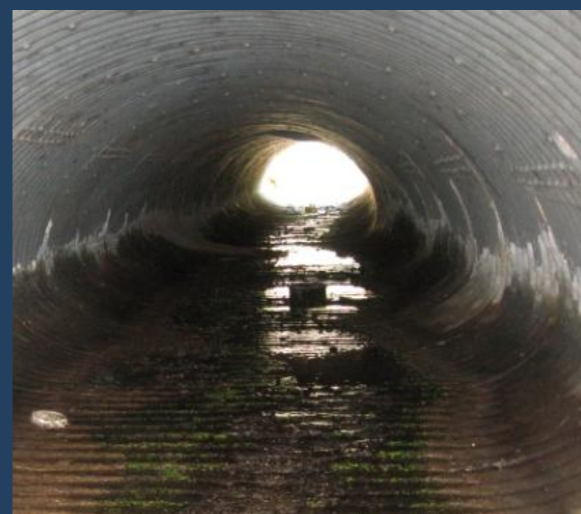
CITY OF VISTA

Jurisdictional Runoff Management Program

2017, rev. 2019, rev. 2023



CITY OF VISTA
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Acronyms and Abbreviations

Acronym/Abbreviation	**Definition**
303(d) list	Clean Water Act Section 303(d) List of Water Quality Limited Segments
ASBS	Area of Special Biological Significance
Basin Plan	Water Quality Control Plan for The San Diego Basin
BMP	Best Management Practice
Caltrans	California Department of Transportation
CASQA	California Stormwater Quality Association
CCTV	Closed-circuit television
CGP	Construction General Permit (SWRCB Order 2009-0009-DWQ, as amended by Orders 2010-0014-DWQ and 2012-0006-DWQ)
CIP	Capital Improvement Project
CIA	Common Interest Area
City	City of Vista
Copermittees	18 incorporated cities in San Diego County, the County of San Diego, the San Diego County Regional Airport Authority, and the San Diego Unified Port District
County	County of San Diego
CWA	Federal Water Pollution Control Act (also known as the Clean Water Act)
DEH	County of San Diego Department of Environmental Health
ESA	Environmentally Sensitive Area
GIS	Geographic Information System
HA	Hydrologic Area
H&H	Hydrology and Hydraulics
HHW	Household Hazardous Waste
HIRT	Hazardous Materials Incident Response Team

Acronym/Abbreviation	Definition
HMP	Hydromodification Management Plan
HOA	Homeowners Association
HPWQC	Highest Priority Water Quality Condition
HSA	Hydrologic Subarea
HU	Hydrologic Unit
IC/ID	Illicit connection and illegal discharge
IDDE	Illicit Discharge Detection and Elimination
IGP	SWRCB Industrial General Permit, Order 2014-0057-DWQ
IPM	Integrated Pest Management
JRMP	Jurisdictional Runoff Management Program
JURMP	Jurisdictional Urban Runoff Management Program
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal separate storm sewer system
MS4 Permit	San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001
NAICS	North American Industrial Classification System
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
OES	State Office of Emergency Services
O&M	Operations and Maintenance
PDP	Priority Development Project
RARE	Rare, Threatened, or Endangered Species
REAP	Rain Event Action Plan
RMA	Residential Management Area
RWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification

Acronym/Abbreviation	Definition
SMARTS	Stormwater Multiple Application and Report Tracking System
SSMP	Sewer System Management Plan
SSO	Sanitary Sewer Overflow
Stormwater Ordinance	Stormwater Management and Discharge Control Program Ordinance (Vista Municipal Code Chapter 13.18)
SWQMP	Storm Water Quality Management Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TTWQ	Threat To Water Quality
VID	Vista Irrigation District
VMC	Vista Municipal Code
WDID	Waste Discharge Identification
WMA	Watershed Management Area
WQIP	Water Quality Improvement Plan
WQTR	Water Quality Technical Reports

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Executive Summary

The Jurisdictional Runoff Management Plan (JRMP) is the City of Vista's approach to improving water quality in its creeks, lagoons, and the ocean through reducing discharges of pollutants to the municipal separate storm sewer system (MS4: hereafter, "storm drain system"). As the operator of a storm drain system, the City of Vista (City) is subject to a National Pollutant Discharge Elimination System (NPDES) MS4 Permit issued by the Regional Water Quality Control Board, San Diego Region (RWQCB). The permit requires the City to reduce pollutants in discharges from its storm drain system to water bodies.

The City's storm drain system, like that of most other jurisdictions across the United States, conveys most runoff from rain, irrigation runoff, natural groundwater seepage, and other sources of water to water bodies without first being directed to a treatment plant. To reduce pollutants in these storm drain system discharges to water bodies, the City implements—or requires its residents and land owners to implement—a variety of measures commonly referred to as Minimum Best Management Practices (BMPs) for Residential, Industrial, Commercial, Construction, and Municipal Sites/Sources. Some examples of BMPs include covering potential pollutant sources to prevent contact with rain, employing erosion reduction techniques at construction sites, adjusting sprinklers to eliminate irrigation runoff, sweeping streets and parking lots, and building green infrastructure techniques like planters that capture and treat runoff for new development projects.

Permit-Required Plans:

- Jurisdictional Runoff Management Plan (1)
- Water Quality Improvement Plans (2)

The most recent permit, RWQCB Order R9-2013-0001, as amended by R9-2015-0001 on February 11, 2015, as amended by R9-2015-0100 on November 18, 2015 (current MS4 Permit), requires the City and the other 20 municipal agencies in San Diego County (collectively, "Co-permittees") to prepare both jurisdictional and watershed-scale plans that detail how they will comply with the new requirements. Each agency, including the City, prepares its own jurisdictional plan. The JRMP presented herein is an update to the City's 2008 Jurisdictional Urban Runoff Management Plan (JURMP), which was prepared in response to the 2007 MS4 Permit. The watershed plans, known as Water Quality Improvement Plans (WQIP), are collaboratively prepared by the municipal agencies, and each focuses on a particular watershed. The Engineering Department's Stormwater Division has led the City's efforts to update this JRMP, and prepare two WQIPs.

Water Quality Improvement Plans

The City is located in the Carlsbad and San Luis Rey Watershed Management Areas (WMA). The City has collaboratively developed WQIPs in these two WMAs, along with the other responsible agencies listed below:

- Carlsbad WMA: the Cities of Carlsbad (lead agency), Encinitas, Escondido, Oceanside, San Marcos, and Solana Beach, and the County of San Diego
- San Luis Rey WMA: the County of San Diego (lead agency), the City of Oceanside, and the California Department of Transportation (Caltrans)

The WQIPs identify specific water quality priorities; establish numeric water quality goals and objectives; the schedules by which they will be achieved; and the implementation strategies to achieve them. The highest-priority water quality conditions for these WMAs and their respective sub-areas are discussed below.

The Carlsbad WMA is comprised of multiple distinct sub-watersheds; and the goals, schedules, and strategies have been formulated in light of the specific characteristics of individual sub-watersheds. Per the March 2016 San Luis Rey River WQIP and the June 2016 Carlsbad WQIP, the highest priority water quality conditions that are in the City's jurisdiction are summarized in Table ES-1 below.

Table ES-1. Highest-Priority Water Quality Conditions for Sub-watershed Areas in Carlsbad and San Luis Rey River WMAs Affecting the City of Vista's JRMP

Hydrologic Area	Receiving Water	Highest-Priority Water Quality Condition, Pollutant, or Stressor
San Luis Rey River WMA		
Lower San Luis Rey	San Luis Rey River	Indicator bacteria
Carlsbad WMA		
Loma Alta	Loma Alta Slough	Eutrophic conditions (nutrients
Buena Vista*	Buena Vista Lagoon	Nutrients, indicator bacteria, sediment/siltation, trash, and riparian habitat degradation
Agua Hedionda	Agua Hedionda Creek	Hydromodification impacts

Source: Adapted from MOE et al. 2016 (Tables 21, 27, and 30), and LWA/AMEC 2016 (Table ES-1).
* No HPWQC is currently identified for the Buena Vista HA (MOE et al. 2016); however, the City is implementing both structural and programmatic BMPs to address priority conditions, such as bacteria, sediment, and nutrients that are water quality issues downstream in the Buena Vista Lagoon. The lagoon is outside City jurisdiction.

The Lower San Luis Rey River Sub-Watershed is subject to a bacteria Total Maximum Daily Load (TMDL), which sets numeric limits for bacteria levels during dry weather, and during and immediately after storms. The San Luis Rey WQIP incorporates numeric goals, timelines by which they are expected to be achieved, and strategies to meet the goals based on the requirements of the TMDL.

This JRMP has been developed in light of the water quality priorities and goals identified in the two WQIPs. The water quality improvement strategies selected for implementation in the WQIP have been incorporated into this JRMP, and are summarized in Appendix A.

Jurisdictional Runoff Management Plan

This JRMP was developed in accordance with Section E of the MS4 Permit, and presents an integrated programmatic approach to:

- Reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP) standard;
- Effectively prohibit non-stormwater discharges; and
- Protect and improve the quality of water bodies in the City.

This JRMP describes operational programs and activities developed to meet the requirements of the current MS4 Permit, and it also serves as the implementation mechanism for WQIP strategies.

WQIP and JRMP Connection

The current MS4 Permit preserves some of the programmatic specificity of past permits, but it generally allows the City and other permitted jurisdictions more discretion in determining the details of how their day-to-day programs will be implemented. This approach is intended to allow the City and other regulated agencies more flexibility in directing resources and activities toward the highest-priority issues identified in each WMA, as presented in the WQIPs. Addressing these highest priorities, however, involves meeting numeric water quality targets. The targets are more stringent metrics than those established by previous stormwater permits, which mostly used programmatic achievements to determine compliance.

Functionally, the WQIP serves as an overarching strategic planning document, setting watershed-scale water quality priorities, goals, schedules, and strategies for the City and the other responsible agencies in each WMA. The JRMP document describes the City's minimum program implementation standards in compliance with the MS4 Permit, and integrates the strategies defined by the WQIP. WQIP strategy integration includes both modifying existing activities to target WQIP priorities more effectively, and developing new activities.

More detail is provided in the following section about JRMP strategies, including where they have been modified to address WQIP priorities and integrate WQIP strategies. The full list of strategies the City has committed to implement in the JRMP and San Luis Rey and Carlsbad WQIPs is also provided in Appendix A.

JRMP Implementation

Each City department is committed to implementing the relevant procedures and BMPs described in this JRMP. The goal of these actions is not only to meet regulatory requirements, but also to improve water quality for the City's residents. Results from the City's implementation of the JRMP are documented, and reported each year as part of the annual reporting process, similar to the approach in past years. Jurisdictional program data are a significant part of the WQIP annual reports in watersheds in which the City has jurisdiction, which are included in annual assessments through the WQIP annual reporting process. As part of the adaptive management and iterative approach, the City continues to refine its programs accordingly as new lessons are learned. Modifications to the JRMP are documented to ensure clear communication and transferability from one staff person to another.

1 Introduction

All cities in San Diego County, including the City of Vista (City), have municipal separate storm sewer systems (MS4s; also known as "storm drain systems") that are distinct from sanitary sewer systems. In contrast to wastewater in sanitary sewer systems, water that enters storm drain systems flows to local creeks and other water bodies without first being directed to a treatment plant. Because runoff that eventually reaches the storm drain systems may first pick up a variety of pollutants as it flows over and through roads, parking lots, outdoor storage areas, landscaped areas, and other developed areas, municipal agencies that operate storm drain systems are subject to permits that require actions to reduce pollution in discharges to storm drain systems. This Jurisdictional Runoff Management Plan (JRMP) is the City's approach to meeting permit requirements and improving water quality in local water bodies through reducing discharges of pollutants to the storm drain system.

1.1 Regulatory Background

Storm drain system permits are a component of the National Pollutant Discharge Elimination System (NPDES) permitting program, which is authorized by the federal Clean Water Act (CWA). The State of California administers the statewide NPDES program, and the San Diego Regional Water Quality Control Board (RWQCB) oversees local NPDES permits in San Diego, South Orange and Riverside Counties. The RWQCB issued the first regional NPDES stormwater permit regulating all municipalities in San Diego County (collectively, "Co-permittees") in 1990. Revised versions were issued in 2001 and 2008, with each successive permit including increasingly prescriptive requirements. The most recent permit, RWQCB Order R9-2013-0001, as amended by Order R9-2015-0001 (MS4 Permit), increases the focus on watershed-level planning and achieving water quality outcomes. The MS4 Permit preserves some of the programmatic specificity of past permits, but it generally allows Co-permittees more discretion in determining how resources are allocated. This approach is intended to allow the City and other regulated agencies more flexibility in directing efforts that address the issues identified as the highest priorities in each Watershed Management Area (WMA), as presented in corresponding Water Quality Improvement Plans (WQIPs) for each regional watershed. However, addressing these highest priorities involves meeting numeric or narrative water quality targets. These targets are more stringent metrics than those established by previous stormwater permits, which mostly used programmatic achievements to determine compliance.

The current MS4 Permit requires the City and the other 20 municipal agencies in San Diego County to prepare both JRMPs and watershed-based Water Quality Improvement Plans (WQIPs) that identify activities they will implement to improve water quality. The JRMP is prepared individually by each agency and applies only in that agency's jurisdiction. Each WQIP focuses on one Watershed Management Area (WMA), and is collaboratively prepared by the municipal agencies in the WMA. The City is a Permit-designated responsible agency in the San Luis Rey and Carlsbad WMAs. The WQIP for those two WMAs identify the priority water quality conditions in each WMA, corresponding numeric or narrative goals, and strategies that the City and other responsible agencies will implement to meet the goals. The relationship between the JRMP and the WQIPs is described in Section 1.2, and the purpose and objective of this JRMP are described in more detail in Section 1.3.

1.2 Integration with Watershed Quality Improvement Plans

Because the City is a responsible agency in the San Luis Rey and Carlsbad Watersheds, it has helped develop the WQIPs for both WMAs. Table 1-1 lists the percentage of the City in each WMA, and WMA boundaries are also shown on Figure 1-1.

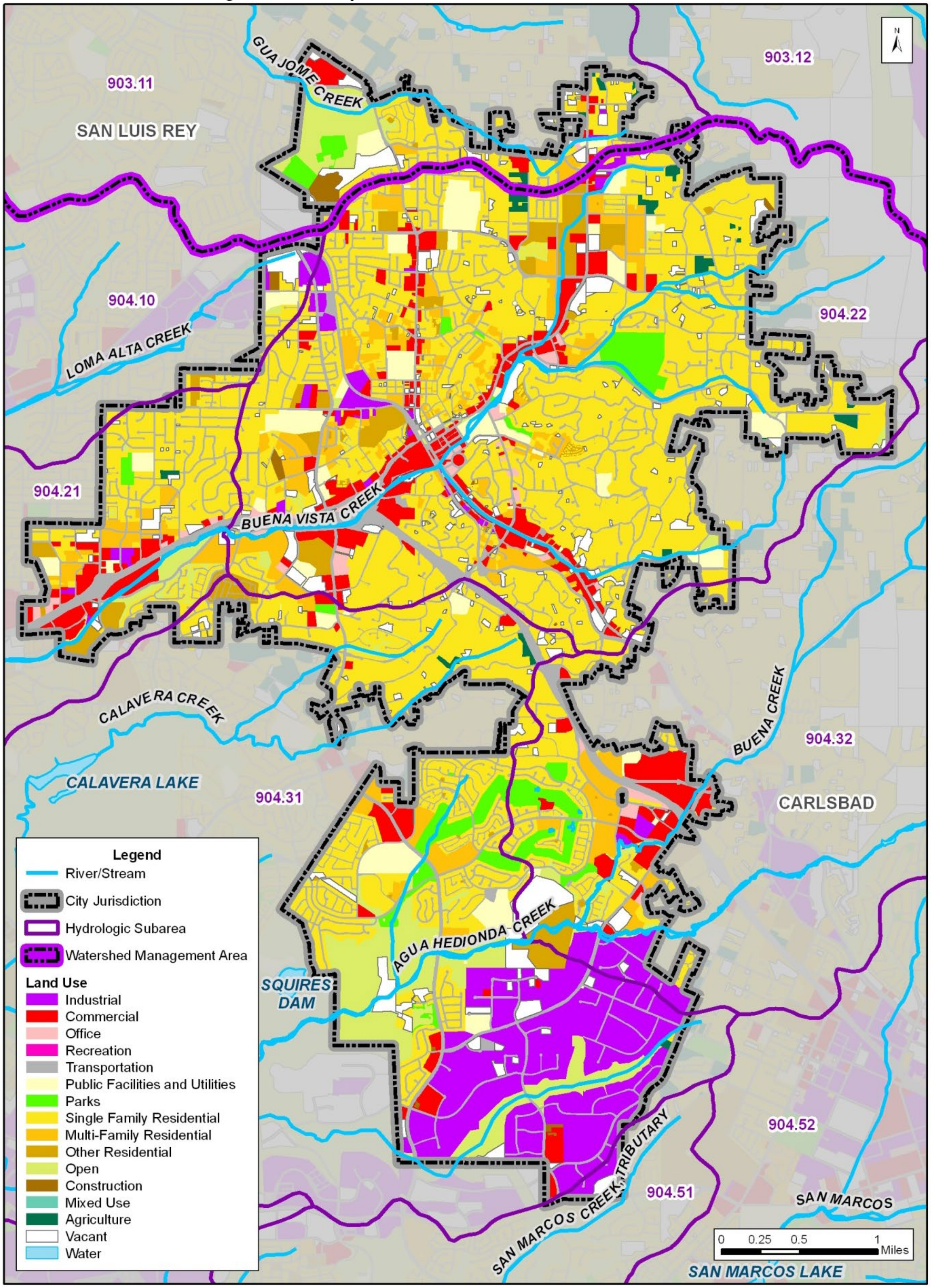
The WQIPs for these two WMAs identify the following highest priority and priority water quality conditions in each respective watershed.

Table 1-1. Priority Water Quality Conditions for Sub-watershed Areas in Carlsbad and San Luis Rey River WMAs Affecting the City of Vista's JRMP

Hydrologic Area	Receiving Water	Priority Water Quality Condition, Pollutant, or Stressor*
San Luis Rey River WMA		
Lower San Luis Rey	San Luis Rey River	**Indicator bacteria**, nutrients (N and P), eutrophic conditions, total dissolved solids, index of biological integrity, chloride, and toxicity
Carlsbad WMA		
Loma Alta	Loma Alta Slough	**Eutrophic conditions (nutrients)**, indicator bacteria, toxicity, trash, and riparian habitat degradation
Buena Vista**	Buena Vista Lagoon	Nutrients, indicator bacteria, sediment/siltation, trash, and riparian habitat degradation
Agua Hedionda	Agua Hedionda Creek	Trash, riparian habitat degradation, indicator bacteria, toxicity, nutrients, sediment-erosion-**hydromodification impacts**

Source: Adapted from MOE et al. 2016 (Tables 21, 27, and 30), and LWA/AMEC 2016 (Table ES-1).
* Bold entries indicate the highest-priority water quality condition (HPWQC).
** No HPWQC is currently identified for the Buena Vista HA (MOE et al. 2016); however, the City is implementing both structural and programmatic BMPs to address priority conditions, such as bacteria, sediment, and nutrients that are water quality issues downstream in the Buena Vista Lagoon. The lagoon is outside City jurisdiction.

Figure 1-1. City of Vista Land Use and Watersheds



Base Data Sources: SWRCB and SanGIS.

Each WQIP established associated numeric or narrative goals for the highest priority water quality condition (HPWQC).

The Lower San Luis Rey River Sub-Watershed is subject to a bacteria Total Maximum Daily Load (TMDL), so numeric targets based on the TMDL standards apply throughout the WMA. In the Carlsbad WMA, numeric targets have been set for several smaller drainages in the WMA, called "focus areas." The City of Vista and most other cities in these WMAs have designed programs that will reduce or eliminate non-stormwater discharges. For example, irrigation runoff is prohibited by the permit because it conveys pollutants, such as nutrients (e.g., fertilizers) and bacteria, to the storm drain system and nearby waterways. Reducing non-stormwater discharges is expected to reduce levels of these priority pollutants when it is not raining. In addition, the City's jurisdictional program is targeting sediment, which is linked to a CWA Section 303(d) (CWA §303(d)) listing in Buena Vista Lagoon, downstream from the City. Because bacteria and nutrients are often conveyed into receiving waters by mobilized sediment particles, it is anticipated that decreasing sediment levels in runoff will also reduce these priority pollutants.

The list of strategies the City implements to address WQIP priority conditions and meet numeric goals is provided in Appendix A. These strategies include the City's core day-to-day operational practices, as well as additional commitments necessary to meet the numeric goals within the timelines specified in the WQIPs. All strategies the City has included in the WQIPs, including both core day-to-day operations and additional commitments, are also included in the JRMP. Appendix A identifies the component(s) of the JRMP into which each WQIP strategy has been incorporated. The JRMP serves as the City's primary mechanism for implementing its WQIP strategies.

1.3 Purpose and Objective

The primary purpose of the JRMP is to outline the strategies and supporting activities the City implements to reduce the discharge of pollutants from its storm drain system to the Maximum Extent Practicable (MEP). To present the full picture of all the activities the City performs to improve water quality and meet the requirements of the MS4 Permit, the strategies identified in the WQIP for each of the WMAs in which the City has jurisdiction are also included in this JRMP.

This JRMP describes how the City implements—or requires its residents and land owners to implement—a variety of measures commonly referred to as Best Management Practices (BMPs) to reduce pollutants in storm drain system discharges to water bodies. Some examples of BMPs include covering potential pollutant sources to prevent contact with rain, employing erosion-reduction techniques at construction sites, adjusting sprinklers to eliminate irrigation runoff, sweeping streets and parking lots, and building green infrastructure techniques like planters that capture and treat runoff from new development projects. The City has developed a Stormwater Standards Manual (Appendix C) that identifies minimum BMPs required for businesses, residents, construction sites, and development projects. The Standards Manual also identifies minimum BMPs required of the City's own activities to effectively prohibit non-stormwater discharges, and to reduce discharges of pollutants in stormwater to the MEP. The Stormwater Management and Discharge Control Program Ordinance (Stormwater Ordinance; Appendix D), codified in Vista Municipal Code (VMC) Chapter 13.18, provides legal authority for the required BMPs and discharge prohibitions.

Each major component of the City's stormwater program, such as construction management and illicit discharge detection and elimination (IDDE), has its own section in the JRMP. To increase usability for City staff who implement these program components, each section has been written and formatted so that it is understandable on its own, without needing to reference a large number of other sections or external documents. For the same reason, acronyms and abbreviations have also been defined the first time they occur in each section. Each JRMP component section also identifies the departments and sections that are responsible for implementing the activities described in the section. Although the City's Stormwater Division has led the effort to update this JRMP, all responsible departments have been involved; therefore, the updated JRMP reflects input from staff in all involved departments.

1.4 City Setting

The City's stormwater program has been developed in consideration of Vista's location in the Carlsbad and San Luis Rey WMAs, and the City's overall geographic setting. Factors that affect the design and implementation of the stormwater program to comply with the MS4 Permit and meet WQIP numeric goals include the following: land use distribution, drainage patterns and watershed setting, locations and types of storm drain infrastructure, and locations of water bodies, including those designated as Environmentally Sensitive Areas (ESAs). These factors are described in more detail below.

1.4.1 Location, Population, and Land Use

The City of Vista is in the northern portion of San Diego County in the Highway 78 corridor, approximately 35 miles north of downtown San Diego, and seven miles inland from the Pacific Ocean. The City is bordered by the City of Oceanside to the west and northwest, the City of San Marcos to the southeast, the City of Carlsbad to the southwest, and unincorporated areas of San Diego County along the eastern and northeastern border of the City. The City itself includes approximately 11,668 acres (19 square miles), and a population of more than 96,000.

Land use in the City is mainly residential; other dominant land uses in the City include transportation, industrial and commercial, and undeveloped open space. Land use categories, with the corresponding percentage of land use in the City's boundaries, are included in Table 1-2, and shown on Figure 1-1.

Table 1-2. City of Vista Land Use Breakdown

Land Use	Total Area (Acres)	Percentage
Single-Family Residential	4,931	42%
Transportation	1,536	13%
Industrial	1,017	9%
Commercial	810	7%
Open	797	7%
Vacant	643	6%
Multi-Family Residential	638	5%
Public Facilities and Utilities	421	4%
Other Residential	366	3%
Parks or Golf Courses	315	3%
Office	80	<1%
Agriculture	72	<1%
Construction	41	<1%
Grand Total	**11,668**	**100%**

Source: 2014 San Diego Association of Governments (SANDAG) land use data

1.4.2 Watersheds

The City lies within two WMAs: the Carlsbad WMA, Hydrologic Unit (HU) 904; and the San Luis Rey WMA, HU 903. The majority of the City lies within the Carlsbad WMA. The Buena Vista and Agua Hedionda Hydrologic Areas (HAs) in the Carlsbad WMA drain the largest percentage of the City. Table 1-3 summarizes the HAs within City boundaries, and associated water bodies. Note that some of the water bodies are downstream of the City, but they are included in the table to provide a watershed context. Watershed boundaries and local water boundaries are also shown on Figure 1-1.

Table 1-3. City of Vista Watersheds and Hydrologic Areas

Watershed Management Area	HA Name	HA Number	Percentage of City within HA	Water Bodies
San Luis Rey	Lower San Luis Rey	903.1	6%	Guajome Lake[1] San Luis Rey River[1]
Carlsbad	Loma Alta	904.1	1%	Loma Alta Creek
	Buena Vista	904.2	54%	Buena Vista Creek Buena Vista Lagoon[1]
	Agua Hedionda	904.3	38%	Agua Hedionda Creek Buena Creek Calavera Creek Agua Hedionda Lagoon[1]

Notes:
HA – hydrologic area
1. Water body is downstream of the City, outside the City's jurisdictional boundaries.

1.4.3 Storm Drain System

The City maintains an inventory if its storm drain system conveyance structures, including inlets, pipes, and channels, in Geographic Information System (GIS) format. A map of the City's storm drain system displaying that data are provided in Appendix G.

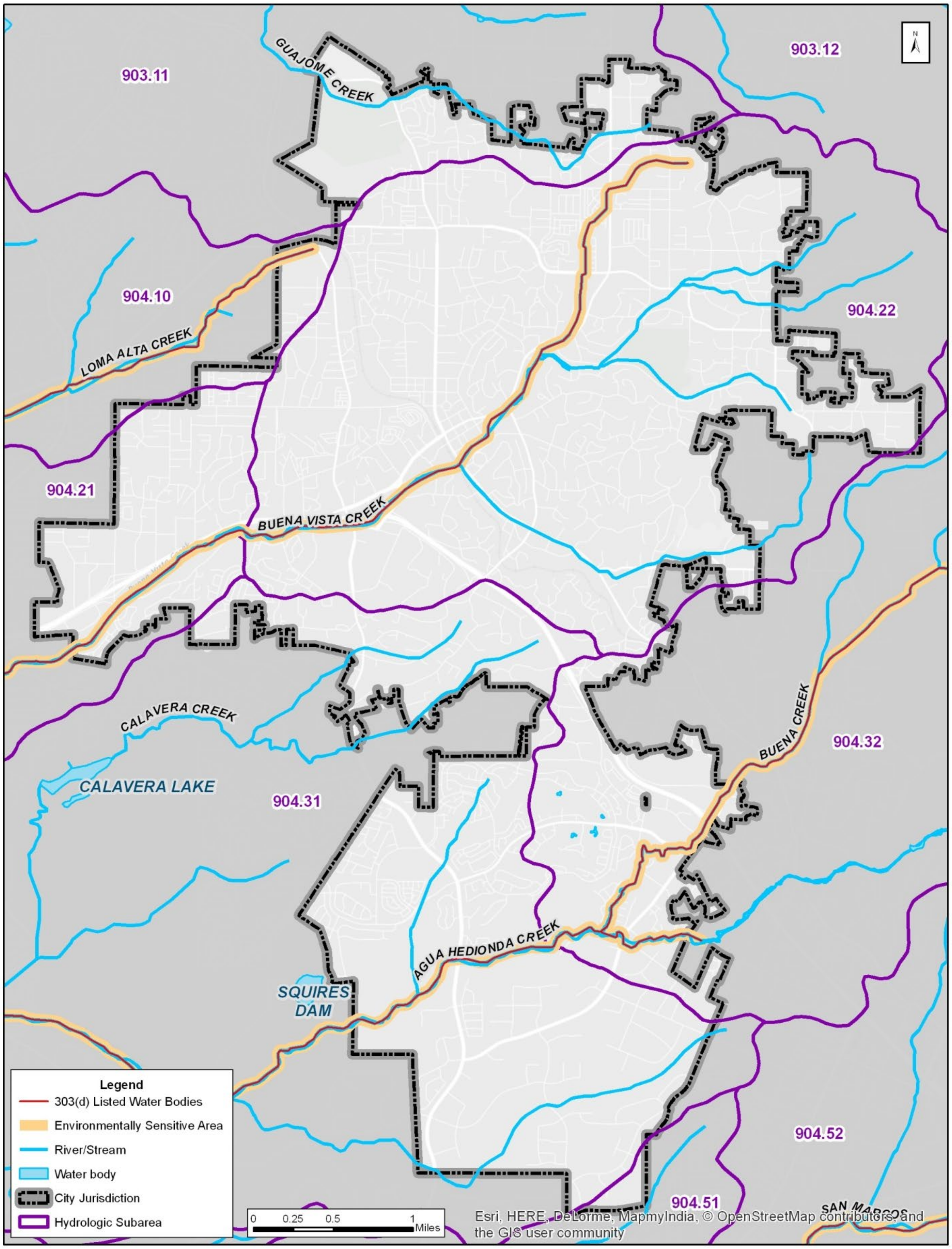
1.4.4 Environmentally Sensitive Areas and Impaired Water Bodies

ESAs, as defined in the MS4 Permit, include the following:

- CWA §303(d) listed impaired water bodies
- Areas designated as Areas of Special Biological Significance (ASBS) by the State Water Resources Control Board (SWRCB) and the RWQCB
- State Water Quality Protected Areas
- Water bodies designated with the Rare, Threatened, or Endangered Species (RARE) beneficial use by the SWRCB and the RWQCB
- Any other equivalent ESAs identified by the City

There are no ASBS or State Water Quality Protected Areas in the City's jurisdiction. The ESAs within the City's boundaries are presented on Figure 1-2 and in Table 1-4, which also summarizes CWA §303(d)-listed impairments and RARE beneficial use designations. Table 1-5 lists pollutant categories associated with impaired water bodies in the City, or farther downstream in the same hydrologic areas (HAs). This table is used as a reference when assessing whether various inventoried sources, as described in later sections, may have the potential to contribute pollutants associated with CWA §303(d)-listed impairments.

Figure 1-2. City of Vista Environmentally Sensitive Areas



Base Data Sources: SWRCB and SanGIS.
Note that the ESAs, as drawn on the map, include a 200-foot buffer on either side of each ESA. Facilities or activities within this buffer are considered "directly adjacent to" an ESA, as defined in the MS4 Permit.

Table 1-4. City of Vista Environmentally Sensitive Areas

ESAs	303(d) Listed Impairment	RARE Beneficial Use
Agua Hedionda Creek	Indicator bacteria, manganese, phosphorus, toxicity, selenium, total dissolved solids, total nitrogen as N	
Buena Creek	DDT, nitrate and nitrite	
Buena Vista Creek	Sediment toxicity, selenium	X
Loma Alta Creek	Selenium, toxicity	

Note:
This table is based on the 2012 CWA §303(d) list of impairments and Section 2 of the Basin Plan (RWQCB, 2012).

Table 1-5. Pollutant Categories Associated with Impairments by Hydrologic Area

Watershed Management Area	Hydrologic Area	Bacteria	Nutrients	Sediment	Dissolved Minerals
Carlsbad	Buena/Agua Hedionda (904.3)	X	X		X
	Buena Vista (904.2)		X	X	
	Loma Alta (904.1)		X		

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2 Program Organization and Legal Authority

2.1 Introduction

The City establishes, maintains, and enforces adequate legal authority in its jurisdiction to control pollutant discharges into and from its storm drain system, and to meet the requirements of MS4 Permit[1] Provision E.1. The City has established local ordinances in the VMC to provide legal authority in support of stormwater program goals, including reducing discharges of pollutants in stormwater to the MEP), and effectively prohibiting non-stormwater discharges. The ordinances also provide the legal authority necessary to implement strategies designed to achieve the City's numeric goals included in the WQIP for the San Luis Rey and Carlsbad WMAs. The following two Chapters of the VMC are the primary ordinances for establishing legal authority to implement the stormwater management program:

- City of Vista Stormwater Management and Discharge Control Program Ordinance (Stormwater Ordinance; Appendix D), VMC Chapter 13.18
- Grading and Erosion Control Ordinance, VMC Chapter 17.56

The Stormwater Ordinance has been updated to reflect changes to the requirements of the MS4 Permit, including new regulations for non-stormwater discharges. The City's Stormwater Ordinance (Appendix D) also makes enforceable the City's revised minimum BMP requirements included in the Stormwater Standards Manual (Appendix C). As with all other City ordinances, VMC chapters 13.18 and 17.56 are also available on the City's website (www.cityofvista.com).

Where violations of the VMC are observed, including violations of requirements in the Stormwater Standards Manual (Appendix C), administrative and judicial procedures may be employed to enforce stormwater requirements. The City also has litter and public nuisance ordinances, which are not specific to stormwater; but may, in some cases, be used to support stormwater program implementation. More detail about enforcement tools and procedures is included in the Enforcement Response Plan (Appendix F). In 2017, the City became subject to new trash control mandates from the RWQCB, which are integrated into this JRMP.

[1] San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001

2.2 Certification of Legal Authority

As required by the MS4 Permit, the City prepares a letter certifying that the City has adequate legal authority to implement and enforce the requirements of Title 40 Code of Federal Regulations Section 122.26(d)(2)(i)(A-F) and Order R9-2013-0001. This certification letter is submitted with the WQIP annual reports.

2.3 Departmental Roles and Responsibilities

The following is a list of departments, divisions, and programs in the City that conduct stormwater program-related activities.

Mayor and City Council

- Adopt ordinance revisions to carry out new MS4 Permit requirements
- Secure fiscal resources and approve budgets
- Provide public participation at City Council meetings
- Review and approve related policies and plans as needed
- Enter into formal agreements with Co-permittees to define management structure, responsibilities, cost sharing, and decision-making procedures for implementation of the MS4 Permit
- Sign reports or have principal executive office sign

City Attorney's Office

- Draft and approve ordinances and assist with enforcement as needed
- Ensure and certify adequate legal authority

City Manager's Office

- Oversee implementation of JRMP across multiple departments
- Coordinate public participation and outreach information via the City's Communication Officer
- Collaborate with enforcement staff on illegal discharges and water quality issues, and enforce applicable department codes
- Sign and certify reports submitted to the RWQCB, or delegate authority to executive staff official
- Provide GIS support, as follows:
    - Assist with the development, maintenance, and access of information about the City's infrastructure, existing facilities, and publicly owned areas

    - Technical support for use of *Cityworks* software to track stormwater-related activities (e.g., inspections, enforcement cases, work orders)
- Provide Information Technology technical support

Engineering Department

- Stormwater Division
    - Coordinate implementation of the JRMP
    - Maintain inventory and conduct inspections and enforcement of existing facilities (industrial, commercial, and residential)
    - Responsible for enforcement of municipal areas and activities
    - Provide enforcement support for construction activities
    - Implement IDDE program, including dry-weather monitoring, investigation, enforcement, and hotline response
    - Assist with training of municipal personnel, and industrial and commercial facility operators
    - Conduct outreach and education for various audiences such as residents, general public, and school children
    - Maintain the structural post-construction BMP inventory and oversee maintenance tracking activities
    - Act as representative in Carlsbad and San Luis Rey watersheds and regional Co-permittee management activities
    - Serve as liaison to City departments regarding implementation of the MS4 Permit and JRMP
    - Coordinate JRMP Annual Report preparation
- Capital Improvement Projects (CIP) Division
    - Ensure that public projects meet development standards
    - Oversee projects for compliance with erosion control requirements
    - Update construction site inventory
    - Contribute to education and outreach for construction audience
    - Provide information for JRMP document updates and JRMP Annual Reports

- Engineering Inspection Division
  - Maintain construction site inventory
  - Conduct inspections and regulate construction sites regarding erosion, structural BMPs, and other site management activities
  - Report non-compliant sites, including SWRCB Construction General Permit, Order 2012-0006-DWQ (CGP) non-filers
  - Contribute to education and outreach for construction audience
  - Provide information for JRMP document updates and JRMP Annual Reports
- Land Development Division
  - Modify development requirements in Stormwater Standards Manual as needed
  - Implement development requirements consistent with Stormwater Standards Manual and the MS4 Permit
  - Maintain inventory of permits
  - Issue grading permits
  - Support structural post-construction BMP compliance and maintenance tracking
  - Responsible for Hydromodification Plan implementation
  - Assist with existing development enforcement for BMP compliance
  - Contribute to education for new development and construction activities
  - Provide information for JRMP document updates and JRMP Annual Reports
- Right-of-Way Division
  - Maintain inventory of municipal areas
  - Provide information for JRMP document updates and JRMP Annual Reports
- Sewer Projects Division
  - Responsible for design, review, and approval of all publicly owned and maintained sewer infrastructure
  - Conduct plan checks and sewer permit issuance for private development connections to the public sewer system
  - Coordinate response to identified cross-connections and sewage spills

Community Development Department

- Development Services Division
  - Issue grading permits
  - Receive and review development and redevelopment applications
  - Responsible for low-impact design (LID) and Hydromodification Management Plan (HMP) development and implementation
  - Develop contract documents and administer contracts, including BMP requirements
- Planning Division
  - Responsible for update to the City's General Plan and Environmental Review process
  - Responsible for ensuring that land uses in the City comply with the City's Municipal Code, General Plan, Council and Planning Commission policies, and State requirements
  - Contribute to education and outreach for new development and construction activities
  - Provide information for JRMP document updates and JRMP Annual Reports
- Building Division
  - Provides building permit applicants with BMP checklist of required pollution prevention activities based on project activities
  - Contribute to treatment control BMP maintenance tracking
  - Responsible for development site enforcement for building activities
  - Provide information for JRMP document update and JRMP Annual Reports

Public Works Department

- Administration Division
  - Oversee contracts with contractors regarding solid waste disposal and Household Hazardous Waste activities
  - Coordinate Public Works Corporate Yard activities, such as BMP implementation, spill prevention/response, and training

- Street Maintenance Division
    - Administer street sweeping program
    - Conduct preventive maintenance
    - Responsible for operation and maintenance of MS4 and City-owned structural post-construction controls
    - Manage pesticides, herbicides, and fertilizers as applicable
    - Provide information for JRMP document updates and JRMP Annual Reports
- Wastewater Maintenance Division
    - Responsible for the maintenance of the City's sanitary sewer system
    - Respond to and clean up sewage spills to prevent or minimize discharges to the MS4
    - Provide information for JRMP document updates and JRMP Annual Reports
- Fleet Maintenance Division
    - Implement equipment maintenance BMPs
    - Contribute to education and outreach for municipal personnel
    - Provide information for JRMP document updates and JRMP Annual Reports
- Parks Maintenance Division
    - Manage pesticides, herbicides, and fertilizers
    - Implement and maintain BMPs at City parks
    - Contribute to education and outreach for municipal personnel
    - Provide information for JRMP document updates and JRMP Annual Reports
- Facilities Maintenance Division
    - Provide general, routine maintenance, as well as BMP implementation and maintenance to select City-owned buildings
    - Contribute to education and outreach for municipal personnel
    - Provide information for JRMP document updates and JRMP Annual Reports

Fire Department

- Implement and maintain BMPs at fire-related facilities and during fire-related activities
- Contribute to education and outreach for municipal personnel

- Provide information for JRMP document updates and JRMP Annual Reports

Code Enforcement Department

- Assist Stormwater Division staff with enforcement cases where appropriate

Finance Department

- Process business license applications and acquire data for use in existing facility inspections or enforcement actions by City staff
- Responsible for assisting with stormwater budget management

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3 Illicit Discharge Detection and Elimination

3.1 Introduction

A core component of the City stormwater plan is the IDDE program. Designed to actively detect and eliminate illicit connections and illegal discharges (IC/IDs) to the storm drain system, this program prevents the discharge of pollutants that would otherwise be conveyed untreated to nearby receiving water bodies. IC/IDs are defined as the following:

- An ***illicit connection*** is a pipe, facility, or other device connected to the storm drain system or receiving waters, which has not been authorized by the City; or a permitted/authorized pipe, facility, or other device, which conveys illegal discharges.
- An ***illegal discharge*** is any discharge into the storm drain system or receiving waters that is prohibited by the City's Stormwater Management and Discharge Control Program Ordinance (Municipal Code Chapter 13.18, referred to as the "Stormwater Ordinance").

IDDE efforts involve coordination between multiple City departments, including Public Works, Wastewater Operations, Engineering, and Fire, as well as Buena Sanitation District, County of San Diego Department of Environmental Health (DEH), and members of the public.

Multiple stormwater program activities contribute to the detection and elimination of IC/IDs. Examples of these activities include:

- Dry Weather Major MS4 Outfall Discharge Monitoring Program (MS4 Outfall Monitoring Program) (Section 3.3.4).
- Irrigation Runoff Reduction Program (Appendix E)
- Existing development inspections (Sections 6, 7, 8, and 9).
- Operation of a Stormwater Hotline, available for reporting any water quality concern (Section 3.3.1).
- Public Education and Participation Program to increase public awareness and encourage environmental stewardship (Section 10).

The City investigates every IC/ID that is reported or detected by the public and City staff to identify the source(s) of the discharge. Consistent with the City's Enforcement Response Plan (Appendix F), the primary goal is to abate the identified source of discharge. Education is used to prevent future IC/IDs, where feasible; however, escalated enforcement may also be employed by City staff when necessary.

This section discusses prohibited discharges, non-stormwater discharge exemptions (allowable discharges), and the City's procedures for IC/ID detection, prevention, response, and enforcement.

3.2 Non-Stormwater Discharges

Non-stormwater discharges to the storm drain system are prohibited unless the discharge has been authorized by a separate NPDES permit, or are conditionally allowed by the new MS4 Permit. Some categories of non-stormwater discharges are allowed on the condition that they are addressed in accordance with the requirements of the Stormwater Ordinance and current MS4 Permit, which are discussed in Section 3.2.2.

The City periodically reviews and evaluates conditionally allowed discharges to determine whether specified categories may be significant sources of pollutants to receiving waters. Where a category of non-stormwater discharge is determined to be a significant source of pollutants, the City takes appropriate enforcement measures and may prohibit the discharge category from entering the storm drain system, or implement BMPs. See Appendix C for a list of the City's minimum BMPs; and Appendix F for the Enforcement Response Plan, which details enforcement measures.

3.2.1 Prohibited Discharges

Consistent with the MS4 Permit, irrigation runoff that enters the City's storm drain system is considered a prohibited discharge. Under the previous MS4 Permit, irrigation runoff was allowed unless it was shown to be a source of pollutants. Irrigation runoff includes intended or unintended overspray, and excessive application of irrigation water from sprinklers, hosing, or other irrigation methods. The City implements strategies and programs to eliminate irrigation runoff. These strategies are listed in Appendix E along with a crosswalk to the JRMP and WQIP locations (Appendix A) where the strategy is discussed.

In addition to irrigation runoff, the following discharges are prohibited, unless covered by RWQCB Order R9-2008-002, or subsequent order *(General Waste Discharge Requirements for Discharges From Groundwater Extraction and Similar Discharges to Surface Waters within the San Diego Region Except for San Diego Bay (WDR))*; RWQCB Order R9-2010-0003 *(General Waste Discharge Requirements for Discharges of Hydrostatic Test Water and Potable Water to Surface Waters and Storm Drains or Other Conveyance Systems within the San Diego Region)*; or other NPDES permit as appropriate:

- Uncontaminated pumped groundwater.
- Water from crawl space pumps.
- Non-stormwater from water line flushing and water main breaks.

- Discharges from foundation drains and footing drains, 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 recycled or reclaimed water lines.

Section E.2.d.(3)(e) of the MS4 Permit requires that if the City is unable to identify and document the source of a recurring non-stormwater discharge to or from the storm drain system, then the City must address the discharge as an illegal discharge, and update this JRMP as needed to address the common and suspected sources of the non-stormwater discharge in its jurisdiction.

On April 7, 2015, the SWRCB adopted Resolution 2015-0019, amending the *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) and the *Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (ISWEBE Plan) to address the impacts of trash to the surface waters (i.e., the Trash Amendments). The effective date of the Trash Amendments was December 2, 2015. The Trash Amendments establish a statewide narrative water quality objective and implementation requirements to control trash, including a prohibition against the discharge of trash to surface waters.

Per Investigative Order R9-2016-0205, the RWQCB is requiring municipalities to implement the Trash Amendments through the implementation of one of two options:

- Track 1: Install, operate, and maintain full-capture systems for all storm drains that capture runoff from the priority land uses in their jurisdictions; or
- Track 2: Install, operate, and maintain any combination of full-capture systems, multi-benefit projects, other treatment controls, and/or institutional controls within either the City's jurisdiction or within the City's jurisdiction and contiguous co-permittee jurisdictions. The City would need to demonstrate that such combination achieves the full-capture system equivalency.

The City has chosen the Track 2 compliance option, and developed a Track 2 Implementation Plan, submitted to the RWQCB on November 29, 2018.

3.2.2 Conditionally Allowed Discharges

The following discharges are allowable discharges unless the City or the RWQCB identifies the discharge as a source of pollutants to receiving waters:

- Diverted stream flows
- Rising groundwaters
- Uncontaminated groundwater infiltration to MS4s

- Springs
- Flows from riparian habitats and wetlands
- Discharges from potable water sources
- Discharges from foundation or footing drains if the system is designed to be located above the groundwater table at all times of the year, and the system is only expected to discharge non-stormwater under unusual circumstances.
- Discharges of non-stormwater to the storm drain system from the following categories are controlled by the requirements listed in the City's Stormwater Standards Manual (Appendix C); otherwise, they are addressed as illegal discharges.
    - Air conditioning condensation
    - Individual residential vehicle washing (this does not include car washing for fundraisers or charity events)
    - Dechlorinated swimming pool discharges

Discharges determined by any authorized enforcement official or staff to be necessary to protect public health and safety are exempt from discharge prohibitions discussed above, provided that any conditions set for such discharges imposed by the authorized enforcement official or staff are satisfied. In emergency circumstances, the determination of an authorized enforcement official or staff that a discharge is necessary may initially be oral, but must be promptly confirmed in writing. In non-emergency situations, a prior written determination is required to exempt a discharge.

3.2.3 Firefighting Discharges

In accordance with Section E.2.a.(5) of the MS4 Permit, firefighting discharges to the MS4 must be addressed as illegal discharges only if the City or the RWQCB identifies the discharge as a significant source of pollutants to receiving water. Firefighting discharges not identified as a significant source of pollutants to receiving waters are addressed, at a minimum, as follows:

Non-emergency firefighting discharges (i.e., discharges from controlled or practice blazes, firefighting training, and maintenance activities not associated with building fire suppression systems) are subject to the municipal BMPs described in the Stormwater Standards Manual (Appendix C) to reduce or eliminate pollutants in such discharges from entering the storm drain system.

During emergency situations, priority of efforts is directed toward life, property, and the environment (in descending order). The BMPs listed in Appendix C should be implemented, but should not interfere with immediate emergency response operations or impact public health and safety.

3.3 Preventing, Detecting, and Responding to Illicit Connections and Illegal Discharges

In support of the City's IDDE efforts, multiple stormwater program activities contribute to the detection of IC/IDs. Examples of these activities include:

- Dry Weather Major MS4 Outfall Discharge Monitoring Program (MS4 Outfall Monitoring Program) (see Appendix G for monitoring program procedures).
- Existing development inspections (see Section 6 for information on industrial and commercial inspections; Sections 7 and 8 for information on municipal facilities inspections; and Section 9 for information on residential inspections).
- Irrigation Runoff Reduction Program and other strategies to reduce and eliminate irrigation runoff (see Appendix E).

3.3.1 Reporting of Illicit Connections and Illegal Discharges

To facilitate the process of reporting and investigating illegal discharges, the City encourages the public, City, and contract staff to report IC/IDs. Water quality or stormwater-related questions and complaints are responded to by appropriate City staff utilizing the reporting mechanisms described below.

Incidents of stormwater pollution, including irrigation runoff, illegal dumping, sediment/mud, or other concerns:

- City of Vista online reporting tool on the City of Vista's homepage (www.cityofvista.com)ACCESS VISTA Smartphone Mobile App
- City of Vista Water Quality Hotline at (760) 643-2804 or email at waterquality@cityofvista.com
- San Diego Region Project Clean Water website

Broken water lines or water waste:

- Vista Irrigation District phone line at (760) 597-3100 or online at www.vidwater.org

Sewage discharges/spills:

- Public Works Department phone line at (760) 639-6177 during business hours or at (760) 825-3135 after hours

Alternatively, a regional public reporting hotline is provided by the County of San Diego at (888) 846-0800. The hotline is answered Monday through Friday, 8:00 a.m. – 5:00 p.m., and provides a voicemail message for 24-hour public access in both English and Spanish.

The City also maintains language on their website at www.cityofvista.com/stormwater to encourage reporting and facilitate public understanding of prohibited discharges and pollutants.

3.3.2 Response to Stormwater-Related Complaints

When a stormwater-related complaint is received (e.g., hotline, email, or in person) it is logged into the *Cityworks* database. The *Cityworks* database enables complaint details, documents, and information to be linked spatially to an address or area. Investigations are initiated by Stormwater Division staff for all complaints suggesting an actual or potential discharge to the storm drain system or receiving waters. If investigators find evidence of a violation with the potential to release pollutants or an actual IC/ID (including irrigation runoff and other prohibited discharges as identified in section 3.2.1), every effort is made to find the responsible party and inform them of the complaint, and/or enact an enforcement measure. Parties found to be responsible for a violation or IC/ID are required to immediately cease, or significantly abate, the discharge. Additional corrective actions or escalated enforcement actions (e.g., Administrative Citation) may also be issued, depending on case-specific circumstances, and consistent with the Enforcement Response Plan (Appendix F).

If a violation is determined to pose a serious threat to human health or the environment, verbal notification is provided to the RWQCB within 24 hours, in accordance with Section 1.l.(6) of Attachment B of the MS4 Permit. Criteria listed below are used to determine the human or environmental health threats of a violation, where applicable:

- Estimated pollutant load discharged from site.
- Estimated volume of discharge.
- Types of pollutants discharged, including if toxic materials were discharged.
- Sensitivity of the receiving water body, including if it is CWA Section 303(d) water body segment listed for any of the pollutants in the discharge.
- Proximity of site to sensitive habitat/endangered species.
- How much, if any, of the discharge reached the receiving water body.
- Beneficial uses for affected water bodies.

3.3.3 Spill Response and Reporting

The City coordinates spill prevention, containment, and response activities throughout all appropriate departments, programs, and agencies so that maximum water quality protection is available at all times. Spills are prevented and mitigated through the implementation and enforcement of minimum BMPs (Appendix C), which include the proper disposal of wash water, maintaining a spill cleanup kit, and employee training regarding spill cleanup and other related BMPs. Spill response teams are used, consisting of both City and County of San Diego (County) resources, and the City coordinates with upstream and downstream agencies as necessary. This subsection provides an overview of the City's general spill response and reporting actions consistent with MS4 Permit Section E.2.b.(4)-(5). For sanitary sewer overflows (SSOs) and hazardous material spills and releases, the City's Sewer Overflow Emergency Response Plan or the Hazardous Materials Response Plan is the first point of reference.

Spills from the City's sanitary sewer system may be discovered during routine maintenance activities of the sewer system, or observed and reported to the City by the public and City Public Works staff. The City has developed and adopted a Sewer System Management Plan (SSMP) in accordance with SWRCB Order 2006-003-DWQ and RWQCB Order R9-2007-0005, applicable to the sewer collections system operated by the City. More information regarding the City's preventive maintenance of the sewer system is provided in Section 8.4. The County DEH responds to sewage spills reaching a receiving water body.

The regional Hazardous Materials Incident Response Team (HIRT) handles all after-normal-business-hour complaints for the County DEH and other designated agencies in San Diego County, including SSOs. The City contributes to the funding of the HIRT, which was founded in 1981 by the Unified Disaster Council, and is funded by a Joint Powers Agreement and services all unincorporated San Diego County areas, 18 municipalities, two military bases, and five Indian Reservations.

If a spill from a private sewer lateral is not contained, and no action is being taken by the responsible party to repair the lateral, Public Works staff take necessary action. Due to the public health risk and safety, parties responsible for private sewer lateral spills are typically issued a Notice of Violation, with conditions to immediately cease and clean up the spill. In addition, the private sewer lateral owner may be required to inspect and repair the private sewer lateral, in accordance with VMC Chapter 14.14.

Spills that result in an illegal discharge to the City's storm drain system are reported annually in the City's JRMP Annual Report, which includes the number of discharges reported, detected, investigated, identified, and eliminated; and the number of associated enforcement actions. As required by the MS4 Permit, the City provides verbal notification to the RWQCB of all instances of noncompliance in its jurisdiction that may pose a threat to human or environmental health within 24 hours from when the City is made aware of the situation. The specific information that must be reported within 24 hours of the incidence of noncompliance can be found in Section 1.l.(6) of Attachment B of the MS4 Permit.

3.3.4 Dry-Weather Major MS4 Outfall Discharge Monitoring

In 2013, the City began routine visual monitoring of discharges from major MS4 outfalls during dry weather to detect non-stormwater and IC/IDs from its storm drain system. A "major outfall" is defined as an outfall that is 36 inches in diameter, or drains to an industrial area and is at least 12 inches in diameter. These efforts contribute to detecting IC/IDs and non-stormwater discharges from the storm drain system.

Under the 2007 MS4 Permit, the City conducted field-screening at all monitoring sites, and tested any water present at the sites for various common stormwater pollutants. The current MS4 Permit emphasizes the identification and elimination of dry-weather discharges from the City's outfalls. By working toward eliminating or reducing dry-weather flows, the City is able to concentrate on reducing and eliminating a wide range of pollutants that may be transported to receiving waters.

The City has implemented procedures to investigate and inspect segments of its storm drain system that have a reasonable potential for receiving, containing, or discharging pollutants due to IC/IDs or other non-stormwater sources. All IC/IDs found during field work are to be investigated immediately by Stormwater Division or contract staff, and appropriate follow-up and/or enforcement actions are taken as necessary. Detailed procedures for dry-weather major MS4 outfall monitoring, IC/ID investigations, and prioritization of investigations are included with the storm drain map in Appendix G.

Note that other monitoring requirements specified in the MS4 Permit include wet-weather MS4 outfall and receiving water monitoring. Those activities are completed by contractors through watershed-level programs for which the cost is shared among the responsible watershed agencies and/or parties. The details of those programs are discussed in the WQIPs for the San Luis Rey and Carlsbad WMAs.

3.3.5 Storm Drain System Map

The City maintains a GIS-based map of its storm drain system that—along with other GIS data (e.g., addresses, land use, sewer infrastructure, contours, streets, etc.)—is available to all City staff through an intranet-based VistaGIS interface or ArcGIS desktop software. Storm drain structures are updated on a regular basis by GIS Division staff, such as when new projects or field corrections are completed. Mapping of the storm drain system, and having access to multiple GIS data layers, provide staff with useful information while investigating and responding to IC/IDs. Appendix G includes a map illustrating the storm drain system, along with the following features required by the MS4 Permit:

- All storm drain system segments owned, operated, and maintained by the City, including MS4 outfall monitoring locations and drainage basins.

- All known locations of inlets that discharge and/or collect runoff into the City's storm drain system.
- All known locations of connections with other storm drain systems not owned or operated by the City (e.g., California Department of Transportation [Caltrans] storm drain systems).
- All known locations of MS4 outfalls and private outfalls that discharge runoff collected from areas in the City's jurisdiction.
- All segments of receiving waters within the City's jurisdiction that receive and convey runoff discharged from the City's MS4 outfalls.
- Locations of the inventoried major MS4 outfalls in the City's jurisdiction, pursuant to Section D.2.a.(1) of the MS4 Permit.
- Locations of the non-stormwater persistent flow MS4 outfall monitoring stations, identified pursuant to Section D.2.a.(1) of the MS4 Permit.

The status of major MS4 outfalls as having persistent flow, transient flow, or being dry will change as the City collects more data from outfall monitoring, and as sources of flow are eliminated. For similar reasons, the sites at which persistent flow analytical monitoring is completed will likely change over time. Updates will be provided through the WQIP annual reporting process.

In accordance with Section E.2 of the MS4 Permit, each watershed in the City's jurisdiction contains at least one monitoring station. If field staff note inaccuracies in the map during field screening, the inaccuracies are reported to the appropriate City staff so that updates can be made. The need for updates to the map are assessed at least annually; at that time, updates are made where necessary. The GIS files used in developing the City's storm drain system map will be made available to RWQCB staff on request.

3.3.6 Investigating Illicit Connections and Illegal Discharges

In addition to the investigation procedures described in the dry-weather MS4 outfall monitoring procedures (Appendix G), the City may also employ the following methods to identify the source of an IC/ID.

Review of Plans

As-built plans for the area of interest can be reviewed to verify intended storm drain and sanitary sewer pipe connections. However, an illicit connection may have occurred after the as-built drawings were created, so additional in-field confirmation is likely necessary.

Dye Testing

Dye testing can confirm hydraulic connections between a potential source and a downstream location. Fluorescent dye is introduced at the source of the potential IC/ID, and presence of the dye is monitored downstream. This method is used only when necessary, because the public and appropriate regulatory agencies in the surrounding area need to be informed about the cause of the water discoloration.

Smoke Testing

By introducing smoke into an underground sewer system, smoke testing can be an effective means of identifying cross-connections between storm drain and sanitary sewers. Due to potential concerns with the presence of smoke (and inference of a fire), the public and appropriate agencies need to be informed when smoke testing is conducted.

Closed-Circuit Television Inspection Monitoring

Closed-Circuit Television Inspection (CCTV) cameras may be used to record video of underground storm drain and sanitary sewer. CCTV can be effective at identifying cross-connections and defects that may contribute to an illegal discharge. The public and regulatory agencies generally do not need to be informed prior to initiating this kind of investigation.

Confined-Space Entry

Confined-space entry may be used to physically enter storm drains, sanitary sewers, or other restricted-entry facilities. All applicable health and safety regulations must be followed. However, the public and regulatory agencies generally do not need to be informed prior to initiating a confined-space entry.

Potential Sewage IC/IDs

Further testing of suspected sewage-related flows is conducted when visual and odor observations do not adequately confirm the presence of sewage.

- Ammonia – Sewage frequently contains ammonia levels of 30 milligrams per liter or greater. This can be measured with an inexpensive field screening kit.
- Bacteria – Sewage generally has high levels of total and fecal coliforms and *Enterococci*. Sewage treatment plants and many laboratories routinely conduct these indicator analyses.

3.3.7 Eliminating Illicit Connections and Illegal Discharges

Action is taken to eliminate IC/IDs and their sources as soon as possible after detection. IC/IDs that pose a serious threat to public health or the environment are eliminated immediately. Action may include the referral to the appropriate City department or other agency for abatement. IC/IDs that are not deemed to pose serious threats to public health or the environment are eliminated through an escalating series of enforcement actions, which are described in the Enforcement Response Plan (Appendix F).

When a discharge originates from a source outside the City's jurisdiction, and the City does not have legal authority to require that the discharge be eliminated, the City will notify the responsible agency with jurisdiction over the source of the discharge so that the agency can take action to eliminate it. In the event that the responsible agency is not responsive or otherwise does not eliminate the discharge in a timely manner, the City will notify the RWQCB, as well.

If a responsible party has been identified during an illegal discharge investigation, the responsible party is required to take appropriate action to eliminate the illegal discharges, and to perform any necessary cleanup or remediation in accordance with the City's Stormwater Standards Manual (Appendix C). Any refusal by the responsible party to perform necessary actions to eliminate the illegal discharge is handled by Stormwater Division staff for appropriate enforcement action. If a responsible party is identified, but neglects to perform the necessary corrective action, the City may bill the responsible party for abatement costs, and/or may take other escalated enforcement measures.

Appropriate remedial actions that may be taken to eliminate illegal discharges may include the following:

- Redirect non-hazardous discharges to the sanitary sewer, collection container, or onsite landscaped or pervious area(s) to infiltrate or evaporate, without resulting in erosion or runoff to the storm drain system or any adjacent property.
- Redirect hazardous discharges to a collection container for reuse or disposal via a licensed hazardous waste disposal service.

The City takes appropriate action to ensure the disconnection, blockage, or diversion of a pipe, facility, or other device connected to the storm drain system or receiving waters that has not been authorized by the City, and is contributing to an illegal discharge to the storm drain system. Examples of appropriate actions may include the following:

- Plug sinks, drains, or faulty irrigation components that are discharging prohibited materials to the storm drain system.
- Divert illegal discharges to the sanitary sewer if approved by the City, or treat on-site.

Illicit connections often require coordination between multiple City divisions, including Public Works Sewer, Stormwater, Building, and Planning. Note that in some cases, special permits from the Encina Wastewater Authority are needed before material can be discharged to the sanitary sewer system, in addition to the City's approval.

3.4 Record Keeping

The City maintains records in *Cityworks* of the following information for IC/ID investigations:

- Location of incident, including hydrologic subarea (HSA), portion of storm drain system receiving the non-stormwater or illegal discharge, and point of discharge or potential discharge from storm drain system to receiving water.
- Source of information initiating the investigation (e.g., public reports, staff or contractor reports and notifications, field screening, etc.).
- Date the information used to initiate the investigation was received.
- Date the investigation was initiated.
- Dates of follow-up investigations.
- Identified or suspected source of the illegal discharge or connection, if determined.
- Known or suspected related incidents, if any.
- Results of the investigation.
- If a source cannot be identified and the investigation is not continued, document the response pursuant to the requirements of MS4 Permit Section E.2.d.(3).

3.5 Enforcement

The City takes action in accordance with its Enforcement Response Plan (Appendix F) to eliminate IC/IDs. If the source of the non-stormwater discharge to the MS4 is natural (i.e. non-anthropogenic), then the City documents the data and evidence necessary to demonstrate to the RWQCB that the discharge arises from a natural source, and does not require enforcement or further investigation.

As detailed in the Enforcement Response Plan, the MS4 Permit requires that violations be corrected within no more than 30 days after the violations are discovered or prior to the next predicted rain event, whichever is sooner. When compliance has not been achieved within 30 days of discovering the violation, Stormwater Division staff document why the violation has not been corrected within the appropriate timeframe.

4 Development Planning

4.1 Introduction

Development projects can result in increased runoff volumes and increased levels of pollutants in runoff relative to pre-development conditions. As a result of new development and re-development projects, the addition of impervious surfaces, such as pavement or rooftops, can be a key contributor to flow runoff volume increases. Increased runoff volumes may increase stream flow rates and durations, which in turn can lead to increased erosion in local rivers and streams. This process is referred to as hydromodification. Increases in impervious surfaces may also result in the increased conveyance of sediment and other pollutants, such as nutrients and bacteria, to local water bodies.

To reduce the potential for pollutants to impact stormwater quality, and to control stormwater discharges (both flow and duration), the City has established design standards for new development and redevelopment projects that require the implementation of permanent stormwater control measures, including LID techniques, source control BMPs, and post-construction structural BMPs. Figure 4-1 identifies the major components of the City's program to reduce the impacts of development projects on the quality and quantity of stormwater discharges: these components are listed in sequential order. The figure also identifies the section(s) of this chapter in which the component is discussed in more detail.

Figure 4-1. Overview of City of Vista Approach to Reducing Stormwater Impacts from Development Projects

Establish post-construction BMP requirements
(Section 4.2)

Require post-construction BMPs through development review process
(Section 4.3)

Verify structural post-construction BMP installation during project construction
(Section 4.4)

Track and enforce ongoing structural post-construction BMP maintenance
(Sections 4.5 and 4.6)

4.2 Development Project Requirements

The City's Stormwater Standards Manual (Appendix C) and Stormwater Ordinance (VMC Chapter 13.18) (Appendix D) require development projects in the City of Vista to incorporate post-construction BMPs into their designs. The requirements in the Stormwater Standards Manual (Appendix C) are based on the Model Standard Urban Stormwater Mitigation Plan and the Hydro-Modification Management Plan (HMP). Both of these plans were developed through a regional effort, which included the City and the 20 other municipal agencies in San Diego County (collectively, "Copermittees").

As a result, the Copermittees developed a revised set of post-construction BMP requirements (i.e., the BMP Design Manual) to address the new MS4 requirements. The new BMP Design Manual was incorporated into the City's Stormwater Standards Manual (Appendix C) in place of the existing post-construction BMP requirements.

4.2.1 Types of Development

The City's Stormwater Standards Manual (Appendix C) defines the categories into which site improvements may be classified:

- Development Projects
    - Priority Development Projects (PDPs)
    - Standard Projects
- Non-Development Projects

All development projects are classified as either PDPs or Standard Projects. Projects with an elevated potential impact on stormwater quality are identified as PDPs, and are defined in the City's Stormwater Standards Manual (Appendix C). This determination is based on a number of factors, such as the amount of impervious area created, the proposed land use, and existing land conditions. The Checklist for New Development and Redevelopment in the City's Stormwater Standards Manual (Appendix C) provides more detailed guidance on how projects are classified.

Not all site improvements are considered "development projects" under the MS4 Permit, because not all improvement work involves activities that have the potential to come in contact with stormwater. For example, work that occurs only on the interior of a building is not considered a development project for stormwater purposes. Projects that are not considered development projects are classified as Non-Development Projects. The Checklist for New Development and Redevelopment also provides guidance to determine whether site improvements should be considered development projects.

4.2.2 BMP Requirements for Development Projects

Table 4-1 summarizes the post-construction BMP requirements provided in the City's Stormwater Standards Manual (Appendix C). PDPs are subject to more BMP requirements than Standard Projects because PDPs are larger, or include activities that have a higher potential to generate pollutants, such as automotive repair shops. The same requirements apply to both private projects and the City's CIPs.

Table 4-1. Summary of Post-Construction BMP Requirements

BMP Type	Standard Projects	Priority Development Projects
Site Design LID	X	X[1]
Source Control	X	X
Treatment Control		X[1]

[1] Numeric sizing standards apply to PDPs. Numeric sizing incorporates design for water quality treatment, and where applicable, peak flow and flow duration control for hydromodification. If numeric sizing standards can be satisfied by LID features only, additional non-LID treatment control BMPs are not required. See the Stormwater Standards Manual (Appendix C) for details.

Through the incorporation of the 2016 BMP Design Manual requirements into the Stormwater Standards Manual (Appendix C), new standards for PDPs apply. As required by the MS4 Permit, the standards are designed to prevent PDPs from having a negative net impact on critical coarse sediment transport into receiving waters (i.e., preventing the migration of coarse-grained sediment critically needed for creek bed and beach replenishment). The regional Watershed Management Area Analysis has identified critical coarse sediment areas and developed a geodatabase that shows their locations. The 2016 BMP Design Manual provides additional information about coarse sediment areas and evaluating their presence at a project site.

4.3 Project Review and Approval

The City has an established multi-departmental review and verification process for all new development and redevelopment projects. Through the implementation of development project requirements in the Stormwater Standards Manual (Appendix C) and application of the procedures detailed below, the City strives to mitigate the negative impacts of urban runoff from development projects to the MEP. City staff review all development projects for minimum stormwater BMP requirements, as shown on Figure 4-2. The process shown on Figure 4-2 is written with private projects in mind, but the same general process also applies to municipal CIPs. A stormwater pollution prevention checklist is required for projects that are issued building permits only (e.g., electrical, water heater, plumbing). The checklist identifies stormwater pollution prevention requirements applicable to project activities.

4.3.1 Planning Phase

During the planning phase, development project proponents may request a pre-application meeting with City staff, prior to submitting a project application. If a pre-application meeting is held, a determination on whether a project is likely to be a Standard Project or PDP is typically made during the meeting.

Project conceptual plans are submitted to the City Community Development Department (Planning Division) for preliminary review and/or processing. At this stage, the project proponent must include the appropriate documents for the project application to be deemed complete. A complete project application must include the post-construction stormwater-related documents listed in Table 4-2. The Stormwater Standards Manual (Appendix C) provides additional detail on submittal requirements.

Table 4-2. Summary of Required Post-Construction Stormwater Documents

Document	Description and Notes
Checklist for New Development and Redevelopment Projects	Used to determine whether a development project is a Priority Development Project or a Standard Project.
Post-construction BMP plan (or SWQMP)[1]	Describes post-construction BMPs and includes supporting calculations. The reports for Priority Development Project require some components not required for Standard Projects; see the Stormwater Standards Manual (Appendix C) for details.
Operation and Maintenance Plan	Describes how structural post-construction BMPs will be maintained after construction has been completed.
Hydrology and Hydraulics Study	Generally focused on flood control, but provides supporting calculations and information that may be used in review of proposed structural post-construction BMP design.

[1] These documents are called Water Quality Technical Reports (WQTR) under 2007 MS4 Permit requirements, which are now called Storm Water Quality Management Plans (SWQMPs) per the 2016 BMP Design Manual.

Throughout the permitting process, Planning Division staff coordinate with the project proponent. Planning Division staff review the conceptual project, the existing and proposed General Plan and Zoning designations, as well as informational studies. Based on this assessment, Planning Division staff determine at what level(s) the review process will be conducted: staff level, Planning Commission, or City Council. Several departments or divisions (i.e., Planning, Building, Land Development, Sewer, Traffic, Public Works, and Fire), review the conceptual plans, including impacts to water quality as a result of the proposed land use and construction. The various departments provide the Planning Division with specific project conditions for permit approval that address project issues, such as water quality. This submittal includes the post-construction BMP plan or Storm Water Quality Management Plan (SWQMP) (formerly known as a Water Quality Technical Report [WQTR]). The SWQMP must document how all required site design, source control, and structural BMPs have been incorporated into the project design. A list of the current standard conditions of approval can be found in the Stormwater Standards Manual in Appendix C.

A final SWQMP is required before the planning phase is concluded. Once a project has received conditions of approval, the project proponent begins the plan check process with the Land Development Division. For CIP projects, the process starts with the City Project Manager determining whether the project is a Standard Project or a PDP.

4.3.2 Land Development Plan Check Phase

During the plan check phase, the project proponent must submit plans and studies that describe the project proposal in detail. This submittal includes plan sheets, the Operations and Maintenance (O&M) Plan, the Hydrology and Hydraulics (H&H) Study and the previously approved SWQMP. The City's Stormwater Standards Manual (Appendix C) provides more detail on what is required to be included in required submittals. The process for CIPs is the same as for private development projects.

Several departments review the project submittals for conformance with the conditions of approval, engineering, zoning, public right-of-way, building code, and other requirements. During plan check, reviewers check that the structural BMPs proposed are consistent with the final SWQMP approved during the planning stage (Section 4.3.1), and with the submitted plans. Reviewers also check that all proposed post-construction BMPs are clearly shown on applicable plan sheets, and that cross-sections are included where necessary. This provides clear direction to the contractor, and also helps City staff verify that structural BMPs have been constructed per plans during the verification inspection at the end of project construction (Section 4.4). Once the plan check process is complete and the project plans are approved for all of the applicable permits, the permits are issued, and construction may begin.

At the conclusion of project construction, before occupancy permits are granted or construction securities are returned, a City inspector makes a final inspection of the construction site to verify installation of all required BMPs for the project, as described in more detail in Section 4.4.

Figure 4-2 summarizes the project review and approval processes described in Sections 4.3.1 and 4.3.2.

4.3.3 Projects Requiring Building Permits Only

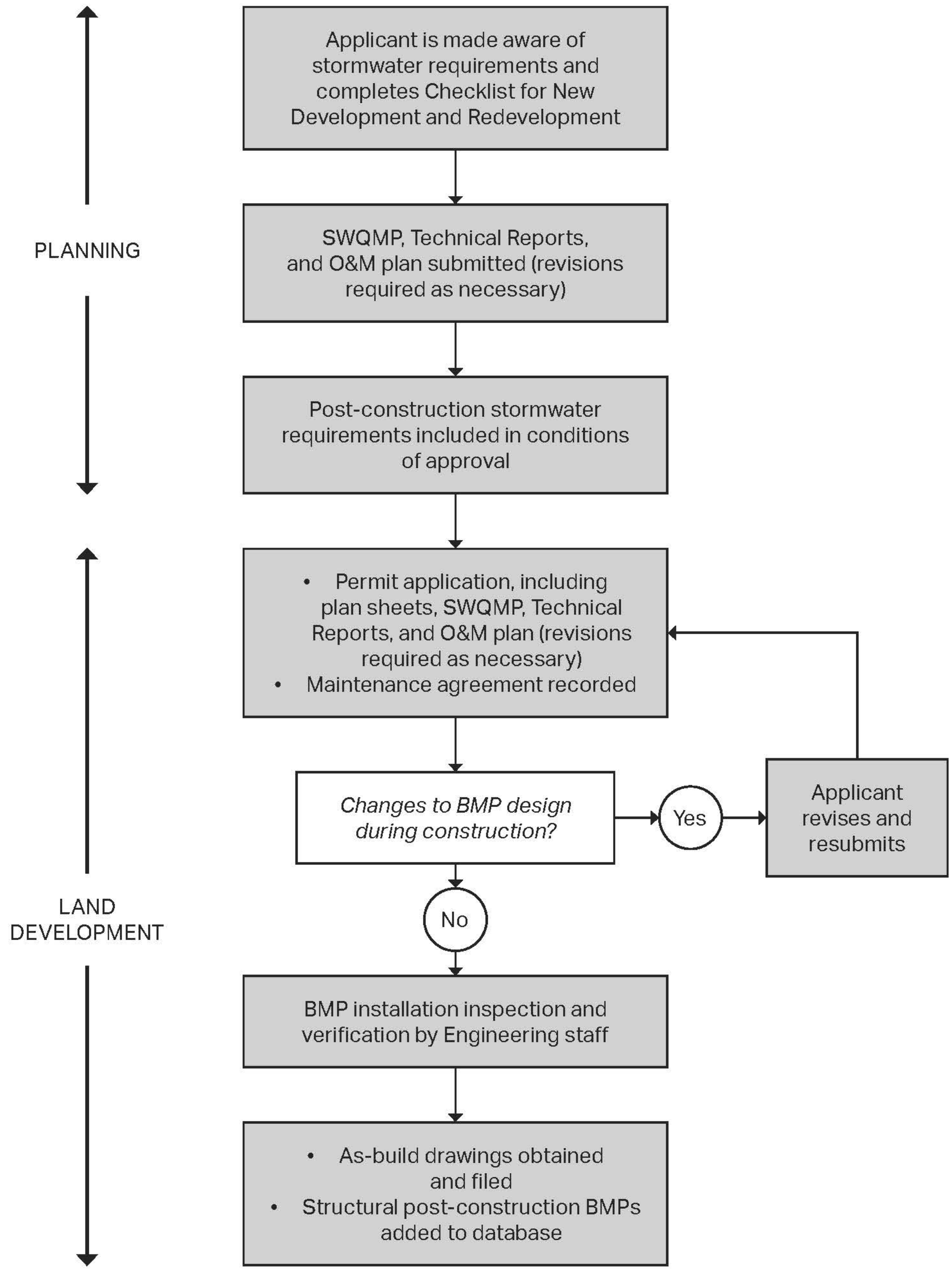
Development project proponents must submit an application through the Building Department for a building permit. In 2019, the City updated their project review process and associated pollution prevention checklist for building permit project applicants. The Building Department issues the pollution prevention checklist and a construction BMP brochure with all permit applications received. The checklist guides project applicants on the implementation of required pollution prevention BMPs applicable to the activities associated with the proposed project. Copies of the completed checklist are retained with the City and with the building permit at the project site.

4.4 Verification of New Structural BMPs

Engineering Department staff (Land Development, inspection, and stormwater staff) inspect the final completion of structural BMPs that are associated with engineering permits (grading permits and public improvement permits) and CIPs. Engineering staff also assist Building staff in inspecting the construction and installation of BMPs as needed. During these inspections, staff compare the project as constructed to the approved plans to verify the structural BMPs have been built per the plans.

Prior to certifying a project is ready for occupancy or returning the applicant’s bonds, City staff verify that structural BMPs have been constructed consistent with approved development plans. The Certificate of Occupancy will not be issued and/or bonds will not be released to private projects unless the proposed structural BMPs have been inspected and signed off as being constructed properly. In the case of CIPs, the City may withhold operational acceptance or notification of completion until structural BMP installation is verified.

Figure 4-2. Typical Priority Development Project Review and Approval Process



<u>Notes</u>
Technical Reports – Examples include hydrology and geology reports
O&M Plan – Operation and Maintenance Plan for post-construction BMPs

4.5 Structural BMP Tracking and Maintenance Verification

Following construction and approval of structural BMPs, the City takes measures to verify that they are being maintained as designed. The program activities described below apply to structural BMPs on both privately owned and City-owned PDP sites.

4.5.1 Inventory Tracking

The City maintains a GIS-based database inventory of structural BMPs using *Cityworks* software. The database is regularly updated as PDPs with structural BMPs are completed, and as site details change (e.g., property sale, contact change). This database includes the following information:

- Project address and HSA
- Structural BMP type(s)
- Structural BMP location(s)
- Approximate project size
- Date of construction (as-built plans date)
- Contact information for responsible parties of BMP maintenance
- Inspection results, enforcement actions, and resolutions

When added to the *Cityworks* database, each PDP site with structural BMPs is assigned an inspection priority of either “high” or ”standard.” Consistent with MS4 Permit Provision E.3.e.(2)(b), the City assigns a “high” inspection priority to PDP sites, based on the following criteria:

1. Located within the City’s portion of a “geographic area of focus” identified in applicable WQIP, including:
    a. Loma Alta HA, basin LA01
    b. Buena Vista HA, basin BV06
    c. Agua Hedionda HA, basin AH04
2. Total project size is more than 20 acres.
3. Project has established a poor compliance history. For prioritization purposes, poor compliance history is defined as being in violation of the City’s requirements for structural post-construction BMP maintenance for the previous two consecutive reporting years.
4. City staff also have discretion to designate a project as high priority based on other factors if deemed necessary to protect water quality.

Projects that do not meet any of the above criteria are assigned a priority of “standard.”

4.5.2 Maintenance Verification and Inspections

4.5.2.1 Annual Maintenance Verification

Operation and maintenance checklists are required with a project's SWQMP, and can be used by responsible parties to guide maintenance activities. In addition, the City implements an annual certification program to verify that structural BMPs associated with PDP sites are being maintained as designed. Each year, responsible parties for PDP sites are required to submit a certification form to the City, documenting dates of inspection/maintenance for each BMP on site.

4.5.2.2 Maintenance Inspections

Structural BMPs installed at development projects are subject to inspection by City inspectors to ensure the BMPs are being maintained and operating as designed. Each year, all high-priority project sites are inspected prior to the start of the rainy season. In addition, any projects that do not provide sufficient documentation to verify that appropriate maintenance work has been performed through the annual maintenance verification program described above are also inspected before the end of the fiscal year. Additional standard priority sites may also be inspected based on site compliance history and City staff professional judgment.

Inspections include examination of all structural BMPs at the site to verify that each structural BMP is in working order, is being maintained properly, and is in compliance with all applicable City ordinances and permits. Results of the inspection are provided to the responsible party (e.g., property owner, manager, or tenant). Appropriate enforcement actions are initiated as necessary. Section 4.6 provides more details on the enforcement process. Inspection results, as well as corrective actions and follow-up inspections, are recorded in *Cityworks*.

4.6 Enforcement

City staff can use a range of enforcement methods to ensure that developers are implementing required stormwater BMPs and that all structural post-construction BMPs are properly maintained. City staff conduct inspections at all building permit issued-project sites. Additional stormwater-specific inspections are conducted at sites with an elevated risk of pollution, considering factors such as permit type (such as pools/spa, house additions, and retaining walls), site characteristics, and time of construction.

Generally, written warnings are issued to initiate corrective actions. Escalated enforcement may also be employed through the use of Notice of Violations or administrative citations. The City's Enforcement Response Plan (Appendix F) provides details on the process for initiating enforcement actions due to structural BMP maintenance deficiencies. As required by the MS4 Permit, a rationale is recorded whenever compliance cannot be achieved within 30 days. Note that enforcement measures related to ensuring structural BMPs are built per the plans, prior to the completion of project construction; these are discussed in Section 4.4 above.

4.7 Existing Development Retrofit and Rehabilitation

As required by the MS4 Permit, the City has developed an approach to identifying potential retrofit and stream, channel, or habitat projects for existing development. The retrofit rehabilitation guidance (Appendix B) describes the City's approach to identifying and implementing potential projects.

5 Construction Management

5.1 Introduction

5.1.1 Purpose

The City of Vista identifies construction sites and activities associated with any land- or soil-disturbing activity as a known or suspected source of pollutants to the storm drain system. Sediment, trash, bacteria, oil and grease, metals, organics, and nutrients are typically generated by construction-related sites and activities. Of these pollutants, sediment and trash are the primary pollutants generated by construction sites and activities. Both sediment and trash can carry nutrients, bacteria, and other pollutants, which can impact local storm drain systems, receiving waters, and watersheds to which they drain.

To reduce or eliminate pollution conveyed by construction site activities, this section identifies City-wide administrative, education, inspection, enforcement, incentive, education, and BMP programs. These required programs implement pertinent City-specific construction strategies identified in the San Luis Rey and Carlsbad WQIPs to address the highest priority and priority water quality conditions discussed in Section 1.

In addition to the WQIP strategies, the JRMP Construction Management Component also addresses the MS4 Permit[2] requirements to:

- Reduce stormwater discharges from construction sites and activities to the MEP and;
- Prohibit non-stormwater discharges from construction sites and activities.

Effective management of construction projects and activities occurs city-wide through the implementation and enforcement of ordinances that require BMPs, regular inspections, and corrective actions for violations. These measures are anticipated to effectively address the highest- and high-priority pollutants and conditions for the San Luis Rey and Carlsbad WMAs. The City implements its Construction Component through administrative, inspection and environmental support functions.

To protect water quality in its watersheds, the City treats all land development construction activities and projects as a high threat to water quality (TTWQ) year-round. However, the inspection program identifies an inspection frequency based on season (wet and dry) and

[2] San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001 and Order R9-2015-0100,

construction phase (grading, vertical, and finish). These inspection frequencies are expected to reduce stormwater and non-stormwater discharges that may transport pollutants such as sediment and trash. For example, this approach is, in part, expected to reduce potential pollutant-loading to water bodies such as Buena Vista Lagoon, which is downstream of the City and is impaired for sediment. Reducing sediment discharges is also expected to reduce other associated pollutant loading that is adsorbed and transported by sediment particles.

5.1.2 Definition of Construction Sites and Activities

Land- or soil-disturbing activities are typically associated with the following:

- Construction of new facilities.
- Removal, replacement, or reconstruction of existing facilities.
- Construction activities associated with the maintenance of existing facilities.

Types of activities that require BMPs to be implemented include, but are not limited to:

- Clearing and grubbing
- Demolition
- Rough-grading
- Stockpiling of materials
- Excavation
- Building, construction, or maintenance
- Concrete work
- Painting
- Finish-grading and landscaping
- Landscaping construction and maintenance
- Utility installation, testing, and maintenance
- Street construction, improvement, and maintenance

The cooperation of various responsible parties who conduct construction activities—such as contractors, owners, and developers—is key to the continued success of the City's construction program in complying with the MS4 Permit.

The following sections detail how the City strives to meet current MS4 Permit requirements (Section E.4) that will reduce the discharge of pollutants in stormwater to the MEP, and prohibit non-stormwater discharges of pollutants from construction activities and sites into the storm drain system, downstream CWA §303(d)-listed water bodies, and other local ESAs. Best Management Practice Requirements

To effectively reduce discharges of pollutants in stormwater from construction sites and activities year-round, an effective combination of BMPs appropriate for each phase of construction and activities is required. The City's BMP requirements are based on three major phases of construction, as defined below:

- **Grading:** Demolition, right-of-way work, site preparation and earthmoving, earthwork, construction or relocation of above-ground and below-ground utilities, construction or relocation of below-ground structures, work associated with construction of above-ground facilities more than 5 feet from structures, and dewatering;
- **Vertical:** Construction of above-ground structures, stucco, framing, mechanical, roofing, painting, electrical, drain flushing, and structure fire-system testing prior to occupancy; and
- **Finish**: Fine-grading, roadways, slurry-seal, asphalt, concrete, walkways, parking lots, landscaping, painting, striping, traffic facilities, lighting facilities, and architectural work.

As required by the MS4 Permit, construction sites and activities in the City's jurisdiction must implement and maintain BMPs in the following categories, where applicable:

- Project Planning
- Erosion Control
- Sediment Control
- Run-on and Runoff Control
- Good Site Management ("Housekeeping"), including Waste Management
- Non-Stormwater Management
- Active or Passive Sediment Treatment Systems

The City standard for BMP selection, installation, and maintenance is the California Stormwater Quality Association (CASQA) BMP fact sheets. The City's Stormwater Standards Manual (Appendix C) provides more detail on the CASQA BMP requirements and explains how they align with the MS4 Permit BMP categories listed above for applicable construction phases, pollutants, and primary objectives.

The 2016 Stormwater Standards Manual (Appendix C) also identifies which CASQA BMPs are required for each phase of construction. Construction contractors are required to schedule in advance which BMPs may be applicable to each construction phase or activity. The City requires a complete set of BMPs at all sites and activities. In addition, the City requires an effective combination of both erosion- and sediment-control BMPs to reduce stormwater discharges. Sediment-control BMPs alone are not considered an effective BMP to reduce high-priority and priority water quality pollutants of concern. For example, a silt fence is primarily used for sediment control rather than erosion control. To ensure that sediment does not mobilize on site, additional erosion control BMPs are required, such as geotextiles and mats.

Construction sites are required to plan for the dry season, and implement seasonally appropriate BMPs in the event of dry-season rain events. The wet season is October 1 through April 30, and the dry season is May 1 through September 30. BMPs are required for active and inactive areas of construction sites and activities year-round.

All implemented BMPs must be properly installed and maintained until they are removed. The BMPs selected for each site or activity must be appropriate to the types of work proposed, including the different phases of construction. BMPs should also comply with other applicable SWRCB or RWQCB NPDES permits, such as the SWRCB CGP[3] and RWQCB dewatering permits. Work in or adjacent to drainage channels or other water bodies may also be subject to additional permits from resource agencies. The Stormwater Standards Manual (Appendix C) provides a list of several different permits or approvals that other agencies may require.

The City may require additional BMPs to be implemented at construction sites or during activities as necessary to prevent pollutant discharges. This may include active or passive treatment systems, as described in the Stormwater Standards Manual (Appendix C).

5.2 Project Approval Process

Construction sites and activities with the potential to generate sediment, nutrients, bacteria, trash, and other pollutants that contribute to the highest priority and priority water quality conditions are associated with private and public projects. Various City departments/divisions issue local permits for private projects or construction activities. Other public agencies that do work or develop projects in the City may also be issued local permits. The City departments/divisions that issue local permits for construction sites include Engineering, Building, Land Development, Traffic, and Public Works. Public projects are reviewed by appropriate City departments and are subject to a review process similar to private project applications. Public projects are also known as CIPs.

All private and public projects that will result in land- or soil-disturbing activities are required to complete a Checklist for New Development and Significant Redevelopment. This checklist is part of the initial permit application, regardless of the department or division that is administering it: Engineering, Public Works, Traffic Engineering, or Planning. In addition, the Building Division requires a stormwater pollution prevention checklist to be completed and signed by the contractor or project owner to ensure required BMPs are identified and implemented at a building permitted site.

[3] SWRCB Order 2009-0009-DWQ, as amended by Order 2010-0014-DWQ and Order 2012-0006-DWQ

The City's requirements for projects that are and are not subject to the CGP are described below. Both public and private projects are subject to essentially the same City review and approval processes.

5.2.1 Local Project Review Requirements

The Land Development Department reviews the Construction BMP Plan submittals for consistency with the BMP requirements listed in the Stormwater Standards Manual (Appendix C). The Construction BMP Plan is included in the grading plan submittal to Engineering as a separate sheet. A grading or building permit is not issued until the entire grading plan submittal, including the Construction BMP Plan, is approved and site inspections have been conducted.

5.2.2 State Project Review Requirements

The City verifies that public and private projects subject to the CGP have coverage under it. The Waste Discharge Identification (WDID) number is noted on the front sheet of the grading plan set. If a development site is one acre or greater, a project, or the phase of a project, is required to obtain coverage under the CGP. In conformance with the CGP, the City requires projects or phases of projects to complete a Stormwater Pollution Prevention Plan (SWPPP), which includes a Construction BMP Plan. As part of its local permit requirements for CGP projects, the City reviews Construction BMP Plans for both private and public projects. A Construction BMP Plan is required for all projects seeking a grading permit through the Land Development Department. The City may require Construction BMP Plans be submitted for appropriate construction phases, if deemed necessary.

Although the City does not review and approve SWPPPs for private projects, it does for public projects; because, in most cases, the CGP designates the City as the legally responsible party.

5.3 Construction Site Inventory

For all public and private projects that are issued a local permit in its jurisdiction, the City maintains a watershed-based inventory. The inventory includes details on each construction site, including project name, location, and construction site priority. Privately owned development projects are added to the City's construction inventory when permits are approved. Public projects are added to the construction inventory when a project begins construction. Other public agency projects, such as state agencies, transit districts, school districts, or service providers, will be identified on the inventory where appropriate, or when issued a local permit. Completed projects are removed from the inventory upon issuance of a certificate of occupancy, or other completion documentation. The City's construction inventory is typically updated on a monthly basis.

The City uses an electronic database to maintain its inventory, which includes the following components required by the MS4 Permit:

- Contact information for each site (e.g., name, address, phone, and email for the owner, developer, and contractor).
- Basic site information, including location (address and HSA), WDID number (if applicable), size of the site, and approximate area of disturbance.
- All construction sites and activities in the City are designated a high threat to water quality;
- Project start and completion dates;
- Required inspection frequency based on season and construction phase;
- Date of permit issuance;
- Date Construction BMP Plan is accepted; and
- Ongoing enforcement actions administered to the site.

5.4 Construction Site BMP Implementation

The City has an established inspection program to evaluate proper BMP implementation at construction sites in the City's jurisdiction. The inspection program is designed to confirm sites reduce the discharge of pollutants in stormwater to the MEP; effectively prohibit non-stormwater discharges; and address the high-priority and priority water quality conditions for both the San Luis Rey and Carlsbad WMAs during the wet and dry seasons.

Pre-construction meetings are typically held with the contractor before work begins. During these meetings, City staff discusses BMP requirements, including how they are applied over the life of the construction project as it progresses from one phase to another. No physical construction occurs until BMPs are in place and an initial BMP inspection is completed. Contractors are also informed that City inspectors have the authority to require implementation of all BMPs the inspector deems necessary to reduce pollutant discharges to the MEP, even if those BMPs are not explicitly documented on the project's Construction BMP Plan.

Once construction starts, Land Development Division inspection staff perform regularly scheduled site inspections to ensure BMPs are implemented consistent with the Construction BMP Plan and the City's BMP requirements during each stage of construction.

5.4.1 Inspection Frequency

Provision E.4 of the MS4 Permit states the City must identify high TTWQ sites on its inventory. TTWQ is then used to determine inspection frequency. As a proactive measure to protect water quality, and because of construction site capacity to discharge bacteria-related pollutants such as trash and sediment, the City classifies all construction sites as a high TTWQ. Accordingly, the City inspects all its inventoried construction sites weekly during the wet season and monthly during the dry season. In addition, the City may enhance its inspection frequency based on construction phase and/or compliance history during the wet and dry seasons.

In addition to more frequent routine inspections, the City also inspects sites prior to rain events. At sites subject to the CGP, City staff also verify that a Rain Event Action Plan (REAP) is present on site, and if the site BMPs are implemented, installed, and maintained to reduce discharges to the City's MS4. Implementing the REAP Team Action Plan helps identify and resolve BMP implementation events prior to rain events.

The City's enhanced construction inspection program is expected to reduce discharges of pollutants associated with sediment and trash, such as bacteria and nutrients. Therefore, the benefits of the City's enhanced program are as follows:

- Reducing sediment and trash discharges may reduce levels of bacteria, nutrients, and other pollutants, which can be transported with sediment and trash.
- Reduced sediment discharges should benefit the Buena Vista hydrologic area, which is impaired for sedimentation.
- Inspecting sites before predicted storms leads to sites with effective BMP implementation during the time when BMP implementation is most critical at a construction site. Most discharges of sediment and trash from construction sites occur when it rains.
- Frequent, regular interaction with site-responsible parties allows City inspectors to ensure appropriate BMPs are in place as construction activities and phases change over time. This helps reduce discharges of bacteria, sediment, trash, and other pollutants from construction sites to the MEP.

Projects issued building permits only will have completed a stormwater pollution prevention checklist during the permit application process. These project sites are less likely to generate pollutants than larger development projects, and therefore have a lower TTWQ. When inspections are conducted, pollution prevention is a principal component of the inspection. These sites are also subject to as-needed stormwater pollution prevention inspections based on review of the checklist and potential for pollutant-generating activities.

5.4.2 Inspection Procedure

Site inspections are performed by the City inspection staff on all inventoried sites. The City inspectors evaluate and confirm compliance with applicable ordinances and permits of required

BMPs for each construction phase. Inspection findings are documented on the City's construction inspection form (Appendix H). At a minimum, inspections include the following components:

- Assessment of the implementation of all required BMPs and any additional BMPs required by the City, whether required through ordinances or permits. This assessment includes evaluating the adequacy and effectiveness of implemented BMPs, including how they are installed and maintained.
- Assessment of whether project proponents are making appropriate adjustments when BMP deficiencies are found as a result of City-conducted inspections.
- Visual observations of actual or potential discharges of sediment and/or construction-related materials from the site.
- Visual observations to evaluate presence of non-stormwater discharges.
- Visual observations of actual or potential illicit connections.
- Verification of coverage under the CGP (WDID number) during initial inspections, when applicable.

When an inspector determines a site is noncompliant, the City follows up with the site until compliance is confirmed. Non-compliant issues are elevated as necessary to obtain compliance, as discussed in Section 5.6, and in the Enforcement Response Plan (Appendix F).

5.4.3 Inspection Tracking

Each inspection form, which includes site photos, is stored electronically. The number of inspections performed at each construction site are tracked in the City's construction project database to ensure all construction sites in the City's inventory are being inspected at the appropriate frequency. At a minimum, inspection records include the following information:

- Site name, location (address and HSA), and WDID number (if applicable).
- Inspection date.
- Approximate amount of rainfall since the last inspection.
- Description of problems observed with BMPs, indication of the need for BMP addition/repair/replacement, any scheduled re-inspection, and date of re-inspection.
- Descriptions of any other specific inspection comments which must, at a minimum, include rationales for longer compliance times beyond 30 calendar days, or prior to the next predicted rain event, whichever is sooner.

- Description of enforcement actions issued in accordance with the City's Enforcement Response Plan.
- Resolution of problems noted and date problems were resolved.

Inspection records and related documentation are made available to RWQCB staff on request.

For projects that are issued building permits only, the stormwater pollution prevention checklist is prescriptive in requirements for pollution prevention BMPs based on permitted activities. Enforcement actions at these sites are tracked as compliance cases.

5.5 Enforcement

The City enforces its construction BMP requirements at all construction sites in its jurisdiction. When violations are observed and documented during a site inspection, the City implements appropriate enforcement measures discussed in the City's Enforcement Response Plan (Appendix F). Enforcement actions are based on the severity of the violation, and can range from written warnings to more severe enforcement such as stop work notices. For example, a stop work order is considered one of the City's escalated enforcement measures. The City does not use verbal warnings as an inspection enforcement measure.

City inspectors typically seek to resolve incidents of observed noncompliance within 72 hours. Additional enforcement actions are taken as necessary to obtain compliance when the required corrections are not made within the initial 72-hour timeline. In cases where the violation cannot be resolved within 30 days, or prior to the next rain event, whichever is sooner; the reason additional time was needed for case resolution is documented and kept in the project's file. The RWQCB will be notified within five calendar days whenever a stop work order or other escalated enforcement action is taken. See the Enforcement Response Plan (Appendix F) for additional details on identification of escalated enforcement actions. When a site is subject to the CGP, City staff may also collaborate with RWQCB staff on enforcement actions.

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6 Existing Development: Industrial and Commercial Facilities

6.1 Introduction

About 16 percent of the land area in the City is classified as industrial or commercial. Figure 6-1 shows the locations of industrial and commercial areas. The City requires industrial and commercial facilities or areas to implement BMPs to reduce discharges of pollutants to the storm drain system. The required BMPs are listed in the City's Stormwater Standards Manual (Appendix C), and have been developed based on the requirements of the current MS4 Permit. The City inventories businesses subject to these requirements and facilitates BMP implementation through education, inspections, and enforcement. The City also incorporates strategies to reduce discharges of highest priority and priority pollutants identified in the Carlsbad and San Luis Rey Watersheds.

6.2 Industrial and Commercial Inventory

6.2.1 Background

A watershed-based inventory of known industrial and commercial businesses and properties (collectively, "facilities") in the City's jurisdiction has been developed and is updated annually. The types of businesses included on the inventory are listed in Section 6.2.3. These business types are believed to have the potential to discharge pollutants into the storm drain system and impact local water quality.

The City's industrial and commercial inspection inventory is property-based. The property-based inventory consists of a parent-child relationship, with a site level (parent) and a business level (child). Each site in the inventory represents a property with commercial or industrial facility(ies).

- A commercial area (or site) is an individual property that has at least one commercial business located on it. Commercial businesses are associated with sites, but individual commercial businesses are not the primary tracking entity used for the inspection inventory.
- Consistent with MS4 Permit requirements, each industrial facility is represented individually for inventory, inspection, and reporting purposes.

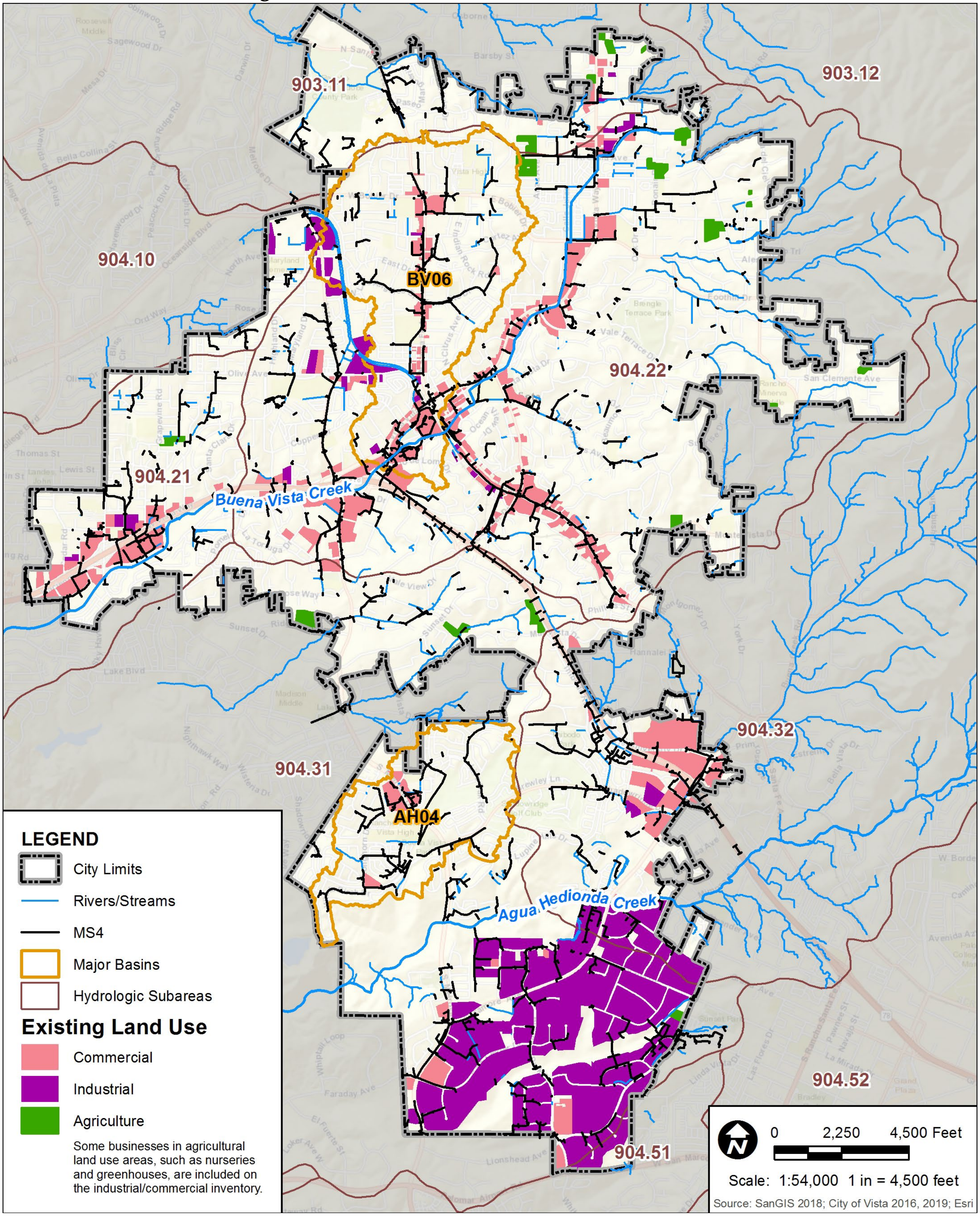
The site level consists of data for each property-based inspection, including property areas such as common space, shared dumpsters, parking lots, and landscape. The business level consists of records for each individual commercial and industrial business within the site.

6.2.2 Data Sources

The City uses business license data, GIS, and *Cityworks* software to regularly maintain and update a watershed-based inventory of industrial and commercial facilities in its jurisdiction. Data are gathered from the following sources to maintain the inventory, which is then integrated with *Cityworks*:

- City business license database (HdL Prime software) and property data
- RWQCB list of businesses with individual NPDES permits
- SWRCB list of facilities covered under the NPDES Industrial General Permit (IGP), Order 2014-0057-DWQ)
- Complaints filed for unregistered businesses

Figure 6-1. Industrial and Commercial Areas



6.2.3 Inventoried Facilities

Per the MS4 Permit, inventory updates are required at least annually. Business data (e.g., business name, activity, owner information) are maintained by HdL Prime business license software and updated weekly to the city's GIS database. Site-specific data (e.g., adjacent to an ESA or potential pollutants generated) is updated when there are updates to identified ESAs or a new 303(d) listing is adopted. New inspection sites, if any, are identified and added to the inventory annually. The inventory consists of the following two facility types:

~~The inventory for Industrial and Commercial properties is updated annually through review of the City's business license data. City staff review the inventoried business Standard Industrial Classification (SIC) and North American Industrial Classification System (NAICS) codes as well as business descriptions, to identify qualifying businesses for the Industrial and Commercial existing development inventory.~~

~~The City maintains a list of codes associated with the types of activities listed below; businesses with those SIC or NAICS codes are included on the inventory.~~

Industrial Facilities

- Facilities subject to the statewide IGP or other individual NPDES permit
- Facilities subject to Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986
- Active landfills
- Hazardous waste treatment, disposal, storage, and recovery facilities

Commercial Facilities

- Automobile repair, maintenance, fueling, or cleaning
- Airplane repair, maintenance, fueling, or cleaning
- Boat repair, maintenance, fueling, or cleaning
- Equipment repair, maintenance, fueling, or cleaning
- Automobile and other vehicle body repair or painting
- Automobile (or other vehicle) parking lots and storage facilities
- Retail or wholesale fueling
- Contractors with significant storage yards
    - Painting and coating
    - Cement-mixing or -cutting
    - Masonry
    - Landscaping

    - Pest control services
    - Other contractors
- Eating or drinking establishments, including food markets
- Botanical or zoological gardens and exhibits
- Nurseries and greenhouses
- Golf courses, parks, and other recreational areas/facilities
- Cemeteries
- Marinas
- Building material retailers and storage
- Animal facilities
- Portable sanitary services

Also inventoried are commercial or industrial facilities that do not fall into the categories above, but may contribute a significant pollutant load to the storm drain.

Mobile businesses are identified through the City's business license application process. Oversight and inspection of mobile businesses with water use is discussed in Section 6.4.3.3, Mobile Business Oversight.

~~Mobile businesses are identified through the City's business license application process, and included with the inventory of stationary industrial and commercial facilities described above. Unlicensed mobile businesses are identified and added to the inventory based on incidents reported to the Stormwater Hotline and violations directly observed by City or contract staff. Examples of mobile businesses include the following:~~

- ~~Mobile vehicle washing~~
- ~~Mobile carpet, drape or furniture cleaning~~
- ~~Pool and fountain cleaning~~
- ~~Power washing services~~

6.2.4 Inventory Data Management

The City maintains its industrial and commercial facility inventory through the use of a GIS-based data management system in accordance with MS4 Permit Section E.5.a. At a minimum, the inventory includes, where applicable, the following information for industrial and commercial facilities in the City's jurisdiction:

1. Name and location (HSA and address).
2. Classification as industrial or commercial.
3. Status of ~~facility or area~~ site or business as active or inactive.
4. ~~Identification of whether a business is a mobile business.~~

~~5.~~4. SIC and/or NAICS code(s).

~~6.~~5. IGP Notice of Intent (NOI) and/or WDID number.

~~7.~~6. Identification of pollutants generated and potentially generated by the facility or area.

~~8.~~7. Whether the ~~facility or area~~site is adjacent to an ESA. "Adjacent to" is defined as being within 200 feet of an ESA. This is in accordance with past procedure and with the most recent definition provided by the RWQCB, which is found in Order R9-2007-0001. A map of ESAs in included in Appendix I.

~~9.~~8. Whether the ~~facility or area~~site is tributary to and within the same HSA as a water body segment listed as impaired on the CWA §303(d) list, and generates pollutants for which the water body segment is impaired. This process is described in Section 6.2.5, below.

The City maintains its inventory in a GIS-based database, and therefore has the ability to map the locations of inventoried sites and businesses~~industrial and commercial facilities~~, watershed boundaries, and water bodies, as required by the MS4 Permit.

6.2.5 Inventory Prioritization for Inspection

Section E.5.c.(1)(a) of the MS4 Permit requires that inspections are performed at an appropriate frequency to confirm that BMPs are implemented to reduce the discharge of pollutants to the storm drain system to the MEP, and are effective in reducing non-stormwater discharges. Each year, the City strives to inspect more than 20% of the commercial/industrial inventory, and ensures the full inventory is inspected within each 5-year permit cycle.

~~The i~~Inspection frequencies are required to consider the potential for a facility or area to discharge non-stormwater and pollutants, and reflect the priorities set forth in the WQIPs. Inspection prioritization is based on the following:

~~1) Sites covered under Industrial NPDES Permits (e.g., California State Industrial General Permit).~~

~~2) Sites containing significant quantities of hazardous materials or other pollutants that pose a threat to water quality if spilled or mismanaged.~~

~~3) Sites with a history of non-compliance or previous enforcement actions.~~

~~4) Professional judgement.~~

~~Each year, the City strives to inspect more than 20% of the commercial/industrial inventory, and ensures the full inventory is inspected within each 5-year permit cycle.~~

Industrial NPDES coverage

Facilities with coverage under the California General Industrial Storm Water Permit (Order 2014-0057-DWQ; IGP) are considered the highest priority, as they have the potential to pose a threat to water quality based on facility activities or conditions. ~~Criteria used to assess their relative priority within the industrial facility inventory are described below.~~

Pollutant threat to water quality

Facilities that do not require coverage under the IGP but maintain significant quantities of onsite hazardous materials or other pollutants that could pose a threat to water quality if spilled or mismanaged are considered high priority.

History of non-compliance

Facilities that are known to have a history of poor compliance with the City's minimum BMP requirements are also classified as high priority. Compliance is based on the results of a facility's most recent inspection. Poor compliance means one or more significant BMP deficiencies or illegal discharges were identified during the inspection, and required the City to take follow-up action to resolve them. A "standard" priority status may eventually be assigned to facilities with a poor compliance record, based on future inspections that document satisfactory and consistent compliance.

Professional Judgement

City staff also have the authority to classify other businesses that may contribute significant pollutant loads or non-stormwater discharges to the City's storm drain system as high priority. The remaining businesses on the inventory are classified as standard priority.

Other inventory facilities

Remaining facilities are inspected in compliance with MS4 Permit requirements such that more than 20% of the commercial/industrial inventory is inspected annually and the entire inventory is inspected within each 5-year permit cycle.

6.3 Best Management Practice Requirements

The City requires commercial and industrial businesses to implement and maintain BMPs to prevent pollutants from entering its storm drain system. The City's ~~has updated its~~ minimum BMPs applicable to industrial and commercial facilities ~~, which~~ are listed in the ~~2016~~ Stormwater Standards Manual (Appendix C). In addition, the City's Stormwater Ordinance gives authorized enforcement staff the authority to require additional BMPs beyond the minimum BMPs, where necessary, to reduce discharges of pollutants to the MEP. Businesses can also be required to develop and implement site-specific BMP or pollution prevention plans.

Consistent with WQIP strategies to reduce discharges of priority water quality pollutants (see Appendix A), irrigation runoff is prohibited because it can transport priority water quality pollutants. Minimum BMP requirements also include sediment and erosion controls to reduce the potential for mobilization of soil particles, and the associated pollutants bound to the soil particulates.

6.4 Best Management Practice Implementation

Property-based inspections are on-site inspections with a focus on property areas where the greatest threat to water quality occurs, including areas with illicit discharges, exposure of pollutants to rainfall, and pathways to storm drain systems. Inspected areas and activities include outdoor business and non-business facility areas and activities, such as trash areas, landscaped areas, parking lots, building structures, loading areas, storage areas, private storm drain infrastructure, etc. Property-based inspections generally do not involve entry and engagement with site personnel unless business-specific issues are identified. However, because industrial facilities are inspected individually on-site, they are often conducted while accompanied by business personnel.

The City inspects inventoried industrial and commercial facilities to require compliance with the established minimum BMPs and the Stormwater Ordinance. The City also provides education and outreach to businesses to make them aware of and encourage compliance with the requirements, as described in Section 10.

6.4.1 Inspection Frequency

The inspection program is designed to meet the following MS4 Permit objectives:

- Inspect all inventoried stationary industrial and commercial facilities at least once within a 5-year period. ~~These inspections may be either onsite inspections or property-based inspections.~~
- Annually complete a number of onsite inspections equal to 20 percent of the total number of inventoried stationary facilities. If multiple onsite inspections are completed at a facility in a given year, including follow-up inspections or inspections in response to a hotline call, those inspections may be counted toward the 20 percent requirement. ~~Property-based inspections, as defined in Section 6.4.3.2, are not counted toward the 20 percent requirement.~~

It is expected that high-priority facilities will be inspected more than once within the MS4 Permit term and may be inspected annually based on prioritization in Section 6.2.5.

Focus areas, identified through strategies in either the San Luis Rey River WQIP or Carlsbad WQIP, may have increased inspection frequency or modified patrol procedures. These inspections may be used to identify priority pollutant generating activities and conduct targeted education and outreach efforts. Current focus areas include AH-04 (Agua Hedionda hydrologic area) and BV-06 (Buena Vista Creek hydrologic area), which are illustrated in Figure 6-1. As discussed in strategies in the Carlsbad WQIP, enhanced patrol-based inspections occur in these focus areas twice annually~~; generally, they are inspected annually. The City also completes~~

~~regular property-based or patrolling-style inspections in Carlsbad WQIP focus areas AH-4 and BV-6, as described in the WQIP. Figure 6-1 shows the locations of these two focus areas~~.

Based on inspection findings, the City implements all follow-up actions (i.e., education and outreach, follow-up inspections, enforcement) necessary to impose and confirm a facility's compliance with the City's minimum BMP requirements. Enforcement actions are discussed in Section 6.5, and in the City's Enforcement Response Plan (Appendix F).

6.4.2 Inspection Data Management

All inspection data for inventoried industrial and commercial facilities are tracked in *Cityworks*, a GIS-based data management program. Inspection records include the following, at a minimum:

- Name and location of facility or area (address and HSA) consistent with the inventory name and location.
- Inspection and re-inspection date(s).
- Inspection method (e.g., property-based onsite, individual business onsite) ~~(i.e., onsite or property-based)~~.
- Observations and findings from the inspection(s).

~~For onsite inspections, the records also include the following:~~

- Description of BMP deficiencies~~any problems~~ or violations found during the inspection(s).
- Description of enforcement actions issued in accordance with the Enforcement Response Plan (Appendix F).
- The date BMP deficiencies or violations were resolved.

6.4.3 Inspection Methods Overview

Inspections of industrial and commercial facilities are ~~typically~~ conducted by designated stormwater compliance inspection staff or contractors. Note that although contract staff may be used to complete inspections, only City staff issue enforcement actions (e.g., Notices of Violation and citations). ~~Inspections consist of either an onsite or a property-based inspection. Data entry forms are available in *Cityworks* so that inspection data, such as results, inspector comments, and photos, can be input to the database consistently. *Cityworks* is also compatible with electronic tablets to accommodate in-field data entry by the inspector~~.

An inspection is typically initiated as a result of one of the following:

- To meet the inspection frequency requirements of the MS4 Permit, as described in Section 6.4.1.
- To investigate a potential illegal discharge as reported through the Stormwater Hotline, or based on MS4 outfall monitoring.
- As a follow-up to a previous inspection during which a violation was noted.

Previous facility inspection results are archived, and available for research prior to conducting new inspections. *Cityworks* has been implemented since 2012 for such purposes; and historic inspection data are readily available to the inspector through the use of electronic tablets in the field, and desktop computers in the office.

6.4.3.1 Property-based Inspections

The City implements a property-based approach to conducting industrial and commercial facility inspections. These inspections treat properties (i.e., sites) as the primary entity for inventory and inspection purposes. Discrete businesses on the properties are considered sub-entities associated with the site and have records of their own. However, individual commercial business inspection records are not populated in *Cityworks* unless there are identified BMP deficiencies specific to a business. Industrial facilities are inspected as individual businesses and not as part of *sites*, and typically on-site with business personnel (see Section 6.4.3.2). Property-based inspections include the following components:

- Inspecting a selected property, evaluating multiple industrial or commercial facilities, rather than visiting each facility/business individually.
- Conducting a visual inspection for the presence of non-stormwater discharges, actual or potential discharges of pollutants, and actual or potential illegal connections.
- Assessing implementation of the minimum BMPs, including preventing non-stormwater discharges, as required by the Stormwater Ordinance.
- Determining whether the description of the facility or area in the inventory has changed, and making corresponding updates if necessary (e.g., business activities or IGP applicability).

The focus for property-based inspections is inspecting for compliance with minimum BMPs, including discharge points of a facility or property for evidence of non-stormwater discharges. Identified non-stormwater discharges are further investigated to determine if they are illegal discharges. If an inspector determines more extensive investigation is needed, an individual business inspection may be conducted. Whenever an illegal discharge is identified, the responsible party is contacted, and the illegal discharge is required to be eliminated.

~~6.4.3.1~~6.4.3.2 *Individual Business Inspections*~~*Onsite Inspections*~~

Individual business ~~O~~onsite inspections include the following components:

- Conducting a visual inspection for the presence of non-stormwater discharges (including over-irrigation), actual or potential discharges of pollutants, and actual or potential illegal connections.
- Determining whether the description of the facility or area in the inventory has changed, and making corresponding updates if necessary.
- Assessing the implementation of the minimum BMPs, including preventing non-stormwater discharges, as required by the Stormwater Ordinance.
- Typically conducted at identified industrial facilities that possess an IGP, or verification of~~Verifying~~ coverage under the IGP, when applicable.
- Enacted when there is a business-specific issue identified during the property-based onsite inspection.

Often, the inspector obtains information from the facility representative or other responsible individual while on site. If the information requested is not available for verification at the time of the inspection, the inspector may verify the information via telephone or email after the inspection. Areas are assessed where pollutant sources and pollutant-generating activities are exposed to direct precipitation, stormwater run-on, or non-stormwater discharges. Inspectors evaluate the effectiveness of the facility's BMPS to determine if they comply with the City's requirements. Inspectors also look for evidence of illegal discharges, such as ongoing leaks or recent spills, or discharges/connections not authorized under an NPDES permit.

After the inspection, the facility representative and/or the responsible party is emailed an inspection summary for their records. If an email address is not available, a hardcopy inspection summary report is mailed to the facility.

~~6.4.3.2 *Property-based Inspections*~~

~~Property-based inspections, referred to as "drive by inspections" in the MS4 Permit, include the following components:~~

- ~~Driving through a selected property that may evaluate multiple industrial or commercial facilities, rather than visiting each facility individually.~~
- ~~Conducting a visual inspection for the presence of non-stormwater discharges, actual or potential discharges of pollutants, and actual or potential illegal connections.~~
- ~~Determining whether the description of the facility or area in the inventory has changed, and making corresponding updates if necessary.~~

~~Property-based inspections are generally more time-efficient than onsite inspections. Their use can allow the City to evaluate a large area in a comparatively short amount of time. They can also be used at lower priority businesses to satisfy the MS4 Permit requirement that all businesses be inspected at least once every 5 years.~~

~~The main focus for property-based inspections is inspecting the discharge points of a facility or property for evidence of non-stormwater discharges. Identified non-stormwater discharges are further investigated to determine if they are illegal discharges. If an inspector determines more extensive investigation is needed, an onsite inspection may be completed. Whenever an illegal discharge is identified, the responsible party is contacted, and the illegal discharge is required to be eliminated.~~

6.4.3.3 Mobile Business Oversight

Mobile businesses that use water have elevated potential to generate prohibited non-stormwater discharges. Examples of these businesses include the following:

- Mobile vehicle washing
- Mobile carpet, drape, or furniture cleaning
- Pool and fountain cleaning
- Power washing services
- Pet bathing services

When applying for a business license with the city, these types of businesses are required to complete a "Mobile Water Use and Pollution Prevention Acknowledgement". The acknowledgement is reviewed with city staff. Because mobile water use businesses are not included in the inventory of stationary facilities to be inspected, mobile business equipment is inspected at time of license application. Education materials are provided regarding stormwater pollution prevention and prohibited discharges. Unlicensed mobile water use businesses are typically identified by city staff through field inspections or incoming complaints. Mobile water use businesses are required to obtain a license, adhere to BMPs consistent with the Stormwater Ordinance. ~~Mobile businesses are subject to the same prohibitions and enforcement mechanisms as stationary industrial and commercial facilities. Through business licensing, the City is able to identify "mobile water users" such as mobile detailers, power washers, window cleaners, or similar businesses that use water in their regular business activities. These businesses' activities have the potential to discharge pollutants to the storm drain system. Prior to receiving an approved business license, the business owner(s) or their representative(s) meet with City staff to discuss planned business activities, discharge prohibitions, spill prevention, and BMP requirements. Mobile water user equipment and BMPs are also subject to inspection~~

~~by City staff. Mobile water users receive their business license only after completing this process.~~

6.5 Enforcement

Through legal authority in the Stormwater Ordinance, VMC Chapter 13.18, and procedures outlined in the Enforcement Response Plan (Appendix F), the City has the ability to issue enforcement actions for industrial and commercial facilities that are out of compliance with the City's stormwater requirements. If BMP deficiencies or other violations of Chapter 13.18 are observed during an inspection, industrial and commercial facilities are typically provided the opportunity to correct BMP deficiencies or violations prior to ~~initiating escalated~~ escalating enforcement~~ action~~, such as issuing a Notice of Violation or an administrative citation. The Enforcement Response Plan (Appendix F) provides more details about the City's enforcement tools and process.

Consistent with MS4 Permit requirements, corrective actions for violations observed at industrial and commercial facilities are intended to be resolved within 30 calendar days from the date of the violation, or prior to the next rain event, whichever is sooner. *Cityworks* is used to track each step of the inspection and enforcement process, including routine and follow-up inspections, inspector notes, photos of BMP deficiencies and corrections, and other related records. *Cityworks* is also used to document the rationale when violations are not corrected within 30 days, as required by the MS4 Permit.

6.5.1 Identification of Industrial Non-filers

The RWQCB will be notified whenever an inspector finds a facility that is potentially subject to the IGP, but ~~has not filed the~~ does not appear to have appropriate documentation with the SWRCB or information in the Storm Water Multiple Application and Report Tracking System (SMARTS). Notification to the RWQCB will be given within 5 calendar days of the inspector's being aware.

Such "non-filers" may be identified based on comparing the City's list of industrial facilities, as identified by SIC codes listed in the IGP, with SMARTS ~~the facilities listed on the State's Storm Water Multiple Application and Report Tracking System (SMARTS) website~~ (https://smarts.waterboards.ca.gov). ~~as having filed for coverage or exemption.~~ Non-filers also may be identified in the field based on inspection results (e.g., if a facility that had filed for a no exposure exemption is found to have significant BMP implementation violations). Written notification will be provided by email to Nonfilers_R9@waterboards.ca.gov.

Table 6-1. Potential Pollutants at Industrial and Commercial Facilities[1]

Category	Heavy Metals[2]	Organics	Oil & Grease[2]	Sediment	Pesticides	Nutrients	Oxygen-- Demanding Substances	Bacteria/ Viruses	Trash
Aggregates	PO	UL	UL	L	UL	UL	PO	UL	UL
Air Transit	PO	PO	PO	PO	UL	UL	UL	UL	UL
Airfields	L	PO	L	PO	UL	UL	PO	UL	PO
Airplane Repair	L	L	L	PO	UL	UL	PO	UL	PO
Animal Facilities	UL	UL	UL	PO	UL	L	L	L	PO
Auto Paint/Body	L	L	PO	PO	UL	UL	PO	UL	PO
Auto Repair	L	L	L	PO	UL	UL	PO	UL	PO
Boat Repair	L	L	L	PO	UL	UL	PO	UL	PO
Botanical/Zoological Exhibits	UL	PO	UL	PO	L	L	PO	L	PO
Building Materials	PO	UL	PO	L	PO	PO	PO	UL	L
Carpet/Furniture Cleaning	UL	PO	UL	PO	UL	UL	PO	UL	PO
Cement-Mixing/Cutting	UL	UL	PO	L	UL	UL	PO	UL	PO
Cemeteries	UL	UL	UL	PO	L	L	PO	PO	PO
Eating/Drinking Establishments	UL	UL	L	PO	UL	UL	L	L	L
Equipment Repair	L	L	L	PO	UL	UL	PO	UL	PO
Fueling	L	L	L	PO	UL	UL	PO	UL	PO
Golf Courses/Parks	UL	UL	UL	L	L	L	PO	PO	PO
Ground Transportation	L	PO	L	PO	UL	UL	PO	UL	PO
Landfills	PO	PO	PO	L	PO	PO	L	L	L
Landscaping	UL	PO	UL	PO	L	L	PO	UL	PO
Manufacturing, Biotech/Pharmaceutical	UL	PO	UL	PO	UL	UL	PO	UL	PO
Manufacturing, Chemicals	UL	PO	PO	PO	PO	UL	PO	UL	PO
Manufacturing, Concrete	PO	UL	PO	L	UL	UL	PO	UL	PO
Manufacturing, Electronics	PO	UL	PO	PO	UL	UL	PO	UL	PO
Manufacturing, Equipment	PO	UL	PO	PO	UL	UL	PO	UL	PO
Manufacturing, Fabric/Clothes	UL	UL	UL	PO	UL	UL	PO	PO	PO

Table 6-1. Potential Pollutants at Industrial and Commercial Facilities (Continued) [1]

Category	Heavy Metals[2]	Organics	Oil & Grease[2]	Sediment	Pesticides	Nutrients	Oxygen--Demanding Substances	Bacteria/ Viruses	Trash
Manufacturing, Fabricated Metal	L	UL	PO	PO	UL	UL	PO	UL	PO
Manufacturing, Food/Drink	UL	UL	PO	PO	UL	UL	PO	L	PO
Manufacturing, Misc.	PO	PO	PO	PO	UL	UL	PO	UL	PO
Manufacturing, Paper	UL	UL	UL	PO	UL	UL	PO	PO	PO
Manufacturing, Plastic/Rubber	UL	PO	PO	PO	UL	UL	PO	UL	PO
Manufacturing, Primary Metal	L	UL	PO	PO	UL	UL	PO	UL	PO
Manufacturing, Stone/Glass	UL	UL	UL	L	UL	UL	PO	UL	PO
Manufacturing, Structural Steel	L	UL	UL	PO	UL	UL	PO	UL	PO
Manufacturing, Wood/Furniture	UL	UL	UL	PO	UL	UL	PO	PO	PO
Marinas	L	PO	L	PO	UL	UL	PO	PO	PO
Masonry	UL	UL	PO	L	UL	UL	PO	UL	PO
Nurseries/Greenhouses	UL	PO	UL	L	L	L	PO	PO	PO
Other Contractor	PO	PO	PO	PO	UL	UL	PO	UL	PO
Other Recreation	UL	UL	UL	UL	UL	UL	PO	PO	L
Painting/Coating	PO	PO	PO	PO	UL	UL	PO	UL	PO
Pest Control	PO	PO	UL	PO	L	UL	PO	UL	PO
Pool/Fountain Cleaning	UL	UL	UL	PO	UL	UL	UL	UL	UL
Portable Sanitation	UL	PO	PO	PO	UL	L	PO	L	PO
Publicly Owned Treatment Works	PO	UL	UL	PO	UL	PO	L	UL	PO
Power Generation	PO	PO	PO	L	UL	UL	UL	UL	UL
Power Washing	PO	PO	PO	PO	UL	UL	UL	UL	UL
Printing	PO	PO	UL	PO	UL	UL	PO	PO	PO
Recycling	L	PO	PO	L	PO	PO	PO	UL	PO
Sewage Sludge	PO	PO	PO	PO	PO	L	L	L	PO
Vehicle Parking/Storage	L	L	L	L	UL	UL	PO	UL	PO
Vehicle Washing	PO	L	PO	PO	UL	UL	PO	UL	PO

Table 6-1. Potential Pollutants at Industrial and Commercial Facilities (Continued) [1]

Category	Heavy Metals[2]	Organics	Oil & Grease[2]	Sediment	Pesticides	Nutrients	Oxygen--Demanding Substances	Bacteria/ Viruses	Trash
Vehicle/Equipment Rental	L	UL	L	PO	UL	UL	PO	UL	PO
Waste Management	PO	PO	PO	L	UL	PO	L	L	L
Water Transit	PO	L	PO	PO	UL	PO	PO	PO	PO
Wholesale Food	UL	UL	PO	PO	UL	UL	L	PO	PO
Wholesale/Storage/Warehousing	UL	UL	PO	PO	UL	UL	PO	PO	PO

<u>Notes:</u>

L – Likely, PO – Possible, UL – Unlikely

1. This table is based on tables in the Co-permittees' Baseline Long-Term Effectiveness Assessment (County of San Diego, 2011) and on the JRMP implementation field experience.
2. Discharge of heavy metals and oil and grease is possible if the facility has onsite parking.

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7 Existing Development: Municipal Facilities

7.1 Introduction

The City's municipal facilities include public parks, administration buildings (e.g., Civic Center, corporate yard), fire stations, sewage pump stations, community facilities (e.g., senior center, Moonlight Outdoor Amphitheater, Wave Recreation Park, Avo Theater), and a number of other City-operated properties. This section discusses stormwater BMPs and programs associated with these facilities. An inventory of the facilities is included in Appendix J. The City also conducts activities and operations such as power-washing, street and sidewalk repair, painting, storm drain system maintenance, and graffiti cleaning. Stormwater BMPs and programs associated with these activities are described in Section 8 (Municipal Infrastructure).

7.2 Municipal Inventory

The City maintains and regularly updates a watershed (GIS-based) inventory of its municipal facilities that have the potential to contribute pollutants and non-stormwater discharges to the City's storm drain system. Managing the inventory in GIS allows the City to map inventoried municipal facilities as needed. The inventory includes the following information, where applicable:

1. Name and location: HSA and address.
2. Status of facility or area as active or inactive.
3. SIC and/or NAICS codes.
4. IGP NOI and/or WDID number.
5. Identification of pollutants generated and potentially generated by the facility or area.
6. Whether the facility or area is adjacent to, or within 200 feet of, any of the following ESAs in the City: Agua Hedionda Creek, Buena Creek, Buena Vista Creek, and Loma Alta Creek. A map of these ESAs can be found in Appendix I.
7. Whether the facility or area is tributary to and in the same HSA as a water body segment listed as impaired on the CWA §303(d) list, and generates pollutants for which the water body segment is impaired.

Inventoried municipal facilities are provided in Appendix J. The inventory is reviewed annually and updated as needed. Further information regarding stationary municipal facilities is included in the following sections.

7.2.1 Stationary Facilities

Parks and Recreational Facilities

The City's Parks Maintenance Division and Recreation and Community Services Department maintains a number of parks, landscaped areas, and other recreational areas for use by the general public. Recreational facilities are defined as facilities that support outdoor activities such as sports fields and outdoor pools. City staff, or contractors under staff supervision, are responsible for park maintenance activities such as landscaping (including proper irrigation practices), waste removal and control, and maintenance of any other facilities on the grounds (such as restrooms or concessions). Post-construction BMPs at City parks are typically maintained by Public Works staff.

Public Works Corporate Yard

The Public Works Corporate Yard consists of equipment and materials to support maintenance activities, including streets, wastewater, stormwater, facilities, and fleet maintenance. A second auxiliary yard, the Buena Yard, is used primarily for material storage (e.g., pipe, fencing, and green waste), as well as decanting of street-sweeping material. Most impervious area runoff at the Buena Yard is controlled by a valve that directs flow to the sanitary sewer until measurable rain is detected, at which time the valve directs flow to the storm drain system.

Wastewater Facilities

The City provides wastewater collection and transmission for its residents and facilities. The City's collection system includes a network of approximately 280 miles of pipeline and approximately 7,000 manholes. There are two pump stations and several metering stations in the City, and two outside city limits (in Carlsbad). The City's Public Works Wastewater Division is responsible for cleaning and maintaining the system on a regular basis. The sewage from a small, northwestern portion of the City is conveyed to Oceanside; however, most of the City's waste is conveyed to the Encina Water Pollution Control Facility in Carlsbad. Additional information about maintenance of the sanitary sewer system is provided in Section 8 (Municipal Infrastructure).

Fire Station Facilities

There are six fire stations within the City's limits. Each station possesses unique characteristics, facilities, and intensity of use that determine if they are to be included with annual inspections. Most fire-fighting training is completed at the City of San Marcos' fire training facility in the City of San Marcos. The City of San Marcos implements BMPs for training activities at that location. Limited fire-related training (e.g., structure entry) occasionally takes place at the City of Vista's Buena Yard, and BMPs are installed as necessary for the training. Fire-fighting vehicle maintenance is performed at the City's Public Works Corporate Yard.

Other Stationary Facilities

The City maintains a number of public buildings, such as administrative buildings, community centers, and leased facilities and/or properties that do not fall into any of the aforementioned categories. These facilities are evaluated for their potential to discharge stormwater and non-stormwater (e.g., irrigation runoff) pollutants, and are inspected at a frequency determined by the facility's priority. Minimum BMPs are applicable to all facilities in the City to prevent and reduce stormwater pollution. These BMPs are implemented throughout the year at all facilities regardless of whether the facility is due for an inspection.

7.2.2 Special Events

The City receives requests to allow special events to occur on City property, streets, and facilities, particularly in the historic downtown area. Examples of special events include food festivals, fairs, parades, and car shows. The City requires organizers to apply for Special Events Permits, which allow City staff from multiple departments (including stormwater staff) to review proposed activities and identify any potential concerns. Depending on the type and size of event, the City may require pre-event meetings with event coordinators to discuss concerns identified by staff.

Potential pollutants associated with special events may include:

- Trash and debris
- Bacteria and oxygen-demanding substances from food preparation and consumption
- Oil and grease from vehicles and/or equipment
- Chemicals and bacteria from portable restrooms

7.2.3 Inventory Prioritization

The annual facility prioritization and inspection process is undertaken to confirm that BMPs are implemented to reduce the discharge of pollutants to the storm drain system to the MEP, and are effective in reducing non-stormwater discharges to the storm drain system. The inspection frequencies are required to consider the potential for a facility or area to discharge polluted non-stormwater, and should reflect the priorities set forth in the San Luis Rey and Carlsbad WQIPs. To ensure municipal facilities are inspected at an appropriate frequency in accordance with the MS4 Permit, the City prioritizes municipal facilities. The specific frequencies at which facilities receive inspections are discussed in Section 7.4.1. Prioritizing municipal facilities includes the criteria discussed below.

Highest-Priority Water Quality Conditions. Regardless of pollution potential, location, and compliance history, 100 percent of the City's municipal facilities are inspected annually.

7.3 Best Management Practice Requirements

7.3.1 Stationary Facilities

The implementation, operation, and maintenance of BMPs at municipal facilities are requirements of the City to prevent pollutants from entering the storm drain system. The City has designated a list of minimum BMP requirements for all municipal facilities and activities; the BMPs are identified in the City's 2016 Stormwater Standards Manual (Appendix C).

If a facility is believed to be a significant source of other pollutants of concern and the minimum BMPs are not adequate, the City may require additional structural or non-structural BMPs so that discharges of pollutants of concern are reduced to the MEP. The City may also elect to prepare a written BMP plan for the facility.

In addition to the minimum BMPs described in the Stormwater Standards Manual (Appendix C), the City has developed programs to identify, prioritize, and implement potential projects to retrofit areas of existing development and to rehabilitate streams, channels, and habitat. The retrofit rehabilitation guidance document provided in Appendix B of this document describes these two programs in further detail.

7.3.2 Special Events

Special Event Permits are required for events that take place on City property. Permit applications are available to the public on the City's website, and are to be submitted for review prior to the planned event. Event organizers complete a permit application and then are subject to meeting with an appointed committee consisting of staff from multiple City departments. Outside agencies, such as the San Diego County Sheriff's Department and North County Transit District, also may participate in these meetings. Through the permitting process, the City confirms that event hosts/organizers are knowledgeable of the City's minimum BMP requirements and that appropriate BMPs will be implemented.

Special events are required to implement the applicable minimum BMPs provided in the Stormwater Standards Manual (Appendix C). The City includes a "Stormwater Protection" section in the special event application to identify requirements that may apply to an event. The application states that event staff are required to be trained on implementing BMPs (e.g., spill prevention). Installation of inlet protection, providing adequate waste management, and having a spill kit are some of the most frequently implemented BMPs for special events.

The City conducts regular inspections of its inventoried municipal facilities to ensure compliance with the established minimum BMPs and applicable local ordinances and permits, and to reduce the discharge of pollutants in stormwater.

7.3.3 Inspection Frequency

7.3.3.1 Stationary Facility Inspections

Stationary municipal facility inspections are conducted annually at selected facilities, and consider the criterion discussed in Section 7.2.3. At least 20 percent of the inventory are inspected annually. Some multi-function facilities, such as the Public Works Corporate Yard, or various high-use parking lots or parks, are anticipated to remain indefinitely on the annual inspection schedule. Other facilities, such as low-use or low-pollution risk facilities (e.g., some recreational facilities and community services sites), are inspected no less than once during the 5-year permit cycle.

7.3.3.2 Special Event Inspections

Coordinators of special events are informed of their responsibility to implement the BMPs, and of the penalties for failing to meet their commitments. Public Works staff are often on duty during a special event and are available as a resource to event staff. Inspections may also be conducted before, during, or after a special event, at the discretion of Stormwater Division staff, and considering event activities. Examples of events more likely to be inspected include new events with coordinators that have not previously organized events in the City, or events expected to draw an especially large number of people. Any violations of the City's requirements are addressed through the enforcement process, as described in Section 7.5.

7.3.4 Inspection Procedures

Inspections of facilities include, at a minimum, visual inspections for the presence of non-stormwater discharges, actual or potential discharges of pollutants, actual or potential illicit connections, and verification that the description of the facility or area in the inventory has not changed. Onsite inspections include, at a minimum:

- Determining whether description of the facility or area in the inventory has changed, and making corresponding updates if necessary.
- Assessment of compliance with applicable local ordinances (VMC Chapter 13.18) and permits related to non-stormwater and stormwater discharges and runoff. This includes the following:
    - Conducting a visual inspection for the presence of non-stormwater discharges (e.g., irrigation runoff), actual or potential discharges of pollutants, and actual or potential illegal connections.
    - Assessing the implementation of the City's minimum BMPs, and any other required BMPs identified in the Stormwater Standards Manual (Appendix C).

- Verification of coverage under the State IGP,[4] if the facility's IGP subjectivity has not already been evaluated. To date, no City municipal facilities have been identified as subject to the IGP. If new facilities are added to the inventory in the future, stormwater staff will evaluate them to determine if they may require coverage under the IGP.

If any violations or concerns are found as a result of the inspection, inspectors initiate appropriate actions in accordance with the Enforcement Response Plan (Appendix F). As with results from any existing facility inspection, municipal facility operators with noted BMP deficiencies are typically provided an opportunity to implement timely corrective actions prior to consideration of escalated enforcement action.

7.3.5 Inspection Content

Inspections of stationary municipal facilities are typically conducted by designated Stormwater staff or contractors under staff supervision. All inspections are conducted on site and are tracked using *Cityworks*. Facility inspections are the primary means of verifying that designated BMPs are being implemented at municipal facilities. The inspections, typically coordinated with City staff from other departments, also provide an opportunity to educate and reinforce the importance of stormwater pollution prevention. Inspections are conducted for the following reasons:

- To ensure that BMPs are properly implemented and functioning effectively;
- To identify maintenance (e.g., material removal) and repair needs;
- To ensure the proper implementation of stormwater management plans;
- To make sure that staff is aware of the stormwater management requirements.

Inspection information, including any corrective actions, is maintained in *Cityworks*. When deficiencies in BMP implementation are found during inspections, the inspector documents corrective actions required to bring the site/activity into compliance. The corrective actions are given to appropriate staff, and the inspection/corrective action documentation is updated to demonstrate resolution once the corrective actions have been addressed.

7.3.6 Inspection Data Management

As with all existing facility inspections, inspectors track all municipal facility investigations and follow-up inspection data in *Cityworks*.

Inspection records include, at a minimum:

- Name and location of facility or area (address and HSA) consistent with the inventory name and location.

[4] State Water Resources Control Board Order 2014-0057-DWQ

- Inspection and re-inspection date(s).
- Inspection method(s).
- Observations and findings from the inspection(s).

For onsite inspections of existing developments, the records also include, as applicable:

- Description of any BMP deficiencies or violations observed during the inspection(s);
- Description of enforcement actions issued in accordance with the Enforcement Response Plan; and
- The date BMP deficiencies or violations were resolved.

7.4 Enforcement

Through legal authority in VMC Chapter 13.18 and procedures outlined in its Enforcement Response Plan, the City has the ability to issue enforcement actions for municipal facilities that are deficient in BMP implementation or demonstrating compliance with the MS4 Permit.

If BMP deficiencies or violations of VMC Chapter 13.18 are observed during an inspection, municipal facilities are typically provided the opportunity to correct BMP deficiencies or violations prior to initiating escalated enforcement action (such as issuing verbal and written warnings) and the procedure described in the Enforcement Response Plan (Appendix F) are followed.

Consistent with MS4 Permit requirements, corrective actions for violations observed at municipal facilities are intended to be resolved within 30 calendar days from date of the violation, or prior to the next rain event (whichever is sooner). *Cityworks* is used to track each step of the inspection process, including inspections, follow-up inspections, notes, photos, and other related records. These features are also used to document situations where violations are not corrected within 30 days, as required by the MS4 Permit.

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8 Existing Development: Municipal Infrastructure

8.1 Introduction

The City has developed a comprehensive program designed to reduce pollutants that are transported in runoff from municipal activities. In accordance with Section E.5.b.(1)(c) of the new MS4 Permit,[5] this section describes *municipal infrastructure-related* pollution prevention activities. Stormwater pollution prevention activities for *existing municipal properties and associated facilities* are discussed in Section 7. Municipal activities are subject to the applicable minimum BMP requirements identified in the 2016 Stormwater Standards Manual (Appendix C), and this section provides discussion on how those BMPs are implemented by the City.

Municipal activities with the potential to introduce pollutants to stormwater include sidewalk repair, painting, and graffiti removal. In contrast, some municipal activities can directly prevent or reduce stormwater pollution, such as street sweeping, inspections, storm drain system maintenance, and regular upkeep of the sanitary sewer system (maintenance and repairs to prevent overflow events).

8.2 Roads, Streets, and Parking Facilities

8.2.1 Background

Roads, streets, highways, and parking facilities are an integral part of City functions. They support travel to residential, business, and recreational areas; however, in doing so, they also collect and convey pollutants due to vehicular operation and other activities. These roadway facilities also are a part of the storm drain system, because they include curb, gutter, and/or roadside ditches, which can convey pollutants deposited on roadways untreated to creeks, other waterways, and eventually the ocean. As a result, regular maintenance is necessary to remove and/or reduce pollutants such as sediment, metals, and debris. To further maintain its infrastructure, the City also conducts roadway activities, which include building new roads, and repairing or resurfacing existing roads. All construction-related activities undertaken by the City will continue to be conducted as described in Section 5 (Construction Management) of this document.

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[5] San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001 and Order R9-2015-0100

8.2.2 Street Sweeping

The City continues to maintain a routine sweeping schedule to reduce pollutant loads generated by City-owned roads, streets, highways, and parking facilities.

The street-sweeping program and schedule have been adjusted to coordinate street sweeping with trash and recycling pick-up schedules. In addition, street-sweeping schedules have been established to meet minimum sweeping frequencies for high, moderate, and low volumes of trash- and debris-generating areas in the City. For the purposes of the street-sweeping program, the terms high, moderate, and low are used only to classify or rank the streets in relation to each other, but do not qualify the streets as generating significant or non-significant amounts of trash and debris. Sweeping occurs during the week, except for holidays.

Although the 2013 MS4 Permit does not have a minimum requirement for street sweeping, the City continues to implement street-sweeping requirements of the 2007 MS4 Permit to prevent, to the MEP, the conveyance of sediment and other pollutants into its storm drain system. Table 8-1 displays the minimum sweeping frequencies for streets with concrete curb-and-gutter and parking facilities in the City.

Table 8-1. Sweeping Frequencies for Roads, Streets, and Parking Facilities

Sweeping Rate Category	Description	Approximate Miles Swept	Sweeping Frequency
High	Commercial streets	75	Minimum of twice per month
Moderate	Residential streets	225	Minimum of monthly
Low	Other streets and parking facilities	75	Minimum of once per year

Sediment and debris are collected and contained in a temporary storage area and protected from stormwater runoff at the Public Works Yard. The material is then disposed of through an approved disposal facility. Because street-sweeping is conducted every week and Code Enforcement staff accompany the sweepers, they can provide the City with further means to observe, respond to, and potentially prevent IC/IDs.

8.2.3 Best Management Practices

Similar to municipal stationary facilities, the City continues to implement the minimum BMPs in the current Stormwater Standards Manual (Appendix C) when conducting maintenance of its roads, streets, and parking facilities. Street sweeping and cleaning continue to be the main BMPs that are implemented for these facilities.

The City also maintains unpaved roads, and applies the appropriate controls to prevent erosion. Unpaved roads are to be stabilized using vegetation, gravel, structural containment such as curbs, or other equivalent measures. In the event that any pervious areas are disturbed or otherwise become destabilized, temporary cover and containment measures will be installed, including erosion control blankets, gravel bags, fiber rolls, or silt fences. These BMPs are maintained until the area can be permanently stabilized.

8.3 Storm Drain System Maintenance and Operations

8.3.1 Background

To prevent flooding during storms, the primary function of the storm drain system is to collect and transport surface runoff to receiving waters. To reduce the risk of flooding, as well as the transport of pollutants into receiving water bodies, the City continues to regularly maintain its storm drain system.

The City's storm drain system consists of streets, curbs, catch basins, inlets, pipes of varying materials, natural creeks and streams, concrete channels, culverts, and detention basins. The City's storm drain system, as one complete entity, is included on the municipal inventory (Appendix J). The City also maintains a number of structural post-construction BMPs, such as vortex separators, bio-retention areas, inlet filter inserts, and detention facilities. More information about post-construction BMP maintenance tracking is provided in Section 4 (Development Planning).

The City's storm drain system management program includes responding to complaints received by the City's Stormwater Hotline, detecting and eliminating IC/IDs, inspecting and maintaining storm drain systems by cleaning, removing sediment, debris, and excessive vegetation. The storm drain management program also includes flushing pipes, repairing and/or replacing damaged or failing storm drain system structures, as well as stenciling warning signs on storm drain inlets that designate the effects of illegal dumping.

With the advent of the 2017 Trash Amendments, additional or enhanced trash capture and cleanup activities are planned based on priority land use designation and the success/effectiveness of public participation and educational outreach campaigns to reduce litter. Trash capture, removal, and management are conducted in accordance with the City's Track 2 Implementation Plan, which undergoes independent revision from this JRMP over the course of the 10-year compliance schedule.

8.3.2 Maintenance

The City maintains a comprehensive storm drain system maintenance schedule, and continually assesses the storm drain system maintenance procedures and results to ensure they are effective. The storm drain system maintenance schedule includes the following:

- MS4 inlets and catch basins are inspected annually. Cleaning is conducted to maintain functionality of the structures
- City-owned structural BMPs are regularly inspected based on the type of BMP and historic maintenance requirements. Some BMPs, such as drain inserts, may be inspected up to four times per year. Structural BMP functionality is also confirmed through annual structural BMP tracking and verification activities (see Section 4.5).
- Non-emergency and emergency repair, maintenance, and construction of storm drain system facilities are conducted on an as-needed basis.

City-owned open channels are cleaned to remove observed anthropogenic litter in a timely manner. The City responds to reports made by citizens or municipal personnel regarding storm drain system facilities that require inspection/cleaning that is beyond regular maintenance activities. Additionally, the City dispatches field crews during rain events to clear debris from inlets, grates, pipe openings, and road shoulders to maintain system functionality.

The City's Track 2 Implementation Plan complies with the 2017 Trash Amendments and requires the systematic integration of trash-capture BMPs based on priority land use designation to further reduce litter.

Above-Ground Maintenance

Maintenance of the above-ground storm drain system primarily includes cleaning creeks, rock-lined channels, concrete channels, and brow ditches. Debris removed from the above-ground storm drain system is transported to the City's municipal yard and properly disposed of by the City's waste hauler. City personnel make sure to handle materials and waste removed during maintenance activities in a manner that will not release the material to the storm drain system, or in any other way contaminate stormwater runoff.

Below-Ground Maintenance

The below-ground maintenance program consists primarily of cleaning inlets, catch basins, and pipelines. Debris removed from the below-ground storm drain system is transported to the City's municipal yard and properly disposed of by the City's waste hauler. Any contaminated material that needs special disposal is handled and disposed of appropriately by an outside contractor.

City personnel handle materials and waste removed during maintenance activities in a manner that will not release the material to the storm drain system, or in any other way contaminate stormwater runoff. The City keeps records to document all storm drain system maintenance activities and inspections. Recordkeeping for preventive maintenance, cleaning, and inspections contains the following information:

- Dates of inspections
- Items inspected
- Locations of facilities inspected or cleaned
- Overall amount of material removed (estimated in either volume or dry weight)
- Disposal site
- IC/IDs detected
- Corrective action required
- Date corrective action was taken

8.3.3 Best Management Practices

The City continues to train field staff on implementing the City's established minimum BMPs, equipment inspection, and the action plan that is followed for regular maintenance, and emergency maintenance and/or discharge control. Additional BMPs are also used as necessary during routine and emergency maintenance, where applicable. The City continues to use backhoes, excavators, and a combination jet-vacuum truck to collect both dry and liquid debris from the storm drain system, thereby preventing sediment and debris transport.

The City continues to use the City-established minimum BMPs in the Stormwater Standards Manual (Appendix C) for municipal areas and activities. BMPs are designed to prevent waste from entering the system, and to ensure that waste collected from the City's storm drain system does not re-enter it. If the City finds that certain portions of the storm drain system itself are contributing pollutants of concern to CWA §303(d)-listed water bodies, additional BMPs are implemented as necessary.

In addition, the City contains a number of flood control facilities, including multiple detention basins and other pollutant removal devices. All of the detention basins serve some pollutant removal capacity, particularly in removing sediment and associated pollutants. Additionally, the City maintains and operates a trash and debris net in Buena Vista Creek, which is regularly maintained to ensure its pollutant removal capacity.

8.4 Sanitary Sewer System

8.4.1 Background

SSOs caused by a defect or failure of a component of the City's sanitary sewer system have the potential to introduce untreated sewage into receiving water bodies. Untreated sewage can contain high concentrations of bacteria, viruses, and parasites, all of which have the potential to negatively impact the environment and pose a significant threat to human health. Although the City prioritizes spill prevention over response, the City promptly responds to SSOs to eliminate or reduce the amount of untreated sewage that reaches the storm drain system. If a discharge does enter the storm drain system, the City cleans up and properly disposes of the SSO overflow residue, as described in Section 3 of this JRMP.

8.4.2 Maintenance

The Public Works Department conducts routine inspections and maintenance of 280 miles of sanitary sewer system to prevent SSOs that may occur due to defects in the sanitary sewer system. Routine inspections and maintenance of the sanitary sewer system reduces the potential for an SSO, and helps prevent and eliminate sewage from entering it. The City's sanitary sewer maintenance program is discussed in the City's SSMP, and is briefly described below.

Preventive Maintenance and Monitoring Activities

The City implements the following preventive maintenance and monitoring measures to prevent wastewater from entering the storm drain system:

- Routine sanitary sewer CCTV inspections and storm drain system surveys;
- Annual cleaning of all sanitary sewer system collection lines with a diameter of 15 inches or less; cleaning of trunk lines larger than 15 inches in diameter on a 5-year rotation; and "Enhanced Maintenance Area" sewer line cleaning conducted quarterly, or more frequently if required;
- Recording and responding to reports of potential SSOs from the public and City staff;
- GIS mapping of sewer and storm drain system intersects;
- Alarm systems at sewer pump stations.

Exfiltration Study

In January 2014, the City initiated a study to investigate potential sources of anthropogenic bacteria load contributions; specifically, through exfiltration from municipal sanitary sewers into the storm drain system, where the two sewer systems cross in close proximity (Dudek 2014). The study was initiated in the San Luis Rey WMA. This study was further analyzed in 2017 by AECOM to prioritize locations for greater investigation (e.g., physical excavation and potential repair) In the future and as appropriate, data and methods from these studies may be used for areas in the City that are located in the Carlsbad Watershed.

8.4.3 Best Management Practices

The City's SSMP includes BMPs to minimize and prevent SSOs. The City continues to maintain and implement an SSMP in response to SWRCB Order 2006-003-DWQ and RWQCB Order R9-2007-0005. The SSMP provides a documented plan that describes all sewer collection system activities and programs to ensure proper management of all sewer collection system assets. Implementing the SSMP helps ensure proper management, operation, and maintenance of all parts of the sanitary sewer system, ultimately helping reduce and prevent SSOs. The SSMP includes the following components:

- GIS mapping of sewer assets
- Preventive Maintenance Program
- Rehabilitation and Replacement Plan
- Training Program for O&M Staff
- Equipment and Parts Inventory
- Design and Performance Provisions
- Overflow Emergency Response Plan
- Fats, Oils, and Grease Control Program
- System Evaluation and Capacity Assurance Plan

Details of these BMPs are provided in the City's SSMP.

8.5 Landscape Maintenance

8.5.1 Background

The City implements a variety of BMPs to reduce or eliminate the amount of pollutants entering the storm drain system from municipal parks and other landscaped areas. Potential pollutants from these areas include sediment (erosion), fertilizers, pesticides, and pet waste. In landscape management, irrigation runoff can be a means for conveying these pollutants. Therefore, BMPs are implemented to address both pollutants and their potential conveyor—irrigation runoff.

8.5.2 Best Management Practices

Contractors that support City staff in conducting landscape maintenance are expected to comply with the Stormwater Ordinance (VMC Chapter 13.18), and implement BMPs just as City staff do. Such requirements are included in contracts for landscape services, and City staff reinforce these requirements in the field.

The use of high efficiency sprinklers (stream rotors, pressure regulated, etc.) is required for projects installing new systems or modifying existing systems.

City staff, or its contractors, regularly check landscape irrigation systems. Irrigation systems at most landscape maintenance areas are inspected either once weekly or twice per month. Repairs or system adjustments are made as soon as possible. Flow sensors track water use and can terminate flow when high flow (breaks) is detected or when rain events occur. Central irrigation sensors/controllers are also used to monitor daily water use for quality control purposes.

To reduce water use at some City facilities, artificial turf has been installed in place of grass turf. For example, grass at the Wave Waterpark was replaced with artificial turf, and it was also installed at the soccer warm-up area at Vista Sports Park. The City continues to consider turf-replacement opportunities.

Due to topography, foot traffic, or limited vegetation cover, some landscape areas have historically demonstrated susceptibility to erosion and soil loss. Mulch is used in many areas, and is refreshed, as necessary, to minimize exposed soils. In other areas, City staff install and maintain sediment control devices to prevent stormwater pollution. For example, straw wattles are often installed and maintained at the toe of slopes or other landscape areas that are adjacent to storm drains or hardscape with potential to discharge sediment.

Pesticides, herbicides, and fertilizers have the potential to be discharged to the storm drain system through: 1) overspray of application; 2) runoff of chemicals applied just prior to storm events; or 3) irrigation runoff. Integrated Pest Management (IPM) is the term used to describe a variety of practices and activities to control pests while reducing pesticide use. IPM is a training component for all pesticide applicators, and it is implemented at City facilities whenever practicable. City staff with pesticide applicator licenses (Qualified Applicator License) regularly participate in continuing education opportunities necessary to maintain their licenses, and renew licenses when required. Qualified Applicator License holders are required to follow guidelines set by the California Department of Pesticide Regulations and the County Agricultural Commission. The City has recently updated its IPM practices to incorporate the use of a non-toxic, non-pesticide gopher control machine that uses carbon monoxide to control the gopher population.

8.6 Mobile Maintenance Activities

8.6.1 Background

The City conducts a number of mobile maintenance activities, which are not designated to a specific location. Because such activities are not confined to a fixed facility, where BMPs may be permanently implemented, BMPs such as wet-vacuum recovery systems, berms, wattles, gravel bags, etc., are actively implemented during mobile municipal activities. Routine mobile maintenance activities include the following:

- Street and sidewalk repair
- Street striping
- Waste removal
- Traffic light maintenance
- Painting
- Landscape/right-of-way maintenance
- Graffiti removal

8.6.2 Best Management Practices

City field crews are routinely trained to implement the City's minimum BMPs during all mobile activities. City personnel involved in mobile activities are trained to identify and eliminate IC/IDs, and to report them to the appropriate persons without delay.

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9 Existing Development: Residential Areas

9.1 Introduction

Approximately 50 percent of the City has a residential land use designation, which includes single-family residences, multi-family residences, and a small portion of other residential areas, such as mobile home parks. Because residential land use comprises such a large area of the City, residential activities (e.g., lawn-watering and/or fertilizing, which can produce runoff that contains bacteria, nutrients, and sediment) can have a considerable effect on the quality of receiving waters in and around it. As a result, the City implements a number of activities to reduce stormwater pollutants from residential areas.

9.2 Residential Inventory

In accordance with the current MS4 Permit, the City has identified designated Residential Management Areas (RMAs) as part of the existing development inventory. The RMAs are based on basins delineated in the City's drainage master plan. To form the RMAs, the basins were edited to remove non-residential land uses and to define the evaluation methodology that applies to each. This process is discussed in more detail in Section 9.4. Inventoried RMAs are managed and tracked through the use of an electronic database. The residential inventory (Table 9-1 and Figure 9-1) captures the following information, as required by the MS4 Permit:

1. Name and location, including HSA.
2. Status of area as active or inactive.
3. Whether the area is or includes a Common Interest Area (CIA), Homeowners' Association (HOA), or mobile home park.
4. Pollutants generated and potentially generated by the area.
5. Whether the area is adjacent to an ESA. "Adjacent to" is defined as being within 200 feet of an ESA. This is in accordance with past procedure and with the most recent definition provided by the RWQCB, which is found in Order R9-2007-0001.
6. Whether the area is tributary to and in the same HSA as a water body segment listed as impaired on the 303(d) list, and generates pollutants for which the water body segment is impaired.

The City maintains a map showing the location of inventoried residential areas, watershed boundaries, and water bodies (Figure 9-1). Because the City's jurisdictional area is almost entirely developed, the RMA boundaries are not expected to change over the life of the MS4

Permit; if boundaries do change, the map is updated to reflect them. The potential pollutants listed in the residential inventory are based on the Co-permittees' Long-Term Effectiveness Assessment, which is an extensive analysis of existing pollutant sources, program activities, and water quality monitoring results (County of San Diego, 2011). Potential pollutants associated with each RMA may be adjusted based on data collected during field evaluations. The presence or absence of CIAs, HOAs, or mobile businesses is also developed, updated, and refined, as needed.

9.3 Best Management Practice Requirements

The City has updated the minimum BMPs required for residents, who are required to eliminate or reduce a number of different types of non-stormwater discharges, and to take other actions. For example, these actions may include the proper use of pesticides and fertilizers to reduce discharges of pollution. Notably, consistent with the MS4 Permit, irrigation runoff, which was previously an allowable discharge under the 2007 MS4 Permit, is now considered an illegal discharge. The full list of required residential BMPs is included in the Stormwater Standards Manual (Appendix C).

9.4 Program Implementation

The main focus of the City's residential program strives to reduce non-stormwater discharges, because this strategy is expected to reduce HPWQC discharges from the City's storm drain system to downstream water bodies. It also is consistent with the 2013 MS4 Permit's increased emphasis on eliminating non-stormwater discharges, including irrigation runoff, and with water conservation efforts being taken in response to the State's ongoing drought.

These efforts are expected to target focus areas identified in the Carlsbad WQIP, and on residential areas in the San Luis Rey WMA. The RMAs that have been identified as focus areas in the Carlsbad WQIP are listed below:

- RMA AH 4 ("AH04" in the WQIP), located along Melrose Drive and Shadowridge Drive in the Agua Hedionda HA.
- RMA BV 6 ("BV06" in the WQIP), located along Bobier Drive and Santa Fe Avenue in the Buena Vista HA.
- RMA LA 1B ("Oceanside and Vista Residential focus area" in the WQIP), located along Cielita Linda Drive, close to the intersection of North Avenue and Olive Avenue, in the Loma Alta HA.

The City's residential-focused efforts were initiated to meet 2013 MS4 Permit requirements. As this program matures and as regulatory drivers change, the program itself also may change through an adaptive management process. Moreover, inspection, monitoring, hotline calls, and enforcement data collected are used to evaluate the effectiveness of the City's residential oversight program, and to modify it as necessary to reduce non-stormwater discharges.

9.4.1 Residential Education

Education and outreach are key mechanisms used to increase residents' awareness and modify behaviors to support BMP implementation. In addition to its own education and outreach efforts, the City contributes to regional education programs run collectively by all municipal agencies in San Diego County. This coordination helps provide consistent and cost-effective messaging across the region. As with the overall residential program emphasis described above, the City's residential outreach efforts focus on reducing non-stormwater discharges, such as irrigation runoff. Other topics may also be covered, such as stabilizing slopes on residential properties to prevent erosion, using fertilizers and pesticides appropriately, pet waste management, and eliminating yard waste from entering the storm drain system. Section 10 of the JRMP, Education and Public Participation, provides more detail on outreach efforts.

As identified in the Carlsbad and San Luis Rey WQIPs, the City collaborates with Vista Irrigation District (VID) to encourage and provide incentives to HOAs and property managers to reduce irrigation runoff. Such measures may include adjusting property landscaping, maintaining irrigation systems, and converting landscaped areas to drought-tolerant plants. These efforts are expected to be especially focused on RMAs AH 4, BV 6, and LA 1B, which have been identified as focus areas in the Carlsbad WQIP, as described above.

The City also develops and distributes outreach materials targeting sediment control for residential areas in portions of the City located in the San Luis Rey WMA. Additional information about WQIP strategies is available in Appendix A.

9.4.2 Oversight Programs and Procedures!!

The primary methods of assessing BMP implementation in RMAs are through property-based inspections or patrols and MS4 outfall monitoring, as further described in subsections 9.4.2.1 and 9.4.2.2, below. These methods are used to meet the MS4 Permit requirement of inspecting each RMA at least once within a 5-year period to evaluate compliance with BMP requirements. Table 9-1 and Figure 9-1 at the end of this section identify which oversight method(s) are used for each of the City's RMAs. Several additional residential oversight mechanisms are used to supplement the primary approaches, as described in subsection 9.4.2.3.

Results from oversight programs are used to help refine educational efforts, as described in Section 9.4.1, where appropriate. Illegal discharges discovered are addressed through the City's enforcement process, as described in Section 9.5.

Table 9-1. Residential Management Areas and Evaluation Methods

No.	Residential Management Area	RMA ID	HSA	CIA, HOA, or Mobile Home[1]	Adjacent to ESA
1	Shadowridge 1[3]	RMA001	904.31, 904.32	Yes	No
2	Shadowridge W[3]	RMA002	904.31	Yes	No
3	Shadowridge SW[3]	RMA003	904.31, 904.32	Yes	Yes
4	Shadowridge SE/E	RMA004	904.31, 904.32	Yes	Yes
5	S Melrose W	RMA005	904.21, 904.22, 904.31	Yes	Yes
6	Thibodo/Mar Vista	RMA006	904.31, 904.32	Yes	No
7	S Melrose E	RMA007	904.22, 904.31	No	No
8	78/Civic Center	RMA008	904.22, 904.31, 904.32	No	Yes
9	W Vista Way[3]	RMA009	904.10, 904.21, 904.22	Yes	Yes
10	Monte Vista	RMA010	904.22, 904.32	No	No
11	N Melrose[5]	RMA011	904.10, 904.21, 904.22	Yes	Yes
12	N Santa Fe W[3]	RMA012	904.10, 904.22	Yes	No
13	N Santa Fe E[3]	RMA013	904.22	Yes	Yes
14	Vale Terrace N	RMA017	904.22, 904.32	Yes	Yes
15	Eucalyptus S	RMA018	904.22	Yes	Yes
16	Vale Terrace S	RMA019	904.22	Yes	Yes
17	SLR2	RMA020	903.11, 904.22	Yes	No
18	Bobier[3]	RMA021	903.11, 904.22	Yes	Yes
19	SLR1	RMA022	903.11, 904.10, 904.22	Yes	No
20	Foothill N	RMA023	903.11, 904.22	Yes	Yes

Notes:

-All RMAs are considered active.

-All RMAs are considered to be tributary to downstream water bodies listed as impaired on the 303(d) list, and generating pollutants for which the water body segment is impaired.

-All RMAs are assumed to potentially generate all of the following pollutants (Metals, Oil & Grease, Sediment, Nutrients, Bacteria, Dissolved Minerals, and Organics). Based on the 2011 Long Term Effectiveness Assessment (County of San Diego 2011).

- All RMAs are assessed using drive-by evaluations except where access is restricted within gated communities.

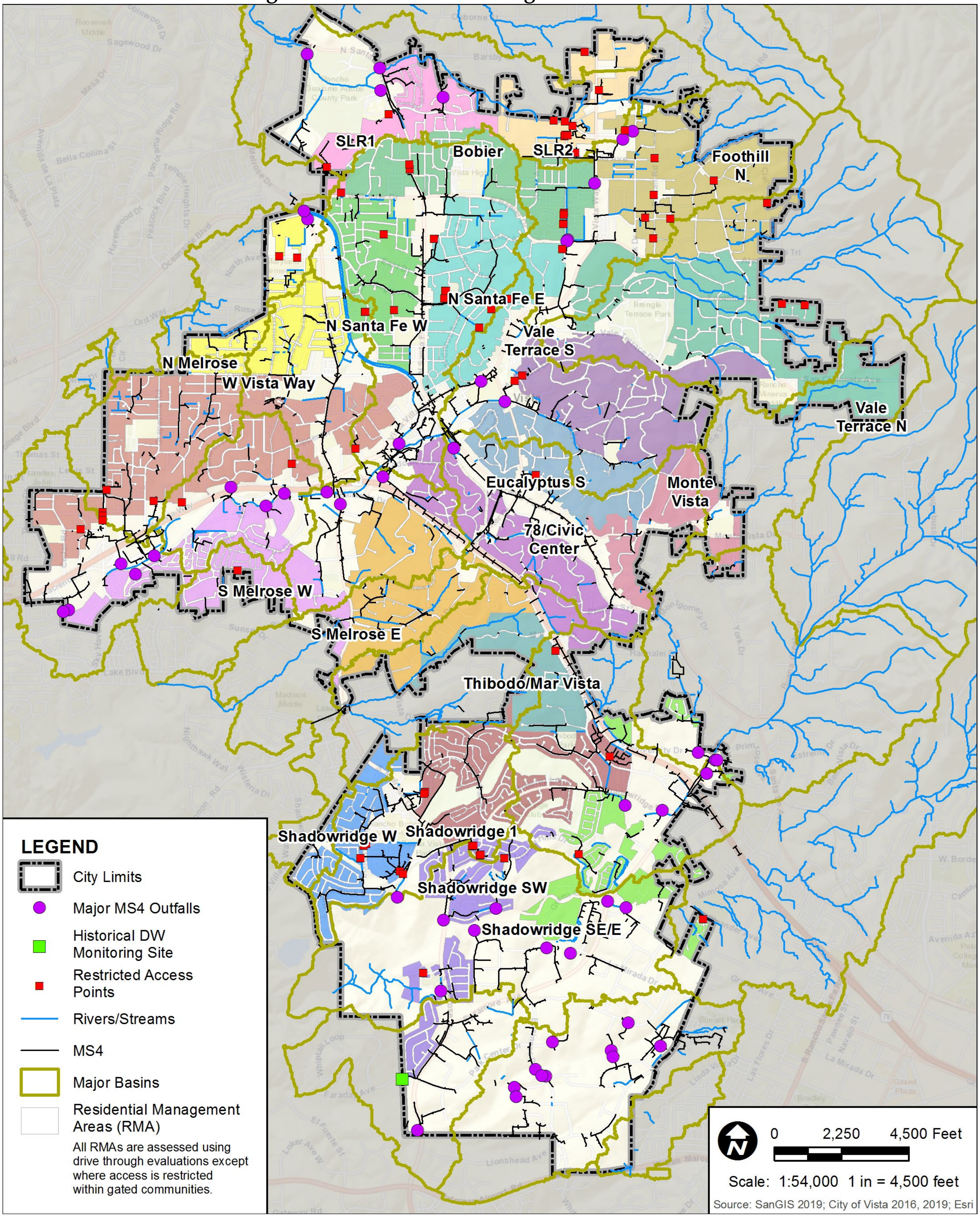
1. Presence of any CIAs, HOAs, and mobile home parks in each RMA will be revised periodically as RMA evaluations are completed, and City databases are updated. The list currently includes Gated Communities only and will be updated and refined over time.

3. This RMA has been identified as part of a focus area in the Carlsbad WQIP.

4. AH-17 is a historical dry-weather monitoring site at which additional observational field screenings are completed to assess for presence of flow.

5. Includes the Oceanside and Vista Residential focus area identified in the Carlsbad WQIP.

Figure 9-1. Residential Management Areas



9.4.2.1 Property-Based Inspections and Patrolling

Property-based inspections or patrols are a primary mechanism for overseeing RMAs. These inspections consist of making observations for actual or potential IC/IDs while driving through neighborhoods or complexes. When violations are observed, and where possible, staff engage residents while in the field, explaining applicable requirements and alternative methods that are acceptable under the City's requirements, thereby directly working with residents to eliminate illicit discharges. When the responsible party may be a property manager or an HOA, staff reach out to the responsible party. Obvious illegal discharges that may pose a threat to human or environmental health are addressed immediately.

As required by the MS4 Permit, at least once per 5-year period, City staff will complete property-based inspections or patrols in all RMAs not assessed through outfall monitoring. The inspection method may be drive-by or onsite. Based staff experience, the most efficient method is likely the drive-by method. The inspections must include a visual assessment of the following:

- Presence of actual non-stormwater discharges;
- Presence of actual or potential discharge of pollutants;
- Presence of actual or potential illicit connections; and
- Verification that the description of the area in the inventory has not changed.
- Residential BMPs per City of Vista Stormwater Standards Manual (Appendix C)

Additional property-based or patrolling inspections were completed for Carlsbad WQIP focus areas AH 4 and BV 6 in 2019, which also have associated MS4 outfall monitoring sites. City staff may elect to complete additional inspections for particular residential areas if they exhibit a history of repeated noncompliance. Onsite inspections, or assessments, may also be conducted at multi-family residential complexes. In addition to assessing for the presence of IC/IDs, onsite assessments include a full evaluation of the implementation of the City's designated residential minimum BMPs (Appendix C).

9.4.2.2 Dry Weather MS4 Outfall Monitoring

Routine MS4 outfall monitoring and identification of non-stormwater discharges is a secondary mechanism for overseeing RMAs. When non-stormwater flow is observed at an outfall during routine monitoring for the Dry Weather MS4 Outfall Monitoring Program, monitoring staff investigate upstream areas to see if a flow source can be identified. During these investigations, residential areas are visited, which the MS4 Permit identifies as RMA inspections. If an illegal discharge is discovered, it is addressed through the enforcement process described in Section 9.5. Outfalls are monitored once or twice per year; those with persistent non-stormwater flows are monitored most frequently. The City's major outfalls are monitored on a rotating schedule based on persistent flow and priority. Samples are also collected for laboratory analyses at selected outfalls with persistent flow. In turn, a larger share of upstream investigation resources are being directed toward identifying and reducing sources of non-stormwater flow in areas upstream of these outfalls, including residential areas. Outfalls that are not discharging flow infer a lack of upstream non-stormwater discharges, and the corresponding RMA is considered inspected. More information about outfall monitoring procedures is included in Section 3 and in Appendix G.

9.4.2.3 Supplemental Oversight Mechanisms

The City's Stormwater Hotline, described in Section 3, is another mechanism for overseeing RMAs and for reporting residential-based violations of the City's Stormwater Ordinance. The hotline number and email address are advertised through various media as part of the City's stormwater education program. Stormwater staff respond to complaints received through the hotline, and *Cityworks* is used to document investigation of the compliant. The corresponding land use, such as Residential, is included with the investigation, as well as mapping capabilities in RMAs.

Staff from multiple departments and other agencies also assist with RMA oversight; examples include the following:

> ***Street Sweeping*** – Street sweepers cover a large portion of the City during routine work, which provides an opportunity for substantial oversight of the City's RMAs. City Code Enforcement officers accompany street sweepers to address cars or equipment blocking sweeping routes. The City will explore developing a process for reporting observed discharges during this activity.
>
> ***Public Works Department*** – Public Works Department field staff (including Parks, Sewer, and Streets) frequent residential areas during routine activities. Staff are encouraged to report discharges to their supervisors for delivery to Stormwater staff.
>
> ***Vista Irrigation District*** – Consistent with the San Luis Rey WMA WQIP, the City coordinates IC/ID response procedures with VID staff. The intent is to consider discharges sourced from VID infrastructure or discharges that VID staff may observe and report to City staff.

9.5 Enforcement

When non-compliance with stormwater requirements are sourced to residential areas, procedure described in the City's Enforcement Response Plan (Appendix F) is followed to attain compliance. Where possible, voluntary compliance is achieved through engaging and educating residents. Particularly in cases when residents are unaware of new requirements, the City will initially take an educational approach to build an effective partnership toward resolving the violation(s). When education is not sufficient to attain compliance, escalated enforcement actions, such as verbal warnings, written warnings (including violation notices), administrative citations, or public nuisance abatement, may be initiated. These actions provide flexibility for enforcement staff to establish appropriate compliance time frames on a case-by-case basis.

The City will typically seek to resolve violations within 30 calendar days of their first observed occurrence, or prior to the next rain event, whichever is sooner. Obvious illegal discharges that may present an immediate threat to human or environmental health do not have 30 days to attain compliance and must be eliminated as soon as possible, as described in Section 3. Violations, their date of resolution, and enforcement actions are documented in *Cityworks*. Whenever a violation cannot be resolved within 30 days, the rationale for why a longer period was needed to attain compliance is also recorded, as required by the MS4 Permit.

10 Education and Participation

10.1 Introduction

Routine daily activities can potentially contribute pollution to urban runoff, and consequently affect the quality of the receiving waters. Although some individual activities may not have a significant effect on water quality; collectively, these activities may contribute a significant amount of pollutants to receiving waters. Receiving water quality is a concern to all, because not only can water degradation have a negative effect on public health and safety; it can also negatively affect the aquatic environment, riparian habitat, and the aesthetic value of the area surrounding the water body.

Education is an important step in improving receiving water quality, both locally and regionally. By increasing public awareness and encouraging a change in the public's behavior and the regulated community (e.g., construction and businesses), the City may reduce or eliminate stormwater pollution caused by common daily activities. The overall goal of the education component is to provide an education program that will:

1) Encourage stormwater pollution prevention behaviors and activities by tailoring promotional messages and materials to better communicate with various audiences, such as municipal staff, residents, businesses, etc. to specific targeted audiences; and

2) Provide the public with opportunities to participate in the development, implementation, and refinement of the WQIPs.

Public participation also plays an important role in achieving the goals of the WQIPs and the City's JRMP. Involving the community and school-aged children in the City's stormwater program helps improve stormwater awareness among individuals, and may lead to improved water quality. Collaboration between the City and the community may also help foster a sense of shared responsibility in protecting water quality, both locally and regionally. The City encourages public participation through the programs discussed in Table 10-1. Educational programs and activities are tailored to meet the needs of the following target audiences:

- Municipal departments and personnel
- Construction site operators
- Industrial and commercial facility owners/operators
- Residential community, general public, and school children
- Other targeted audiences/activities, where applicable

10.2 Municipal Staff Training

The City educates and trains City employees and contractors on applicable stormwater regulations to assure that proper stormwater management practices are applied to all municipal projects and activities. It is important for all City staff and contractors to be aware of stormwater regulations so that their knowledge can be shared with citizens throughout the community. All municipal staff are encouraged to report non-stormwater discharges. The City continues to update its educational program to include information regarding plan review practices and current BMP technologies. Educational opportunities include annual training sessions, on-the-job training, weekly and monthly staff meetings, and Citywide emails and newsletters. Municipal personnel are also made aware of any stormwater-related workshops or additional training seminars that are available. Table 10-1 summarizes key municipal staff training and education on stormwater-related issues, and the frequencies at which they occur.

10.3 Educational Outreach

In accordance with Section E.7 (Public Education and Participation) of the MS4 Permit[6] and the strategies described in the Carlsbad and San Luis Rey WQIPs, the City implements a stormwater education program designed to promote and encourage behaviors that reduce stormwater pollution. The educational activities discussed in this section are intended to develop sustainable behavior changes in target communities, particularly behaviors that may be sources of pollutants that have been identified as the priority water quality conditions throughout the City.

The City may provide educational material to commercial businesses on issuance and/or re-issuance of a business license; distribute educational material during inspections and/or complaint investigations; and may conduct workshops as needed. Municipal stormwater personnel keep educational material in their City vehicles and distribute as necessary to commercial facilities. Table 10-2 summarizes the key outreach activities the City uses to educate residents, schoolchildren, and other target audiences on stormwater-related issues.

[6] San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001 and Order R9-2015-0100

Table 10-1. Municipal Staff Education and Training

Municipal Staff (Division)	Targeted Pollutants	Training/Education Topics	Typical Frequency
Public Works Dept. (Facilities Division)	• Bacteria • Sediment • Trash • Non-stormwater discharges	• Good housekeeping • IC/IDs (identifying, reporting, and response) • Spill response, containment, and recovery • Implement BMPs to control sediment	Annual
Construction Site Inspectors (Engineering Dept.)	• Sediment • Trash • Bacteria	• Minimum BMPs for construction sites (including erosion and sediment control BMPs) • Inspection procedures • Rain Event Action Plan preparation and implementation • Pre-construction meeting topics	Annual
Stormwater Inspectors (Engineering Dept.)	• Nutrients • Sediment • Trash • Bacteria	• Minimum BMPs for industrial, commercial, and residential areas • Spill response, containment, and recovery • IC/IDs • Non-stormwater discharge prohibitions • Methods to reduce the impact of residential and charity car washing	Ongoing training from supervisors; as-needed formal training
Building Inspectors (Engineering Dept.)	• Nutrients • Sediment • Trash	• Federal, state, and local water quality laws and regulations • BMP types: facility- or activity-specific, source control, and treatment control • Selection of the most effective treatment control BMPs for the pollutants of concern	Annual
Fire Dept.	• Sediment • Non-stormwater discharges	• BMPs during training exercises • Site-specific BMPs for each station • Spill response, containment, and recovery	As-needed
Planning (Land Development Division)	• Nutrients • Hydromodification • Bacteria • Sediment • Trash	• Source control BMPs • Low-Impact Development and Structural BMPs • Priority Development Projects • Active construction	As-needed

Table 10-1. Municipal Staff Education and Training (Continued)

Municipal Staff (Division)	Targeted Pollutants	Training/Education Topics	Typical Frequency
City-wide	• Nutrients • Bacteria • Sediment • Trash • Non-stormwater discharges	• Distinction between storm drain system and sewer system • IC/IDs • Irrigation runoff elimination • Reporting to Stormwater Hotline • Water conservation	As Needed

Notes:
IC/IDs – illicit connection and illegal discharge
BMP – best management practice

10.4 Public Participation Programs

Community involvement plays an important role in achieving the goals of the JRMP. Community involvement with implementing JRMP-related activities helps to improve stormwater awareness among individuals and may lead to improved water quality. Collaboration between the City and the community helps foster a sense of shared responsibility in protecting water quality, both locally and regionally. Some programs, such as cleanup events, have direct water quality benefits.

When the public has the opportunity to become more involved, there are several positive outcomes. Those involved become more knowledgeable about stormwater issues, which in turn promotes their actions as educators and stewards for the City and the watershed. The outcome provides important feedback to the City regarding the concerns of the public and issues that may be overlooked. The City regularly co-sponsors cleanup events, and will specifically focus on sponsoring trash collection events in the City's jurisdiction, in accordance with the WQIP strategies outlined in Appendix A.

During the development of this JRMP, the City encouraged public participation in its review, implementation, and refinement. This was accomplished through making the JRMP available for review on the City's website, as well as through the ongoing implementation of the City's stormwater program, which involves various community audiences. Also, the City has notified the public of opportunities to provide recommendations on and to participate in updating the City's highest-priority water quality conditions, numeric goals, and water quality improvement strategies and their effectiveness set forth in the WQIPs.

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Table 10-2. Education and Outreach Opportunities

Education/ Outreach Opportunity	Target Audience	Description	Targeted Topics and Strategies	Targeted Messages	Typical Frequency
Outreach events (e.g., Coastal Cleanup Day, Earth Day, etc.)	• General public • Residents • School children	• Participate in volunteer cleanup or public education events (e.g., hosting an information booth, distributing materials and brochures, and discussing stormwater pollution prevention)	• Bacteria • IC/IDs • Nutrients • Trash	• General stormwater concepts • Eliminating irrigation runoff • Identifying and reporting IC/IDs • Proper HHW disposal • Proper pet waste disposal	Two events per fiscal year
Regional outreach and coordination	• All	• Active participant with the San Diego Co-permittees' Education and Residential Sources Workgroup	• Bacteria • IC/IDs • Nutrients • Trash • Irrigation runoff	• Various	Quarterly
Oil recycling event	• Residents	• Promote and encourage management of motor oil, other automotive fluids, and oil filters (coordinated by City Public Works staff)	• Illegal discharges	• General stormwater concepts • Preventing IC/IDs • Proper HHW disposal	Multiple events per year
Household Hazardous Waste (HHW) collection facility	• Residents • School children	• Collect HHW to prevent illegal discharges (additional information can be found at www.cityofvista.com or www.earth911.com) • Promote to residents • Promote to qualified businesses	• Illegal discharges	• General stormwater concepts • Preventing IC/IDs • Proper HHW disposal	Open on weekends to residents

Table 10-2. Education and Outreach Opportunities (Continued)

Education/ Outreach Opportunity	Target Audience	Description	Targeted Topics and Strategies	Targeted Messages	Typical Frequency
Articles in *Spotlight on Vista* newsletter	• Municipal staff	• Prepare stormwater-related articles	• Bacteria • IC/IDs • Nutrients • Trash • Irrigation runoff	• Various	As-needed
Articles in *Our Vista* newsletter	• Residents • Tourists	• Prepare stormwater-related articles	• Bacteria • IC/IDs • Nutrients • Trash • Irrigation runoff	• General stormwater concepts • Eliminating irrigation runoff • Preventing and reporting IC/IDs • Proper HHW disposal • Proper pet waste disposal • Proper fertilizer/pesticide application	As-needed
Paseo Santa Fe Targeted Outreach Effort Program	• Residents • Industrial facility operators • Commercial facility operators	• Conduct assessment of behaviors and conduct outreach/education to residents and businesses	• Irrigation runoff • Bacteria • Trash	• Minimum BMPs • Eliminating irrigation runoff	Project is grant-funded; outreach will occur during grant period
Stormwater Hotline	• All	• Maintain and promote hotline for reporting any water quality concerns (operated by Public Works staff)	• IC/IDs	• Identifying and reporting IC/IDs	24 hours per day/7 days a week

Table 10-2. Education and Outreach Opportunities (Continued)

Education/ Outreach Opportunity	Target Audience	Description	Targeted Topics and Strategies	Targeted Messages	Typical Frequency
City website	• All	• Update and maintain website for stormwater-related information • Promoting Stormwater Hotline	• Bacteria • IC/IDs • Nutrients • Trash • Irrigation runoff	• General stormwater concepts • Stormwater Hotline • Minimum BMPs • Eliminating irrigation runoff • Proper waste disposal	24 hours per day/7 days a week
Development project pre-meetings	• Construction site operators	• Established list of stormwater discussion items at pre-construction meetings	• Sediment • IC/IDs	• General stormwater concepts • Preventing and reporting IC/IDs • Minimum BMPs	Once per pre-construction meeting
Active construction site inspections and outreach	• Construction site operators	• Send wet-weather notification letters • Provide information on appropriate erosion and sediment controls • Inspections by City staff	• Sediment • IC/IDs	• General stormwater concepts • Preventing and reporting IC/IDs • Minimum BMPs	• Prior to wet season • Inspections conducted in accordance with the schedule in Section 4
Existing development inspections	• Industrial facility operators • Commercial facility operators • Residents • Municipal staff	• Provide education of minimum BMP requirements during routine inspections	• Bacteria • IC/IDs • Nutrients • Trash • Irrigation runoff	• General stormwater concepts • Preventing and reporting IC/IDs • Minimum BMPs	See sections 6, 7, and 9 for respective inspection frequencies

Table 10-2. Education and Outreach Opportunities (Continued)

Education/ Outreach Opportunity	Target Audience	Description	Targeted Topics and Strategies	Targeted Messages	Typical Frequency
Priority Development Projects with structural post-construction BMPs	• Priority Development Project proponents	• Distribute site-specific information packet for structural post-construction BMP maintenance • Provide/discuss inspection results for structural post-construction BMP maintenance needs	• Sediment • Trash • Bacteria	• BMP maintenance • Minimum BMPs • IC/IDs	• Distribute information packet (once) • Inspection results (annual) • Certification of maintenance (annual)
Irrigation Runoff Reduction targeted at Basins AH 4 and BV 6 (WQIP strategy; see Appendix A)	• Residents • Businesses • Property managers	• Collaborate with Vista Irrigation District (VID) to promote behaviors to reduce landscape irrigation runoff • Publicize grants and rebates available to help fund turf removal, implementing weather-based irrigation controllers for sprinkler systems, and similar retrofits of landscaped areas.	• Irrigation runoff	• Minimum BMPs • Eliminating irrigation runoff	Frequencies to be determined based on coordination with VID and available resources.

Notes:
IC/ID – illicit connection and illegal discharge
BMP – best management practice
HHW – household hazardous waste
VID – Vista Irrigation District

11 Fiscal Analysis

11.1 Introduction

The current MS4 Permit requires the City to secure the resources necessary to implement its JRMP. This includes the actions the City has committed to in the WQIPs for the Carlsbad and San Luis Rey WMAs. Those actions, referred to as "strategies" in the WQIPs, are summarized in Appendix A of the JRMP.

The City is also responsible for annually providing a stormwater fiscal analysis to the RWQCB, including information about expenditures and funding sources. To satisfy this requirement, each department or division involved in the stormwater program compiles financial information and provides it to the Engineering Department's Stormwater staff, who analyze the fiscal information and report the findings to the RWQCB.

11.2 MS4 Permit Compliance Funding Needs and Sources

Each budget cycle's estimated costs for implementing the stormwater program are prepared as part of the budget process. The specific amounts allocated and their corresponding funding sources are set in each year's final adopted budget.

11.2.1 Funding Needs

The stormwater program funding needs are primarily driven by the following regulations:

- The MS4 Permit, including the JRMP requirements of Provision E and the WQIP requirements of Provision B.
- The San Luis Rey bacteria TMDL, which is incorporated into the MS4 Permit, and which the San Luis Rey WQIP has been prepared to address.

The activities necessary to comply with these regulations are described in the JRMP. Examples of these activities include street sweeping, storm drain cleaning, maintaining structural BMPs, water quality monitoring, and inspecting construction sites and businesses to verify they are implementing appropriate measures to protect water quality. Other activities include increased efforts in focused areas of the City, which are necessary to meet WQIP numeric goals. All WQIP strategies are listed in JRMP Appendix A.

11.2.2 Funding Sources

Through the budgeting process, the City identifies sources of funding to comply with stormwater requirements. Specific funding sources are set during each budget process, and are subject to change over time. The main sources of past and anticipated future funding are discussed below.

Historically, the City's Sewer Utility fund has been the primary source of funding MS4 Permit-required activities. Additional funding has also come from the acquisition of grants, when available. The City sometimes obtains funds from the Used Oil Block Grant and Department of Conservation Recycling Grant programs to supplement educational activities; however, Sewer Utility funds provide the majority of financial support for outreach and education efforts. Recently, the City obtained Proposition 84 funds from the State for the Paseo Santa Fe green street project. The City will continue to pursue opportunities for grant funding in the future.

11.3 Fiscal Analysis Reporting

As part of the required annual reporting process, the City prepares a summary of expenditures from the reporting period. The City also prepares a list of funding sources for both the current and upcoming fiscal years.

Information necessary to complete the annual fiscal analysis is collected from each responsible department or division. In accordance with MS4 Permit Provision E.8 (Fiscal Analysis), the City reports stormwater expenditures for capital projects, O&M, and staffing. Staffing and O&M costs mainly relate to day-to-day program activities, such as storm drain cleaning, reviewing plan submittals for development projects, and enforcing the Municipal Code's stormwater requirements. Examples of capital project expenditures include the cost of storm drain system improvements and installation of LID features associated with larger City construction projects.

The City reports its fiscal analysis information in its JRMP annual reports until 2017, when this reporting effort becomes integrated with the WQIP annual reports. The City's fiscal analysis data will be included in the WQIP annual reports, for which the City is a responsible party.

12 Reporting

12.1 JRMP Annual Reports

Section F.3.b.(1) of the MS4 Permit[7] requires the City to document and demonstrate compliance with the MS4 Permit by completing an Annual Report. The report provides an opportunity to communicate the status of JRMP activities to both the RWQCB and the public. The City's annual reports use the JRMP Annual Report Form specified in the MS4 Permit, which are completed for both the San Luis Rey and Carlsbad WMAs beginning in 2017.

The JRMP and annual reporting process involves a range of staff from different departments, such as Public Works and Land Development, who are responsible for implementing and collecting data for their stormwater program component. Although Stormwater Division staff facilitate and monitor the overall program throughout the year, they rely on several key departments and divisions to achieve compliance and accurately document it for the annual report. Discussion for each of the subsections that follow is in order of the JRMP Annual Report form sections.

12.1.1 Legal Authority

In each annual report, the City must confirm that adequate legal authority has been established and is being maintained in its jurisdiction to control pollutant discharges into and from its MS4. As part of the first 2018 WQIP annual report, the City submits a formal certification of legal authority, as required by MS4 Permit Section E.1.b. That certification statement must be signed by a Principal Executive Officer, Ranking Elected Official, or Duly Authorized Representative.

12.1.2 JRMP Document Update

It will be stated in the JRMP annual report if any updates to the JRMP document were required or recommended by the RWQCB during the reporting period. The City must confirm that the JRMP document was in fact updated accordingly and made available, within the reporting period, on the Regional Clearinghouse, a website used for the collection and distribution of information developed and maintained by the Copermittees. If the required or recommended update was not completed and made available on the Regional Clearinghouse, the City will attach a schedule for completing and posting it. The City will also explain why the update and posting were not completed during the reporting period.

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[7] San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001

12.1.3 Illicit Discharge Detection and Elimination Program

The total number of non-stormwater discharges that were reported by the public, detected by the City or contract staff, investigated, and/or eliminated in each of the City's WMAs within the reporting period are documented on the annual report form. Additionally, the total number of identified sources of non-stormwater and illegal discharges, the number of IC/IDs identified and/or eliminated, and the number of associated enforcement and escalated enforcement actions taken are reported.

All non-stormwater discharges are considered illegal discharges unless the source is identified as one of the categories of non-stormwater discharges discussed in Section 3 of this report. If a non-stormwater discharge is identified but not included in one of the categories of non-stormwater discharges listed in Section 3, then the discharge is both a non-stormwater discharge and an illegal discharge.

12.1.4 Development Planning Program

Development planning program implementation numbers are reported annually, including the total number of development projects submitted for review during the reporting period. Of these projects, the number that are PDPs and the number of PDPs that were approved and/or granted occupancy during the reporting year are also reported. Any projects approved during the fiscal year that were granted any exemptions from the current BMP Design Manual requirements and/or allowed to implement alternative compliance options in accordance with Permit Section E.3.c.(3) are also reported.

The numbers of completed PDPs in the City's inventory, high-priority PDP structural BMP inspections, PDP structural BMP violations, and associated enforcement and escalated enforcement actions taken are also included in the annual report.

12.1.5 Construction Management Program

In accordance with the current MS4 Permit-specified annual report form, the annual report quantifies active and inactive construction sites, construction sites closed/completed, construction site inspections and violations, enforcement and escalated enforcement actions issued.

12.1.6 Existing Development Program

The City must also report on its Existing Development Program, which includes the following components: municipal, commercial, industrial, and residential. The numbers of inventoried facilities or areas in the inventory, routine and follow-up inspections, violations, as well as enforcement and escalated enforcement actions are reported for each of these four components.

12.1.7 Fiscal Analysis and Supplemental Data

Each year, the City prepares a fiscal analysis summary, as described in JRMP Section 11 (Fiscal Analysis), and submits it with the JRMP annual report form. In addition to the JRMP annual report forms and fiscal analysis data, where applicable, the City may include supplemental tables, data, and narrative to document program successes and challenges during the reporting period. Additional supplemental descriptions of the City's progress in implementing applicable WQIP strategies are included as part of the annual reporting process.

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13 Conclusions and Recommendations

The City has updated this JRMP based on priorities, goals, and schedules identified in the WQIPs for the San Luis Rey and Carlsbad WMAs. In addition, this process has relied on experience gained through developing and implementing programs during the previous permit cycle. The updates include adjusting existing programs and developing new programs to target WQIP priorities and to meet new MS4 Permit[8] requirements.

As the JRMP continues its implementation, the City assesses and refines its program. Moreover, recognizing that program implementation is an evolving process, the City will, as necessary, adjust its strategies and activities according to assessment results. This adaptive management approach is expected to more effectively reduce discharges of pollutants and non-stormwater flow rates in the City's storm drain system, which should ultimately benefit local water bodies. To foster and sustain watershed and regional water quality improvements, the City will continue to work with the other agencies in San Diego County and in the San Luis Rey and Carlsbad Watersheds.

[8] San Diego Regional Water Quality Control Board Order R9-2013-0001, as amended by Order R9-2015-0001

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Appendix A

Summary of City of Vista Water Quality Improvement Plan Strategies

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Appendix A. Summary of City of Vista Water Quality Improvement Strategies

Strategy	Geographic Extent of Implementation	Location in JRMP (Section or Appendix)
Irrigation Runoff Reduction Program	Agua Hedionda Focus Area AH-04	Sections 3, 6, 9, 10
Property Based/Patrol Inspections	Agua Hedionda Focus Area AH-04	Sections 6, 9
Irrigation Runoff Reduction Program	Buena Vista Focus Areas BV-06	Sections 3, 6, 9, 10
Perform Property Based Inspections/Patrol	Buena Vista Focus Areas BV-06	Sections 6, 9
Runoff and Nutrients Source Reduction	Loma Alta Focus Area LA 1B	Sections 3, 6, 7, 9, 10
Administrative BMPs[1, 2]	Citywide[3]	Sections '3 - 10
Construction Site Inspections[2]	Citywide[3]	Section 5
Development and Redevelopment Requirements[2]	Citywide[3]	Section 4
Employee Training[2]	Citywide[3]	Section 10
Enforcement[2]	Citywide[3]	Appendix B (Enforcement Response Plan)
Existing Development Facilities, Areas and Activities Inspections[2]	Citywide[3]	Sections 6, 7, 8
General Education and Outreach[2]	Citywide[3]	Section 10
Investigations[2]	Citywide[3]	Section 3
MS4 Inspections/ Cleaning[2]	Citywide[3]	Section 8
Outfall Monitoring	Citywide[3]	Section 3
Partnership Program(s) [2]	Citywide[3]	Section 10
Program for Retrofitting Areas of Existing Development[2]	Citywide[3]	Appendix E (Retrofitting and Rehabilitating Existing Development)
Program for Stream, Channel and/or Habitat Restoration in Areas of Existing Development[2]	Citywide[3]	Appendix E (Retrofitting and Rehabilitating Existing Development)
Street Sweeping[2]	Citywide[3]	Section 8

Notes
- Optional WQIP strategies and strategies applicable only to other jurisdictions are not included in this table.
1. Examples of Administrative BMPs include plan development, program standardization, maintaining and prioritizing inventories, updating education materials, etc.
2. General descriptions of these strategies are included as an appendix to the WQIP.
3. Citywide strategies are implemented throughout the City, in both the Carlsbad and San Luis Rey Watershed Management Areas.

Appendix B

Retrofitting and Rehabilitating Existing Development

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Appendix B. Retrofitting and Rehabilitating Existing Development

1 Introduction

The Regional Water Quality Control Board, San Diego Region (RWQCB) Order R9-2013-0001, as amended by Order R9-2015-0001 (MS4 Permit), requires all 21 San Diego area government agencies to identify areas of existing development to address sources of pollutants and/or stressors that contribute to the highest priority water quality conditions in the Watershed Management Areas (WMAs). Retrofit projects, such as strategically placed structural best management practices (BMPs), may be used to reduce pollutants discharged due to stormwater runoff or hydro-modification from existing development areas. In addition, the RWQCB requires agencies to develop a program to rehabilitate streams, channels, and/or habitats. As a responsible agency in both the San Luis Rey WMA and Carlsbad WMA, the City will focus its retrofit and rehabilitation programs on the highest priority and priority water quality conditions (HPWQC and HPWQCs) identified in each watershed

Section 2 discusses the City's strategy and approach for identifying, prioritizing, and implementing candidate retrofit and stream rehabilitation projects.

2 Program Development Strategies

Regional guidance for initiating a Copermittee-specific retrofit and rehabilitation program was initiated through the Watershed Management Area Analysis (WMAA) process and development of WQIPs. Development and refinement of the City's retrofit and rehabilitation program will be influenced by gaining a better understanding of the dynamic between Vista's existing development and highest priority water quality conditions identified in the San Luis Rey and Carlsbad Water Quality Improvement Plans (WQIPs). Over time, the City will develop a retrofit and rehabilitation program that will identify feasible and cost-effective opportunities to improve water quality conditions created, in part, by existing development. The following strategies will be considered and/or implemented as the City develops its retrofit and rehabilitation program:

- Alternative compliance provisions for development projects, which allow offsite retrofit or rehabilitation projects in lieu of meeting the applicable storm water requirements solely through onsite BMPs. This effort is being considered by the City and other Copermittees, who are collectively completing research to provide technical information that can serve as a foundation for future alternative compliance programs. The processes for approving, implementing, maintaining, and reporting on such projects will be identified when this effort is more mature.

- Obtaining grants for storm water improvements. The City has been successful in obtaining grant funding in the past, including award of funding to assist with completion of the first phase of the Paseo Santa Fe Green Street Project. The project improved a major transportation corridor in Vista, while also incorporated bioretention Silva Cells and pervious pavers to manage stormwater runoff. Additional grant funding is being pursued for future phases of the project. In 2012, the City was awarded a grant for improvements at Bengle Terrace Park, including creation of a new nature trail, restoration of riparian habitat, and construction of bioretention facilities.
- Identifying and implementing projects, such as existing facility structural BMP retrofits and green infrastructure improvements, as opportunities arise. The City recently completed a structural BMP retrofit on Main Street in downtown Vista. While improving street side parking and adjacent sidewalk, a bioretention basin was constructed in an area that otherwise would not have been utilized by the project (Figure 1).

Figure 1. Bioretention basin on Main Street in Vista

- Restore riparian habitats to protect water quality, particularly for highly erodible areas. Consistent with goals identified for the Agua Hedionda Hydrologic Area in the Carlsbad WQIP, the City has initiated field studies and conceptual design of a riparian restoration project on Roman Creek, a tributary of Agua Hedionda Creek. When completed, this project will address impacts of hydromodification, while also improving water quality and riparian habitat.

Overall, the City will employ a range of strategies to facilitate the implementation or construction of retrofit and rehabilitation projects in accordance with the WQIPs. As discussed, some of these retrofit strategies are already underway. In the future, the City may also consider partnering with other neighboring jurisdictions to install regional BMPs where retrofit projects are deemed to provide a greater net benefit to the City than projects implemented only by the City.

3 Candidate Projects

The following discussion provides a framework for identifying candidate retrofit and rehabilitation project areas.

3.1 Project Criteria

As defined by the MS4 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." Retrofit projects often involve the introduction of structural BMPs to a previously underserved area, such as constructing new detention or bioretention facilities. Retrofits can also include downspout disconnection efforts (redirecting downspouts to pervious areas); the installation of rain barrels; or implementation of 'green street' practices.

Similarly related are *rehabilitation* projects, which implement methods of in-stream restoration, off-line storm water management practices installed in the system corridor or upland areas, or a combination of in-stream and out-of-stream techniques. Rehabilitation projects may include riparian zone restoration, constructed wetlands, channel modifications, and daylighting of drainage systems.

The following criteria will be considered by the City when identifying candidate retrofit and rehabilitation projects:

- **HPWQC and WQIP numeric goals.** Priority will be assigned to retrofit and rehabilitation candidate projects that help meet WQIP numeric and narrative goals by targeting the HPWQCs (i.e., hydromodification in the Carlsbad WMA, and bacteria in the San Luis Rey WMA) or by targeting conditions contributing to the HPWQC. Because numeric goals in the Carlsbad WMA apply to specific focus areas within the City, projects located in focus areas identified in the Carlsbad WQIP are especially desirable, such as with the Roman Creek project.
- **Project feasibility.** The feasibility of a project includes consideration of characteristics such as cost, constructability, pollutant-removal potential, long-term operation, and

project impediments. However, projects that place a considerable burden on City resources relative to their environmental and/or compliance benefit may be infeasible.

- **Land use.** Land use of the area tributary to a potential retrofit project is an important consideration when selecting retrofit and rehabilitation project candidates. Projects that receive runoff from land uses with a higher potential to contribute pollutants associated with HPWQCs are likely to be most helpful in meeting WQIP numeric goals.
- **Multiple project benefits or uses.** Candidate projects with the potential to contribute to the overall enhancement of the local community are preferred, and preference may be given to the following:
  - Improved flood control and protection
  - Enhanced walkability, pedestrian safety, and accessibility
  - Improved access to open spaces or recreational opportunities
  - Community beautification, such as streetscape aesthetics or incorporating murals other features with significant artistic value
  - Enhanced or expanded habitat for native plant and animal communities
- **Land availability.** Land availability and ownership are critical in evaluating candidate retrofit or rehabilitation projects. For example, candidate projects consisting of multiple privately-owned properties may prove more challenging than projects sited on single-owner property. Similarly, City-owned property may provide retrofit and rehabilitation opportunities not feasible at privately-owned proprieties.
- **Maximize infiltration and retention.** Priority will be assigned to candidate projects that maximize stormwater infiltration and retention. Such projects provide multiple benefits through pollutant removal, runoff volume reduction, and groundwater recharge. Site-specific conditions (e.g., soil type, depth to groundwater, topography, existing structures) will influence the feasibility of implementing infiltration and retention practices.

3.2 Potential Projects

As previously noted, the City has already begun evaluating and implementing retrofit projects. Given the preceding criteria, the City will continue to identify candidate retrofit and rehabilitation projects as strategic and feasible opportunities arise. These opportunities may emerge through alternative compliance proposals, capital improvement projects, grant funding/awards, public and citizen interest, or private-development partnerships. The San Luis Rey and Carlsbad WQIPs and previous studies, such as the regional WMAA, the Agua

Hedionda Watershed Management Plan, and the San Luis Rey Comprehensive Load Reduction Plan (CLRP) also provide resources for identifying candidate retrofit and rehabilitation projects.

During preparation of the San Luis Rey CLRP, which was developed in response to the bacteria TMDL, the City and the other responsible parties identified priority storm drain catchments for implementing retrofits. Catchments were prioritized to identify infrastructure within the watershed that had the potential to generate the highest pollutant load during a rain event. In some cases, locations were identified for potential structural BMPs. These potential structural BMPs were identified within high priority catchments, and considered factors such as parcel size, land ownership, and proximity to storm drains. Additional information can be found in the San Luis Rey CLRP (Geosyntec 2012).

More recently, as part of the development of WQIPs in 2016, candidate projects were identified through the WMAA for both the Carlsbad WMA and the San Luis Rey River WMA. The WMAA includes a GIS-based analysis of each WMA's physical characteristics, such as present and anticipated future land uses, as well as locations of physical structures within streams and upland areas that impact watershed hydrology (i.e., bridges, culverts, and flood management basins). Using this information, candidate projects were discussed. The WMAA results, including discussion of candidate projects, are included as attachments to the Carlsbad WQIP (MOE 2016; Appendices D and E) and San Luis Rey WQIP (LWA/AMEC2016; Appendix 3H).

References

California Regional Water Quality Control Board, San Diego Region, 2015. Order No. R9-2013-0001, as amended by Order No. R9-2015-0001. *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*.

Geosyntec, 2012. *Comprehensive Load Reduction Plan for the San Luis Rey River Watershed.*

Larry Walker Associates/AMEC (LWA/AMEC), 2016. *San Luis Rey River Watershed Management Area Water Quality Improvement Plan*. Revised March.

Mikhail Ogawa Engineering (MOE), et al., 2015. *Carlsbad Watershed Management Area Water Quality Improvement Plan.* June.

Appendix C

Stormwater Standards Manual

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City of Vista

Stormwater Standards Manual

June 2015, rev. 2019

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Table of Contents

Tables

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1 Introduction

1.1 Stormwater Standards Manual

This Stormwater Standards Manual (hereafter, "Manual") supports the City of Vista's (City) Stormwater Management and Discharge Control Program Ordinance (Stormwater Ordinance), codified as Vista Municipal Code (VMC) Chapter 13.18. The Manual also supports the water quality protection provisions of the Grading and Erosion Control Ordinance, codified as VMC Chapter 17.56. Moreover, the Manual is not a stand-alone document but must be read with applicable parts of the Stormwater Ordinance and the Grading and Erosion Control Ordinance (collectively, "Ordinances"). In general, this Manual categorically and explicitly establishes what Dischargers must do to comply with the Ordinances and to receive permits for projects and activities that are subject to them. The Manual and the Ordinances have been prepared to provide the City with the respective legal authority and administrative actions necessary to comply with the requirements of California Regional Water Quality Control Board, San Diego Region (RWQCB) Order R9-2013-0001, as amended by Order R9-2015-0001 and Order R9-2015-0100 (Municipal Separate Storm Sewer System [MS4] Permit).

1.2 Purposes and Use

The Manual establishes minimum stormwater management requirements and controls to address the highest priority water quality conditions in the Water Quality Improvement Plans (WQIPs) for the San Luis Rey and Carlsbad Watershed Management Areas (WMAs). Further, the Manual supports the following objectives stated in Section 13.18.020 of the Stormwater Ordinance:

- To establish requirements for discharges into the MS4, receiving waters, and the environment;
- To protect, to the maximum extent practicable (MEP), life, property, receiving waters, aquatic life, and the environment from loss, injury, degradation, or damage by discharges from within the City's jurisdiction;
- To protect the MS4 from damage; and
- To meet the requirements of state and federal law.

In the San Luis Rey WMA, bacteria has been identified as the highest priority water quality condition; nutrients (eutrophic conditions) and hydromodification impacts are the highest water quality conditions in the Carlsbad WMA. During dry-weather conditions, non-stormwater flows transport these priority pollutants downstream in the watershed. For this reason, the City has minimum requirements to effectively prohibit non-stormwater discharges and will implement activities to reduce them. Because sediment can transport nutrients and bacteria, the City has also designed program activities to reduce discharges of sediment, primarily during wet-weather conditions. Efforts to decrease sediment discharges are intended to reduce these pollutants in stormwater discharges, and sediment loading in nearby receiving waters.

The Manual describes best management practices (BMPs), which are required activities to be implemented to reduce the amount of pollutants discharged to the City's MS4 (hereafter, "storm drain system"[1]). The Manual informs residents, businesses, contractors, developers, and City staff about what is necessary to meet the City's stormwater requirements. All terms used in the Manual have the same meaning as defined in VMC Chapter 13.18, unless otherwise noted.

[1] Throughout the Manual, the term "storm drain system" is typically used in place of "MS4.".

2 Other Potentially Applicable Regulations

The Manual describes stormwater BMPs required by the City of Vista. Some actions and activities associated with stormwater BMP requirements may be subject to additional requirements or approvals, such as other City departments or non-municipal agencies. The legally responsible person must identify all other applicable requirements and obtain the necessary permits or approvals. Some of the more common regulations to consider are discussed in this section; however, this discussion is not meant to be exhaustive.

2.1 Other City of Vista Requirements

Discharges to the sanitary sewer system may require approval from the City's Engineering Department. Call (760) 639-6111 for more information.

Structural improvements to properties, such as building an overhead canopy, may require City permits. Contact Development Services at (760) 639-6108 for more information.

2.2 Requirements of Other Agencies

Work in and around natural drainages, wetlands, and other water resources may require permits from multiple agencies, including the following:

- US Army Corps of Engineers
- California Department of Fish and Wildlife
- US Fish and Wildlife Service
- RWQCB

The RWQCB and State Water Resources Control Board (SWRCB) issue permits and conditional waivers for a number of activities that have potential to impact stormwater discharges. Consideration may be given to the following permits and waivers:

- State of California Industrial General Permit, SWRCB Order 2014-0057-DWQ
- State of California Construction General Permit, SWRCB Order 2009-0009-DWQ
- Groundwater Dewatering Permit, RWQCB Order R9-2015-0013
- Permit for Discharges of Hydrostatic Test Water or Potable Water, RWQCB Order R9-2010-003
- Utility Vault Dewatering Permit, SWRCB Order 2014-0174-DWQ
- Conditional Waiver 1, Discharges from On-site Disposal Systems
- Conditional Waiver 2, "Low Threat" Discharges to Land
- Conditional Waiver 3, Discharges from Animal Operations
- Conditional Waiver 4, Discharges from Agricultural and Nursery Operations
- Conditional Waiver 5, Discharges from Silvicultural Operations

- Conditional Waiver 6, Discharges of Dredged or Fill Materials Nearby or Within Surface Waters
- Conditional Waiver 7, Discharges of Solid Wastes to Land
- Conditional Waiver 8, Discharges of Solid Wastes to Land
- Conditional Waiver 9, Discharges of Slurries to Land
- Conditional Waiver 10, Discharges of Emergency/Disaster Related Wastes
- Conditional Waiver 11, Aerially Discharged Wastes Over Land

Information on the most current requirements for RWQCB and SWRCB permitting and waivers can be obtained from the following website: http://www.waterboards.ca.gov/sandiego/

3 Minimum BMP Requirements

This section presents minimum BMP requirements for the following land uses, activities, and projects within the City:

- Industrial, commercial and municipal facilities or areas
- Residential properties
- Construction sites
- Development projects (post-construction BMPs)

These are the minimum BMP requirements that must be implemented for applicable activities. However, additional consideration should be given to the following:

- Due to site-specific conditions, some BMP requirements reference terms such as "where applicable" or "where feasible." These terms require that BMPs be implemented at the discretion and with the final determination made by Authorized Enforcement Staff. VMC Chapter 13.18 defines "Authorized Enforcement Staff" as follows: "any City employee or contractor hired by the City who is assigned to duties involving permits and other City approvals, inspections, or enforcement related to this chapter."
- Authorized Enforcement Staff also have the authority to require additional BMPs, if necessary, to comply with the Stormwater Ordinance and/or the MS4 Permit.
- References to "CASQA Factsheets" refer to factsheets in manuals prepared by the California Stormwater Quality Association (CASQA). CASQA materials can be accessed at www.casqa.org. Some materials may not be viewable without a paid subscription.

3.1 Industrial, Commercial, and Municipal

Minimum BMP requirements for industrial, commercial and municipal sites and activities are provided in Table 1. These BMPs have been developed, and are supported by, factsheets adopted by CASQA[2]. City exceptions to the procedures described in the CASQA factsheets are identified in footnotes. Where any conflict may exist between CASQA factsheets and requirements in the Manual or the VMC, the requirements of the Manual and the VMC shall prevail. Complying with the BMPs described in the Manual does not ensure compliance with all other regulatory requirements, including requirements of other agencies. See Section 2 for more information about other potentially applicable requirements.

[2] CASQA (2015). *Stormwater Best Management Practice Portal: Industrial and Commercial*. www.casqa.org.

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Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
		Discharge Control									
1	Eliminate illicit connections and illegal discharges (IC/IDs) to the storm drain system.	Do not allow any material (solid or liquid) or pollutant, except uncontaminated stormwater, to enter the City's storm drain system. Conditional exceptions apply, as described in VMC Chapter 13.18. Additional activity-specific BMPs related to illegal discharges are described in BMP No.'s 3 through 10 (below). Report any suspected or active illegal discharges to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-11, SC-44	x	x	x	x		x	x	x
2	Eliminate IC/IDs to the storm drain system.	Illicit connections are any drain or connection that allows for an illegal discharge to enter the storm drain system. Find and abate all illicit connections to the storm drain system through properly approved procedures, permits, and protocols. Report any suspected or active illicit connections to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-44	x	x	x	x		x	x	x
3	Properly dispose of water used to clean outdoor areas.	All water used to clean outdoor areas (e.g., power washing) shall be contained, captured, and reused, or properly disposed of to the sanitary sewer, an appropriate waste hauler, or to landscaping or other pervious surfaces.	SC-10, SC-41[3], BG-62	x	x	x	x	x	x	x	x

[3] Exception to guidance in factsheet: Factsheet SC-41, Building & Grounds Maintenance, states (in regards to pressure washing), "If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff." However, non-stormwater discharges of this nature, even if filtered, are not allowed to enter the City's storm drain system. Wash water must be contained, collected, and disposed of properly.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
4	Eliminate the discharge of vehicle and equipment wash water.	Water associated with vehicle or equipment-washing activities shall not be allowed to enter the storm drain system. Uncovered designated wash areas must either drain to the sanitary sewer, or all wash water must be contained, captured, and disposed of appropriately. Wash water containing pollutants such as oil, grease, paint, or other hazardous waste must be disposed in accordance with applicable regulations. If approved by the City, drains located in vehicle or equipment washing areas may be connected to the sanitary sewer system. Contact the Engineering Department at (760) 639-6111 for approval.	SC-10, SC-21, BG-64[4]		x	x			x	x	x
5	Properly dispose of water from fire sprinkler maintenance activities.	Fire sprinkler system discharges shall be discharged to the sanitary sewer system when permitted by the City. For approval, contact the Engineering Department at (760) 639-6111. When not practicable or allowed to discharge to the sanitary sewer system due to the presence of prohibited contaminants, the water shall be collected and disposed of by an appropriately certified party. Fire sprinkler system discharges without corrosion inhibitors, fire suppressants, or antifreeze may be discharged to landscaping or other pervious surfaces. Fire sprinkler system discharges may be directed to the storm drain system if the following are implemented: (1) prior to entering the storm drain system, the discharge must be clear, odorless, and pH neutral, and (2) the flow path must be cleaned to ensure that pollutants such as trash and debris are not conveyed to the storm drain system. Discharges shall not result in erosion or in runoff to any adjacent property.	SC-10, SC-41		x	x			x		x

[4] Exception to guidance in factsheet: Factsheet BG-64, Mobile Cleaning – Vehicle and Equipment Washing, states that water used to rinse new cars "May discharge to storm drain." However, water used to rinse new cars is not allowed to be discharged to the City's storm drain system.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
6	Eliminate irrigation runoff.	Irrigation runoff to the storm drain system shall be eliminated. For example, irrigation water and associated pollutants (e.g., sediment, fertilizer, pesticides) from businesses and facilities such as landscape areas, nurseries, and garden centers, shall be prevented from reaching the storm drain system.	SC-10[5], SC-41	x		x	x				
7	Properly dispose of discharges from swimming pools, spas, or water features.	Water from swimming pools, spas, and water features shall be properly disposed of to prevent pollutants from entering the storm drain system. Such discharges to the storm drain system are allowed only if the water is: 1) dechlorinated, 2) has a pH level in the 7-8 range, 3) is near or at ambient temperature, 4) does not have algae or suspended solids, and 5) is not saline. Other related discharges, such as from filter backwash or saline pools, are prohibited from entering the storm drain system. At the discretion of the City, discharges of saline water to the sanitary sewer system may be allowed. Contact the Engineering Department at (760) 639-6111 for approval.	SC-10, BG-63[6]			x					
8	Control air conditioning condensation discharges.	Air conditioning condensation shall be directed to landscaped areas or other pervious surfaces where feasible.	SC-10, SC-42			x			x		

[5] Exception to guidance in factsheet: Factsheet SC-10, Non-Stormwater Discharges, states that "landscape irrigation drainage and landscape watering" may be discharged to the storm drain with conditions; however, in accordance with the MS4 Permit and the City's Stormwater Ordinance, no irrigation runoff may be discharged to the City's storm drain system.

[6] Exception to guidance in factsheet: Factsheet BG-63, Mobile Cleaning – Swimming Pools & Spas, states that discharges from swimming pools and spas to the storm drain system are not permitted; however, discharges of this nature are permitted if the conditions described in BMP 7 are met.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
9	Eliminate discharges from cleaning indoor areas.	Water used to clean indoor areas, such as during floor mopping or mat washing, shall not be discharged to the storm drain system. Indoor wash areas, mop sinks, or indoor floor drains may be utilized if they drain to the sanitary sewer system. Alternatively, such waste water may be suitable for collection, recovery, and discharge to landscape.	SC-10, SC-21, BG-30	x		x				x	x
10	Eliminate pumped groundwater, foundation, and footing drain discharges.	Unless approved by a National Pollutant Discharge Elimination System (NPDES) permit, or the RWQCB has determined in writing that no permit is needed, the following discharges are not allowed: 1) pumped groundwater, such as water from crawl space or sump pumps, 2) discharges from foundation and footing drains that are at or below groundwater elevation.	SC-10			x					
BMP and Storm Drain Conveyance and Structure Maintenance											
11	Regularly inspect and maintain storm drain structures to retain designed functionality.	Storm drain conveyances and structures for which the property owner is responsible for maintenance shall be inspected, maintained, and cleaned to maintain design functionality. All structural BMPs (e.g., treatment and flow control facilities) shall be maintained in accordance with recorded maintenance agreements, and where applicable, structural BMPs shall demonstrate compliance with the City's certification program.	SC-44	x	x		x	x	x	x	x
Erosion and Sediment Control											
12	Protect unpaved and landscaped areas from erosion.	Exposed soils that are eroding or are likely to erode shall be stabilized to prevent sediment from mobilizing in stormwater and entering the storm drain system. Mulch, vegetation, and other stabilization techniques for erosion and sediment control may be implemented. Significant accumulations of eroded soil shall be removed or contained to prevent discharge to the storm drain system.	SC-40, SC-42	x	x		x				

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
Good Housekeeping											
13	Regularly clean parking areas, driveways, and hardscape.	Paved parking lots, private roads, and other hardscape, shall be inspected and cleaned as necessary to remove trash, debris, and pollutants that may enter the storm drain system. Sweeping is the preferred method of cleaning. Wet-cleaning methods, such as mopping or power washing, may be conducted if all wash water is contained, captured, and disposed of appropriately.	SC-41, SC-43, BG-62[7]		x			x	x	x	x
14	Implement good housekeeping in outdoor areas.	Outdoor areas shall be inspected and cleaned as necessary to keep them free of trash, sediment, litter, and other debris. Additional attention shall be given to areas such as trash enclosures, loading docks, compactors, and material storage locations.	SC-41	x	x			x	x		

[7] Exception to guidance in factsheet: Factsheet BG-62, Mobile Cleaning – Surface Cleaning, states (in regards to pressure washing) that screened, or filtered, wash water can be discharged to a gutter, street, or storm drain. Non-stormwater discharges of this nature, even if filtered, are not allowed to enter the storm drain system, which includes the streets and gutters. Wash water must be contained, collected, and disposed of properly.

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
		Material Storage and Handling									
15	Provide and maintain secondary containment to catch spills if storing potential stormwater pollutants.	To prevent leaks and spills from discharging to the storm drain system, effective secondary containment shall be provided and maintained for all containers of material (liquid or solid) with the potential to discharge onto outdoor areas. Drums and other containers shall be kept in good condition and securely closed when not in use. Secondary containment shall also be provided for all liquids during transport to prevent spills due to leaks or punctures. Spills, liquids, and precipitation that accumulate within secondary containment devices shall be regularly removed and disposed of appropriately. Other applicable regulations will apply to the use of secondary containment, as appropriate, especially for hazardous materials, which are regulated by the County of San Diego Department of Environmental Health.	SC-20, SC-31						x	x	x
16	Cover, contain, and/or elevate materials stored outside that may become a source of pollutants in stormwater or non-stormwater.	Materials stored outdoors shall be covered, contained, and/or elevated to prevent stormwater and non-stormwater from contacting and/or transporting materials to the storm drain system. Cover types may include roofs, awnings, and the use of tarps. Where coverage is not feasible or is cost-prohibitive, alternative approaches to pollution prevention may be allowed, such as installing berms around the stored materials, directing runoff to pervious areas, or installing treatment devices. The installation of structural overhead cover may require obtaining City-issued permits. Contact Development Services at (760) 639-6108 for information.	SC-20, SC-33		x		x	x	x	x	x

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
17	Properly store and dispose of hazardous materials.	Hazardous materials and wastes shall be stored, managed, and disposed in accordance with federal, state, and local laws and regulations—notably, but not limited to, County of San Diego Department of Environmental Health regulations. Hazardous materials and their primary storage containers shall be stored such that they will not come into contact with stormwater, even if leaks or spills occur (e.g., secondary containment and appropriately covered). Disposal of hazardous wastes requires the use of authorized hazardous waste collection services. See BMPs 16 and 17 for additional details regarding storage.	SC-20, SC-31, SC-33						x		x
Pesticide and Fertilizer Management											
18	Properly manage pesticides and fertilizers.	Pesticides and fertilizers shall be used in strict accordance with manufacturer's labels, as authorized by the U.S. Environmental Protection Agency. See BMPs No.'s 15 and 16 for secondary containment and cover requirements. Waste products shall be disposed in accordance with the manufacturer's label and applicable hazardous waste regulations. The use of integrated pest management (IPM) principles is encouraged to reduce or eliminate use of chemicals. For more information about integrated pest management, see the University of California Statewide IPM Program at: http://www.ipm.ucdavis.edu	SC-35, SC-41, BG-40				x				x

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted							
				Bacteria	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
Outdoor Work Areas											
19	Implement controls to minimize pollution from exposed outdoor work areas.	Activities that may generate pollutants shall be conducted in covered, contained areas; alternatively, adequate measures shall be implemented to prevent the discharge of activity-sourced pollutants. Outdoor work areas shall consider and implement the following, as appropriate: (1) conduct activities indoors; (2) when it is raining, do not conduct outdoor activities that may generate pollutants; (3) prevent runoff from upstream areas from flowing through the work area ; (4) contain the work area to prevent spills or by-products from escaping; (5) install cover or use canopies in areas where outdoor activities are performed; (6) protect storm drain inlets and ensure adequate spill response materials are readily available; and, (7) regularly clean outdoor work areas to remove accumulated debris, materials, and pollutants. Structural BMPs (stormwater treatment devices) may be prescribed if these measures are determined to be ineffective at preventing stormwater pollution from outdoor work activities.	SC-20, SC-30, SC-32, SC-34, SC-42		x		x	x	x	x	x
Spill Prevention and Response											
20	Prevent or capture liquid leaks from vehicles or equipment.	Leaking vehicles or equipment shall be repaired promptly. Drip pans or other equivalent means shall be used to capture spills or leaks from vehicles and equipment. Captured fluids shall be disposed of in accordance with applicable hazardous materials regulations.	SC-11, SC-22						x	x	x
21	Immediately clean up spills.	Spills shall be cleaned up immediately and prevented from entering the storm drain system. Dry-cleaning methods of cleanup are recommended, such as the use of a broom, absorbent, or shop-vac. Consistent with BMP No. 1, uncontained spills must be reported to the City's Stormwater Hotline at (760) 643-2804.	SC-11						x	x	x

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

BMP No.	Requirement	Description	Applicable CASQA BMP Factsheet(s)	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather Flow	Nutrients	Trash	Metals	Oil & Grease	Organics
22	Maintain readily accessible and appropriately supplied spill cleanup materials (or kit).	Spill cleanup materials and equipment shall be kept on-site and, appropriately supplied for the type and quantity of spills that may occur. One or more designated 'spill cleanup kits' are recommended. Spill cleanup materials shall be stored in close proximity to where a spill may occur.	SC-11, SC-22						x	x	x
Waste Management											
23	Keep waste storage and dumpster areas free of exposed trash, sediment, and debris.	Waste storage and dumpster areas shall be cleaned to keep them free of uncontained trash, debris, or other potential pollutants. Liquid waste, hazardous waste, medical waste, universal waste, and other items prohibited by current regulations shall not be placed in solid waste dumpsters. Dry-cleaning methods such as sweeping are preferred. If wet cleaning methods are used, all wash water must be contained, captured, and disposed of appropriately. See BMP 3 for information on appropriate wet cleaning practices.	SC-34, SC-41, BG-30	x	x			x			
24	Protect waste storage and dumpster areas from contact with stormwater and non-stormwater flows onto the property.	Waste storage and dumpster areas shall be protected from contact with stormwater and non-stormwater flows. Waste storage lids shall be closed at all times. Dumpsters, compactors, or storage containers that leak shall be promptly repaired or replaced. Overhead structural cover of waste storage areas is recommended.	SC-34	x				x			

Table 1. Minimum BMPs for Industrial, Commercial and Municipal Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
BMP No.	**Requirement**	**Description**	**Applicable CASQA BMP Factsheet(s)**	**Bacteria**	**Sediment**	**Dry Weather Flow**	**Nutrients**	**Trash**	**Metals**	**Oil & Grease**	**Organics**
25	Cooking oil waste shall be managed to prevent illegal discharges.	Waste containers for fats, oils, and grease (FOG) shall be kept indoors where feasible. Where not feasible, the waste containers shall be kept in an area with secondary containment. FOG waste containers shall be maintained to prevent spills and discharges to the storm drain system. Documentation of this maintenance shall be available to City inspectors upon request.	SC-34, BG-30	x						x	
26	Manage animal waste and animal washing in a manner that prevents transport of pollutants.	Animals and animal waste shall be managed and stored in a manner that prevents waste and wash water from entering the storm drain system. Collect animal waste and dispose of it to the trash or sanitary sewer, as approved and appropriate.	SC-34, BG-10	x	x		x				

3.2 Residential

Table 2 below presents the minimum required BMPs for residential sites and sources. The City's BMP standards are based on the CASQA BMP factsheets. City exceptions to the procedures described in the factsheets are identified in footnotes. Where any conflict may exist between CASQA factsheets and requirements in the Manual or the VMC, the requirements of the Manual and the VMCshall prevail. Complying with the BMPs described in the Manual does not ensure compliance with all other regulatory requirements, including requirements of other agencies. See Section 2 for more information about other potentially applicable requirements.

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Table 2. Minimum BMPs for Residential Sites/Sources[8]

				Pollutants or Conditions Targeted							
No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
Discharge Control											
1	Eliminate illegal discharges to the storm drain system.	Do not allow any material (solid or liquid) or pollutant, except uncontaminated stormwater, to enter the City's storm drain system. Conditional exceptions apply, as described in VMC Chapter 13.18. Additional activity-specific BMPs related to illicit discharges are described in BMP No.'s 3 through 10 (below). Report any suspected or active illicit discharges to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-11, SC-44	x	x	x	x		x	x	x
2	Eliminate illicit connections to the storm drain system.	Illicit connections are any drain or connection that allows for an illegal discharge to enter the storm drain system. Find and abate all illicit connections to the storm drain system through properly approved procedures, permits, and protocols. Report any suspected or active illicit connections to the City's Stormwater Hotline at (760) 643-2804.	SC-10, SC-11, SC-44	x	x	x	x		x	x	x
3	Properly dispose of water used to clean outdoor areas.	All water used to clean outdoor areas (e.g., power washing) shall be contained, captured, and reused, or properly disposed of to the sanitary sewer, an appropriate waste hauler, or to landscaping or other pervious surfaces.	SC-10, SC-41[10], BG-62	x	x	x	x	x	x	x	x

[8] To the extent practicable, the City's established minimum BMPs for industrial, commercial, municipal sites/sources shall also be implemented for any industrial/commercial type of activities conducted at a residence where appropriate.

[9] CASQA BMP factsheet references refer to factsheets included in the *Stormwater Best Management Practice Portal: Industrial and Commercial* (2015) since CASQA has not produced a residential BMP manual. BMPs for businesses are generally applicable to residential activities as well.

[10] Factsheet SC-41 - Building & Grounds Maintenance, states (in regards to pressure washing), "If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff." Non-stormwater discharges of this nature, even if filtered, are not allowed to enter the storm drain system. Wash water must be contained, collected, and disposed of properly.

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
4	Properly dispose of vehicle and equipment wash water.	Wash water from individual residential vehicle washing shall be prevented from discharging to the City's storm drain system, e.g., by directing wash water to landscaped areas or other pervious surfaces, where feasible. Where it is not feasible to prevent discharges to the City's storm drain system, use of water and detergents and other vehicle wash products must be minimized. Discharges to the City's storm drain system from non-commercial car washes, such as fundraisers and other similar activities, are prohibited. For questions, contact the Stormwater Division at (760) 643-2804.	SC-10, SC-21		x	x			x	x	x
5	Properly dispose of water from fire sprinkler maintenance activities.	Fire sprinkler system discharges shall be discharged to the sanitary sewer system when permitted by the City. For approval, contact the Engineering Department at (760) 639-6111. When not practicable or allowed to discharge to the sanitary sewer system due to the presence of prohibited contaminants, the water shall be collected and disposed of by an appropriately certified party. Fire sprinkler system discharges without corrosion inhibitors, fire suppressants, or antifreeze may be discharged to landscaping or other pervious surfaces. Fire sprinkler system discharges may be directed to the storm drain system if the following are implemented: (1) prior to entering the storm drain system, the discharge must be clear, odorless, and pH neutral, and (2) the flow path must be cleaned to ensure that pollutants such as trash and debris are not conveyed to the storm drain system. Discharges shall not result in erosion or in runoff to any adjacent property.	SC-10, SC-41		x	x			x		x

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

				Pollutants or Conditions Targeted							
No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
6	Eliminate irrigation runoff.	Irrigation runoff to the storm drain system shall be eliminated. For example, irrigation water and associated pollutants (e.g., sediment, fertilizer, pesticides) from landscape areas and gardens shall be prevented from reaching the storm drain system.	SC-10[11], SC-41	x		x	x				
7	Properly dispose of discharges from swimming pools, spas, or water features.	Water from swimming pools, spas, and water features shall be properly disposed of to prevent pollutants from entering the storm drain system. Such discharges to the storm drain system are allowed only if the water is: 1) dechlorinated, 2) has a pH level in the 7-8 range, 3) is near or at ambient temperature, 4) does not have algae or suspended solids, and 5) is not saline. Other related discharges, such as from filter backwash or saline pools, are prohibited from entering the storm drain system. At the discretion of the City, discharges of saline water to the sanitary sewer system may be allowed. Contact the Engineering Department at (760) 639-6111 for approval.	SC-10, BG-63[12]			x					
8	Control air conditioning condensation discharges.	Air conditioning condensation shall be directed to landscaped areas or other pervious surfaces where feasible.	SC-10, SC-42			x			x		

[11] Factsheet SC-10 – Non-Stormwater Discharges states that "landscape irrigation drainage and landscape watering" may be discharged to the storm drain with conditions; however, in accordance with the MS4 Permit and the City's Stormwater Ordinance, no irrigation runoff may be discharged to the City's storm drain system.

[12] Exception to guidance in factsheet: Factsheet BG-63, Mobile Cleaning – Swimming Pools & Spas, states that discharges from swimming pools and spas to the storm drain system are not permitted; however, discharges of this nature are permitted if the conditions described in BMP 7 are met.

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
9	Eliminate discharges from cleaning indoor areas.	Water used to clean indoor areas, such as during floor mopping or mat washing, shall not be discharged to the storm drain system. Indoor sinks or indoor floor drains may be utilized if they drain to the sanitary sewer system. Alternatively, such waste water may be suitable for collection, recovery, and discharge to landscape.	SC-10, SC-21, BG-30	x		x				x	x
10	Eliminate pumped groundwater, foundation, and footing drain discharges.	Unless approved by an NPDES permit, or the RWQCB has determined in writing that no permit is needed, the following discharges are not allowed: 1) pumped groundwater, such as water from crawl space or sump pumps, 2) discharges from foundation and footing drains that are at or below groundwater elevation.	SC-10			x					
BMP and Storm Drain Conveyance and Structure Maintenance											
11	Regularly inspect and maintain storm drain structures to retain designed functionality.	Storm drain conveyances and structures for which the property owner is responsible for maintenance shall be inspected, maintained, and cleaned to maintain design functionality. All structural BMPs (e.g., treatment and flow control facilities) shall be maintained in accordance with recorded maintenance agreements, and where applicable, structural BMPs shall demonstrate compliance with the City's certification program.	SC-44	x	x		x	x	x	x	x
Erosion and Sediment Control											
12	Protect unpaved and landscaped areas from erosion.	Exposed soils that are eroding or are likely to erode shall be stabilized to prevent sediment from mobilizing in stormwater and entering the storm drain system. Mulch, vegetation, and other stabilization techniques for erosion and sediment control may be implemented. Significant accumulations of eroded soil shall be removed or contained to prevent discharge to the storm drain system.	SC-40, SC-42	x	x		x				

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Pollutants or Conditions Targeted							
				Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
Good Housekeeping											
13	Implement good housekeeping in outdoor areas.	Outdoor areas shall be inspected and cleaned as necessary to keep them free of trash, sediment, litter, and other debris. Additional attention shall be given to outdoor trash storage areas and and material storage locations.	SC-41	x	x			x			
Pesticide and Fertilizer Management											
14	Properly manage pesticides and fertilizers.	Pesticides and fertilizers shall be used in strict accordance with manufacturer's labels, as authorized by the U.S. Environmental Protection Agency. See BMPs No.'s 16 and 17 for secondary containment and cover requirements. Waste products shall be disposed in accordance with the manufacturer's label and applicable hazardous waste regulations. The use of integrated pest management (IPM) principles is encouraged to reduce or eliminate use of chemicals. For more information about integrated pest management, see the University of California Statewide IPM Program at: http://www.ipm.ucdavis.edu	SC-35, SC-41, BG-40				x				x
Spill Prevention and Response											
15	Prevent or capture liquid leaks from vehicles or equipment.	Leaking vehicles or equipment shall be repaired promptly. Drip pans or other equivalent means shall be used to capture spills or leaks from vehicles and equipment. Captured fluids shall be disposed of in accordance with applicable hazardous materials regulations.	SC-11, SC-22						x	x	x
16	Immediately clean up spills.	Spills shall be cleaned up immediately and prevented from entering the storm drain system. Dry-cleaning methods of cleanup are recommended, such as the use of a broom, absorbent, or shop-vac. Consistent with BMP No. 1, uncontained spills must be reported to the City's Stormwater Hotline at (760) 643-2804.	SC-11						x	x	x

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
17	Maintain readily accessible and appropriately supplied spill cleanup materials (or kit).	Spill cleanup materials and equipment shall be kept on-site and, appropriately supplied for the type and quantity of spills that may occur. One or more designated 'spill cleanup kits' are recommended. Spill cleanup materials shall be stored in close proximity to where a spill may occur.	SC-11, SC-22						x	x	x
Waste Management											
18	Keep waste storage and dumpster areas free of exposed trash, sediment, and debris.	Waste storage and dumpster areas shall be cleaned to keep them free of uncontained trash, debris, or other potential pollutants. Liquid waste, hazardous waste, medical waste, universal waste, and other items prohibited by current regulations shall not be placed in solid waste dumpsters. Dry-cleaning methods such as sweeping are preferred. If wet cleaning methods are used, all wash water must be contained, captured, and disposed of appropriately. See BMP 3 for information on appropriate wet cleaning practices.	SC-34, SC-41, BG-30	x	x			x			
19	Protect waste storage and dumpster areas from contact with stormwater and non-stormwater flows onto the property.	Waste storage and dumpster areas shall be protected from contact with stormwater and non-stormwater flows. Waste storage lids shall be closed at all times. Dumpsters, compactors, or storage containers that leak shall be promptly repaired or replaced. Overhead structural cover of waste storage areas is recommended.	SC-34	x				x			

Table 2. Minimum BMPs for Residential Sites/Sources (Continued)

No.	BMP Title	BMP Description	CASQA BMP Factsheet Reference[9]	Pollutants or Conditions Targeted: Bacteria	Sediment	Dry Weather	Nutrients	Trash	Metals	Oil & Grease	Organics
20	Manage animal waste and animal washing in a manner that prevents transport of pollutants.	Animals and animal waste shall be managed and stored in a manner that prevents waste and wash water from entering the storm drain system. Collect animal waste and dispose of it to the trash or sanitary sewer, as approved and appropriate.	SC-34, BG-10	x	x		x				

3.3 Construction

Table 3 below presents the minimum BMPs required for construction sites within the City's jurisdiction. The City's BMP standards are based on the CASQA BMP factsheets. Where any conflict may exist between CASQA factsheets and requirements in the Manual or the VMC, the requirements of the Manual and the VMC shall prevail. Complying with the BMPs described in the Manual does not ensure compliance with all other regulatory requirements, including requirements of other agencies. See Section 2 for more information about other potentially applicable requirements. Note that Table 3 must be used as directed in Section 3.3.1, which provides direction on the interpretation and use of Table 3.

Construction site BMPs are required to be implemented in an effective combination of BMPs that are site specific, construction phase appropriate, and seasonally appropriate. Dry-season (May 1 through September 30) BMP implementation must plan for and address rain events that may occur in the Dry Season. Non-stormwater discharges from construction sites into the City's storm drain system are prohibited year-round. City inspectors have the authority to require additional BMPs to prevent discharges of pollutants and to prevent non-stormwater discharges to the City's storm drain system from construction sites year round. Construction sites also must adhere to the requirements of all applicable additional SWRCB or RWQCB general or site specific NPDES permits for construction activities (see Section 2) at the time of construction.

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Table 3. Minimum BMPs for Construction Sites

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE-SPECIFIC BMP REQUIREMENTS. Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits. *Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions*												
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**					
Required BMPs	**Other Permits Potentially Required**	**CASQA BMP Factsheet No.**	**CASQA BMP Factsheet Name**	**MS4 Permit Compliance Category**	**CASQA BMP Factsheet Targeted Pollutants**	**On-Site or Off-site Work: Construction Phase**	**CASQA BMP Factsheet Categories & Objectives (P = Primary S= Secondary)[1]**					
							Effective Combination Required		**TC**	**WE**	**NS**	**WM**
							EC	**SE**				
X	n/a	n/a	Training	PP,SMWM EC,SE	n/a	G, V, F						
X	✓	EC-1	Scheduling	PP, EC,SE,SMWM	Sediment, Trash	G, V, F	P	S	S	S		
X[a]	✓	EC-2	Preservation of Existing Vegetation	PP,EC	Sediment	G, V, F	P					
X[a]	n/a	EC-3	Hydraulic Mulch	PP,EC, SMWM	Sediment	G, V	P			S		
X[a]	✓	EC-4	Hydroseeding	PP,EC	Sediment	G, V	P			S		
X[a]	n/a	EC-5	Soil Binders	PP,EC	Sediment	G, V	P			S		
X[a]	n/a	EC-6	Straw Mulch	PP,EC	Sediment	G, V	P			S		
X[a]	n/a	EC-7	Geotextiles and Mats	PP,EC	Sediment	G, V, F	P			S		
X[a]	n/a	EC-8	Wood Mulching	PP,EC	Sediment	G, V, F	P			S		
X[a]	✓	EC-9	Earth Dikes and Drainage Swales	PP,EC,RUROC	Sediment	G, V	P					
X[a]	✓	EC-10	Velocity Dissipation Devices	PP,EC,RUROC	Sediment	G, V, F	P					
X[a]	✓	EC-11	Slope Drains	PP,EC,RUROC	Sediment	G, V, F	P					
X[a]	✓	EC-12	Stream Bank Stabilization	PP,EC,SE,NS	Sediment	G, V, F	P	S			S	
X[a]	n/a	EC-14	Compost Blankets	PP,EC	Sediment	G, V, F	P					
X[a]	n/a	EC-15	Soil Preparation Roughening	PP, EC, SE	Sediment	G	P	S				
X[a]	n/a	EC-16	Non-Vegetative Stabilization	PP, EC, SE, RUROC	Sediment	G, V, F	P	S			S	

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE-SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
X[b]	n/a	SE-1	Silt Fence	PP, SE, RUROC	Sediment (coarse)	G, V, F		P				
X[b, c]	✓	SE-2	Sediment Basin	PP, SE, RUROC, APS	Sediment, Trash	G, V		P				
X[b, c]	✓	SE-3	Sediment Traps	PP, EC, RUROC, APS	Sediment, Trash	G, V		P				
X[b]	n/a	SE-4	Check Dam	PP, EC, RUROC	Sediment	G, V	S	P				
X[b]	n/a	SE-5	Fiber Rolls	PP, EC, SE, RUROC	Sediment	G, V	S	P				
X[b]	n/a	SE-6	Gravel Bag Berm	PP, EC, SE, RUROC	Sediment	G, V, F	S	P				
X[b]	n/a	SE-7	Street Sweeping and Vacuuming	PP, SE	Sediment, Trash, Oil & Grease, Bacteria	G, V		S	P			
X[b]	n/a	SE-8	Sandbag Barrier (note: gravel to be used)	PP, EC, RUROC	Sediment	G, V, F	S	P				
X[b]	n/a	SE-10	Storm Drain Inlet Protection	PP, SE, RUROC	Sediment, Trash, Oil And Grease, Bacteria	G, V, F		P				
d	✓	SE-11	Active Treatment Systems	PP, APS	Sediment	G	P					
e	n/a	SE-12	Manufactured Linear Sediment Controls	PP, SE, RUROC	Sediment, Trash	G, V	S	P				P

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE-SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
e	n/a	SE-13	Compost Socks and Berms	PP, EC, SE, RUROC	Sediment, Metals, Bacteria, Oil & Grease	G, V	S	P				
e	n/a	SE-14	Bio Filter Bags	PP, SE, RUROC	Sediment	G, V, F		P				
X	n/a	WE-1	Wind Erosion Control	PP, SMWM, SE	Sediment	G, V		S		P		
X	n/a	TC-1	Stabilized Construction Entrance/Exit	PP, SMWM, EC, SE, RUROC	Sediment	G, V	S	S	P			
X	n/a	TC-2	Stabilized Construction Roadway	PP, SMWM, EC, SE, RUROC	Sediment	G, V	S	S	P			
X	n/a	TC-3	Tire Wash	PP, SMWM, SE	Sediment	G, V		S	P			
X	✓	NS-1	Water Conservation Practices	PP, SMWM, SE, NS	Sediment, Nutrients, Bacteria	G, V, F	S	S			P	
f	✓	NS-2	Dewatering Operations	PP, SMWM, SE, NS	Sediment, Oil & Grease	G		S			P	
X	n/a	NS-3	Paving and Grinding Operations	PP, SMWM, NS	Sediment, Oil & Grease	G, V, F					P	S
f	✓	NS-4	Temporary Stream Crossing	PP, EC, SE NS	Sediment	G, V	S	S	S		P	
f	✓	NS-5	Clear Water Diversion	PP, NS	Sediment	G					P	

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE-SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
X	✓	NS-6	Illicit Connection/ Discharge	SMWM, NS	Sediment, Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V, F					P	
X	✓	NS-7	Potable Water/Irrigation	SMWM, NS	Sediment, Nutrients, Metals, Organics,Bacteria	G, V, F					P	
X	n/a	NS-8	Vehicle and Equipment Cleaning	PP, SMWM, NS	Sediment, Nutrients, Oil & Grease, Organics	G, V, F					P	
X	n/a	NS-9	Vehicle and Equipment Fueling	PP, SMWM, NS	Oil & Grease	G, V, F					P	
X	n/a	NS-10	Vehicle and Equipment Maintenance	PP, SMWM, NS	Nutrients, Trash Oil & Grease, Organics	G, V, F					P	
f	n/a	NS-11	Pile Driving Operations	PP, SMWM, NS	Sediment, Oil & Grease	G, V					P	
X	n/a	NS-12	Concrete Curing	PP, SMWM, NS	Sediment, Metals, Oil & Grease	G, V, F					P	P
X	n/a	NS-13	Concrete Finishing	PP, SMWM, NS	Sediment, Metals, Oil & Grease	G, V, F					P	P

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE-SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	Other Permits Potentially Required	CASQA BMP Factsheet No.	CASQA BMP Factsheet Name	MS4 Permit Compliance Category	CASQA BMP Factsheet Targeted Pollutants	On-Site or Off-site Work: Construction Phase	CASQA BMP Factsheet Categories & Objectives (P = Primary S= Secondary)[1]					
							Effective Combination Required		TC	WE	NS	WM
							EC	SE				
f	✓	NS-14	Material Over Water	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V, F					P	P
f	✓	NS-15	Demolition Adjacent to Water	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V						P
f	✓	NS-16	Temporary Batch Plants	PP, SMWM, NS	Sediment, Trash, Metals	G						P
X	n/a	WM-1	Material Delivery & Storage	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	n/a	WM-2	Material Use	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	n/a	WM-3	Stockpile Management	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F	S	S				P

Table 3. Minimum BMPs for Construction Sites (Continued)

THIS MATRIX IS A GENERAL GUIDANCE DOCUMENT AND IS NOT A SUBSTITUTION FOR SITE-SPECIFIC BMP REQUIREMENTS.
Construction sites that are subject to other SWRCB or RWQCB permits must also adhere to the BMP Requirements of the additional permits
Refer to the notes at the end of this table for acronyms, reference documents, footnotes, and permit definitions

A	B	C	D	E	F	G	H					
Required BMPs	**Other Permits Potentially Required**	**CASQA BMP Factsheet No.**	**CASQA BMP Factsheet Name**	**MS4 Permit Compliance Category**	**CASQA BMP Factsheet Targeted Pollutants**	**On-Site or Off-site Work: Construction Phase**	**CASQA BMP Factsheet Categories & Objectives (P = Primary S= Secondary)[1]**					
							Effective Combination Required		**TC**	**WE**	**NS**	**WM**
							EC	**SE**				
X	n/a	WM-4	Spill Prevention & Control	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	n/a	WM-5	Solid Waste Management	PP, SMWM, NS	Sediment, Nutrients, Trash, Metals, Oil & Grease, Organics	G, V, F						P
X	✓	WM-6	Hazardous Waste Management	PP, SMWM, NS	Nutrients, Trash, Metals, Bacteria, Oil & Grease, Organics	G, V, F						P
f	✓	WM-7	Contaminated Soil Management	PP, SMWM, NS	Nutrients, Trash, Metals, Oil & Grease, Organics	G						P
X	n/a	WM-8	Concrete Waste Management	PP, SMWM, NS	Sediment, Metals, Trash	G, V, F					S	P
X	✓	WM-9	Sanitary/ Septic Waste Management	PP, SMWM, NS	Nutrients, Trash, Bacteria, Organics	G, V, F						P
X	✓	WM-10	Liquid Waste Management	PP, SMWM, NS	Sediment, Metals, Nutrients, Trash, Metals, Oil & Grease	G, V						P

Note: Table 3 must be used as directed in Section 3.3.1, Use and Guidance for Table 3.

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3.3.1 Use and Guidance for Table 3

The following discussion provides additional guidance on the application of Table 3 to construction projects, including definitions of acronyms and abbreviations used. The guidance below is organized by table column, beginning with Column A.

Column A:

This column identifies required BMPs. BMPs with an "X" are required when applicable. BMPs are required for each phase of construction on site or offsite regardless of size. Projects are required to schedule in advance which BMPs may be applicable to each phase of construction (construction phases are defined in the notes on Column G below). Footnotes "a" and "b", which are included for some required BMPs, are defined below.

a. An appropriate BMP, or combination of BMPs, by construction phase for erosion control must be selected. Typically not every erosion control BMP listed in Table 3 will be required to meet this standard. The appropriate and effective BMP selection is based on site specific characteristics, construction phase, and as listed factsheet constraints such as slope, site size or drainage area, and soils. All applicable design requirements must be met. Project owners/operators are required to adjust the BMP selection by scheduling necessary BMPs onsite for each construction phase and season to prevent pollutant discharge to the Storm Drain System. The City may require additional submittals of BMP plans prior to releasing permits for additional construction phases.
b. An appropriate BMP, or combination of BMPs, by construction phase for sediment control must be selected. Typically not every sediment control BMP listed in Table 3 will be required to meet this standard. The appropriate and effective BMP selection is based on site specific characteristics, construction phase, and as listed factsheet constraints such as slope, site size or drainage area, and soils. All applicable design requirements must be met. Project owners/operators are required to adjust the BMP selection by scheduling necessary BMPs onsite for each construction phase and season to prevent pollutant discharge to the Storm Drain System. The City may require additional submittals of BMP plans prior to releasing permits for additional construction phases.
c. Sediment Basins and Sediment Traps must be designed in accordance with the most current CASQA and City design requirements. Design must be conducted by a licensed CA professional engineer (PE). Maintenance, stabilization of slopes during construction, safety requirements, and Vector Control must be addressed in the design. Planned or future discharge or outlets must be approved by the City prior to installation.

Other BMPs that may also be required in some cases are identified using the following identifiers in column A.

d. Active Treatment Systems (ATS) may be required for Risk Level 3 Construction General Permit projects, as necessary to meet Construction General Permit requirements. The City at its discretion and based on project location, violation history, or other criteria may require ATS for projects of any Risk Level or for projects under 1 acre.
e. These BMPs may be used as part of the project's system of sediment-control BMPs (described in note "b" above) if approved by City staff.
f. This BMP may require securing additional regulatory permits prior to implementing. Permits must be on site prior to implementing these BMPs, including work in drainage channels.

Column B:

This column identifies BMPs that address situations that may also require permits or approvals from other agencies or other departments or divisions within the City (see Section 2). The project owner is responsible for determining which, if any, additional permit are necessary and securing the required permits prior to starting work. Acquisition of these permits may require additional time and engineering reports or submittals. The project owner is also responsible for maintaining compliance with the permits over the duration of the project, including completing any required monitoring and reporting.

A check mark (✓) in column B indicates that a permit or approval from another agency or another department or division within the City may be required. An "n/a" means that additional permits or approvals are typically not required. However, it is possible that in specific circumstances additional permits could also be required even for the BMPs marked as "n/a." An "n/a" does not guarantee that no other permit or approval is required.

Columns C and D:

These columns present the CASQA identification code and title for each factsheet. Unless specified differently in the Manual or the VMC, the City of Vista standard for BMP installation, use, location, and maintenance schedule is CASQA. BMP codes incorporate two letter abbreviations by BMP type, as follows: EC = Erosion Control; SE = Sediment Control; TC = Tracking Control; WE= Wind Erosion; NS = Non Stormwater Controls; WM = Waste Management. For more information see the CASQA website, www.casqa.org. Note that a subscription is required to view the CASQA factsheets, and the City of Vista does not provide subscription access.

Column E:

This column identifies which of the construction BMP categories listed in MS4 Permit Section E.4 are addressed by each CASQA factsheet. The MS4 Permit BMP categories are abbreviated as follows: PP = Project Planning; SMWM = Site Management, Housekeeping, Waste Management; NS = Non-Stormwater Management; EC= Erosion Control; SE = Sediment Control; RUROC: Run-on and Runoff Control; APS = Active/Passive Sediment Treatment Systems.

Column F:

This column identifies the pollutant(s) likely to be reduced by implementing each BMP. Pollutants addressed are a combination of designations by the CASQA factsheets and other studies identifying the effect of BMPs.

Column G:

This column identifies the construction phases during which a BMP is most likely to be applicable. Construction phases are defined as follows:

- **Grading ("G")**: Demolition, ROW Work, Site Preparation and Earthmoving, Earthwork, Construction or Relocation of Above Ground and Below Ground Structures and Utilities, channels, dewatering, hydrostatic testing of utilities and fire systems
- **Vertical ("V"):** Construction of Above Ground Structures to area 5 feet from Structures, Stucco, Framing, Mechanical, Roof, Painting, drain flushing, fire system testing (hydrants, sprinklers)
- **Finish ("F"):** Roadways, Slurry Seal, Asphalt, Concrete, Walkways, Parking Lots, Landscaping, Painting, Striping, Traffic/Lighting Facilities, Architectural

Column H:

This column identifies the objectives CASQA has defined for each BMP. While the primary objective is typically identified by the two digit letter code at the beginning of the BMP factsheet number (see notes on Column E above), many BMPs also provide additional secondary benefits. A "P" indicates a primary objective, and an "S" indicates a secondary objective. The CASQA objective abbreviations and their definitions are as follows: EC = Erosion Control; SE = Sediment Control; TC = Tracking Control; WE= Wind Erosion; NS = Non Stormwater Controls; WM = Waste Management.

3.4 BMP Requirements for Development Projects

~~The City's BMP requirements for new and re-development projects are presented in the Standard Urban Stormwater Mitigation Plan (SUSMP), which is included as Attachment A. These BMPs include, but are not limited to, site design, source control, and post-construction structural BMPs (e.g., flow control or treatment control devices).~~

~~3.4.1 Notice of Upcoming Changes to Requirements~~

In 2016, the City updated its BMP requirements for new and re-development projects to be consistent with the new MS4 Permit adopted in 2013. The updated requirements and associated guidance document (referred to as the "BMP Design Manual" in the MS4 Permit) has been prepared cooperatively with staff from multiple San Diego County municipalities and other interested parties. *The City of Vista BMP Design Manual For Permanent Site Design, Stormwater Treatment and Hydromodification Management* (June 2016) document is available on the City's Land Development website. Contact the City Engineering Department to determine project applicability requirements of these development standards. Projects requiring building permits only are also subject to BMP requirements, as guided by a pollution prevention checklist completed for all building permits issued. ~~Contact the City Engineering Department to determine project applicability requirements of these new development standards.~~

~~The City continues to publish notices and inform the development community of these new requirements as projects are submitted for Building Permit review. Contact the City Engineering Department to determine project applicability requirements of these new development standards.~~

Attachment A

~~Standard Urban Stormwater Mitigation Plan~~City of Vista BMP Design Manual For Permanent Site Design, Stormwater Treatment and Hydromodification Management

Also available at:

https://www.cityofvista.com/services/city-departments/community-development/building-planning-permits-applications/land-development-autocad-templates/storm-water-forms

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City of Vista BMP Design Manual

For Permanent Site Design, Stormwater Treatment and Hydromodification Management

Updated June 2016, Revised September 2021

CITY OF VISTA
CALIFORNIA

Summary of Document Updates

Date	Document Section(s)	Summary of Update
September 2021	Section 1.4.1	Removed the example and exclusion language pertaining to Order R9-2013-0001 Provision E.3.b.(1)(f) Greater than 1 Acre Disturbance Added language to describe pollutant generating development projects Removed item 3.b from the topic, Areas that may be excluded from impervious area calculations for determining if the project is a PDP
June 2016	Section 1.4.3	Added local 'green street' exemption consistent with Order No. R9-2013-0001
	Section 6.3.7	Removed text from title of section; section content unchanged
	Section 7.2	Clarified property owner as responsible party to conduct maintenance
	Section 8.1.1	Updated titles for forms and checklists
	Section 8.2.1	Updated titles for forms and checklists
	Section 8.2.1.1	Clarified use of O&M Plan template
	Section 8.2.2	Clarified requirements for construction plans
February 2016	New document	Replaced 2011 Standard Urban Stormwater Mitigation Plan with BMP Design Manual

Summary

In May 2013, the San Diego Regional Water Quality Control Board (SDRWQCB) issued a municipal storm water National Pollutant Discharge Elimination System (NPDES) permit (Permit). This Permit regulates discharges from Municipal Separate Storm Sewer Systems (MS4). The Permit covers the San Diego, Orange and Riverside County regions that are regulated by the SDRWQCB.

For the San Diego region, the permit went into effect in 2013 (Order No. R9-2013-0001).

Since the 2013 Permit substantially updates and expands storm water requirements for new development and redevelopment, this Best Management Practices (BMP) Design Manual replaces the City of Vista's (City's) 2011 Standard Urban Stormwater Mitigation Plan (SUSMP), which is part of the City's Stormwater Standards Manual.

Projects may not be "grandfathered" under the City's SUSMP without prior lawful approval from the City. Any development project that does not obtain prior lawful approval before the new requirements go into effect must update its design to comply with the new requirements. The City will apply the updated definition of prior lawful approval, adopted by the SDRWQCB on November 18, 2015 during the MS4 adoption hearing.

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 private and public developments, their representatives responsible for preparation of Storm Water Quality Management Plans (SWQMP) and the City's personnel responsible for review of these plans.

The following list summarizes 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 85^{th} 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 85^{th} 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 *(Biofiltration Standard and Checklist)*.

- There are fewer exemptions from hydromodification management, and certain categories of exemptions that are not identified in the MS4 Permit must be evaluated separately.
- 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 was revised.
- Hydromodification management requirements are expanded to include requirements to protect critical coarse sediment yield areas.
- If the City implements an alternative compliance program, offsite (alternative) compliance approaches are provided as an option to satisfy pollutant control or hydromodification management performance standards. Moreover, the MS4 Permit provides the City discretion 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 private and public projects. The MS4 Permit includes provisions for discretionary participation in an alternative compliance program and implementation of "Green Streets" design concepts. This manual, which precedes the development of local implementation guidance, neither **provides guidance for participation in an alternative compliance programs nor serves as a Green Streets design manual**. This manual only indicates the conditions under which project applicant--public or private, can seek to participate in alternative compliance or implement Green Streets at the discretion of the City. 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.

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 the storm water management requirements that are applicable to the project: source control BMPs, site design LID, pollutant controls, and hydromodification management. This chapter also introduces the procedural requirements for preparation, review, and approval of project submittals. General City requirements for processing project submittals are provided in this chapter.

Chapter 2 defines the performance standards for source control and site design LID 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 LID 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-through 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 City 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. In addition, this chapter pertains specifically to the content of project submittals, but not to specific details of City requirements for processing of submittals; it is intended to complement the requirements for processing 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[1] are presented in Chapter 4. Additional requirements applicable only to PDPs are presented in Chapters 5 through 7. While source control and site design LID 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.

[1] At the City's discretion, projects may be required to implement post-construction BMPs if applicable to the project.

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Appendices

Figures

Tables

List of Acronyms

303(d)	Refers to Clean Water Act Section 303(d) list of impaired and threatened waters
ASBS	Area of Special Biological Significance
ASTM	American Society for Testing and Materials
BF	Biofiltration (BMP Category)
BMPs	Best Management Practices
CEQA	California Environmental Quality Act
DCV	Design Capture Volume
DMA	Drainage Management Area
ESA	Environmentally Sensitive Area
FT	Flow-through Treatment Control BMP (BMP Category)
GLUs	Geomorphic Landscape Units
GR	General Requirements
HMP	Hydromodification Management Plan
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)
SC	Source Control
SCCWRP	Southern California Coastal Water Research Project
SD	Site Design
SDHM	San Diego Hydrology Model
SDRWQCB	San Diego Regional Water Quality Control Board
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

In coordination with the City's storm water program staff, this manual is intended to help a project applicant develop a Storm Water Quality Management Plan (SWQMP) for a development project (public or private) that complies with local and Municipal Separate Storm Sewer System (MS4) Permit requirements. Most applicants will require the assistance of a qualified civil engineer, architect, and/or landscape architect to prepare a SWQMP. Because every project is unique, the applicant should begin by checking specific requirements with the City's Engineering staff.

Unless stated otherwise, references to chapters or sections refer to portions of this BMP Manual.

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 Priority Development Project "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 planning, design, construction, operation, and maintenance processes, including associated City review and approval steps that lead to compliance. A flow chart that shows how to categorize a project in terms of applicable post-construction storm water requirements is included in Chapter 1. Table Ex-1 lists the sections of this Manual that address each project type.

TABLE Ex-1. Project type and Representative Sections

Project Type	Applicable Requirements		
	Source Control and Site Design (Chapter 4)	Storm Water Pollutant Control BMPs (Chapter 5)	Hydromodification Management BMPs (Chapter 6)
Non-"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[2]	X		
PDPs with only Pollutant Control Requirements	X	X	
PDPs with Pollutant Control and Hydromodification Management Requirements	X	X	X

[2] At the City's discretion, projects may be required to implement post-construction BMPs if applicable to the project.

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 to understand the meaning of key terms within the context of this manual, please refer to the List of Acronyms provided at the beginning of this document

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 Chapters 1 and 2; rather it is intended to help develop 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 into project plans and submittals at the appropriate time in the City review process. It also facilitates a common framework for discussion between the applicant and the reviewer. However, because each project is different, 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.

TABLE Ex-2. Final Steps in Using This Manual: Designing Best Management Practices (BMPs) and preparing documents for compliance based on project type, Standard or PDP

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 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.** Storm water quality compliance should be thoroughly understood 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, Site Design/Low Impact Development (LID) 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 **<u>retention</u> of the 85th percentile storm volume** (see Chapter 5). Flow-through treatment cannot be used <u>to</u> satisfy permit requirements, unless the project also participates in an alternative compliance effort (i.e., supporting an offsite restoration or rehabilitation project). Under some conditions, certain proprietary BMPs may be classified as "biofiltration" according to Appendix F of this manual *(Biofiltration Standard and Checklist)* and can be used for primary compliance with storm water pollutant treatment requirements (i.e., without alternative compliance).

- **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 Operation and Maintenance (O&M) of structural BMPs, select structural BMPs that can be effectively operated and maintained by the ultimate property owner, and include design measures to ensure access for maintenance and to control maintenance costs (see Chapter 7).

Chapter

1

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 City.

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 entitled "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 Municipal Separate Storm Sewer System (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 the City 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). The MEP standard includes the application of BMPs that are effective in decreasing the discharge of pollutants in storm water runoff. MEP is defined in the MS4 Permit and in Appendix I (*Glossary of Key Terms)*.

Different requirements apply to different project types.

The MS4 Permit requires all development projects to implement source control (preventing pollutants from coming into contact with storm water) and site design practices (treating storm water before it enters the storm drain system) that will minimize the generation of pollutants. While all development projects are required to implement source control and site design/Low Impact Development (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 Priority Development Projects (PDPs), are required to incorporate structural Best Management Practices (BMPs) into the project plan to reduce the discharge of pollutants and address potential hydromodification impacts resulting from changes in flow and sediment supply.

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, 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.

Whether a City permit or Storm Water Quality Management Plan (SWQMP) is required to be submitted, all Dischargers engaged in land development or redevelopment activities in the City shall implement post-construction Best Management Practices (BMPs) applicable to their project.

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[3] that meets the performance standards specified in the MS4 Permit. By following the process outlined in this manual, project applicants (for both private and public 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. 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.

Alternative BMP design approaches that meet applicable performance standards may also be

[3] 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 City, in their submittal, compliance with applicable performance standards without necessarily following the process identified in this manual.

acceptable.

If applicants choose not to use the unified BMP design approach presented in this manual, the submittal will need to demonstrate compliance with applicable performance standards. These performance standards are described in **Chapter 2** and in Section E.3.c of the MS4 Permit.

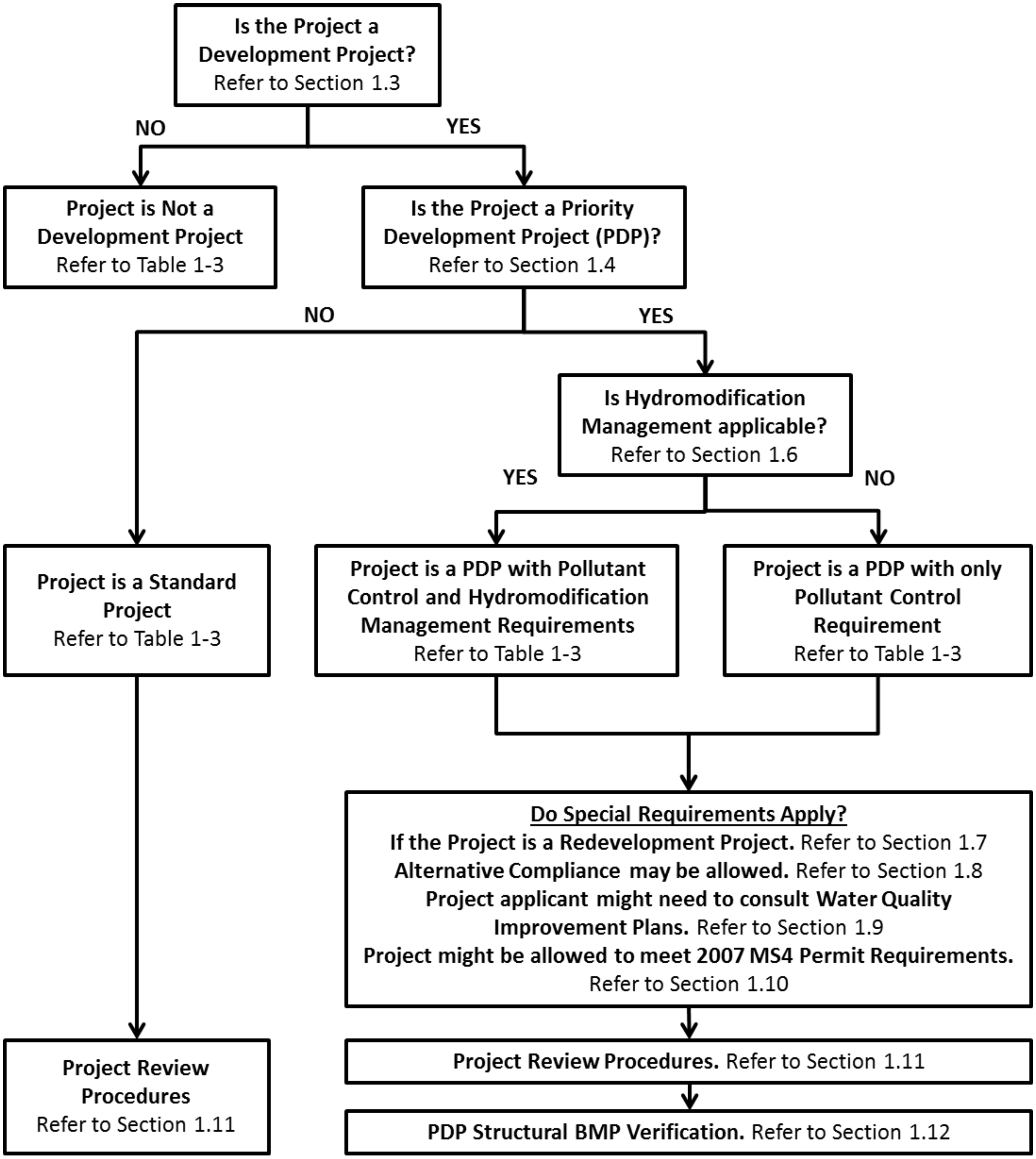


FIGURE 1-1. Procedural Requirements for a Project to Identify Storm Water Requirements

1.2.1 Determining Applicability of Permanent BMP Requirements

The following Table 1-1 reiterates the procedural requirements indicated in Figure 1-1 in a step-wise checklist format. The purpose of Table 1-1 is to guide applicants to appropriate sections in Chapter 1 to identify the post-construction storm water requirements applicable for a project. Table 1-1 is **not** intended to be used as a project intake form. A project applicability checklist of permanent, post-construction storm water BMP requirements, which is also used as a project intake form, is provided in Appendix A and titled "Project Determination Checklist".

TABLE 1-1. Checklist to Identify Applicable Post-Construction Storm Water Requirements

Step 1. Is the project a Development Project? See Section 1.3 for guidance. A phase of a project can also be categorized as a development project. If "Yes" then continue to Step 2. If "No" then stop here; Permanent BMP requirements do not apply i.e. requirements in this manual are not applicable to the project.	☐ Yes	☐ No
Step 2. Is the project a PDP?		
Step 2a. Does the project fit one of the PDP definitions a-f? **See Section 1.4.1 for guidance**. If "Yes" then continue to Step 2b. If "No" then stop here; <u>only</u> Standard Project requirements apply.	☐ Yes	☐ No
Step 2b. Does the project qualify for requiring meeting 2007 MS4 Permit requirements? **See Section 1.10 for guidance.** If "Yes" then continue to Step 2c. If "No" then go to Step 2d.	☐ Yes	☐ No
Step 2c. Does the project fit one of the PDP definitions in the 2007 MS4 Permit? **See** SD**RWQCB Order No. R9-2007-0001, Provision D.1.d.** If "Yes" then continue to Step 2d. If "No" then stop here; Standard Project requirements apply.	☐ Yes	☐ No
Step 2d. Do one of the exceptions to PDP definitions in this manual apply to the project? **See Section 1.4.3 for guidance.** If "Yes" then stop here; Standard Project requirements apply, along with additional requirements that qualify the project for the exception. If "No" then continue to Step 3; the project is a PDP.	☐ Yes	☐ No
Step 3. Is the Project Subject to Earlier PDP Requirements Due to a Prior Lawful Approval? **See Section 1.10 for guidance.** If "Yes" then you may follow the structural BMP requirements, including any hydromodification management exemptions, found in the earlier version of the SUSMP Model manual for the City. If "No" then continue to Step 4.	☐ Yes	☐ No
Step 4. Do Hydromodification Control Requirements Apply? **See Section 1.6 for guidance.** If "Yes" then continue to Step 4a. If "No" then stop here; PDP with only pollutant control requirements, apply to the project.	☐ Yes	☐ No
Step 4a. Does Protection of Coarse Sediment Supply Areas Apply? **See Section 1.6 for guidance.** If "Yes" then stop here; PDP with pollutant control and hydromodification management requirements and requirements to protect coarse sediment supply areas, apply to the project. If "No" then stop here; PDP with pollutant control and hydromodification management requirements, but exclusive of requirements to protect coarse sediment supply areas, apply to the project.	☐ Yes	☐ No

1.2.2 Determine Applicability of Construction BMP Requirements

Even if they are exempted from meeting some or all of the Permanent BMP requirements, all projects, or phases of projects are required to implement temporary erosion, sediment, good housekeeping and pollution prevention BMPs to mitigate storm water pollutants during the construction phase. For further information on these requirements, see **Section 3.3 of the City's Stormwater Standards Manual titled "Minimum BMP Requirements, Construction"**.

1.3 Defining a Project

Not all site improvements are considered "development projects" under the MS4 Permit.

This manual is intended for new development and redevelopment projects, inclusive of both private- and public-funded projects. Development projects are defined by the MS4 Permit as "construction, rehabilitation, redevelopment, or reconstruction of any public or private projects". Development projects are issued local permits to allow construction activities. To further clarify, this manual applies only to new development or redevelopment activities and/or projects 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 follows: 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. "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. This requirement precludes "piece-mealing," which is the improper (and often artificial) separation of a project into smaller parts to avoid preparing Environmental Impact Report level documentation.

As indicated above, for the purposes 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, thereby resulting in increased flows and storm water pollutants.

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 1-2 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 1-2 then permanent BMP requirements do not apply to the project i.e. requirements in this manual are not applicable. If permanent BMP requirements apply to a project, Sections 1.4 to 1.7 will further 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 more specific requirements for projects that are classified as PDPs.

TABLE 1-2. Applicability of Permanent, Post-Construction Storm Water Requirements

Do permanent storm water requirements apply to your project?
Requirements DO NOT apply to:
Replacement of impervious surfaces that are part of a routine maintenance activity, such as: • Replacing roof material on an existing building • Rebuilding a structure to original design after damage from earthquake, fire or similar disasters • Restoring pavement or other surface materials affected by trenches from utility work • Resurfacing existing roads and parking lots, including slurry, overlay and restriping • Routine replacement of damaged pavement, including full depth replacement, if the sole purpose is to repair the damaged pavement • Resurfacing existing roadways, sidewalk, pedestrian ramps or bike lanes on existing roads • Restoring a historic building to its original historic design • Routine replacement of damaged pavement, such as pothole repair **Note**: Work that creates impervious surface outside of the existing impervious footprint is not considered routine maintenance. 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 building (does not include building additions or projects where the existing building is demolished)

1.4 Is the Project a PDP?

MS4 Permit Provision E.3.b.(1)

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 City. Section 1.4.3 presents specific local 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 PDP Project Form 1. 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 residential 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, residential, mixed-use, and public development projects on public or private land.

(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.

(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 discharge 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; 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 City.

For projects adjacent to an ESA, but not discharging to an ESA, the 2,500 sq-ft threshold does not apply as long as the project does not physically disturb the ESA and the ESA is upstream of the project.

There are no Areas of Special Biological Significance (ASBS) or State Water Quality Protected Areas in the City's jurisdiction. The ESAs within the City's boundaries which include 303(d)-listed impairments and RARE beneficial use designations are listed below:

- Agua Hedionda Creek
- Buena Creek
- Buena Vista Creek
- Loma Alta Creek

(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 satisfies the City of Vista that pollutants in stormwater discharges will not exceed pre-construction background levels.

Areas that may be excluded from impervious area calculations for determining if the project is a PDP:

(a) Consistent with Table 1-2, areas of a project that are considered exempt from storm water requirements (e.g. routine maintenance activities, resurfacing, etc.) shall not be included as part of "added or replaced" impervious surface in determining project classification.

Redevelopment projects may have special considerations with regard to the total area required to be treated. Refer to Section 1.7.

1.4.2 Local Additional PDP Categories and/or Expanded PDP Definitions

The City of Vista does not have additional PDP categories, nor expanded PDP definitions, that would apply to Section 1.4.1.

1.4.3 Local PDP Exemptions or Alternative PDP Requirements

The City of Vista allows for PDP Exemptions as defined by the MS4 Permit:

(a) New or retrofit paved sidewalks, bicycle lanes, or trails that meet the following criteria:

(i) Designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas; OR

(ii) Designed and constructed to be hydraulically disconnected from paved streets or roads; OR

(iii) Designed and constructed with permeable pavements or surfaces in accordance with USEPA Green Streets guidance (see reference below).

(b) Retrofitting or redevelopment of existing paved alleys, streets or roads that are designed and constructed in accordance with USEPA Green Streets guidance (see reference below).

See "Managing Wet Weather with Green Infrastructure – Municipal Handbook: Green Streets" *USEPA 2008).

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			
Standard Project[4]	☑	☑	NA	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.

1.6 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. Exemptions typically require direct discharge of storm water to channels lined by concrete contiguously to the Pacific Ocean, or discharge to the ocean itself. As a

[4] At the City's discretion, projects may be required to implement post-construction BMPs if applicable to the project.

result, some of these exemptions are not applicable to projects within the City of Vista. However, all potential exemptions are discussed below.

PDP exemptions from hydromodification management requirements are based on the receiving water system.

It is unlikely that any of the following exemptions will apply in the City of Vista. However, the City has 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 City as appropriate for an exemption by the optional Watershed Management Area Analysis (WMAA) incorporated into the Water Quality Improvement Plan (WQIP) pursuant to Provision B.3.b.(4) of the MS4 Permit.

- San Luis Rey River from Pacific Ocean to upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15;
- Existing underground storm drains or concrete-lined channels discharging directly to the recommended exempted reach of the San Luis Rey River. These systems were identified based on storm drain data provided by the City via data call. These systems may not represent all discharges to exempt bodies or rivers. Additional systems may be considered exempt if there is no evidence or erosion at the storm drain outfall of the conveyance system, and any other critical determined by the City.

The above criteria reflects the latest list of exemptions that are allowed under the MS4 Permit and therefore supersedes criteria found in earlier publications.

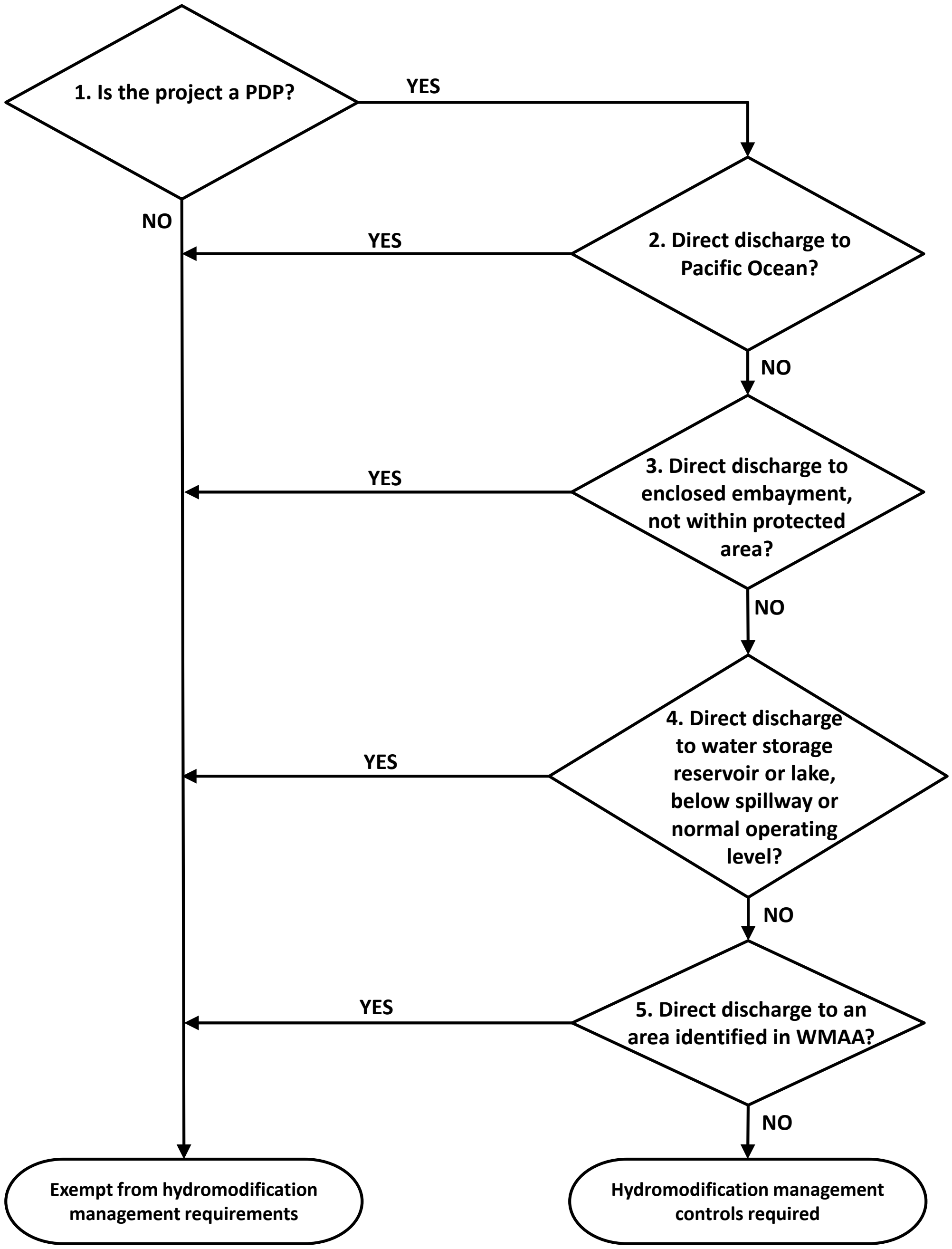
Refer to Figure 1-2 and the associated criteria describing nodes in Figure 1-2 to determine applicability of hydromodification management requirements. The criteria reflect the latest list of exemptions that are allowed under the 2013 MS4 Permit, and therefore supersede criteria found in earlier publications.

- **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.
    - o 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 , 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 not applicable to the City at this time.
- **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.
  - o 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 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:
  - o 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 City Engineer, but shall never exceed the 100-year floodplain elevation. The City Engineer 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 Percent 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 50 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 50 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 Percent 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 Percent Rule Test**</u>: Is step 4 more than 50 Percent 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 square foot development proposes replacement of 4,000 square feet of impervious area. The treated area is less than 50 percent of the total development area and only the 4,000 square foot 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.

The Permit provides the City with the discretion to independently develop an alternative compliance program for its jurisdiction.

As of the effective date of this Manual, the City has not developed an alternative compliance program or options.

However, the City may allow an applicant to implement an alternative compliance project in lieu of complying with applicable structural BMP requirements on site. In this scenario, the applicant is fully responsible for the alternative compliance project design, construction, operation and long term maintenance. Also in this scenario, applicant-proposed alternative compliance projects would not be authorized by the City until the San Diego Regional Water Quality Board approves the project and the water quality equivalency calculations.

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-through treatment controls and offsite mitigation of the DCV not retained onsite.

PDP applicants may be allowed to participate in an alternative compliance program by using onsite BMPs to treat offsite runoff. PDP applicants must consult the City manuals for specific guidelines and requirements for using onsite facilities for alternative compliance.

The PDP applicant utilizing the alternative compliance program would (at a minimum) provide flow-through treatment control BMPs onsite, then fund, contribute to, or implement an offsite alternative compliance project deemed by the City-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 locations 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). PDP applicants must consult the City 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 the City <u>may allow for PDP applicants to proceed directly to an alternative compliance project without</u>

demonstrating infeasibility of retention and/or biofiltration BMPs onsite.

Participation in an alternative compliance program also requires onsite flow-through treatment control BMPs.

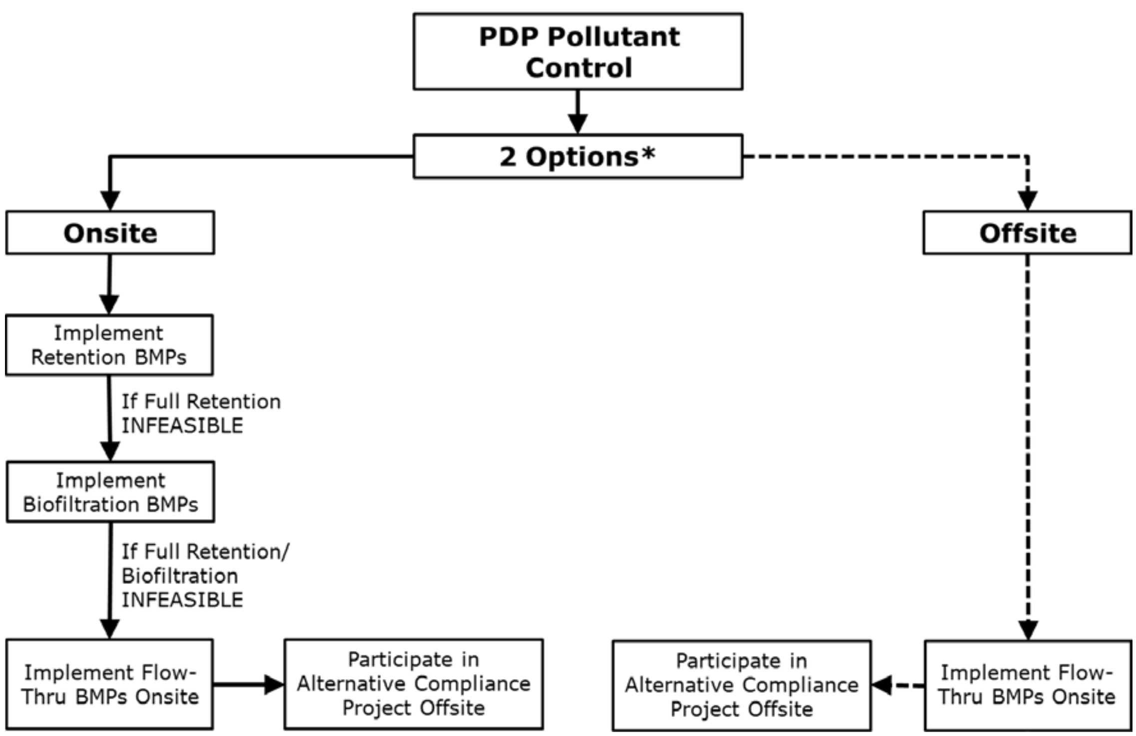
Participation in an offsite alternative compliance project **and** the obligation to implement flow-through treatment controls for the DCV not reliably retained or biofiltered onsite, are linked and cannot be separated. The PDP should consult with the City regarding processing requirements if this is 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

Since the City of Vista does not currently offer an alternative compliance program, the Water Quality Equivalency (WQE) calculation must be accepted by the San Diego Water Board. 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 a regional and technical basis for demonstrating a greater water quality benefit for the watershed.



*PDPs may be allowed to directly participate in an offsite project without demonstrating infeasibility of retention and/or biofiltration BMPs onsite if the project applicant demonstrates that the San Diego Regional Board has approved the project for alternative compliance.

FIGURE 1-3. Pathways to Participating in Alternative Compliance Program

The City does not currently administer an alternative compliance program; however, the City may allow an applicant to implement an alternative compliance project in lieu of complying with applicable structural BMP requirements 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 City 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 toward addressing the conditions in the watershed. The MS4 Permit also provides an option to perform a Watershed Management Area Analysis (**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-through treatment BMPs, selection of the type of BMP shall consider the pollutants and conditions of concern. 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

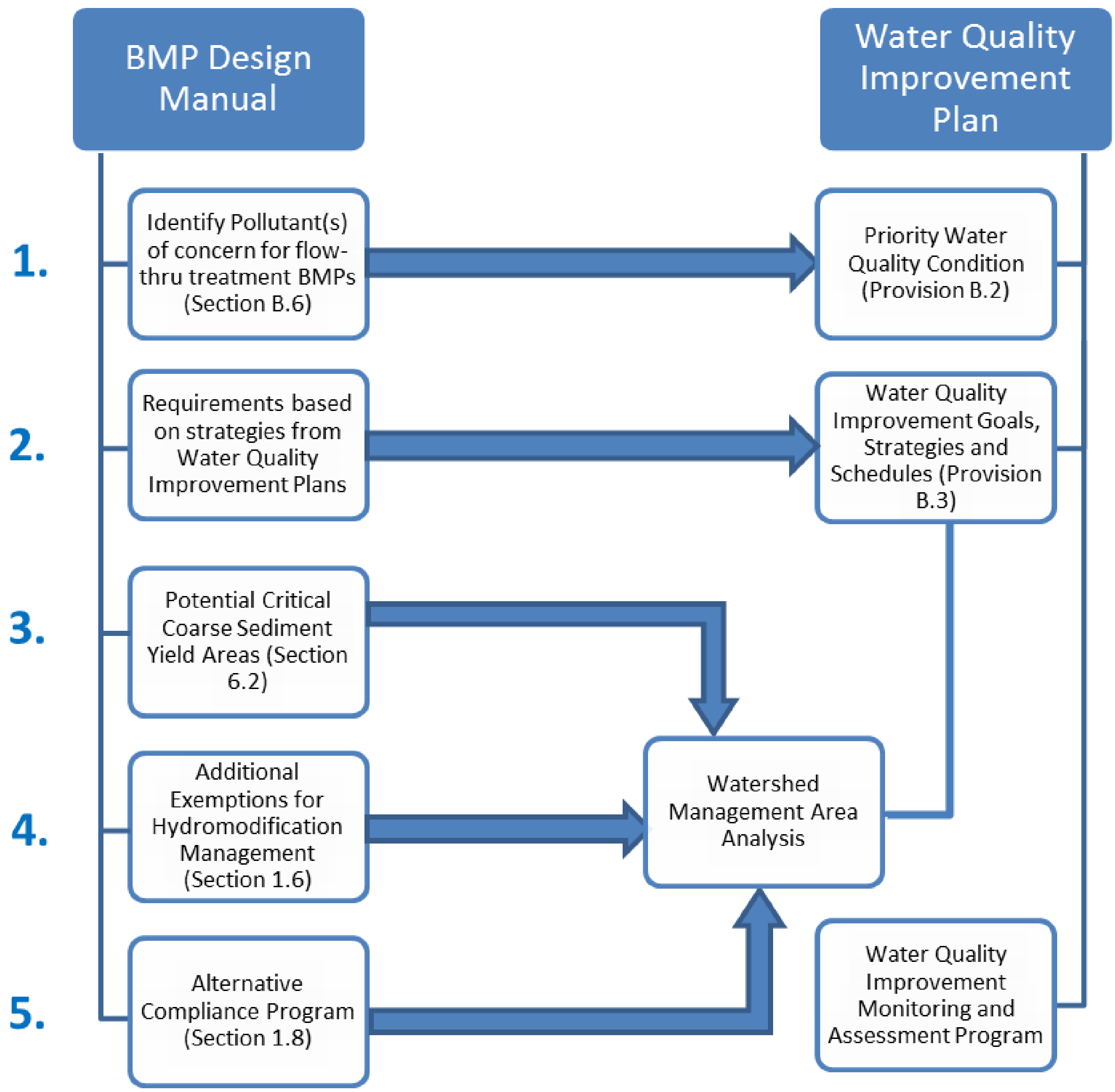
Section 1.8.[5]

The City of Vista is located within the Carlsbad and San Luis Rey Watershed Management Areas (WMA). The City has collaboratively developed WQIPs in these two WMAs along with the other responsible agencies, which can be found at the Project Clean Water website at:

www.projectcleanwater.org

At this website, click on the "Watersheds" tab to be directed to WMA-specific documents and information.

These relationships between this manual and WQIP are presented in Figure 1-4.



[5] Currently, the City of Vista does not have an alternative compliance program in place.

FIGURE 1-4. Relationship between this Manual and WQIP

1.10 Storm Water Requirement Applicability Timeline

MS4 Permit Provision E.3.e.(1)(a)

By February 16, 2016, the City anticipates adopting the updated requirements and associated BMP Design Manual in accordance with the 2013 MS4 Permit. The City has informed the development community of these new requirements. Project applicants who anticipate acquiring City approvals for construction prior to February 16, 2016, or initiating construction near then, are advised to contact the City Engineering Department to evaluate applicability of the new requirements.

Until the City's Manual is formally implemented, the City's current Stormwater Standards Manual will be an effective guidance document for PDPs.

1.11 Project Review Procedures

The City reviews project plans for compliance with applicable requirements of this manual and the MS4 Permit.

Specific submittal requirements for documentation of permanent, post-construction storm water BMPs may vary by project type; however, in all cases the project applicant must provide sufficient documentation to demonstrate that applicable requirements of the BMP Design Manual and the MS4 Permit will be met.

For Standard Projects, this typically means using forms and/or a Standard Project SWQMP or other equivalent documents approved by the City Engineer to document that the following general requirements of the MS4 Permit are met, and show applicable features for onsite grading, building, improvement and landscaping plans:

- BMP Requirements for All Development Projects, which include 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 typically means preparing a PDP SWQMP to document that the following general requirements of the MS4 Permit are met, and showing applicable features for onsite grading and landscaping plans:

- BMP Requirements for all Development Projects, which include 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 include 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 City Engineer must be provided with the first submittal of a project or another preliminary planning stage defined by the City. 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.

1.12 PDP Structural BMP Verification

MS4 Permit Provision E.3.e.(1)

Structural BMPs will be verified by the City prior to project occupancy.

Pursuant to MS4 Permit Provision E.3.e.(1), the City will require and confirm the following with respect to PDPs constructed within the City's jurisdiction:

(a) The City will 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) The City will 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].

(c) The City will require that the Engineer of Record add structural BMPs to the "line and grade letter".

For PDPs, this means that after structural BMPs have been constructed, the current City Engineer may request the project owner 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 City Engineer may require inspection of the structural BMPs at each significant construction stage and at completion. Following construction, the City may require an addendum to the SWQMP and as-built drawings to address any changes to the structural BMPs that occurred during construction that were approved by the City Engineer. The City may also require a final update to the O&M Plan, and/or execution of a maintenance agreement that will be recorded for the property. A maintenance agreement that is recorded with the property title can then be transferred to future owners.

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 City 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 Municipal Separate Storm Sewer System (MS4) Permit establishes separate performance standards for (1) source control and site design practices, (2) storm water pollutant control Best Management Practices (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 Background of Hydromodification Principles

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. 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 and provides additional background on hydromodification processes and resulting problems.

2.2 Source Control and Site Design Requirements for All Development Projects

2.2.1 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 Priority Development Projects (PDPs)) when local permits are issued, including unpaved roads and flood management projects.

2.2.1.1 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).

2.2.1.2 Source Control Requirements

Source control BMPs are features that must be implemented to address specific sources of pollutants at *all* development project sites.

The following source control BMPs must be implemented at all development projects where applicable and technically feasible:

(a) Prevention of illicit discharges into the storm drain system;

(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 City to minimize pollutant generation at each project.

Further guidance is provided in Section 2.1.2 and Chapter 4 of this BMP Manual.

2.2.1.3 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 Low

Impact Development (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)[6];

(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;

(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 storm drain system;

(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 storm drain system 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 City 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.

[6] 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.

2.2.2 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 that exceed what would occur naturally. The increased pollutant loads, storm water volume, discharge rates and velocities, and discharge durations from the storm drain system 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 seek to control storm water at the source. This source control is achieved by using small-scale integrated site design and management practices to mimic the natural hydrology of a site. Examples of these approaches include retaining storm water runoff by minimizing soil compaction and impervious surfaces and by disconnecting storm water runoff from conveyances to the storm drain system. Moreover, 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 design tends to be more flexible in the early stages of project planning when plans are less 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 the 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 the 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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods).* 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 standards 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 standards specify that onsite BMPs must remove pollutants from runoff prior to discharging to any receiving waters or the storm drain system, 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.

2.3 Storm Water Pollutant Control Requirements for PDPs

2.3.1 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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)* 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 for the remaining volume not reliably retained. Biofiltration BMPs must be designed as described in Appendix F *(Biofiltration Standard and Checklist)* to have an appropriate hydraulic loading rate to maximize storm water retention and pollutant removal, as well as to prevent erosion, scouring, 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-through 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.

(ii) If biofiltration BMPs are not technically feasible, then the PDP shall utilize flow-through 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-through treatment control BMPs must be sized and designed to:

[a]. Remove pollutants from storm water to the Maximum Extent Practicable (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 inches 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-through 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 if an alternative compliance program is available, 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-through treatment control BMPs must be implemented to treat the portion of the DCV that is not reliably retained onsite. Flow-through 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 Watershed Management Area Analysis (WMAA) of the Water Quality

Improvement Plan (WQIP) if the requirements in Section 1.8 are met at the discretion of the City Engineer.

Demonstrations of feasibility findings and calculations to justify BMP selection and design shall be provided by the project applicant in the Storm Water Quality Management Plan (SWQMP) to the satisfaction of the City Engineer. Methodology to demonstrate compliance with the performance standards, described above, applicable to storm water pollutant control BMPs for PDPs is detailed in Chapter 5.

2.3.2 Concepts and References

Retention BMPs are the most effective type of BMPs to reduce pollutants discharging to the storm drain system 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 storm drain system). 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 storm drain system, 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 property owners and the City. 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 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, (*Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods*) and Appendix F (*Biofiltration Standard and Checklist)*. 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-through 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-through 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-through 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 are 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).[7]

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:

2.3.2.1 Best Management Practices (BMPs)

To minimize confusion, this manual considers all references to "structures (structural)", "facilities," "features," or "controls" to be incorporated into development projects as BMPs.

2.3.2.2 DCV

The MS4 Permit requires pollutants to 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 a 30-year 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.

2.3.2.3 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, per the SWQMP templates in Appendix A:

- The PDP applicant first needs to implement **all** feasible onsite retention BMPs needed to meet the storm water pollutant control BMP requirements prior to implementation of onsite biofiltration BMPs.
- The PDP applicant will then implement onsite biofiltration BMPs prior to implementation of onsite flow-through treatment control BMPs.

[7] Currently, the City of Vista does not have an alternative compliance program in place.

- PDPs may be allowed to participate in an alternative compliance program[8]. 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.

Flow-through treatment control BMPs: Structural measures that provide flow-through treatment as part of the pollutant control strategy. Examples include vegetated swales and media filters.[9]

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 at a future date, if the City 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 *[Geotechnical and Groundwater Investigation Requirements]* and D *[Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs]*) 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 demonstrating that it is only technically feasible to implement biofiltration BMPs 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-through treatment control BMPs to treat the pollutants in the remaining 2,000 ft^3. Refer to Appendix B.6 for guidance for designing flow-through 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.

2.3.2.4 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

[8] Currently, the City of Vista does not have an alternative compliance program in place.
[9] Currently, the flow through treatment in not an option as the City of Vista does not have an alternative compliance program in place.

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 the selection of BMPs that are undesirable for a given site; and
- As part of an approved WMAA **and** an alternative compliance program developed or promoted by the City where the project resides, 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.

2.3.2.5 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, scouring, and channeling within the BMP. To meet these required goals, Appendix F *(Biofiltration Standard and Checklist)* of this manual has guidance for hydraulic loading rates and other biofiltration design criteria. Appendix F also has a checklist that will need to be completed by the project Storm Water Quality Management Plan (SWQMP) preparer during plan submittal. Guidance for sizing biofiltration BMPs is included in Chapter 5 and Appendices B.5 and F.

2.3.2.6 Flow-through Treatment Control BMPs (for use with Alternative Compliance)

MS4 Permit Requirement E.3.d.2-3

The MS4 Permit requires that the flow-through treatment control BMP selected by the PDP applicant be ranked with high or medium pollutant removal efficiency for the most significant pollutant of concern identified by the WQIP where the project is located. Steps to select the flow-through 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-through treatment control BMP for the identified most

significant pollutant of concern

Methodology for sizing flow-through treatment control BMPs and the resources required to identify the pollutant(s) of concern and effectiveness of flow-through treatment control BMPs are included in Chapter 5 and Appendix B.6.

2.4 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 City 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 City 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 City Engineer; or
- 0.5Q2 to Q10 for streams with low susceptibility to erosion and which has a stream susceptibility study prepared and approved by the City Engineer.

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 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.

2.5 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 the following: post-project runoff, the potential transport of pollutants offsite, and 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. 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 these objectives are BMPs that are based on the 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 Best Management Practices (BMPs), as applicable, requires coordination of site, landscape, and project storm water plans. It also involves provisions for Operation and Maintenance (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 Priority Development Projects (PDPs).

STEP 1: **Coordinate Between Disciplines** Refer to Section 3.1	*Purpose:* Engage and coordinate with owner 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.

City-specific requirements to consider during project planning and design 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.

Owner:

- 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., California Environmental Quality Act (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, and 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 Storm Water Quality Management Plan (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

In order 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 and submittal templates in Appendix A *(SWQMP Submittal Templates)* 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 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 (Standard Project Form 2).

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. Conceptual layout of the project site must consider the following items:

a. Can onsite critical coarse sediment yield areas be avoided?
b. What measures will be necessary to ensure that the conveyance of coarse sediment from critical coarse sediment yield areas within the site is uninterrupted?
c. If critical coarse sediment yield areas within the site are not avoided, or conveyance of critical coarse sediment will be interrupted, how will this be mitigated?
d. If runoff from upstream, offsite critical coarse sediment yield areas will be conveyed through the project site, what measures will be necessary to ensure the conveyance of coarse sediment from offsite is uninterrupted?

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.

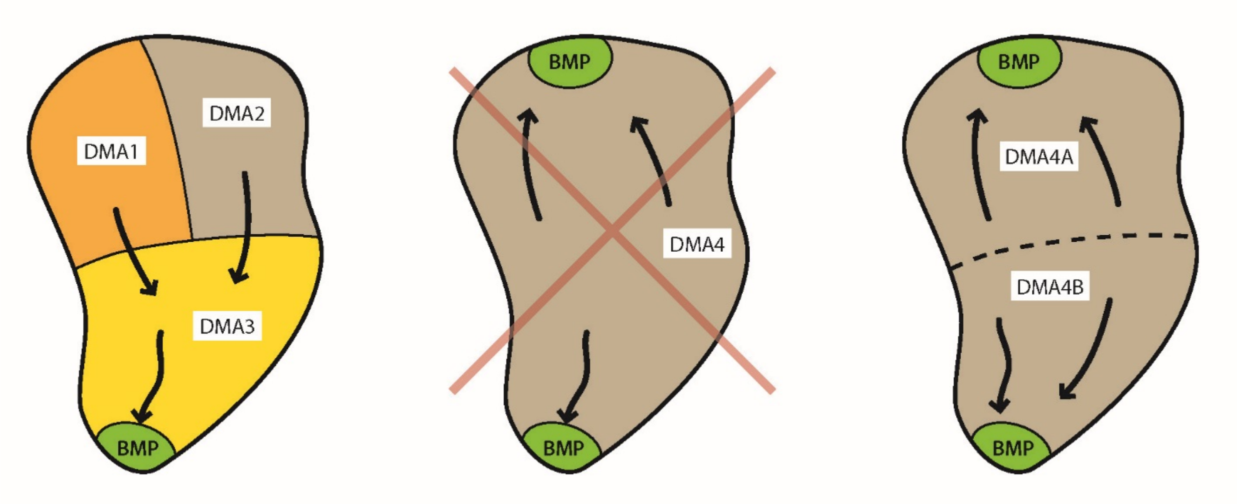


FIGURE 3-2. DMA Delineation

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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods*) provides guidance in estimating the runoff factor for the drainage area draining to a BMP.

BMPs must be sized to treat the Design Capture Volume (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.

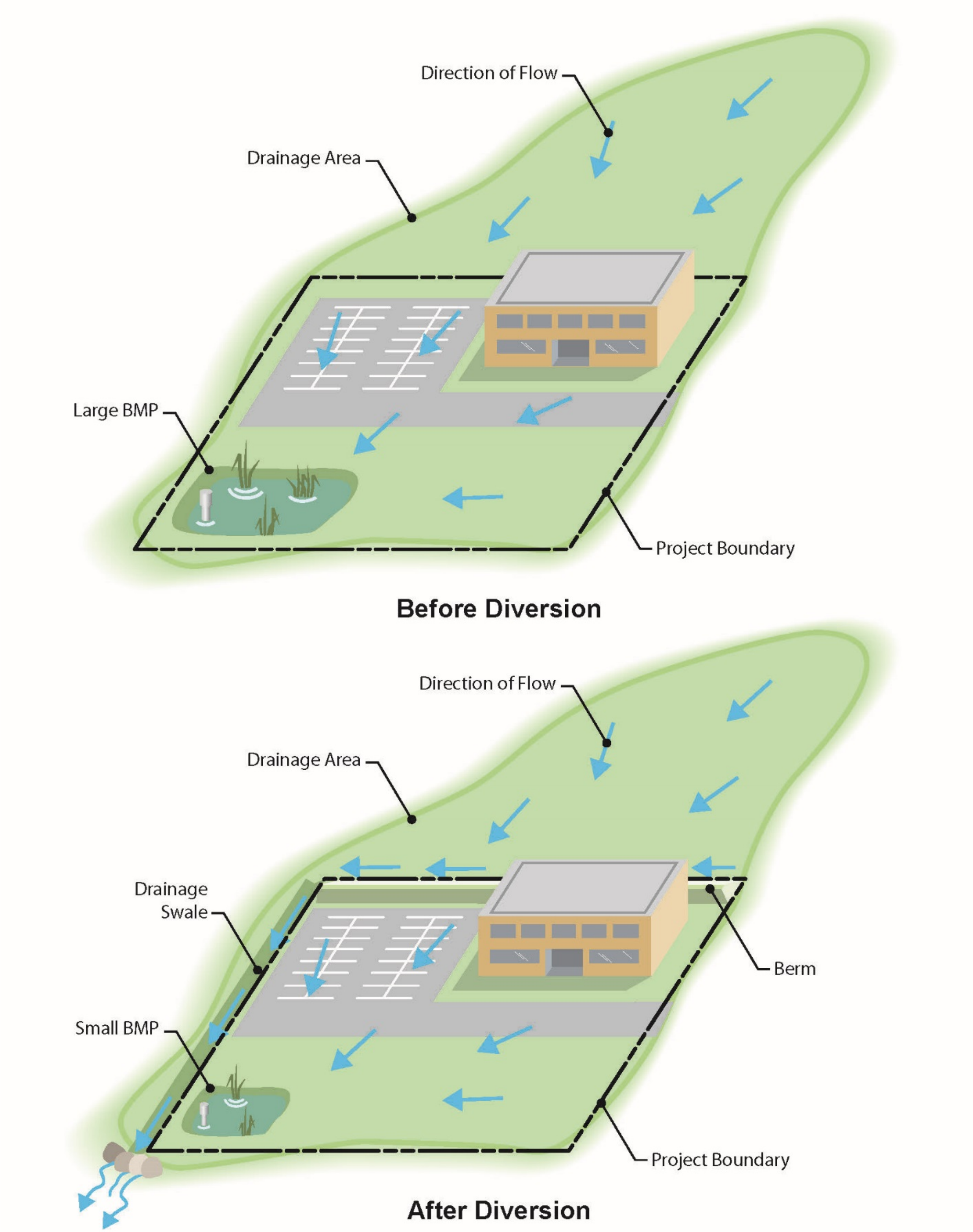


FIGURE 3-3. Tributary Area for BMP Sizing

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 (PDP Project Form 2)).
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 identify 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 *(Geotechnical and Groundwater Investigation Requirements)* and D (*Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs)*provide methods for geotechnical and groundwater assessment applicable for screening at the planning level and design-level requirements. The City may allow alternate assessment methods with appropriate documentation at the discretion of the City Engineer.

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, provide necessary site planning allowances (access roads, inspection openings, setbacks, etc.), and coordinate with the City 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 City. In addition consider the use of the site. Some BMPs may not be suitable for maintenance by individual home owners.
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-through 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-through 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 controls. 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-through 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-through 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

Chapter 7 (Long-Term Operation and Maintenance) presents the mechanisms and requirements for ensuring long-term functionality of structural BMPs constructed at development sites. Because structural BMPs must remain functional in perpetuity, BMP maintenance should be considered early in the project planning process. Adequate access must be provided for structural BMPs for inspection and maintenance activities. Site features necessary to complete these activities may impact project site layout (such as structures, easements, equipment accessibility, maintenance equipment, or inspection ports).

3.6 Phased Projects

As part of an application for approval of a phased development project, fully designed reports for all phases of the project shall be required. The project submittal shall describe and illustrate how the drainage and BMP design for the project will comply with the Manual requirements. The level of detail in the project submittal should be consistent with the scope and level of detail of the development approval being considered.

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, including Standard Projects and Priority Development Projects (PDPs). Standard and Priority Development Project SWQMP templates are included Appendix A *(SWQMP Submittal Templates)* and can be used to document conformance with the requirements.

4.1 General Requirements (GR)

GR-1: Onsite Best Management Practices (BMPs) must be located 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.

> <u>**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.</u>

GR-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 the City.

> <u>**How to comply**: Projects shall demonstrate compliance with this requirement by showing the location of BMPs on project plans, and describe or depict the location of receiving waters.</u>

GR-3: Onsite BMPs must be designed and implemented with measures to avoid the creation of nuisances or pollution 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 likely to support 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. For water retained in biofiltration facilities that are not accessible to mosquitoes, this criteria is not applicable (e.g., 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 *(BMP Design Fact Sheets)* provides guidance for identifying source control BMPs applicable to a project. The "Source Control BMP Checklist for All Development Projects" or Standard Project Form 3 and PDP Project Form 3, shall be used to document compliance with source control BMP requirements.

SC-1: Prevent illicit discharges into the storm drain system

An illicit discharge is any discharge to the storm drain system 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 storm drain system. 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.

SC-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 City. 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.

SC-3: Protect *outdoor material storage areas* 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; or
  - Covered and elevated (e.g. on pallets) to avoid storm water contact
- 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.

SC-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.

SC-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 or awnings on all trash enclosures, to minimize exposure.
- Locate storm drains away from the 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.

SC-6: Use any additional BMPs determined to be necessary by the City to minimize pollutant generation at each project site

Appendix E *(BMP design Fact Sheets)* 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. The applicant shall implement all applicable and feasible source control BMPs listed in Appendix E.

4.3 Site Design (SD) BMP Requirements

Site design BMPs (also referred to as Low Impact Development (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.

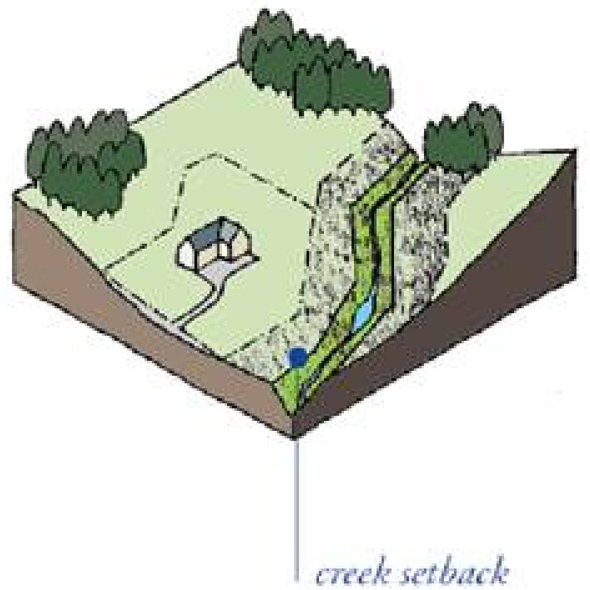
Site design BMPs shall be applied to all development projects as appropriate and practicable for the project site and project conditions. Site design BMPs are described in the following subsections.

> **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," or Standard Project Form 4 and PDP Project Form 4, shall be used to document compliance with site design BMP requirements.

SD-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, because 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 setback 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 City for other specific requirements.



Source: County of San Diego LID Handbook

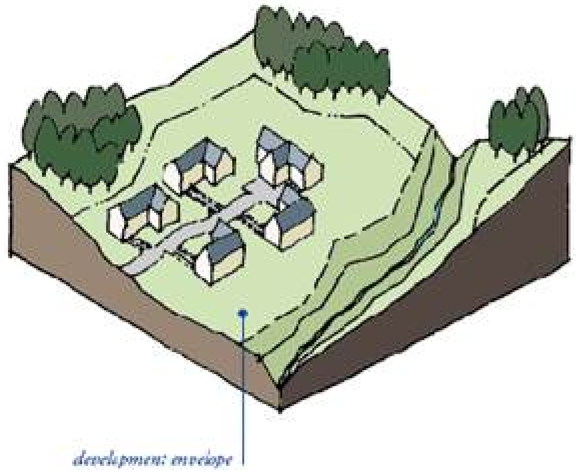
Projects can incorporate SD-1 into a project by implementing the following planning and design phase techniques as applicable and practicable:

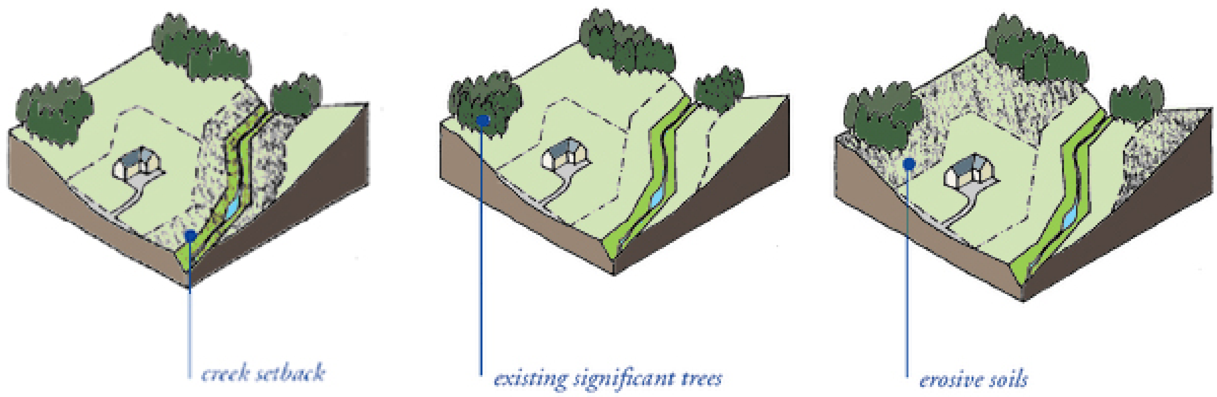
- Evaluate surface drainage and topography in considering selection of Site Design BMPs that will be most beneficial for a given project site. Where feasible, maintain topographic depressions for infiltration.
- Optimize the site layout and reduce the need for grading. Where possible, conform the site 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 Regional Water Quality Control Board (SDRWQCB), California Department of Fish and Wildlife; U.S. Army Corps of Engineers, etc.) prohibits maintenance or activity in the area.

SD-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.



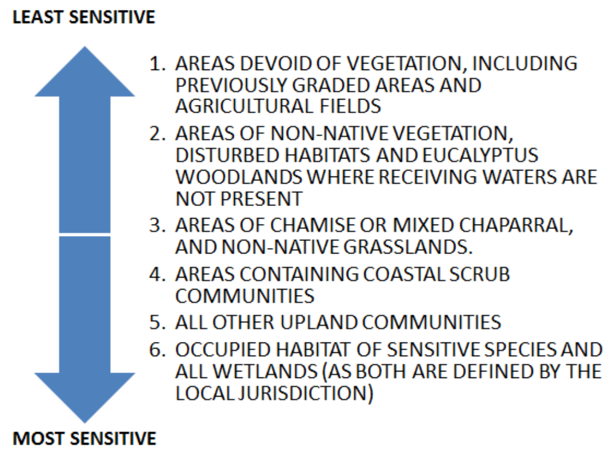


The upper soil layers of a natural area contain organic material, soil biota, vegetation, and a configuration favorable for storing and slowly conveying storm water and establishing or restoring vegetation to stabilize the site after construction. The canopy of existing native trees and shrubs also provide 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 City for specific requirements for mitigation of removal of sensitive areas.

Projects can incorporate SD-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.

SD-3: Minimize impervious area

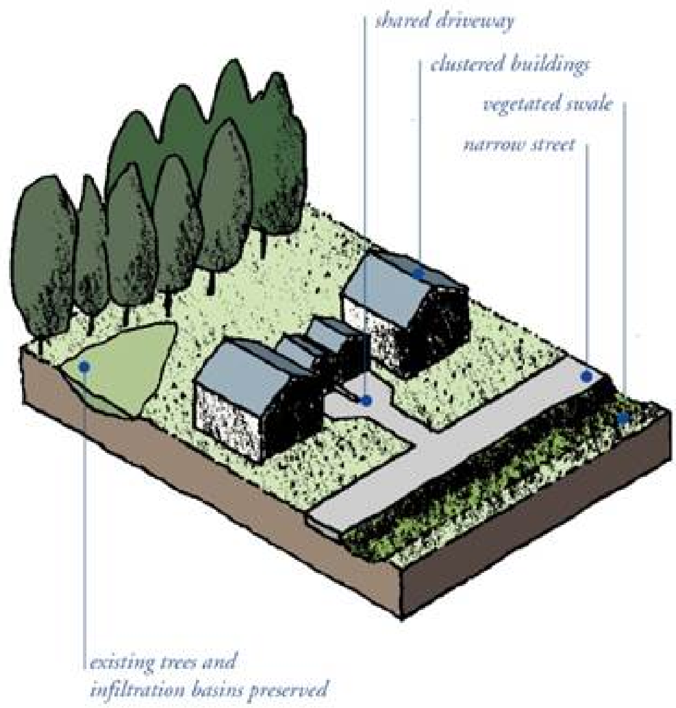
- Construct streets, sidewalks or parking lots aisles to the minimum widths necessary, provided public safety is not compromised
- Minimize the impervious footprint of the project

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 the 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 SD-3 by implementing the following planning and design phase techniques as applicable and practicable:



Source: County of San Diego LID Handbook

- 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.
- 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.

SD-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 SD-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.

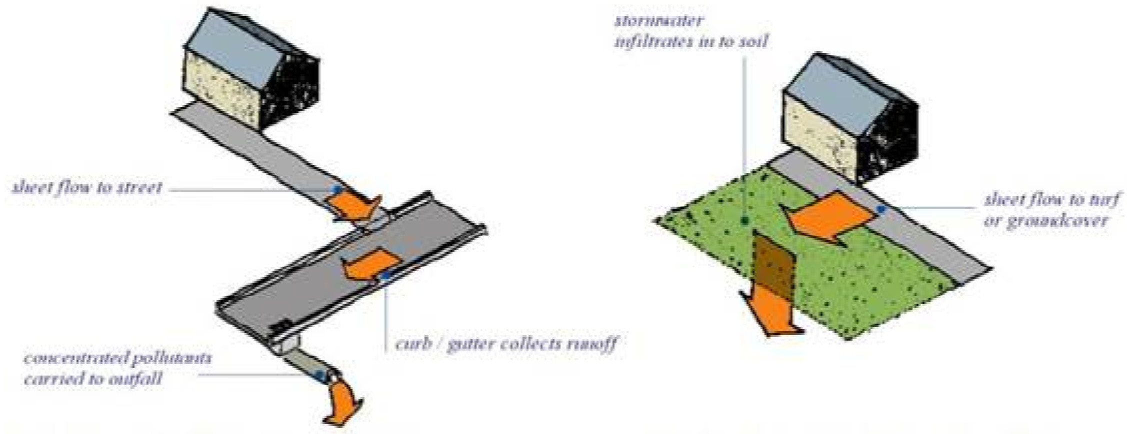
SD-5: Disperse impervious areas

- 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 storm drain system

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 Design Capture Volume (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. Low retaining walls can be used to create terraces that can accommodate BMPs.



Source: County of San Diego LID Handbook

Projects can incorporate SD-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 (SD-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 percent.

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 storm drain system and receiving waters

- Use permeable material for projects with low traffic areas and appropriate soil conditions

Control of storm water runoff from the site on a micro scale can be accomplished by applying small collection techniques (e.g. green roofs), or integrated management practices, on small sub-catchments or on residential lots. Small collection techniques foster opportunities to maintain the natural hydrology and provide a much greater range of control practices. This allows a project applicant to integrate 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 palettes that minimize required resources (irrigation, fertilizers and pesticides) and pollutants generated from landscape areas. Native plants require fewer 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.

Projects can incorporate SD-7 by landscaping with native and drought-tolerant species. A recommended plant list is included in Appendix E (Fact Sheet PL, Page E.20).

SD-8: Harvest-and-use precipitation

Harvest-and-use BMPs capture and store 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.

Photograph Courtesy of Arid Solutions, Inc.

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), fewer 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 Best Management Practices (BMPs) discussed in Chapter 4, Priority Development Projects (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-through treatment of storm water runoff generated on the project site.

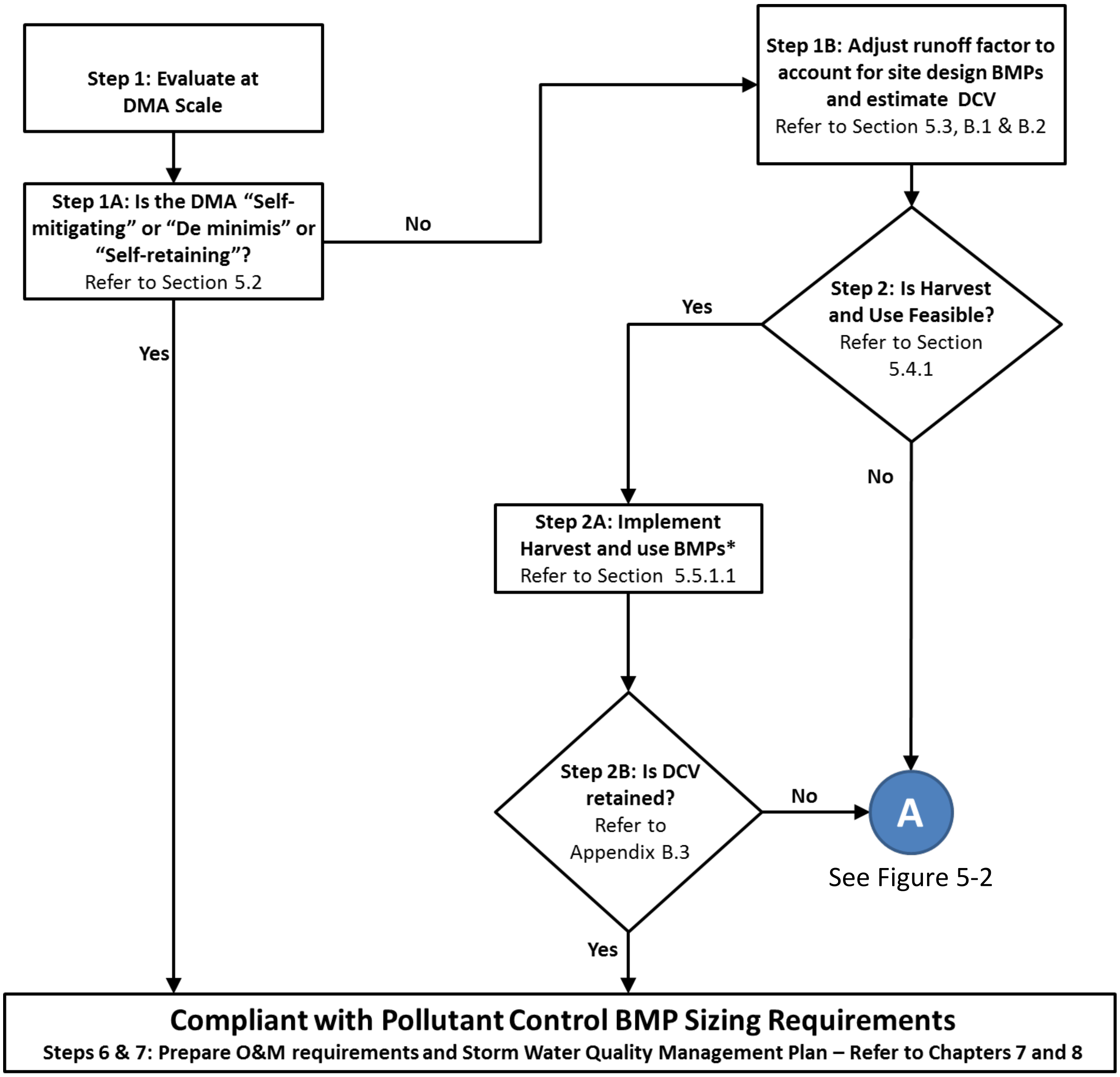
This chapter describes the specific process for determining which category of pollutant control BMP, or combination of BMPs, is most appropriate for the PDP site and how to design the BMP to meet the storm water pollutant control performance standard (per Section 2.2).

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 required at PDPs. These criteria must be met whether 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.

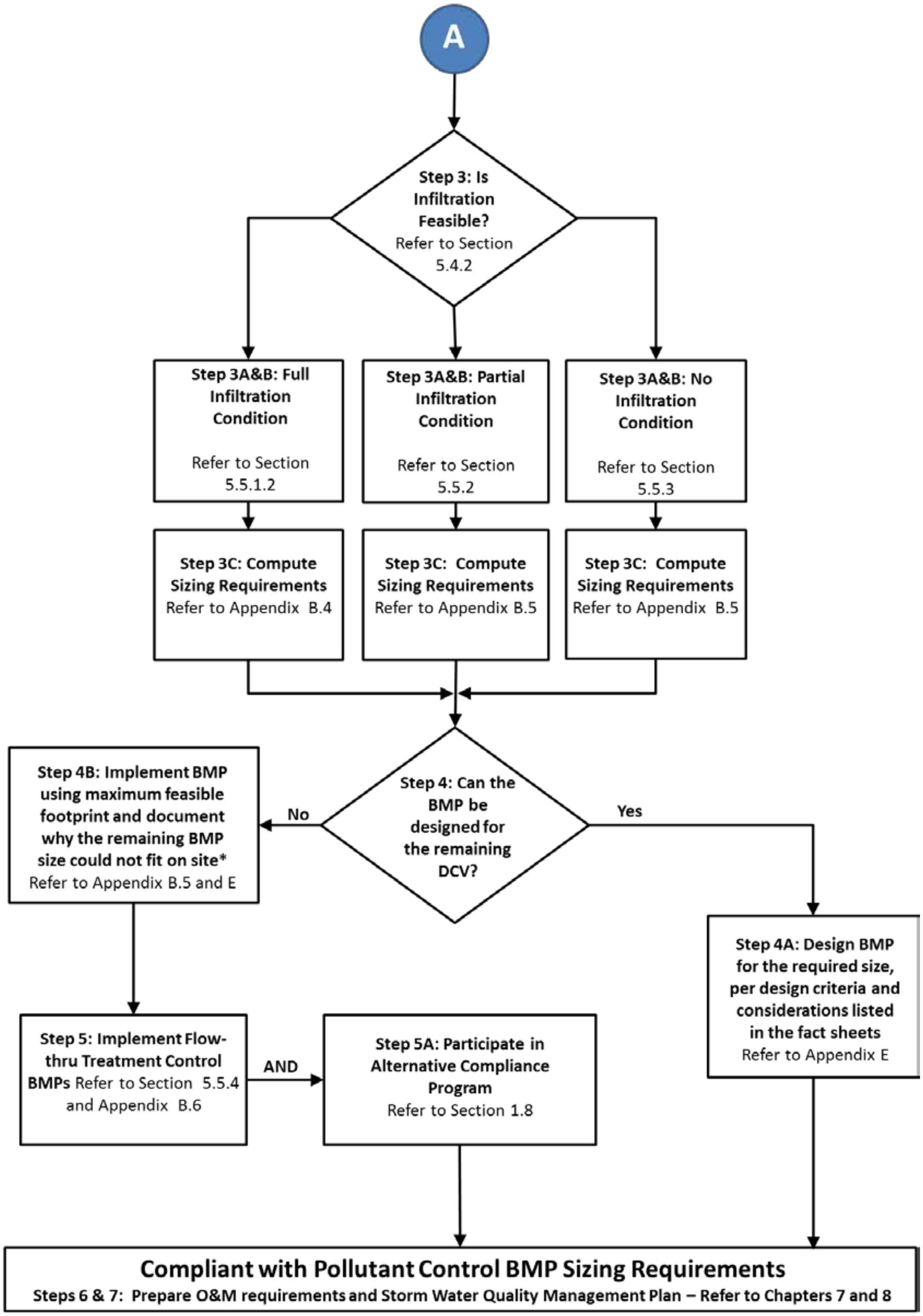
5.1 Steps for Selecting and Designing Storm Water Pollutant Control BMPs

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 [City Engineer]

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 Drainage Management Area (DMA) delineations developed during the site-planning phase (See Section 3.3.3), calculate the Design Capture Volume (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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)*. 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. However, 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 A *(PDP SWQMP)* 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 *(Geotechnical and Groundwater Investigation Requirements)* and D *(Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs)* 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 *(BMP Design Fact Sheets)*. By doing this, the project should meet 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. If the entire DCV could not be treated because the BMP size did not fit within the project footprint, project approval is at the discretion of the City Engineer.

Step 5. Implement flow-through treatment control BMPs for the remaining DCV. See Section 5.5.4 and B.6 for additional guidance.

When flow-through treatment control BMPs are implemented, the project applicant must also participate in an alternative compliance program. See Section 1.8.

Step 6. Prepare a Storm Water Quality Management Plan (SWQMP). See Chapter 8.

Step 7. Identify and document Operation and Maintenance (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 with 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 City Engineer and DMAs should be called out in the PDP SWQMP submittal.

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.

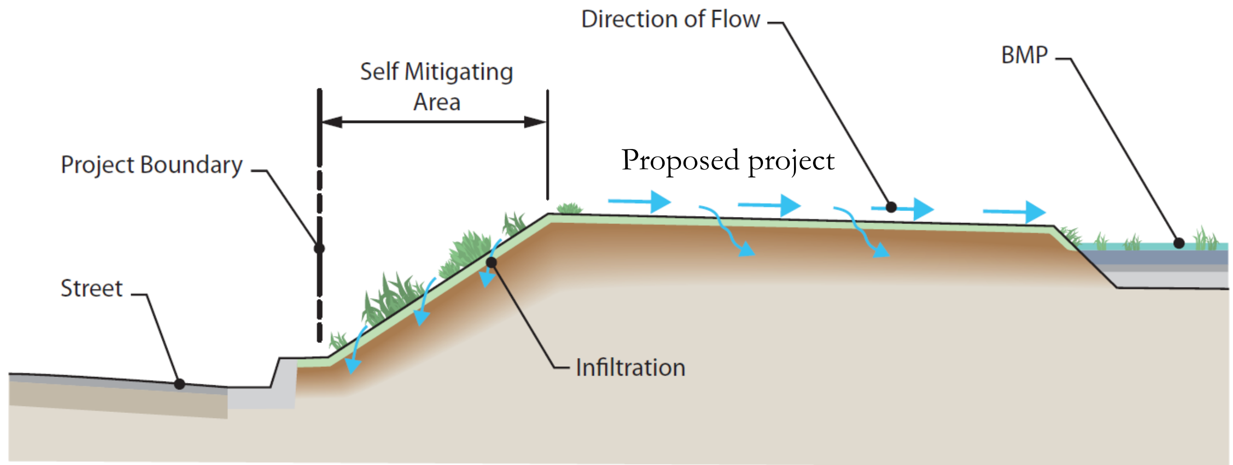


FIGURE 5-3. Self Mitigating Area

5.2.2 De Minimis DMAs

De minimis DMAs consist of areas that are very small, are not considered to be significant contributors of pollutants, and are not practicable to drain to a BMP according to the owner and the City Engineer. 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 that 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 (see PDP SWQMP Attachment 1).

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 City Engineer may accept or reject a proposed self-retaining DMA meeting these criteria at his/her 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 *[Guidance for Continuous Simulation and Hydromodification Management Sizing Factors]*) 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 City Engineer. Figure 5.4 illustrates the concept of self-retaining DMAs.

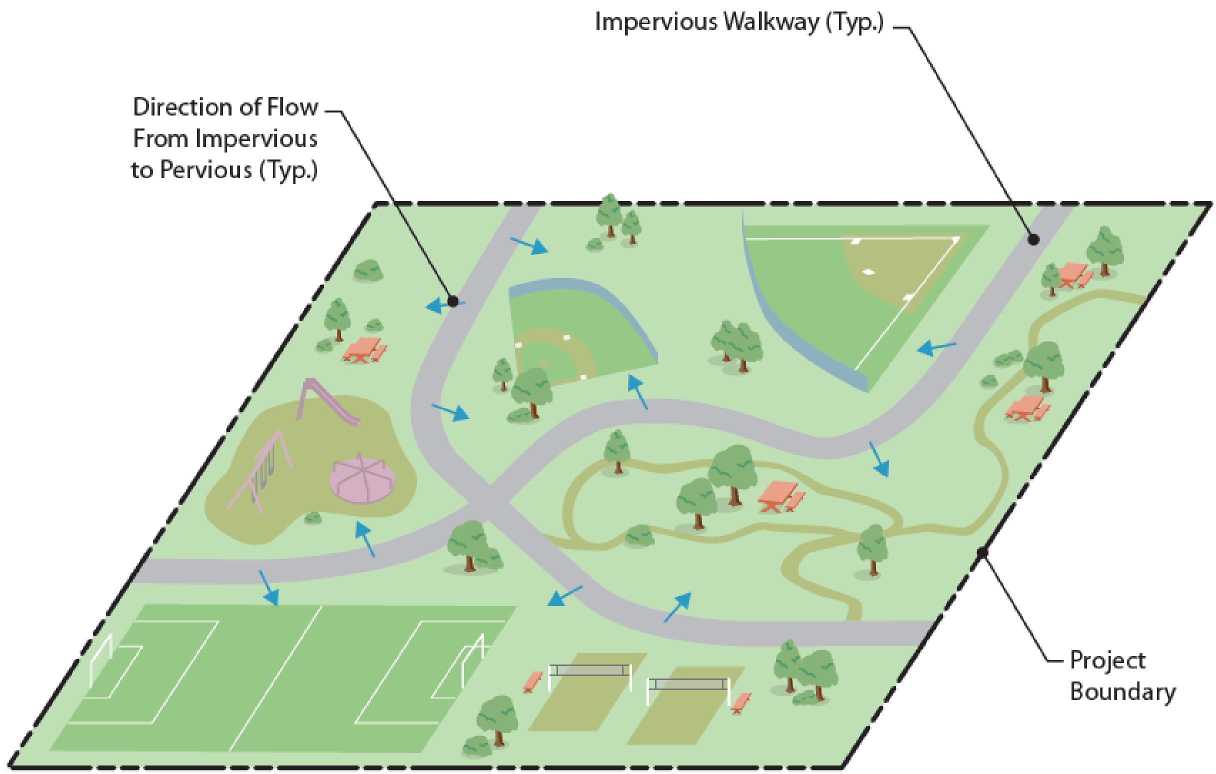


FIGURE 5-4. Self-retaining Site

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 used in calculating the size of downstream structural BMPs when the following site design BMPs are incorporated into the project as effective site design:

- 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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)*. 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 City Engineer.

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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)* 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. When answering these questions, if 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-through 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 A *(PDP SWQMP Template)* 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 *(Geotechnical and Groundwater Investigation Requirements)* and D (*Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs)*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 by 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.

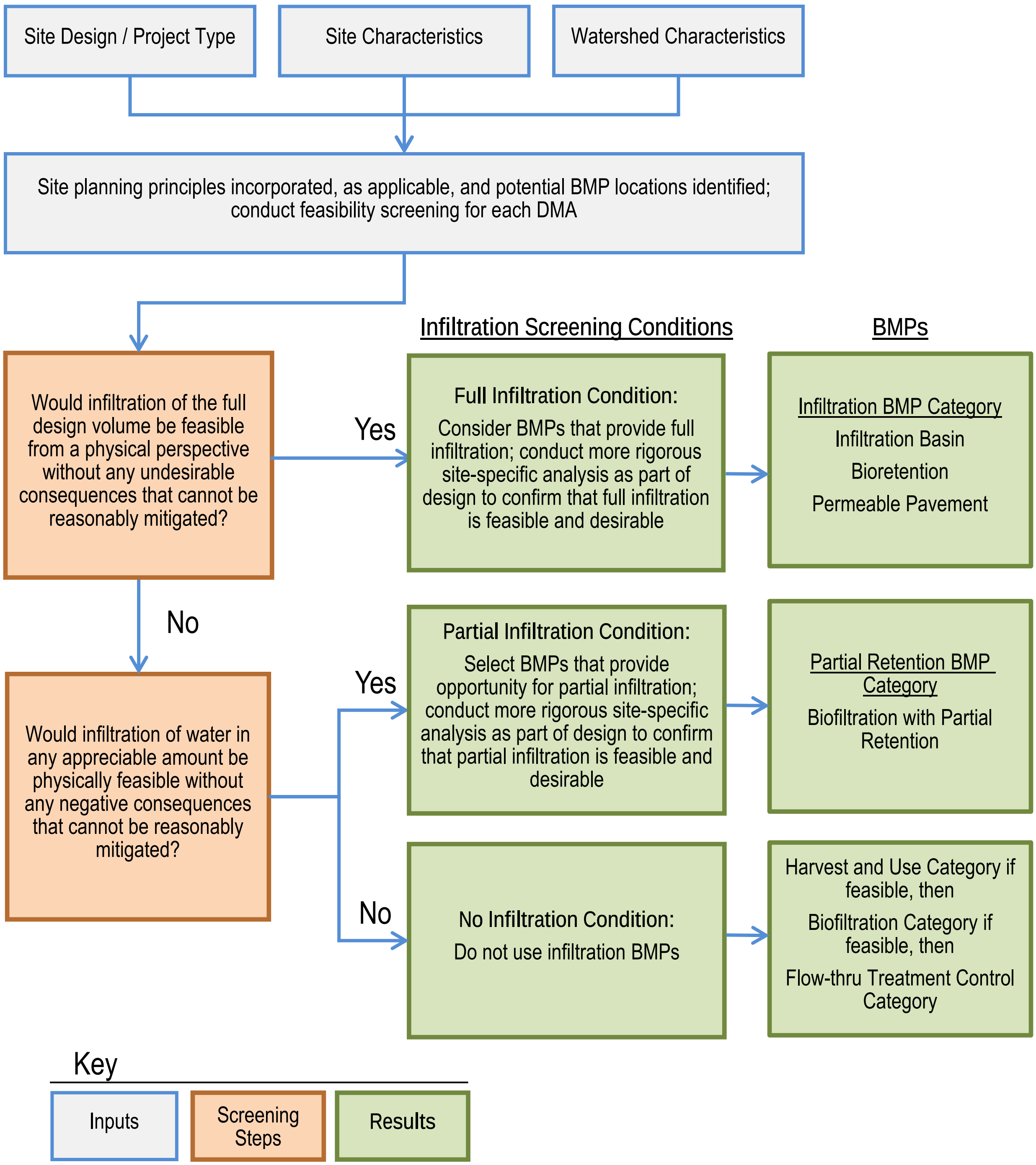


FIGURE 5-5. Infiltration Feasibility and Desirability Screening Flow Chart

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 City Engineer 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-through treatment control	Flow-through 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-through 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 (also see Appendix B.3, *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)*. 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

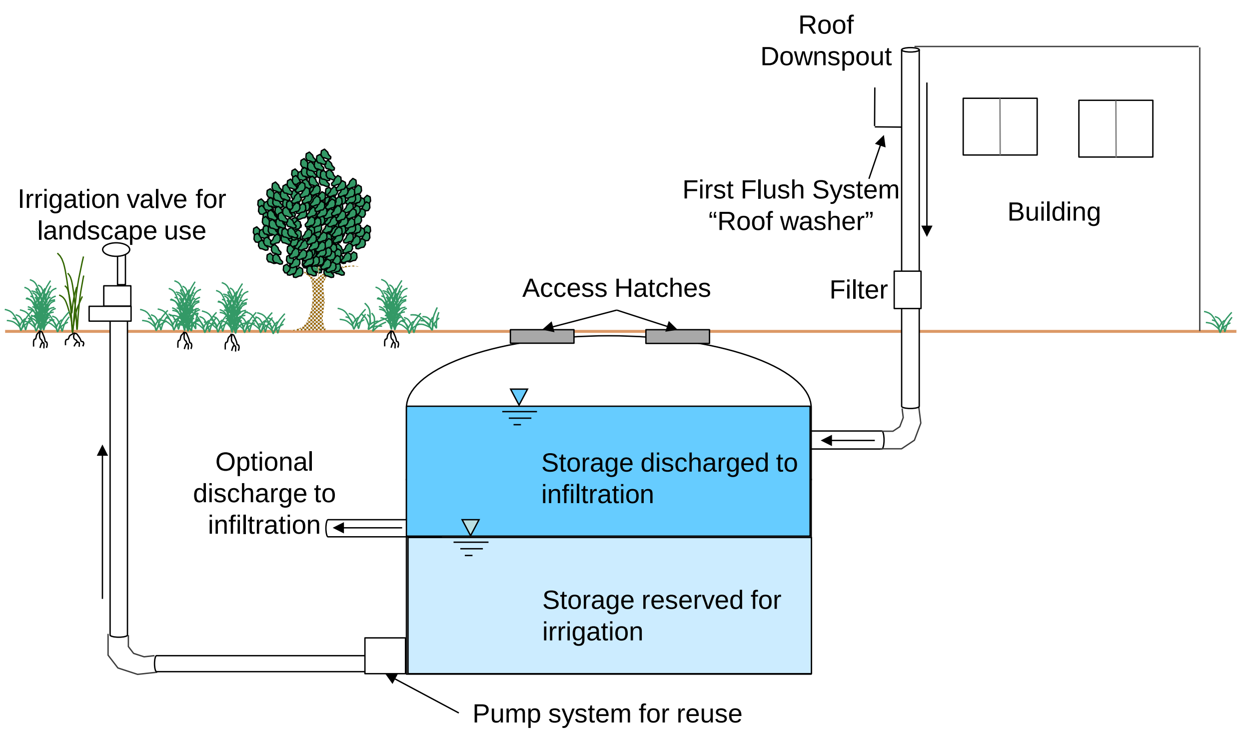


FIGURE 5-6. Schematic of a Typical Cistern

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 *(Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs)* guidance for estimating infiltration rates for use in design the BMP
- 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

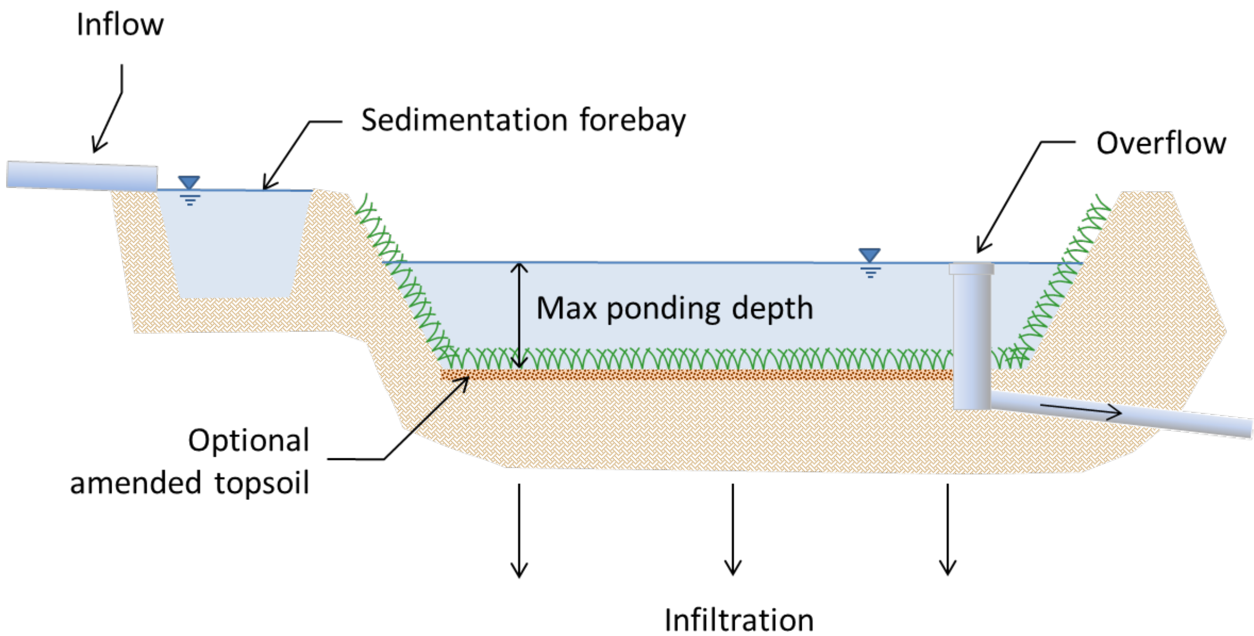


FIGURE 5-7. Schematic of a Typical Infiltration Basin

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, 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
- Appendix E provides a fact sheet to design biofiltration with partial retention BMP.

BMP option under this category:

- PR-1: Biofiltration with partial retention

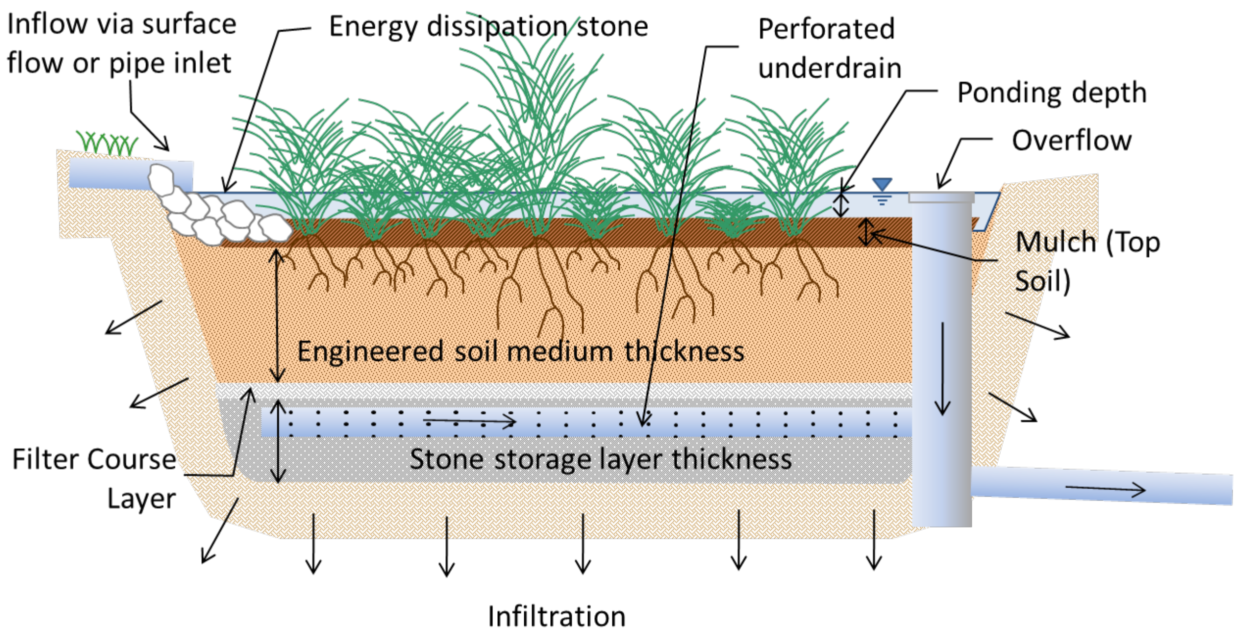


FIGURE 5-8. Schematic of a Typical Biofiltration with Partial Retention BMP

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 City Engineer, 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
- 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

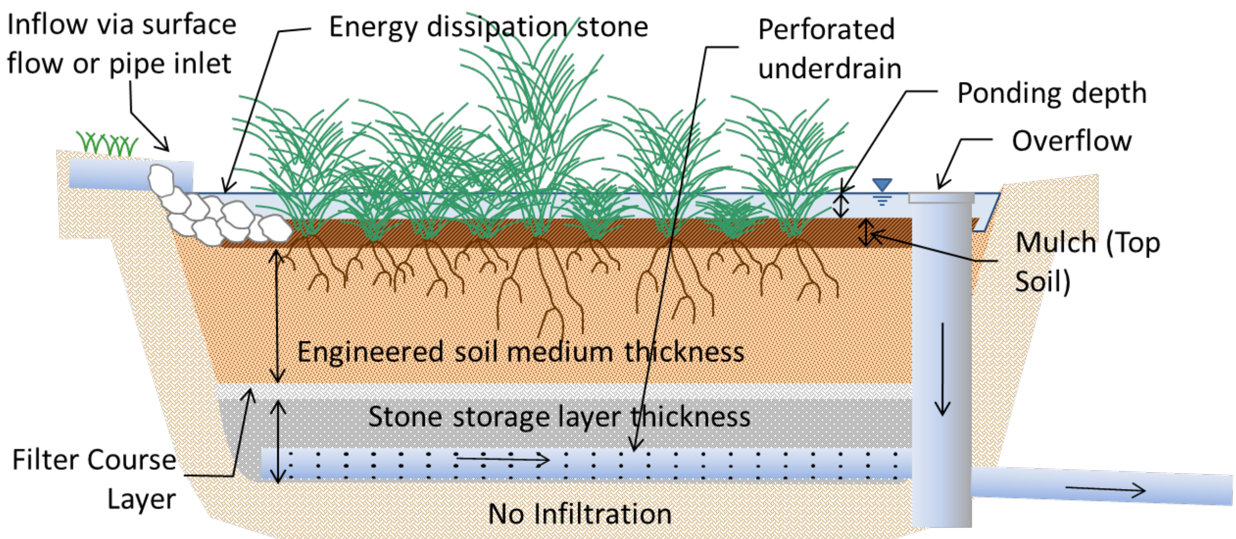


FIGURE 5-9. Schematic of a Typical Biofiltration Basin

Alternative Biofiltration Options: Other BMPs, including proprietary BMPs (See fact sheet BF-3) may be classified as biofiltration BMPs if they (1) meet the minimum design criteria listed in Appendix F *(Biofiltration Standard and Checklist)*, 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, and (3) are acceptable at the discretion of the City Engineer. 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, the City Engineer 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.

5.5.4 Flow-through Treatment Control BMPs (for use with Alternative Compliance) Category[10]

Flow-through 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.

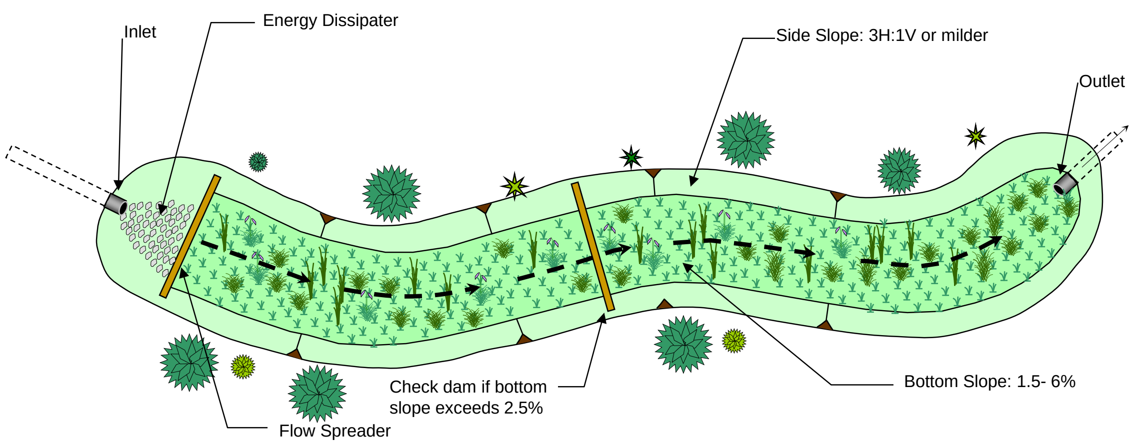
Selection: Flow-through treatment control BMPs shall be selected based on the criteria in Appendix B.6 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)*. Flow-through treatment control BMPs may only be implemented to satisfy PDP structural BMP performance requirements if an 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 the City (See Section 1.8).

Design:

- Appendix B.6 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)* provides the methodology, required tables and worksheet for sizing flow-through treatment control BMPs
- Appendix E *(BMP Design Fact Sheets)* provides fact sheets to design the following flow-through treatment control BMPs
- Figure 5-10 shows a schematic of a Vegetated Swale as an example of a flow-through 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-through treatment control



[10] Currently, the City of Vista does not have an Alternative Compliance Program in place.

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-through treatment control BMP if (1) it is demonstrated to meet the flow-through treatment performance criteria in Appendix B.6 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)*, (2) is designed and maintained in a manner consistently with is applicable performance certifications, and (3) is acceptable at the discretion of the City Engineer. 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-through treatment control BMP.

5.5.5 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 City Engineer. Alternate BMPs must meet the standards for biofiltration BMPs or flow-through BMPs (depending on how they are used), as described in Appendix F *(Biofiltration Standard and Checklist)* and Appendix B.6 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)*, respectively.

In determining the acceptability of any proprietary flow-thru treatment control BMP, the City Engineer 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.

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, because hydromodification management requirements can influence the sizing of structural BMPs, the approach for project design may change. The following process can be used to document compliance with storm water pollutant control BMPs 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 *(BMP Design Fact Sheets)* 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 *(BMP Design Fact Sheets)* and F *(Biofiltration Standard and Checklist)* 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 Operation and Maintenance (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 City Engineer and shall be documented in the SWQMP. Also refer to Section 6.3.6 for additional guidance.

Chapter

6

Hydromodification Management Requirements for PDPs

The purpose of hydromodification management requirements for Priority Development Projects (PDPs) is to minimize the potential for altered flow regimes and excessive downstream erosion in receiving waters as a result of storm water discharges. Hydromodification management implementation for PDPs includes two components, including: 1) protection: flow control from post-project runoff and the preservation of critical coarse sediment yield areas, and 2) 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.

This chapter, along with Appendix G *(Guidance for Continuous Simulation and Hydromodification Sizing Factors)*, provides the majority of guidance necessary for a civil engineer to fulfill a project's hydromodification management requirements. Watershed-specific information from the Carlsbad or San Luis Rey Watershed Management Area Analysis (WMAA) may also apply. Should unique project circumstances require additional context or information beyond that provided in this manual, historical development of the hydromodification management requirements can be found in the *March 2011 Final HMP*

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 Municipal Separate Storm Sewer System (MS4) Permit. The *March 2011 Final HMP* was prepared based on the 2007 MS4 Permit, not the 2015 MS4 Permit that supports this manual. In instances where there are changes to hydromodification management criteria or procedures based on the 2015 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 introduced in Chapter 1, Section 1.6, the MS4 Permit allows for some projects to be exempt from hydromodification management requirements. Exemptions typically require direct discharge of storm water to channels lined by concrete contiguously to the Pacific Ocean, or discharge to the ocean itself. As a result, some of these exemptions are not applicable to projects within the City of Vista. However, all potential exemptions are provided as follows:

- 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[11], 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 receiving waters or conveyance systems that are recommended exempt in the watershed based on studies that were prepared as part of the Regional WMAA, this includes:
    i. San Luis Rey River from Pacific Ocean to upstream river limit of Basin Plan subwatershed 903.1 upstream of Bonsall and near Interstate 15;
    ii. Existing underground storm drains or concrete-lined channels discharging directly to the recommended exempted reach of the San Luis Rey River. These systems were identified based on storm drain data provided by the City via data call. These systems may not represent all discharges to exempt bodies or rivers. Additional systems may be considered exempt if there is no evidence or erosion at the storm drain outfall of the conveyance system, and any other critical determined by the City.

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.

6.2 Protection of Critical Coarse Sediment Yield Areas

According to Section 6.1, when hydromodification management requirements are applicable to a project, the applicant must determine if the project will impact any areas that are determined to be

[11] Exempt water storage reservoirs and lakes in San Diego County are shown in the WMAA for each watershed.

critical coarse sediment yield areas. A critical coarse sediment yield area is an area that has been identified as an active or potential source of coarse sediment to downstream channel reaches. *Potential* critical coarse sediment yield areas for each watershed management area are delineated in the associated WMAA. A map of the critical course sediment yield areas in the regional San Diego county watersheds can be found at the following website:

http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=248

If potential critical coarse sediment yield areas are identified within the project drainage boundaries based on the maps included in the WMAA, the areas should be assumed to be critical coarse sediment yield areas requiring protection unless further study determines any of the following:

(1) Based on detailed project-level verification of Geomorphic Landscape Units (GLUs) described in Section 6.2.1, the areas are not actually potential critical coarse sediment yield areas, or

(2) Based on the flow chart in Section 6.2.2, the receiving water system is not sensitive to reduction of coarse sediment yield, or

(3) Based on detailed investigation described in Section 6.2.3, the areas are not producing sediment that is critical to receiving streams.

For projects with critical coarse sediment yield areas identified within the project drainage boundaries, Section 6.2.4 provides management measures for areas that are onsite, and Section 6.2.5 provides management measures for areas that are offsite and draining through the project. If no potential critical coarse sediment yield areas are identified within the project drainage boundaries, no measures for protection of critical coarse sediment are necessary. The project will require measures for flow control only (see Section 6.3).

The first step to determine if the project will impact any critical coarse sediment yield areas is to consult the map included in the WMAA. The outcome of that initial analysis will determine the need for subsequent analysis as follows:

- If the project is shown to not impact any potential critical coarse sediment yield areas according to the WMAA map, typically no further analysis is required. This includes reviewing the entire drainage area draining through the project site for nearby potential critical coarse sediment yield areas where the runoff will travel through the project site. Because the WMAA maps are macro-level maps that may not represent project-level detail, the City Engineer may require additional project-level investigation described in Section 6.2.1 even when the maps included in the WMAA do not indicate the presence of potential critical coarse sediment yield areas.
- If the project is shown to impact potential critical coarse sediment yield areas according to the WMAA map, then the applicant will conduct further analyses as described in Sections 6.2.1, 6.2.2, and 6.2.3. The additional analyses are optional. The result of any of the additional analyses may invalidate the finding or modify the finding of the WMAA map, or it may confirm the finding of the WMAA map. Section 6.2.1 details GLU verification procedures, Section 6.2.2 describes downstream sensitivity analysis, and Section 6.2.3 describes the "Santa Margarita Region HMP" and provides methods determine whether a portion of the site is a significant source of bed material to the receiving stream.
- If it is determined that the project will impact critical coarse sediment yield areas after the

applicant has exercised all options for further analyses (see bullet above), then management measures described in Sections 6.2.4 and 6.2.5 are required.

6.2.1 Verification of GLUs Onsite

The potential critical coarse sediment yield areas are identified in the WMAAs. These are areas that are considered potential critical coarse sediment yield areas based on their GLU. A GLU is a combination of slope, geology, and land cover. A regional-level WMAA was prepared that determined GLUs that are considered to be potential critical coarse sediment yield areas. These GLUs are areas with a combination of open (undeveloped) land cover, high relative sediment production based on a normalized revised universal soil loss equation analysis, and coarse grained geologic material (material that is expected to produce greater than 50 percent sand when weathered).

The maps included in the WMAA are macro-level maps that may not represent project-level detail. If the WMAA maps indicate the presence of potential critical coarse sediment yield areas within the project site, detailed project-level review of GLUs onsite will be performed to verify the presence or absence of potential critical coarse sediment yield areas within the project site. The City reserves the right to require verification of GLUs for all projects (including projects where the WMAA maps do not indicate the presence of potential critical coarse sediment yield areas).

The following data are required to verify the GLUs onsite:

- Project boundary
- Classification of pre-project slopes within the project boundary and drainage basin into four (4) categories defined in Appendix H *(Guidance for Investigating Potential Critical Coarse Sediment Yield Areas)*
- Classification of underlying geology within the project boundary into seven (7) categories defined in Appendix H
- Classification of pre-project land cover within the project boundary into six (6) categories defined in Appendix H. In this context, use "pre-project" land cover, including any existing impervious areas. Assumption of "pre-development" land cover is not required for GLU analysis

Intersect the geologic categories, land cover categories, and slope categories within the project boundary to create GLUs. This is a similar procedure to intersecting land uses with soil types to determine runoff coefficients or runoff curve numbers for hydrologic studies, but there are three categories to consider for the GLU analysis (slope, geology, and land cover), and the GLUs are not to be composited into a single GLU. When GLUs have been created, determine whether any of the GLUs listed in Table 6-1 are found within the project boundary. The GLUs listed in Table 6-1 are considered to be potential critical coarse sediment yield areas.

TABLE 6-1. 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%

GLU	Geology	Land Cover	Slope (%)
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%

If none of the GLUs listed in Table 6-1 are present within the project boundary, no measures for protection of critical coarse sediment yield areas onsite are necessary. If one or more GLUs listed in Table 6-1 are present within the project boundary, they shall be considered critical coarse sediment yield areas and protected with measures described in Section 6.2.4, or the project applicant may elect to continue to Section 6.2.2 to determine whether downstream systems would be sensitive to reduction of coarse sediment yield from the project site. If any of the GLUs listed in Table 6-1 are present offsite within the area that drains through the project site, see Section 6.2.5 for management measures for critical coarse sediment yield areas offsite and draining through the project.

6.2.2 Downstream Systems Sensitivity to Coarse Sediment

If 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. Protection of critical coarse sediment yield areas is a necessary element of hydromodification management because coarse sediment supply is as much an issue for causing erosive conditions to receiving streams as are accelerated flows. However, not all downstream systems warrant preservation of coarse sediment supply. In some cases, downstream systems are negatively impacted by coarse sediment. For example, existing storm drain system that cannot convey coarse sediment and become clogged, resulting in urban flood hazards and on-going maintenance needs. In some cases, downstream channels are aggrading with undesirable results (e.g. impacts to habitat or urban flooding). Use Figure 6-1 and the associated node descriptions to determine whether downstream systems require protection.

A checklist based on Figure 6-1 is provided in Appendix H *(Guidance for Investigating Potential Critical Coarse Sediment Yield Areas)*. If, based on Figure 6-1, downstream systems do not warrant preservation of coarse sediment supply, no measures for protection of critical coarse sediment yield areas are necessary. If, based on Figure 6-1, downstream systems must be protected, continue to Section 6.2.3 for optional additional analysis that may refine the extents of critical coarse sediment yield areas onsite, and Section 6.2.4 for management measures.

- Figure 6-1, Node 1 – Determine what type of system receives the project site runoff: does the project connect to an existing hardened storm drain system or discharge to an un-lined channel?

- Figure 6-1, Node 2 – If the project discharges runoff to an existing hardened storm drain system, determine whether the system can convey sediment (self-cleaning system) or will trap (sink) sediment. Existing systems with very low slope, constrictions, existing treatment control (pollutant control) Best Management Practices (BMPs), or existing detention basins typically will trap sediment, which can result in flooding and increased maintenance costs. When existing systems will trap sediment, measures to allow coarse sediment to be conveyed into the storm drain system are not recommended. Consult the City Engineer to determine if existing storm drain system are impacted by sediment, and any other criteria defined by the City Engineer.
- Figure 6-1, Node 3 – If the existing storm drain system can convey coarse sediment (self-cleaning system, e.g. velocity will be greater than 6 feet per second in a 2-year storm event), determine what type of system receives the runoff.
- Figure 6-1, Node 4 – Un-lined channels shall be assumed to require protection of coarse sediment supply unless the channel has been identified by the City Engineer's maintenance records as impacted by deposition of sediment, and any other criteria defined by the City Engineer.

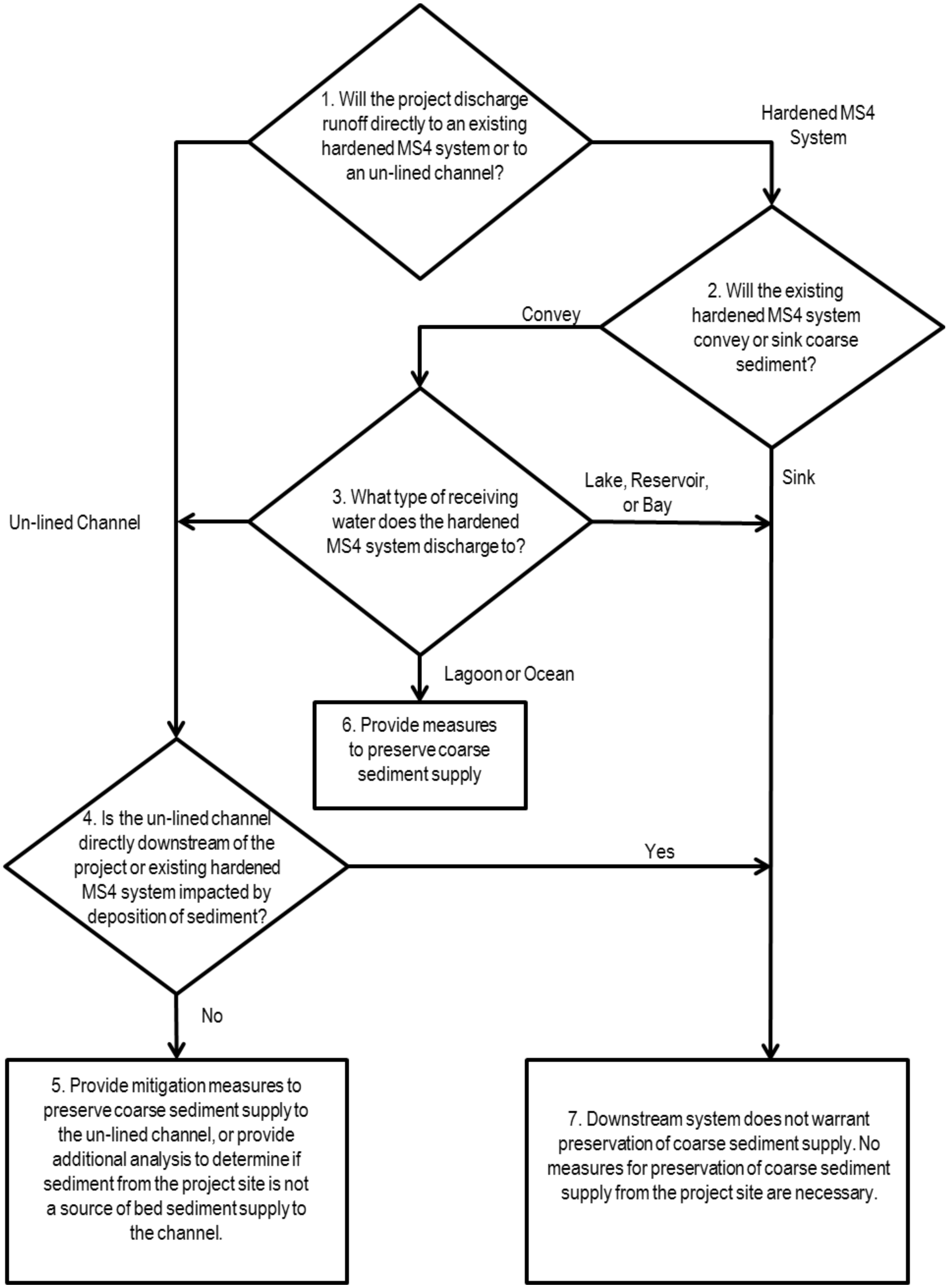


FIGURE 6-1. Evaluation of Downstream Systems Requirements for Preservation of Coarse Sediment Supply

6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite

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, additional analysis may be performed that may refine the extents of actual critical coarse sediment yield areas to be protected onsite.

The GLU analysis that identifies potential critical coarse sediment yield areas does not define whether the areas are actually producing sediment that is critical to receiving streams. The GLU analysis identifies "potential" areas, which will be assumed to be critical 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).

Section 2.3.i of the "*Santa Margarita Region HMP*," dated May 2014 (herein "*May 2014 SMR HMP*"), provides methods of analysis to determine whether a portion of the site is a significant source of bed material to the receiving stream ("Step 1" of the *May 2014 SMR HMP's* three-step process for compliance with the sediment supply performance standard). The analysis will identify areas that are a significant source of bed sediment supply to the receiving stream, or eliminate areas that are not expected to be a significant source of bed sediment supply to the receiving stream. A civil engineer designing a PDP in San Diego may opt to prepare this analysis to refine the extents of actual critical coarse sediment yield areas to be protected onsite, using the worksheets that were developed for the Santa Margarita Region Water Quality Management Plan Template. A copy of the relevant portion of the *May 2014 SMR HMP* is included in Appendix H of this manual *(Guidance for Investigating Potential Critical Coarse Sediment Yield Areas)*. For additional information, consult the *May 2014 SMR HMP*.

Areas that are not expected to be a significant source of bed sediment supply to the receiving stream do not require protection. If it is determined that the potential critical coarse sediment yield areas are producing sediment that is critical to receiving streams, or if the optional additional analysis presented above has not been performed, the project must provide management measures for protection of critical coarse sediment yield.

6.2.4 Management Measures for Critical Coarse Sediment Yield Areas Onsite

The following are management measures for protection of critical coarse sediment yield areas onsite:

1 Avoid disturbing critical coarse sediment yield areas, or

2 Subject to the City's approval, provide project-specific onsite measures if critical coarse sediment yield areas will be disturbed.

6.2.4.1 Avoidance of Critical Coarse Sediment Yield Areas

Avoidance of critical coarse sediment yield areas is the preferred management measure.

The civil engineer shall designate onsite areas that are to be avoided (undisturbed) for the purpose of preserving coarse sediment yield. When feasible, the same areas should be considered as potential habitat preservation areas. If undisturbed critical coarse sediment yield areas will drain through developed portions of the project, these undisturbed areas must not be routed through detention basins or other facilities with restricted outlets that will trap sediment. The project storm water conveyance system shall be designed to bypass these areas to ensure that critical coarse sediment can be discharged to receiving waters, such that there is no net impact to the receiving water. The bypass shall be designed with sufficient capacity and slope to convey sediment from undisturbed areas and not result in sediment accumulation on developed areas of a site.

6.2.4.2 Project-Specific Onsite Measures

If it is determined that avoidance of critical coarse sediment yield areas is infeasible, the City Engineer may allow the civil engineer to propose project-specific onsite measures to ensure that critical coarse sediment can be discharged to receiving waters, such that there is no net impact to the receiving water.

For example, adjusting the post-project flow duration curve to maintain pre-project conditions in the receiving channel with the expected change in bed sediment supply from the site. The following text excerpted from pages 32-33 of the *May 2014 SMR HMP* provides potential methods of analysis:

> "Alternatively, the User may propose adjusting the flow duration curve to maintain pre-project conditions in the receiving channel with the expected change in Bed Sediment Supply discharge from the project site. The erosion potential (total sediment transported in the proposed condition vs. the baseline) should be modeled and used to adjust the flow duration curve to ensure a condition that does not vary more than 10 percent from the natural condition. Bledsoe (2002) introduced the index of stream erosion potential (Ep), which compares the erosive power of pre- and post-development stream flows. This index allows comparison of sediment-transport relationships to ensure that an erosion potential that is comparable to pre-development conditions is achieved. Changes in Total Sediment Supply after development are accounted for by changing the target Ep from 1.0 (proposed is the same as pre-project) in proportion to the change in Bed Sediment Supply (post-development/pre-development), calculated using the six steps above. This option may not be practical when changes in Bed Sediment Supply are relatively large (greater than 50 percent). The User should determine, using best professional judgment, if the alternative modeling approach is applicable."
>
> "The alternative modeling approach must include the following:
>
> 1 Continuous hydrologic simulation for the project baseline condition and proposed condition over the range of flow values up to the pre-project 10-year event;
> 2 Sediment transport model of the receiving channel for the PDP baseline condition and proposed condition;
> 3 Analysis of the change in Bed Sediment Supply from the PDP baseline condition to the proposed condition;
> 4 Explanation of method used to control the discharge from the PDP to account for changes in the delivered Bed Sediment Supply; and
> 5 Summary report."
>
> "The User must demonstrate through a channel stability impact assessment that the changes to both the amount of Bed Sediment Load being transported and the amount of sediment supplied to the receiving channel will maintain the general trends of aggradation and degradation in the different impacted channel reaches, which are representative of the pre-development geomorphologic state of a channel. Typical channel sediment continuity analysis

procedures may be performed using moveable bed fluvial models such as HEC-6t or equivalent."

"Receiving channel monitoring may be required for the project site to verify that the PDP does not result in long-term changes to the receiving channel. The User should make a recommendation if long-term monitoring is required, for concurrence by the City. Some of the considerations in assessing the need for a long-term monitoring program are:

1. Total area of the watershed at the PDP discharge point vs. the PDP area;
2. Condition and type of receiving channel;
3. Magnitude of change in Bed Sediment Supply to the receiving channel;
4. Relief of the land on the project site;
5. Number of channels (density) potentially delivering Bed Sediment Supply to the receiving channel, and the delivery ratio; and
6. Soil characteristics on the project site."

The project-specific onsite measures described above may be approved subject to the discretion of the City Engineer. Applicants considering such measures should consult the City Engineer to determine study requirements.

6.2.5 Management Measures for Critical Coarse Sediment Yield Areas Offsite and Draining Through the Project

Critical coarse sediment yield areas that are offsite and draining through the project also require attention in the project design.

When critical coarse sediment yield areas are identified adjacent to the project site (e.g. hillsides that will drain through the site), protection of these areas is similar to protection of undisturbed critical coarse sediment yield areas onsite. These areas must not be routed through detention basins or other facilities with restricted outlets that will trap sediment. The project storm water conveyance system shall be designed to bypass these areas to ensure that critical coarse sediment can be discharged to receiving waters, such that there is no net impact to the receiving water. The bypass shall be designed with sufficient capacity and slope to convey sediment from undisturbed areas and not result in sediment accumulation atop developed areas of a site.

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 discusses 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: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 over and 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 Design Capture Volume (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.

If the project site discharges to multiple discrete outfalls, multiple structural BMPs may be necessary to meet hydromodification management requirements. 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, the POC(s) for flow control analysis shall be placed at the project boundary, unless the project is draining to and accommodated by an approved master planned or regional flow control BMP. This can be completed by comparing the pre-development and post-project flows from the project area only, not analyzing the total watershed draining to the offsite POC.

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 City Engineer.

Structural BMPs for flow control must be designed to avoid trapping sediment from natural areas, even if a natural area contains critical coarse sediment.

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. This condition 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, 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 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 those impervious areas 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 Percent Rule (i.e., redevelopment projects that result in the creation or replacement of impervious surface in an amount of less than 50 percent 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 between developed to pre-developed conditions) 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 offsite storm water. The City Engineer 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 hydromodification depends on the erosion susceptibility of the receiving stream.

The range of flows to control is as follows:

- $0.1Q_2$ 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 City Engineer, 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 City Engineer.

The project applicant may opt to design to the default low-flow threshold of $0.1Q_2$, or provide assessment of the receiving stream ("channel screening" a.k.a. "geomorphic assessment"), which may result in a higher low-flow threshold of $0.3Q_2$ or $0.5Q_2$ for project hydromodification management.

The use of a higher low-flow threshold of $0.3Q_2$ or $0.5Q_2$ 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 Hydromodification Management Plan* and can also be accessed through SCCWRP's website. The result of applying the channel-screening tool will be the classification of high, medium, or low susceptibility to erosion, corresponding to low-flow thresholds of $0.1Q_2$, $0.3Q_2$, and $0.5Q_2$, respectively, for the receiving stream. Note that the City Engineer 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. If runoff from the project site is conveyed by hardened systems from the project site to the un-lined channel, a project may have a different POC for channel screening versus a POC for flow control facility sizing. 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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)* 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. Moreover, 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. 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 *(Guidance for Continuous Simulation and Hydromodification Management Sizing Factors)* 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 peaks 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 *(Guidance for Continuous Simulation and Hydromodification Management Sizing Factors)* 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. If feasible, increase retention or employ 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 other methods may be identified 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 performance standards for both pollutant control and hydromodification management are being 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 Stormwater Quality Water Management Plan (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. When this option is selected, project approval is at the discretion of the City Engineer.

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*.

The 96 hour drawdown time is based on guidance 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 but is not limited to detention basins, underground storage vaults, and the above-ground storage portion of Low Impact Development (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 governing municipality.

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 the 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. At a minimum, Vector Management Plans should include the following information:

- 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

Prior to submission, project applicants must also obtain approval of their proposed management practices from the Department of Environmental Health Vector Control Program staff. The property owner and applicant:

> "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 in 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. Hydromodification flow control BMPs are designed based on continuous simulation modeling. 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 the 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 *(Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods)* 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.

6.4 In-Stream Rehabilitation

An alternative to onsite flow control for post-project runoff may be in-stream rehabilitation.[12]

Project applicants may be allowed to participate in an in-stream rehabilitation project in lieu of implementing onsite flow control BMPs. Refer to section 1.8 and local alternative compliance guidance document to determine if this option is available in the project's watershed.

[12] Currently, the City of Vista does not have an Alternative Compliance Program in place.

Chapter

7

Long Term Operation & Maintenance (O&M)

Permanent structural Best Management Practices (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 Municipal Separate Storm Sewer System (MS4) Permit requires the City to implement a program that requires and confirms structural BMPs on all Priority Development Projects (PDPs) are designed, constructed, and maintained to remove pollutants in storm water to the Maximum Extent Practicable (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 / Low Impact Development (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; 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 City Engineer requires confirmation of maintenance of source control BMPs and site design 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 its functionality. 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 Regional Water Quality Control Board (SDRWQCB), 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 the 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.**

Experience has shown provisions to finance and implement maintenance of structural BMPs can be a major stumbling block to project approval, particularly for ***small residential subdivisions***. Project owners 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	Determine structural BMP ownership, party responsible for permanent O&M, and maintenance funding mechanism	Prior to first submittal of a project application – discuss with staff at pre-application meeting
2	Identify expected maintenance actions	In initial submittal, coordinate with planning and zoning application
3	Develop detailed O&M Plan	As required by the City Engineer, prior to issuance of construction, grading, building, site development, or other applicable permits

Item	Description	Time Frame
4	Interim operation and maintenance of facilities	During and following construction including warranty period
5	Formal transfer of operation and maintenance responsibility	On sale and transfer of property or permanent occupancy
6	Ongoing maintenance and compliance with inspection and reporting requirements	In perpetuity

Consistent with City of Vista Municipal Code (VMC) Chapter 13.18 *Stormwater Management and Discharge Control Program*, storm drain systems and associated structural BMPs are required to be maintained in perpetuity. Such systems and BMPs may be subject to periodic inspection or certification by City staff to ensure they function as designed. A well-prepared O&M Plan, specific to the storm drain system facilities on site, can help ensure compliance with long-term maintenance requirements

Transfer to Public Ownership

Currently, the City of Vista does not own or maintain any privately built structural BMPs. Moreover, long term maintenance requirements for the structural BMPs are the responsibility of the property owner.

7.3 Maintenance Responsibility

Who is responsible for the maintenance of the permanent structural BMPs into perpetuity?

The property owner is responsible to ensure inspection, O&M of permanent structural BMPs on their property unless responsibility has been formally and legally transferred to an agency, community facilities district, homeowners association, property owners association, or other special district. When property ownership changes (i.e., the property is sold or otherwise transferred to a new owner), maintenance responsibility also transfers to the new owner through a maintenance agreement recorded against the property by the County Assessor. For structural BMPs that will be transferred to an agency, community facilities district, homeowners association, property owners association, or other special district, there is an interim period during which the property owner is responsible until maintenance responsibility is formally transferred.

From the time that the structural BMP is constructed and activated (i.e., it is operating and processing storm water from storm events), it requires inspection and maintenance to ensure it continues to function as designed. Because of this, the MS4 Permit requires that the City must "require the project applicant to submit proof of the mechanism under which ongoing long-term maintenance of all structural BMPs will be conducted." Requirements for proof of the maintenance mechanism may also differ depending on whether the long term O&M will be provided by a public or private party.

7.4 Long-Term Maintenance Documentation

As part of on-going structural BMP maintenance into perpetuity, property owners are required to provide documentation of maintenance for the structural BMPs on their property to support the City's reporting requirements to the SDRWQCB.

The MS4 Permit requires the City 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." The City 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 SDRWQCB annually.

Based on these MS4 Permit requirements and consistent with the Vista Municipal Code (VMC) Chapter 13.18, the City implements a structural BMP inspection, enforcement, and annual certification program. The City's PDP inventory assigns each PDP site with structural BMPs an inspection priority. The priority is based on project characteristics such as: location within the watershed, size of project site, compliance history, and best professional judgement. Section 4.5 of the City's Jurisdictional Runoff Management Program (June 2015) describes these criteria in greater detail.

7.5 Inspection and Maintenance Frequency

How often is a property owner required to inspect and maintain permanent structural BMPs on their property?

Inspection and maintenance frequency requirements for structural BMPs are site specific, and maintenance may be required more frequently than annually (in response to the City's annual certification program). 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 owner'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 first year of conducting frequent inspections, the minimum inspection and maintenance frequency can be evaluated based on conditions and results observed during that time.

In addition to inspection and maintenance performed by responsible parties at PDP sites, the City of Vista implements a structural BMP inspection and annual certification program. The inspection and certification process generally follows the schedule and process outlined below:

- Summer months – City staff conduct inspections of structural BMPs at PDP sites based on priority. Not all PDP sites may be inspected within a given year, and some sites may be inspected more regularly than others based on criteria mentioned in Section 7.4.
- Late summer – The City distributes annual certification forms and inspection results to

responsible parties (or designated contacts) for PDP sites. The certification form is used to document that structural BMPs are being maintained and remain functional as designed. As such, corrective actions identified in the inspection results should be addressed by the completed certification form.

- October 1 – Annual certification forms, and any supplemental documentation or records, must be returned to the City.

PDP sites that do not adequately resolve corrective actions identified through inspection results, or do not return certification forms by October 1, may be subject to enforcement action.

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. This can be achieved through effective implementation of source control and site design BMPs, as required and described in Chapter 4 of this manual.

Vegetated structural BMPs should be sited such that they have reduced potential to become jurisdictional waterways by one or more resource agencies (e.g., California Department of Fish and Wildlife, Army Corps of Engineers, or State Water Resources Control Board). Such jurisdictional designation could trigger a requirement for permits or other limitations in how maintenance is conducted. Structural BMPs should include design features to facilitate maintenance, as discussed below.

Considerations for placement of vegetated BMPs:

- Locate structural BMPs outside of floodway, floodplain, and other resource agency jurisdictional areas (e.g., stream or creek).
- 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, capture device, or settling area to trap gross pollutants (trash/debris) 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. Alternatively, a gross pollutant separator could be installed in the storm drain system prior to draining into a downstream structural BMP.

Measures to access the structural BMP:

- The structural BMP must be accessible to equipment needed for any anticipated maintenance, including consideration of BMP repair or replacement. 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. These BMPs may also require excavation of clogged media (e.g. bioretention soil media, or sand for the sand filter), and must be made 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 and infiltration vaults/pipes, media filters, or gross pollutant separators must be provided access for equipment used for inspection and maintenance. Manholes or cleanouts will typically be required at upstream and downstream locations for underground BMPs to allow for equipment and personnel access.
- Proprietary BMPs such as media filters or gross pollutant separators may require access by a forklift or other hoist equipment for delivery and removal of 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. Projects sites with structural BMPs that are maintained by use of a vactor truck must consider access, structure clearances, and easements necessary to conduct maintenance safely.
- 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.

Measures to facilitate inspection of the structural BMP

- Structural BMPs shall include inspection ports, cleanouts, or manholes for observing all underground components that require inspection and maintenance. This requirement also applies to perforated pipe within a structural BMP.
- Silt-level posts or other markings may be included in structural BMP components that will trap and store sediment, trash, and/or debris (e.g., basin forebay, trash collection rack). These markings can help determine the volume and depth of material in the BMP.
- Vegetation requirements including plant type, coverage (planting density and spacing), and minimum height (or pot size) shall be provided on the structural BMP and/or landscaping plans as appropriate or as required by the City Engineer.
- Signage indicating the location, boundary, and purpose 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 project owner should consider the long-term cost of maintenance and what type of maintenance contracts a future property owner, homeowners association or property owners association will need to manage. The types of materials used (e.g., proprietary versus non-proprietary parts), equipment used (e.g., landscape equipment versus 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 described and shown 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 structural 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, engineered soils/media, subsurface gravel layer, underdrain, and/or impermeable liner. The project civil engineer is responsible for determining which maintenance indicators and actions shown in Table 7-2 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.

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
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 rock at flow entry points to dissipate flow, 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 City Engineer 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 City Engineer 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 soils with clogged sediment 'caked' surface or compacted soils.
Obstructed inlet or outlet structure	Clear debris and 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.	

7.7.2 Maintenance of Non-Vegetated Infiltration BMPs

Non-vegetated infiltration BMPs are structural 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, engineered soils/media, 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 in Table 7-3 are applicable based on the components of the structural BMP.

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 City Engineer 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 and/or sweeping 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 Drainage Management Area (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 soil or 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 include basins, cisterns, vaults, and underground galleries that are designed to temporarily store runoff for controlled release to downstream storm drain systems. For the purpose of the maintenance discussion, this category does not include an infiltration component (refer to Sections 7.7.1 and 7.7.2 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 in Table 7-5 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

C I T Y O F V I S T A B M P D E S I G N M A N U A L

Submittal Requirements

It is necessary for the City Engineer to review project plans for compliance with applicable requirements of this manual and the Municipal Separate Storm Sewer System (MS4) Permit.

The review process must verify that storm water management objectives were considered in the project planning process and that Best Management Practices (BMP) requirements have been addressed. The review process must confirm the site plan, landscape plan, and project storm water documents are congruent. The City requires a submittal package that documents storm water management design for projects subject to the requirements of this manual. Compliance with storm water specific requirements is achieved through completion of a Storm Water Quality Management Plan (SWQMP). A complete and thorough project submittal will 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. Reports and documents submitted for project approval may be requested in both hardcopy and electronic format.

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 and narrative that documents all permanent source control and site design BMPs have been considered for the project and have been implemented where feasible. All applicable features from the Standard Project SWQMP 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 A of this manual *(SWQMP Submittal Templates)*:

- Project Determination Checklist
- Site Information for Standard Projects
- Source Control BMP Checklist
- 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 Operation and Maintenance (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 *(SWQMP Submittal Templates)*. The PDP SWQMP is a compilation of checklists and narrative that documents all permanent source control and site design BMPs have been considered for the project and have been implemented where feasible. All applicable features from the PDP SWQMP shall be shown on site plans. The PDP SWQMP shall consist of the following forms and/or checklists included in Appendix A of this manual:

- Project Determination Checklist
- Site Information for PDPs
- Source Control BMP Checklist
- Site Design BMP Checklist
- Summary of PDP Structural BMPs

The PDP SWQMP shall also include copies of the relevant plan sheets showing source control, site design, treatment control and hydromodification BMPs, as well as identify drainage management areas (DMAs).

A PDP SWQMP must be provided with the first submittal of a project application.

Storm water requirements will directly affect the layout of the project. Storm water requirements must be considered from the project concept stage and reviewed with each 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 City Engineer's 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 and accurate PDP SWQMP must be provided with each submittal of revised project plans.* The updated

PDP SWQMP must include documentation of changes to the site layout and features, and explanation of changes made. 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

The PDP SWQMP provides O&M requirements for structural BMPs. The City of Vista O&M Plan template, or equivalent, must be provided to the City for a project submittal to be deemed complete. An O&M Plan template is available on the City's website.

8.2.2 Requirements for Construction Plans

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 conform with project design features identified in the PDP SWQMP.

On their own plan sheets, project construction plans shall clearly illustrate all storm drain improvements, features, and structural BMPs. Storm drain construction plan sheets must, at minimum, include the following:

- Identification and location of Source Control BMPs.
- Identification and location of Site Design BMPs.
- Identification and of Pollution Control BMPs.
- Identification of Hydromodification Management BMPs.
- Identification of all storm drain facilities or structures (including but not limited to pipe, inlets, outlets, manholes, cleanouts, flow dissipaters, culverts, BMPs, etc.).
- Identification and location of natural water features (waterways, ditches, wetlands, ponds, etc.).
- Grading, drainage, and draining management areas (DMAs), consistent with the SWQMP.
- Identification of all point(s) of discharge, including overflow routes for storm water in event of structural BMP failure or rainfall that exceeds BMP design.
- Flow direction from impervious surfaces, from point of concentration (e.g., roof drains, curb cuts, pipe inlets/outlets) to final approved point of discharge.
- Plan and profile details for each structural BMP on site as required. 'Typical' drawings may only be used for structural BMPs with similar shape and design.

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.

If changes to the storm drain system or any BMP are proposed during the construction phase, additional civil engineering reports, documents, or designs will be required with implementation of those changes. Any changes in storm drain system design or any BMP must first be approved by the City Engineer. 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 SWQMP and other documents must be revised to ensure the revised project layout and features meet the requirements of this manual and the MS4 Permit. Certification of Constructed BMPs.

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.

Prior to certifying a project is ready for occupancy or returning the applicant's bonds, City staff verify that structural BMPs have been constructed consistent with approved development plans. The Certificate of Occupancy will not be issued and/or bonds will not be released to private projects unless the proposed structural BMPs have been inspected and signed off as being constructed properly. In the case of Capital Improvement Projects (CIPs), the City may withhold operational acceptance or notification of completion until structural BMP installation is verified.

8.2.3.3 Maintenance Agreements for Private Structural BMPs

For structural BMPs on privately-owned development projects, the City requires execution of a Maintenance Agreement document.

The City of Vista requires that a *Private Storm Water Pollution Control Facilities Maintenance Agreement* be recorded with the San Diego County Recorder's Office. The agreement is used to legally document long-term maintenance obligations for structural BMPs on a project site.

Chapter

9

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Appendices Table of Contents

A.1 Standard SWQMP

The standard SWQMP Template and Instructions are offered as a tool to assist users in complying with RWQCB Order NO. R9-2015-0001 (Permit), and is not intended to warrant or guarantee Permit compliance, which is the independent and sole responsibility of the user. The Template is subject to revision without notice, at any time.

Plan Number(s): LD________________ PC______________ GP________________

City of Vista

CITY OF VISTA
CALIFORNIA

STANDARD DEVELOPMENT PROJECT

STORM WATER QUALITY MANAGEMENT PLAN

FOR

[PROJECT NAME]

ENGINEER OF WORK

INSERT NAME OF EOW- PE NUMBER –EXPIRATION – WET SIGNATURE & STAMP

PREPARED FOR:

[INSERT APPLICANT NAME]
[INSERT ADDRESS]
[INSERT CITY, STATE ZIP CODE]
[INSERT TELEPHONE NUMBER]
[INSERT EMAIL]

STANDARD PROJECT SWQMP PREPARED BY:

[INSERT ENGINEER-OF-WORK]
[INSERT ADDRESS]
[INSERT CITY, STATE, ZIP CODE]
[INSERT TELEPHONE NUMBER]
[INSERT EMAIL]

PREPARED: MONTH, YEAR

STORM WATER QUALITY MANAGEMENT PLAN	
Reviewed and Approved:	
City Engineer	Date

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ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

STANDARD PROJECT SWQMP PROJECT OWNER'S CERTIFICATION PAGE

Project Name: [Insert Project Name]
Permit Application Number: [Insert Permit Application Number]

PROJECT OWNER'S CERTIFICATION

This Standard Project SWQMP has been prepared for [INSERT PROJECT OWNER'S COMPANY NAME] by [INSERT SWQMP PREPARER'S COMPANY NAME]. The Standard Project SWQMP is intended to comply with the Standard Project requirements of the City of Vista (City) BMP Design Manual, which is a design manual for compliance with local City and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. 2013-0001, as amended by Order No. R9-2015-0001) requirements for storm water management.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan. Once the undersigned transfers its interests in the property, its successor-in-interest shall bear the aforementioned responsibility to implement the best management practices (BMPs) described within this plan. A signed copy of this document shall be available on the subject property into perpetuity.

____
Project Owner's Signature

____
Print Name

____
Company

____
Date

____
E-mail

Page intentionally blank

SUBMITTAL RECORD

Use this Table to keep a record of submittals of this Standard Project SWQMP. Each time the Standard Project SWQMP is re-submitted, provide the date and status of the project. In column 4 summarize the changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments behind this page.

Submittal Number	Date	Project Status	Summary of Changes
1		☐ Preliminary Design / Planning/ CEQA ☐ Final Design	Initial Submittal
2		☐ Preliminary Design / Planning/ CEQA ☐ Final Design	
3		☐ Preliminary Design / Planning/ CEQA ☐ Final Design	
4		☐ Preliminary Design / Planning/ CEQA ☐ Final Design	

PROJECT VICINITY MAP

Project Name: [Insert Project Name]

Permit Application Number: [Insert Permit Application Number]

[Insert Project Vicinity Map here]

Form 1: Insert completed Checklist *for New and Redevelopment: Applicability of Permanent, Post-Construction Storm Water BMP Requirements and Project Type Determination*

Form 2 - Site Information Checklist For Standard Projects	City of Vista BMP Design Manual
Project Summary Information	
Project Name	
Project Address	
Assessor's Parcel Number(s) (APN(s))	
Permit Application Number	
Watershed	**Hydrologic Area and Sub-Area *(select appropriate checkbox)***
San Luis Rey	☐ Lower San Luis Rey – Mission, 903.11
Carlsbad	☐ Loma Alta – Loma Alta, 904.10
	☐ Buena Vista – El Salto, 904.21
	☐ Buena Vista – Vista, 904.22
	☐ Agua Hedionda – Los Monos, 904.31
	☐ Agua Hedionda – Buena, 904.32
	☐ San Marcos – Batiquitos, 904.51
Project Watershed (Complete Hydrologic Unit, Area, and Subarea Name with Numeric Identifier)	_________ Acres (_____________ Square Feet)
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)

Form 2 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 ☐ Demolition completed without new construction ☐ 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): ☐ Drainage Ditch/Swale ☐ 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 2 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 2 Page 4 of 4
Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply): ☐ On-site 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 Description / Additional Information:

Form 3 - Source Control BMP Checklist for All Development Projects (Standard Projects and Priority Development Projects)			City of Vista BMP Design Manual
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 Model BMP Design 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 Model BMP Design 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 3 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):			
☐ On-site 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 <u>all</u> "No" answers shown above.			

Form 4 - Site Design BMP Checklist for All Development Projects	City of Vista BMP Design Manual		
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 Model BMP Design 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 Model BMP Design 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 4 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:			

ATTACHMENT 1
Copy of Plan Sheets Showing Permanent Storm Water BMPs

This is the cover sheet for Attachment 1.

Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

☐ Show all applicable permanent site design and source control BMPs as noted in Forms 3 and 4

A.2 PDP SWQMP

The Priority SWQMP Template and Instructions are offered as a tool to assist users in complying with RWQCB Order No. R9-2015-0001 (Permit), and is not intended to warrant or guarantee Permit compliance, which is the independent and sole responsibility of the user. The Template is subject to revision without notice, at any time.

Plan Number(s): LD_______________ PC_____________ GP_______________

CITY OF VISTA CALIFORNIA
PRIORITY DEVELOPMENT PROJECT STORM WATER QUALITY MANAGEMENT PLAN FOR **[PROJECT NAME]**
ENGINEER OF WORK:
INSERT NAME OF EOW- PE NUMBER-EXPIRATION-WET SIGNATURE & STAMP

PREPARED FOR:
[INSERT APPLICANT NAME]
[INSERT ADDRESS]
[INSERT CITY, STATE ZIP CODE]
[INSERT TELEPHONE NUMBER]
[INSERT EMAIL]

Priority PROJECT SWQMP PREPARED BY:
[INSERT ENGINEER-OF-WORK]
[INSERT ADDRESS]
[INSERT CITY, STATE, ZIP CODE]
[INSERT TELEPHONE NUMBER]
[INSERT EMAIL]

PREPARED: MONTH, YEAR

STORM WATER QUALITY MANAGEMENT PLAN	
Reviewed and Approved:	
City Engineer	Date

PDP SWQMP PREPARER'S CERTIFICATION PAGE

Project Name: [Insert Project Name]
Permit Application Number: [Insert Permit Application Number]

PREPARER'S CERTIFICATION

I hereby declare that I am the Engineer in Responsible Charge of design of storm water best management practices (BMPs) for this project, and that I have exercised responsible charge over the design of the BMPs as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the PDP requirements of the City of Vista BMP Design Manual, which is a design manual for compliance with local City and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the BMP Design Manual. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

____
Engineer of Work's Signature, PE Number & Expiration Date

____
Print Name

____
Company

____
Date

____
E-mail

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ACRONYMS

APN	Assessor's Parcel Number
BMP	Best Management Practice
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWQMP	Storm Water Quality Management Plan

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PDP SWQMP PROJECT OWNER'S CERTIFICATION PAGE

Project Name: [Insert Project Name]
Permit Application Number: [Insert Permit Application Number]

PROJECT OWNER'S CERTIFICATION

This PDP SWQMP has been prepared for [INSERT PROJECT OWNER'S COMPANY NAME] by [INSERT SWQMP PREPARER'S COMPANY NAME]. The PDP SWQMP is intended to comply with the PDP requirements of the City of Vista BMP Design Manual, which is a design manual for compliance with local City and regional MS4 Permit (California Regional Water Quality Control Board San Diego Region Order No. R9-2015-0100) requirements for storm water management.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan. Once the undersigned transfers its interests in the property, its successor-in-interest shall bear the aforementioned responsibility to implement the best management practices (BMPs) described within this plan, including ensuring on-going operation and maintenance of structural BMPs. A signed copy of this document shall be available on the subject property into perpetuity.

____
Project Owner's Signature

____
Print Name

____
Company

____
Company Address and Phone Number

____
Date

____
E-mail

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PROJECT VICINITY MAP

Project Name: [Insert Project Name]

Permit Application Number: [Insert Permit Application Number]

[Insert Project Vicinity Map here]

Form 1: Insert completed *Checklist for New and Redevelopment: Applicability of Permanent, Post-Construction Storm Water BMP Requirements and Project Type Determination*

<table>
<tr><th colspan="2">Form 2 - Site Information Checklist
For PDPs</th><th>City of Vista BMP Design Manual</th></tr>
<tr><td colspan="3">Project Summary Information</td></tr>
<tr><td>Project Name</td><td colspan="2"></td></tr>
<tr><td>Project Address</td><td colspan="2"></td></tr>
<tr><td>Assessor's Parcel Number(s) (APN(s))</td><td colspan="2"></td></tr>
<tr><td>Permit Application Number</td><td colspan="2"></td></tr>
<tr><td>Project Hydrologic Unit, Select One:</td><td>Hydrologic Area</td><td>Hydrologic Sub-Area</td></tr>
<tr><td>☐ San Luis Rey - 903.00</td><td>☐ Lower San Luis 903.10</td><td>☐ Mission 903.11</td></tr>
<tr><td rowspan="6">☐ Carlsbad - 904.00</td><td rowspan="2">☐ Buena Vista Creek 904.20</td><td>☐ El Salto 904.21</td></tr>
<tr><td>☐ Vista 904.22</td></tr>
<tr><td rowspan="2">☐ Agua Hedionda 904.30</td><td>☐ Los Monos 904.31</td></tr>
<tr><td>☐ Buena 904.32</td></tr>
<tr><td rowspan="2">☐ San Marcos 904.50</td><td rowspan="2">☐ Batiquitos 904.51</td></tr>
<tr></tr>
<tr><td>Parcel Area
(total area of Assessor's Parcel(s) associated with the project)</td><td colspan="2">_________ Acres (_____________ Square Feet)</td></tr>
<tr><td>Area to be Disturbed by the Project
(Project Area)</td><td colspan="2">_________ Acres (_____________ Square Feet)</td></tr>
<tr><td>Project Proposed Impervious Area
(subset of Project Area)</td><td colspan="2">_________ Acres (_____________ Square Feet)</td></tr>
<tr><td>Project Proposed Pervious Area
(subset of Project Area)</td><td colspan="2">_________ Acres (_____________ Square Feet)</td></tr>
<tr><td colspan="3">Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project.
This may be less than the Parcel Area.</td></tr>
</table>

Form 2 Page 2 of 9
Description of Existing Site Condition
Current Status of the Site (select all that apply and describe below): ☐ Existing development ☐ Previously graded but not built out ☐ Demolition completed without new construction ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Describe:
Existing Land Cover Includes (select all that apply and describe below): ☐ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☐ Impervious Areas Describe:
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 (GW): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☐ 10 feet < GW Depth < 20 feet ☐ GW Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply and describe in next section): ☐ Drainage ditch/Swale/Waterways ☐ Seeps ☐ Springs ☐ Wetlands ☐ None

Form 2 Page 3 of 9
Description of Existing Site Drainage Patterns
How is storm water runoff conveyed from the site? At a minimum, this description should answer: (1) Is existing site drainage conveyance natural or improved storm drain (urbanized); (2) Is runoff from offsite conveyed through the site? If yes, quantify all offsite drainage areas, design flows, and locations where offsite flows enter the project site, and summarize how such flows are conveyed through the site; (3) Provide details regarding existing project site drainage conveyance network, including any existing storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels; and (4) Identify all discharge locations from the existing project site along with a summary of conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations. Describe existing site drainage patterns:

Form 2 Page 4 of 9
Description of Proposed Site Development
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 Describe:

Description of Proposed Site Drainage Patterns

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

☐ Yes

☐ No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural or constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre- and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Describe proposed site drainage patterns:

Identification and Narrative of Receiving Water and Pollutants of Concern

Describe flow path of storm water from the project site discharge location(s), through urban storm conveyance systems as applicable, to receiving creeks, rivers, and lagoons as applicable, and ultimate discharge 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 and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs / WQIP Highest Priority Pollutant

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 expected from the project site based on all proposed use(s) of the site (see BMP Design Manual Appendix B.6):

Pollutant	Not Applicable to the Project Site	Expected 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			

Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual; select one box and describe below)?

☐ 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.

Describe:

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 (select all that apply and describe below)? Additional signed and stamped reports must be provided to document any exemption from coarse sediment yield requirements.

☐ 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 BMP Design Manual been performed?

☐ 6.2.1 Verification of Geomorphic Landscape Units (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 2.b 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.

Describe:

Form 2 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 for hydromodification management flow control (see Section 6.3.1). Identify each point of compliance for flow control on the Hydromodification Management Exhibit in Attachment 2a.
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 the report.   Discussion / Additional Information: (optional)

Form 2 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.

Form 3 - Source Control BMP Checklist for All Development Projects			City of Vista BMP Design Manual
Project Identification			
Project Name			
Permit Application Number			
Source Control BMPs			
All development projects must implement source control BMPs SC-1 through SC-6, unless justification is provided by qualified design professional See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement source control BMPs shown in this checklist. Answer each category below pursuant to the following, and provide description. • "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. • "No" means the BMP is applicable to the project but it is not feasible to implement. • "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).			
Source Control Requirement	**Applied?**		
SC-1 Prevention of Illicit Discharges into the MS4	☐ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible:			
SC-2 Storm Drain Stenciling or Signage	☐ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible:			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☐ N/A
Describe how source control will be implemented, or justify if not feasible:			

Form 3 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
Describe how source control will be implemented, or justify if not feasible:			
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
☐ On-site 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 <u>all</u> "No" answers shown above.			

Form 4 - Site Design BMP Checklist for All Development Projects			City of Vista BMP Design Manual
Project Identification			
Project Name			
Permit Application Number			
Site Design BMPs			
All development projects must implement site design BMPs SD-1 through SD-8, unless justification is provided by qualified design professional. See Chapter 4 and Appendix E of the Model BMP Design Manual for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following, and provide description. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the Model BMP Design Manual. • "No" means the BMP is applicable to the project but it is not feasible to implement. • "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).			
Site Design Requirement	**Applied?**		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			
SD-2 Conserve Natural Areas, Soils, and Vegetation	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			
SD-3 Minimize Impervious Area	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			
SD-4 Minimize Soil Compaction	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			
SD-5 Impervious Area Dispersion	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			

Form 4 Page 2 of 2			
Site Design Requirement	**Applied?**		
SD-6 Runoff Collection	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			
SD-7 Landscaping with Native or Drought Tolerant Species	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☐ N/A
Describe how site design will be implemented, or justify if not feasible:			

Form 5 - Summary of PDP Structural Pollutant Control and Hydromodification Management BMPs (PDPs)	City of Vista BMP Design Manual
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 BMP Design 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 BMP Design 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 and engineer of record to certify construction of the structural BMPs (see Section 1.12 of the BMP Design Manual). PDP structural BMPs must be maintained into perpetuity, and the local jurisdiction must confirm the maintenance (see Section 7 of the BMP Design 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 BMP Design Manual were followed, and the results (type of BMP selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate structures.	

Form 5 Page 2 of X
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1)

SWQMP ATTACHMENT 1

POLLUTANT CONTROLS: Support Documentation & Checklist

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	**Contents**	**SWQMP Inclusion Requirement**	**Checklist**
Attachment 1a	Drainage Management Area (DMA) Exhibit See DMA Exhibit Checklist on next page.	Required	☐ Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	Required	☐ Included on DMA Exhibit in Attachment 1a ☐ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form 6, Harvest and Use Feasibility Screening Checklist Refer to Appendix B.3-1 of the BMP Design Manual to complete Form 6.	Required, unless the entire project will utilize Infiltration BMPs	☐ Included ☐ Not included because the entire project will use Infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition Refer to Appendices C and D of the *BMP Design Manual* to complete Form I-8.	Required, unless the project will utilize Harvest and Use BMPs	☐ Included ☐ Not included because the entire project will use Harvest and Use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines	Required	☐ Included

DMA Exhibit Checklist and Tabular Summary of DMAs

Provide a map of project site titled "DMA Exhibit", which must identify the following elements:

- ☐ Underlying hydrologic soil group
- ☐ Approximate depth to groundwater
- ☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands, etc.)
- ☐ Critical coarse sediment yield areas to be protected
- ☐ Existing topography and impervious areas
- ☐ Existing and proposed site drainage network and storm drain structures
- ☐ Proposed connections to offsite drainage
- ☐ Proposed demolition
- ☐ Proposed grading
- ☐ Proposed impervious features
- ☐ Proposed design features and surface treatments used to minimize imperviousness
- ☐ Drainage management area (DMA) boundaries
- ☐ DMA identification numbers (DMA ID)
- ☐ DMA areas (square footage or acreage)
- ☐ DMA type (Drains to BMP, Self-mitigating, De Minimis, or Self-retaining)
- ☐ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form 2)
- ☐ Proposed Structural BMPs (location, type, and size/detail)

The template tabular summary below may be used on the DMA Exhibit to address many of the elements identified above. An example is provided.

DMA ID	DMA Surface Type (roof, street, etc.)	DMA Area (sq.ft.)	DMA Type[1]	Proposed Structural BMP Type[2]	Structural BMP ID	Structural BMP Area[3]
1	Asphalt street	8,000 sq.ft.	Drains to BMP	Bioretention	BMP 1	320 sq.ft.

[1] DMA Type can only be: 1) Drains to BMP, 2) Self-mitigating, 3) De Minimis, or 4) Self-retaining
[2] BMP Type must be consistent with terminology in this BMP Design Manual and/or CASQA Fact Sheets
[3] Structural BMP Area is the final facility construction size, typically presented as an area (sq.ft.)

NOTE: We may also suggest a table like this be used as well for bioretention facilities (as applicable):

BMP ID	BMP Area	Gravel Depth	Media Depth	Total Depth	Orifice Elevation	Orifice Size	Orifice Count	Ponding depth (surface to riser)

Instructions for PDP WQTR Attachment 1.b Tabular Summary of Drainage Management Areas (DMAs) and Design Capture Volume (DCV) Calculations
Use 'Data Sheet' (included in this Workbook) for data entry

Data Sheet Column ID	Data Sheet Column Header	Instructions
A	DMA ID	Provide DMA identification number matching the DMA exhibit
B	DMA Area, A (ft^2)	Provide DMA Area in square feet
C	Hydrologic Soil Group (A, B, C, or D)	Provide DMA Hydrologic Soil Group (A, B, C, or D)
D	Post-Project Surface Type From Table B.1-1	Provide DMA Post-Project Surface Type From Table B.1-1 of BMP Design Manual
E	Post-Project Surface Runoff Factor, C From Table B.1-1	Provide DMA Post-Project Surface Runoff Factor From Table B.1-1 of BMP Design Manual
F	DMA Excluded from Pollutant Control Design Capture Volume (DCV) Calculations in Accordance with BMP Design Manual Chapter 5.2? (YES / NO)	Indicate YES or NO (see Chapter 5.2 of the BMP Design Manual for DMAs that can be excluded from pollutant control DCV calculations) For 'NO' answer, continue to column G. For 'YES' answer, indicate basis of exclusion (e.g., 'YES, self-mitigating'). PDP WQTR must include relevant calculations for DMAs excluded from DCV calculations when applicable (e.g., self-retaining DMAs via Qualifying Site Design BMPs require backup calculations for ratios of site area requiring volume reduction:site area promoting volume reduction). For 'YES' answer in this column, do not fill Columns G to M. Skip to Column N and enter 'NO' in Column N.
G	Un-Adjusted DCV (ft^3)	Provide un-adjusted DCV in cubic feet (see Appendix B.1 of the BMP Design Manual) Un-adjusted DCV (cubic feet) = Runoff Factor (unitless) x 85th Percentile Precipitation (feet) x DMA Area (square feet) Note: 85th Percentile Precipitation presented in Figure B.1-1 is reported in inches - convert to feet for DCV calculation.
H	DCV Reduction Through Site Design BMPs Applied? (YES / NO)	Indicate YES or NO (see Appendix B.2 of the BMP Design Manual for adjustments to reduce DCV through site design BMPs) For 'NO' answer, continue to Column I and copy un-adjusted DCV from Column G to Column I. For 'YES' answer, indicate type of adjustment and relevant Site Design Fact Sheet (SD-1, 5, 6A, 6B, or 8) (e.g., 'YES, SD-5 Impervious Area Dispersion'). PDP WQTR must include relevant calculations for adjustments. Continue to Column I and provide adjusted DCV.
I	Site Design Adjusted DCV (ft^3)	Provide DCV adjusted for site design BMPs If no adjustments are applicable, then Column I = Column G.
J	Retention BMPs Implemented? (YES / NO)	Indicate YES or NO For 'YES' answer, indicate type of retention BMP (e.g., 'YES, Infiltration'). PDP WQTR must include relevant feasibility worksheet and calculations. For 'NO' answer, PDP WQTR must include both Infiltration Feasibility AND Harvest & Use Feasibility Worksheets (Forms 5 and 6).
K	DCV Remaining After Retention BMPs Implemented (ft^3)	Provide DCV remaining after implementation of retention BMPs. If no retention BMPs implemented, copy DCV from column I and continue to Column L. if remaining DCV after implementation of retention BMPs > 0, continue to Column L. If remaining DCV after implementation of retention BMPs = 0, go to Column N, and Column N = NO.
L	Biofiltration BMPs Implemented? (YES / NO)	Indicate YES or NO For 'YES' answer, PDP WQTR must include relevant calculations. For 'NO' answer, PDP WQTR must describe reason for infeasibility.
M	DCV Remaining After Biofiltration BMPs Implemented (ft^3)	Provide DCV remaining after implementation of biofiltration BMPs. If no biofiltration BMPs, provide DCV from Column K, then Column N = YES if remaining DCV > 0, then Column N = YES if remaining DCV = 0 then Column N = NO
N	Offsite Alternative Compliance and Onsite Flow-Thru Treatment Control BMPs Required? (YES / NO)	Offsite Alternative Compliance and Onsite Flow-Thru Treatment Control BMPs will be required if there is any remaining DCV in column M (if column M > 0)

PDP WQTR ATTACHMENT 1.b
TABULAR SUMMARY OF DRAINAGE MANAGEMENT AREAS (DMAs) AND DESIGN CAPTURE VOLUME (DCV) CALCULATIONS

Note: Instructions to complete this Data Sheet are provided in the Worksheet titled 'Instructions' (within this Workbook)

Project Name:
Date:

85TH Percentile Rainfall:

A	B	C	D	E	F	G	H	I	J	K	L	M	N
DMA ID	DMA Area, A (ft^2)	Hydrologic Soil Group (A, B, C, or D)	Post-Project Surface Type From Table B.1-1	Post-Project Surface Runoff Factor, C From Table B.1-1	DMA Excluded from Pollutant Control Design Capture Volume (DCV) Calculations in Accordance with BMP Design Manual Chapter 5.2? (YES / NO)	Un-Adjusted DCV (ft^3)	DCV Reduction Through Site Design BMPs Applied? (YES / NO)	Site Design Adjusted DCV (ft^3)	Retention BMPs Implemented? (YES / NO)	DCV Remaining After Retention BMPs Implemented (ft^3)	Biofiltration BMPs Implemented? (YES / NO)	DCV Remaining After Biofiltration BMPs Implemented (ft^3)	Offsite Alternative Compliance and Onsite Flow-Thru Treatment Control BMPs Required? (YES / NO)

SWQMP ATTACHMENT 2
HYDROMODIFICATION MANAGEMENT CONTROLS: Support Documentation & Checklist

☐ Check this box if the project is exempt from PDP hydromodification management requirements.

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	SWQMP Inclusion Requirement	Checklist
Attachment 2a	Hydromodification Management Exhibit	Required	☐ Included See Hydromodification Management Exhibit Checklist on the back of this Attachment cover sheet.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas See Section 6.2 of the BMP Design Manual.	Exhibit – Required* Analyses – As Applicable *Exhibit must show where Coarse Sediment Yield Areas are relative to project site.	☐ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map Analyses, as applicable, for Critical Coarse Sediment Yield Area Determination, per BMP Design Manual: ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels See Section 6.3.4 of the BMP Design Manual.	Optional	☐ Not performed ☐ Included ☐ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design, including Structural BMP Drawdown Calculations and Overflow Design Summary	Required	☐ Included ☐ Submitted as separate stand-alone document

Attachment Sequence	Contents	SWQMP Inclusion Requirement	Checklist
	See Chapter 6 and Appendix G of the BMP Design Manual		
Attachment 2e	Vector Control Plan	As Applicable	☐ Included ☐ Not required because BMPs will drain in less than 96 hours

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

☐ Underlying hydrologic soil group
☐ Approximate depth to groundwater
☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐ Critical coarse sediment yield areas to be protected
☐ Existing topography
☐ Existing and proposed site drainage network and connections to drainage offsite
☐ Proposed grading
☐ Proposed impervious features
☐ Proposed design features and surface treatments used to minimize imperviousness
☐ Point(s) of Compliance (POC) for Hydromodification Management
☐ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☐ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE: Support Documentation & Checklist

Each of the attachments indicated below should be considered for inclusion with the SWQMP. Use this checklist to indicate which attachments are included behind this coversheet.

Attachment Sequence	Contents	SWQMP Inclusion Requirement	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions	Required	☐ Included See Structural BMP Maintenance Information Checklist on the back of this Attachment cover sheet.
Attachment 3b	Draft Maintenance Agreement (when applicable)	Required	☐ Included ☐ Not Applicable

ATTACHMENT 4
REQUIREMENTS FOR BMP PLANS

Use this checklist to ensure project BMP construction plans submitted for review include necessary information for storm drain improvements.

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 conform with project design features identified in the PDP SWQMP.

On their own plan sheets, project construction plans shall clearly illustrate all storm drain improvements, features, and structural BMPs. Storm drain construction plan sheets must, at minimum, include the following:

- Identification, count, and location of Source Control BMPs.
- Identification, count, and location of Site Design BMPs.
- Identification, count, and construction specifications of Pollution Control BMPs.
- Identification, count, and construction specifications of Hydromodification Management BMPs.
- Identification, count, and construction specifications of all storm drain facilities or structures (including but not limited to pipe, inlets, outlets, manholes, cleanouts, flow dissipaters, culverts, BMPs, etc.).
- Identification and location of natural water features (waterways, ditches, wetlands, ponds, etc.).
- Grading, drainage, and draining management areas (DMAs), consistent with the SWQMP.
- Identification of all point(s) of discharge, including overflow routes for storm water in event of structural BMP failure or rainfall that exceeds BMP design.
- Flow direction from impervious surfaces, from point of concentration (e.g., roof drains, curb cuts, pipe inlets/outlets) to final approved point of discharge.
- Construction specifications, and plan and profile details for each structural BMP on site. 'Typical' drawings may only be used for structural BMPs with similar shape and design.
- A statement indicating: *"Stormwater BMPs on this project are designed for compliance with Local, State, and Federal water quality requirements. BMP design must not be changed without prior approval by the design engineer and City of Vista. Additional reports, documents, or designs will be required with implementation of changes."*

Appendix

B

CITY OF VISTA BMP DESIGN MANUAL

Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

February 2016

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

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.

Surface	Runoff Factor
Natural (A Soil)	0.10
Natural (B Soil)	0.14
Natural (C Soil)	0.23
Natural (D Soil)	0.30

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.

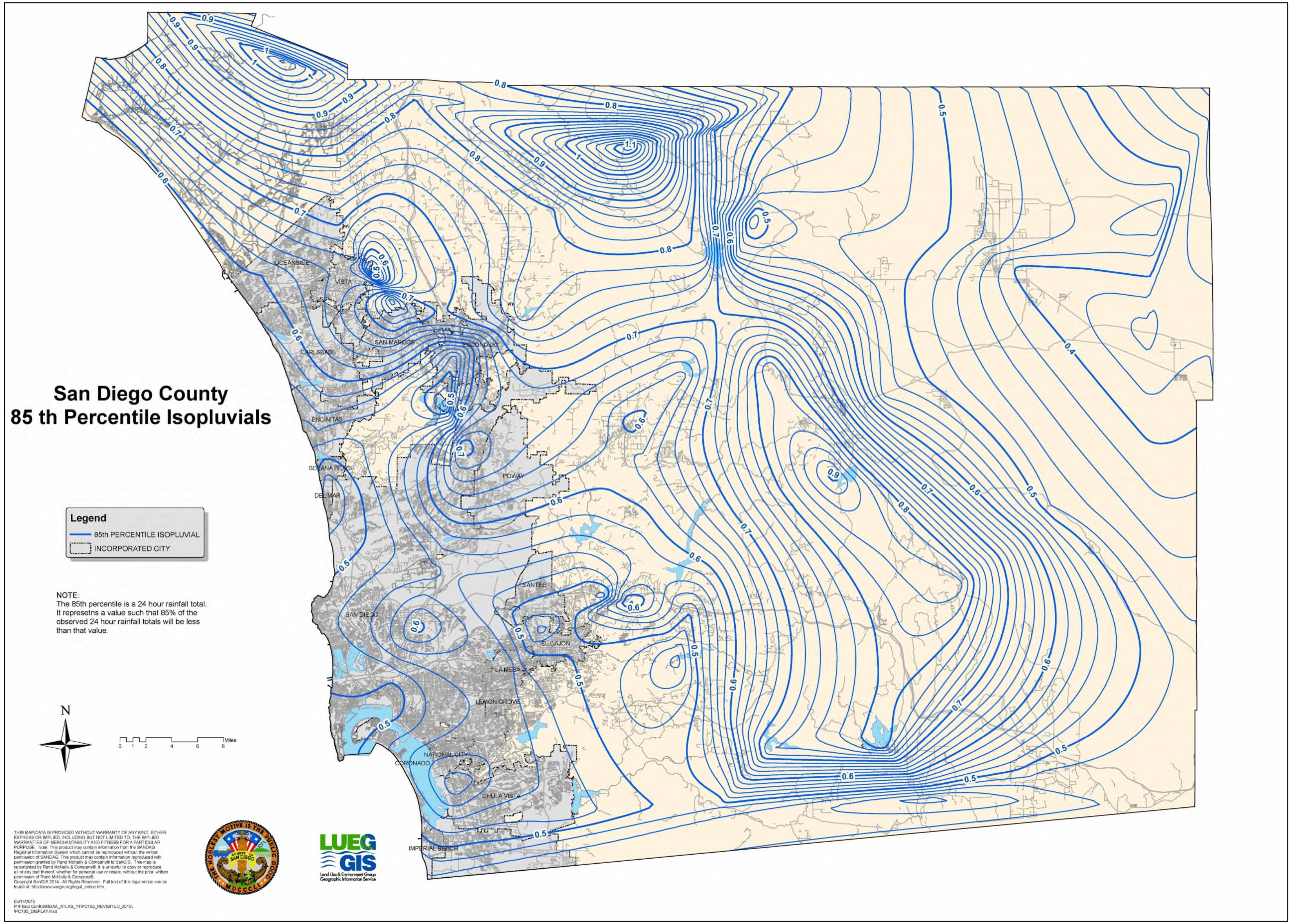


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

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 City Engineer.

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>Worsksheet 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 City Engineer. 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.

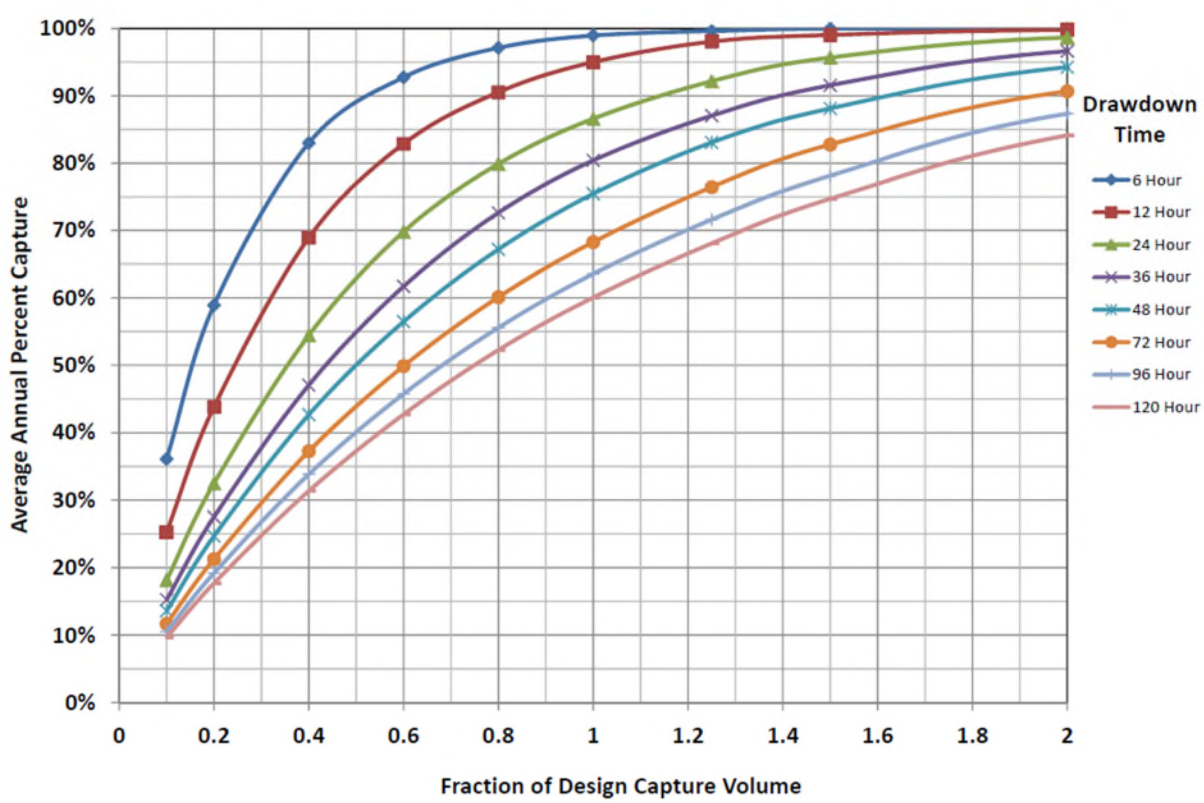


Figure B.4-1: Percent Capture Nomograph

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.

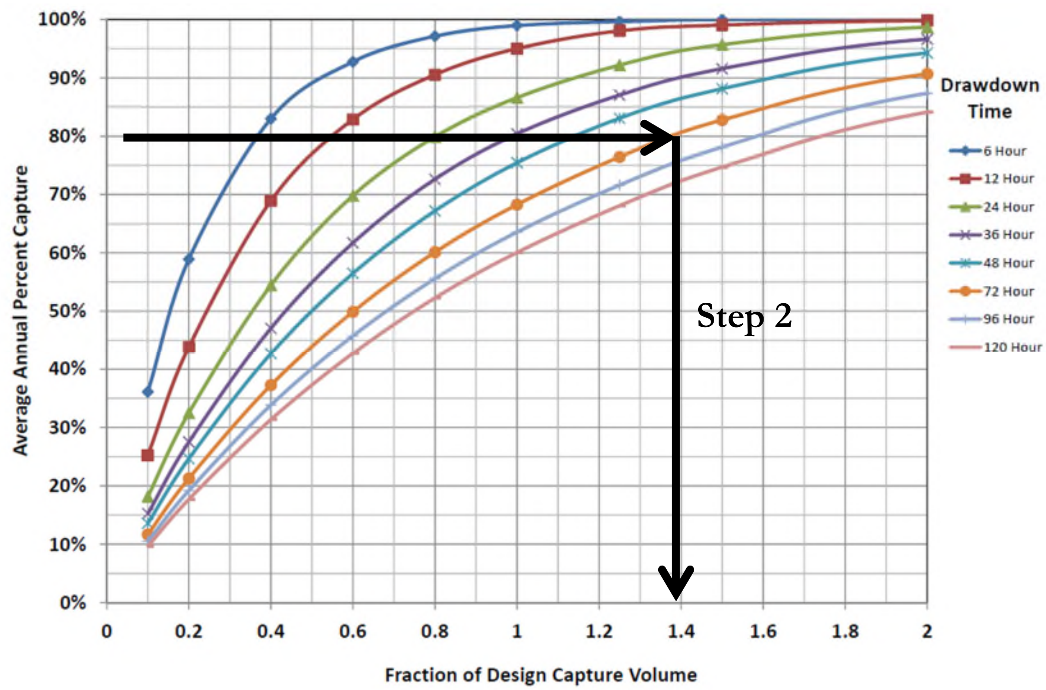
See the respective BMP facts sheets for BMP-specific instructions for the calculation of volume and drawdown time. The above method can also be used to size and/or evaluate the performance of other retention BMPs (evapotranspiration, harvest and use) that have a drawdown rate that can be approximated 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.

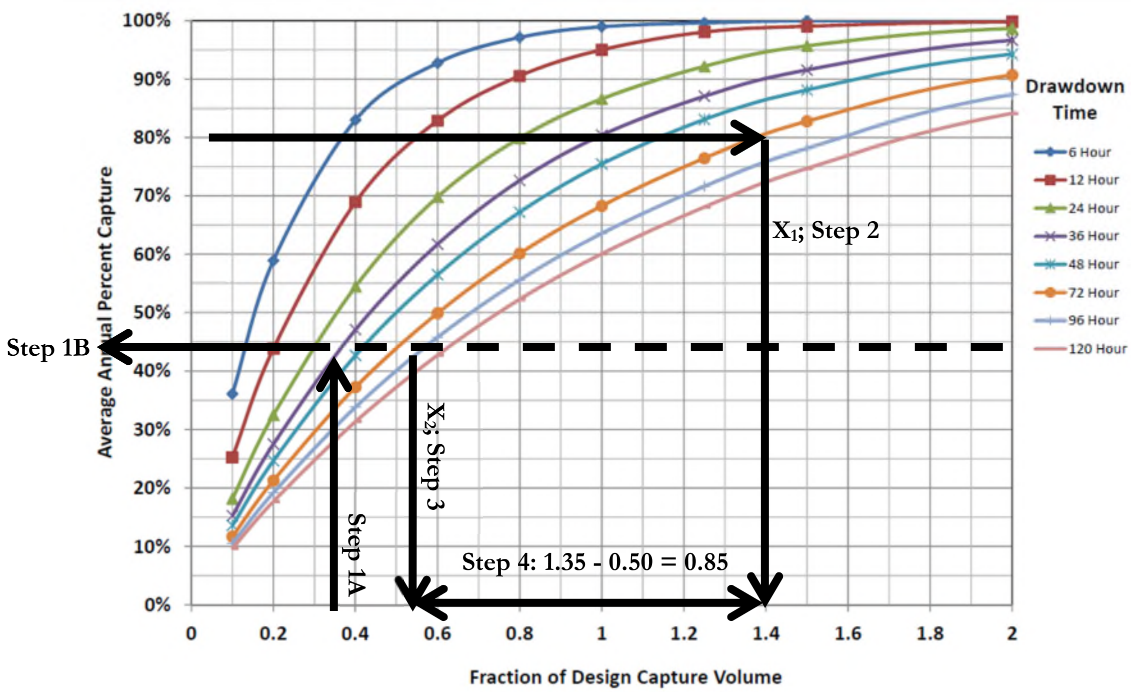
See the respective BMP facts sheets for BMP-specific instructions for the calculation of volume and drawdown time.

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.

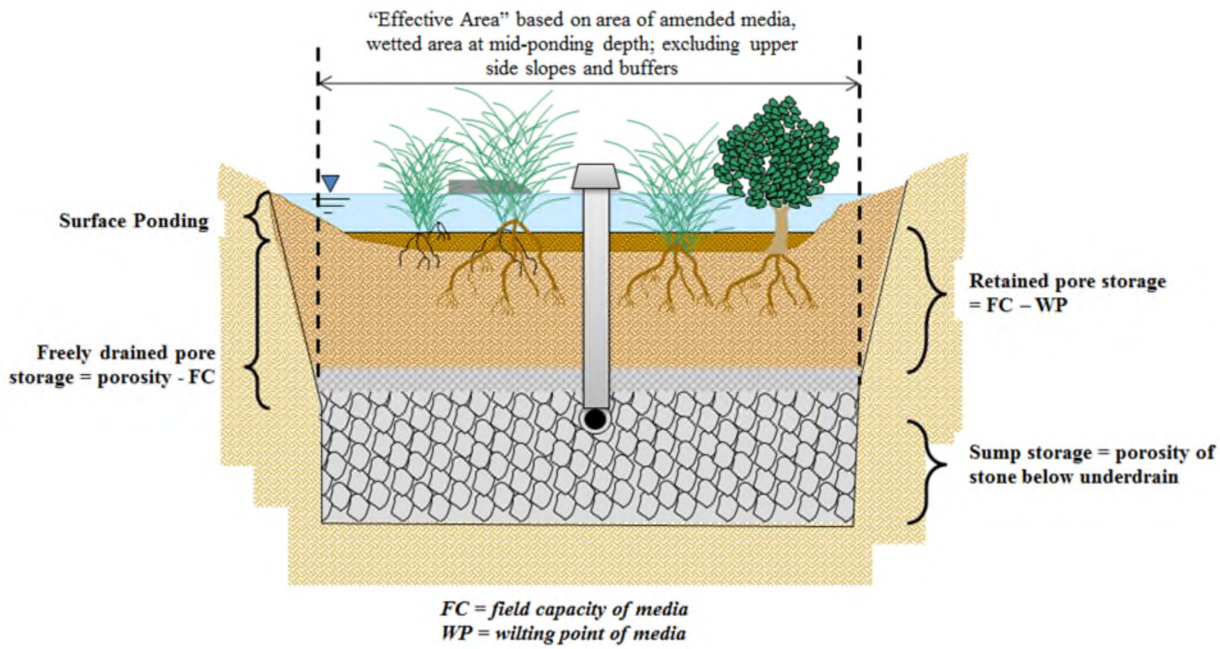
As such, this equivalency (between DCV draw down in 36-hours and 80 percent capture) has been utilized to provide a common currency between volume-based BMPs with a wide range of drawdown rates. This approach allows flexibility in the design of BMPs while ensuring consistent performance.

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	
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
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	Minimum BMP Footprint [Line 24 x Line 25 x 0.03]		sq-ft
25	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 26)		sq-ft

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1	
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 [City Engineer], 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.5-3.

B.5-3: 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. City Engineer 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 [City Engineer]. 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 [City Engineer]. 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		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

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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 **<u>not</u>** 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 [City Engineer] if the BMP meets the requirements in Appendix F **<u>and</u>** 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. **<u>No infiltration condition</u>**: 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 [City Engineer]. 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. **<u>Partial infiltration condition</u>**: 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 [City Engineer].
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 [City Engineer] if the BMP meets the requirements in Appendix F and Option 1 or Option 2 sizing in Worksheet B.5-1.

B.6 Flow-Through Treatment Control BMPs (for use with Alternative Compliance)

The following methodology shall be used for selecting and sizing onsite flow-through treatment control BMPs for use as pre-treatment.

Note that the City of Vista does not have an alternative compliance program, so flow through treatment control BMPs should only be used for pre-treatment as of the implementation date of this Manual.

This methodology consists of three steps:

1) Determine the PDP most significant pollutants of concern (Appendix B.6.1).
2) Select a flow-through 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-through 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-Through Treatment Control BMPs

The following steps shall be followed to select the appropriate flow-through 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-through 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-through 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-through 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-through 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-Through 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-Through Treatment Control BMPs Meeting Performance Standard

List of Acceptable Flow-Through 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-through treatment purposes. Porous pavement for retention purposes is an infiltration BMP, not a flow-through 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 City Engineer.** 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. The City Engineer has no obligation to accept any proprietary flow-through BMP.

In determining the acceptability of a proprietary flow-through treatment control BMP, the City Engineer 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.

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-through 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-through 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. The City Engineer has no obligation to accept any proprietary flow-throughthrough BMP.

       In determining the acceptability of a proprietary flow-through treatment control BMP, the City Engineer 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.

Table B.6-5: Performance Standard for Flow-ThroughThrough 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-Through Treatment Control BMPs Meeting Nutrient Treatment Performance Standard

List of Acceptable Flow-Through 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-Through Treatment Control BMPs:

Flow-through 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-through 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-Through Design Flows

Flow-through 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-through (Line 1 – Line 2 – 0.67*Line 3)	$DCV_{flow-through}$		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-through BMPs. That is, if the flow-through BMP is upstream of the project's retention and biofiltration BMPs then the flow-through BMP shall be sized using an adjustment factor of 1.
2) Volume based (e.g., dry extended detention basin) flow-through 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

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, and 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, and other high threat to water quality land uses and activities as designated by each Copermittee, 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, residential 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; 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>Criteri</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 City Engineer 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.**		

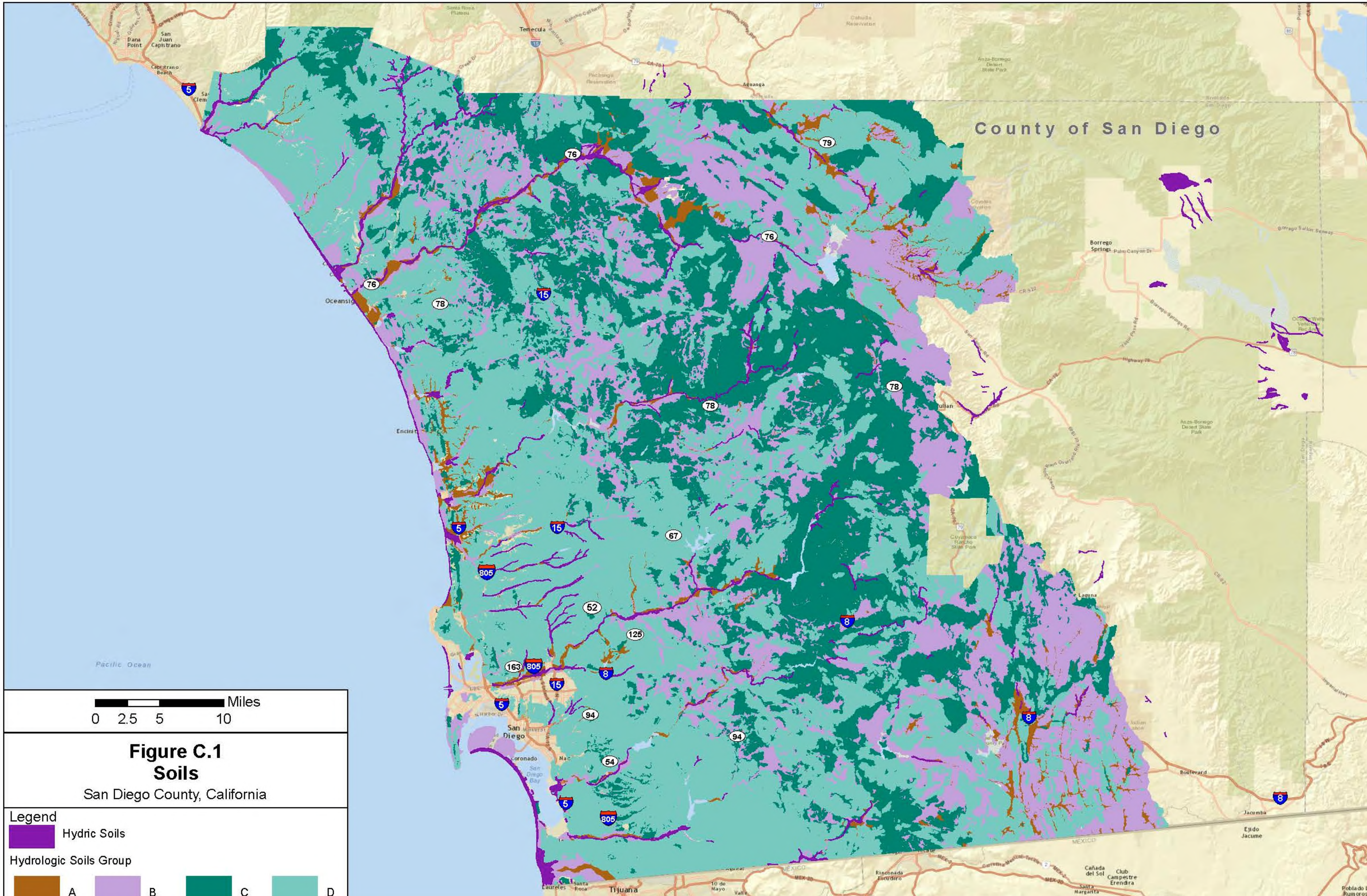
*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

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	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/


County of San Diego
Pacific Ocean
Miles
0 2.5 5 10
Figure C.1
Soils
San Diego County, California
Legend
Hydric Soils
Hydrologic Soils Group
A
B
C
D

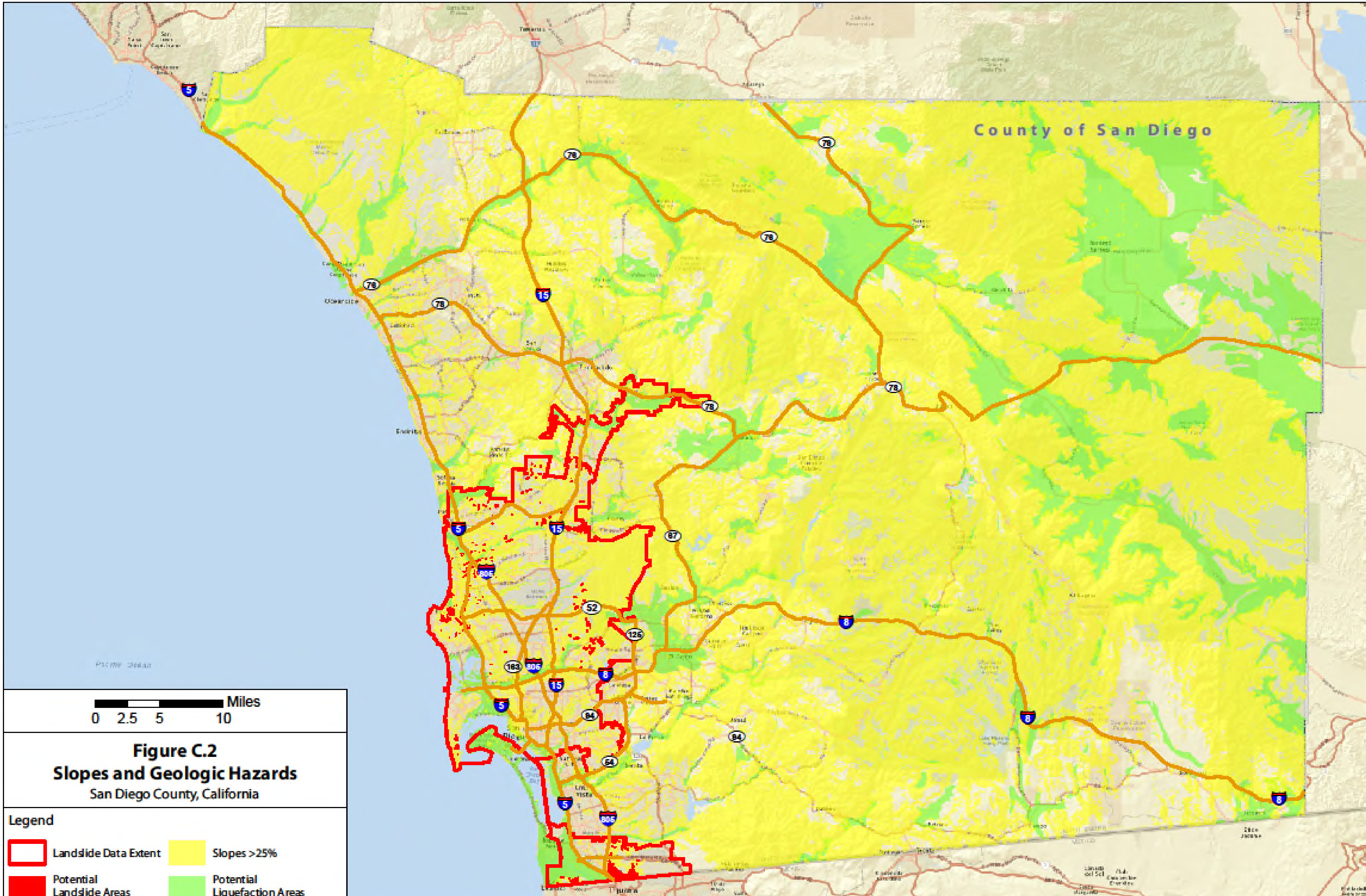


Figure C.2
Slopes and Geologic Hazards
San Diego County, California

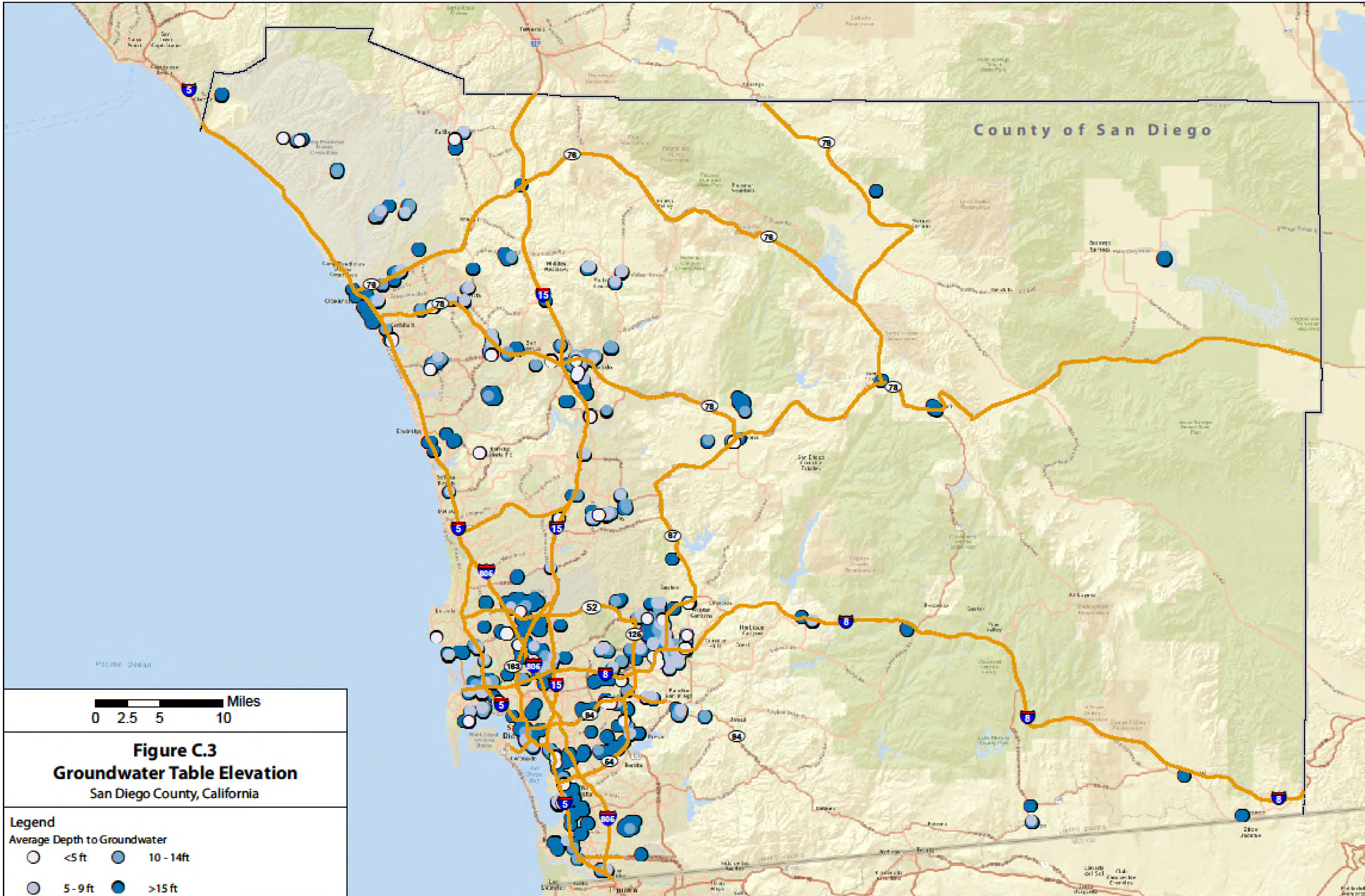


Figure C.3
Groundwater Table Elevation
San Diego County, California

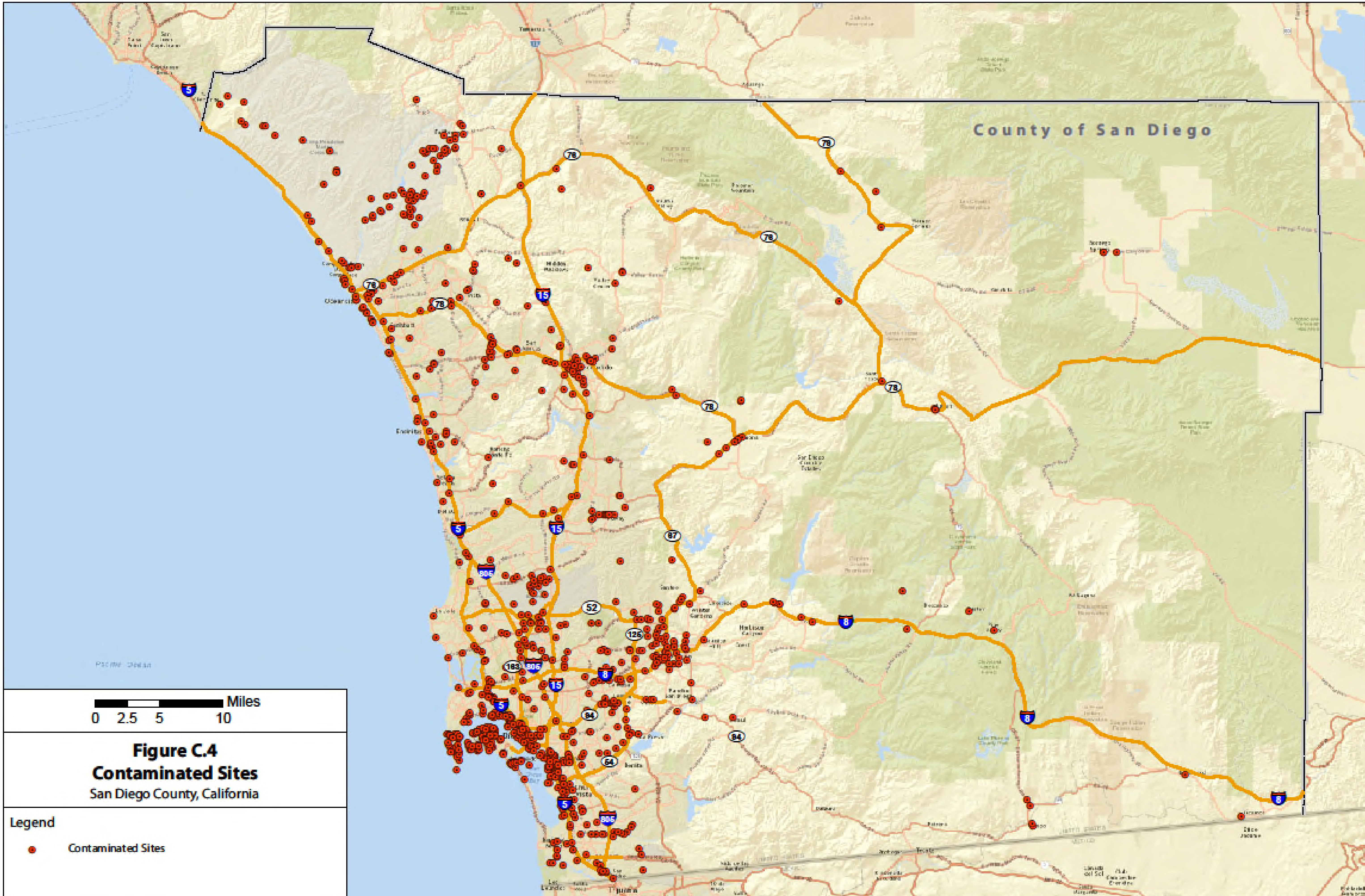


Figure C.4
Contaminated Sites
San Diego County, California

Appendix

D

CITY OF VISTA BMP DESIGN MANUAL

Approved Infiltration Rate Assessment Methods for Selection of Storm Water BMPs

February 2016

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 City Engineer, 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 City Engineer.

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

Should I use a factor of safety for design infiltration rate?

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-through 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-through 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

Factor of Safety and Design Infiltration Rate Worksheet			Worksheet D.5-1		
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:					

Appendix E

CITY OF VISTA BMP DESIGN MANUAL

BMP Design Fact Sheets

Appendix E BMP Design Fact Sheets

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-through Treatment Control	Flow-through 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-through 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 the words "No Dumping! Flows to Bay" or similar.	❑ Maintain and periodically repaint or replace inlet markings. ❑ Provide storm water pollution prevention information to new site owners, lessees, or operators. ❑ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. ❑ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."

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 owners, lessees, 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 owners, lessees 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): ❑ Wash water 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 rinse water 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 property owner 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. Wash water 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 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 [City Engineer], 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 [City Engineer] 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 City Engineer if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	**Tree species** is appropriately chosen for the development (private or public). 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 used by all county municipalities are provided in Appendix E.20	Proper tree placement and species selection minimizes problems such as pavement damage by surface roots and poor growth.

	Siting and Design	*Intent/Rationale*
☐	**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 City Engineer 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 [City Engineer] 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 [City Engineer] 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,

Siting and Design	***Intent/Rationale***
	the tree credit 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.2. 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	

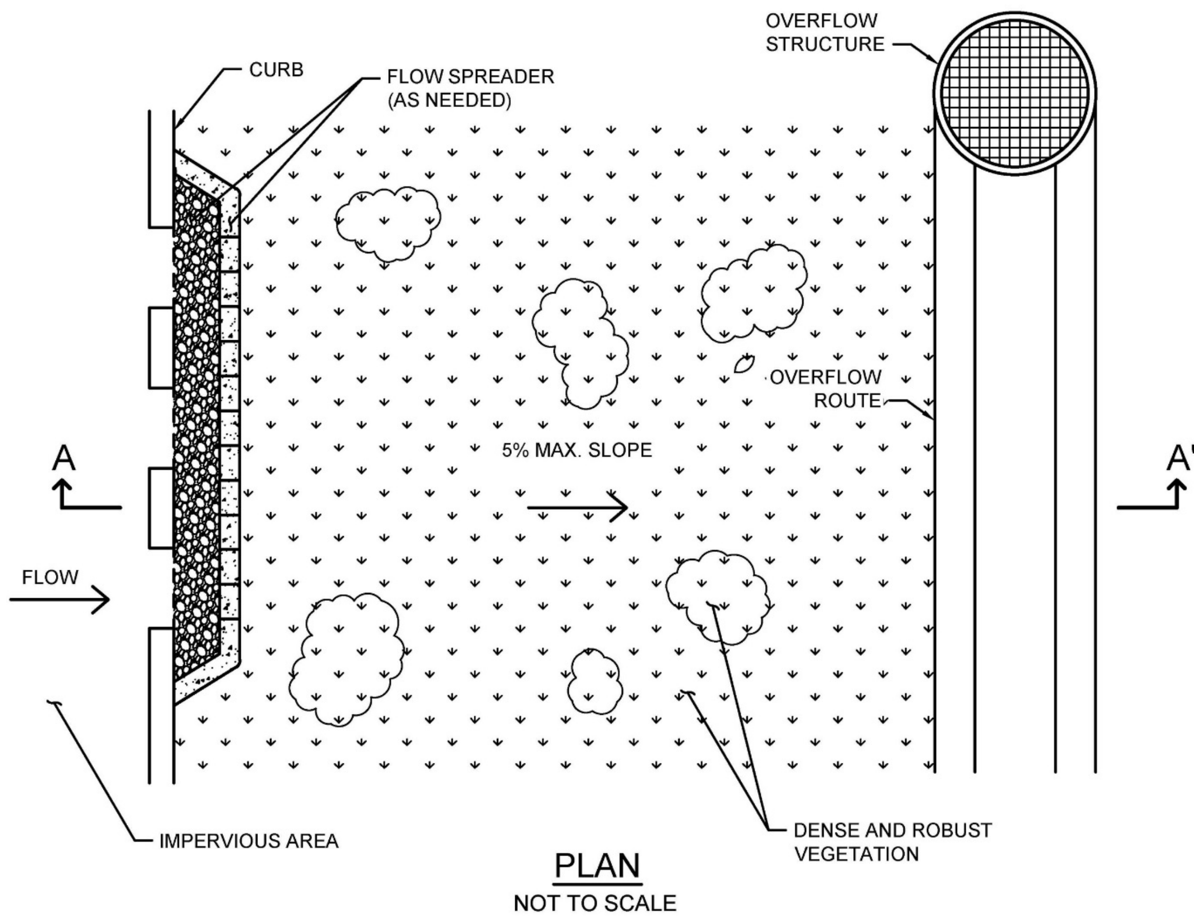
Photo Credit: Orange County Technical Guidance Document

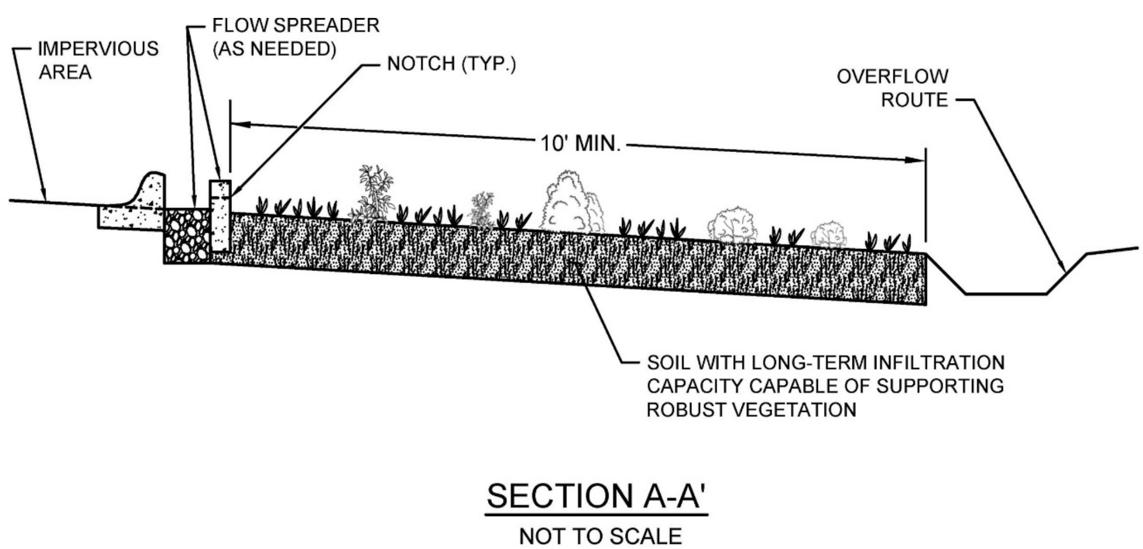
Description

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 City Engineer 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 owned by the project owner and 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

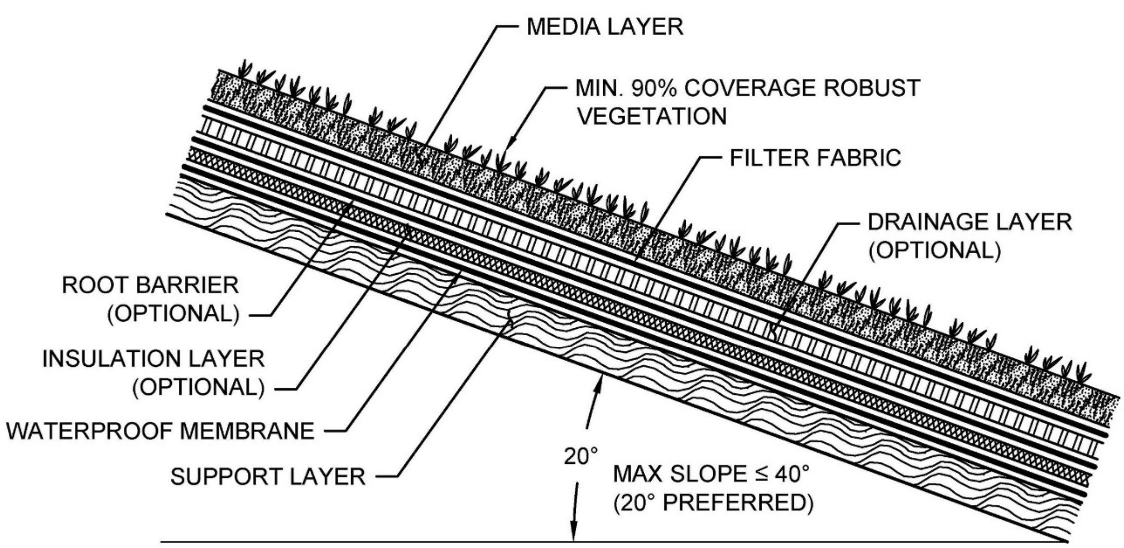
Description

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 City Engineer 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

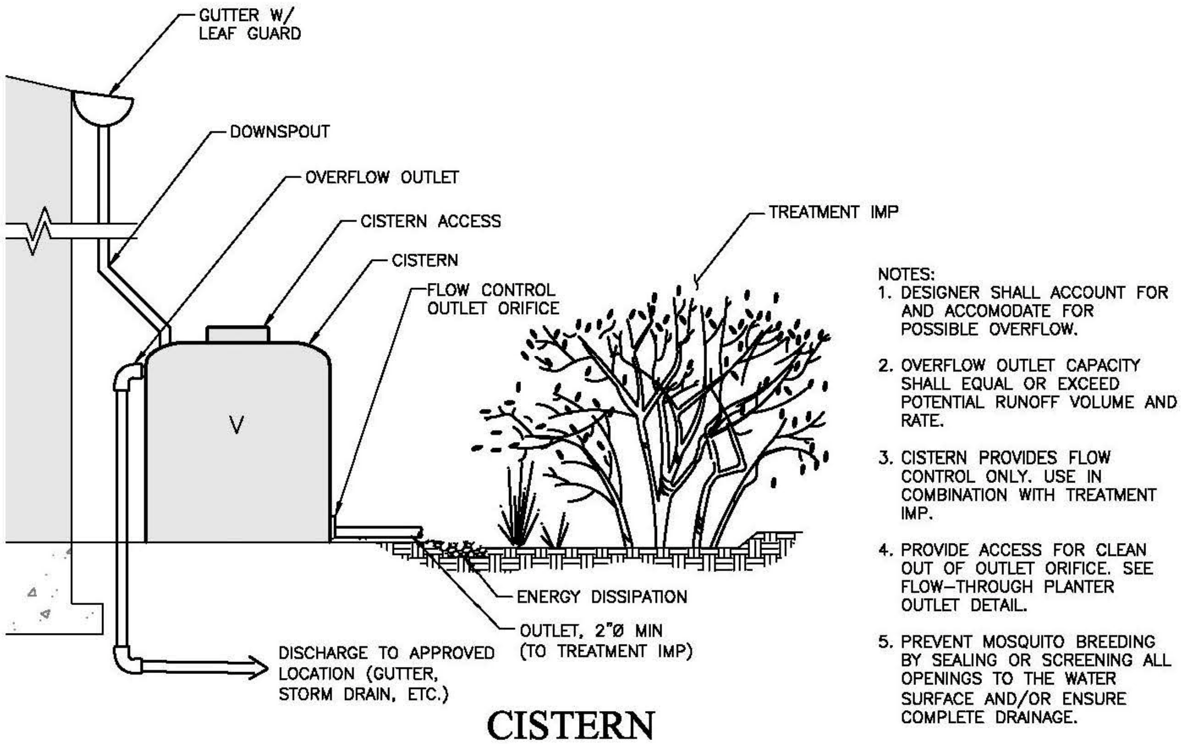
Photo Credit: Water Environment Research Foundation: WERF.org

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 City Engineer 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

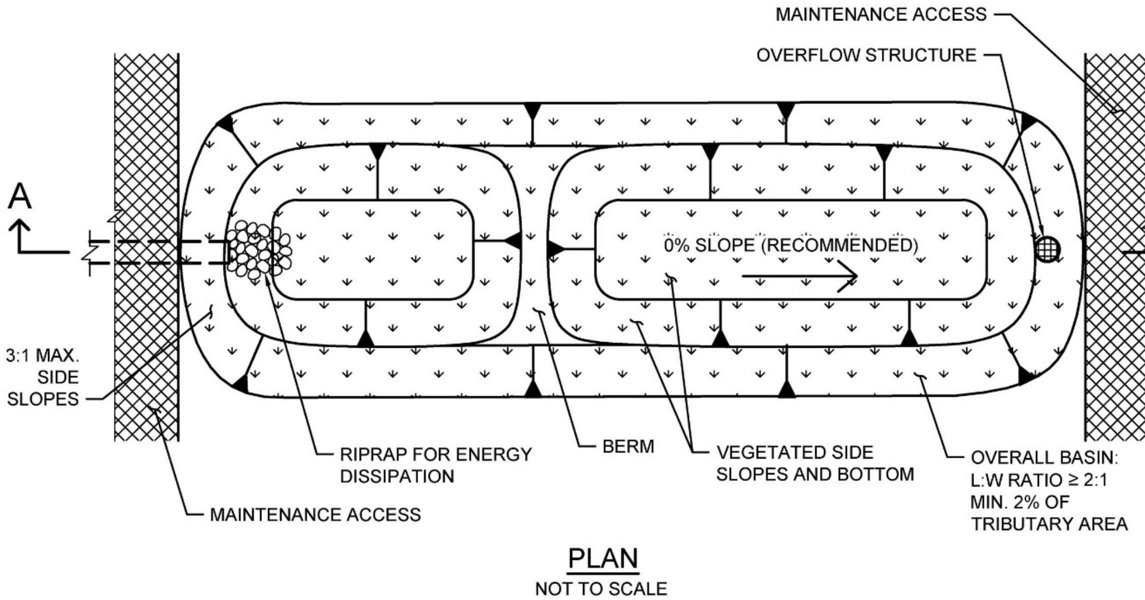
Photo Credit: http://www.stormwaterpartners.com/facilities/basin.html

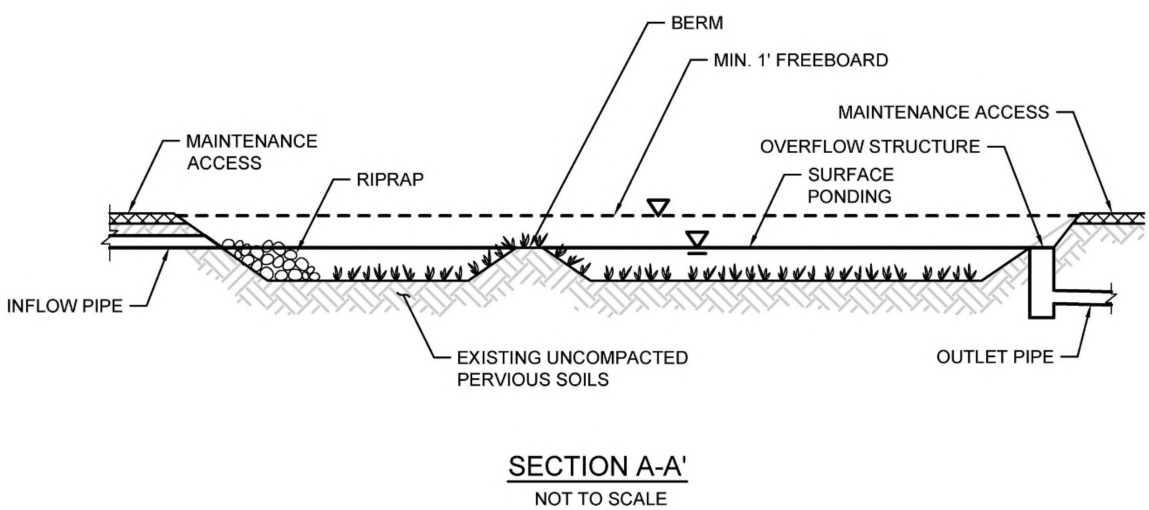
Description

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 City Engineer 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.
☐	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.

Inflow and Overflow Structures

	Siting and Design	*Intent/Rationale*
☐	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 in ground 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:

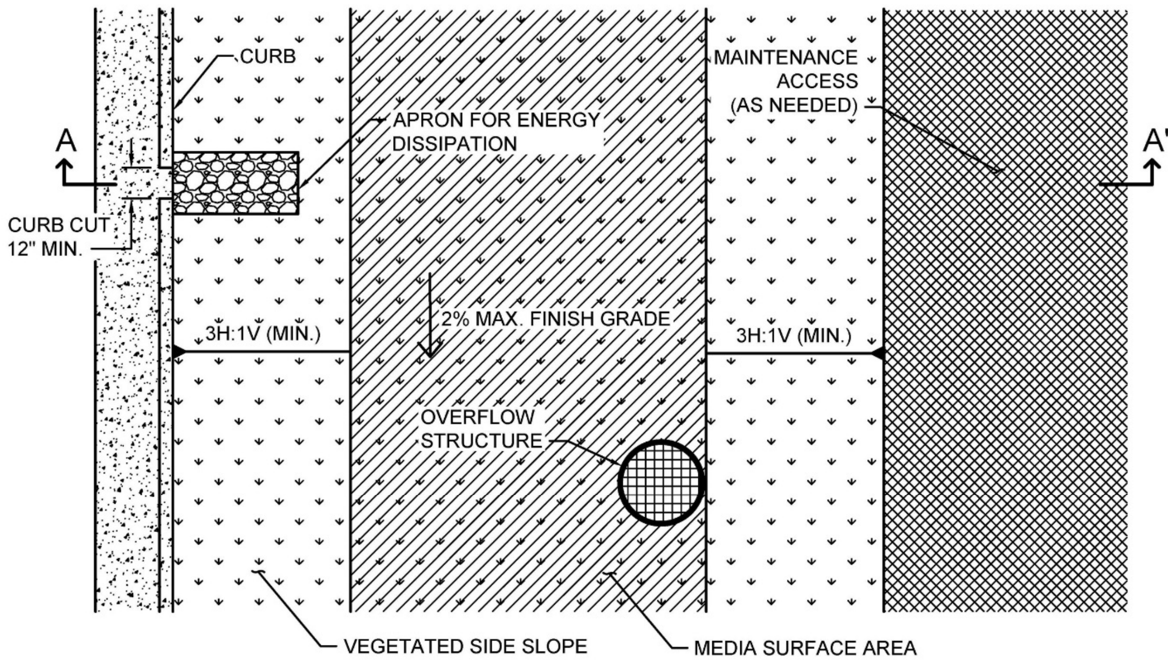
- Inflow distribution mechanisms (e.g., perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer (optional)
- 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.



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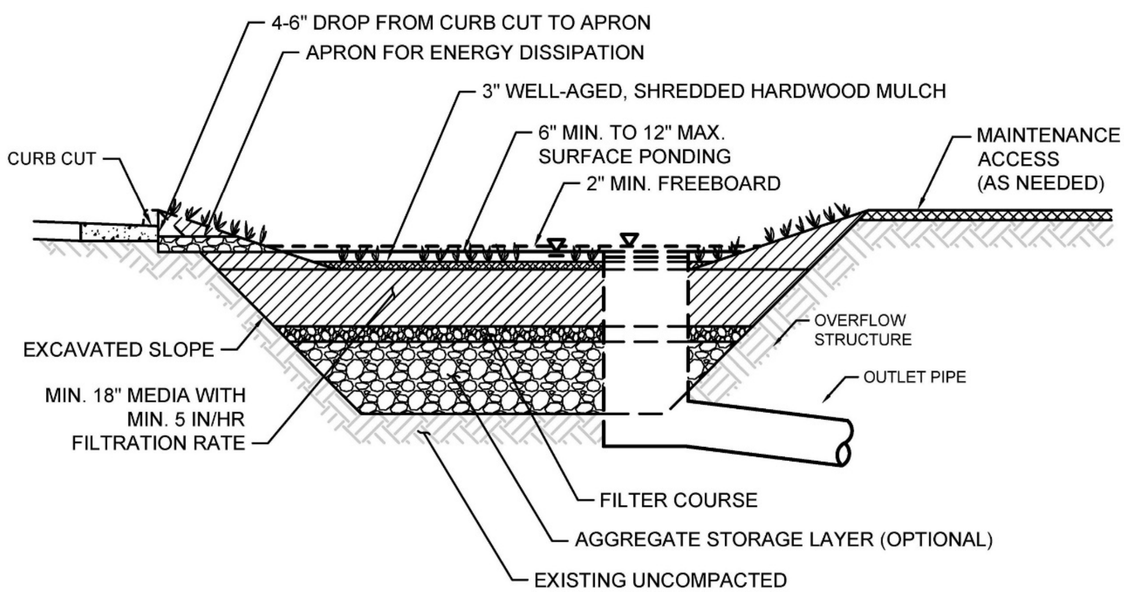


SECTION A-A'
NOT TO SCALE

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 City Engineer 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.
☐	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 [City Engineer} 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 City Engineer for proper performance of the regional 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 City Engineer 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 City Engineer 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.
Media Layer		

	Siting and Design	*Intent/Rationale*
☐	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 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)

Location: Kellogg Park, San Diego, California

MS4 Permit Category

Retention
Flow-through Treatment Control

Manual Category

Infiltration
Flow-through Treatment Control

Applicable Performance Standard

Pollutant Control
Flow Control

Primary Benefits

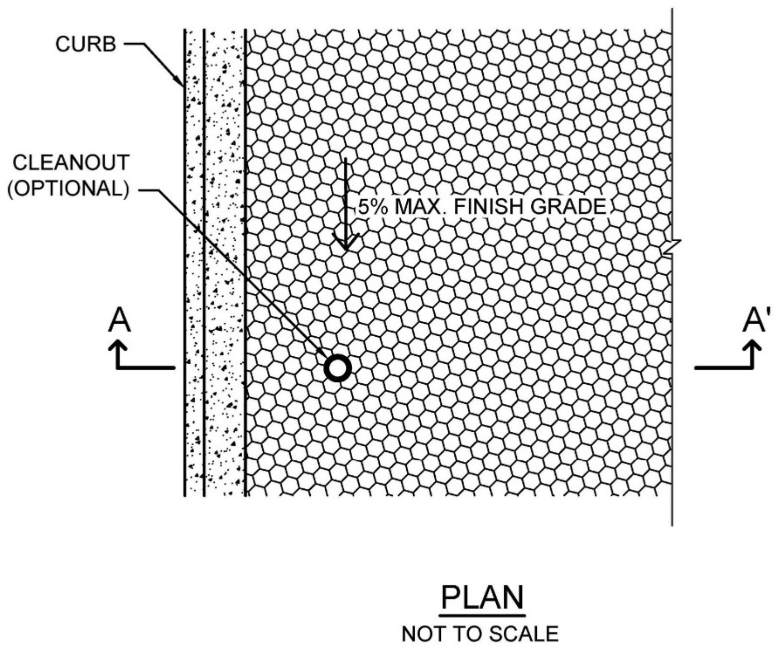
Volume Reduction
Peak Flow Attenuation

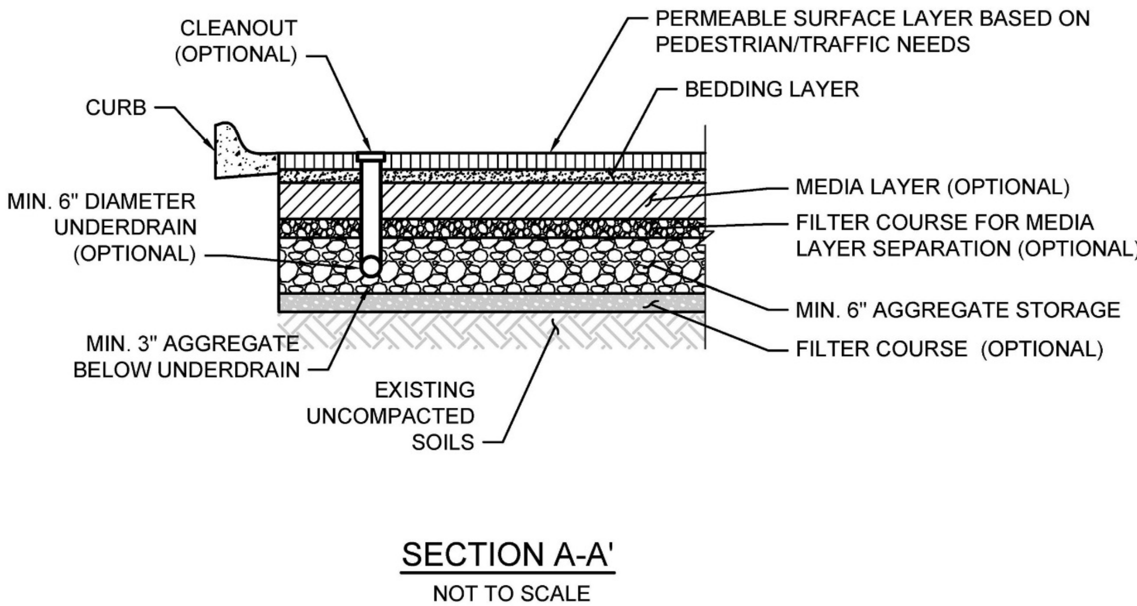
Description

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, and 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-through 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-through treatment and is not considered biofiltration treatment. Storage provided above the underdrain invert is included in the flow-through treatment volume.

Flow-through 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-through 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-through 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 City Engineer 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.
☐	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.
☐	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.

	Siting and Design	Intent/Rationale
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.
☐	Aggregate used for bedding layer is washed prior to placement.	Washing aggregate will help eliminate fines that could clog the permeable

	Siting and Design	*Intent/Rationale*
		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.
☐	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.

	Siting and Design	*Intent/Rationale*
☐	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-through 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-through 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

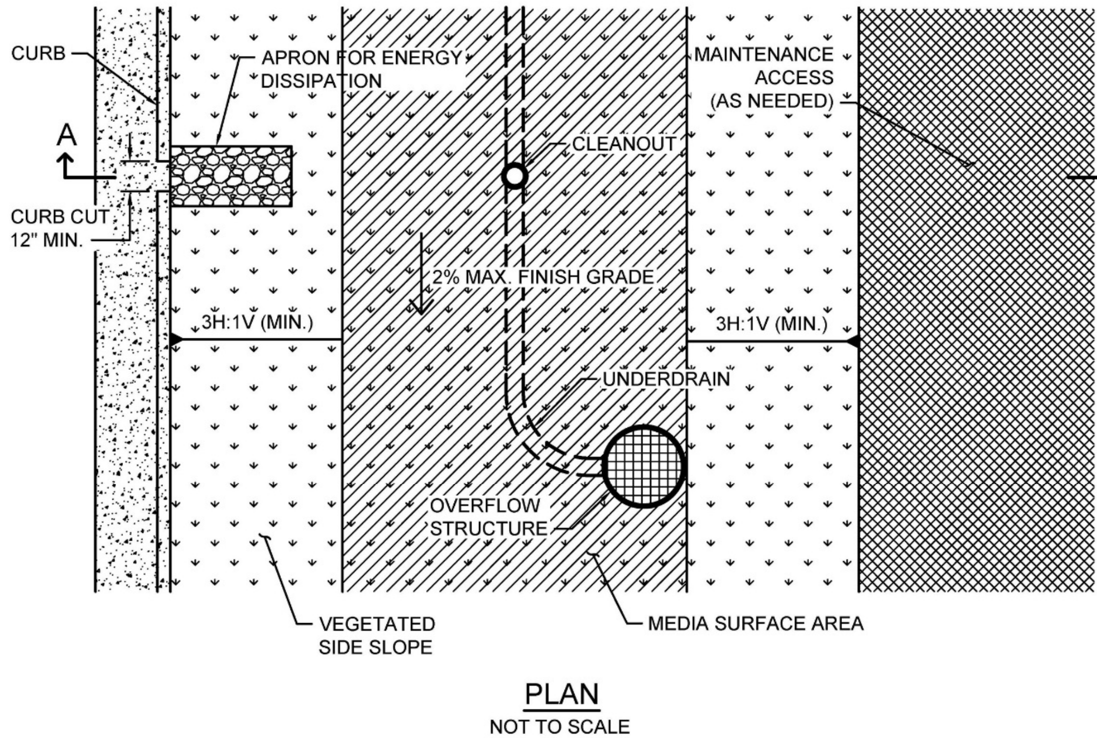
Volume Reduction
Treatment
Peak Flow Attenuation

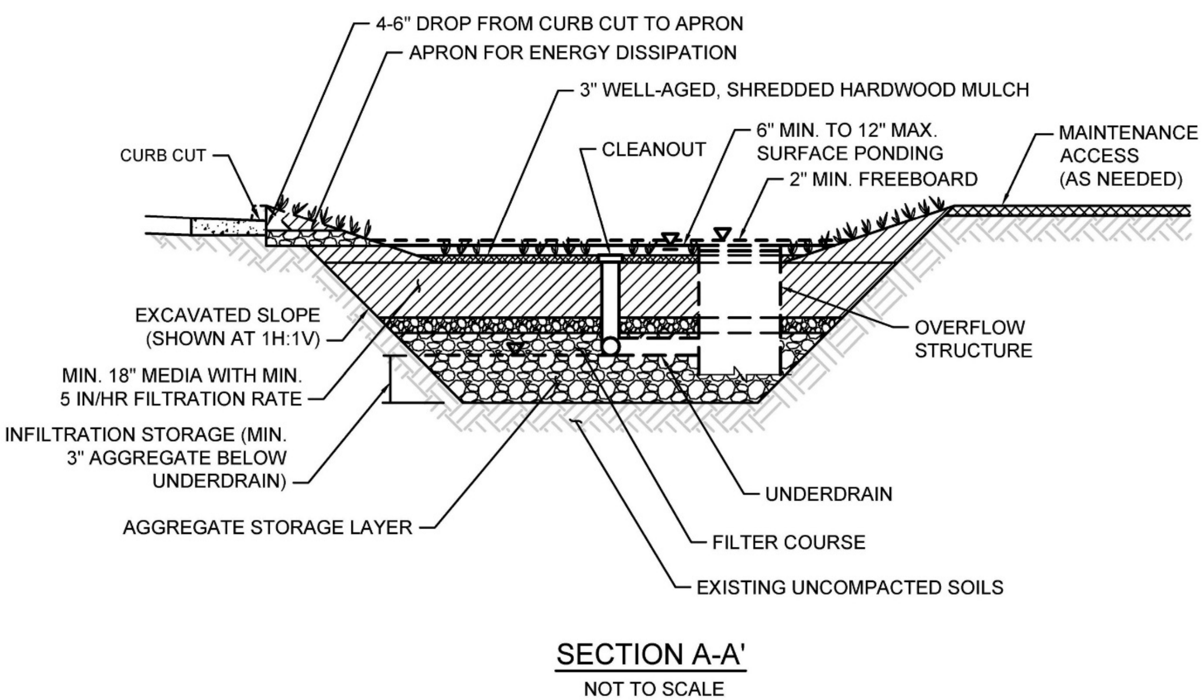
Description

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 (Optional)
- 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 City Engineer 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.
☐	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.
☐	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 [City Engineer} 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

	Siting and Design	*Intent/Rationale*
		design features requested by the City Engineer for proper performance of the regional 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 City Engineer 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 City Engineer 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 or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		

	Siting and Design	*Intent/Rationale*
☐	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.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: 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 or County LID Manual, the media meets the pollutant treatment performance criteria in	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.

	Siting and Design	*Intent/Rationale*
	Section F.1.	
☐	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
☐	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	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.

	Siting and Design	*Intent/Rationale*
	filter course layer at the top of the crushed rock is required.	
☐	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 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	Planning for overflow lessens the risk of property damage due to flooding.

Siting and Design	*Intent/Rationale*
for on-line infiltration basins and water quality peak flow for off-line basins.	

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

Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category
Biofiltration

Manual Category
Biofiltration

Applicable Performance Standard
Pollutant Control
Flow Control

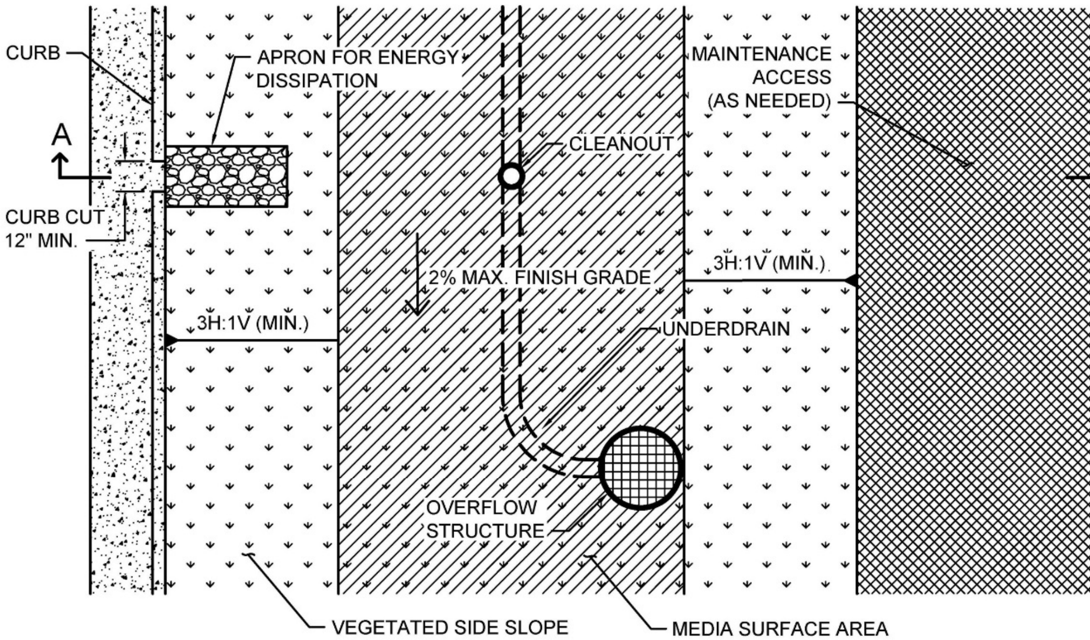
Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

Description

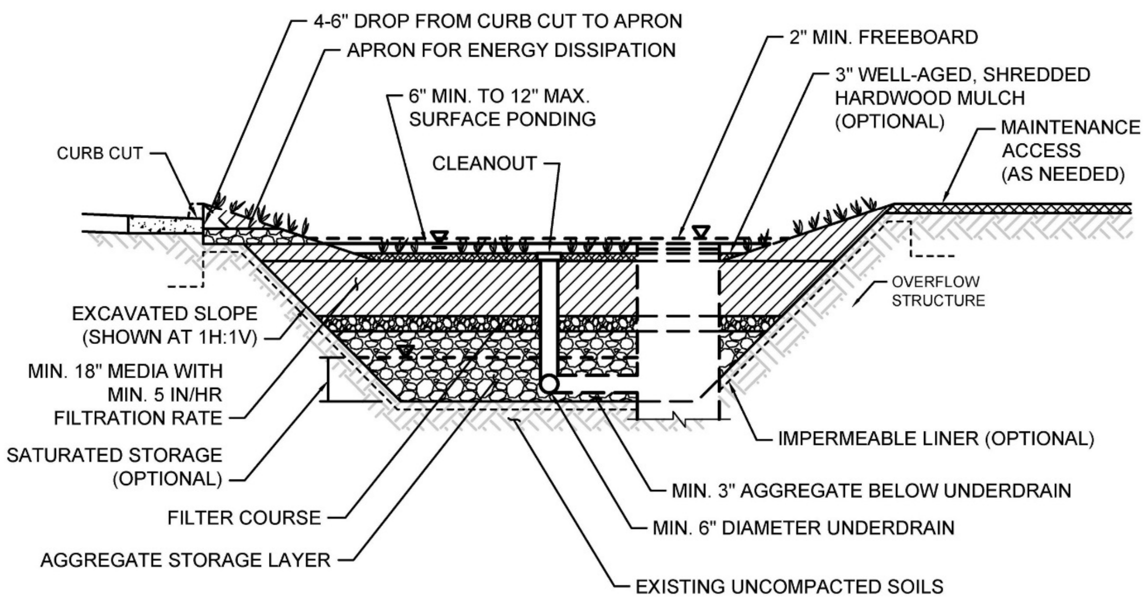
Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated 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 (Optional)
- 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 City Engineer 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 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 City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in

Siting and Design		Intent/Rationale
		the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional 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 hour for plant health. 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.
☐	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 City Engineer 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 2 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		

	Siting and Design	***Intent/Rationale***
☐	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 Low Impact Development Design Manual (page B-18) (July 2011, 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 City 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 F.1 ensures that adequate treatment performance will be provided.

	Siting and Design	Intent/Rationale
☐	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.
☐	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	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.

Siting and Design		Intent/Rationale
	filter course layer at the top of the crushed rock is required.	
☐	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 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	Planning for overflow lessens the risk of property damage due to flooding.

Siting and Design	*Intent/Rationale*
for on-line infiltration basins and water quality peak flow for off-line basins.	

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 City Engineer. The City Engineer has no obligation to accept any proprietary biofiltration BMP. In determining the acceptability of a BMP, the City Engineer 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.

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-through Treatment Control

Manual Category
Flow-through 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

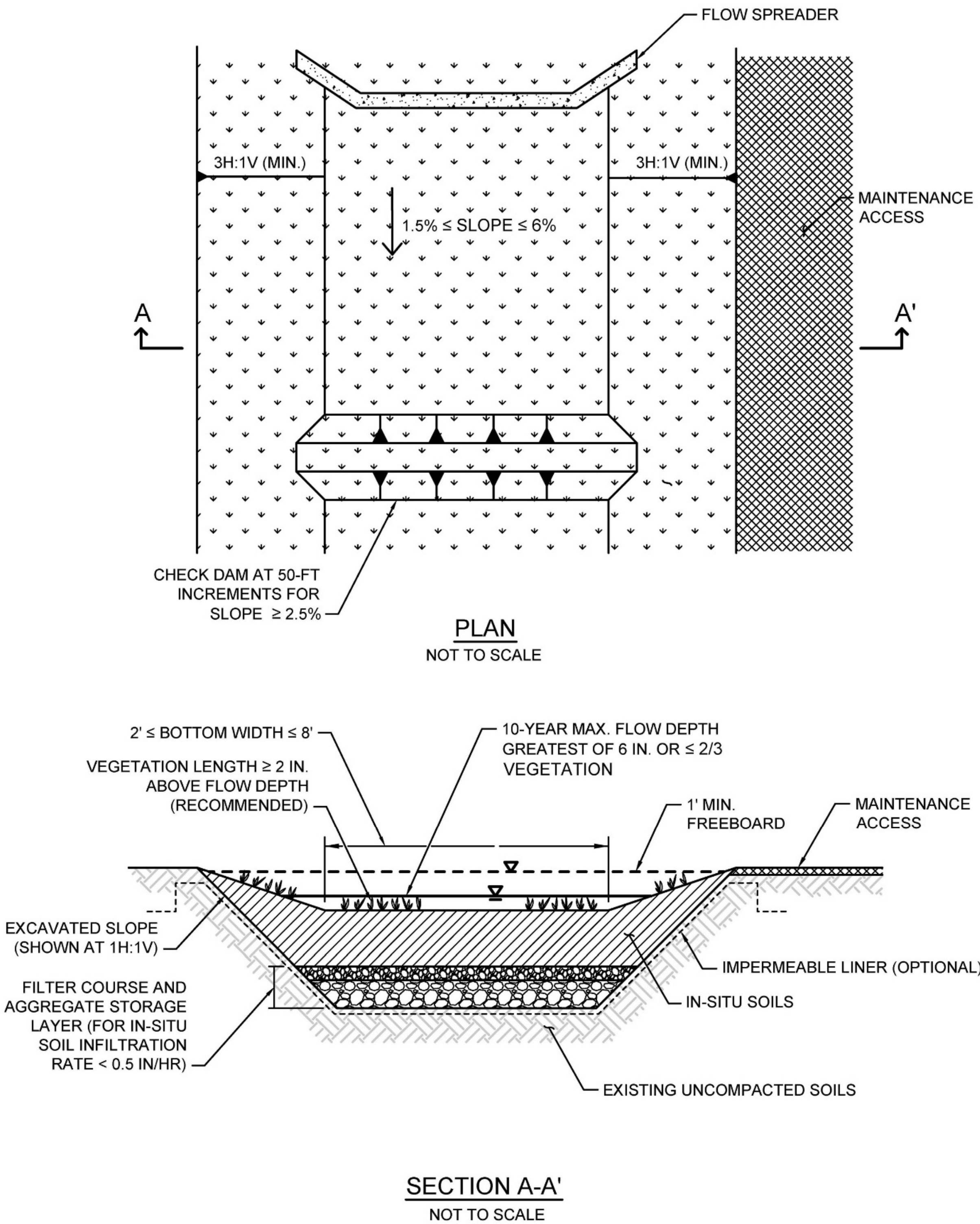
Description

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.

Note that the City of Vista does not have an alternative compliance program, so flow through treatment control BMPs should only be used for pre-treatment as of the implementation date of this Manual.

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-through 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-through treatment via horizontal surface flow through the swale. Sizing for flow-through 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 City Engineer 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 Low Impact Development Design Manual, July 2011 (page B-18); 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-through 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-through Treatment Control

Manual Category
Flow-through 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-through BMP selection requirements described in Appendix B.6**. Treatment effectiveness is contingent upon proper maintenance of filter units.

Note that the City of Vista does not have an alternative compliance program, so flow through treatment control BMPs should only be used for pre-treatment as of the implementation date of this Manual.

Typical media filter components include:

- Vault for flow storage and media housing
- Inlet and outlet
- Media filters

Design Adaptations for Project Goals

Flow-through treatment BMP for storm water pollutant control. Water quality treatment is provided through filtration. This configuration is considered to provide flow-through 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-through 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 City Engineer 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

Photo Credit: City of San Diego LID Manual

MS4 Permit Category

Flow-through Treatment Control

Manual Category

Flow-through Treatment Control

Applicable Performance Standard

Pollutant Control

Flow Control

Primary Benefits

Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

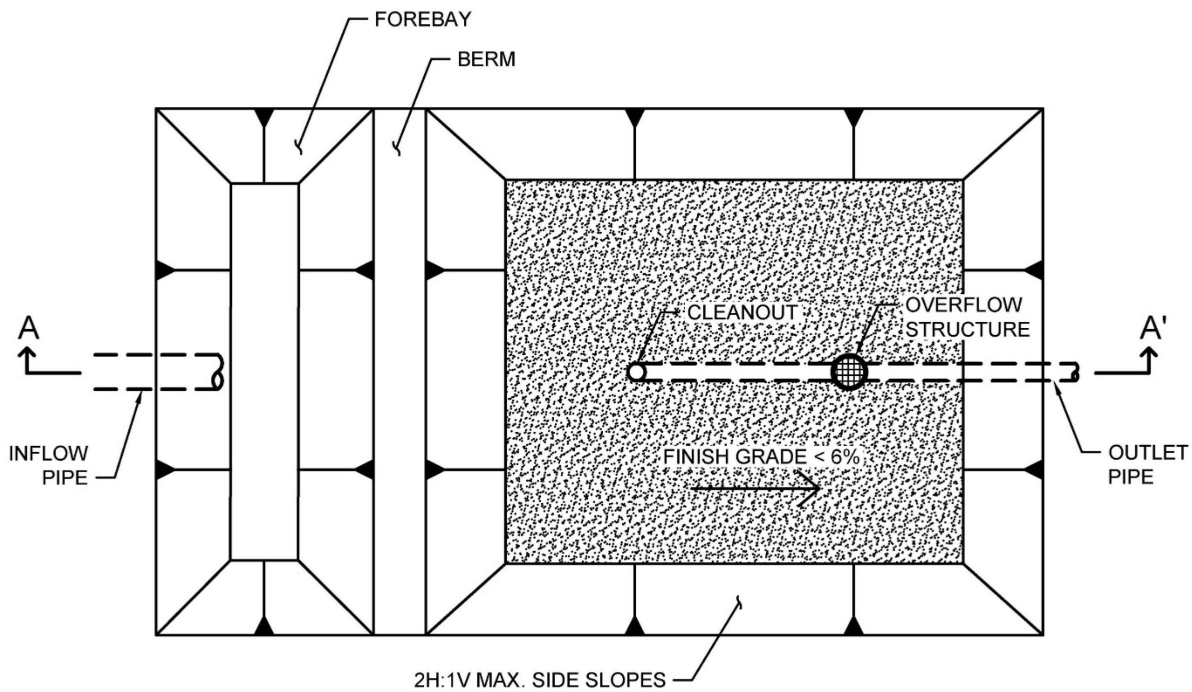
Description

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.

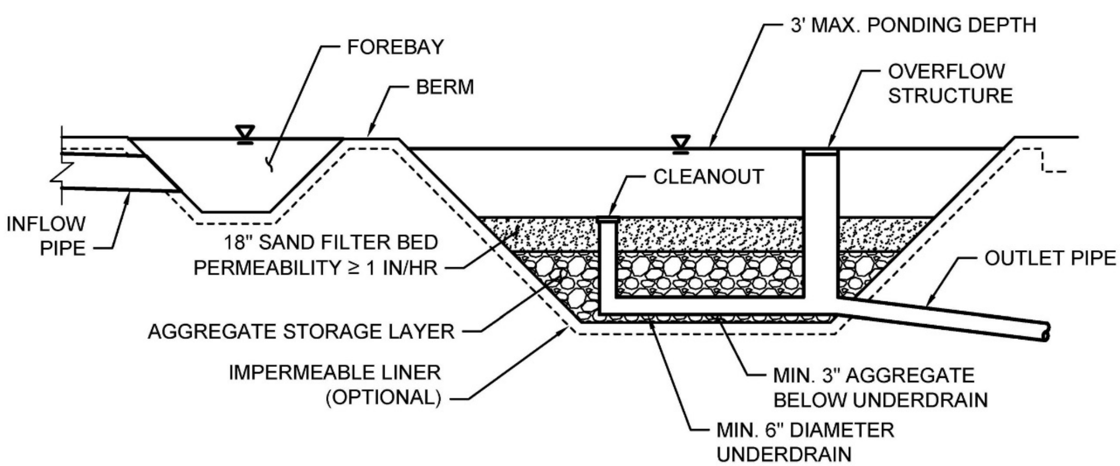
Note that the City of Vista does not have an alternative compliance program, so flow through treatment control BMPs should only be used for pre-treatment as of the implementation date of this Manual.

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-through 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-through 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-through 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 City Engineer 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 (≤ 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 [City Engineer} 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

Siting and Design		*Intent/Rationale*
		City Engineer for proper performance of the regional 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.
☐	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.

	Siting and Design	*Intent/Rationale*
☐	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

Location: Rolling Hills Ranch, Chula Vista, California; Photo Credit: Eric Mosolgo

MS4 Permit Category
Flow-through Treatment Control

Manual Category
Flow-through Treatment Control

Applicable Performance Standard
Pollutant Control
Flow Control

Primary Benefits
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation

Description

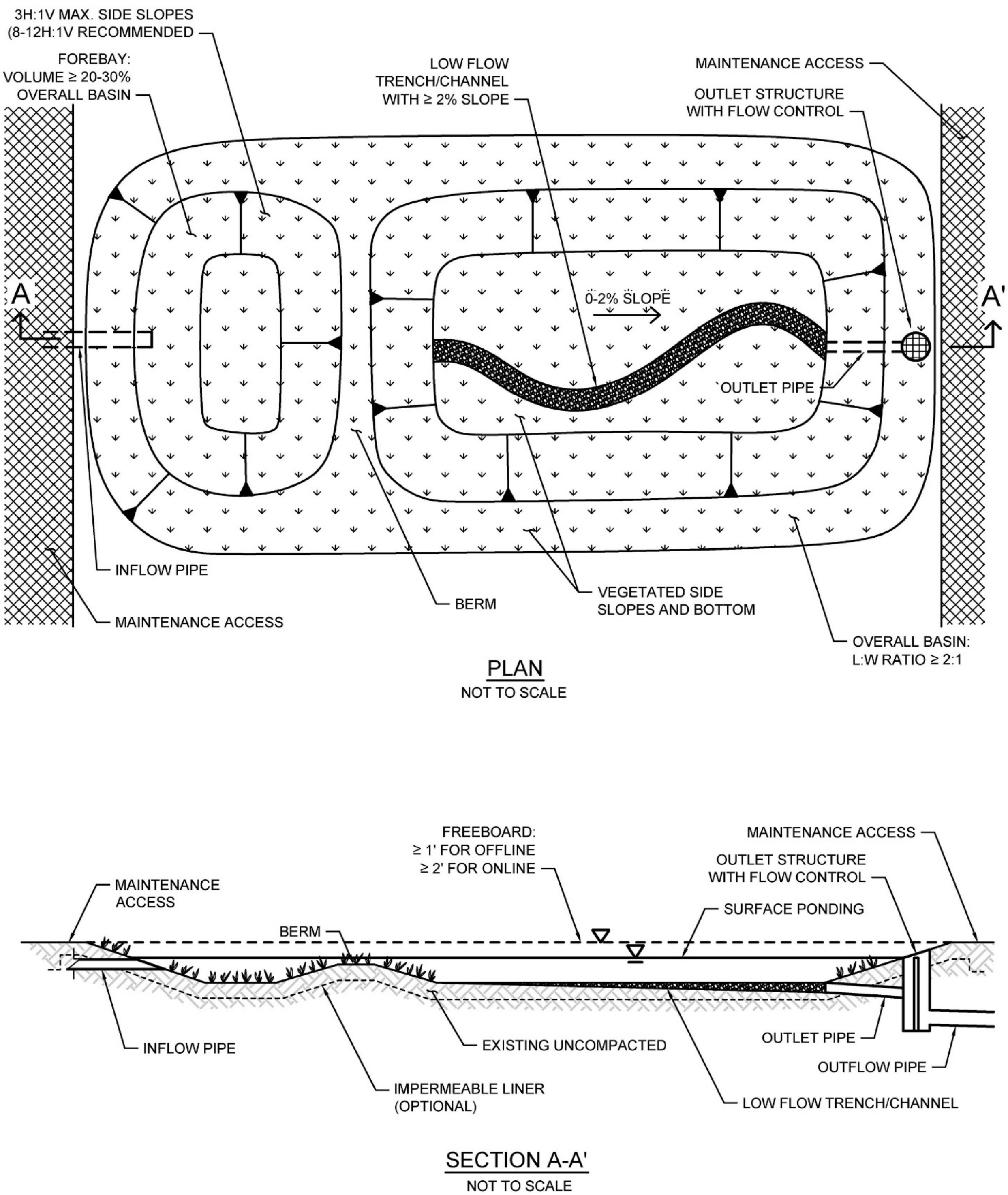
Dry extended detention basins are basins that have been designed to detain storm water for an extended period to allow sedimentation and typically drain completely between storm events. A portion of the dissolved pollutant load may also be removed by filtration, uptake by vegetation, and/or through infiltration. 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.

Note that the City of Vista does not have an alternative compliance program, so flow through treatment control BMPs should only be used for pre-treatment as of the implementation date of this Manual.

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-through 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-through 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-through 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 City Engineer 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-through 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-Through Treatment Control BMPs

The purpose of this fact sheet is to help explain the potential role of proprietary BMPs in meeting flow through 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.

Note that the City of Vista does not have an alternative compliance program, so flow through treatment control BMPs should only be used for pre-treatment as of the implementation date of this Manual. ***Criteria for Use of a Proprietary BMP as a Flow-Through Treatment Control BMP***

A proprietary BMP may be acceptable as a "flow-through 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 City Engineer. The City Engineer has no obligation to accept any proprietary flow-through treatment control BMP. In determining the acceptability of a BMP, the City Engineer 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.

Guidance for Sizing Proprietary BMPs

Proprietary flow-through BMPs must meet the same sizing guidance as other flow-through treatment control BMPs. Guidance for sizing flow-through 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

February 2016

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-through 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 City Engineer. 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

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[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 project submittal 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).	Submit sizing worksheets (Appendix B) or other equivalent documentation with project submittal.

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 project submittal 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 shown in Appendix B.5.1.	Provide a table that compares the minimum sizing factor per Appendix B.5.1 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 "Infiltration Not Feasible."	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 "Infiltration Not Feasible" 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.

[9] Compact biofiltration BMPs are defined as features with infiltration storage footprint less than the minimum sizing factors in Appendix B.5.1. Note that if a biofiltration BMP is accompanied by an infiltrating area

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 City or County LID Manual, including the maximum allowable design filtration rate and minimum thickness of media.	Provide documentation that media meets the specifications in City or County LID Manual.
	OR	
☐	Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the City 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.
☐	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.
☐	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.

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downstream that has a footprint equal to at least the minimum sizing factors in Appendix B.5.1, 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 a larger footprint infiltration area, the BMP would still need to comply with Item 5 of this checklist for pollutant treatment effectiveness.

☐	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 applicable to 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.
☐	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.

[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

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. 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.

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 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, orEnhanced 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 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:
    - Calculate the runoff flow rate from a 0.2 inch per hour uniform intensity precipitation event (See methodology Appendix B.6.3), or
    - 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

CITY OF VISTA BMP DESIGN MANUAL

Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

February 2016

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.

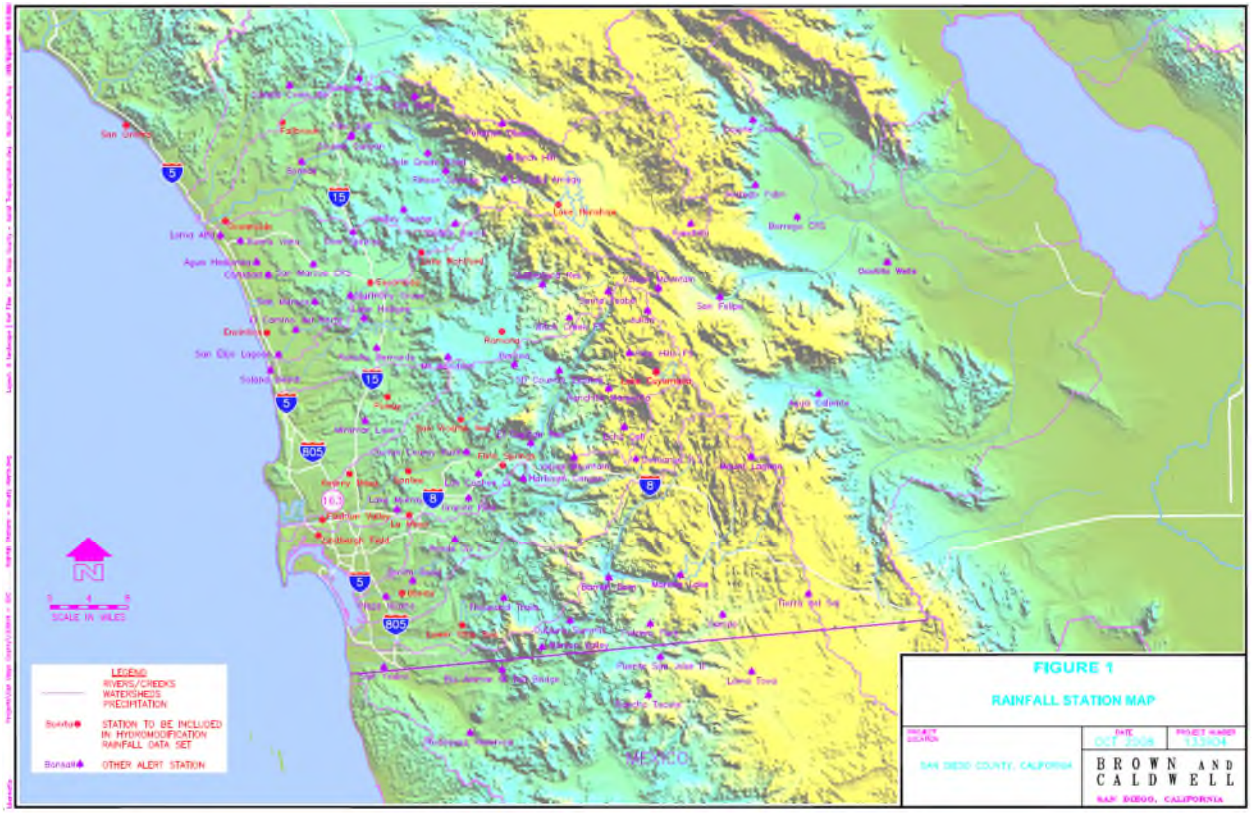


Figure G.1-1: Rainfall Station Map

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.

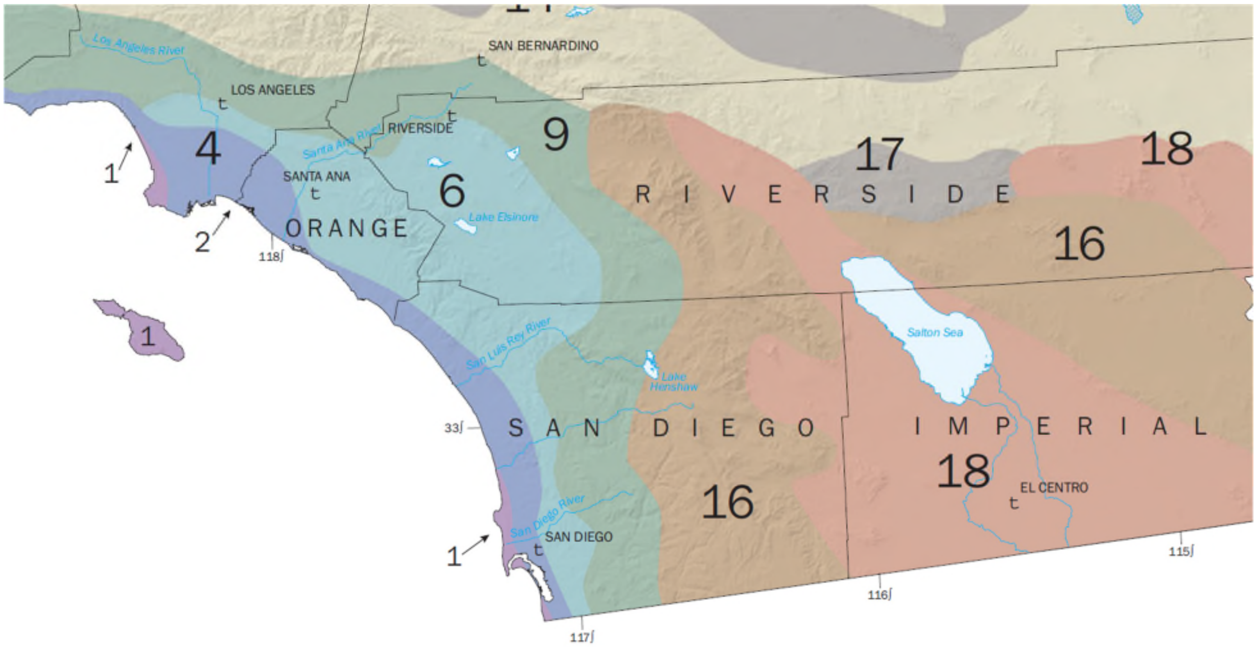


Figure G.1-2: California Irrigation Management Information System "Reference Evapotranspiration Zones"

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 PARAMETERS

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 City Engineer 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.

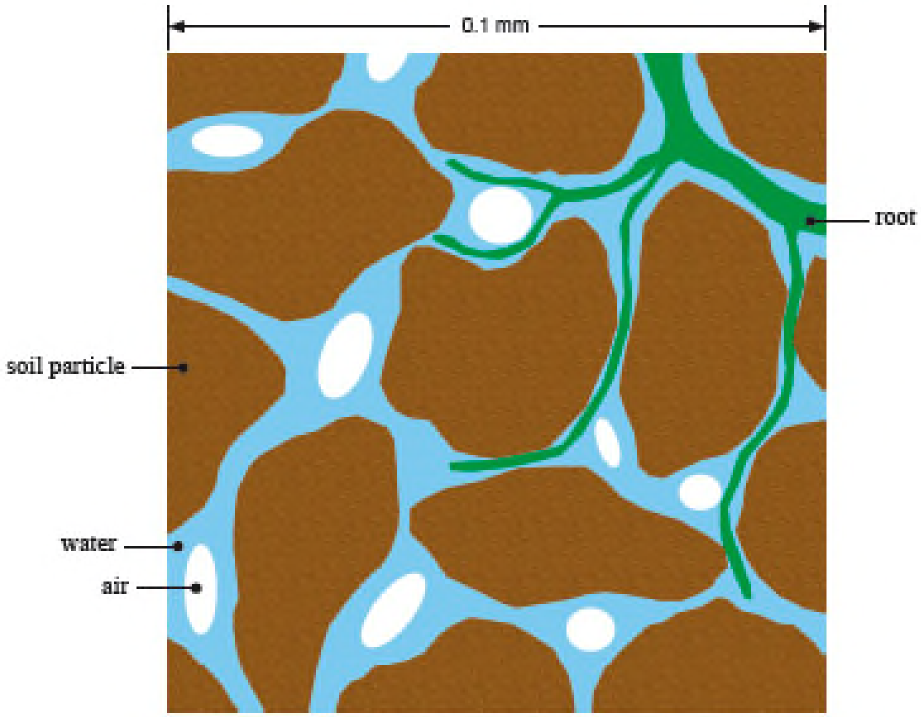


Figure G.1-3: Unsaturated Soil Composition

Unsaturated soil is composed of solid particles, organic material and pores. The pore space will contain air and water.

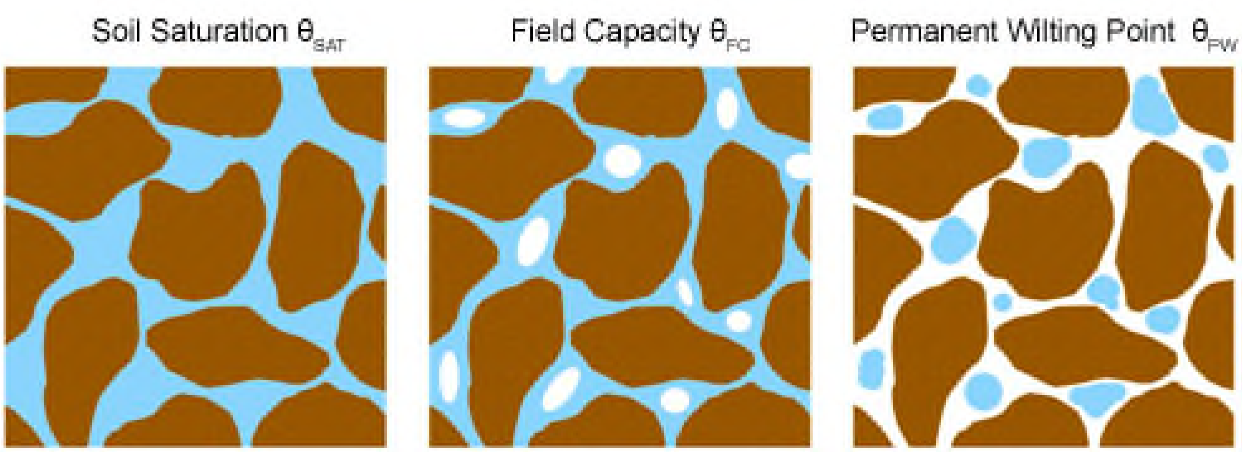


Figure G.1-4: Soil saturation, field capacity, and wilting point

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.

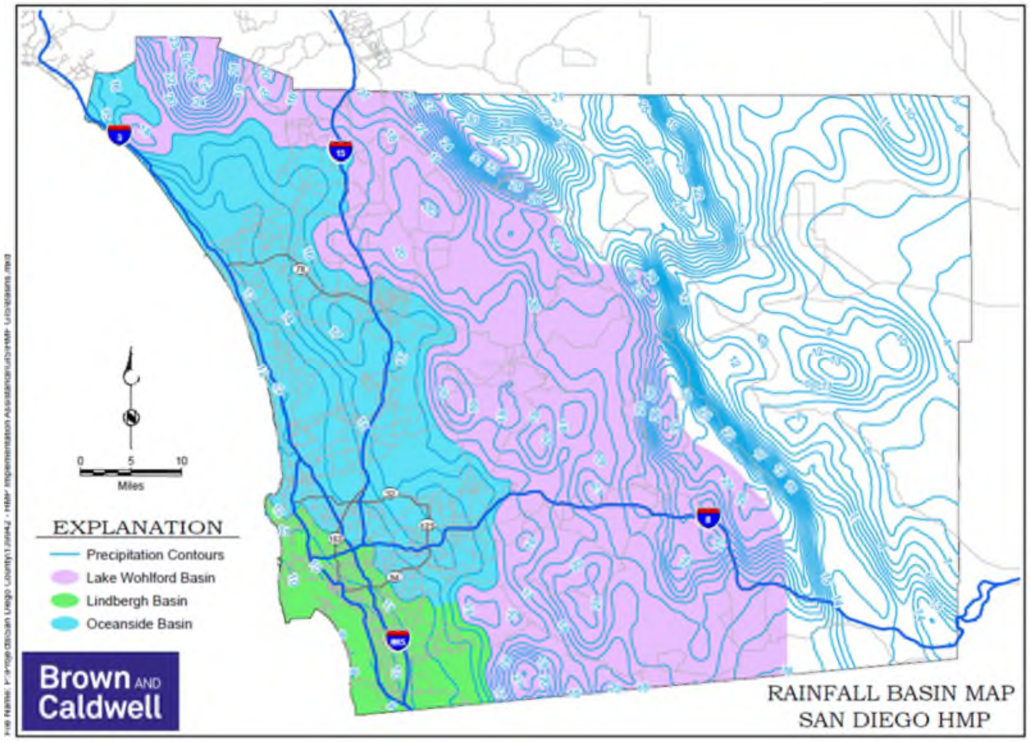


Figure G.2-1: Appropriate Rain Gauge for Project Sites

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

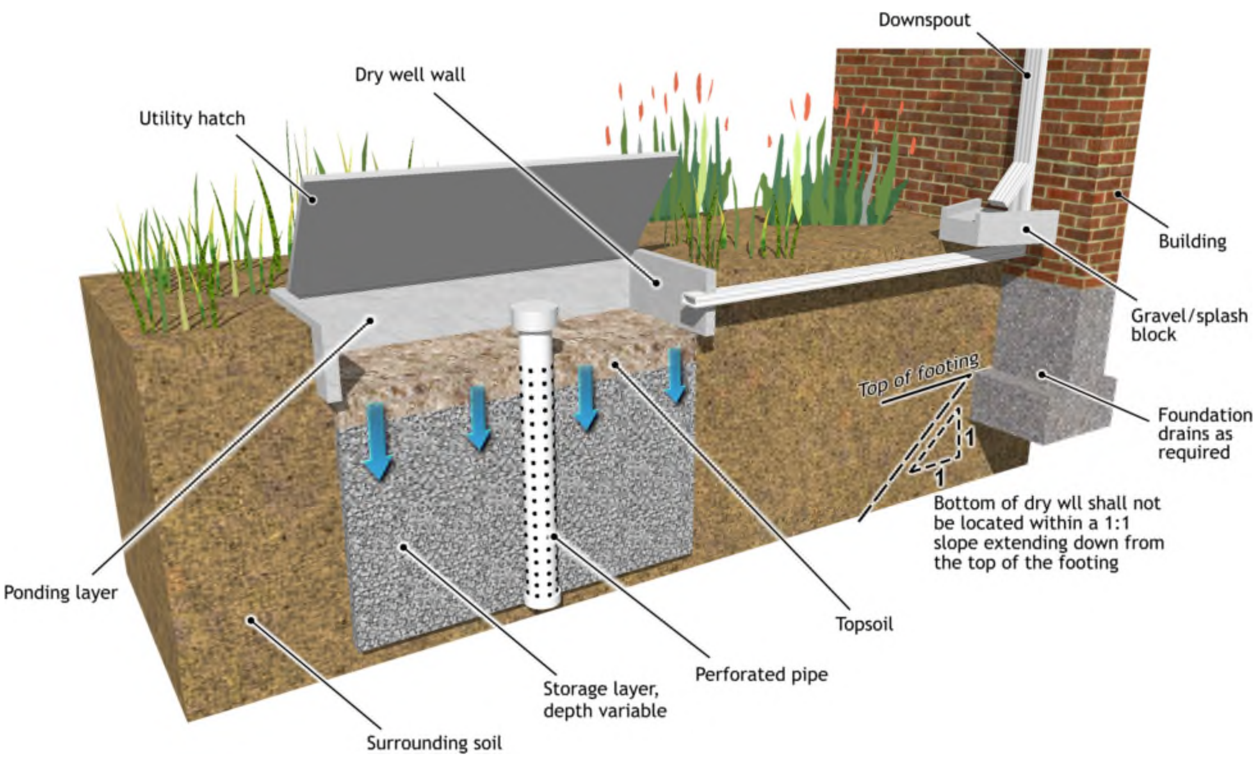
Unit Runoff Ratios for Sizing Factor Method					
Rain Gauge	**Soil**	**Cover**	**Slope**	**Q_2 (cfs/acre)**	**Q_{10} (cfs/ac)**
Lake Wohlford	A	Scrub	Low	0.136	0.369
Lake Wohlford	A	Scrub	Moderate	0.207	0.416
Lake Wohlford	A	Scrub	Steep	0.244	0.47
Lake Wohlford	B	Scrub	Low	0.208	0.414
Lake Wohlford	B	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"

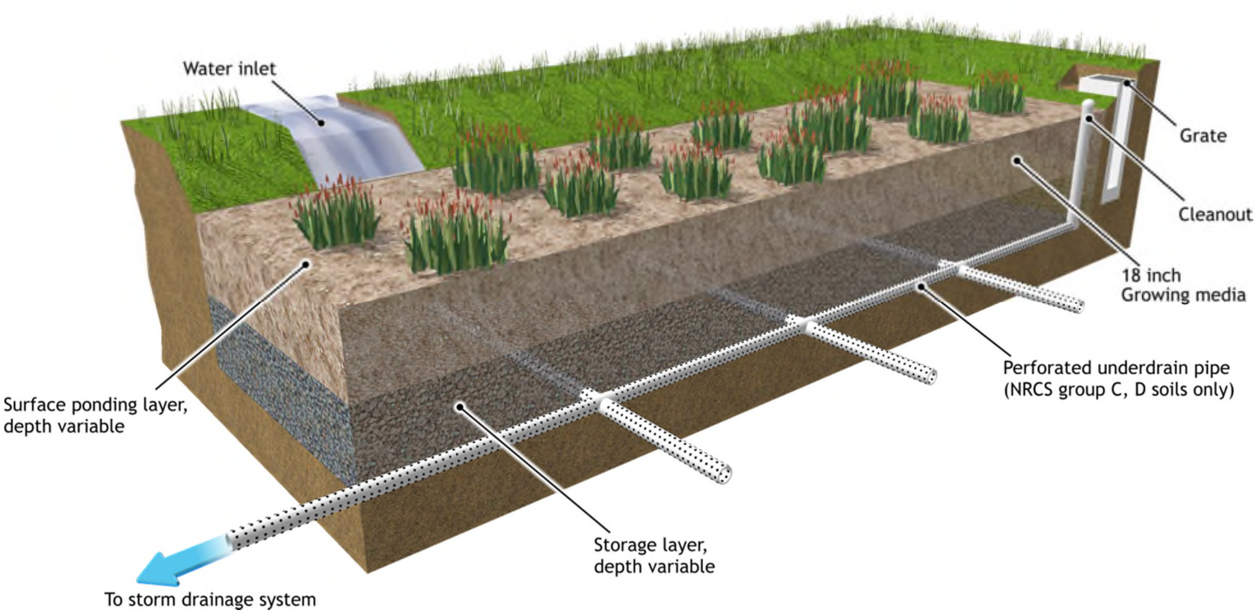
- Soil groups A and B: N/A in column V2 means there is no V2 element in this bioretention BMP for soil groups A and B
- Soil groups C and D: N/A in all elements (A, V1, V2) for soil groups C and D means sizing factors developed for "bioretention" in soil groups C and D under the 2007 MS4 Permit are not 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"

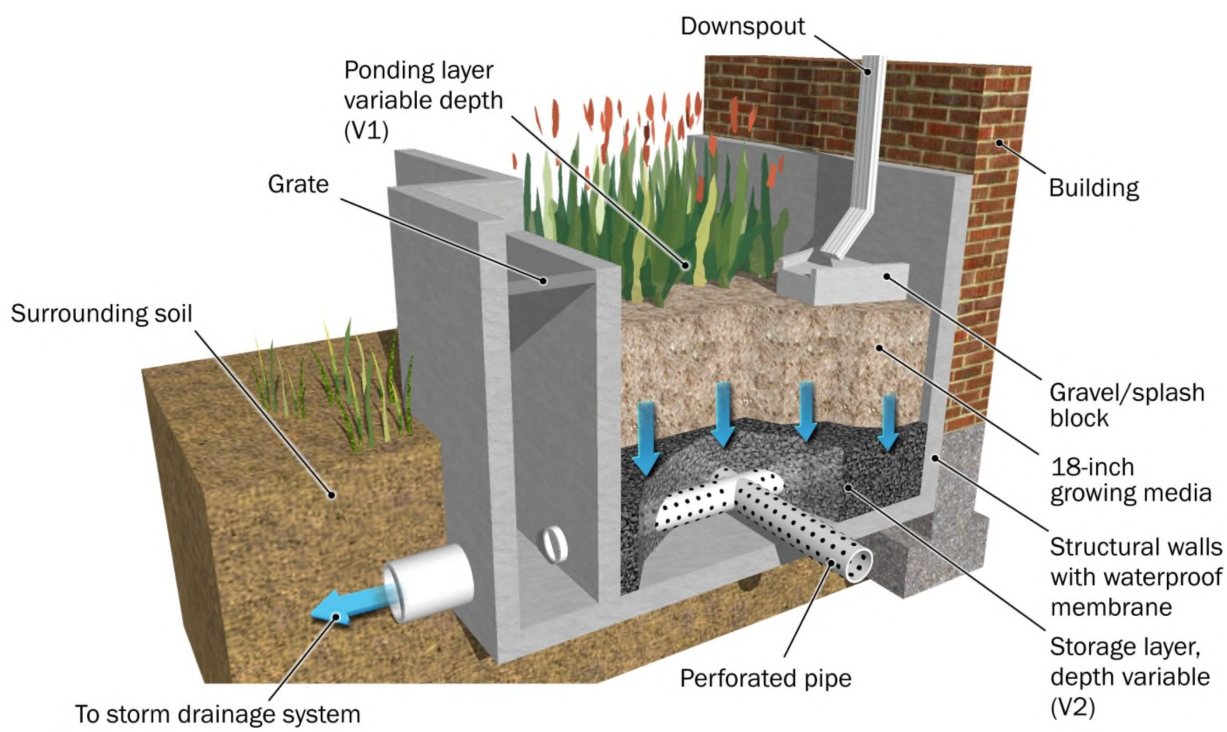
- Soil groups A and B: N/A in all elements (A, V1, V2) for soil groups A and B means sizing factors were not developed for biofiltration (i.e., with an underdrain) for soil groups A and B. If no underdrain is proposed, refer to Appendix G.2.3, Sizing Factors for Bioretention. If an underdrain is proposed, 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

CITY OF VISTA 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 City Engineer 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 City Engineer 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 Big cone Spruce (Big cone Douglas Fir)-Canyon Oak Forest		Forest
40	84230 Sierran Mixed Coniferous Forest		Forest
41	84500 Mixed Oak/Coniferous/Big cone/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 Brackish water		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 Vegetation		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

CITY OF VISTA BMP DESIGN MANUAL

Glossary of Key Terms

Appendix I 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-through 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 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 public or private 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 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.
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-through Treatment	Treatment from a BMP meeting the flow-through treatment control standard.

Flow-Through Treatment BMPs	Flow-through 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-through 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	PDPs that need to meet Source Control, Site Design, Pollutant Control and Hydromodification Management Requirements.

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 City Engineer 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 (SDRWQCB)	California RWQCBs are responsible for implementing pollution control provisions of the Clean Water Act and California Water Code within their jurisdiction. There are nine California RWQCBs.
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-through 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 Copermittee, 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 Copermittee 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 SDRWQCB 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 D

Stormwater Ordinance

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ORDINANCE NO. 2015-

AN ORDINANCE OF THE CITY COUNCIL OF THE CHARTERED CITY OF VISTA, CALIFORNIA, AMENDING CHAPTER 13.18 OF THE VISTA MUNICIPAL CODE REGARDING THE STORMWATER MANAGEMENT AND DISCHARGE CONTROL PROGRAM

The City Council of the City of Vista does ordain as follows:

1. Findings. The City Council hereby finds and declares that:

A. The Regional Water Quality Control Board for the San Diego region (RWQCB) has approved Order No. R9-2013-0001 and later amended as R9-2015-0001, National Pollutant Discharge Elimination System (NPDES) Permit No. CAS0109266 (Permit); and

B. The Permit requires certain changes be made to the Stormwater Management and Discharge Control Ordinance (Chapter 13.18 of the Vista Municipal Code).

C. The purpose of this Ordinance is to update the Stormwater Management and Discharge Control Ordinance to comply with the Permit; and

D. Adoption of this ordinance and the associated Stormwater Standards Manual are exempt from review under the California Environmental Quality Act pursuant to section 21080.5 of the Public Resources Code and 14 CCR sections 15060(3)(1), 15060(c)(3), 15251(g), 15307 and 15308.

2. Code Amendment.

Chapter 13.18 is hereby amended to read as follows:

Chapter 13.18

Stormwater Management and Discharge Control Program

Sections:

Section 13.18.010 Title

This chapter shall be known as the "Stormwater Management and Discharge Control Ordinance."
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.020 Purpose

The purposes of this chapter are as follows:

A. To establish requirements for discharges into the Municipal Separate Storm Sewer System (MS4), receiving waters, and the environment;

B. To protect, to the maximum extent practicable (MEP), life, property, receiving waters, aquatic life, and the environment from loss, injury, degradation, or damage by discharges from within the City's jurisdiction;

C. To protect the MS4 from damage; and

D. To meet the requirements of state and federal law and the City of Vista's (City's) MS4 Permit.

(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.030 Definitions

When used in this chapter and reference documents (including the Stormwater Standards Manual), the following definitions shall have the meanings given by this section, whether or not these words or phrases are capitalized:

"Advanced Treatment" means using mechanical or chemical means to flocculate and remove suspended sediment from runoff from construction sites prior to discharge.

"Authorized Enforcement Staff" means any City employee or contractor hired by the City who is assigned to duties involving permits and other City approvals, inspections, or enforcement related to this chapter.

"Authorized Enforcement Official" means the City Manager or his/her designee who is responsible for enforcing the provisions of this chapter.

"Best Management Practices" or "BMPs" are the 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 **"MS4"**. Best Management Practices 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. Best Management Practices may include any type of pollution prevention and pollution control measure that can help to achieve compliance with this Chapter.

"Channel" means natural or improved watercourse with a definite bed and banks that conveys continuously or intermittently flowing water.

"City" means the City of Vista

"Contamination" as defined in the Porter-Cologne Water Quality Control Act, is "an impairment of the quality of waters of the State by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease. Contamination includes any equivalent effect resulting from the disposal of waste whether or not waters of the State are affected."

"County" means the County of San Diego.

"Developer" is a person who seeks or receives permits for or who undertakes land development activities.

"Development Project Proponent" refers to Developer.

"Direct Discharge" means stormwater or non-stormwater that enters receiving waters from a facility or activity, without mixing with any stormwater or non-stormwater from another facility or activity prior to entering such receiving waters.

"Discharge" when used as a verb, means to allow pollutants to directly or indirectly enter stormwater, or to allow stormwater or non-stormwater to directly or indirectly enter the **"MS4"** or receiving waters, from an activity or operations, which one owns or operates. When used as a noun, discharge means the pollutants, stormwater and/or non-stormwater that is discharged.

"Discharger" is any person or entity engaged in activities or operations or owning facilities, which will or may result in pollutants entering stormwater, the **"MS4"**, or receiving waters; and the owners of real property on which such activities, operations or facilities are located; provided, however, that a local government or public authority is not a discharger as to activities conducted by others in public rights-of-way.

"Erosion" refers to any process in which land is diminished or worn away due to wind, water, or glacial ice. Often the eroded debris (silt or sediment) becomes a pollutant via storm water runoff. Erosion occurs naturally but can be intensified by land-clearing activities such as farming, development, road building, and timber harvesting.

"Groundwater" means subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

"Illegal Connection" means a pipe, facility, or other device connected to the **"MS4"** or receiving waters, which has not been authorized by the City; or a permitted/authorized pipe, facility, or other device, which conveys illegal discharges.

"Illegal Discharge" is any discharge into the MS4 or receiving waters that is prohibited by this Chapter. This includes, but is not limited to, discharges of non-stormwater that are not exempt discharges listed in Section 13.18.060, discharges of irrigation runoff to the **"MS4"**, any discharge from an illegal connection, and any discharge that contains additional pollutants due to the absence of a required BMP or the failure of a BMP. Discharges that require a City permit or an RWQCB permit that has not been issued or has not been acknowledged by the discharger to be applicable are illegal discharges. Discharges regulated under an applicable NPDES Permit are illegal discharges for purposes of this Chapter, unless compliance with all applicable permit and SWPPP conditions are maintained.

"Impaired Water Body" is a water body that is listed by the **"RWQCB"** and **"SWRCB"** as impaired by a particular pollutant or pollutants, pursuant to Section 303(d) of the Federal Clean Water Act. **"303(d)-Listed Water Body"** has the same meaning.

"Impervious Cover or Impervious Surface" refers to constructed or modified surfaces that cannot effectively infiltrate rainfall. The term includes, but is not limited to, building rooftops, pavement, sidewalks, and driveways.

"Impervious Surface Area" means the ground area covered or sheltered by an impervious surface, measured in plan view (i.e., as if from directly above). For example, the impervious surface area for a pitched roof is equal to the ground area it shelters, rather than the surface area of the roof itself.

"Industrial Stormwater Permit" is the State General Industrial Stormwater Permit.

"Land Development Activity" is any activity or proposed activity that requires any of the permits or approvals listed in Section 13.18.040.C of this Chapter.

"Land Disturbance Activity" is any activity that moves soils or substantially alters the pre-existing vegetated or man-made cover of any land. This includes, but is not limited to, grading, digging, cutting, scraping, stockpiling or excavating of soil; placement of fill materials; paving, pavement removal, exterior construction; substantial removal of vegetation where soils are disturbed, including, but not limited to, removal by clearing or grubbing; or any activity which bares soil or rock or involves streambed alterations or the diversion or piping of any watercourse. Land disturbance activity does not include routine maintenance to maintain original line and grade, hydraulic capacity, or the original purpose of the facility, nor does it include emergency construction activities (i.e., land disturbances) required to protect public health and safety.

"Land Owner" is the holder of legal title to the land, and other persons or entities who exercise control over a land development project pursuant to rights granted in a purchase agreement, joint venture agreement, development agreement, or long term lease.

"Maintenance of a BMP" refers to the regular action taken to maintain the as-designed performance of a BMP, and includes, but is not limited to, repairs to the BMP as necessary, and replacement of the BMP by an equally effective or more effective BMP at the end of its useful life.

"Maximum Extent Practicable" "MEP" is an acceptability standard for Best Management Practices (BMPs). When BMPs are required to meet this standard, the BMPs must be the most effective set of BMPs that are still practicable. A BMP is effective if it prevents, reduces or removes the pollutants that would otherwise be present in runoff due to human activity. A BMP is practicable if: it complies with other regulations as well as stormwater regulations; is compatible with the area's land use, character, facilities, and activities; is technically feasible (considering area soil, geography, water resources, and other resources available); is economically feasible; and provides benefits that are reasonable in relation to costs.

"MS4 Permit" refers to RWQCB Order No. R9-2013-0001, NPDES Permit No. CAS0109266, as may be amended.

"Municipal Separate Storm Sewer System" or "MS4" means 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 CWA 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 **"POTW"** as defined at 40 CFR 122.26.

"Non-Storm Water Discharge" is any discharge to the Storm Water Conveyance System or **"Receiving Waters"** that is not composed entirely of stormwater.

"NPDES Permit" is a National Pollutant Discharge Elimination System permit issued by the U.S. Environmental Protection Agency, the "**SWRCB"**, or the **"RWQCB".**

"Person" means any individual, corporation, partnership, organization, enterprise, or similar entity whether for profit or nonprofit.

"Pollutant" means any agent that may cause or contribute to the degradation of water quality such that a condition of pollution or contamination is created or aggravated.

"Pollution,**"** as defined in the Porter-Cologne Water Quality Control Act, is "the alteration of the quality of the waters of the State by waste, to a degree that unreasonably affects either of the following: 1) The waters for beneficial uses; or 2) Facilities that serve these beneficial uses." Pollution may include contamination.

"Premises" means any building, lot parcel, land or portion of land whether improved or unimproved.

"Priority Development Project" "PDP" refers to new development and redevelopment project categories as more fully set forth in Section E.3.b of the MS4 Permit and in the "**Stormwater Standards Manual"**.

"Public Nuisance" has the same meaning as in Vista Municipal Code section 8.36.030.

"Receiving Waters" refers to all waters that are "waters of the state" within the scope of the State Water Code, including, but not limited to, natural streams, creeks, rivers, reservoirs, lakes, ponds, water in vernal pools, lagoons, estuaries, bays, the Pacific Ocean, and ground water.

"Redevelopment" is 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 a 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 lane on existing roads; or routine replacement of damaged pavement, such as pothole repair.

"Runoff" means all flows in an MS4, including stormwater (wet weather flows) and non-stormwater (dry weather flows).

"RWQCB" means the California Regional Water Quality Control Board for the San Diego Region.

"State" means the State of California.

"State General Construction Stormwater Permit" refers to **"NPDES"** Permit No. CAS000002, as may be amended.

"State General Industrial Stormwater Permit" refers to NPDES Permit No. CAS000001, as may be amended.

"Stop Work Order" is an order issued which requires that specifically identified activity or all activity on a site be stopped.

"Storm Water Quality Management Plan" or "SWQMP" is a report that documents how a Priority Development Project complies with applicable BMP requirements for land development and redevelopment activities listed in the **"Stormwater Standards Manual"**.

"Stormwater" refers to the surface runoff and drainage associated with storm events.

"Stormwater Management" is the use of structural or non-structural BMPs that are designed to reduce urban runoff pollutant loads, discharge volumes, and/or peak discharge flow rates or velocities. When applied to the City, the County or another municipality, stormwater management also includes planning and programmatic measures.

"Stormwater Pollution Prevention Plan" "SWPPP" is a document that meets the requirements for a **"SWPPP"** set out in the State General Construction Stormwater Permit or State General Industrial Stormwater Permit.

"Stormwater Standards Manual" refers to the manual described in Section 13.18.040.B.

"Structural BMP" A subset of BMPs that 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. This subset of BMPs requires regular maintenance to function as designed.

"Structural Post-Construction BMP" is a structural BMP (other than a temporary construction-related BMP) put in place in connection with a land development activity or redevelopment project to prevent or reduce contamination in stormwater or receiving waters, or to prevent or reduce erosion downstream from the project.

"SWRCB" means the State Water Resources Control Board.

"Watercourse" is a permanent or intermittent stream, creek, or other body of water, either natural or improved, which gathers or carries surface water.

"Water Pollution Control Plan" (WPCP) is a document that describes the BMPs to be implemented by the Land Owner or Discharger to eliminate or reduce to the MEP discharges of pollutants to the MS4. A WPCP must include all measures necessary to comply with this Chapter and the Stormwater Standards Manual to the satisfaction of Authorized Enforcement Staff. A WPCP is typically shorter than a SWPPP. A SWPPP may be accepted in lieu of a WPCP at the discretion of Authorized Enforcement Staff.

"Water Quality Standards" are defined as the beneficial uses (e.g., swimming, fishing, municipal drinking water supply, etc.) of water and the water quality objectives adopted by the State or the United States Environmental Protection Agency to protect those uses.

"Waters of the United States" are waters subject to the regulatory jurisdiction of the United States under the Federal Clean Water Act and applicable case law. (In general, this includes navigable waters, waters tributary to navigable waters, and adjacent wetlands.)
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.040 General Provisions

A. Construction and Application. Interpretation of the meanings of parts of this Chapter shall assure consistency with the purpose and intent of this chapter. This includes, but is not limited to, consistency with the requirements of the MS4 Permit. This Chapter is not intended to interfere with, abrogate or annul any other ordinance, rule or regulation, statute, or other provision of law. The requirements of this Chapter should be considered minimum requirements, and where any provision of this Chapter imposes restrictions different from those imposed by any other ordinance, rule or regulation, 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. Stormwater Standards Manual. The Authorized Enforcement Official may establish a written description of the runoff management measures and programs, including minimum BMPs that the City will implement, or require to be implemented, to ensure compliance with this Chapter. These documents shall be known collectively as the Stormwater Standards Manual. Amendments to the Stormwater Standards Manual shall be approved by the Authorized Enforcement Official. The Stormwater Standards Manual shall have the same force and effect as the provisions of this Chapter, and a violation of the Stormwater Standards Manual shall constitute a violation of this Chapter and be subject to all remedies and penalties as exist for a violations of the provisions of this Chapter. A copy of the Stormwater Standards Manual, and all amendments thereto, shall be posted to the City's website.
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.045 Watercourse Protection

Every person owning or occupying property through which a natural watercourse of a stormwater conveyance system passes shall:

A. Keep and maintain that part of the watercourse within the property free of trash, debris and other materials that would pollute, contaminate, retard, or divert the flow of water through the watercourse or the MS4;

B. Maintain existing structures within or adjacent to such a watercourse so that those structures will not become a hazard to the use, function, or physical integrity of the watercourse or the MS4; and

C. Not remove healthy bank vegetation beyond that necessary for maintenance, nor remove vegetation in such a manner as to increase the vulnerability of the watercourse to erosion;

D. Deposit in, plant in, or remove any material from a watercourse, including its banks, except as required for necessary maintenance;

E. Construct, alter, enlarge, connect to, change, or remove any structure in a watercourse; or

F. Carry out developments within 50 feet of the centerline of any watercourse or 20 feet from the top of a bank of a watercourse, whichever is the greater distance from the centerline of the watercourse;

G. The above requirements do not supersede any requirements set forth by the California Department of Fish and Game, the SWRCB, the RWQCB, or the United States Army Corps of Engineers regulating waters of the United States and/or storm water discharges.

(Ord. No. 2002-24, Added, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.050 Discharge Prohibitions

A. <u>Illegal Discharges</u>. Illegal discharges are prohibited except where exempted in Section 13.18.060 of this Chapter. As defined in Section 13.18.030 of this Chapter, illegal discharges include, but are not limited to, discharges of non-stormwater that are not exempt, discharges listed in Section 13.18.060, discharges of irrigation runoff to the MS4, any discharge from an illegal connection, and any discharge that contains additional pollutants due to the absence of a required BMP or the failure of a BMP. Discharges that require a City permit or an RWQCB permit that has not been issued or has not been acknowledged by the discharger to be applicable are illegal discharges. Discharges regulated under an applicable NPDES Permit are illegal discharges for purposes of this Chapter unless compliance with all applicable permit and SWPPP conditions are maintained.

B. <u>Illegal Connection</u>. The establishment of illegal connections is prohibited. As defined in Section 13.18.030 of this Chapter, illegal connection means a pipe, facility, or other device connected to the MS4 or receiving waters, which has not been authorized by the City; or a permitted/authorized pipe, facility, or other device, which conveys illegal discharges. The use of illegal connections is prohibited, even if the connection was established pursuant to a valid City or County permit and was legal at the time it was constructed.

C. <u>Prevention of Illegal Discharges</u>. Throwing, depositing, leaving, abandoning, maintaining or keeping materials or wastes on public or private lands in a manner and place where they may result in an illegal discharge is prohibited.

D. <u>Violations of the MS4 Permit</u>. It is unlawful for any person to, jointly or individually, cause by action or omission a condition, occurrence, event, or situation which causes or threatens to cause any discharge into or from the MS4 that results in or contributes to a violation of the MS4 Permit.

(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.060 Exemptions to Discharge Prohibitions

A. Permitted Discharges. Any discharge to the MS4 that is regulated under a NPDES permit issued to the 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.

B. Groundwater Discharges Typically Requiring Permits. Non-storm water discharges to the MS4 from the following categories are allowed if: (i) the discharger obtains coverage under NPDES Permit No. CAG919002 (RWQCB Order No. R9-2008-0002, or subsequent order) for discharges to surface waters other than San Diego Bay, and the discharger is in compliance with all requirements of the applicable NPDES permit and all other applicable laws and regulations; or (ii) the RWQCB determines in writing that coverage under NPDES Permit No. CAG919002 (or subsequent permit) is not required. Otherwise, non-storm water discharges from the following categories are illicit discharges:

1. Discharges from uncontaminated pumped groundwater;
2. Discharges from foundation 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. Discharges from water from crawl space pumps;
4. Discharges from 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.

C. Discharges from Water Lines. 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 (Regional Water Quality Control Board 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. Discharges from recycled or reclaimed water lines to the MS4 are 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.

D. Allowable Discharges. Non-storm water discharges to the MS4 from the following categories are allowed, unless the enforcement official or the Regional Water Quality Control Board identifies the discharge as a source of pollutants to receiving waters, in which case the discharge is considered an illicit discharge:

1. Discharges from diverted stream flows;
2. Discharges from rising groundwater;
3. Discharges from uncontaminated groundwater infiltration to the MS4;
4. Discharges from springs;
5. Discharges from flows from riparian habitats and wetlands;
6. Discharges from potable water sources, except as set forth in Vista Municipal Code section 13.18.060.C;

7. 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

8. 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.

E. Conditionally Allowed Discharges. Non-storm water discharges from the following categories are allowed if they are addressed as follows. Otherwise, non-storm water discharges from the following categories are illicit discharges:

1. Air conditioning condensation. Air conditioning condensation discharges shall comply with applicable BMPs identified in the Stormwater Standards Manual.

2. Individual residential vehicle washing. Wash water from individual residential vehicle washing must be directed to landscaped areas or other pervious surfaces, where feasible. Where discharges cannot be feasibly prevented, BMPs must be implemented in accordance with the Stormwater Standards Manual. Non-commercial car washes, such as fundraisers and other similar activities, are not considered individual residential vehicle washing. Discharges from such activities are therefore considered Illegal Discharges.

3. Water from swimming pools.

a. Chlorinated swimming pool water. Chlorine, algaecide, filter backwash, and other pollutants shall be eliminated prior to discharging swimming pool water to the MS4.

b. Saline swimming pool water. Saline swimming pool water must be directed to the sanitary sewer, landscaped areas, or other pervious surfaces that can accommodate the volume of water, unless the saline swimming pool water can be discharged directly to a naturally saline water body.

F. Firefighting Activities. Non-storm water discharges to the MS4 from firefighting activities are allowed if they are addressed as follows:

1. 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.

2. 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.

G. Exemptions not Absolute. Notwithstanding the categories of non-storm water discharges conditionally allowed by Vista Municipal Code sections 13.18.060.A through F, if the RWQCB or the Authorized Enforcement Official determines that any of these categories of otherwise 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 shall be prohibited from entering the MS4.

(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.070 BMP Requirements for All Dischargers

A. Best Management Practices. Any person engaged in activities which may result in discharges to the MS4 shall, to the MEP, undertake all measures to reduce the risk of non–storm water discharges and pollutant discharges. The following requirements shall apply:

1. Every person and/or entity undertaking any activity or use of a premises that may cause or contribute to storm water pollution or contamination, illicit discharges, or non-storm water discharges to the MS4 shall comply with BMP guidelines or pollution control requirements, as may be established by the Authorized Enforcement Official. . Such BMPs include the minimum BMPs set forth in the Stormwater Standards Manual.

2. An Authorized Enforcement Official may require any business or operations that is engaged in activities which may result in pollutant discharges to the MS4 to develop and implement a Water Pollution Control Plan, which must include an employee training program and the applicable minimum BMPs from the Stormwater Standards Manual.

3. Each discharger that is subject to any NPDES Permit shall comply with all requirements of all such permits. The discharger must also make reports submitted to the RWQCB or other permitting agency, including monitoring data, available to the City upon request.

4. Parties undertaking land disturbance activities shall comply with all applicable requirements of Section 13.18.080.

5. Parties undertaking land development and redevelopment activities shall comply with all applicable requirements of Section 13.18.090.

B. Guidance Documents. Any Authorized Enforcement Official under the supervision of the City Engineer may prepare, disseminate and maintain guidance documents addressing the use of BMPs for specific activities or facilities, illegal connections, and illegal discharges. These guidance documents may set out additional compliance alternatives that, in specified circumstances, can provide the same environmental protection that is afforded by the BMPs required by this chapter or specified in the Stormwater Standards Manual.

C. Significant Sources of Pollutants. Where Authorized Enforcement Staff identify a discharge that is in violation, or is likely to result in a violation, of Vista Municipal Code Section 13.18.050.D or 13.18.060.G, Authorized Enforcement Staff may order the discharger to install, implement and maintain additional BMPs. Any such order shall specify a reasonable date by which those BMPs must be put in place. A failure to install, implement, or maintain additional BMPs as required by any such order is a violation of this Chapter.

D. Collection and Use of Stormwater. An Authorized Enforcement Official may modify any requirement imposed by this chapter to allow the on-site collection and use of stormwater, or the collection of stormwater for delivery to and use at City-designated sites, provided the modified requirements are enforceable and provide equivalent environmental protection.

Section 13.18.080 BMP Requirements for Land Disturbance Activity

A. Permit Issuance. No discharger and/or development project proponent shall receive any City grading, clearing, building or other land development permit without first meeting the requirements of this Chapter, Chapter 17.56, and the Stormwater Standards Manual.

B. Owners and Operators both Responsible and Liable. Persons or entities performing land disturbance activities (including, but not limited to, construction activities) in the City, and the owners of land on which land disturbance activities are performed, are dischargers for purposes of this Chapter, provided, however, that a local government or public authority is not a discharger as to activities conducted by others in public rights-of-way.

C. Plan Submittal Requirements. Any Authorized Official under supervision of the City Engineer may prepare plan submittal requirements for permit applications, consistent with the Stormwater Standards Manual.

D. Agricultural Grading and Clearing. The BMP requirements imposed by this Section for land disturbance activities apply to agricultural grading and clearing, whether a city-issued grading and clearing permit is required for that activity. Tilling or cultivating land exclusively for

the purpose of growing plants or animals is not considered to be grading or clearing, provided all disturbed material remains on the same site, the tilling or cultivating will not block or divert any natural drainage way, and the land to be tilled or cultivated has been in agricultural production within the preceding five years.
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.090 BMP Requirements for Development and Redevelopment Projects

A. Application to Development and Redevelopment Projects. No land owner or development project proponent in the City shall receive any City grading, clearing, building or other land development permit required for land development activity or redevelopment activity unless the project meets or will meet the requirements of this chapter and the applicable requirements defined in the City's Stormwater Standards Manual. For Priority Development Projects, the project's SWQMP must be approved prior to the issuance of such permits.

B. Owners and Developers Responsible and Liable. Developers, development project proponents, and land owners for land on which development activities are performed are dischargers for purposes of this chapter, provided, however, that a local government or public authority is not a discharger as to activities conducted by others in public rights-of-way.

C. Post-Construction Best Management Practices Required. Land development and redevelopment activities with the potential to add pollutants to stormwater or to affect the flow rate or velocity of stormwater runoff after construction is completed, shall be designed to include and shall implement post-construction BMPs to 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 Water Quality Standards in accordance with the requirements defined in the City's Stormwater Standards Manual.

D. Land Development Associated with Agricultural Operations. The requirements imposed by this Section for land development activities apply to such activities when they are associated with agricultural operations.
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.100 Maintenance Requirements

A. Existing Development. Dischargers shall maintain the designed functionality of the storm drain system and BMPs they rely upon to achieve and maintain compliance with this chapter.

B. Responsibility to Maintain. The owners and occupants of lands on which a storm drain system and BMPs have been installed to meet the requirements of this chapter shall ensure the maintained functionality of those structures, regardless if other persons or entities identified in 13.18.100.C fail to do so. .

C. Maintenance Obligations Assumed by Contract or Other Agreement. Primary responsibility to maintain a BMP may be transferred through a contract or other agreement. If that contract provides that it will be submitted to the City pursuant to this Chapter as part of a development permit application, and if that contract is so submitted, the person or entity accepting a maintenance obligation in such a contract or agreement will also be legally obliged to maintain that BMP pursuant to this Chapter.

D. Obligation to Maintain BMPs not Avoided by Contracts or Other Agreements. For purposes of City enforcement, no contract or other agreement imposing an obligation to maintain a BMP can relieve a person or entity of any obligation to maintain a BMP imposed by this chapter.

E. Disclosure of Maintenance Obligations. Any developer who transfers ownership of land on which a BMP is located or will be located, or who otherwise transfers ownership of a BMP or responsibility for the maintenance of a BMP to another person or entity, shall provide clear written notice of the maintenance obligations associated with that BMP to the new or additional responsible party prior to that transfer.

F. Maintenance Plans for Land Development Activities. The proponents of any land development activity or redevelopment activity that requires installation of structural post-construction BMPs shall provide to the City for review and approval prior to issuance of permits for the project a plan for maintenance of all structural post-construction BMPs associated with the project. The plan shall specify the persons or entities responsible for maintenance activity, the persons or entities responsible for funding, schedules and procedures for inspection and maintenance of the BMPs, worker training requirements, and any other activities necessary to ensure BMP maintenance. The plan shall provide for servicing of all structural post-construction BMPs at least annually, and for the retention of inspection and maintenance records for at least three years.

G. Access Requirements. Storm drain system structures shall be provided adequate access for long-term inspection and maintenance purposes.

H. Assurance of Maintenance for Land Development Projects. The proponents of any land development activity or redevelopment activity that requires a City permit shall provide to the City, prior to issuance of permits for the project, proof of a mechanism acceptable to the City which will ensure ongoing long-term maintenance of all structural post-construction BMPs associated with the proposed project. The proponents shall be responsible for maintenance of BMPs unless, and until, an alternative mechanism for ensuring maintenance is accepted by the City and becomes effective.

(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.110 Inspection and Sampling

A. Regulatory Inspections and Certification Programs. The Authorized Enforcement Official may establish inspection or certification programs to evaluate and enforce compliance with the requirements of this Chapter. Authorized enforcement officials and authorized enforcement staff may inspect facilities, activities, and properties subject to this chapter at reasonable times and in a reasonable manner to carry out the purposes of this Chapter. If entry for a regulatory inspection is refused by the facility owner or operator, or by the occupant of a residence, an inspection warrant shall be obtained prior to inspection.

B. Inspections of New Construction. When any new storm drain system or BMP is installed on private property as part of a project that requires a City permit, in order to comply with this Chapter, the property owner shall grant to the City access permission to enter the property at reasonable times and in a reasonable manner to ensure compliance with this Chapter. This includes the right to enter the property without prior notice for routine inspections, to enter as needed for additional inspections during construction, to enter for any needed follow-up inspections, and to enter when necessary for abatement of a nuisance or correction of a violation of this chapter.

C. Scope of Inspections. Inspections may include all actions necessary to determine whether any illegal discharges or illegal connections exist, whether the BMPs installed and implemented are adequate to comply with this Chapter, whether those BMPs are being properly

maintained, and whether the facility or activity complies with the other requirements of this Chapter.
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

Section 13.18.120 Violations of Chapter.

A. This Chapter is violated any time a person violates any provision of this Chapter or fails to act, as required by this Chapter. For purposes of assessing and determining administrative penalties, civil penalties, or criminal penalties, a person shall be responsible or guilty of a separate offense for each and every day on which such a violation occurs and continues.

B. Failure by a person to take the actions required by an order or directive of an authorized enforcement official or authorized enforcement staff in the manner and by the time required by such order or directive shall constitute a separate violation of this Chapter apart from any other violations that may have occurred. Each day (or part thereof) in excess of the allowed period for correction shall constitute a separate violation of this Chapter.

C. A violation of this Chapter occurs any time a person makes a misrepresentation or omission of fact in a voluntary disclosure, a submission, a report, or a filing provided to the City to avoid, delay, or curtail a possible enforcement action or remedial action by the City.

D. Causing, permitting, aiding, abetting or concealing a violation of any provision of this Chapter shall constitute a violation of such provision.

Section 13.18.130 Administrative Enforcement Powers.

A. In addition to the other enforcement powers and remedies established by this Chapter, any authorized enforcement official has the authority to utilize the following administrative remedies or to issue the following orders to any person responsible, in whole or part, for any violation of this Chapter:

B. Notice of Violation. When an authorized enforcement official finds that a discharge has taken place or is likely to take place in violation of this Chapter, the official may issue a notice of violation and direct that those persons not complying shall take the following actions within the time periods specified by the authorized enforcement officials:

1. Cease and desist all activities that may cause or contribute to any discharge or condition violating any provision of this Chapter;
2. Comply with a time schedule for compliance;
3. Take appropriate remedial or preventative action to prevent the violation from recurring;
4. Submit and implement a plan approved by the enforcement official for the correction and prevention of the discharge or condition violating any provision of this Chapter;
5. Clean up any release of pollutants causing or resulting from the violation of any provision of this Chapter;
6. Mitigate any circumstances that may cause or contribute to any discharge or condition violating any provision of this Chapter; and
7. Adopt and implement best management practices and/or a stormwater pollution prevention plan approved by the enforcement official.
8. Require a business or organization to establish the elements of an employee training program as may be necessary to fulfill the purposes of this Chapter where

such a program has been required as part of a stormwater prevention plan or represents a BMP.

9. Assess and charge a person, business, or organization responsible for a violation the cost of any cleaning or repair of the MS4 system which resulted from an obstruction, damage or impairment caused by the violation.

10. Assess and charge a person, business, or organization responsible for a violation any and all costs which the City incurred, including any direct and indirect costs resulting from the violation.

11. Issue stop work notices or orders for any work under a city permit which is occurring in a manner to cause or threaten to cause a discharge in violation of this Chapter.

12. Suspend or revoke any permit, license, certificate, or approval issued by the City for any development, operations, use, or activity if the activities undertaken pursuant to that permit, license, certificate or approval are occurring in a manner to cause or threaten to cause a discharge in violation of this Chapter.

C. When, in the opinion of the enforcement official, any discharge from any source to the stormwater conveyance system causes or threatens to cause a condition that presents an imminent hazard to the public health, safety, or welfare, or the environment, or a violation of a NPDES permit, the Authorized Enforcement Official may issue a notice requiring the owner or occupant of the premises where the discharge is occurring to immediately abate the discharge. In any case where the discharge is not immediately abated, or for any reason the owner or occupant of the subject premises does not receive the notice, or the Authorized Enforcement Official determines that time constraints are such that abatement must occur without providing the notice, the Authorized Enforcement Official may summarily abate the condition in accordance with the provisions of Chapter 8.36 of the Vista Municipal Code or other applicable law.

D. If any violation of this Chapter constitutes a seasonal and recurrent nuisance, the Authorized Enforcement Official shall so declare in the notice and order issued pursuant to subsection B, above. Thereafter, the owner or occupant of the subject premises shall abate such seasonal and recurrent nuisance every year without the necessity of any further notice and order. If at any time the nuisance is not abated as required herein, the enforcement official may summarily abate the condition in accordance with the provisions of Chapter 8.36 of the Vista Municipal Code or other applicable law.

E. The owner of any premises in the city from which is made a discharge in violation of this Chapter, and any person making or causing to be made the discharge, if different from the owner, shall be jointly and severally liable for the costs incurred by the City for any abatement, clean-up or restoration, including any related inspection and testing costs, arising from the discharge, and the cost therefor shall be invoiced to the owner of the premises. If the invoice is not paid within sixty (60) days, the Authorized Enforcement Official may commence proceedings for recovery of in accordance with the provisions of Chapter 8.36 of the Vista Municipal Code or other applicable law.

F. Administrative Penalties. In addition to any other remedy or penalty set forth in this Chapter or this code, administrative penalties may be imposed pursuant to applicable provisions of Chapter 1.13 of the Vista Municipal Code against any responsible party, whether owner, lessee, sublessor, sublessee or occupant of any premises in violation of any of the provisions of this Chapter. Imposition, enforcement, collection and administrative review of administrative penalties imposed shall be conducted pursuant to Chapter 1.13 of the Vista Municipal Code.

Section 13.18.140 Civil Actions.

A. In addition to any other remedies provided in this Chapter, any violation of this section may be enforced by civil action brought by the City. In any such action, the City may seek, without limitation, and the court shall grant, as appropriate, any or all of the following remedies:

1. Injunctive relief;
2. Assessment of the violator for the costs of any investigation, inspection, or monitoring survey which led to the establishment of the violation, and for the reasonable costs of preparing and bringing legal action under this subsection;
3. Costs incurred in removing, correcting, or terminating the adverse effects resulting from the violation;
4. Compensatory damages for loss or destruction to water quality, wildlife, fish and aquatic life.
5. Payment or reimbursement of any governmental fines or penalties imposed on the City as a result of the violation.
6. Civil penalties imposed either on a daily basis or a per-gallon basis, but not both, for any discharge of nonstormwater to the stormwater conveyance system violating any provision of this Chapter. Civil penalties imposed on a daily basis shall not exceed five thousand dollars ($5,000.00) for each day or portion of a day that the discharge occurs, and civil penalties imposed on a per-gallon basis shall not exceed ten dollars ($10.00) for each gallon of the discharge. The amount of civil penalties imposed shall be determined by taking into consideration some or all of the following factors: the nature, circumstances, extent, and gravity of the discharge, whether the discharge is susceptible to cleanup or abatement, the degree of toxicity of the discharge, and, with respect to the violator, the ability to pay, the effect on its ability to continue in business, any voluntary cleanup efforts undertaken, any prior history of violations, the degree of culpability, the economic benefit or savings, if any, resulting from the violation, and such other matters as justice may require.

Section 13.18.150 Criminal Penalties.

A. Any person who knowingly or intentionally violates any provision of this Chapter shall be guilty of a misdemeanor punishable by imprisonment in the county jail for a period not to exceed one year, or a fine not to exceed ten thousand dollars for each day such a violation exists, or both. There is no requirement that administrative enforcement authorities be used before such actions are filed. A citation and notice to appear as prescribed by Chapter 1.12 may be issued.
B. Notwithstanding paragraph A, any such violation constituting a misdemeanor under this Chapter may, in the discretion of the City Attorney or City Prosecutor, be charged and prosecuted as an infraction.
C. The immunities prescribed in Section 836.5 of the California Penal Code shall be applicable to public officers or employees acting in the course and scope of employment pursuant to this Chapter.

Section 13.18.160 Violations Deemed a Public Nuisance.

A. Any condition caused or permitted to exist in violation of any of the provisions of this Chapter is a threat to the public health, safety and welfare and is declared and deemed to be a public nuisance subject to abatement.
B. A nuisance resulting from violation of any provisions of this Chapter may be summarily abated by any authorized enforcement official, and/or through a civil action to abate,

enjoin or otherwise compel the cessation of such nuisance. Such actions may be undertaken by or on behalf of the City pursuant to Chapter 8.36 of the Vista Municipal Code or any other provision of law.

B. The cost of such abatement and restoration shall be borne by the owner of the property and the cost thereof shall be a lien upon and against the property and such lien shall continue in existence until the same shall be paid.

Section 13.18.170 Remedies Not Exclusive.

Remedies under this Chapter are in addition to and do not supersede or limit any and all other remedies, civil or criminal. The remedies provided for herein shall be cumulative and not exclusive.

Section 13.18.180 Use of Penalties or Assessments.

Any monetary penalties or assessments collected by the city pursuant to violations of this Chapter, shall be used for storm water pollution prevention and program management.

Section 13.18.190 Appeal.

If a decision or action of the Authorized Enforcement Official is not subject to an appeal procedure under any other provision of this Chapter or code, any person who is affected by the Authorized Enforcement Official's decision or action may appeal the decision or action to the City Manager or designee within ten (10) days following the effective date of the decision or action, by filing a written appeal with the City Manager or designee. Upon receipt of such appeal, the City Manager may request a report and recommendation from the authorized enforcement official and shall set the matter for an informal hearing at the earliest practical date. Not less than seven days prior to the date of hearing, the City Manager or designee shall provide written notice of the hearing to the person appealing the decision or action of the enforcement official. At the hearing, the appellant may be represented by any person of appellant's choice. The City Manager or designee shall hear any additional evidence presented by the appellant or the Authorized Enforcement Official, and may reject, affirm or modify the Authorized Enforcement Official's decision. The decision of the City Manager or designee shall be the City's final administrative determination of the matter.

Section 13.18.200 Severability

If any section, subsection, sentence, clause or phrase of this chapter is for any reason held to be invalid or unconstitutional, such decision shall not affect the validity of the remaining portions of this chapter. The City Council hereby declares that it would have passed this chapter, and each section, subsection, sentence, clause and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases had been declared invalid or unconstitutional, and if for any reason this chapter should be declared invalid or unconstitutional, then the original ordinance or ordinances shall be in full force and effect.
(Ord. No. 93-18, Enacted, 7/6/93; Ord. No. 2002-10, Amended, 3/29/02; Ord. No. 2002-24, Amended, 11/12/02; Ord. No. 2008-14, Repealed and Replaced, 4/8/08)

3. Effective Date. This ordinance shall be effective on the 31st day following the date of its adoption.

4. Adoption. INTRODUCED AND ADOPTED at a meeting of the City Council held on________________________, 2015, by the following vote:

AYES:

NOES:

ABSTAIN:

____
JUDY RITTER, MAYOR

APPROVED AS TO FORM:
DAROLD PIEPER, CITY ATTORNEY

By:________________________________

ATTEST:
MARCI KILIAN, CITY CLERK

By:________________________________

APPROVED
Jonathan B. Stone
1132 052015

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Appendix E

Irrigation Runoff Elimination Strategies

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Appendix E City of Vista WQIP and JRMP Strategies to Reduce and Eliminate Irrigation Runoff

Strategy Name	Description of Strategy	Carlsbad WQIP Strategy Number	San Luis Rey Strategy Number	City of Vista JRMP Reference
Irrigation Runoff Reduction Program	The City implements an Irrigation Runoff Reduction Program (IRRP) to eliminate or reduce dry weather flow contributions, concurrent with the final goals, coming from irrigation runoff, regardless of the time of day the discharges occur. Core elements include: • Developing municipal codes that prohibit irrigation runoff • Developing educational materials and outreach program specific towards irrigation runoff • Assessing dry weather flows at outfall(s) • Identifying key times to perform site observations • Performing site observations to identify sources of irrigation runoff • Collaboration with the City of Carlsbad Public Works Department to address municipal property irrigation systems • Initiating contact and correspondence with property managers/owners • Periodically assessing flows • Optionally developing and implementing an incentive program to encourage the elimination of irrigation runoff	14	--	Sections 3.2 and 3.3.4; Section 10.4, Table 10-2; Appendix F
Property-Based Inspections/Patrol, Existing Development Facilities, Areas and Activities Inspections, & Investigations	The City implements inspections and investigations of existing development areas to reduce discharges to the MS4. The inspections are expected to eliminate dry weather flows, but can also reduce the wet weather loading potential and provide opportunities for identification of potential retrofit projects.	5, 15	DP 1	Sections 6.4, 7.3.3, 8, and 9.4

Appendix E City of Vista WQIP and JRMP Strategies to Reduce and Eliminate Irrigation Runoff

Strategy Name	Description of Strategy	Carlsbad WQIP Strategy Number	San Luis Rey Strategy Number	City of Vista JRMP Reference
Administrative BMPs, Runoff and Nutrients Source Reduction, & Enforcement	Based on findings from preliminary assessments, the City implements strategies to address irrigation issues found regarding persistent, anthropogenic flows from focus area and repeat violators within focus area. The City actively enforces prohibitions related to illicit discharges and connections.	11, 10, 22	IDDE 16, IDDE 17	Sections 6, 7, 8, and 9 and Appendix F
General Education, Employee Training/Focused Training, Homeowners Association and Property Manager Outreach Program, and Outreach & Enhanced Education Program	The City implements a baseline education program and makes enhancements to the program when deemed appropriate to address specific pollutants, BMPs, or target specific areas/audiences within the City. The enhancements can include production and distribution of educational materials, outreach events, trainings or seminars, and individual educational encounters (one-on-one meetings). The program is designed to engage the public, jurisdictional staff, and other agency staff to proactively identify and report illicit discharges. The program also encourages and/or incentivizes HOAs and business property managers to implement measures to reduce dry weather and/or wet weather flows leaving their properties.	8, 9, 17, 18, 20	DP 3, DP 4, ED 12, ED 2, ED 3, ED 13, ED 14, IDDE 1, IDDE 2, IDDE 3, IDDE 4, IDDE 5, & IDDE 6	Section 10
Program for Retrofitting Areas of Existing Development	The City requires implementation of structural (engineered) BMPs or retrofitting existing structural BMPs to address flow and/or pollutant issues.	12	ED 23, ED 33, ED 34	Sections 4.7 and 7.3.1, and Appendix B

BMP = Best Management Practice; HOA = Homeowners Association; JRMP = Jurisdictional Runoff Management Program; WQIP = Water Quality Technical Report

Appendix F

Enforcement Response Plan

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Appendix F. City of Vista Enforcement Response Plan

The City of Vista (City) ensures that pollution prevention methods, also known as best management practices (BMPs), are implemented by enforcing Vista Municipal Code (VMC) Chapter 13.18, the Stormwater Management and Discharge Control Program Ordinance (Stormwater Ordinance). In accordance with Section E.6 of the Regional Water Quality Control Board, San Diego Region (RWQCB) Order R9-2013-0001, as amended by Order R9-2015-0001 (MS4 Permit), compliance with the City's ordinances are assessed through a variety of means, including inspections, responses to hotline calls, and the routine municipal separate storm sewer system (MS4) outfall monitoring. Where violations of the Stormwater Ordinance are observed, the enforcement actions and procedures described in this Enforcement Response Plan are employed to enforce stormwater requirements.

The City typically employs a tiered, escalating enforcement system. However, the City reserves the right to use whatever tools the Authorized Enforcement Official deems most appropriate for a given situation, as dictated by the specifics of each case. The Stormwater Ordinance defines Authorized Enforcement Official as the party who is responsible for enforcing the requirements of Chapter 13.18. This is the City Manager or his or her designee. The Authorized Enforcement Official also may assign other staff enforcement responsibilities. These staff are referred to as Authorized Enforcement Staff in the Stormwater Ordinance. Throughout this Enforcement Response Plan enforcement actions are described as being taken by the Authorized Enforcement Staff. However, the Authorized Enforcement Official has the final authority to determine which enforcement actions are appropriate for particular cases or as overall matters of enforcement policy.

Examples of enforcement and escalated enforcement actions can be found in the following sections. It should be noted that experience and professional judgment of City staff are important in guiding the appropriate response to a violation. Escalated enforcement actions continue to increase in severity, as necessary, to compel compliance as soon as possible.

1 Administrative Enforcement Actions (VMC § 13.18.130)

Several different types of administrative enforcement actions can be used to enforce compliance with the Stormwater Ordinance, as discussed below.

1.1 Documented Warnings

When a violation of the Stormwater Ordinance is observed, a written warning is typically the City's first level of enforcement action. Written warnings can be issued using a variety of methods, including documented warnings, Notices of Violation, cease and desist orders, and notice and order to clean, test, or abate.

Notices and orders to clean, test, or abate may be issued to perform any act required by the VMC. When written warnings are issued, the violation is noted, a time frame to correct the violation is given, and a follow-up date is scheduled. Authorized Enforcement Staff follow up as necessary to determine whether compliance has been achieved.

1.2 Public Nuisance Abatement

Violations that are deemed to be a threat to public health, safety, and welfare may be identified as a public nuisance. Costs for pollution detection and abatement may be recovered from the discharger in addition to any other penalties. If cost recovery is initiated by the City and not paid in full by the discharger, any unrecovered costs may be made a lien against the discharger's property. This provision is in accordance with the City's abatement procedure (VMC Chapter 8.36, Property Maintenance and Nuisance Abatement).

1.3 Enforcement of Contracts

If a contractor is performing work for the City, then the City may use provisions within the contract for enforcement of non-compliance. Such contract provisions may allow the City to refuse payment, stop work (without time penalties), and/or revoke contracts, if contractors performing activities do not comply with all appropriate permits, laws, regulations, and ordinances.

1.4 Stop-Work Order

Authorized Enforcement Staff may order work to be stopped if such work is in violation of the VMC. stop work orders are issued in writing. Any person receiving a stop-work order is required to immediately stop such work until approved by the Authorized Enforcement Staff to proceed with the work.

As discussed in Enforcement Response Plan Section 8 (Program Enforcement – Construction Management), a stop-work order is generally used as an elevated enforcement tool for all phases of active land development projects—both public and private. In some cases a stop-work order may be used for an Industrial/Commercial operations issue, but this is rare. Because stop-work orders prohibit further regular site activity until compliance has been achieved, they are effective compliance mechanisms. Moreover, stop-work orders are typically issued if requirements designated in written warnings have not been adequately addressed, or if an observed violation poses a significant threat to water quality.

To restart work once a stop-work order has been issued, the responsible party must request that Authorized Enforcement Staff re-inspect the site to verify that the deficiencies have been satisfactorily corrected. When Authorized Enforcement Staff verifies in writing that the appropriate corrections have been implemented, activities may resume.

1.5 Permit Suspension or Revocation

City permits, licenses, or other approvals may be suspended or revoked if a notice of violation (NOV) is issued and compliance is not achieved within the specified timeframe. If the responsible party pursues an appeals/hearing process that determines he/she is still in violation, the suspensions remains in effect until the designated requirements are met. For example, in persistent cases of non-compliance, or significant discharges relating to development and/or construction activities, the City may revoke a responsible party's existing building or grading permits or deny future permits. Prior to resuming work, the responsible party will need to re-apply for permits and meet the City-specified requirements.

1.6 Administrative Citations and Penalties

Authorized Enforcement Staff may issue administrative citations for violations of the Vista Municipal Code pursuant to VMC § 1.13.060. Maximum citation amounts for each violation of the same code section or permit condition depend on the number of previous violations, with the current penalty schedule as follows:

- Initial violation: $100
- Second violation within one year of the first violation: $200
- Additional violations within one year of the first violation: $500

When administrative citations are issued, a violator may request a hearing to contest the determination that a violation of the City's stormwater requirements has occurred. Details on the City's hearing and appeals process can be found in VMC Chapter 1.13.

2 Judicial Enforcement Actions (VMC §§ 13.18.140-150)

In addition to administrative enforcement procedures, the City also may use the judicial enforcement actions described below. Judicial enforcement actions involve both Authorized Enforcement Staff and the City Attorney. Although there is no requirement that administrative enforcement procedures be pursued before judicial enforcement actions are filed, most violations are resolved through the administrative enforcement process.

2.1 Civil Penalties and Remedies

The City Attorney is authorized to file criminal and civil actions and to seek civil penalties and/or other remedies to enforce the Stormwater Ordinance.

2.2 Injunctive Relief

The City may pursue enforcement by judicial action for preliminary or permanent injunctive relief for any violation of the Stormwater Ordinance.

2.3 Arrest or Issue Citations

Violators may be arrested, with the assistance of a peace officer, pursuant to the provisions of the California Penal Code. Violators may also be issued a citation and notice to appear as prescribed in the California Penal Code.

2.4 Criminal Penalties and Remedies

It is unlawful for any person, firm, corporation, or other responsible entity to violate any provision for failure to comply with any of the restrictions or requirements of the Vista Municipal Code, including the Stormwater Ordinance. A violation of the Stormwater Ordinance constitutes a misdemeanor and may be enforced and punished per the California Penal Code and Government Code.

3 Documentation

During investigations of activities in violation of the VMC, a wide variety of information may be collected and documented. The information listed below is recorded for use in administrative and judicial enforcement actions, where applicable. *Cityworks*, a database system with GIS capabilities, is the primary system used to store enforcement-related documentation:

- Chronology of events
- Case summary
- Time and expense log
- Inspection reports
- Complaints
- Phone conversation records
- Correspondence
- Maps and diagrams
- Photographs
- Witness list
- Explanation of the violations
- Request-to-file form
- Field notes
- Emergency incident reports
- Lab results
- Chain-of-custody forms for samples
- Permit applications
- Sampling plans
- Other supporting documents
- Reports from regulatory agencies

4 Program Enforcement - Municipal

During routine municipal facility inspections, City or contract staff assess facility areas and activities to ensure all are maintained in accordance with City regulations, ordinances, and BMP requirements. If BMPs are found to be deficient or otherwise ineffective, the responsible party or department is provided with required corrective actions. If the Authorized Enforcement Staff notes that specific areas of a leased facility require additional BMPs, the City may require the implementation of BMPs in addition to the required minimum for the specific area/activity. If a leased facility continues to be out of compliance, the City may choose to discontinue the lease, which would remove the tenant from that particular site.

If the responsible City staff member or department/division does not perform the necessary corrective actions in response to the direction of their immediate superior, escalated enforcement action is taken by involving higher ranking representatives within the responsible department or division, who may enact internal disciplinary procedures, until the deficiencies are resolved.

As required by the MS4 Permit, City staff seek to resolve incidents of observed non-compliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where the violation cannot be resolved within 30 days, the reason additional time was needed for case resolution is documented and kept on file.

5 Program Enforcement - Industrial and Commercial

During industrial and commercial facility inspections, Authorized Enforcement Staff document each observed violation of stormwater ordinance requirements. Enforcement action is taken where necessary to achieve compliance. If the Authorized Enforcement Staff observes a significant and/or immediate threat to water quality, action is taken to require the facility owner and/or operator to cease and correct the discharge or activity.

Conditions that could warrant such action may include runoff from a business that is not reasonably controlled by existing protective measures or a BMP failure resulting or potentially resulting in a release of pollutants that may substantially degrade water quality. Violations deemed to pose a threat to health or the environment will be reported to the RWQCB verbally within 24 hours and in writing within 5 days, as required by Attachment B of the MS4 Permit (see also Enforcement Response Plan Section 9).

Events of non-compliance are evaluated according to the following criteria to determine whether they pose a threat to human or environmental health:

- The event of non-compliance resulted in a spill or discharge of hazardous materials, pollutants, or runoff containing pollutants that had an effect on a receiving water body.
- The quantity and/or concentration of the pollutants in the spill or discharge affecting the receiving water was such that it may cause or contribute to an exceedance in water quality objectives as specified in the San Diego Basin Plan.

Depending on the nature and severity of the violation, enforcement may consist of any of the actions listed in Sections 3.1 or 3.2. Typical enforcement actions are listed below; escalated enforcement actions are marked with an asterisk (*):

- Verbal warnings
- Written warnings, including notices of violation
- Administrative citations*
- Public nuisance abatement*

Escalated enforcement is used as needed to ensure compliance, providing flexibility for Authorized Enforcement Staff to establish appropriate compliance time frames on a case-by-case basis. Through the Stormwater Ordinance, the City maintains the authority to require facilities to implement additional actions to address violations, such as preparation of a Storm Water Pollution Prevention Plan, conducting sampling and analysis, or revising training activities.

As required by the MS4 Permit, Authorized Enforcement Staff seek to resolve incidents of observed non-compliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where the violation cannot be resolved within 30 days, the reason additional time was needed for case resolution is documented and kept on file.

When a site is subject to the Industrial General Permit (IGP), City staff may also collaborate with RWQCB staff on enforcement actions. The City will notify the RWQCB of any industrial facilities required to obtain coverage under the IGP that, to the City's knowledge, have not filed for coverage, within 5 calendar days from the time the City became aware of the circumstances. At minimum, the business name, business type, and address will be provided to the RWQCB. Written notification may be provided electronically by email to Nonfilers_R9@waterboards.ca.gov.

5.1 Mobile Business Enforcement

Violations associated with mobile businesses are typically related to illegal discharges. The City's enforcement approach to such discharges often requires the discharge to be abated and the area cleaned. Education is provided to operators who are not aware of the City's stormwater requirements, and a Mobile Water Use license may be required for their business activities. Businesses that do not possess the materials necessary to implement the required BMPs are required to demonstrate to the City that they have obtained such materials and can properly use them before the City allows them to resume operations within its jurisdiction. Discharges related to non-compliance deemed to pose a threat to health or the environment are reported using the same process described above in Section 5.

As required by the MS4 Permit, Authorized Enforcement Staff seek to resolve incidents of observed non-compliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where the violation cannot be resolved within 30 days, the reason additional time was needed for case resolution is documented and kept on file.

6 Program Enforcement - Residential

The following mechanisms are used by the City to determine residential areas where enforcement actions may be necessary, where appropriate:

- Public reporting hotline
- Analysis of field screening and analytical monitoring results
- Observations from City personnel

Residential-based stormwater 'complaints' are typically received through calls or emails to the City's Water Quality Hotline. Residents occasionally contact City staff directly while in the field. Activities by City staff also assist in identifying residential-based violations, including residential area inspections/observations, scheduled MS4 outfall monitoring, and routine maintenance activities such as storm drain system inspection/cleaning. Targeted investigations of areas upstream of outfalls with obvious pollutants present during the Dry Weather MS4 Outfall Monitoring Program and complaint response investigations provide additional information sources. The combination of public reporting, direct observations, targeted investigations, and in-field monitoring provide effective oversight of residential areas and activities.

During investigations of incidents discovered through the mechanisms described above, the City continues to use the opportunity to address any other issues of concern and provide educational materials where appropriate. Enforcement mechanisms are implemented to eliminate each IC/ID once its source has been identified. Further details of enforcement mechanisms pertaining to IC/IDs can be found in Section 9 of this document.

Follow-up inspections are conducted for BMP deficiencies and violations in residential areas as needed. Depending on the nature and severity of the violation, enforcement may consist of any of the actions listed in Sections 1 or 2. Typical enforcement actions are listed below; escalated enforcement actions are marked with an asterisk (*):

- Verbal warnings
- Written warnings
- Administrative citations*
- Public nuisance abatement*

Violations deemed to pose a threat to health or the environment will be reported to the RWQCB verbally within 24 hours and in writing within 5 days, as required by Attachment B of the MS4 Permit (see also Enforcement Response Plan Section 9).

As required by the MS4 Permit, Authorized Enforcement Staff seek to resolve incidents of observed noncompliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where the violation cannot be resolved within 30 days, the reason additional time was needed for case resolution is documented and kept on file.

7 Program Enforcement - Development Planning

The City may use a variety of enforcement methods to ensure stormwater requirements are appropriately implemented for all development projects within the City's jurisdiction. This section discusses enforcement for project planning and post-construction structural BMP components, whereas Section 8 discusses active construction enforcement activities.

7.1 Development Review and Approval

The City implements a development review and plan check process that verifies post-construction BMPs are included in project designs in accordance with the City's requirements. Projects are not allowed to begin construction before plans have been approved. Section 4 of the JRMP provides more information about the review process.

7.2 Pre-Occupancy Installation Verification

Since all structural BMPs included in the Storm Water Quality Management Plan are required to be shown on the project's grading plans, Engineering inspectors confirm that structural BMPs are being constructed per plan during routine inspections. If structural BMP construction or installation varies from approved plans, the City requires that in-field corrections be made, or for the project engineer to confirm that revisions continue to comply with project requirements. Engineering inspectors and Stormwater staff jointly complete a 'final' inspection to verify structural BMPs have been installed in accordance with the grading plans prior to release of project occupancy. Occupancy is not granted until all BMPs have been installed.

7.3 Ongoing Operation and Maintenance for Completed Projects

Following occupancy, ongoing operation and maintenance is verified through inspections or through review of submitted maintenance verification certifications. Stormwater staff are responsible for this part of the program. If a project is found not to be maintaining BMPs as required, depending on the nature and severity of the violation, enforcement may consist of any of the actions listed in Sections 1 or 2. Typical enforcement actions are listed below; escalated enforcement actions are marked with an asterisk (*):

- Verbal warnings

- Written warnings
- Administrative citations*
- Public nuisance abatement, which may include placing a lien against the property*

If Authorized Enforcement Staff finds maintenance deficiencies with any structural BMPs at a site, he or she documents deficiencies and necessary corrective actions and provides these to the responsible party. Minor deficiencies and corrective actions may warrant resolution through a verbal warning. If the responsible party performs all necessary corrective actions promptly, the case is closed, and the resolution is documented. Where appropriate, the Authorized Enforcement Staff may decide to formally document non-compliance by issuing a written warning with required corrective actions. Responsible parties are required to perform the corrective actions and demonstrate that all necessary maintenance activities were completed through a re-inspection with the Authorized Enforcement Staff or through providing photographs of corrections. The Authorized Enforcement Staff may also request additional documentation (e.g., maintenance records or invoices) or perform a re-inspection at their discretion.

Annual self-certification is also a requirement of the City's annual inspection program. Priority Development Project sites with structural BMPs are required to submit certification that documents the BMPs' on-going maintenance and functionality. If a responsible party fails to provide a certification to the City, a written warning is issued. The warning documents non-compliance per failure to timely to submit a certification form and the BMP maintenance responsibilities related to the annual certification process. The warning also designates the required certification to be submitted. If a responsible party fails to sufficiently respond to a notice from the City by the response deadline, the Authorized Enforcement Staff may issue a NOV or pursue escalated enforcement actions. .

To document compliance status, follow-up inspections may be performed at sites where structural BMP deficiencies have been identified. Escalated enforcement action may be used, where appropriate, to facilitate compliance with structural BMP maintenance requirements. If a development site continues to demonstrate non-compliance and is not responsive to administrative enforcement actions, judicial enforcement actions may be initiated.

Violations deemed to pose a threat to health or the environment will be reported to the RWQCB verbally within 24 hours and in writing within 5 days, as required by Attachment B of the MS4 Permit (see also Enforcement Response Plan Section 9).

As required by the MS4 Permit, Authorized Enforcement Staff seek to resolve incidents of observed non-compliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where the violation cannot be resolved within 30 days, the reason additional time was needed for case resolution is documented and kept in the project's file.

8 Program Enforcement - Construction Management

The City is responsible for enforcement of applicable local ordinances and permits at all construction sites in its jurisdiction. The Stormwater Ordinance (VMC Chapter 13.18) and the Grading and Erosion Control Ordinance (VMC Chapter 17.56) provide legal authority for enforcement at construction sites. When violations are observed during a site inspection, the City implements appropriate enforcement measures based on the severity of the violation. Verbal warnings are not used as means of enforcement at active construction sites. Enforcement can range from correction notices to more severe enforcement such as NOVs and Stop-Work Orders. Stronger enforcement measures are used as necessary if proper corrective actions are not implemented during the allotted time frame or if the severity of the violation warrants stricter enforcement.

The typical progressive enforcement steps that the City implements include the following; actions considered escalated enforcement are marked with an asterisk (*):

- Correction notices
- NOVs
- Enforcement of contracts (CIP projects)
- Administrative citations
- Stop-work orders*
- Public nuisance abatement, which may include BMP implementation by City-hired contractor, with cost reimbursement to the City*
- Revocation of permits*

Escalated enforcement actions will be reported to the RWQCB within f5 days, as required by the MS4 Permit.

The City works closely with all development projects prior to the commencement of construction activities. All construction sites are expected to be aware of the City's construction BMP requirements. Accordingly, a written correction notice is the first enforcement step. Written corrections, NOVs, and administrative citations are the most common measures used to bring about compliance. However, if a construction site demonstrates continued non-compliance with Vista Municipal Code, more severe actions, such as a stop-work order or judicial enforcement action may be imposed. Construction site inspections are performed by the City inspection staff to evaluate compliance with minimum BMP requirements (Appendix C) and applicable ordinances and permits (building, grading, stormwater etc.). Follow-up inspections conducted as a result of construction BMP deficiencies are performed. Site inspections are discussed in greater detail in Chapter 5.

Authorized Enforcement Staff seek to resolve incidents of observed noncompliance at construction sites within 72 hours, or prior to the next rain event, whichever is sooner. When a violation has not been resolved within 72 hours, additional enforcement actions is taken as necessary to achieve compliance. If a violation has not been resolved within 30 days, the reason additional time was needed for case resolution is documented and kept in the project's file, as required by the MS4 Permit.

The City implements a robust process to ensure construction sites obtain CGP coverage before they begin work, as described in JRMP Section 5 (Construction Management). When a site is subject to the Construction General Permit (CGP), City staff may also collaborate with RWQCB staff on enforcement actions. The City will notify the RWQCB in writing 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 of other non-compliance. Written notification may be provided to the appropriate RWQCB staff member by email. If any construction site that is subject to the CGP but has not obtained coverage (e.g., a project that had been operating without permits) is discovered in the field, the City will notify the RWQCB promptly. Written notification may be provided electronically by email to Nonfilers_R9@waterboards.ca.gov.

Violations deemed to pose a threat to health or the environment will be reported to the RWQCB verbally within 24 hours and in writing within 5 days, as required by Attachment B of the MS4 Permit. Criteria listed below may be used in addition to the criteria listed in Enforcement Response Plan Section 9 to determine the human or environmental health threats of non-compliance, whether from stormwater or non-stormwater discharges, where applicable:

- Estimated area of erosion caused by discharge
- Total suspended solids concentration and turbidity of discharge
- Other materials discharged that pose a threat (concrete washout, sanitary washes, etc.)

9 Program Enforcement – Illegal Discharges

The City implements and enforces its ordinances, orders, or other legal authority to prevent illicit connections and illegal discharges (IC/IDs) to its storm drain system. If the City identifies the source as a controllable source of non-stormwater or as an IC/ID, the administrative and judicial enforcement measures previously listed will be used, as necessary, to eliminate IC/IDs.

If a complaint is received that indicates a potential IC/ID, Authorized Enforcement Staff will conduct a field investigation for complaints with details suggesting an actual or potential discharge to the storm drain system or receiving water body. If investigators find evidence of a violation with the potential to release pollutants or an actual IC/ID, every effort is made to find the responsible party to resolve the situation. Parties found to be responsible for a violation or IC/ID are required to clean up or remove pollutants to the maximum extent practicable.

The appropriate level of enforcement for IC/IDs is determined on a case-by-case basis and is based on factors such as the severity of the violation, the threat to human or environmental health, site-specific circumstances, and past compliance history. If the situation is determined to pose an immediate risk to public health or the environment, an NOV or administrative citation may be issued immediately. When public health is at risk, the City may coordinate with other agencies or teams that are specially trained to assess and mitigate the discharge (e.g., those involving hazardous wastes/materials, etc.). Violations deemed to pose a threat to health or the environment will be reported to the RWQCB verbally within 24 hours and in writing within 5 days, as required by Attachment B of the MS4 Permit. Section 3.3 of the JRMP (Preventing, Detecting, and Responding to Illegal Connections and Illegal Discharges) provides additional detail on IC/ID investigation, response, and reporting.

Criteria listed below may be used to determine the human or environmental health threats of a non-compliance event, whether from stormwater or non-stormwater discharges, where applicable:

- Estimated pollutant load discharged from site
- Estimated volume of discharge
- Types of pollutants discharged, including if toxic materials were discharged
- Sensitivity of the receiving water body, including if it is 303(d) listed for any of the pollutants in the discharge
- Proximity of site to sensitive habitat/endangered species
- Proximity of site to public water supply (well head, monitoring wells)
- Quantity, if any of the discharge reached the receiving water body
- Beneficial uses for affected water bodies

Upstream investigations of suspected illicit discharges are conducted, and appropriate enforcement action is taken and documented when/if the discharge source is determined. As necessary, follow-up inspections are conducted to confirm compliance with enforcement actions.

As required by the MS4 Permit, Authorized Enforcement Staff seek to resolve incidents of observed non-compliance within 30 calendar days, or prior to the next rain event, whichever is sooner. In cases where the violation cannot be resolved within 30 days, the reason additional time was needed for case resolution is documented and kept on file.

Appendix G

Dry Weather MS4 Outfall Monitoring Procedures and Storm Drain System Map

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Appendix G. Dry Weather MS4 Outfall Monitoring Procedures and Storm Drain System Map

1 Introduction

In accordance with the Regional Water Quality Control Board, San Diego Region (RWQCB) Order R9-2013-0001, as amended by Order R9-2015-0001 and Order R9-2015-0100 (MS4 Permit), the City of Vista (City), along with other copermittees, is required to monitor discharges from its major municipal separate storm sewer system (MS4) outfalls during dry weather. Weather is considered dry if the preceding 72 hours has been without measurable precipitation (> 0.1 inch).

The MS4 Permit defines a major MS4 outfall as follows: 1) a single pipe with an inside diameter of at least 36 inches or its equivalent (i.e., discharge from a single conveyance other than a circular pipe which is associated with a drainage area of more than 50 acres); 2) any outfall that discharges from a single pipe with an inside diameter of at least 12 inches or its equivalent (i.e., discharge from other than a circular pipe associated with a drainage area of at least 2 acres) that receives runoff from an area zoned for industrial activity (based on comprehensive zoning plans or equivalent).

This procedural document describes field protocols for conducting routine dry weather MS4 outfall monitoring and for investigations to identify sources of water observed during monitoring.

2 Major MS4 Outfall Inventory

The City has identified the major outfalls within its jurisdiction and maintains an inventory of them as required by the MS4 Permit. In cases where a major outfall is permanently inaccessible (e.g., due to private property constraints, safety concerns, etc.), the nearest accessible upstream location within the MS4 is designated as a proxy for the monitoring site. The major MS4 outfall inventory includes the following information for each monitoring location:

- Latitude and longitude of major MS4 outfall (or the upstream proxy site)
- Watershed Management Area
- Hydrologic subarea
- Outfall size (inches)
- Accessibility (i.e. safety and without disturbance of critical habitat)
- Approximate drainage area (acres)
- Classification of whether the outfall is known to have persistent, transient, none, or unknown dry weather flows

A map of the City's major outfalls is included as Attachment 1.

3 Routine Dry-Weather Major MS4 Outfall Site Visits

During each site visit, a field datasheet (Attachment 2) is completed. Steps for completing the datasheet are described in the following sections, which follow datasheet section headings:

3.1 Site Location and Documentation

The first task in conducting a routine site visit is locating the site. This is achieved by using GPS coordinates and the location description provided by the major outfall monitoring site inventory. A hand-held GPS device is used in the field to verify or update coordinates. Once the site has been located and verified, photos are taken to document the condition of the site. Photos are taken facing upstream and downstream of the site so they sufficiently display any water present and notable landmarks when possible.

3.2 Atmospheric Conditions

Weather conditions and rainfall information are recorded on the field datasheet. No City outfalls are influenced by the tide. Since monitoring is only permitted during dry weather, it is important to document that it is being completed during dry-weather-defined conditions: >72 hours since the last rain, or <72 hours since the last ran and ≤0.1 inches of precipitation. If neither of those conditions is met, then dry-weather monitoring cannot be conducted. The field team should then stop work until dry weather conditions apply again.

3.3 Flow Measurements

At each site, the outfall is assessed for the presence of flow, and the appropriate qualitative option is marked for "Water Flow."

If a site has flowing water, sampling staff should also observe whether the flow reaches the receiving water body. If the sampling site is upstream of the outfall itself due to accessibility constraints, it is usually not possible to visually observe whether the flow reaches the receiving water body. In these cases the "Unknown" option is selected.

At sites with flowing water, the flow rate is also measured and recorded on the field datasheet in gallons per minute (gpm) or cubic feet per second (cfs). If the site location is within a manhole, width, depth and velocity measurements cannot be precisely determined and the flow rate must be estimated. If an outfall has ponded water, the flow is recorded as zero gpm. If an outfall is dry, the flow rate is recorded as "Dry".

There are several methods that can be used to measure the rate of flow, but the most commonly used is the velocity-area ("leaf float") method. This is done by using a stop watch or equivalent to measure the time it takes for a leaf or similar object to float across a pre-measured distance of flowing water. The flow rate can then be calculated by using width, depth, and velocity measurements.

The three methods used to measure flow rate and a description of each are included below:

Velocity-area method ("leaf float") - The most common method for measuring the discharge of a channel is the velocity-area method. This method requires the physical measurement of the cross-sectional area and the velocity of the flowing water. Discharge is determined as the product of the area times the velocity:

Flow rate (ft^3/sec, or cfs) = Velocity (ft/sec) x Depth (ft) x Width (ft)

The leaf-float method involves using a stop watch to measure the time (in seconds) it takes for a leaf or similar object to float across a pre-measured distance (in feet) of the surface of the flowing water. The flow rate can then be calculated by using the equation above. A correction factor between 0.5 and 0.8 should be applied to the flow rate calculation while in the field, based on the width and depth of the flow, as well as on the roughness of the conveyance surface material. In general, the rougher the conveyance surface material, the lower the correction factor that must be applied to the flow rate.

Filling a bottle or known volume method - The rate can be determined by measuring the diameter of the outfall and the length of time it takes to fill a 1-liter bottle or any other container with a known volume. Dividing the volume by the time gives a flow rate. Appropriate conversion factors are then applied to convert that flow rate to gpm or cfs if needed. For example, 1 liter per second is equal to 15.85 gpm.

Partially filled pipe method - This method is applicable to discharges from circular pipes. All measurements should be converted to feet before calculation so that the final flow rate is given in cfs.

The water depth and inside pipe diameter are measured, then the following approach is applied using the partially filled pipe formula chart in Table 1.

- Calculate D/d
  - D = water depth (ft) and d = inside pipe diameter (ft)
- Find the tabulated (Ta) value on the partially filled pipe formula chart below using the D/d value (e.g., If D/d = 0.26 then Ta =0.1623)
- Find the area using the formula a = Ta*d^2
- Calculate flow: Q (flow, cfs) = a (ft^2) x Velocity (ft/sec)
- If desired, convert to gpm as follows: 1 cfs = 448.8 gpm

Table 1: Partially Filled Pipe Formula Chart

Calculating the Area (a) of the Cross Section of a Circular Pipe Flowing Partially Full										
D = Depth of water			a = area of water in partially filled pipe							
d = diameter of the pipe			Ta = Tabulated Value				Then a = Ta*d^2			
D/d	**0.00**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
0.0	0.0000	0.0013	0.0037	0.0069	0.0105	0.0147	0.0192	0.0242	0.0294	0.0350
0.1	0.0409	0.0470	0.0534	0.0600	0.0668	0.0739	0.0817	0.0885	0.0951	0.1039
0.2	0.1118	0.1199	0.1281	0.1365	0.1440	0.1535	0.1623	0.1711	0.1800	0.1890
0.3	0.1982	0.2074	0.2187	0.2280	0.2355	0.2450	0.2540	0.2642	0.2780	0.2836
0.4	0.2934	0.3032	0.3130	0.3220	0.3328	0.3428	0.3527	0.3627	0.3727	0.3827
0.5	0.3980	0.4030	0.4130	0.4230	0.4330	0.4430	0.4520	0.4620	0.4720	0.4820
0.6	0.4920	0.5020	0.5120	0.5210	0.5310	0.5400	0.5500	0.5590	0.5690	0.5780
0.7	0.5870	0.5960	0.6050	0.6140	0.6230	0.6320	0.6400	0.6490	0.6570	0.6660
0.8	0.6740	0.6810	0.6890	0.6970	0.7040	0.7120	0.7190	0.7250	0.7320	0.7360
0.9	0.7450	0.7500	0.7560	0.7610	0.7660	0.7710	0.7750	0.7790	0.7820	0.7840

Source: County of San Diego. May 2011. *Dry Weather and MS4 Analytical and Field Screening Monitoring Procedures Manual*

3.4 Observations

If a site has either ponded or flowing water, a clean, clear plastic cup or a triple-rinsed clear glass container (e.g., jar, beaker, etc.) is used to collect a sample of the water. If the site is within a catch basin or a manhole, a rope attached to a triple-rinsed plastic bucket, a sampling pole, or a peristaltic pump may be used to collect the sample.

Observations for odor, color, clarity, and floatables are assessed and recorded on the datasheet. When the site is dry, the checkbox "na (dry)" is marked, meaning "not analyzed" and/or "dry site". Whenever an "Other" box is checked, a description should be written on the datasheet.

Odor: Choose any of the following options that is most representative of site conditions: none, sewage, sulfides, petroleum, manure, other. Note that "sulfides" indicates the distinct rotten-egg smell associated with hydrogen sulfide gas. A petroleum odor usually refers to a smell of gasoline/diesel. Any time a sewage or petroleum odor is noted, additional source investigation should be completed and/or the appropriate authorities (sewer agency or County of San Diego Department of Environmental Health) should be notified.

Color: Choose one of the following options most representative of the water when viewed *in situ*: none, yellow, brown (silty), white (milky), gray, other.

Clarity: If the water has minimal or no turbidity, mark "Clear." For more turbid water, the clarity options "Cloudy" and "Murky" are distinguished as follows:

- Cloudy - If able to see more than 4" below the surface of the water, the clarity field is marked as "Cloudy (> 4" vis)."

- Murky - If visibility is limited to less than 4" below the surface of the water, it is marked as "Murky (<4" vis)."

Floatables: Select one or more of the following: none, trash, bubbles/foam, sheen, algae, biofilms, other. Only materials present on or very close to the surface of the water shall be included for this observation. For example, if trash is observed well below the water surface or at a dry site, trash should not be marked as a floatable. However, trash would still be recorded in the trash assessment section in these cases.

Observations of deposits, vegetation, and biology noted at the site, and the structural condition of the outfall, are recorded for all sites, even if the site is dry.

Deposits: Select one or more of the following: none, coarse particulate, fine particulate, stains/minerals, oily deposit, other. Coarse particulates include particles such as sand or gravel. Fine particulates include any particulates that are smaller than the coarse particulates, such as from the presence of clay sediment. Stains or oily deposits, if observed, may require upstream source investigations. Mineral deposits can result in orange/red deposits and oil deposits are black in color.

Vegetation: Sites within manholes will almost always have no vegetation, so "none" should be marked on the datasheet. If the vegetation is observed as less than what is typical for the site (e.g., due to excessive erosion or plant removal), the site is considered to have "Limited" vegetation. Sites with vegetation that is overgrown and is impeding, or may impede, flow from the site, or that may contribute to other water quality issues, are considered to have "Excessive" vegetation. Sites observed with typical vegetation are marked as "Normal".

Biology: Select all applicable options (more than one can be selected). Note that additional categories of organisms can also be notes by writing them in next to the "Other" option.

Structural Condition: "Damaged" means that the outfall structure is cracked, has partially collapsed, or is otherwise in need of repair. "Scour Pond" means an unpaved area just downstream of the outfall has been eroded by outfall discharges such that a depression that allows water to collect and pond has formed. Scour ponds may be sources of bacteria. "Erosion" means there is evidence of erosion at or downstream of an outfall that could either result in a blockage or water quality issues. "Blockage" means the flow path through the outfall is significantly obstructed. Outfalls to which none of the above apply and that are in good structural condition are marked as "Normal."

3.5 Trash Assessment

A trash assessment is conducted at each outfall visited for field screening. The area assessed is typically between 5 to 15 feet in length and width, but is ultimately determined by best professional judgment of the field team. If trash, or other observed pollutants, at the site is determined to pose a threat to human health or the environment, the reporting and response procedures described in the Illicit Discharge Detection and Elimination section of the City's Jurisdictional Runoff Management Plan will be followed. The trash assessment is conducted utilizing the following trash rating system, which was used in the regional data sharing template developed by the Copermittees' Regional Monitoring Workgroup in 2013.

Table 2. Trash Assessment Ratings

Copermittee Data Sharing Format Trash Assessment Ratings
None (0 pieces observed)
Low (<50 pieces observed)
Medium (50-400 pieces observed)
High (>400 pieces observed)

4 Source Identification and Elimination

If a site has flowing or ponded water, an upstream investigation may be necessary to assess the potential source of flow. Mapping of the City's storm drain system (MS4 map) assists with the upstream investigation. The MS4 Permit requires an investigation for sites that have ponded water. However, the source of that water might not be confirmed due to the ceased flow and dry upstream storm drain. Observations and notes are recorded on the field datasheet for evidence of an illicit connection/illegal discharge (IC/ID), flow source, basis for source identification, and source elimination.

4.1 Evidence of Obvious IC/ID

Evidence of an IC/ID is documented on the field datasheet by listing physical characteristics of the flow, such as odor, color, clarity, floatables, deposits, high flow rate, non-standard connection, or anything else that may suggest evidence of an IC/ID. For example, sediment-laden water may indicate an upstream washing activity or construction site discharge. Upstream investigations are conducted immediately in cases where obvious IC/IDs are observed.

4.2 Flow Source

Potential flow source categories include groundwater, seepage, irrigation runoff, vehicle washing, wet cleaning or power washing, construction, pool or spa discharge, water line break, NPDES-permitted discharge, other, or unable to determine. Examples of NPDES-permitted discharges include line flushing by local water utilities and groundwater dewatering conducted after obtaining a discharge permit from the RWQCB. More than one source may be recorded if observed during the upstream investigation. If the site is dry, then "na" (not applicable) should be checked on the field datasheet.

If the field crew identifies the source as a controllable source of non-stormwater or illicit discharge or connection, the discharge or connection will be eliminated. Enforcement actions will be taken, as necessary, as described in the Enforcement Response Plan (Appendix B). If the City suspects the source of the non-stormwater discharge is natural in origin (i.e., non-anthropogenically influenced) and in conveyance into the MS4, then the City will document and provide the data and evidence necessary to demonstrate to the RWQCB that it is natural in origin and does not require further investigation.

4.3 Basis for Flow Source Identification

The evidence or basis for a source of observed flow is recorded on the datasheet. If the site is dry, or the source of flow is unable to be determined, "na" should be marked on the datasheet. Otherwise, one of the following should be completed:

- **Observed Discharge:** During the upstream investigation, water is observed discharging into a structure that drains to the site. For example, irrigation runoff from landscaping is observed flowing to a curb inlet upstream from the site.
- **Indirect Evidence:** An active discharge is not observed, but there is evidence of a recent discharge that may have contributed to water observed at the site. For example, a wet vehicle is parked in a driveway and ponded water with soap bubbles is observed in an upstream street gutter.
- **Historical Data:** Results of previous monitoring efforts can be useful in assessing the source of flow, even if direct (observed) or indirect evidence of a discharge is not noted at the time of the current visit. Useful historical data may also include local groundwater monitoring well data, or results from other complaint investigations or inspections.

4.4 Flow Source Elimination

If the source of observed flow or ponding is identified and eliminated, the "Yes" checkbox should indicate as such. Otherwise, "No" should be checked if the source was not eliminated, or "na" checked if the site was dry. An example of flow source elimination is if a business's washing is stopped after talking with the responsible party and reporting the issue to the City. If multiple sources were identified, and some but not all sources were eliminated, "No" should be marked, and a full explanation of actions taken to eliminate any flow source should be described in the comments.

4.5 Prioritization for Follow-Up Investigations

As previously described, an upstream investigation will be conducted if flowing or ponded water is observed during outfall monitoring activities. Select outfalls with persistent flow will be identified for discharge monitoring (i.e., samples of the flow will be taken; see Section 5). When a discharge or flow source cannot be identified during the time of field visit, follow-up investigations may be conducted at a later date. Follow-up investigations will be conducted considering the following criteria:

- IC/ID – Observed illicit connections or illegal discharges will be investigated immediately. Samples may be taken to help evaluate the pollutants present and their concentrations if deemed necessary to support the investigation or enforcement efforts.
- Source of discharge – Known or likely sources of flow or pollutants will be investigated and pursued more readily than unknown sources. Consideration will be given to physical characteristics observed during outfall monitoring, as well as any monitoring data available for the outfall site.
- Pollutant type – Where data is available, priority will be given to outfall discharges that consistently exhibit the following:
    - Cause or contribute to highest priority water quality conditions identified in San Luis Rey and Carlsbad WQIPs;
    - Cause or contribute to impairment of Clean Water Act Section 303(d)-listed (303(d) listed) waterbodies; and/or
    - Cause or contribute to an exceedance of a non-stormwater action level (NAL) as defined by NPDES permits
- Flow rate and volume – Consideration will be given to the quantity and quality of outfall discharge, relative to storm drain system or receiving waterbody. Priority will be given to outfalls with flows observed to reach, or are highly likely to reach, a receiving water body. Persistent flowing water will be of priority compared to dry, ponded, or transient flows.

4.6 Additional Flow-Source Investigation Methods

If a flow source cannot be identified using the typical investigation methods described above, and there is persistent flow or it is possible an IC/ID may be contributing flow to the site, the field team may use alternate methods for identifying the flow source. Further details regarding different monitoring parameters and investigative procedures for each source category can be found in the County of San Diego's *San Diego County Permittees Draft Investigation Procedures* Manual. A few of the more common alternate source investigation methods are summarized below.

Additional Water Quality Parameters

Although not required for routine site visits under the new MS4 Permit, it may be necessary to perform additional field or laboratory tests to investigate the source of a persistent flow. The field team should be equipped with field meters that are capable of measuring parameters such as pH, conductivity, and temperature. Sample collection bottles and a cooler should also be available in the event laboratory analysis is necessary.

- Measuring the chlorine concentration and conductivity to assess whether a water line break or leak may be contributing to flow at the site.
- Measuring levels of ammonia, bacteria, and detergents (methylene blue active substances) to assess whether sewage may be a contributing source.
- Measuring the conductivity at the site. Higher conductivity values may indicate the infiltration of groundwater into the MS4 pipe, and further investigation may be necessary to confirm this conclusion (e.g., analyzing local ground water monitoring well data if available, sending a camera through the MS4 line, etc.).

Review of Plans

As-built plans for the area of interest can be reviewed to verify intended storm drain and sanitary sewer pipe connections. However, an illicit connection may have occurred after the as-built drawings were created, so additional in-field confirmation is likely necessary.

Dye Testing

Dye testing can confirm hydraulic connections between a potential source and a downstream location. Fluorescent dye is introduced at the source of the potential IC/ID and presence of the dye is monitored downstream. This method is used only when necessary, because the public and appropriate regulatory agencies in the surrounding area need to be informed about the cause of the water discoloration.

Smoke Testing

By introducing smoke into an underground sewer system, smoke testing can be an effective means of identifying cross-connections between storm drain and sanitary sewers. Due to potential concerns with the presence of smoke (and inferring of a fire), the public and appropriate agencies need to be informed when smoke testing is conducted.

Closed-Circuit Television Inspection Monitoring

Closed-Circuit Television Inspection (CCTV) cameras may be used to record video of underground storm drain and sanitary sewer. CCTV can be effective at identifying cross-connections and defects that may contribute to an illicit discharge. The public and regulatory agencies generally do not need to be informed prior to initiating this kind of investigation.

Confined Space Entry
Confined space entry may be used to physically enter storm drains, sanitary sewers, or other restricted-entry facilities. All applicable health and safety regulations must be followed. The public and regulatory agencies, however, generally do not need to be informed prior to initiating a confined space entry.

5 Non-Stormwater Persistent Flow MS4 Outfall Discharge Monitoring

Pursuant to Section D.2.b.(2) of the MS4 Permit, if during transitional and routine MS4 outfall discharge monitoring, sites are found to have persistent flow, the City will collect samples for laboratory analysis at the highest priority sites with persistent flow. At least five sites per WMA must be considered high priority and monitored, except that when there are less than five persistently flowing sites in a WMA, the City will monitor all of its major MS4 outfalls within that WMA that have persistent flows. Test results from these samples will be compared to the NAL included in Provision C of the MS4 Permit, unless alternative NALs have been established in the Carlsbad or San Luis Rey WQIP. As of this writing no alternative NALs have been established through the WQIPs.

The highest priority sites will be monitored during dry weather at least semi-annually until one of the following occurs:

- The non-stormwater discharges have been effectively eliminated (i.e., no flowing, pooled, or ponded water) for three consecutive dry weather monitoring events.
- The source(s) of the persistent flows has been identified as a category of non-stormwater discharges that does not require an NPDES permit and does not have to be addressed as an illegal discharge because it was not identified as a source of pollutants (i.e., parameters in non-stormwater discharge do not exceed NALs), and the persistent flow can be re-prioritized to a lower priority.
- The parameters in the persistent flow non-stormwater discharge do not exceed NALs, and the persistent flow can be re-prioritized to a lower priority.
- The source(s) of the persistent flows has been identified as a non-stormwater discharge authorized by a separate NPDES permit.

If none of the conditions listed on the following page is met, but the threat to water quality has been reduced, the site can be reprioritized as a lower priority. The City records removal or re-prioritization of the highest priority persistently flowing MS4 outfalls in the WQIP Annual Reports.

5.1 Non-Stormwater Persistent Flow Major MS4 Outfall Discharge Monitoring Parameters

Non-stormwater persistent flow MS4 outfall sites will be monitored semi-annually for the parameters listed in Table D-7 of the MS4 Permit. Additional parameters associated with NALs and 303(d) listings are also required to be tested; these parameters vary by watershed. A full list of parameters to be tested at each persistent flow monitoring site can be found by referencing Attachment D of the Carlsbad WQIP Monitoring Plan and Appendix 4A of the San Luis Rey WQIP.

Sampling, analysis and quality assurance/quality control are conducted in accordance with the procedures in the monitoring plans in the Carlsbad WQIP (Attachment D) and San Luis Rey WQIP (Appendix 4A). Table D-1 of the Carlsbad WQIP Monitoring Plan and Appendix 4A of the San Luis Rey WQIP specify suggested target reporting limits and analytical methods. All chemical, bacteriological, and toxicity analyses will be conducted at a laboratory certified for such analyses by the California Department of Public Health or a laboratory approved by the RWQCB. Attachment F of the Carlsbad WQIP Monitoring Plan provides more detail on quality assurance/quality control procedures for MS4 outfall monitoring.

6 Enforcement

If the source of a discharge is identified as a category of non-exempt non-stormwater discharges, and the discharge is in exceedance of NALs listed in the Water Quality Improvement Plan, then the City will determine if it is either of the following:

1) an isolated incident or a set of circumstances that will be addressed through its Enforcement Response Plan, or;
2) a prohibited discharge that will also be addressed through measures (likely escalated) described in the Enforcement Response Plan.

7 Reporting

All field datasheets, reports, and data associated with the City's MS4 outfall monitoring program will be made available to the RWQCB in a standardized and compatible format. The City's Jurisdiction Runoff Management Program (JRMP) Annual Report will also include the number of IC/IDs detected, identified, and eliminated within the reporting period. Reporting IC/IDs to other agencies such as the RWQCB and the County of San Diego Department of Environmental Health is discussed in Section 3 (Illicit Discharge Detection and Elimination) of the City's JRMP document.

8 References

California Regional Water Quality Control Board, San Diego Region, 2015. Order R9-2013-0001, as amended by Order R9-2015-0001. *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.*

County of San Diego. 2011. *Dry Weather and MS4 Analytical and Field Screening Monitoring Procedures Manual,* May.

County of San Diego. 2013. *San Diego County Permittees Draft Investigation Procedures,* June.

Attachment 1

Storm Drain System and Monitoring Locations Map

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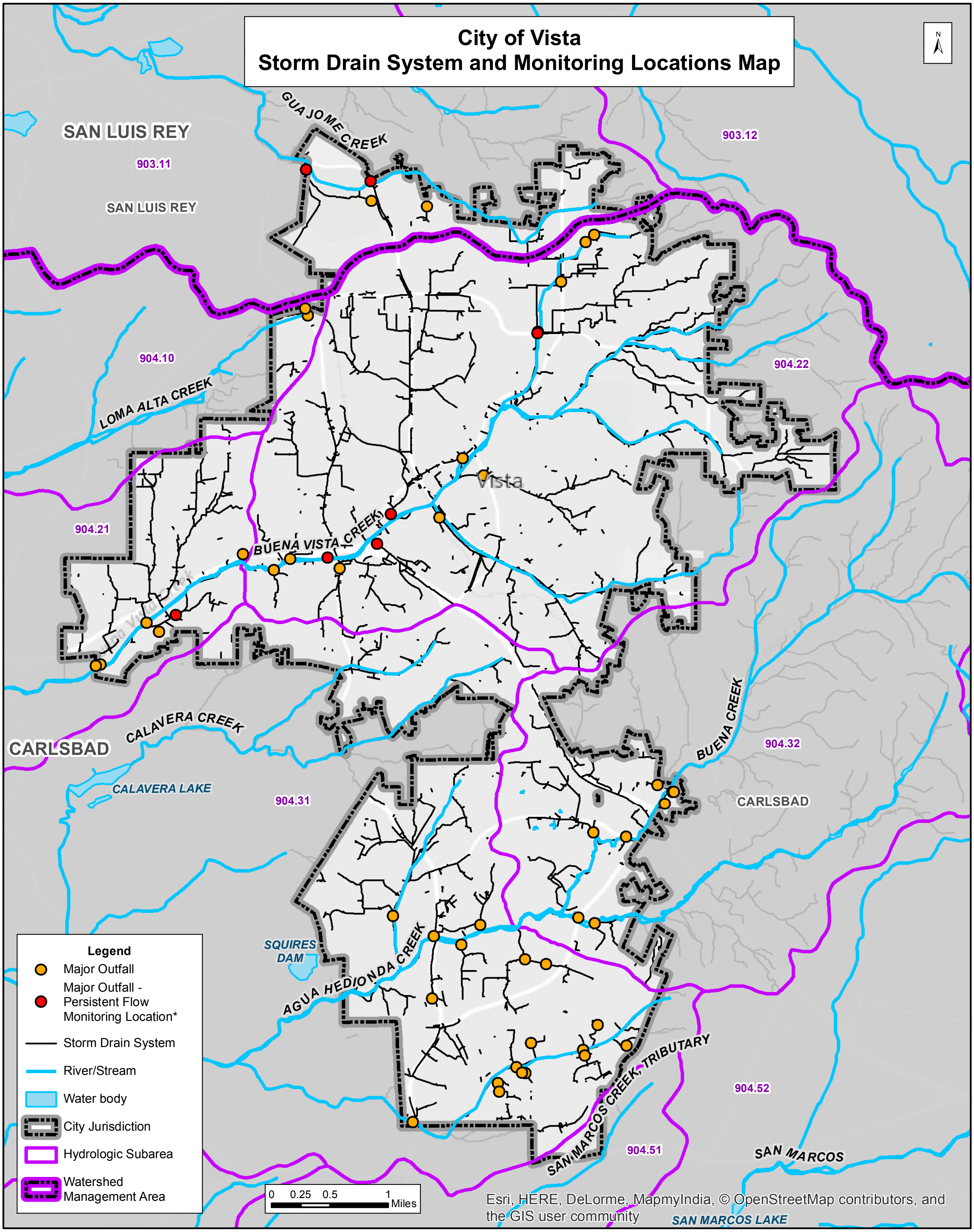

Base Data Sources: SanGIS and City of Vista

*The status of major MS4 outfalls as having persistent flow, transient flow, or being dry will change in the future as the City collects more data from outfall monitoring and as sources of flow are eliminated. For similar reasons, the sites at which persistent flow analytical monitoring is completed will likely change over time. Updates will be provided through the WQIP annual reporting process.

Appendix H

Construction Inspection Form

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CONSTRUCTION SITE
STORMWATER INSPECTION FORM

1. Summary

Date & Fiscal Year:	/ / FY 2022 - 23	Type:	☐ Routine ☐ Reinspection ☐ Other
Inspector Name:		Inspector Type:	☐ City ☐ Contractor ☐ Other

2. Project Information

Project Name:			
Address:			
Construction General Permit: (project site 1 acre or greater)	☐ Yes, WDID#: ☐ No		
Permit Numbers: (provide all applicable)	LD#: GP#:	CIP# DWG#:	Building#
Watershed and Hydrologic Area	☐ Carlsbad Watershed, AND: ☐ Loma Alta ☐ Buena Vista Creek ☐ Agua Hedionda ☐ San Marcos	**OR**	☐ San Luis Rey Watershed, Lower San Luis Rey

3. Observations & Results

Total Rainfall Since Previous Inspection[1]	☐ Less than 0.5" ☐ 1" or more ☐ 0.5-1.0"	**Chance of Rain Within Next 48 Hours[1]**	☐ Less than 50% ☐ 50% or more
>50% chance of rain in 48 hours and BMPs appear ineffective?		☐ Yes[2] ☐ No ☐ Not Applicable	
Observed discharge of sediment from site (mud, tracking, etc.)?		☐ Yes[2] ☐ No	
Observed discharge or spill of construction related materials from site?		☐ Yes[2] ☐ No	
Observed illicit connection?		☐ Yes[2] ☐ No	
If 72 hr reinspection, previous corrective actions resolved?		☐ Not Resolved[2] ☐ Resolved	

Corrections	Observations	Compliance & Reinspection
☐ No Corrections Necessary ☐ Corrections Required	☐ Observed Discharge or Spill ☐ BMP Missing/Ineffective ☐ BMP Maintenance ☐ Illicit Connection	☐ 72 hours to comply or prior to rain ☐ Enforcement initiated[2]: ☐ Written Warning ☐ Notice of Violation ☐ Citation ☐ Stop Work

Additional Comments

[1] *Weather forecast based on NOAA at: www.weather.gov*
[2] *Coordinate enforcement with Stormwater Engineering at 760-643-2804 or waterquality@cityofvista.com*

Inspector Signature		**Date**	/ /
Reviewed By		**Date**	/ /
Inspection Provided To		**Date**	/ /

☐ Email: ☐ In Person ☐ Owner/Developer ☐ QSP/QSD ☐ Other

CONSTRUCTION SITE
STORMWATER INSPECTION FORM

CASQA BMP #/Title	Status	Location	Effectiveness	Photo Log #	Comments
EC-3/EC-4/EC-5 Hydraulic Mulch/Hydroseeding/Soil Binders	Not Used	NA	NA		
EC-7 Geotextiles and Mats	Not Used	NA	NA		
SE-1 Silt Fence	Not Used	NA	NA		
SE-2/SE-3 Sediment Basin/Sediment Trap	Not Used	NA	NA		
SE-4 Check Dam	Not Used	NA	NA		
SE-5 Fiber Rolls	Not Used	NA	NA		
SE-6 Gravel Bag Berm	Not Used	NA	NA		
SE-7 Street Sweeping and Vacuuming	Not Used	NA	NA		
SE-8 Sandbag Barrier	Not Used	NA	NA		
SE-10 Storm Drain Inlet Protection	Not Used	NA	NA		
WE-1 Wind Erosion Control (Dust)	Not Used	NA	NA		
TC-1/TC-2 Stabilized Construction Entrance/Exit/Roadway	Not Used	NA	NA		
NS-2 Dewatering Operations (Need Prior Permit and/or City Approval)	Not Used	NA	NA		
NS-3 Paving & Grinding Operations	Not Used	NA	NA		
NS-6 Illicit Connection /Discharge	Not Used	NA	NA		
NS-8/NS-9/NS-10 Vehicle & Equipment Cleaning/Fueling/Maintenance	Not Used	NA	NA		
NS-12/NS-13 Concrete Curing/Finishing	Not Used	NA	NA		
WM-1 Material Delivery and Storage	Not Used	NA	NA		
WM-3 Stockpile Management (CW)	Not Used	NA	NA		
WM-4 Spill Prevention and Control	Not Used	NA	NA		
WM-5 Solid Waste Management (CW)	Not Used	NA	NA		
WM-Hazardous Waste Management (CW)	Not Used	NA	NA		
WM-7 Contaminated Soil Management (CW)	Not Used	NA	NA		
WM-8 Concrete Waste Management	Not Used	NA	NA		
WM-9 Sanitary/Septic Waste Management	Not Used	NA	NA		
WM-10 Liquid Waste Management	Not Used	NA	NA		

CONSTRUCTION SITE
STORMWATER INSPECTION FORM

PHOTO LOG

1Click here to enter text.	**2**Click here to enter text.
3Click here to enter text.	**4**Click here to enter text.
5Click here to enter text.	**6**Click here to enter text.
7Click here to enter text.	**8**Click here to enter text.

PROJECT STORMWATER INFORMATION FORM

Form must be completed and provided to city inspection staff <u>prior to beginning construction</u> activities.

1. Project Location

Project Name:			
Address:			
APN(s):			
Watershed and Hydrologic Area*	☐ Carlsbad Watershed, AND: ☐ Loma Alta ☐ Buena Vista Creek ☐ Agua Hedionda ☐ San Marcos	**OR**	☐ San Luis Rey Watershed, Lower San Luis Rey

** To confirm watershed, refer to "What Watershed is My Project In?" on city website at:*
https://www.cityofvista.com/departments/community-development/permits-forms/land-development-autocad-templates/storm-water-forms

2. Contact Information

Developer:	☐ Private Development ☐ City/CIP Project ☐ Other		
Owner Name:		**Owner Phone:**	
Owner Email:			
Site Contact Name:		**Site Contact Phone:**	
Site Contact Email:			

3. Project Details

Project Type:	☐ Priority (PDP)	☐ Standard	☐ Non-Development
Total Project Area:	☐ Acres or ☐ Sq. Ft.	**Area of Disturbance:**	☐ Acres or ☐ Sq. Ft.
Construction General Permit: (project site 1 acre or greater)	☐ No ☐ Yes, WDID#: QSP/QSD Name: QSP/QSD Email: QSP/QSD Phone:		
Permit Numbers: (provide all applicable)	LD#: GP#:	CIP#: DWG#:	Building#:
Pre-Con Meeting Date:	/ /	**Date BMP Plan Approved**	/ /

PROJECT STORMWATER INFORMATION FORM

4. *Inspection Priority and Frequency*

Project Work (check all boxes that apply)	**Inspection Priority**	**Inspection Frequency**
☐ All State-issued Construction General Permit sites (greater than one acre of soil disturbed) ☐ Water Quality Environmentally Sensitive Areas. Projects with excavation greater than 50 yd^3 or disturbing soil greater than 5,000 ft^2, and are within 200 ft or less from: ○ Agua Hedionda Creek ○ Buena Creek ○ Buena Vista Creek ○ Loma Alta Creek ☐ Excavation, removal, or fill – greater than 50 yd^3 ☐ Soil disturbed - greater than 5,000 ft^2 but less than one acre	High	• WEEKLY on site during wet season ○ October 1 – April 30 • MONTHLY on site during dry season ○ May 1 –September 30
☐ Project does not meet High Priority criteria	Low	• Private Development Projects ○ Visual when called for inspection ○ 10 sites per MONTH • City/CIP Projects – At least ONE on site for duration of project if active 3 or more days

Form Completed By:	
Date:	/ /

Place a copy of this form in the project folder where future construction site inspection forms will be saved.

CITY OF VISTA
CALIFORNIA

MUNICIPAL NPDES STORMWATER PERMIT CONSTRUCTION SITE AND ACTIVITIES INSPECTION FORM

INSPECTION DATE: Click here to enter a date. **Inspector:** Choose an item. **Inspection Season:** **Wet (10/1 - 4/30)**

Project Name: **Address:**

APN: **Pre-Con Date:** **Lat:** **Long:**

Water Quality Threat Priority: High *Note: ALL Sites and Activities are HIGH TTWQ*

WMA: Choose an item. **HA:** Choose an item. **HSA:** Loma Alta 904.10
Total Acres: **Total Disturbed Acres:**
Project Application: ☐ **LD #:** ☐ **GP#:** ☐ **Other :**
Project Type: ☐ Land Dev ☐ CIP ☐ Other Agency
Construction Start Date: **Construction End Date:** Click here to enter a date.
SUSMP Designation: SUSMP Priority

Inspection Location(s): ☐**On-Site** ☐**Off-Site** ☐**Other:**

Construction Phase(s): ☐ **Grading** ☐ **Utility/Underground** ☐ **Building/Vertical** ☐ **Finishing**

SWRCB CONSTRUCTION GENERAL PERMIT(Order 2009-0009/2010-0014/2012-0006) ☐ **YES** ☐ **NO**
WDID#: **Risk Level:** Choose an item.
SWPPP/Construction BMP Plan Onsite: ☐ **YES** ☐ **NO**

Actual Non-Storm water Discharge from Site: ☐ YES ☐ NO
* If Yes CC: Storm water Program Manager

Actual Storm water Discharge from Site: ☐ YES ☐ NO
***If Yes CC: Storm water Program Manager**

***Potential* Illicit Connection or Discharge** ☐ **YES** ☐ **NO**

Type of Inspection Check all that apply:

Follow-Up: ☐**Yes** ☐**No** **Weekly:** ☐**Yes** ☐**No** **Date Corrected** Click here to enter a date.

REAP: ☐**Yes** ☐**No** ***Date Site Notified of REAP:***

Chance of Rain: 0% **24 hour forecast** **Rainfall: Estimate Since Last inspection:** 0 in

NOAA: http://forecast.weather.gov ***NOTE: 50% Chance of Rain 48 hours Ahead Triggers REAP TEAM Action Plan***

☐**GCP Only: REAP Onsite AND Site Stabilized 24 hrs prior to storm event** ☐ **Yes** ☐**No**
***If NO - Enforcement Action Required – Fill in Enforcement Action Summary Box Below**

☐**Non GCP: BMPs Employed 24 hrs prior to storm event** ☐ **Yes** ☐**No**

BMPs are Required Year Round For Each Phase of Construction. The City Inspector Can Require Additional BMPs to Protect the City's Storm Drain System From Stormwater and Non-Stormwater Discharges of Sediment and Pollutants from Construction Activities.

MUNICIPAL NPDES STORMWATER PERMIT CONSTRUCTION SITE AND ACTIVITIES INSPECTION FORM

DETAILED INSPECTION REPORT

CASQA #/Title	Status	Location	Effectiveness	Photo Log #	Comment
EC-3/EC-4/EC-5 Hydraulic Mulch/Hydroseeding/Soil Binders	Not Used	☐Onsite ☐ Offsite	NA		
EC-7 Geotextiles and Mats	Not Used	☐Onsite ☐ Offsite	NA		
SE-1 Silt Fence	Not Used	☐Onsite ☐ Offsite	NA		
SE-2/SE-3 Sediment Basin/Sediment Trap	Not Used	☐Onsite ☐ Offsite	NA		
SE-4 Check Dam	Not Used	☐Onsite ☐ Offsite	NA		
SE-5 Fiber Rolls	Not Used	☐Onsite ☐ Offsite	NA		
SE-6 Gravel Bag Berm	Not Used	☐Onsite ☐ Offsite	NA		
SE-7 Street Sweeping and Vacuuming	Not Used	☐Onsite ☐ Offsite	NA		
SE-8 Sandbag Barrier	Not Used	☐Onsite ☐ Offsite	NA		
SE-10 Storm Drain Inlet Protection	Not Used	☐Onsite ☐ Offsite	NA		
WE-1 Wind Erosion Control (Dust)	Not Used	☐Onsite ☐ Offsite	NA		
TC-1/TC-2 Stabilized Construction Entrance/Exit/Roadway	Not Used	☐Onsite ☐ Offsite	NA		
NS-2 Dewatering Operations (Need Permit Prior to Start and/or Agency Approval)	Not Used	☐Onsite ☐ Offsite	NA		
NS-3 Paving & Grinding Operations	Not Used	☐Onsite ☐ Offsite	NA		
NS-6 Illicit Connection /Discharge : CC Stormwater	Not Used	☐Onsite ☐ Offsite	NA		
NS-8/NS-9/NS-10 Vehicle & Equipment/Cleaning/Fueling/Maintenance	Not Used	☐Onsite ☐ Offsite	NA		
NS-12/NS-13 Concrete Curing/Finishing	Not Used	☐Onsite ☐ Offsite	NA		
WM-1 Material Delivery and Storage	Not Used	☐Onsite ☐ Offsite	NA		
WM-3 Stockpile Management	Not Used	☐Onsite ☐ Offsite	NA		
WM-4 Spill Prevention and Control	Not Used	☐Onsite ☐ Offsite	NA		
WM-5 Solid Waste Management	Not Used	☐Onsite ☐ Offsite	NA		
WM-Hazardous Waste Management	Not Used	☐Onsite ☐ Offsite	NA		
WM-7 Contaminated Soil Management	Not Used	☐Onsite ☐ Offsite	NA		
WM-8 Concrete Waste Management	Not Used	☐Onsite ☐ Offsite	NA		
WM-9 Sanitary/Septic Waste Management	Not Used	☐Onsite ☐ Offsite	NA		
WM-10 Liquid Waste Management	Not Used	☐Onsite ☐ Offsite	NA		

MUNICIPAL NPDES STORMWATER PERMIT CONSTRUCTION SITE AND ACTIVITIES INSPECTION FORM

BMP INSPECTION SUMMARY:

- **Comments:** Click here to enter text.
- **Correction (mark all that apply) and Resolution:**

BMP Missing/ Ineffective	☐
BMP Maintenance Required	☐
No REAP/ Document	☐
No Corrections Needed	☐

Corrected	☐
Additional Corrections Needed	☐
Enforcement Escalated	☐
Reported to SDRWQB & SWRCB	☐

ENFORCEMENT ACTION SUMMARY (Required for REAP)

INSPECTOR Recommended Enforcement Action:

☐Correction Notice **(72 hours to Correct)** ☐NOV ☐**Stop Work**

NOTE: Stop Work Must be copied to Stormwater Program Manager for Required Report to SDRWQCB within 5 calendar days

Inspector Signature: ______________________ **Date:**__________ **Re-inspection Date:**_______________

Enforcement Action Approved: ☐Correction Notice (72 hrs to Correct) ☐NOV ☐**Stop Work** ☐NA

City Supervisor Signature or Delegated Representative: ______________________________: **Date:**_________

Site Representative:

Received By: ______________________ **Print Name:**___________________ **Date:**________________

☐**E-Mailed to:** ☐**Owner/Developer** ☐**QSP** ☐**QSD** ☐**Other:**

PHOTO LOG

***** If applicable, include follow-up number and date of correction.**

1Click here to enter text.	1
2	2
3	3

CITY OF VISTA
CALIFORNIA

MUNICIPAL NPDES STORMWATER PERMIT CONSTRUCTION SITE AND ACTIVITIES INSPECTION FORM

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Appendix I

Environmentally Sensitive Areas

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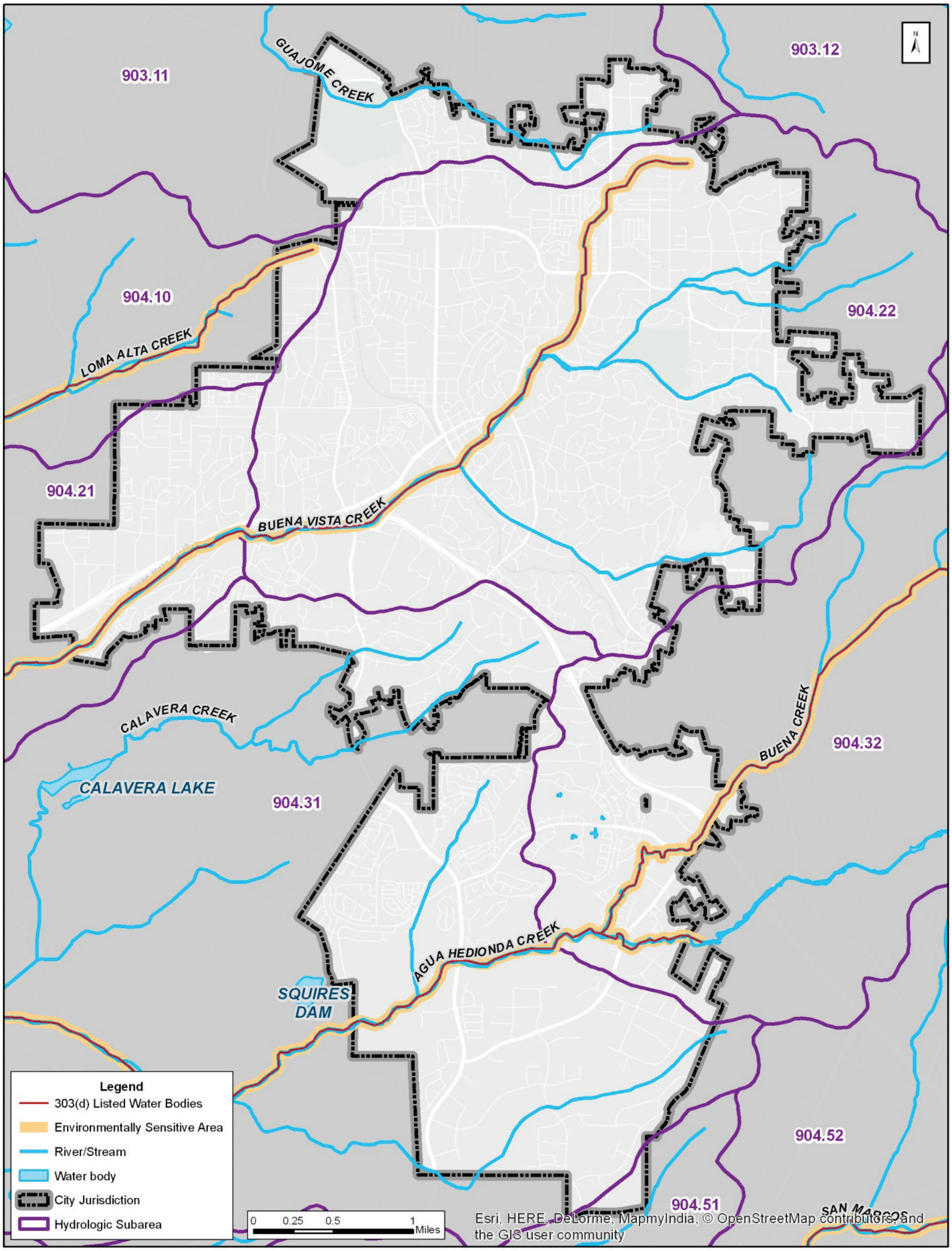
Appendix I. Environmentally Sensitive Areas



Base Data Sources: State Water Resources Control Board and SANGIS

Note that the Environmentally Sensitive Areas (ESA), as shown on the map, include a 200 foot buffer on either side of each ESA. Facilities or activities within this buffer area are considered "directly adjacent to" an ESA, as defined in the MS4 Permit.

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Appendix J

Municipal Inventory

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Appendix J. Municipal Facilities Inventory, City of Vista rev.2023

Facility	Address Number	Address Street	Description	HSA_Number	HSA_Name	Watershed	WMA	Pollutants: Sediment	Nutrients	Trash	Metals	Bacteria	Oil & Grease	Organics	Pesticides	Oxygen Demanding Substances	Adjacent to ESA (200 ft)	Within HSA and generage same 303(d) pollutants
523 S. Santa Fe - Parking Lot	523	S. Santa Fe	Parking Lot - 523 S. Santa Fe	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		
Avo Playhouse	303	Main St	Theater and Parking Lot	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Breeze Hill Park	645	S. Melrose Dr.	Park and Parking Lot	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X		X			X	X		X
Brengle Terrace Detention Basin	1100	Vale Terrace Dr.	Detention Basin	904.22	Vista	Buena Vista Creek	Carlsbad	X									X	
Brengle Terrace Park	1200	Vale Terrace Dr.	Park, Parking Lot, and Maintenance Area	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X	X	
Brengle Terrace Recreation Center	1200	Vale Terrace Dr.	Recreation Facilities (basketball, tennis courts)	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Broadway & Citrus Parking Lot		Broadway & Citrus	Parking lot with treatment BMPs	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X	X	X
Bub Williamson Park	530	Grapevine Rd	Park and Parking Lot	904.21	El Salto	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Buena Creek Sewer Pump Station	2080	S. Melrose	Wastewater - Buena Pump Station	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X	X	X				X	X	X
Buena Sanitation Yard	2525	Lupine Hills	Buena Station 52, Corporate Yard, and Storage	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X	X	X	X	X	X	X		X
Buena Vista Park	2009	S. Melrose Dr.	Open Space Trails and Park (at Agua Hedionda)	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X		X			X	X	X	X
Buena Vista Park (Duck Pond)	1749	Shadowridge Dr.	Duck Pond, Park, and Parking Lot	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X		X			X	X		X
Buena Vista Creek Trail		Hacienda Dr	The Buena Vista Creek Trail, located off Hacienda Drive across from the BMW dealership	904.21	El Salto	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Creekside Park		Main St. & Wave Dr.	Park and high flow channel	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X	X	
Cypress Basin		Monte Vista Dr. & Cypress Dr.	Detention & Mitigation Basin	904.22	Vista	Buena Vista Creek	Carlsbad	X										
Downtown Facilities		S. Indiana @ Main St	Parking and Pedestrian Use	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X	X	X
Fire Station #1	175	N. Melrose Dr	Fire Station	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Fire Station #2	1050	Valley Drive	Fire Station	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Fire Station #3	1070	Old Taylor St.	Fire Station	903.11	Mission	Lower San Luis Rey	San Luis Rey	X	X	X	X	X	X	X	X	X		X
Fire Station #4	2121	Thibodo Rd	Fire Station	904.32	Buena	Agua Hedionda	Carlsbad	X	X	X	X	X	X	X	X	X		X
Fire Station #5	2009	S. Melrose Dr.	Fire Station	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X	X	X	X	X	X	X	X	X
Fire Station #6	651	E. Vista Way	Fire Station	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X	X	
Guajome Adobe Park	2206	N. Santa Fe	County Park and Adobe	903.11	Mission	Lower San Luis Rey	San Luis Rey	X	X	X		X			X	X		
HHW / Auxillary Yard	1145	E. Taylor St	Household Hazardous Waste Collection Center	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Inland Rail Trail -		South Santa Fe Ave.	Rail Trail-Site	904.32	Buena	Agua Hedionda	Carlsbad	X	X	X		X			X	X		X
Inland Rail Trail -		N Melrose Dr & North Ave	Rail Trail-Site	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Indian Rock	343	Apollo Dr	Park	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Kiwanis Parkette		Civic Center Dr at Pala Vista Dr	Park	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
La Mirada Canyon	1219	Park Center	Open Space	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X		X			X	X		
Landscape Maintenance	Varies			varies	varies	varies	varies	X	X	X		X			X	X	Varies	Varies
Luz Duran (Townsite) Park	340	E.Townsite Dr.	Park	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
McClellan Senior Center	1400	Vale Terrace Dr.	Senior Center and Parking lot	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Monte Vista Detention Basin		Monte Vista Dr. & Valley Dr.	Detention Basin	904.22	Vista	Buena Vista Creek	Carlsbad	X										
Moon Sheriffs Office	1477	Moon Rd	Sheriff substation	904.21	El Salto	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Moonlight Amphitheater	1200	Vale Terrace	Amphitheater	904.22	Vista	Buena Vista Creek	Carlsbad	X		X		X						
MS4 Maintenance	Varies		MS4 System Maintenance	varies	varies	varies	varies	X		X								
NCTD Parking Lot		W. Vista Way @ S. Emerald	Park-and-Ride, north of WB HWY 78, Emerald offramp	904.21	El Salto	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		
Open Space		Ruby Dr. @ Ravine Rd.	City Owned Property, North of Bub Williamson Park	904.21	El Salto	Buena Vista Creek	Carlsbad	X		X		X						
Parking Lot C11	303 - 307	Main St	Parking Lot - by Avo Playhouse	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		
Parking Lot C2		E. Broadway - Hanes Pl.	Parking Lot - east of Sonic Drive In	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		
Parking Lot E1		Main St / S. Indiana Ave. S/E corner	Parking Lot - corner Vista Village and N Santa Fe	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		

Appendix J. Municipal Facilities Inventory, City of Vista rev.2023

								Pollutants										
Facility	**Address Number**	**Address Street**	**Description**	**HSA_Number**	**HSA_Name**	**Watershed**	**WMA**	**Sediment**	**Nutrients**	**Trash**	**Metals**	**Bacteria**	**Oil & Grease**	**Organics**	**Pesticides**	**Oxygen Demanding Substances**	**Adjacent to ESA (200 ft)**	**Within HSA and generage same 303(d) pollutants**
Parking Lot E3	200 Block	Main St	Parking Lot - north of businesses	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		
Parking Lot E4		Main St - Michigan Ave.	Parking Lot	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X		
Paseo Santa Fe, Phases 1 -3		South Santa Fe Ave.	Parking and Pedestrian Use	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X		X	X	
Plaza and Sidewalk Cleaning	Varies			varies	varies	varies	varies	X		X		X	X				Varies	Varies
Public Works	1165	E. Taylor Street	Corporate Yard	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Raceway Sewer Pump Station	2685	S. Melrose	Wastewater - Raceway Pump Station	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X	X	X				X		X
Raintree Park	545	Townsite Dr.	Park	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Rancho Buena Vista Adobe	640	Alta Vista	Attraction	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X		X	
Rancho Buena Vista Park (Baseball Fields)	1851	S. Melrose Dr.		904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X		X			X	X		X
Rancho Buena Vista Park (Baseball East Parking Lot)	1851	S. Melrose Dr.	East Parking Lot, North of Shadowridge	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X	X	X	X	X		X		
Rancho Buena Vista Park (Baseball West Parking Lot)	1851	S. Melrose Dr.	West Parking Lot, North of Shadowridge	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X	X	X	X	X		X		
Road and Street Maintenance	Varies			varies	varies	varies	varies	X			X		X	X		X	Varies	Varies
S. Santa Fe Detention Basin		Monte Vista Dr / S. Santa Fe Ave.	Detention Basin	904.22	Vista	Buena Vista Creek	Carlsbad	X										
San Diego County Library	700	Eucalyptus	Library and Parking Lot	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Shadowridge Park	2101	Lupine Hills	Park	904.32	Buena	Agua Hedionda	Carlsbad	X	X	X		X			X	X		X
Skatepark - South Park	400	N Santa Fe	Skatepark	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X		X	X	X		X
Skatepark - North Park	510	N Santa Fe	Skatepark	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X		X	X	X		X
South Buena Vista Park (Dog Park) and Basin	1602	Mountain Pass Cr.	Park and Detention Basin	904.31	Los Monos	Agua Hedionda	Carlsbad	X	X	X		X			X	X		X
Thibodo Park	1150	Lupine Hills Dr.	Park, Community Center, Parking Lot	904.32	Buena	Agua Hedionda	Carlsbad	X	X	X		X		X	X	X		X
~~Thibodo Sheriffs Office~~	~~2082~~	~~Thibodo~~	~~Sheriff substation~~	~~904.32~~	~~Buena~~	~~Agua Hedionda~~	~~Carlsbad~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~		~~X~~
Townsite Service Center	642	Vista Village Dr.	Community Center	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Townsite Sheriffs Office	340	E. Townsite	Sheriff substation	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Vista Civic Center	600	Eucalyptus	City Hall, Park, and Parking Lot	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X		
Vista Sports Park	1600	Sports Park Way	Park and Sports Fields	903.11	Mission	Lower San Luis Rey	San Luis Rey	X	X	X		X			X	X		
~~Vista Village Sheriffs Office~~	~~30~~	~~Main St.~~	~~Sheriff substation~~	~~904.22~~	~~Vista~~	~~Buena Vista Creek~~	~~Carlsbad~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~		
Vista Village Walk		Vista Village Dr / Michigan Ave.	Green Belt Walkway	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X		
Waste Handling and Disposal	Varies			varies	varies	varies	varies	X	X	X	X	X	X	X	X	X	Varies	Varies
Wastewater Utility Maintenance	Varies			varies	varies	varies	varies	X	X	X	X	X				X	Varies	Varies
Wave Waterpark	101	Wave Dr.	Waterpark	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X	X	X	X	X	X	X	X	
Wildwood Park	651	E. Vista Way	Park and Parking Lot (at Fire Station #6)	904.22	Vista	Buena Vista Creek	Carlsbad	X	X	X		X			X	X	X	

Notes:
SIC and NAICS codes are designed to categorize business operations and are not considered applicable to municipal facilities.
All inventoried municipal facilities are considered active.
No municipal facilities are subject to the Industrial General Permit.
Pollutant categories with an "X" indicate a *likely* or *potential* source for that pollutant.
~~Strikethrough~~ - sites removed from previous version
Red highlights - new or revised sites added since previous version