CITY OF SOLANA BEACH BEST MANAGEMENT PRACTICE DESIGN MANUAL

Best Management Practice Design Requirements for Development Applications

February 2016

Visit www.ci.solana-beach.ca.us for updates.

This page intentionally left blank.

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 County Copermittees 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 Solana Beach'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 Water Quality Technical Reports (WQTR) and City 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 85th percentile storm volume, defined as the event that has a precipitation total greater than or equal to 85 percent of all daily storm events larger than 0.01 inches over a given period of record in a specific area or location.
- For situations where onsite retention of the 85th percentile storm volume is technically not feasible, biofiltration must be provided to satisfy specific "biofiltration standards." These standards consist of a set of siting, selection, sizing, design and operation and maintenance (O&M) criteria that must be met for a BMP to be considered a "biofiltration BMP" – see Section 2.2.1 and Appendix F *(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 is 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[2]. 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.

Table of Contents

SUMMARY ..... **I**

TABLE OF CONTENTS ..... **VI**

LIST OF ACRONYMS ..... **XI**

HOW TO USE THIS MANUAL ..... **XII**

1. POLICIES AND PROCEDURAL REQUIREMENTS **1-1**

1.1 INTRODUCTION TO STORM WATER MANAGEMENT POLICIES 1-1

1.2 PURPOSE AND USE OF THE MANUAL 1-2

1.2.1 Determining Applicability of Permanent BMP Requirements 1-3

1.2.2 Determine Applicability of Construction BMP Requirements 1-4

1.3 DEFINING A PROJECT 1-5

1.4 IS THE PROJECT A PDP? 1-6

1.4.1 PDP Categories 1-7

1.4.2 City of Solana Beach PDP Exemptions or Alternative PDP requirements 1-7

1.5 DETERMINING APPLICABLE STORM WATER MANAGEMENT REQUIREMENTS 1-10

1.6 APPLICABILITY OF HYDROMODIFICATION MANAGEMENT REQUIREMENTS 1-10

1.7 SPECIAL CONSIDERATIONS FOR REDEVELOPMENT PROJECTS (50 PERCENT RULE) 1-14

1.8 ALTERNATIVE COMPLIANCE PROGRAM 1-15

1.9 RELATIONSHIP BETWEEN THIS MANUAL AND WQIPS 1-17

1.10 STORM WATER REQUIREMENT APPLICABILITY TIMELINE 1-19

1.11 PROJECT REVIEW PROCEDURES 1-20

1.12 PDP STRUCTURAL BMP VERIFICATION 1-20

2. PERFORMANCE STANDARDS AND CONCEPTS **2-1**

2.1 BACKGROUND OF HYDROMODIFICATION PRINCIPLES 2-1

2.2 SOURCE CONTROL AND SITE DESIGN REQUIREMENTS FOR ALL DEVELOPMENT PROJECTS 2-2

2.2.1 Performance Standards 2-2

2.2.2 Concepts and References 2-4

2.3 STORM WATER POLLUTANT CONTROL REQUIREMENTS FOR PDPS 2-6

2.3.1 Storm Water Pollutant Control Performance Standard 2-6

2.3.2 Concepts and References 2-7

2.4 HYDROMODIFICATION MANAGEMENT PERFORMANCE STANDARDS 2-11

2.5 RELATIONSHIP BETWEEN PERFORMANCE STANDARDS 2-12

3. DEVELOPMENT PROJECT PLANNING AND DESIGN 3-1

3.1 COORDINATION BETWEEN DISCIPLINES 3-2

3.2 GATHERING PROJECT SITE INFORMATION 3-3

3.3 DEVELOPING CONCEPTUAL SITE LAYOUT AND STORM WATER CONTROL STRATEGIES 3-4

3.3.1 Preliminary Design Steps for All Development Projects 3-4

3.3.2 Evaluation of Critical Coarse Sediment Yield Areas 3-5

3.3.3 Drainage Management Areas 3-5

3.3.4 Developing Conceptual Storm Water Control Strategies 3-8

3.4 DEVELOPING COMPLETE STORM WATER MANAGEMENT DESIGN 3-9

3.4.1 Steps for All Development Projects 3-10

3.4.2 Steps for PDPs with only Pollutant Control Requirements 3-10

3.4.3 Steps for Projects with Pollutant Control and Hydromodification Management Requirements 3-11

3.5 PROJECT PLANNING AND DESIGN REQUIREMENTS 3-12

3.6 PHASED PROJECTS 3-12

4. SOURCE CONTROL AND SITE DESIGN REQUIREMENTS FOR ALL DEVELOPMENT PROJECTS 4-1

4.1 GENERAL REQUIREMENTS (GR) 4-1

4.2 SOURCE CONTROL (SC) BMP REQUIREMENTS 4-2

4.3 SITE DESIGN (SD) BMP REQUIREMENTS 4-4

5. STORM WATER POLLUTANT CONTROL REQUIREMENTS FOR PDPS 5-1

5.1 STEPS FOR SELECTING AND DESIGNING STORM WATER POLLUTANT CONTROL BMPS 5-1

5.2 DMAS EXCLUDED FROM DCV CALCULATION 5-5

5.2.1 Self-mitigating DMAs 5-5

5.2.2 De Minimis DMAs 5-6

5.2.3 Self-retaining DMAs via Qualifying Site Design BMPs 5-7

5.3 DCV REDUCTION THROUGH SITE DESIGN BMPS 5-8

5.4 EVALUATING FEASIBILITY OF STORM WATER POLLUTANT CONTROL BMP OPTIONS 5-9

5.4.1 Feasibility Screening for Harvest-and-Use Category BMPs 5-9

5.4.2 Feasibility Screening for Infiltration Category BMPs 5-9

5.5 BMP SELECTION AND DESIGN 5-12

5.5.1 Retention Category 5-13

5.5.2 Partial Retention BMP Category 5-15

5.5.3 Biofiltration BMP Category 5-16

5.5.4 Flow-through Treatment Control BMPs (for use with Alternative Compliance) Category 5-18

5.5.5 Alternate BMPs 5-19

5.6 DOCUMENTING STORM WATER POLLUTANT CONTROL BMP COMPLIANCE WHEN HYDROMODIFICATION MANAGEMENT APPLIES 5-20

6. HYDROMODIFICATION MANAGEMENT REQUIREMENTS FOR PDPS 6-1

6.1 HYDROMODIFICATION MANAGEMENT APPLICABILITY AND EXEMPTIONS 6-1

6.2 PROTECTION OF CRITICAL COARSE SEDIMENT YIELD AREAS 6-2

6.2.1 Verification of GLUs Onsite 6-3

6.2.2 Downstream Systems Sensitivity to Coarse Sediment 6-5

6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite 6-8

6.2.4 Management Measures for Critical Coarse Sediment Yield Areas Onsite 6-8

6.2.5 Management Measures for Critical Coarse Sediment Yield Areas Offsite and Draining Through the Project 6-10

6.3 FLOW CONTROL FOR HYDROMODIFICATION MANAGEMENT 6-10

6.3.1 Point(s) of Compliance 6-11

6.3.2 Offsite Area Restrictions 6-12

6.3.3 Requirement to Control to Pre-Development (Not Pre-Project) Condition 6-12

6.3.4 Determining the Low-Flow Threshold for Hydromodification Flow Control 6-13

6.3.5 Designing a Flow Control Facility 6-14

6.3.6 Integrating HMP Flow Control Measures with Pollutant Control BMPs 6-15

6.3.7 Drawdown Time 6-17

6.4 IN-STREAM REHABILITATION 6-18

7. LONG TERM OPERATION & MAINTENANCE (O&M) 7-1

7.1 NEED FOR PERMANENT INSPECTION AND MAINTENANCE 7-1

7.1.1 MS4 Permit Requirements 7-1

7.1.2 Practical Considerations 7-1

7.2 SUMMARY OF STEPS TO MAINTENANCE AGREEMENT 7-2

7.3 MAINTENANCE RESPONSIBILITY 7-3

7.4 LONG-TERM MAINTENANCE DOCUMENTATION 7-3

7.5 INSPECTION AND MAINTENANCE FREQUENCY 7-4

7.6 MEASURES TO CONTROL MAINTENANCE COSTS 7-4

7.7 MAINTENANCE INDICATORS AND ACTIONS FOR STRUCTURAL BMPS 7-6

7.7.1 Maintenance of Vegetated Infiltration or Filtration BMPs 7-7

7.7.2 Maintenance of Non-Vegetated Infiltration BMPs 7-8

7.7.3 Maintenance of Non-Vegetated Filtration BMPs 7-9

7.7.4 Maintenance of Detention BMPs 7-9

8. SUBMITTAL REQUIREMENTS 8-11

8.1 SUBMITTAL REQUIREMENT FOR STANDARD PROJECTS 8-11

8.1.1 Standard Project WQTR 8-11

8.2 SUBMITTAL REQUIREMENTS FOR PDPS 8-11

8.2.1 PDP WQTR 8-11

8.2.2 Requirements for Construction Plans 8-13

8.2.3 Design Changes During Construction and Project Closeout Procedures 8-14

9. BIBLIOGRAPHY I

Appendices

Appendix A: WQTR Submittal Templates

Appendix B: Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Appendix C: Geotechnical and Groundwater Investigation Requirements

Appendix D: Approved Infiltration Rate Assessment Methods for Selection and Design of Storm Water BMPs

Appendix E: BMP Design Fact Sheets

Appendix F: Biofiltration Standard and Checklist

Appendix G: Guidance for Continuous Simulation and Hydromodification Management Sizing Factors

Appendix H: Guidance for Investigating Potential Critical Coarse Sediment Yield Areas

Appendix I: Glossary of Key Terms

Figures

FIGURE 1-1. Procedural Requirements for a Project to Identify Storm Water Requirements 1-3
FIGURE 1-2. Applicability of Hydromodification Management BMP Requirements 1-14
FIGURE 1-3. Pathways to Participating in Alternative Compliance Program 1-17
FIGURE 1-4. Relationship between this Manual and WQIP 1-19
FIGURE 3-1. Approach for Developing a Comprehensive Storm Water Management Design 3-1
FIGURE 3-2. DMA Delineation 3-6
FIGURE 3-3. Tributary Area for BMP Sizing 3-7
FIGURE 5-1. Storm Water Pollutant Control BMP Selection Flow Chart 5-2
FIGURE 5-2. Storm Water Pollutant Control BMP Selection Flow Chart 5-3
FIGURE 5-3. Self Mitigating Area 5-6
FIGURE 5-4. Self-retaining Site 5-8
FIGURE 5-5. Infiltration Feasibility and Desirability Screening Flow Chart 5-11
FIGURE 5-6. Schematic of a Typical Cistern 5-13
FIGURE 5-7. Schematic of a Typical Infiltration Basin 5-15
FIGURE 5-8. Schematic of a Typical Biofiltration with Partial Retention BMP 5-16
FIGURE 5-9. Schematic of a Typical Biofiltration Basin 5-17
FIGURE 5-10. Schematic of a Vegetated Swale 5-19

FIGURE 6-1. Evaluation of Downstream Systems Requirements for Preservation of Coarse Sediment Supply 6-7

Tables

TABLE 1-1. Checklist for a Project to Identify Applicable Post-Construction Storm Water Requirements ..1-4
TABLE 1-2. Applicability of Permanent, Post-Construction Storm Water Requirements 1-6
TABLE 1-3. Applicability of Manual Sections for Different Project Types 1-10
TABLE 3-1. Applicability of Section 3.3 Sub-sections for Different Project Types 3-4
TABLE 3-2. Applicability of Section 3.4 Sub-sections for Different Project Types 3-10
TABLE 5-1. Permanent Structural BMPs for PDPs 5-12
TABLE 6-1. Potential Critical Coarse Sediment Yield Areas 6-4
TABLE 7-1. Schedule for Developing O&M Plan and Agreement 7-2
TABLE 7-2. Maintenance Indicators and Actions for Vegetated BMPs 7-7
TABLE 7-3. Maintenance Indicators and Actions for Non-Vegetated Infiltration BMPs 7-8
TABLE 7-4. Maintenance Indicators and Actions for Filtration BMPs 7-9
TABLE 7-5. Maintenance Indicators and Actions for Detention BMPs 7-9

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
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
WQTR	Water Quality Technical Report

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 Water Quality Technical report (WQTR) 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 WQTR. 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)	Hydromodificatio n 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[3]	X		
PDPs with only Pollutant Control Requirements	X	X	
PDPs with Pollutant Control and Hydromodification Management Requirements	X	X	X

[3] 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

Standard Projects	PDPs
Standard Projects will proceed to **Chapter 4** for guidance on implementing source control and site design requirements. After Chapter 4, Standard Projects will proceed to **Chapter 8** for project submittal requirements.	PDPs will also proceed to **Chapter 4** for guidance on implementing source control and site design requirements. PDPs will use **Chapters 5 through 7** and associated Appendices to implement pollutant control requirements and hydromodification management requirements for the project site, as applicable. These projects will proceed to **Chapter 8** for project submittal requirements.

Plan Ahead to Avoid Common Mistakes

The following list identifies some common errors made by applicants that delay or compromise development approvals with respect to storm water compliance.

- **Not planning for compliance early enough.** 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 **retention of the 85th percentile storm volume** (see Chapter 5). Flow-through treatment cannot be used to 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

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 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 of Solana Beach 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)*.

The technologically-based 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 is 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 storm water 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.

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 approval is required or not, and whether a WQTR 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[4] 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

[4] 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.

be 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.

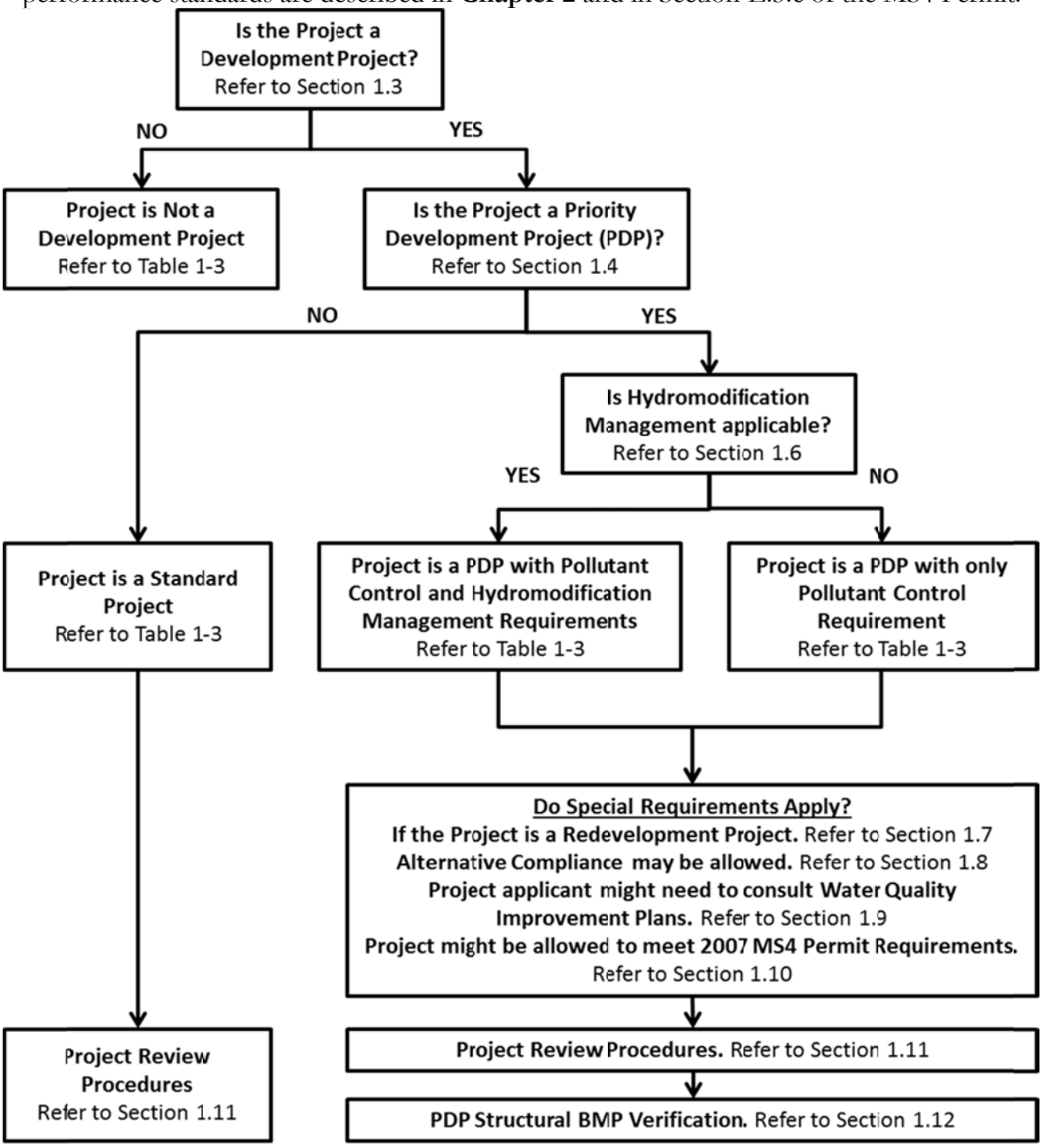


FIGURE 1-1. Procedural Requirements for a Project to Identify Storm Water Requirements

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 Intake Form (Project Type Determination)*.

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; only 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 SDRWQCB 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 1.4.2 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 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 1.4.2 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 square foot 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. Within the City's boundaries, areas designated as an ESA are located along the City's northern border and drain to the San Elijo Lagoon or Escondido 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. This means 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 the following:

i. Grading, digging, cutting, scraping, stockpiling, pavement removal, and exterior construction;

ii. Substantial removal of vegetation where soils are disturbed including but not limited to removal by clearing or grubbing; or

iii. Any activity which bares soil or rock or involves streambed alterations or the diversion or piping of any watercourse.

Exclusions that apply to this category only: Projects creating less than 5,000 square feet of impervious surface and where any added landscaping does not require regular use of pesticides and fertilizers, such as a slope stabilization project using native plants, are excluded from this category. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as for emergency or maintenance access or for bicycle or pedestrian use, if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces.

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.

(b) Swimming pools and decorative ponds with adequate freeboard or an overflow structure that does not release overflow to the storm drain system.

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

1.4.2 City of Solana Beach PDP Exemptions or Alternative PDP Requirements

Projects within the following two categories can be exempt from being classified as PDPs. However, each development project shall still meet minimum BMP requirements of incorporating both source control BMPs and site design/LID BMPs as discussed in Section 1.5.

(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 ["Managing Wet Weather with Green Infrastructure- Municipal Handbook: Green Streets" (USEPA, 2008)].

(b) Retrofitting or redevelopment of existing paved alleys, streets or roads that are designed and constructed in accordance with the USEPA Green Streets guidance ["Managing Wet Weather with Green Infrastructure- Municipal Handbook: Green Streets" (USEPA,2008)].

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 unless otherwise determined by the City that additional structural BMPs are also applicable to Standard Projects. 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[5]	☑	☑	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)

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

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

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

Under the MS4 Permit, 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, lagoons, 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, lagoons, or the Pacific Ocean.

(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.

For the City, this includes existing underground storm drains or concrete-lined channels discharging directly to the Pacific Ocean. 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.
  - This exemption is subject to the following additional criteria defined by this manual:
    - a) The outfall must be located on the beach (not within or on top of a bluff),

b) A properly sized energy dissipation system must be provided to mitigate outlet discharge velocity from the direct discharge to the ocean for the ultimate condition peak design flow of the direct discharge,

c) The invert elevation of the direct discharge conveyance system (at the point of discharge to the ocean) should be equal to or below the mean high tide water surface elevation at the point of discharge, unless the outfall discharges to quay or other non-erodible shore protection.

- **Figure 1-2, Node 3** – As allowed by the MS4 Permit, projects discharging directly to enclosed embayments (e.g., San Elijo or San Dieguito Lagoons), 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.
  - 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,

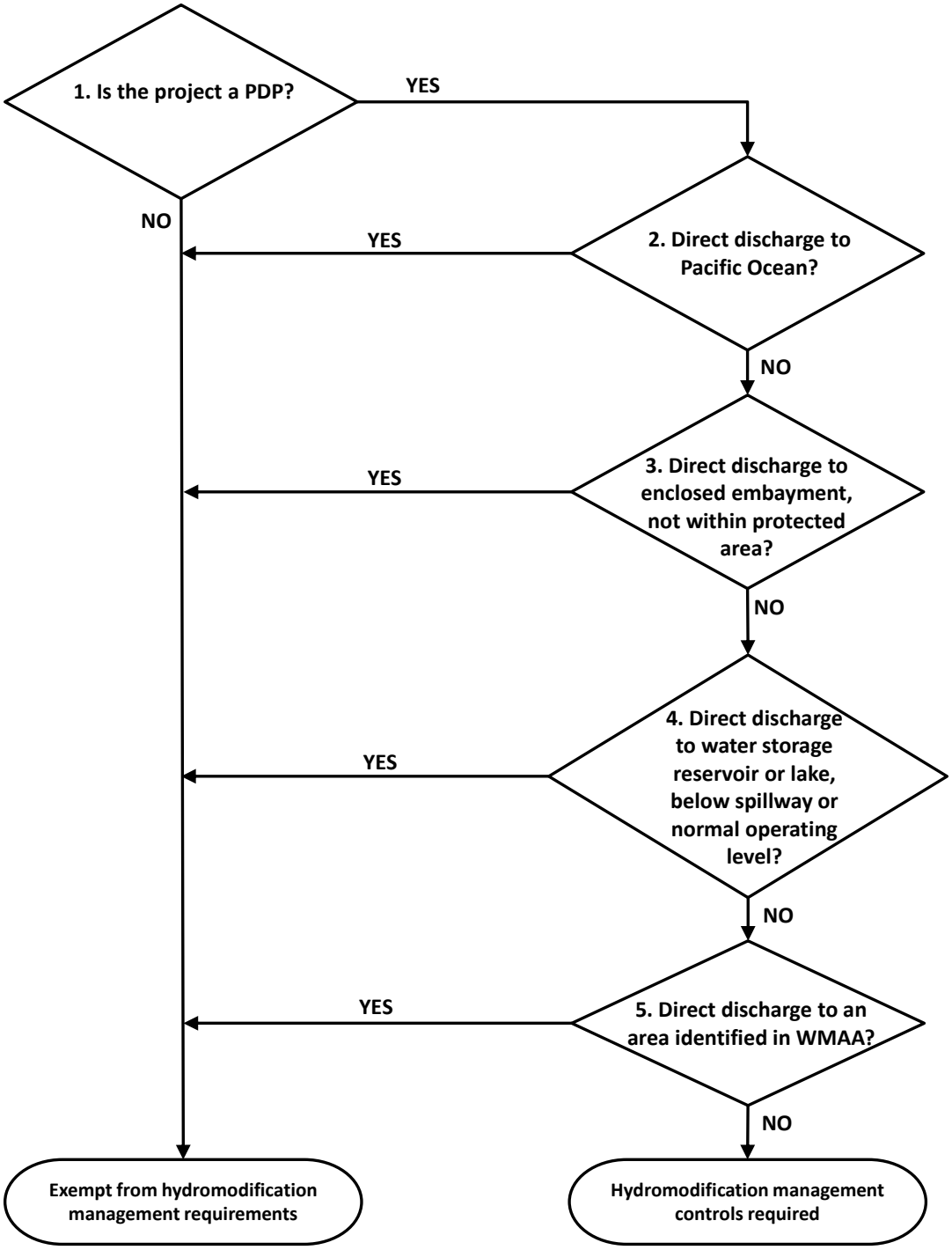
    b) The invert elevation of the direct discharge conveyance system (at the point of discharge to the water storage reservoir or lake) should be equal to or below the lowest normal operating water surface elevation at the point of discharge, unless the outfall discharges to quay or other non-erodible shore 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. 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 fifty percent of the surface area of the previously existing development, then the structural BMP performance requirements of Provision E.3.c [of the MS4 Permit] apply only to the creation or replacement of impervious surface, and not the entire development; or

(b) Where redevelopment results in the creation or replacement of impervious surface in an amount of more than fifty percent of the surface area of the previously existing development, then the structural BMP performance requirements of Provision E.3.c [of the MS4 Permit] apply to the entire development.

These requirements for managing storm water on an entire redevelopment project site are commonly referred to as the "50% rule". For the purpose of calculating the ratio, the surface area of the previously existing development shall be the area of impervious surface 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. **50% rule test**: Is step 4 more than 50% of Step 1? If yes, treat all impervious surface on the site. If no, then treat only Step 4 impervious surface and any area that comingles with created and/or replaced impervious surface area.

Note: Step 2 and Step 3 must not overlap as it is fundamentally not possible for a given area to be both "replaced" and "created" at the same time. Also activities that occur as routine maintenance shall not be included in Step 2 and Step 3 calculation.

For example, a 10,000 sq. ft. development proposes replacement of 4,000 sq. ft. of impervious area. The treated area is less than 50% 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.

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 demonstrating infeasibility of retention and/or biofiltration BMPs onsite</u>.

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

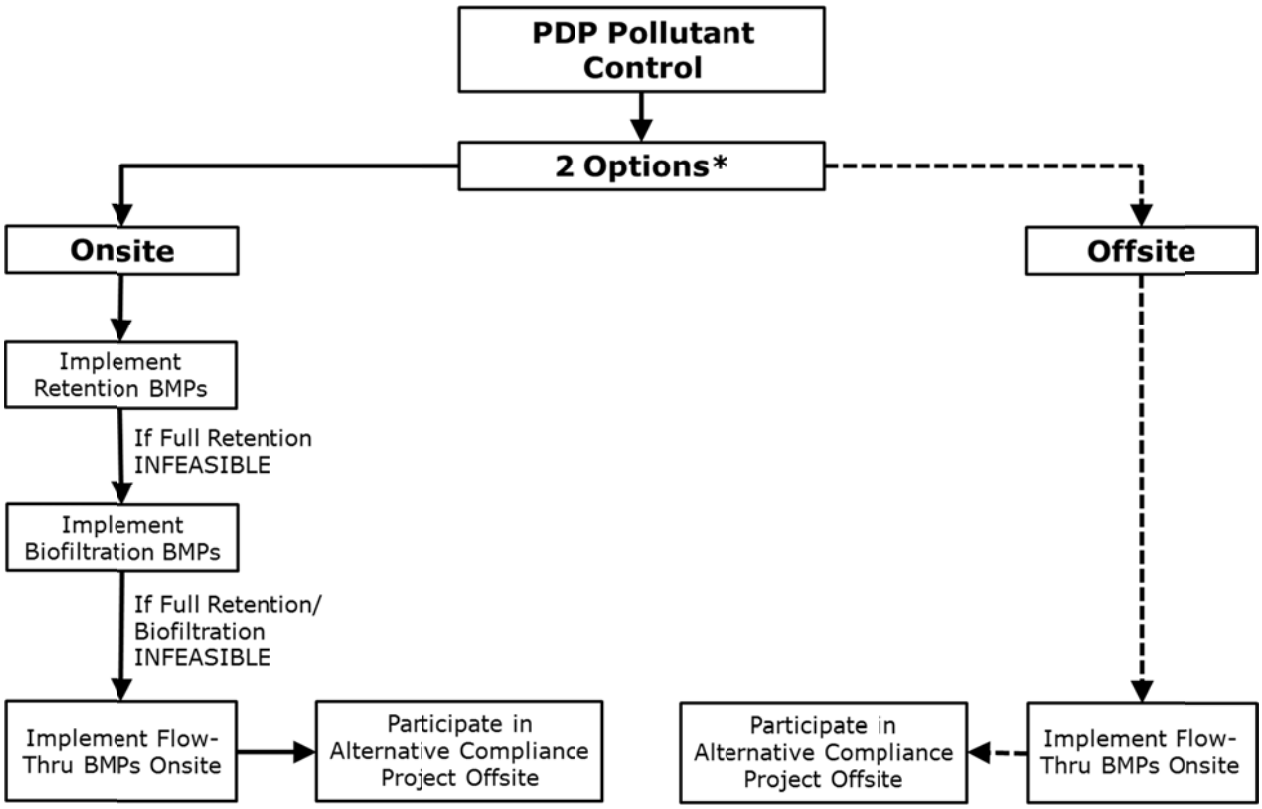
Participation in an offsite alternative compliance project **and** the obligation to implement flow-through treatment controls for the DCV not reliably retained or biofiltered onsite, are linked and cannot be separated. The PDP should consult with the City regarding processing requirements if this is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

The Water Quality Equivalency (WQE) calculation, which is required prior to administering an alternative compliance program, was accepted by the San Diego Water Board's Executive Officer in December of 2015. The Water Quality Equivalency provides currency calculations to assess water quality and hydromodification management benefits for a variety of potential offsite project types and provides regional and technical basis for demonstrating a greater water quality benefit for the watershed.



*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 until the Regional Water Quality Board accepts the project's water quality equivalency calculations.

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.[6]

   The City of Solana Beach is located within the Carlsbad and San Dieguito 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 their respective websites (see below), including updates:

- Carlsbad:

  http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=3&Itemid=39

- San Dieguito River Watershed:

  http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=207&Itemid=194

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

[6] Currently, the City of Solana Beach does not have an Alternative Compliance Program in place.

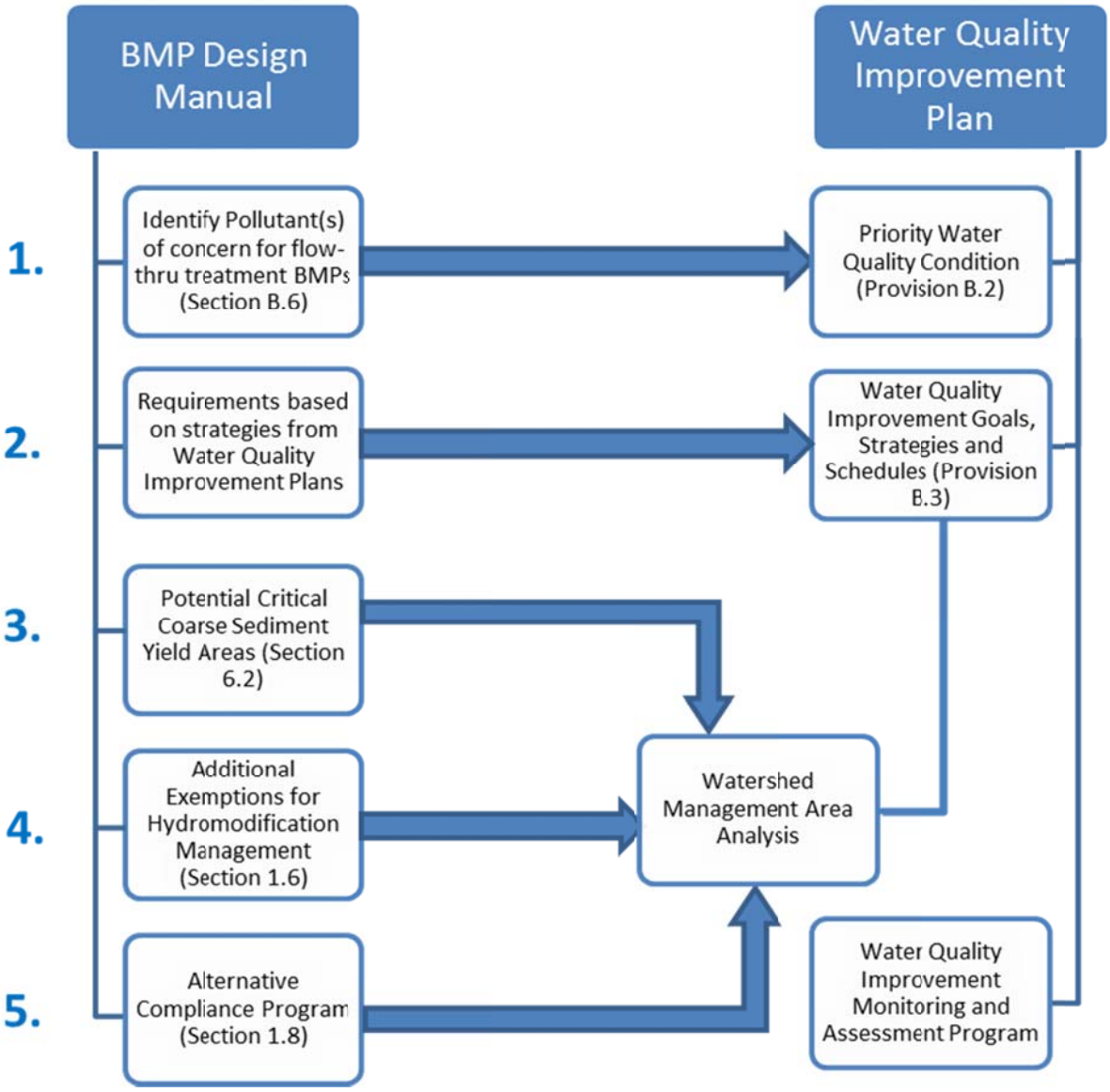


FIGURE 1-4. Relationship between this Manual and WQIP

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 Standard Urban Storm Water

Mitigation Plan 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 WQTR 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 WQTR 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].

For PDPs, this means that after structural BMPs have been constructed, the 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 WQTR 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

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

Pollutant 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 2.2.2 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)[7];

(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 <u>where applicable and feasible</u>. Responsible implementation of this performance standard depends on evaluating applicability and feasibility. Further guidance is provided in Section 2.2.2 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

[7] 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.

require additional site design practices, beyond those listed above, to be considered and documented as part of demonstrating conformance to storm water pollutant control and hydromodification management requirements.

2.2.2 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 WQTR 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).[8]

Methods to design and demonstrate compliance with storm water pollutant control BMPs are presented in Chapter 5 of this Manual. . Definitions and concepts that should be understood when sizing storm water pollutant control BMPs to be in compliance with the performance standards are explained below:

2.3.2.1 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.

[8] Currently, the City of Solana Beach does not have an Alternative Compliance Program in place.

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 WQTR templates in Appendix A.3:

- 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.
- PDPs may be allowed to participate in an alternative compliance program. Refer to Section 1.8 for additional guidance.

Retention BMPs: Structural measures that provide retention (i.e. intercept, store, infiltrate, evaporate and evapotranspire) of storm water as part of pollutant control strategy. Examples include infiltration BMPs and cisterns, bioretention BMP's and biofiltration with partial retention BMP's.

Biofiltration BMPs: Structural measures that provide biofiltration of storm water as part of the pollutant control strategy. Example includes biofiltration BMP's.

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

[9] Currently, flow-thru treatment is not an option as the City of Solana Beach does not have an alternative compliance program in place.

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 2.3.2.3 based on determinations of technical feasibility. In order to assist the project applicant in selecting BMPs, this Manual includes a defined process for evaluating feasibility. Conceptually, the feasibility criteria contained in this Manual are intended to:

- Promote reliable and effective long-term operations of BMPs by providing a BMP selection process that eliminates the use of BMPs that are not suitable for site conditions, project type or other factors;
- Minimize significant risks to property, human health, and/or environmental degradation (e.g., geotechnical stability, groundwater quality) as a result of 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 WQTR 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

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 WQTR 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 *(WQTR 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.

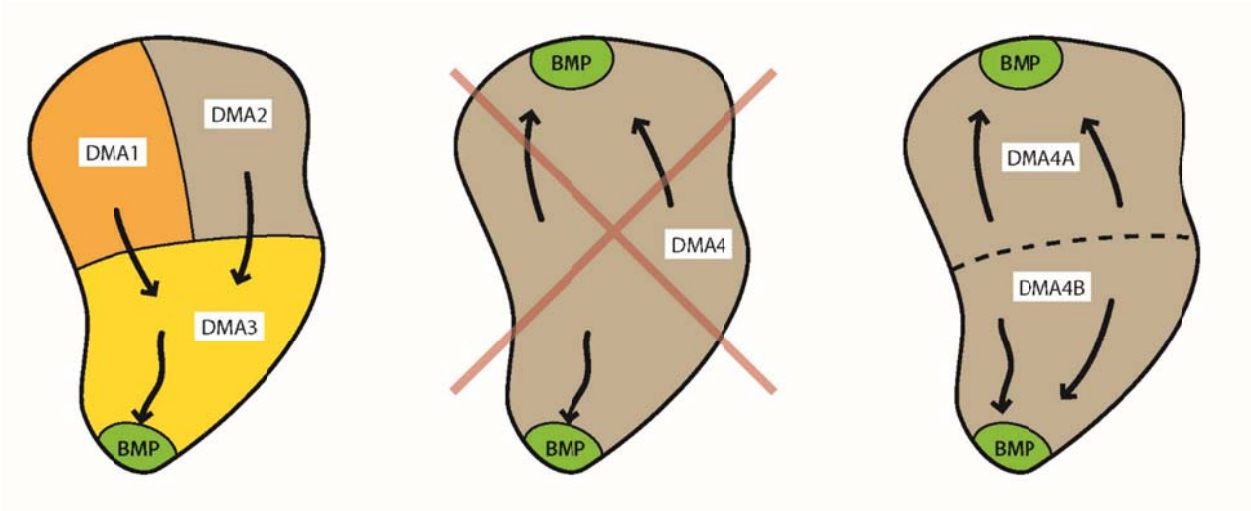


FIGURE 3-2. DMA Delineation

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.

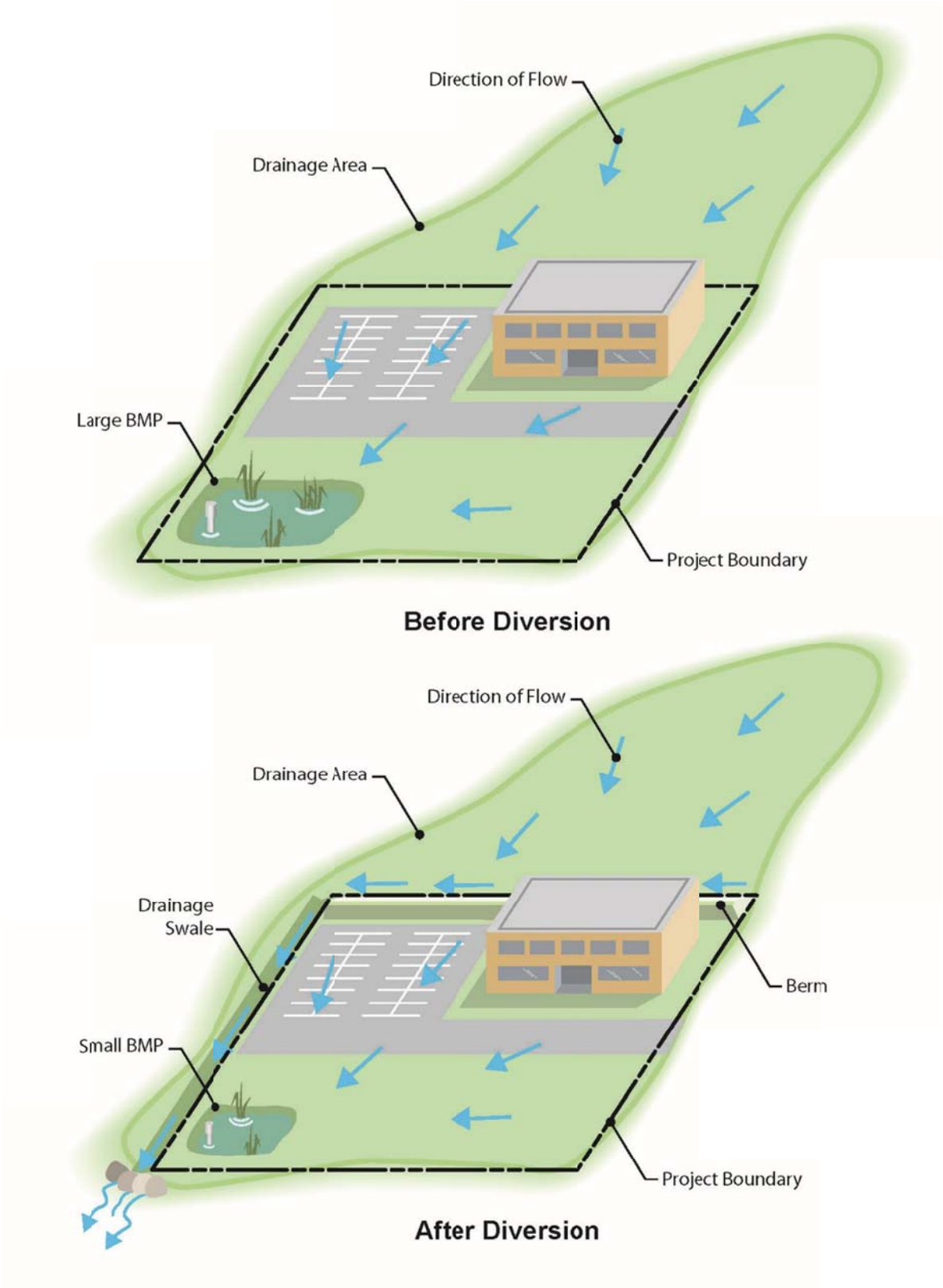


FIGURE 3-3. Tributary Area for BMP Sizing

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 WQTR 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 WQTR 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 WQTR 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/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

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 WQTR templates are included Appendix A *(WQTR 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.

> **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.

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.

> **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.

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:

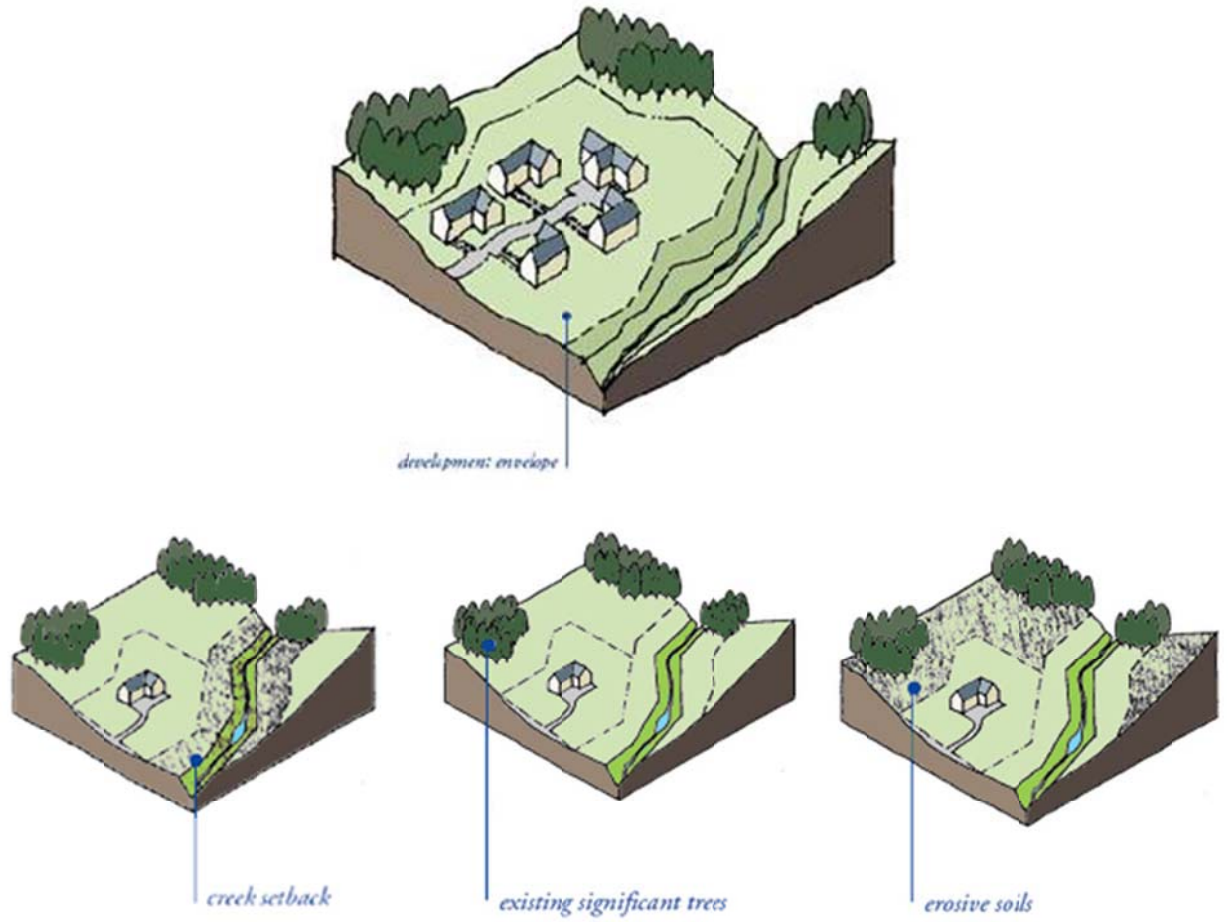
- Evaluate surface drainage and topography in considering selection of Site Design BMPs that will be most beneficial for a given project site. Where feasible, maintain topographic depressions for infiltration.
- Optimize the site layout and reduce the need for grading. Where possible, conform the site 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. 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.

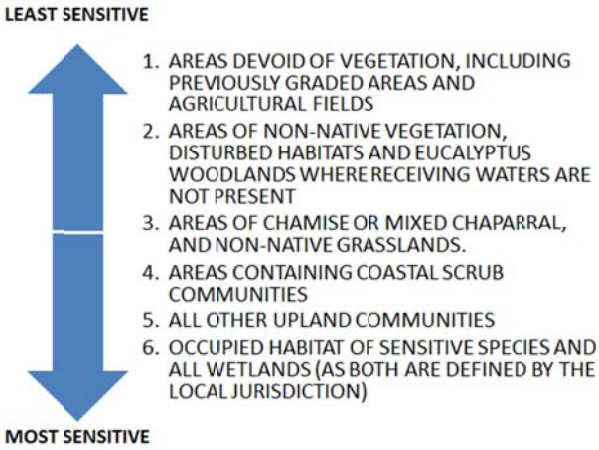


The upper soil layers of a natural area contain organic material, soil biota, vegetation, and a configuration favorable for storing and slowly conveying storm water and establishing or restoring vegetation to stabilize the site after construction. The canopy of existing native trees and shrubs also provide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

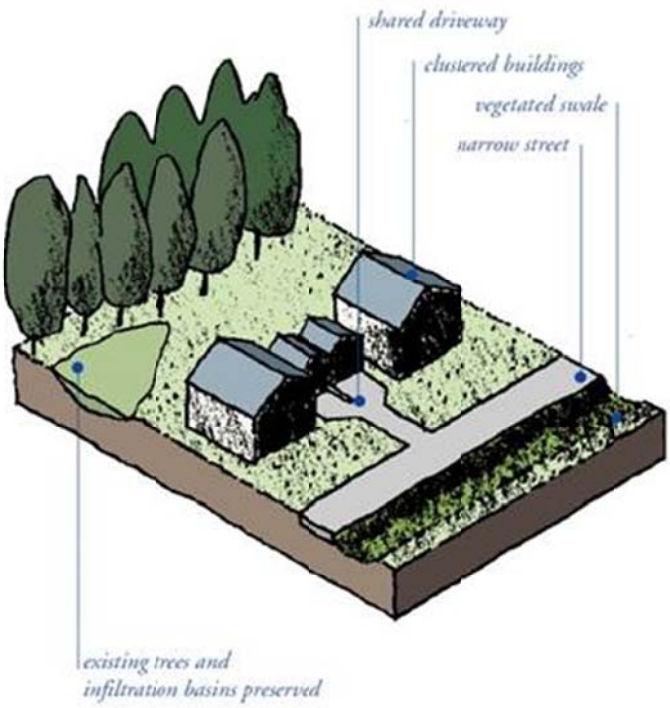
- First, the combination of paved surfaces and piped runoff efficiently collects urban pollutants and transports them, in suspended or dissolved form, to surface waters. These pollutants may originate as airborne dust, be washed from the atmosphere during rains, or may be generated by automobiles and 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:

- 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.



Source: County of San Diego LID Handbook

- 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.

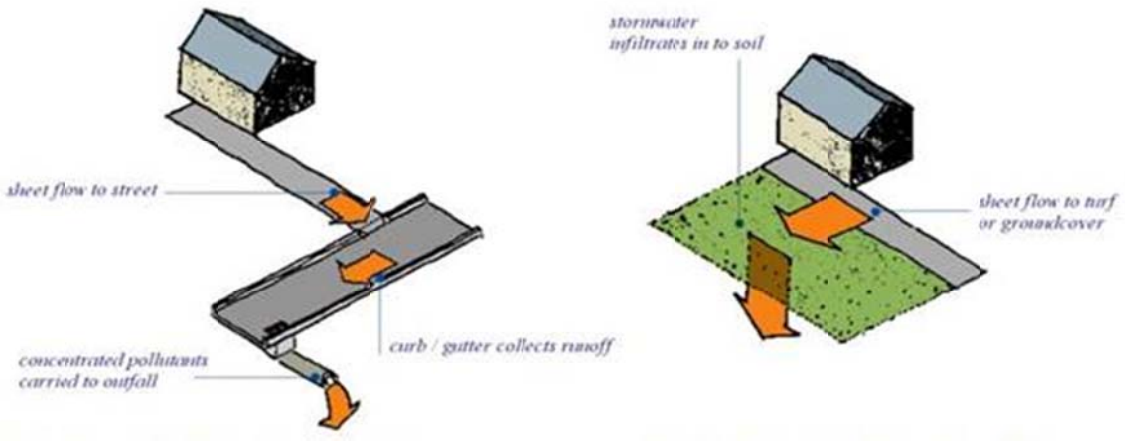
SD-5: Disperse impervious areas

- ☐ 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

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).

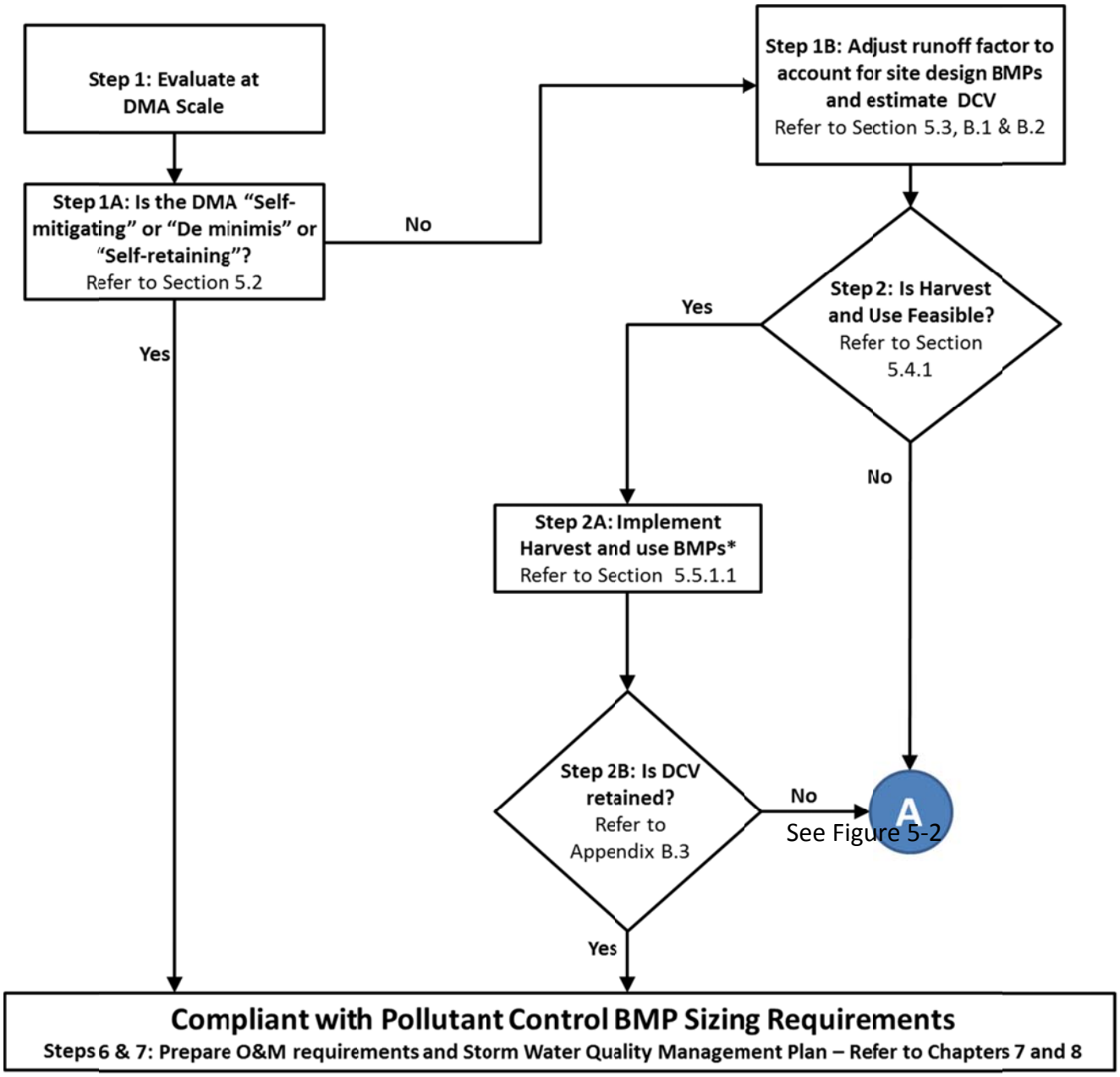
This chapter by itself is not a complete design guide for project development. It is intended to provide guidance for selecting and designing storm water pollutant control BMPs. Specifically:

- 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

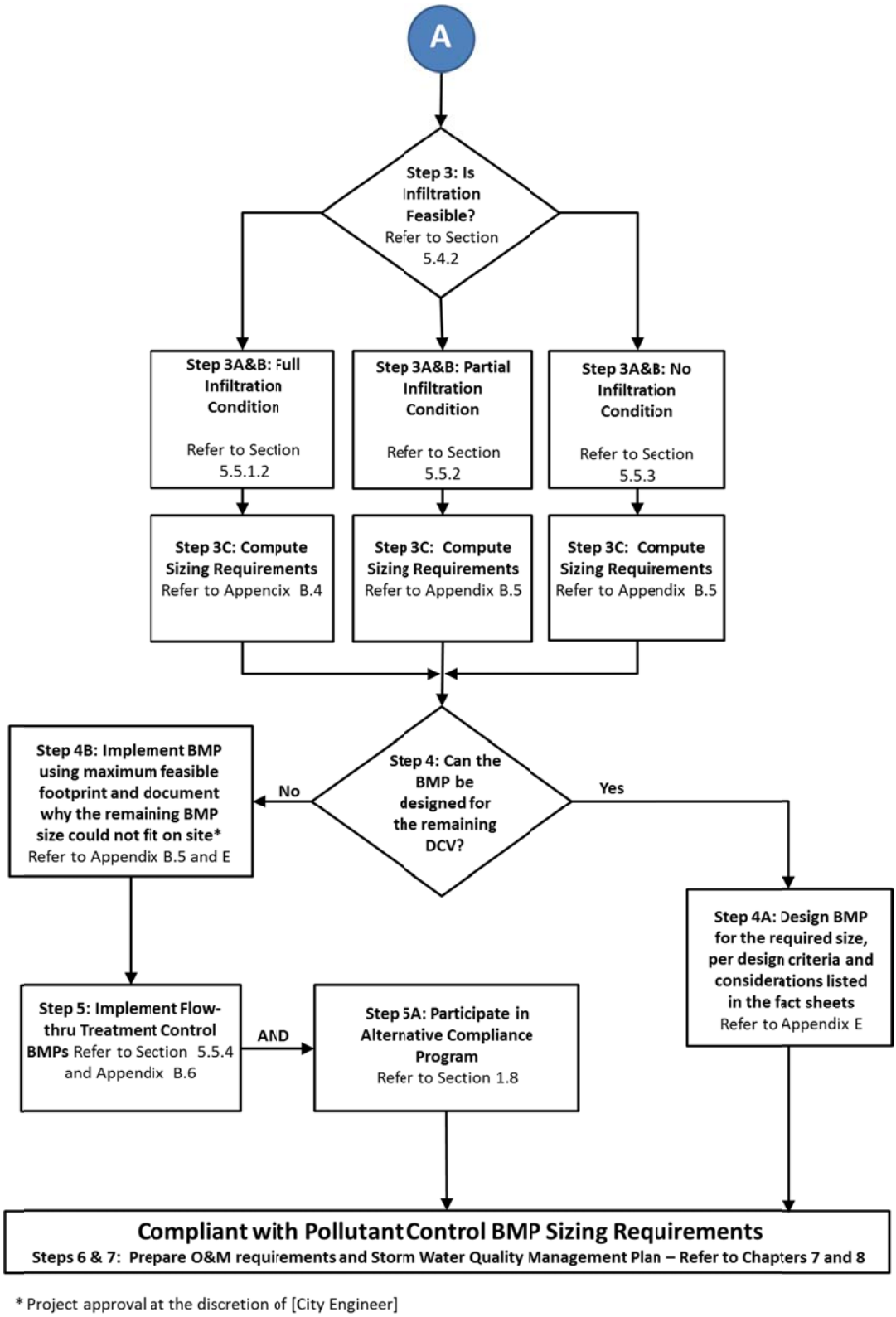


FIGURE 5-2. Storm Water Pollutant Control BMP Selection Flow Chart

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.3 *(PDP WQTR)* 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 WQTR. See Appendix C and D for additional guidance.

Step 4. Evaluate if the required BMP footprint will fit, considering the site design and constraints.

A. If the calculated footprint fits, then size and design the selected BMPs accordingly using design criteria and considerations from fact sheets presented in Appendix E *(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.

The project applicant must also participate in an alternative compliance program when implementing flow-through treatment control BMPs. See Section 1.8.

Step 6. Prepare a WQTR documenting site planning and opportunity assessment activities, final site layout and storm water management design. 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 WQTR 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.

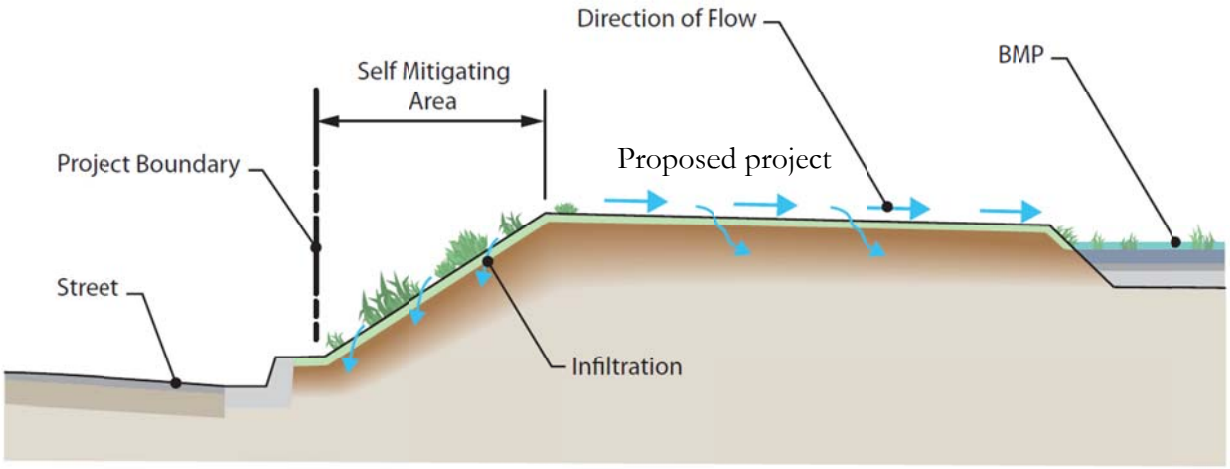


FIGURE 5-3. Self Mitigating Area

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 WQTR must document the reason that each de minimis area could not be addressed otherwise (see PDP WQTR 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 WQTR.
- 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.

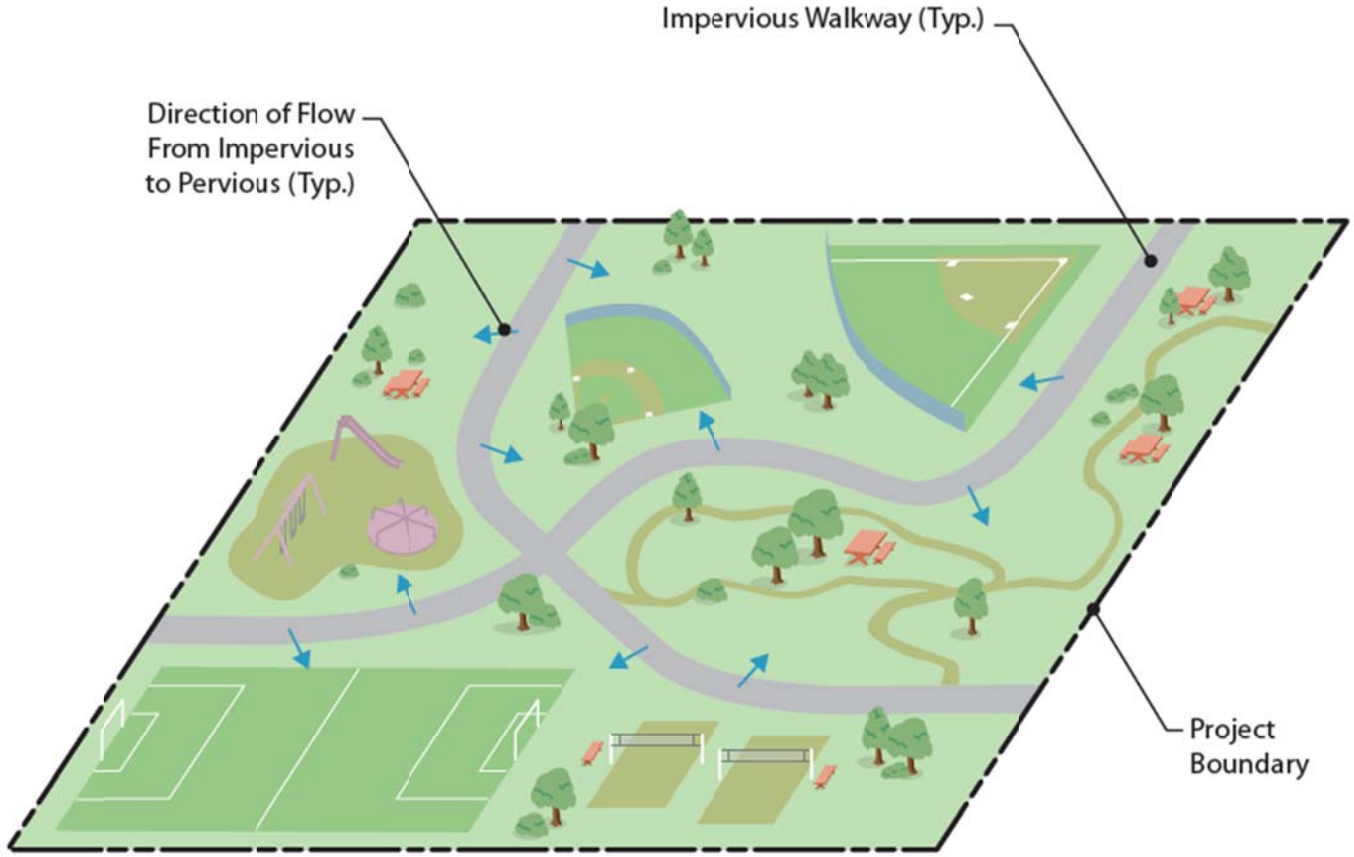


FIGURE 5-4. Self-retaining Site

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 WQTR. 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.3 *(PDP WQTR 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 WQTR. Geotechnical and groundwater investigation report requirements are listed in Appendix C.

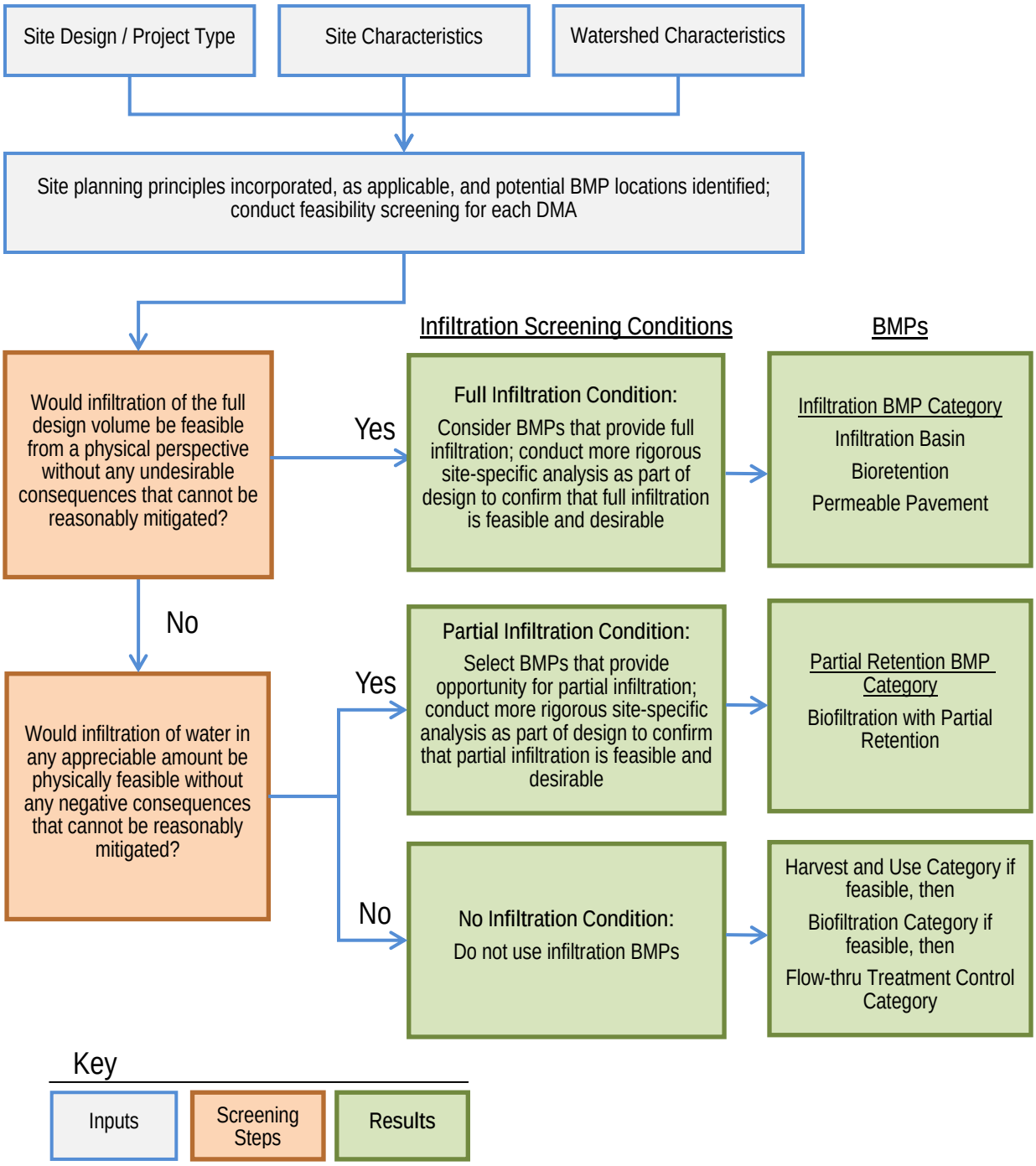


FIGURE 5-5. Infiltration Feasibility and Desirability Screening Flow Chart

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 WQTR.

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

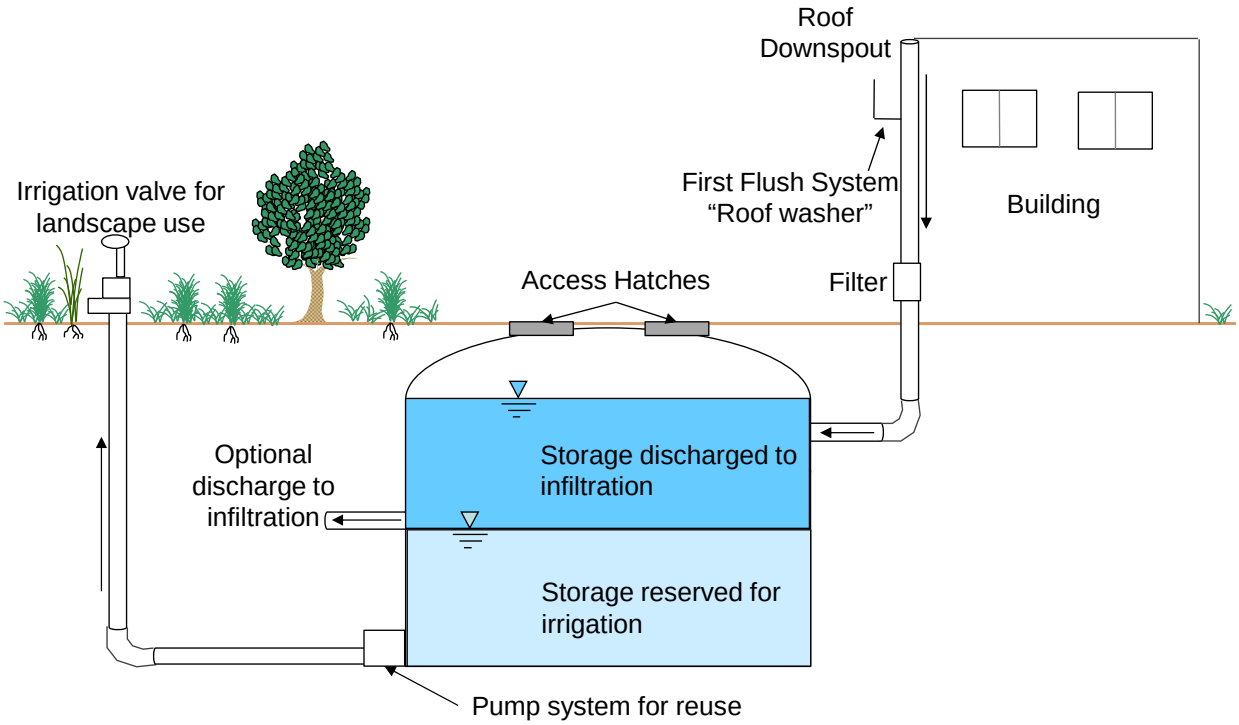


FIGURE 5-6. Schematic of a Typical Cistern

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

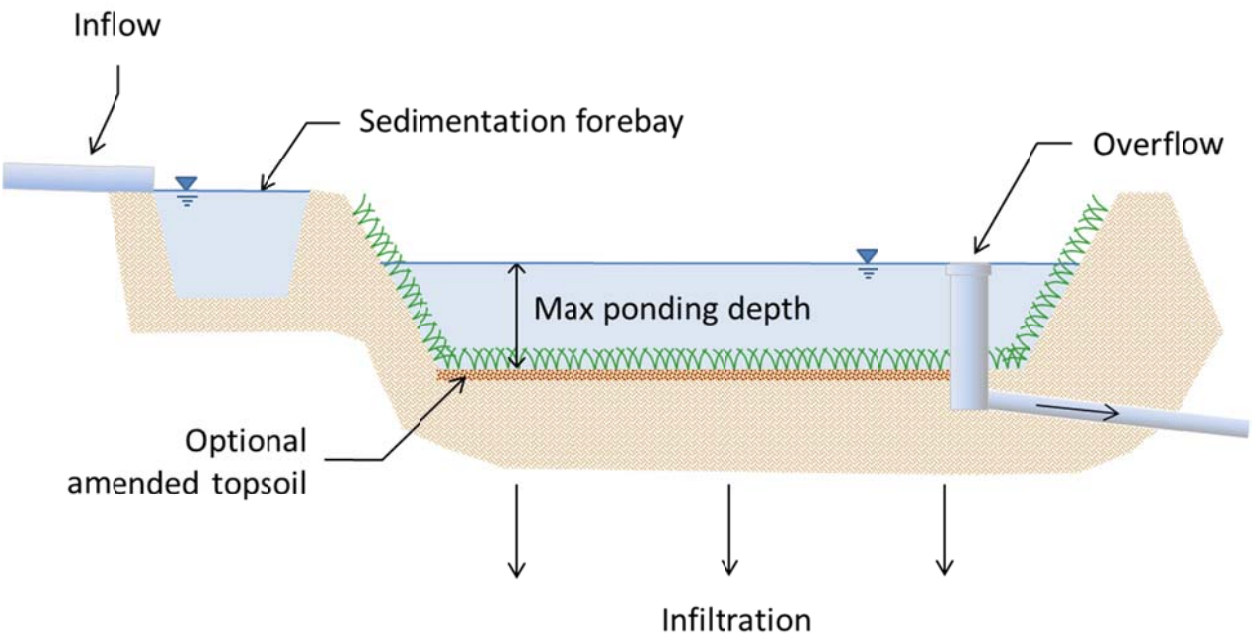


FIGURE 5-7. Schematic of a Typical Infiltration Basin

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, and vegetation.

Selection: Biofiltration with partial retention BMP shall be selected if the project site feasibility analysis performed according to Section 5.4.2 determines a partial infiltration feasibility condition.

Design:

- Appendix B.5 provides guidance for sizing biofiltration with partial retention BMP
- Appendix E provides a fact sheet to design biofiltration with partial retention BMP.

BMP option under this category:

PR-1: Biofiltration with partial retention

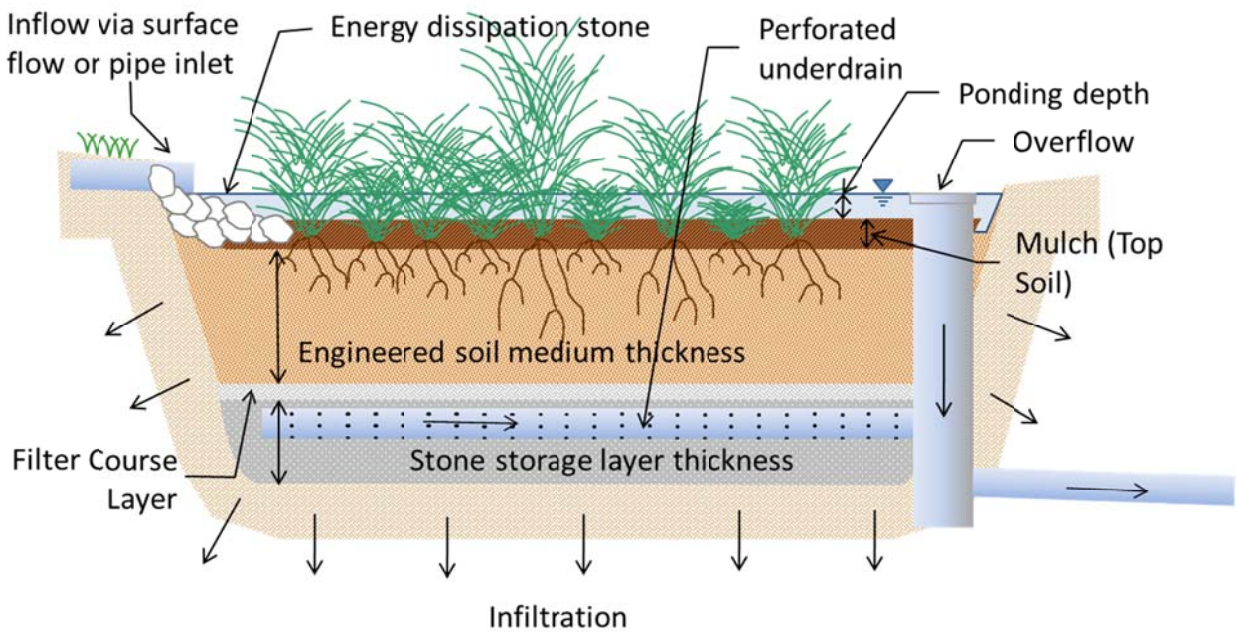


FIGURE 5-8. Schematic of a Typical Biofiltration with Partial Retention BMP

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

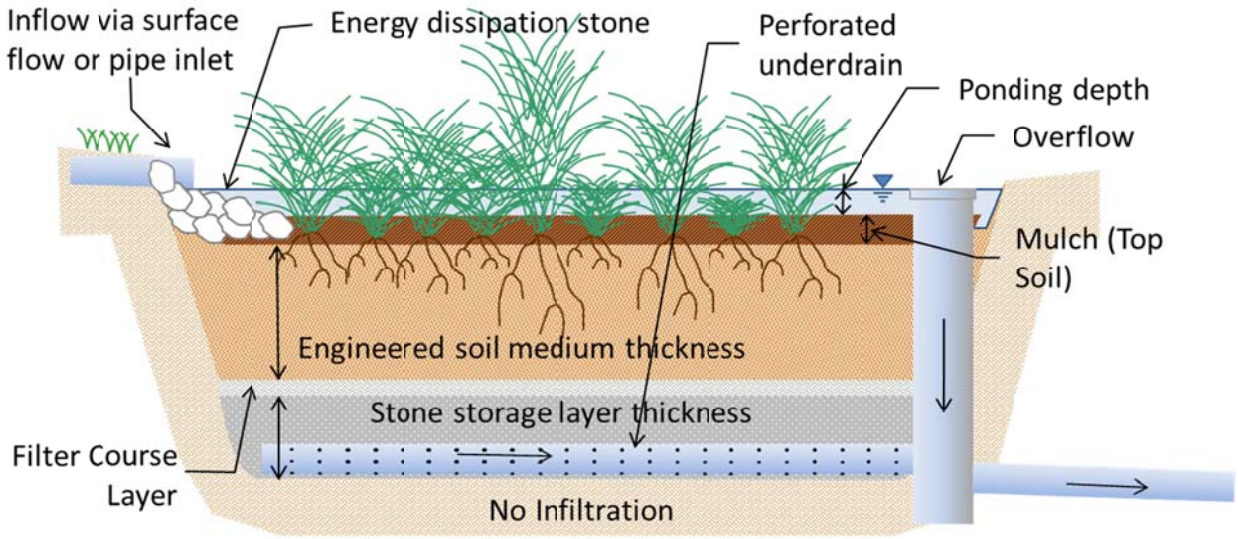


FIGURE 5-9. Schematic of a Typical Biofiltration Basin

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. If a proposed BMP is not accepted by the City Engineer, a written explanation/reason will be provided to the applicant.

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, flow-thru treatment is not an option as the City of Solana Beach does not have an alternative compliance program in place.

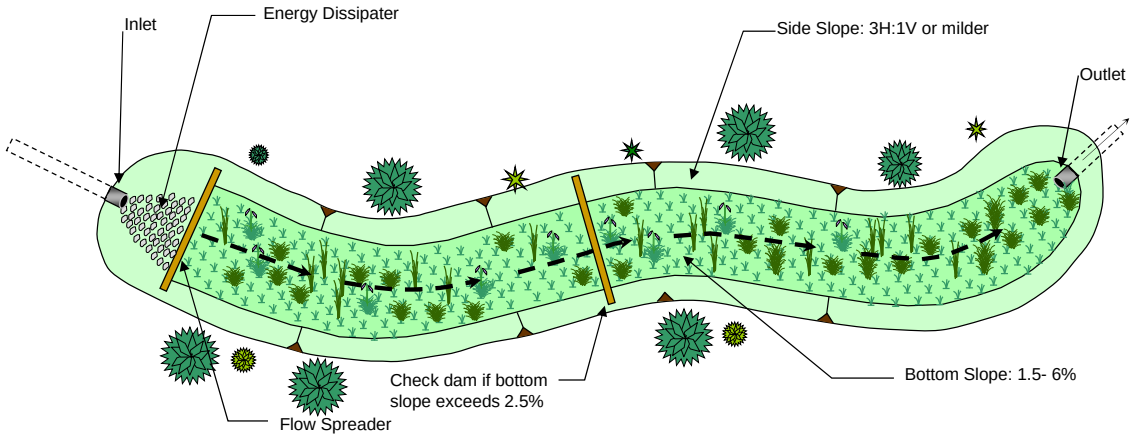


FIGURE 5-10. Schematic of a Vegetated Swale

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 an 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. If a proposed BMP is not accepted by the City Engineer, a written explanation/reason will be provided to the applicant.

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 WQTR. Also refer to Section 6.3.6 for additional guidance.

Chapter

6

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 Dieguito Watershed Management Area Analysis (WMAA) may also apply. Should unique project circumstances require additional context or information beyond that provided in this Manual, then consult the March 2011 Final HMP, which documents the historical development of the hydromodification management requirements.

Guidance for flow control of post-project runoff is based on the *March 2011 Final HMP*, with modifications in this Manual based on updated requirements in the 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 Solana Beach. 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, 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 existing underground storm drains or concrete-lined channels discharging directly to the Pacific Ocean. 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.

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

Exempt water storage reservoirs and lakes in San Diego County are shown in the WMAA for each watershed.

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 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.

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%
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%

GLU	Geology	Land Cover	Slope (%)
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.

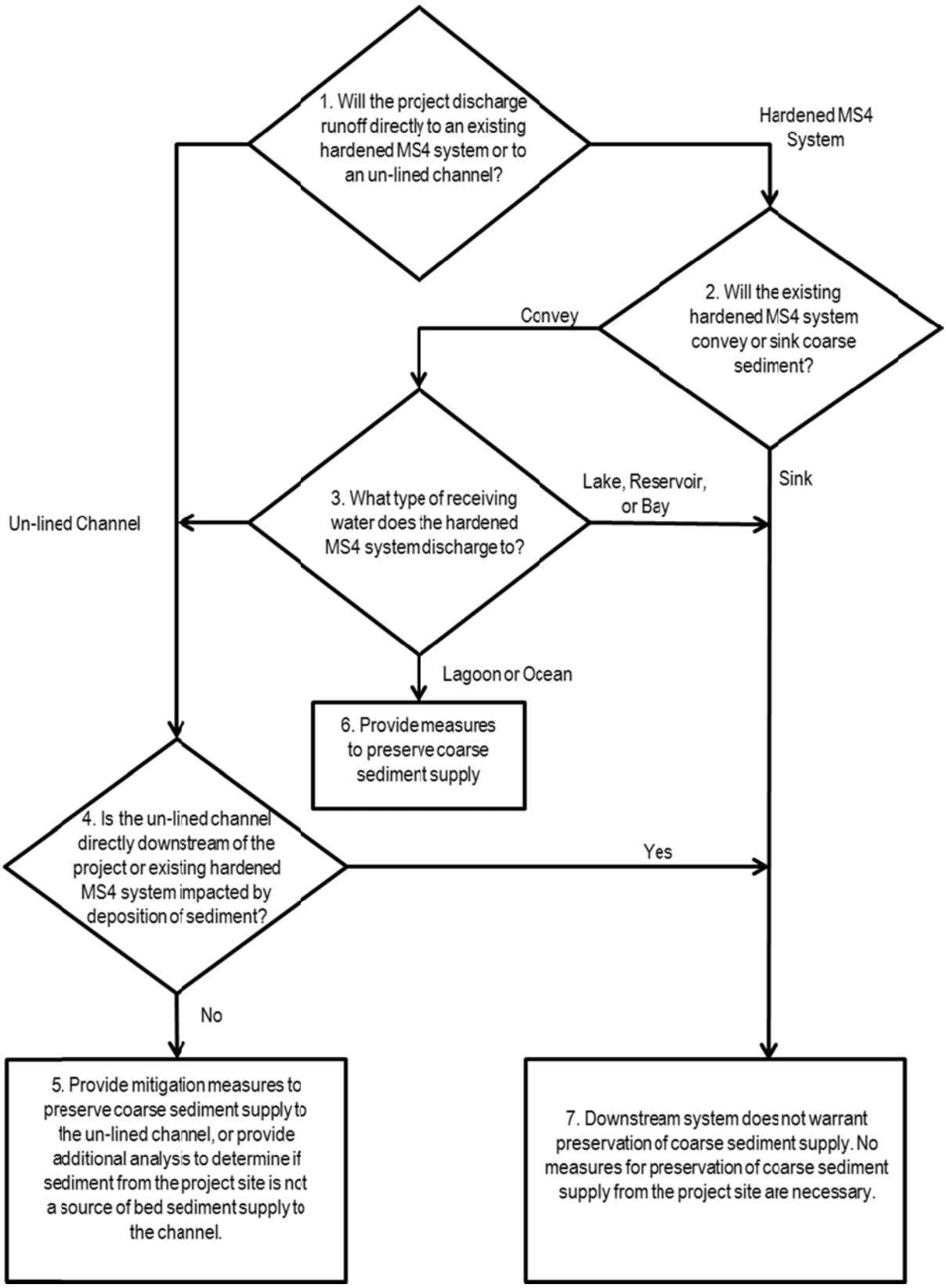


FIGURE 6-1. Evaluation of Downstream Systems Requirements for Preservation of Coarse Sediment Supply

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;
> 3) Sediment transport model of the receiving channel for the PDP baseline condition and proposed condition;
> 4) Analysis of the change in Bed Sediment Supply from the PDP baseline condition to the proposed condition;
> 5) Explanation of method used to control the discharge from the PDP to account for changes in the delivered Bed Sediment Supply; and
> 6) 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:

1) For flow rates ranging from 10 percent, 30 percent or 50 percent of the pre-development 2-year runoff event ($0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-development 10-year runoff event (Q_{10}), the post-project discharge rates and durations must not exceed the pre-development rates and durations by more than 10 percent. The specific lower flow threshold will depend on the erosion susceptibility of the receiving stream for the project site (see Section 6.3.4).

In this context, Q_2 and Q_{10} refer to flow rates determined based on either continuous simulation hydrologic modeling or an approved regression equation. The range from a fraction of Q_2 to Q_{10} represents the range of geomorphically significant flows for hydromodification management in San Diego. The upper bound of the range of flows to control is pre-development Q_{10} for all projects. The lower bound of the range of flows to control, or "lower flow threshold" is a fraction of pre-development Q_2 that is based on the erosion susceptibility of the stream and depends on the specific natural system (stream) that a project will discharge to. Tools have been developed in the *March 2011 Final HMP* for assessing the erosion susceptibility of the stream (see Section 6.3.4 below for further discussion of the lower flow threshold).

When selecting the type of structural BMP to be used for flow control, consider the types of structural BMPs that will be utilized onsite for pollutant control.

Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMPs. For example, a full infiltration BMP that infiltrates the 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:

1. 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 WQTR **or**
2. 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 WQTR. When this option is selected, project approval is at the discretion of the City Engineer.

Appendix B.5.2 provides a methodology to optimize the footprint of the downstream biofiltration BMP that is required to meet the pollutant control performance standard, when there is an upstream hydromodification flow control BMP (e.g. cistern, vault, etc.)

6.3.7 Drawdown Time

The maximum recommended drawdown time for hydromodification management facilities is 96 hours based on Section 6.4.6 of the *March 2011 Final HMP*.

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 WQTR 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.[11]

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.

[11] Currently, the City of Solana Beach does not have an alternative compliance program in place.

Chapter

8

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
4	Interim operation and maintenance of facilities	During and following construction including warranty period

Item	Description	Time Frame
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

Typically, these agreements may provide that the City may collect a management and/or inspection fee established by a standard fee schedule. The agreement may provide that, if the property owner fails to maintain the storm water facility, the City may enter the property, restore the storm water facility to good working order and obtain reimbursement, including administrative costs, from 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 City Engineer will require property owners to provide annual self-certification that inspection and maintenance has been performed, provide details of the program. The City's PDP inventory assigns each PDP site with structural BMPs an inspection results and maintenance activities, and confirm or update the contact information for the party responsible to ensure inspection and maintenance is performed.

Property owners shall grant to the City an easement to enter the property at reasonable times and in a reasonable manner to ensure that the BMP is working properly. This includes the right to enter the property without prior notice once per year for routine inspections, to enter as needed for additional inspections when the City has a reasonable basis to believe that the BMP is not working properly, to enter for any needed follow-up inspections, and to enter when necessary for abatement of a nuisance or correction of a violation of the City's Ordinance.

7.5 Inspection and Maintenance Frequency

How often is a property owner required to inspect and maintain permanent structural BMPs on their property?

Structural BMP maintenance frequency needs are site specific, and maintenance may be required more frequently than annually (such as 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.

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:

1. Locate structural BMPs outside of floodway, floodplain, and other resource agency jurisdictional areas (e.g., stream or creek).
2. Avoid direct connection to a natural surface water body.
3. 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:

1. 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.
2. 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.
3. Above-ground detention basins should include access ramps for trucks to enter the basin to bring equipment and to remove materials.
4. 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.
5. 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.
    a. 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.
6. 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.
7. All manhole access points to underground structural BMPs must include a ladder or steps.

Measures to facilitate inspection of the structural BMP

1. Structural BMPs shall include inspection ports, cleanouts, or manholes for observing all underground components that require inspection and maintenance. This includes perforated pipe within a structural BMP.
2. 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 will help determine the volume and depth of material in the BMP.
3. 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.
4. 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.
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.

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
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 "vegetated infiltration or filtration BMPs" or "non-vegetated infiltration BMPs" above). Applicable Fact Sheets may include HU-1 (cistern) or FT-4 (extended detention basin). There are many possible configurations of above ground and underground detention BMPs, including both proprietary and non-proprietary systems. The project civil engineer is responsible for determining which maintenance indicators and actions shown 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.

Typical Maintenance Indicator(s) for Detention Basins	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 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.

8 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 "WQTR." 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 WQTR

For Standard Projects, the project submittal shall include a "Standard Project WQTR."

The Standard Project WQTR 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 WQTR shall be shown on site plans and landscaping plans. The Standard Project WQTR template is included in Appendix A.2 of this manual *(WQTR Submittal Templates)*:

The Standard Project WQTR 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 WQTR

For PDPs, the project submittal shall include a "PDP WQTR."

The PDP WQTR 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 WQTR template provided in Appendix A.3 *(WQTR Submittal Templates)*.

The PDP WQTR 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 WQTR shall be shown on site plans and landscaping plans. The PDP WQTR shall consist of the following forms and/or checklists included in Appendix A.3 of this manual:

- PDP Form 1: Checklist for New Development and Redevelopment
- PDP Form 2: Site Information for PDPs
- PDP Form 3: Source Control BMP Checklist
- PDP Form 4: Site Design BMP Checklist
- PDP Form 5: Summary of PDP Structural BMPs
- PDP Form 6: Projected Storm Water BMP Maintenance Mechanism

The PDP WQTR shall also include copies of the relevant plan sheets showing source control and site design BMPs, as well as identify drainage management areas (DMAs).

Maintenance of BMPs

PDP Form 6, Projected Storm Water BMP Maintenance Mechanism, must identify the following:

- How to access the structural BMP to inspect and perform maintenance;
- Features that are provided to facilitate inspection (e.g. manholes, observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds);
- Manufacturer and part number for proprietary parts;
- Maintenance thresholds specific to the structural BMP, with a location-specific frame of reference (e.g. level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP);
- Recommended equipment to perform maintenance; and
- When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management.

A PDP WQTR 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* WQTR *must be provided with each submittal of revised project plans*. The updated PDP WQTR should 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 WQTR provides O&M requirements for structural BMPs.

8.2.2 Requirements for Construction Plans

8.2.2.1 BMP Identification and Display on Construction Plans

To verify that permanent post-construction BMPs are constructed per the requirements of approved WQTRs, approved BMPs are incorporated onto separate and distinct construction drawings including mass grading plans, finish grading plans, building plans, improvement plans and landscape plans. Plan sets may be reviewed by City Staff and be inspected during construction by different construction inspectors over extended periods of time. For post-construction BMP verification of LID and other structural permanent BMPs, the City requires a single plan BMP sheet as part of the WQTR. See Section 8.2.3.2 for further details regarding required BMP sheets.

8.2.2.2 Structural BMP Maintenance Information on Construction Plans

Plans for construction of the project must provide sufficient information to describe maintenance requirements (thresholds and actions) for structural post-construction BMPs such that in the event all other separate O&M documents were lost, a new party studying plans for the project could identify the structural post-construction BMPs and identify the required maintenance actions based on the plans.

For the purpose of long term O&M, the project plans must identify the following:

- How to access the structural post-construction BMP to inspect and perform maintenance;

Plans for construction of the project (grading plans, improvement plans, and landscaping plans, as applicable) must show all permanent site design, source control, and structural BMPs, and must be congruent with the PDP WQTR.

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.).
- 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 Solana Beach."*

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 prior to 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 WQTR 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

To verify that all permanent post-construction BMPs for a particular project have been installed, the City requires the submittal of a single plan BMP sheet attached to each construction drawing as part of the WQTR. The BMP sheet shall include a site plan of the project detailing the location of each required LID site design, source control, and structural BMP. Additionally, the plan shall contain a matrix listing of the required BMPs cross referenced with a list of the specific construction drawings where the specific BMP construction is detailed.

At the end of project construction, before occupancy permits are granted or construction securities are returned, a City inspector will conduct a final inspection of the site using the single plan BMP

sheet to verify installation of all required BMPs for the project.

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 Solana Beach 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

9 Bibliography

ASTM International. 2009. ASTM Standard D3385-09. Retrieved from http://www.astm.org/Standards/D3385.htm

Breuer, L., Eckhardt, K, and Frede, H. 2003. Plant Parameter Values for Models in Temperate Climates. Ecological Modelling. 169:237-293. November.

California Department of Water Resources. 1947. Evaporation from Water Surfaces in California, A Summary of Pan Records and Coefficients, 1881 to 1946. Bulletin No. 54. California State Printing Office.

California Department of Water Resources. 2012. California Irrigation Management Information System Reference Evapotranspiration Zones.

Caltrans. 1986. Method for Determining the Percolation Rate of Soil Using a 6-inch-diameter Test Hole. California Test 750. http://www.dot.ca.gov/hq/esc/sdsee/wwe/documents/Test_750.pdf

Cedergren, H.R. 1997. Seepage, drainage, and flow nets, third ed. John Wiley and Sons, Inc., New York.

Cities and County of Riverside. 2012. Water Quality Management Plan for the Santa Margarita Region of Riverside County.

City of Los Angeles. 2011. Development Best Management Practices Handbook. Low Impact Development Manual.

City of Portland. 2008. Storm water Management Manual.

City of San Diego. 2011. Guidelines for Geotechnical Reports.

City of San Diego. 2011. San Diego Low Impact Development Design Manual.

City of San Diego. 2012. Storm Water Standards.

City of Santa Barbara. 2013. Storm Water BMP Guidance Manual.

City of Solana Beach. 2015. Jurisdictional Runoff Management Plan (JRMP).

City of Solana Beach Municipal Code. 2014. Chapter 13.10: Storm Water Management.

City of Solana Beach. 2008. Standard Urban Storm Water Mitigation Plan (SUSMP).

Clear Creek Solutions, Inc. 2012. San Diego Hydrology Model User Manual.

County of Los Angeles Department of Public Works. 2014. Low Impact Development, Standards Manual.

County of Orange. 2011. Model Water Quality Management Plan (Model WQMP).

County of Orange. 2011. Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs).

County of San Bernardino. 1992. Suitability of Lots and Soils for Use of Leachlines or Seepage Pits, Soil Percolation (PERC) Test Report Standards, Onsite Waste Water Disposal System, August 1992.

County of San Diego. 2007. Low Impact Development Handbook: Stormwater Management Strategies.

County of San Diego. 2011. Final Hydromodification Management Plan.

County of San Diego. 2012. County of San Diego SUSMP: Standard Urban Stormwater Mitigation Plan Requirements for Development Applications.

County of San Diego. 2014. Low Impact Development Handbook: Stormwater Management Strategies.

County of San Diego. 2003. Stormwater Standards Manual.

County of Ventura. 2011. Ventura County Technical Guidance Manual for Stormwater Quality Control Measures.

Darcy, H, 1856. Les fontaines publiques de la Ville de Dijon (The public fountains of the City of Dijon). Trans. Patricia Bobeck. Paris: Dalmont. (Kendall/Hunt, 2004) 506 p.

Double Ring Infiltrometer Test (ASTM 3385)-ASTM International. 2009.

Emerson, C. 2008. Evaluation of Infiltration Practices as a Means to Control Stormwater Runoff. Civil and Environmental Engineering. Villanova University.

Emerson, C.H. 2008. Evaluation of Infiltration Practices as a Means to Control Stormwater Runoff. Doctoral dissertation, Villanova University. May 2008.

Galli, J. 1992. Analysis of urban stormwater BMP performance and longevity in Prince George's County, Maryland. Metropolitan Washington Council of Governments, Washington, D.C.

Gobel, P. et al. 2004. Near-Natural Stormwater Management and its Effects on the Water Budget and Groundwater Surface in Urban Areas Taking Account of the Hydrogeological Conditions. Journal of Hydrology 299, 267-283.

Gulliver, J., Erickson, A., and Weiss, P. 2010. Optimizing Stormwater Treatment Practices: A Handbook of Assessment and Maintenance.

Hazen, A. 1892. Some Physical Properties of Sands And Gravels, With Special Reference To Their Use In Filtration. 24th Annual Rep., Massachusetts State Board of Health, Pub. Doc. No. 34, 539-556.

Hazen, A. 1911. Discussion of Dams On Sand Foundations' by A.C. Koenig. Trans. Am. Soc. Civ. Eng., 73, 199-203.

Hazen, A., 1892. Some Physical Properties of Sands and Gravels, With Special Reference to their Use in Filtration. 24th Annual Rep., Massachusetts State Board of Health, Pub. Doc. No. 34, 539-556.

Hazen, A., 1911. Discussion of Dams on Sand Foundations' by A.C. Koenig. Trans. Am. Soc. Civ. Eng., 73, 199-203.

King County Department of Natural Resources and Parks. 2009. King County, Washington Surface Water Design Manual. Retrieved from http://your.kingcounty.gov/dnrp/library/water-and-land/stormwater/surface-water-design-manual/SWDM-2009.pdf

Lindsey, G., L. Roberts, and W. Page. 1991. Storm Water Management Infiltration. Maryland Department of the Environment, Sediment and Storm Water Administration.

Lindsey, P. and Bassuk, N. 1991. Specifying Soil Volumes to Meet the Water Needs of Mature Urban Street Trees and Trees in Containers. Journal of Arboriculture 17(6): 141-149.

Minnesota Pollution Control Agency (MPCA). (n.d.). Minnesota Stormwater Manual. Retrieved October 2014 from: http://stormwater.pca.state.mn.us/index.php/Calculating_credits_for_tree_trenches_and_tree_boxes

Orange County Watersheds Protection Program. 2011. Project-Specific Alternatives to the Interim Sizing Tool.

Philips C. and W. Kitch 2011. A review of methods for characterization of site infiltration with design recommendations. California State Polytechnic University-Pomona. http://www.csupomona.edu/~wakitch/arts/Philips_&_Kitch_2011.pdf

Phillips, E., and Kitch, W. 2011. A Review of Methods for Characterization of Site Infiltration with Design Recommendations. Journal of the Nevada Water Resources Association, Summer 2011, Vol. 6, No. 1, pp. 29-46.

Pitt, R., Chen, S., Clark, S., Lantrip, J., and C. Ong. 2008. Compaction's Impacts on Urban Stormwater Infiltration, J. Irr. and Drainage Eng., January 2008.

Pitt, R., Chen, S., Clark, S., Swenson, J., and Ong, C. 2008. "Compaction's Impacts on Urban Storm-Water Infiltration." J. Irrig. Drain Eng. 134, SPECIAL ISSUE: Urban Storm-Water Management, 652–658.

Riverside County. 2011. Riverside County - Low Impact Development BMP Design Handbook – Appendix A – Infiltration Testing http://rcflood.org/downloads/NPDES/Documents/LIDManual/Appendix%20A_Infiltration_Testing.pdf

Riverside County Copermittees. 2014. Santa Margarita Region Hydromodification Management Plan.

Riverside County Flood Control and Water Conservation District. 2011. Design Handbook for Low

Impact Development Best Management Practices.

Riverside County Percolation Test (2011), California Test 750 (1986), San Bernardino County Percolation Test (1992); USEPA Falling Head Test (1980).

Rossman, Lewis A. 2010. Storm Water Management Model User's Manual Version 5.0. EPA/600/R-05/040.

San Diego County Copermittees. 2002. Model Standard Urban Storm Water Mitigation Plan for San Diego County, Port of San Diego, and Cities in San Diego County.

San Diego County Copermittees, 2011. Countywide Model SUSMP.

San Diego County Copermittees. 2012. San Diego BMP Sizing Calculator Methodology.

San Diego County Copermittees. 2014. San Diego County Regional Watershed Management Area Analysis.

San Diego County Copermittees. 2008. Countywide Model SUSMP.

San Diego Water Quality Control Board. 2015. Order No. R9-2013-0001, as Amended by Order Nos. R9-2015-0001 and R9-2015-0100. NPDES No. CAS0109266.

SCCWRP. 2010. Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility. Brian P. Bledsoe; Robert J. Hawley; Eric D. Stein; Derek B. Booth. Technical Report 606.

SCCWRP. 2012. Hydromodification Assessment and Management in California. Eric D. Stein; Felicia Federico; Derek B. Booth; Brian P. Bledsoe; Chris Bowles; Zan Rubin; G. Mathias Kondolf and Ashmita Sengupta. Technical Report 667.

Schwab, G., Fangmeier, D., Elliot, W., and Frevert, R. 1993. Soil and Water Conservation Engineering. Fourth Edition. John Wiley & Sons, Inc.

Scurlock, J., Asner, G., and Gower, S. 2001. Global Leaf Area Index from Field Measurements, 1932-2000. Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/584.

U.S. Department of the Interior, Bureau of Reclamation. 1990. "Procedure for Performing Field Permeability Testing by the Well Permeameter Method (USBR 7300-89)" in Earth Manual, Part 2. Materials Engineering Branch Research and Laboratory Services Division, Denver, Colorado.

U.S. Department of the Interior, Bureau of Reclamation. 1993. Drainage Manual: A Water Resources Technical Publication. Retrieved from http://www.usbr.gov/pmts/wquality_land/DrainMan.pdf

United States Environmental Protection Agency. 2000. BASINS Technical Note 6 – Estimating Hydrology and Hydraulic Parameters for HSPF. EPA-823-R00-012.

Urban Drainage and Flood Control District, Denver, CO. (2010). Urban Storm Drainage Criteria Manual. Volume 3, Best Management Practices.

US Department of Interior Bureau of Reclamation. 1993. Drainage Design Manual.

USEPA. 1980. Onsite Wastewater Treatment and Disposal Systems (EPA No. 625/1-80-012). Retrieved from nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=300043XO.txt

USEPA. 1999. Preliminary data summary of urban storm water best management practices. EPA-821-R-99-012, U. S. Environmental Protection Agency, Washington, D.C.

Washington Department of Ecology. 2012. Stormwater Management Manual for Western Washington.

Washington State Department of Ecology. 2012. Stormwater Management Manual for Western Washington - Volume 3: Hydrologic Analysis and Flow Control BMPs. Retrieved from https://fortress.wa.gov/ecy/publications/summarypages/1210030.html