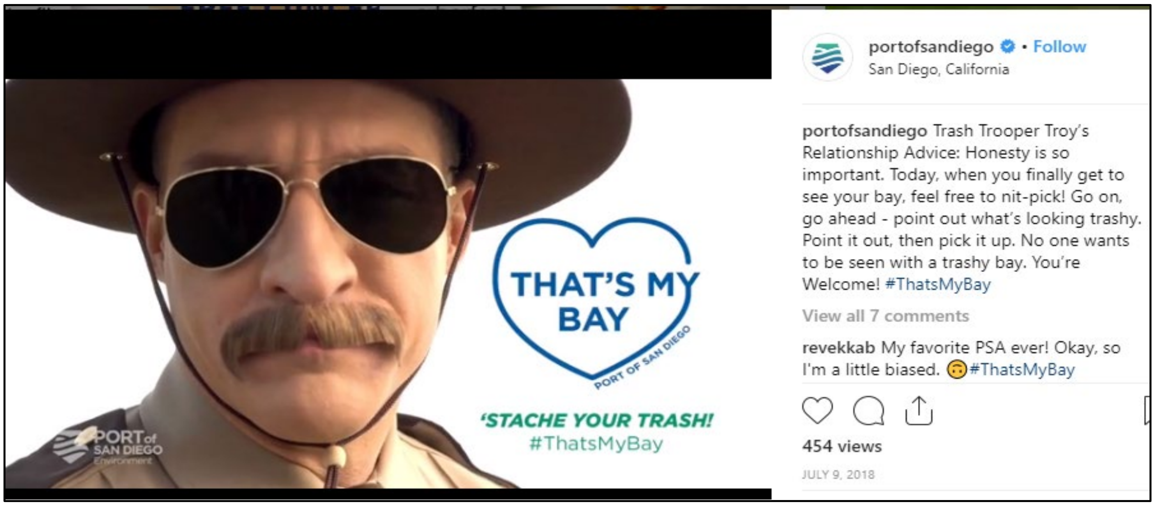
Pay-Per-Click Advertising

- YouTube Pre-Roll – Each video posted is being supported with promoted pre-roll advertising campaigns, having the spots run prior to other YouTube content based on target user profiles within the target markets.
- Facebook promoted content – Separate sponsored video and slideshow ads ran in Facebook ads targeted to the campaign audience profile in order to optimize video views and to drive traffic to the website.

Direct Marketing

- Port E-Blast – The campaign was launched with an introduction to the video series being distributed in the monthly events e-newsletter.
- Events – A variety of events have featured Trash Trooper Troy, campaign slides at movies, or #ThatsMyBay booths with environmental trivia and giveaways. Events include Operation Clean Sweep, #ThatsMyBay Service Day, Extreme Sailing and multiple waterfront outdoor movies.

Examples of Tweets, Posts and Videos from the Port for the #ThatsMyBay campaign:



Port of San Diego @portofsandiego · 3 Dec 2018

OH NOES!

#DYK: The toxins from just one cigarette butt are enough to contaminate an entire liter of water? When cigarette butts end up in the bay, the toxins can harm or even kill sea life. Do your part & dispose of your cigarette butts in the appropriate receptacles!

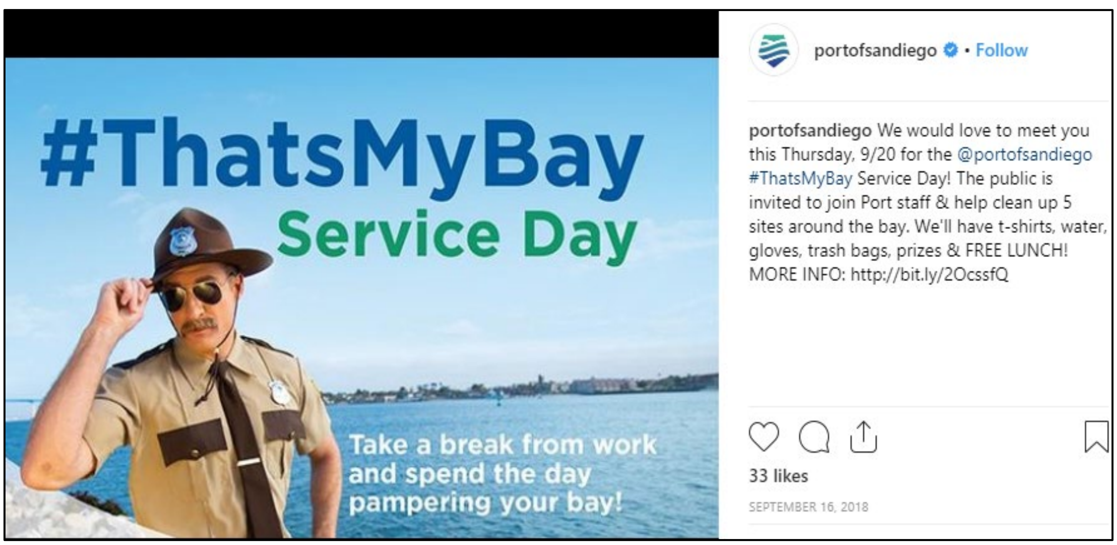
Port of San Diego @portofsandiego · 28 Dec 2018

Keep a lid on it! Trash Trooper Trish says "Closed lids keep the animals out. Open trash cans invite rodents and other animals to eat garbage, from mice, to rats, to raccoons!" She's a smart kid. #ThatsMyBay ow.ly/whjg30n49Gp


Port of San Diego shared a live video.
December 20, 2018 at 10:52 AM
#ThatsMyBay
-2:47
541 Views
Caltrans District 11 was live.
December 20, 2018 at 10:47 AM
Trash Talk Thursday - Illegal Dumping


Port of San Diego Retweeted
DBW @Boat_California · 16 Jul 2018
When you've got to dump, remember the pump! Click here to find a list of pumpout stations near you: buff.ly/2upfdAW
ECO PUMP-A-HEAD
1
10
57

The #ThatsMyBay campaign also includes a signature clean up event. The first annual #ThatsMyBay Service Day was held on September 20, 2018. The 2nd Annual #ThatsMyBay Service Day was held on November 7, 2019. The Port also volunteers at other events to promote pollution prevention. Here are some posts promoting these events:



Port of San Diego @portofsandiego · 20 Sep 2018
Check out the before and after photos from one of our #Thatsmybay Service Day clean up spots. We collected close to 3,000 pounds of #trash this morning at 5 locations around the bay! Thank you to everyone who helped out! #SanDiego

1 6 13

Port of San Diego Retweeted
Katie Gugino @katie_gugino · 26 Oct 2018
Spent my Friday volunteering for the @portofsandiego to help promote their 'Stash your Trash campaign with Trash Trooper Troy! #thatsmybay #wonderfront #workingmom #SDbusiness #entrepreneurlife #extremesailing

4 11

Port of San Diego @portofsandiego · 17 Aug 2018

The Port of San Diego participated in STEMFEST 2018, a community-empowerment event. The purpose is to introduce students to a wide spectrum of industries & occupations by providing a pathway for students & STEM professionals to link educational practices to career opportunities.

Port of San Diego @portofsandiego · 27 Aug 2018

The @SDPTA 's #OperationCleanSweep on August 25th was a success! Thank you to all of the tenants and public who participated in making our bay a cleaner place. #ThatsMyBay #SanDiego

2 7