

City of Lemon Grove

**Best Management Practices (BMP)
Design Manual**

February 2016



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Summary

In May 2013, the California Regional Water Quality Control Board, San Diego Region (RWQCB) reissued a municipal stormwater National Pollutant Discharge Elimination System permit (Municipal Separate Storm Sewer System [MS4] Permit) that covered its region. The jurisdictions subject to the MS4 Permit include municipal agencies in San Diego, Orange, and Riverside counties, including the City of Lemon Grove (collectively, “Copermittees”). The MS4 Permit reissuance to the San Diego County Copermittees went into effect in 2013 (Order No. R9-2013-0001).

The reissued MS4 Permit updates and expands stormwater requirements for new developments and redevelopments. In February 2015, the MS4 Permit was amended by Order R9-2015-0001. As required by the reissued MS4 Permit, the Copermittees prepared the *Model BMP Design Manual San Diego Region for Permanent Site Design, Stormwater Treatment, and Hydromodification Management* (Model BMP Design Manual) (from hereafter referred to as “Model BMP Design Manual”) to replace the current Countywide Model Standard Urban Stormwater Mitigation Plan (SUSMP), dated March 25, 2011, which was based on the requirements of the 2007 MS4 Permit. The Model BMP Design Manual was submitted to the RWQCB on behalf of the Copermittees, including the City of Lemon Grove (City), in June 2015.

This City of Lemon Grove BMP Design Manual (from hereafter referred to as “BMP Design Manual” or “manual”) is based on the Model BMP Design Manual, with edits to clarify local practices and procedures that apply in the City. The City has also adopted an updated Post-Construction BMP Design Standards Ordinance, Chapter 8.52 of the Lemon Grove Municipal Code, to provide legal authority for the implementation of the requirements described in the Lemon Grove BMP Design Manual.

Throughout this manual, new or revised text present in the Lemon Grove BMP Design Manual not present in the Model BMP Design Manual is identified via **gray** highlight. Longer discussions of local practices and procedures are shown in gray-highlighted boxes like the one below.

Gray boxes, like this one, contain extended discussions of local practices and procedures or other City of Lemon Grove-specific guidance.

What this Manual is intended to address:

This Manual addresses updated onsite post-construction stormwater requirements for Standard Projects and Priority Development Projects (PDPs), and provides updated procedures for planning, preliminary design, selection, and design of permanent stormwater 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 Stormwater Quality Management Plans (SWQMPs) and City personnel responsible for review of these plans.

The following are significant updates to stormwater requirements of the MS4 Permit compared to the 2007 MS4 Permit and 2011 Countywide Model SUSMP:

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- 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 stormwater pollutant control (also known as treatment control) is retention of the 24-hour 85th percentile storm volume, defined as the event that has a precipitation total greater than or equal to 85 percent of all daily storm events larger than 0.01 inches over a given period of record in a specific area or location.
- For situations where onsite retention of the 85th percentile storm volume is technically not feasible, biofiltration must be provided to satisfy specific “biofiltration standards.” These standards consist of a set of siting, selection, sizing, design and operation and maintenance (O&M) criteria that must be met for a BMP to be considered a “biofiltration BMP” – see Section 2.2.1 and Appendix F.
- Exemptions from hydromodification management are reduced, and certain categories of exemptions that are not identified in the MS4 Permit must be identified in a Watershed Management Area Analysis (WMAA).
- The flow control performance standard for hydromodification management is based on controlling flow to pre-development condition (natural) rather than pre-project condition. This change result affects redevelopment projects, for which the existing (pre-project) condition is developed rather than natural.
- Hydromodification management requirements are expanded to include requirements to protect critical coarse sediment yield areas.
- Alternative compliance approaches are provided as an option to satisfy pollutant control or hydromodification management performance standards in some cases.

What this manual does not address:

This manual provides guidelines for compliance with onsite post-construction stormwater requirements in the MS4 Permit, which apply to both private and public projects. This manual also indicates the conditions under which project applicants, public or private, can seek to participate in alternative compliance. Crediting systems for alternative compliance approaches have not yet been developed on a regional basis, and contributing in-lieu fees or other payments and through use of alternative compliance projects implemented after the completion of a development project are not available as alternative compliance approaches at this time. Additionally, this manual addresses only post-construction stormwater requirements and is not intended to serve as a guidance or criteria document for construction-phase stormwater controls.

Disclaimer

Currently, some of the Copermittees are pursuing a subvention of funds from the State to pay for certain activities required by the 2007 Municipal Permit, including activities that require Copermittees to perform activities outside their jurisdictional boundaries and on a regional or watershed basis. Nothing in this manual should be viewed as a waiver of those claims or as a waiver of the rights of Copermittees to pursue a subvention of funds from the State to pay for certain activities required by the MS4 Permit, including the preparation and implementation of the BMP Design Manual. In addition, several Copermittees have filed petitions with the State Board challenging some of the requirements of Provision E of the MS4 Permit. Nothing in this manual

should be viewed as a waiver of those claims. Because the State Board has not issued a stay of the 2013 Municipal Permit, Copermittees must comply with the MS4 Permit's requirements while the State Board process is pending.

This manual is organized in the following manner:

An introductory section titled **“How to Use this Manual”** provides a practical orientation to intended uses and provides examples of recommended workflows for using the manual.

Chapter 1 provides information to help the manual user determine which of the stormwater management requirements are applicable to the project; source controls/site design, pollutant controls, and hydromodification management. This chapter also introduces the procedural requirements for preparation, review, and approval of project submittals. City requirements for processing project submittals are also described in this chapter.

Chapter 2 defines the performance standards for source control and site design BMPs, stormwater 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 stormwater 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 stormwater requirements. This chapter is intended to be used by both Standard Projects and PDPs; however, certain steps will not apply to Standard Projects (as identified in the chapter).

Chapter 4 presents the source control and site design requirements to be met by all development projects and is therefore intended to be used by Standard Projects and PDPs.

Chapter 5 applies to PDPs. It presents the specific process for determining which category of onsite pollutant control BMP, or combination of BMPs, is most appropriate for the PDP site and how to design the BMP to meet the stormwater pollutant control performance standard. The prioritization order of onsite pollutant control BMPs begins with retention, then biofiltration, and finally flow-thru treatment control. Flow-thru treatment control is **only** allowable in combination with an alternative compliance approach. 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

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Permit. This chapter is applicable to Standard Projects and PDPs. This chapter pertains specifically to the content of project submittals, and not to specific details of jurisdictional requirements for processing of submittals; it is intended to complement the requirements for processing of project submittals that are included in Chapter 1.

Appendices to this manual provide detailed guidance for BMP design, calculation procedures, worksheets, maps and other figures to be referenced for BMP design. These Appendices are not intended to be used independently from the overall manual – rather they are intended to be used only as referenced in the main body of the manual.

This manual is organized based on project category. Requirements that are applicable to both Standard Projects and PDPs are presented in Chapter 4. Additional requirements applicable only to PDPs are presented in Chapters 5 through 7. While source control and site design BMPs are required for both Standard Projects and PDPs, structural BMPs are only required for PDPs. Throughout this manual, the term "structural BMP" is a general term that encompasses the pollutant control BMPs and hydromodification management BMPs required for PDPs under the MS4 Permit. Structural BMPs are referred to as "structural post-construction BMPs" in the Lemon Grove Municipal Code, but are generally simply called "structural BMPs" in this manual for brevity. A structural BMP may be a pollutant control BMP, a hydromodification management BMP, or an integrated pollutant control and hydromodification management BMP. Both pollutant control BMPs and integrated pollutant control and hydromodification management BMPs may also be referred to as "treatment control BMPs." Hydromodification management BMPs are also referred to as flow control BMPs in this manual.

**Chronology of Stormwater Regulations
and San Diego Region Model Guidance Documents**

Date	Document	Notes
July 16, 1990	MS4 Permit	The RWQCB issued general stormwater requirements to all jurisdictions within the County of San Diego via the MS4 Permit
February 21, 2001	MS4 Permit	Land Development SUSMP requirements were written into the MS4 Permit during permit reissuance
February 14, 2002	Model SUSMP	Countywide model guidance document was issued for implementation of the 2001 MS4 Permit requirements
January 24, 2007	MS4 Permit	LID and HMP requirements were written into the MS4 Permit during reissuance
July 24, 2008	Model SUSMP	Countywide model guidance document for implementation of the 2007 MS4 Permit requirements, including interim HMP criteria, was prepared
March 2011	Final HMP	Final HMP addresses HMP requirements of the 2007 MS4 Permit
March 25, 2011	Model SUSMP	Countywide model guidance document for implementation of the 2007 MS4 Permit requirements, including final HMP, was completed
May 8, 2013	MS4 Permit	Stormwater retention requirements and requirements for protection of critical coarse sediment yield were written into the MS4 Permit during reissuance
February 11, 2015	MS4 Permit	Amends 2013 MS4 permit and provides clarification on water quality equivalency and provides other technical revisions.
June 27, 2015	Model BMP Design Manual	Countywide model guidance document for implementation of the MS4 Permit requirements "Model BMP Design Manual" updates former "Model SUSMP"
November 17, 2015	Lemon Grove Municipal Code Chapter 8.52	Lemon Grove Municipal Code Chapter 8.52, Post-Construction BMP Standardards, had its second reading and was adopted by the City Council.
February 2, 2016	Lemon Grove BMP Design Manual	Lemon Grove BMP Design Manual approved by City Council as an implementing resolution.

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List of Acronyms

303(d)	Clean Water Act Section 303(d) List of Water Quality Limited Segments
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-thru Treatment Control BMP (BMP Category)
GLUs	Geomorphic Landscape Units
GR	General Requirements
HMP	Hydromodification Management Plan
HOA	Homeowners' Association
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)
RWQCB	California Regional Water Quality Control Board, San Diego Region
SC	Source Control
SCCWRP	Southern California Coastal Water Research Project
SD	Site Design
SDHM	San Diego Hydrology Model
SIC	Standard Industrial Classification
SUSMP	Standard Urban Stormwater Mitigation Plan
SWFMA	Stormwater Facilities Maintenance Agreement
SWMM	Stormwater Management Model
SWQMP	Stormwater Quality Management Plan
TN	Total Nitrogen
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WMA	Watershed Management Area

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WMAA Watershed Management Area Analysis
WQIP Water Quality Improvement Plan

How to Use this Manual

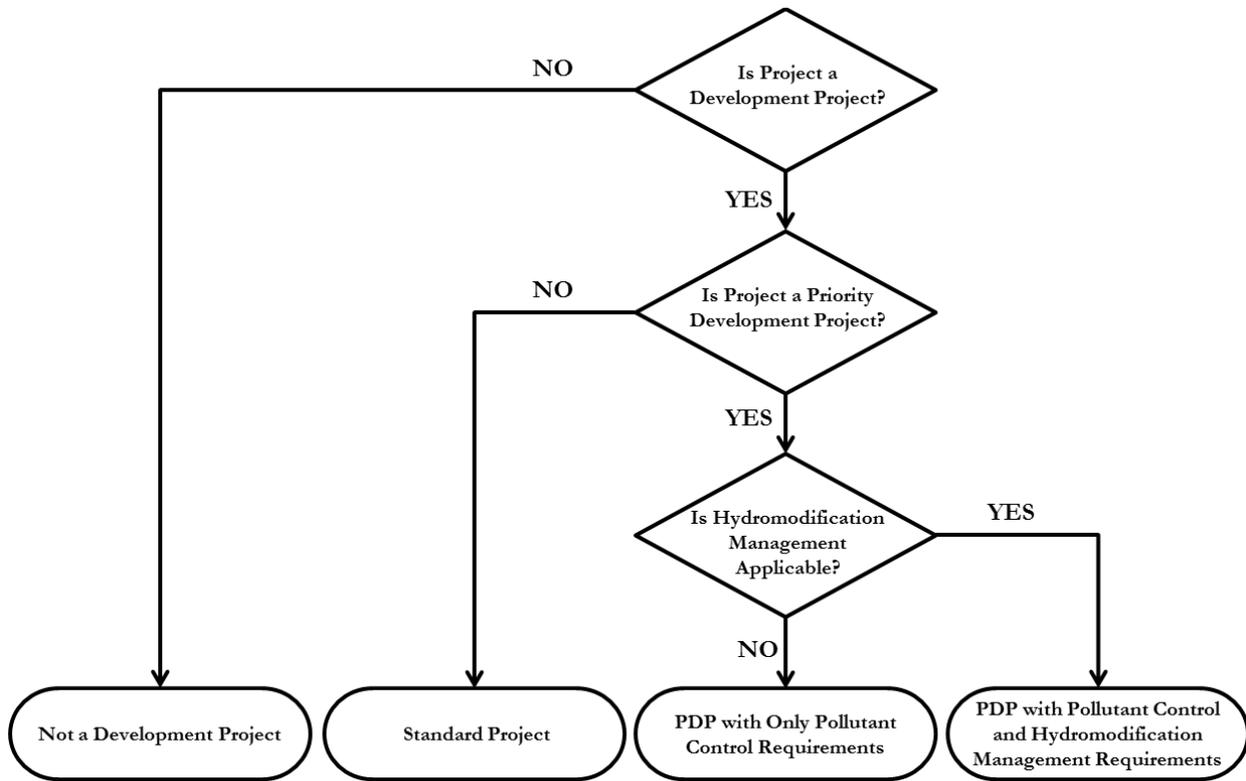
This manual is intended to help a project applicant, in coordination with the City of Lemon Grove Stormwater Division staff, develop a post-construction BMP plan for a development project (public or private) that complies with local and MS4 Permit requirements. Post-construction BMP plans may be referred to as Water Quality Technical Reports (WQTRs), Water Quality Management Plans (WQMPs), Stormwater Management Plans (SWMPs), and Stormwater Quality Management Plan (SWQMPs). Throughout this document the term SWQMP will be used to refer to post-construction BMP plans. Most applicants will require the assistance of a qualified civil engineer, architect, and/or landscape architect to prepare a SWQMP. The applicant should begin by checking specific requirements with City of Lemon Grove staff, because every project is different.

Beginning Steps for All Projects: What requirements apply?

To use this manual, start by reviewing **Chapter 1** to determine whether your project is a “Standard Project” or a “PDP” (refer also to local requirements) and which stormwater quality requirements apply to your project.

Not all of the requirements and processes described in this manual apply to all projects. Therefore, it is important to begin with a careful analysis of which requirements apply. Chapter 1 also provides an overview of the process of planning, design, construction, operation, and maintenance, with associated City review and approval steps, leading to compliance. A flow chart that shows how to categorize a project in terms of applicable post-construction stormwater requirements is included below. The flow chart is followed by a table that lists the applicable section of this manual for each project type.

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Project Type	Applicable Requirements		
	Source Control and Site Design (Chapter 4)	Stormwater Pollutant Control BMPs (Chapter 5)	Hydromodification Management BMPs (Chapter 6)
Not a Development Project (without impact to stormwater quality or quantity – e.g. interior remodels, routine maintenance; Refer to Section 1.3)	Requirements in this manual do not apply		
Standard Projects	X		
PDPs with only Pollutant Control Requirements	X	X	
PDPs with Pollutant Control and Hydromodification Management Requirements	X	X	X

Once an applicant has determined which requirements apply, **Chapter 2** describes the specific performance standards associated with each requirement. For example, an applicant may learn from

Chapter 1 that the project must meet stormwater pollutant control requirements. Chapter 2 describes what these requirements entail. This chapter also provides background on key stormwater concepts to help understand why these requirements are in place and how they can be met. Refer to the list of acronyms and glossary as guidance to understanding the meaning of key terms within the context of this manual.

Next Steps for All Projects: How should an applicant approach a project stormwater management design?

Most projects will then proceed to **Chapter 3** to follow the step-by-step guidance to prepare a stormwater project submittal for the site. This chapter does not specify any regulatory criteria beyond those already specified in Chapter 1 and 2 – rather it is intended to serve as a resource for project applicants to help navigate the task of developing a compliant stormwater project submittal. Note that the first steps in Chapter 3 apply to both Standard Projects and PDPs; while other steps in Chapter 3 only apply to PDPs.

The use of a step-by-step approach is highly recommended because it helps ensure that the right information is collected, analyzed, and incorporated in to project plans and submittal at the appropriate time in the City’s review process. It also helps facilitate a common framework for discussion between the applicant and the reviewer. However, each project is different and it may be appropriate to use a different approach as long as the applicant demonstrates compliance with the MS4 Permit requirements that apply to the project.

Final Steps in Using This Manual: How should an applicant design BMPs and prepare documents for compliance?

Standard Projects	PDPs
<p>Standard Projects will proceed to Chapter 4 for guidance on implementing source control and site design requirements.</p> <p>After Chapter 4, Standard Projects will proceed to Chapter 8 for project submittal requirements.</p>	<p>PDPs will also proceed to Chapter 4 for guidance on implementing source control and site design requirements.</p> <p>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.</p>

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 stormwater compliance.

- Not planning for compliance early enough. The strategy for stormwater quality compliance should be considered before completing a conceptual site design or sketching a layout of

project site or subdivision lots (see Chapter 3). Planning early is crucial under current requirements compared to previous requirements; for example, LID/site design is required for all development projects and onsite retention of stormwater 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 stormwater treatment facilities will be adequate for compliance and/or relying on strategies acceptable under previous MS4 Permits may not be sufficient to meet compliance. Under the MS4 Permit, the standard for pollutant control for PDPs is **retention of the 85th percentile storm volume** (see Chapter 5). Flow-thru treatment cannot be used to satisfy permit requirements unless the project also participates in an alternate compliance program. Under some conditions, certain proprietary BMPs may be classified as “biofiltration” according to Appendix F of this manual and can be used for primary compliance with stormwater 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 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).

Policies and Procedural Requirements

This chapter introduces stormwater management policies and is intended to help categorize a project and determine the applicable stormwater 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 Stormwater Management Policies

MS4 Permit Provision E.3.a-c; E.3.d.(1)

Stormwater management requirements for development projects are derived from the MS4 Permit and implemented by local jurisdictions, including the City of Lemon Grove.

On May 8, 2013, the California Regional Water Quality Control Board, San Diego Region (RWQCB) reissued a municipal stormwater permit titled “National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharges from the MS4s draining the watersheds within the San Diego Region” (Order No. R9-2013-0001; referred to as MS4 Permit) to the municipal Copermittees, including the City of Lemon Grove (City). The MS4 Permit was issued by the RWQCB 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 (USEPA), and Chapter 5.5, Division 7 of the California Water Code. The MS4 Permit, in part, requires each Copermittee, including the City, to use its land use and planning authority to implement a development planning program to control and reduce the discharge of pollutants in stormwater from new development and significant redevelopment to the maximum extent practicable (MEP). MEP is defined in the MS4 Permit.

Different requirements apply to different project types.

The MS4 Permit requires all development projects to implement source control and site design practices that will minimize the generation of pollutants. While all development projects are required to implement source control and site design/LID practices, the MS4 Permit has additional requirements for development projects that exceed size thresholds and/or fit under specific use categories. These projects, referred to as PDPs, are required to incorporate structural BMPs into the project plan to reduce the discharge of pollutants, and address potential hydromodification impacts from changes in flow and sediment supply.

1.2 Purpose and Use of the Manual

This manual presents a “unified BMP design approach.”

Chapter 1: Policies and Procedural Requirements

To assist the land development community, streamline project reviews, and maximize cost-effective environmental benefits, the Copermittees have developed a unified BMP design approach¹ 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, stormwater 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 stormwater requirements; and
3. Understand how to submit projects for review and verification.

This figure also indicates where specific procedural steps associated with this process are addressed in Chapter 1.

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

Applicants may choose not to use the unified BMP design approach present in this manual, in which case they will need to demonstrate to the satisfaction of the City, in their submittal, compliance with applicable performance standards. These performance standards are described in **Chapter 2** and in Section E.3.c of the MS4 Permit.

¹ The term “unified BMP design approach” refers to the standardized process for site and watershed investigation, BMP selection, BMP sizing, and BMP design that is outlined and described in this manual with associated appendices and templates. This approach is considered to be “unified” because it represents a pathway for compliance with the MS4 Permit requirements that is anticipated to be reasonably consistent across the local jurisdictions in San Diego County. In contrast, applicants may choose to take an alternative approach where they demonstrate to the satisfaction of the City, in their submittal, compliance with applicable performance standards without necessarily following the process identified in this manual.

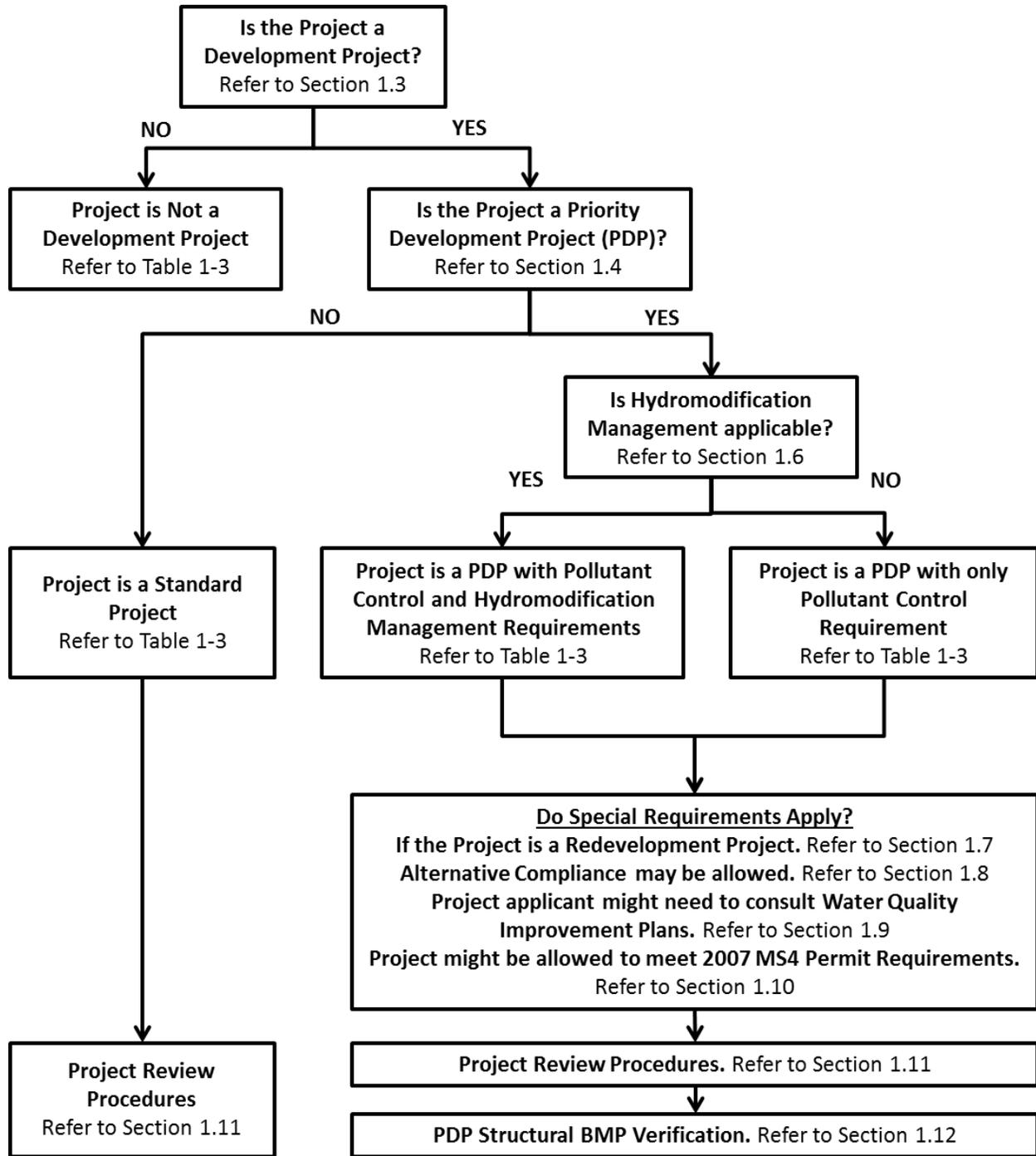


FIGURE 1-1. Procedural Requirements for a Project to Identify Stormwater Requirements

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 stormwater requirements applicable for a project. Table 1-1 is not intended to be used as a project intake form. An applicability checklist of

permanent, post-construction stormwater BMP requirements that may be used as a project intake form is provided in Appendices I-1, I-2, and I-3.

TABLE 1-1. Checklist for a Project to Identify Applicable Post-Construction Stormwater Requirements

<p>Step 1. Is the project a Development Project?</p> <p>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.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 2. Is the project a PDP?</p>	
<p>Step 2a. Does the project fit one of the PDP definitions?</p> <p>See Section 1.4.1 for guidance. If “Yes” then continue to Step 2b. If “No” then stop here; <u>only</u> Standard Project requirements apply.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 2b. Does the project qualify for grandfathering under 2007 MS4 Permit requirements?</p> <p>See Section 1.10 for guidance. If “Yes” then continue to Step 2c. If “No” then go to Step 2d.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 2c. Does the project fit one of the PDP definitions in the 2007 MS4 Permit?</p> <p>See RWQCB Order No. R9-2007-0001, Provision D.1.d. If “Yes” then continue to Step 2d. If “No” then stop here; Standard Project requirements apply.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 2d. Do one of the exceptions to PDP definitions in this manual apply to the project?</p> <p>See Section 1.4.3 for guidance. If “Yes” then stop here; Standard Project requirements apply, along with additional requirements that qualify the project for the exception. If “No” then continue to Step 3; the project is a PDP.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 3. Is the Project Subject to Earlier PDP Requirements Due to a Prior Lawful Approval?</p> <p>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.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 4. Do Hydromodification Control Requirements Apply?</p> <p>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.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<p>Step 4a. Does Protection of Coarse Sediment Supply Areas Apply?</p> <p>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.</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>

1.2.2 Determine Applicability of Construction BMP Requirements

All projects, or phases of projects, even if exempted from meeting some or all of the Permanent BMP Requirements, are required to implement temporary erosion, sediment, good housekeeping and pollution prevention BMPs to mitigate stormwater pollutants during the construction phase. Refer to the City of Lemon Grove Stormwater BMP Manual and Chapters 8.48 and 18.08 of the Lemon Grove Municipal Code for detailed information on these requirements.

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 development or redevelopment activities that have the potential to contact stormwater 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."

California Environmental Quality Act defines a project as: a discretionary action being undertaken by a public agency that would have a direct or reasonably foreseeable indirect impact on the physical environment. This includes actions by the agency, financing and grants, and permits, licenses, plans, regulations or other entitlements granted by the agency. California Environmental Quality Act requires that the project include “the whole of the action” before the agency. This requirement precludes "piecemealing," which is the improper (and often artificial) separation of a project into smaller parts in order to avoid preparing EIR-level documentation.

In the context of this manual, the "project" is the "whole of the action" which has the potential for adding or replacing or resulting in the addition or replacement of, roofs, pavement, or other impervious surfaces and thereby resulting in increased flows and stormwater 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 stormwater requirements.

When defining the project, the following questions are considered:

- What are the project activities?
- Do they occur onsite or offsite?
- What are the limits of the project (project boundary)?
- What is the whole of the action associated with the project (i.e. what is the total amount of new or replaced impervious area considering all of the collective project components through all phases of the project)?
- Are any facilities or agreements to build facilities offsite in conjunction with providing service to the project (street widening, utilities)?

Table 1-2 is used to determine whether stormwater 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 Stormwater Requirements

Do permanent stormwater requirements apply to your project?
<i>Requirements DO NOT apply to:</i>
<p>Replacement of impervious surfaces that are part of a routine maintenance activity, such as:</p> <ul style="list-style-type: none"> • 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 damage • Constructing new sidewalk, pedestrian ramps or bike lanes on existing roads (within existing street right-of-way) • Restoring a historic building to its original historic design <p>Repair or improvements to an existing building or structure that do not alter the size:</p> <ul style="list-style-type: none"> • 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 of Lemon Grove. Section 1.4.3 presents specific local exemptions.

1.4.1 PDP Categories

In the MS4 Permit, PDP categories are defined based on project size, type and design

features.

Projects shall be classified as PDPs if they are in one or more of the PDP categories presented in the MS4 Permit, which are listed below. Review each category, defined in (a) through (f), below. A PDP applicability checklist for these categories is also provided in Appendix I-3. 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

Chapter 1: Policies and Procedural Requirements

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 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.
- (e) New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.

Exclusions that apply to this category only: Projects creating less than 5,000 sf 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. See Section 1.4.2 for additional guidance.

Note that the environmentally sensitive areas (ESA) PDP category included in the MS4 Permit is not included in Section 1.4.1 above. This is because no ESAs have been identified within the City of Lemon Grove as of this writing.

Area 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 stormwater 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 MS4.

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

1.4.2 Local Additional PDP Categories and/or Expanded PDP Definitions

The City has not defined any additional PDP categories or expanded upon any of the PDP category definitions in Section 1.4.1.

1.4.3 Local PDP Exemptions or Alternative PDP Requirements

There are two categories of projects that can be exempted from being classified as PDPs, as defined by MS4 Permit Provision E.3.b.(3). These projects are referred to as PDP Exempt projects. These projects are exempt from the PDP requirements described in Section 1.5 (i.e., structural pollutant control and hydromodification management requirements) but shall still meet the Standard Project requirements described in Section 1.5 (i.e., source control and site design requirements).

PDP Exemption Category 1: PDP exemption for new or retrofit paved sidewalks, bicycle lanes, or trails

This exemption may be applied to new or retrofit paved sidewalks, bicycle lanes, or trails if the project meets one of the following criteria:

- a. Designed and constructed to direct stormwater runoff to adjacent vegetated areas, or other non-erodible permeable areas; OR
- b. Designed and constructed to be hydraulically disconnected² from paved streets or roads; OR
- c. Designed and constructed with permeable pavements or surfaces.

PDP Exemption Category 2: PDP exemption for retrofitting or redevelopment of existing paved alleys, streets or roads

This exemption may be applied to retrofitting or redevelopment of existing paved alleys, streets, or roads if the project is designed in accordance with USEPA Green Streets guidance, as defined in the Lemon Grove BMP Design Manual (Appendix J)*.

Note that not all work within the right-of-way is considered to be a redevelopment project. Redevelopment does not include routine maintenance activities, such as trenching and resurfacing associated with utility work; pavement grinding; resurfacing existing roadways, sidewalks, pedestrian ramps, or bike lanes on existing roads; and routine replacement of

² A sidewalk, bicycle lane, or trail would be considered to be hydraulically disconnected from paved streets or roads if they drain via separate drainage pathways (e.g., separate inlets) such that overland flows do not comingle with street or road runoff.

damaged pavement, such as pothole repair.

* Designs prepared in accordance with Green Streets guidance adopted by other San Diego Region Copermittees may also be considered at the discretion of the Development Services Director.

1.5 Determining Applicable Stormwater Management Requirements

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

Depending on project type and receiving water, different stormwater 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. Stormwater 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	☑	☑	NA	NA
PDP with only Pollutant Control Requirements*	☑	☑	☑	NA
PDPs with Pollutant Control and Hydromodification Management Requirements	☑	☑	☑	☑

* Some PDPs may be exempt from Structural Hydromodification Management BMPs, refer to Section 1.6 to determine.

1.6 Applicability of Hydromodification Management Requirements

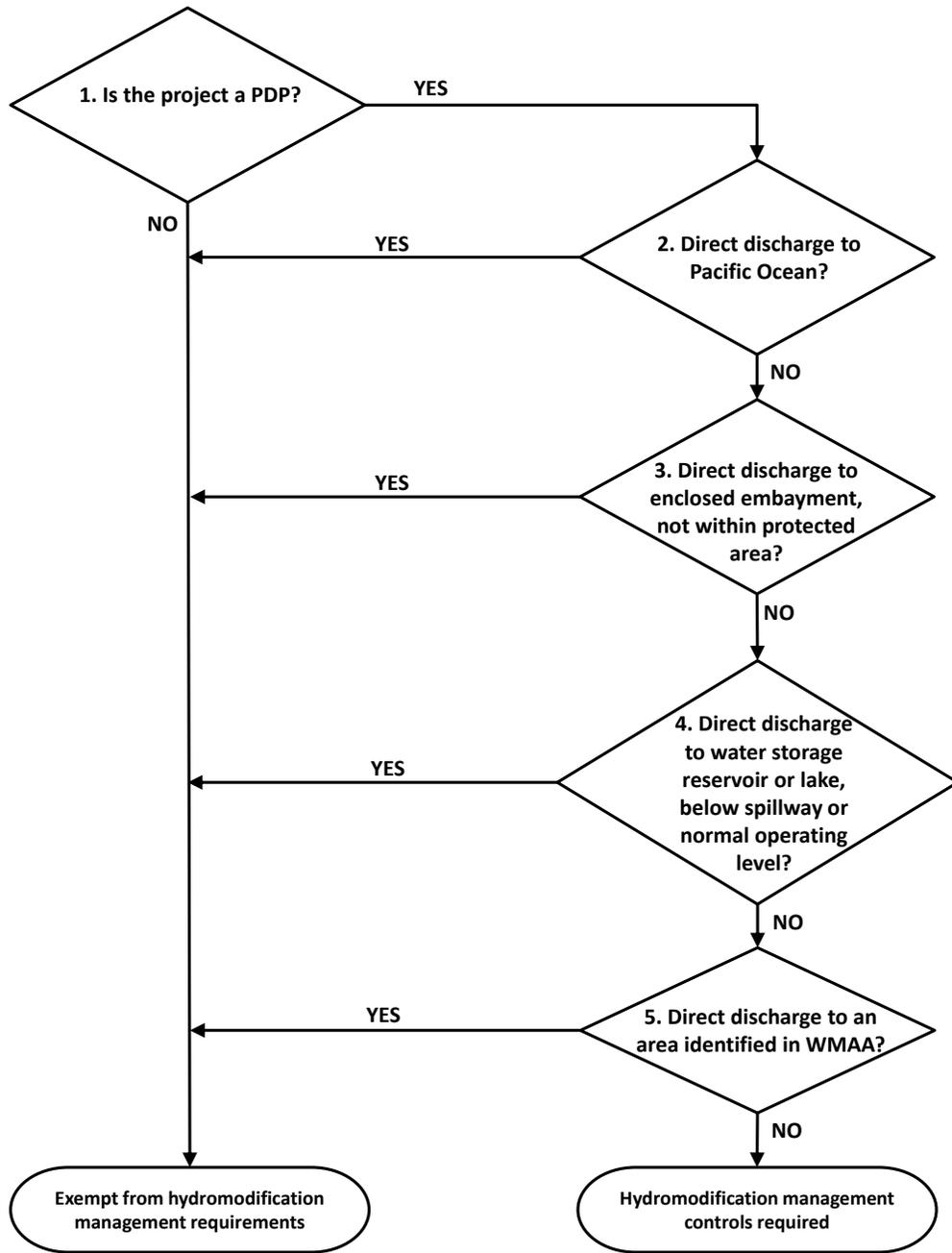
MS4 Permit Provision E.3.c.(2)

Hydromodification management requirements apply to PDPs only.

If the project is a Standard Project, hydromodification management requirements do not apply. Hydromodification management requirements apply to PDPs (both new and re-development) unless the project meets specific exemptions discussed below.

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

Figure 1-2 summarizes hydromodification exemptions as laid out in the MS4 Permit. However, as of the writing of this manual, there are no known areas in the City of Lemon Grove that qualify for the hydromodification exemptions described in the MS4 Permit and summarized in Figure 1-2.



*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

Summary of hydromodification management exemptions applicable in Lemon Grove:
Enclosed Embayments: Not applicable
Water Storage Reservoirs and Lakes: Not applicable

Areas Identified in the WMAA (Exempt River Reaches and Lagoons)

Exempt River Reaches:

There are no exempt river reaches within the City of Lemon Grove.

A portion of the Sweetwater River downstream of Lemon Grove will be eligible to be considered an exempt river reach upon RWQCB acceptance of the San Diego Bay Water Quality Improvement Plan. However, as of the writing of this document, there are no areas within the City known to have a “direct discharge” to the Sweetwater River, as defined earlier in this section.

1.7 Special Considerations for Redevelopment Projects (50% Rule)

MS4 Permit Provision E.3.b.(2)

Redevelopment PDPs (PDPs on previously developed sites) may need to meet stormwater 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 HMP 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 stormwater 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 surfaces 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% of the total development area and only the 4,000 sq. ft area is required to be treated.

1.8 Alternative Compliance Program

MS4 Permit Provision E.3.c.(1).(b); E.3.c.(2).(c); E.3.c.(3)

PDPs may be allowed to participate in an alternative compliance program.

The City has the discretion to independently develop an alternative compliance program for its jurisdiction. The alternative compliance program allows PDPs to participate in this program in lieu of meeting either the PDP structural BMP performance requirements for retention or a portion of DCV that is not retained onsite in conjunction with onsite mitigation.

PDPs may be allowed to participate in an alternative compliance program by using onsite BMPs to treat offsite runoff, provided that the BMPs are design in accordance with WQE standards approved by the RWQCB. PDPs must consult with Stormwater staff for specific guidelines and requirements for using onsite facilities for alternative compliance

Potential future compliance option:

At this time, the City of Lemon Grove’s alternative compliance program does not allow for the use of offsite BMPs. However, after additional resources, such as a regional crediting system, have been developed the City may allow for the use of offsite BMPs in its alternative compliance program.

Water Quality Equivalency calculations must be accepted by the RWQCB

The WQE calculation must be accepted by the RWQCB’s Executive Officer prior to administering an alternative compliance program. The WQE provides currency calculations to assess water quality and hydromodification management benefits for a variety of potential project types and provides regional and technical basis for demonstrating a greater water quality benefit for the watershed.

Applicant-Implemented Alternative Compliance Projects: The City may, at the discretion of the Development Services Director, allow an applicant to implement an alternative compliance project. Such alternative compliance projects shall be designed to meet the requirements of Lemon Grove Municipal Code Section 8.52. Applicant-implemented alternative compliance projects may propose using onsite BMPs to treat run-on from offsite. The applicant is fully responsible for the alternative compliance project design, construction, and long-term operation and maintenance. To satisfy requirements for long-term operation and maintenance, the

applicant must provide evidence of an operation and maintenance mechanism that will ensure the operation and maintenance of the proposed BMPs in perpetuity.

1.9 Relationship between this Manual and WQIPs

This manual is connected to other permit-specified planning efforts.

The MS4 Permit requires the Copermittees within each Watershed Management Area (WMA) within the San Diego Region to develop a **WQIP** that identifies priority and highest priority water quality conditions and strategies that will be implemented with associated goals to demonstrate progress towards addressing the conditions in the watershed. The MS4 Permit also provides an option to perform a Watershed Management Area Analysis (**WMAA**) as part of the WQIP to develop watershed specific requirements for structural BMP implementation in the watershed management area. The Copermittees have elected to perform the WMAA, and the results of the WMAA have been incorporated in the WQIPs. PDPs should expect to consult either of these separate planning efforts as appropriate when using this manual as follows:

1. For PDPs that implement flow-thru treatment BMPs (i.e., projects pursuing alternative compliance³, as described in Section 1.8), selection of the type of flow-thru BMP shall consider the pollutants and conditions of concerns. Among the selection considerations, the PDP must consult the highest priority water quality condition as identified in the WQIP for that particular watershed management area.
 - a. The City of Lemon Grove is in the San Diego Bay WMA. The highest priority water quality conditions in the San Diego Bay WMA are bacteria and heavy metals. The full San Diego Bay WQIP can be accessed at the San Diego Bay Watershed page at Project Clean Water (www.projectcleanwater.org).⁴
2. There may be watershed management area specific BMPs or strategies that are identified in the San Diego Bay WQIP, 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.
 - a. Critical coarse sediment yield areas are available as pdf maps, GIS shapefiles, and Google Earth files on the WMAA page on the Project Clean Water website

³ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

⁴ The direct link to the San Diego River WQIP is http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=222&Itemid=205.

www.projectcleanwater.org.⁵

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 WQIP. PDPs should consult the WMAA for recommended hydromodification management exemptions to determine if the project is eligible.
 - a. Additional exemptions identified in the WMAA and incorporated into the San Diego Bay WQIP are described in Section 1.6 above. Note that these exemptions cannot be used by projects until the San Diego Bay WQIP is approved by the RWQCB.
5. PDPs may have the option of participating in an alternative compliance⁶ program. Refer to Section 1.8.

These relationships between this manual and WQIP are presented in Figure 1-3.

⁵ The direct link to the WMAA page is

http://www.projectcleanwater.org/index.php?option=com_content&view=article&id=248

⁶ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

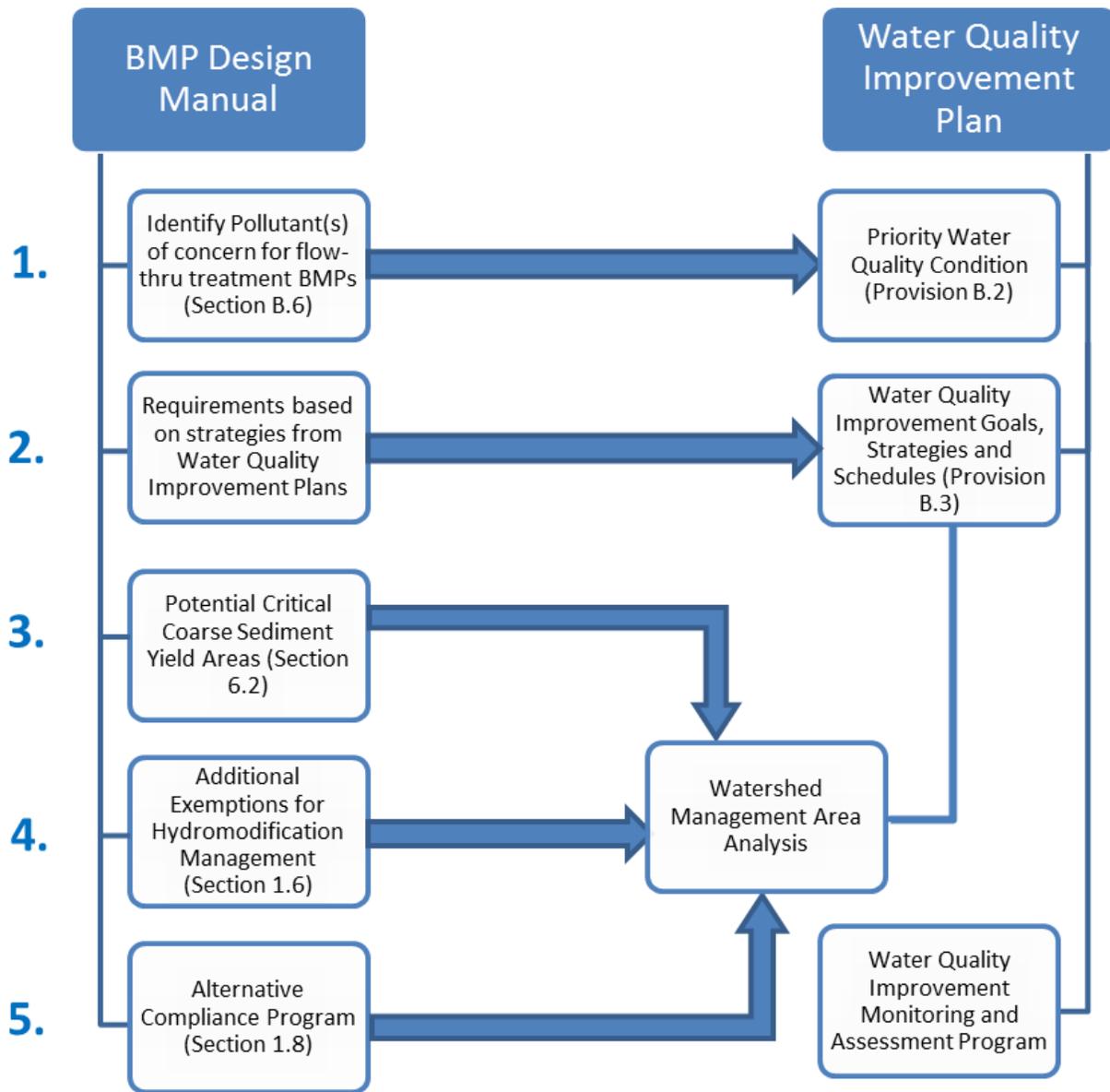


FIGURE 1-3. Relationship between this Manual and WQIP

1.10 Stormwater Requirement Applicability Timeline

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

Guidance on Prior Lawful Approval (“Grandfathering”)

The effective date of the Lemon Grove BMP Design Manual is February 2, 2016. A Priority Development Project may be allowed to meet the requirements of the previous Lemon Grove SUSMP rather than the BMP Design Manual if it meets the City’s prior lawful approval

requirements. A project is considered to have prior lawful approval if it meets ALL of the following conditions:

- (a) Prior to February 2, 2016, the project received approval by the City for a design that incorporates the storm water drainage system for the Priority Development Project in its entirety, including all applicable structural pollutant treatment control and hydromodification management BMPs consistent with the 2007 MS4 Permit (RWQCB Order No. R9-2007-0001).
- (b) Prior to February 2, 2016, the project was issued a private project permit or approval, or functional equivalent for public projects, that authorized the Priority Development Project applicant to commence construction activities based on a design that incorporates the storm water drainage system approved in conformance with item (a) above.
- (c) Construction activities on the Priority Development Project site commenced within the 365 days prior to the effective date of the BMP Design Manual (i.e., on or after February 2, 2015), OR construction activities on the Priority Development Project site commenced within the 180 days after the effective date of the BMP Design Manual (i.e., on or before July 31, 2016), where construction activities are undertaken in reliance on the permit or approval, or functional equivalent for public projects, described in item (b) above.
- (d) All subsequent private project permits or approvals, or functional equivalent for public projects, that are needed to implement the design initially approved in conformance with item (a) above are issued within 5 years of the effective date of the BMP Design Manual (i.e., on or before February 2, 2020). The storm water drainage system for the Priority Development Project in its entirety, including all applicable structural pollutant treatment control and hydromodification management BMPs must remain in substantial conformity with the design initially approved in conformance with item (a) above.

Acceptance of a determination made by a project applicant regarding prior lawful approval, and subjectivity to the previous Lemon Grove SUSMP, is at the discretion of the Development Services Director. The Development Services Director has no obligation to accept the determination made by the project applicant. Note that a project is also considered to have prior lawful approval if the City lacks the land use authority or legal authority to require the project to meet the updated requirements described in this BMP Design Manual, as determined by the City Attorney.

1.11 Project Review Procedures

The City of Lemon Grove reviews project plans for compliance with applicable requirements of this manual, the City's Post-Construction Best Management Practices (BMP) Design Standards Ordinance (Lemon Grove Municipal Code Chapter 8.52), and the MS4 Permit.

The project applicant must provide sufficient documentation to demonstrate that applicable requirements of the BMP Design Manual, Post-Construction BMP Design Standards Ordinance, and the MS4 Permit will be met.

For Standard Projects, this typically means using forms and/or a Standard Project SWQMP or other

equivalent documents approved by the Development Services Director to document that the following general requirements of the MS4 Permit are met, and showing proposed features onsite on grading, building, improvement, and landscaping plans, as applicable:

- BMP Requirements for All Development Projects, which includes general requirements, source control BMP requirements, and narrative (i.e. not numerically-sized) site design requirements (MS4 Permit Provision E.3.a).

For PDPs, this typically means preparing a PDP SWQMP to document that the following general requirements of the MS4 Permit are met, and showing applicable features onsite grading and landscaping plans:

- BMP Requirements for All Development Projects, which includes general requirements for siting of permanent, post-construction BMPs, source control BMP requirements, and narrative (i.e. not numerically-sized) site design requirements (MS4 Permit Provision E.3.a);
- Stormwater Pollutant Control BMP Requirements, for numerically sized onsite structural BMPs to control pollutants in stormwater (MS4 Permit Provision E.3.c.(1)); and
- Hydromodification Management BMP Requirements, which includes protection of critical sediment yield areas and numerically sized onsite BMPs to manage hydromodification that may be caused by stormwater 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 stormwater BMPs at the discretion of the Development Services Director must be provided with the first submittal of a project or another preliminary planning stage defined by the City. Stormwater requirements will directly affect the layout of the project. Therefore stormwater 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 Post-Construction BMP Verification

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

Structural BMPs must be verified by the City of Lemon Grove prior to project occupancy.

Pursuant to MS4 Permit Provision E.3.e.(1), the City of Lemon Grove must require and confirm the following with respect to PDPs constructed within its jurisdiction:

- (a) The City must require and confirm that appropriate easements and ownerships are properly recorded in public records and the information is conveyed to all appropriate parties when there is a change in project or site ownership.
- (b) The City must require and confirm that prior to occupancy and/or intended use of any portion of the PDP, each structural BMP is inspected to verify that it has been constructed and is operating in compliance with all of its specifications, plans, permits, ordinances, and the requirements of the MS4 Permit.

For PDPs, this means that after structural post-construction BMPs have been constructed,

the Development Services Director may request the project owner provide a certification that the site improvements for the project have been constructed in conformance with the approved stormwater management documents and drawings.

The Development Services Director may also require inspection of the structural BMPs at each significant construction stage and at completion. Following construction, if any changes to the structural BMP design were made, the City will require an addendum to the SWQMP, including the O&M Plan, and As Builts to document the changes to the structural BMPs that occurred during construction. Changes will also be required to be incorporated into the project's maintenance agreement and recorded against the property. Changes to BMP design must be approved by the Development Services Director. A maintenance agreement that is recorded with the property title can then be transferred to future owners, addressing requirement (a) in the above bullet list.

Certification of structural BMPs, updates to reports, and recordation of a maintenance agreement may occur concurrently with project closeout, but could be required sooner, at the discretion of the Development Services Director. 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.

Performance Standards and Concepts

Projects must meet three separate performance standards, as applicable.

The MS4 Permit establishes separate performance standards for (1) source control and site design practices, (2) stormwater pollutant control BMPs, and (3) hydromodification management BMPs. Chapter 1 provided guidance for determining which performance standards apply to a given project. This chapter defines these performance standards based on the MS4 Permit, and presents concepts that provide the project applicant with technical background, explains why the performance standards are important, and gives a general description of how these performance standards can be met. Detailed procedures for meeting the performance standards are presented in Chapters 4, 5, and 6.

Performance standards can be met through an integrated approach.

While three separate performance standards are defined by this manual, an overlapping set of design features can be used as part of demonstrating conformance to each standard. Further discussion of the relationship between performance standards is provided in Section 2.4.

2.1 Source Control and Site Design Requirements for All Development Projects

2.1.1 Performance Standards

MS4 Permit Provision E.3.a

This section defines performance standards for source control and site design practices that are applicable to all projects (regardless of project type or size; both Standard Projects and PDPs) when local permits are issued, including unpaved roads and flood management projects.

2.1.1.1 General Requirements

All projects shall meet the following general requirements:

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

2.1.1.2 Source Control Requirements

Pollutant source control BMPs are features that must be implemented to address specific sources of pollutants.

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

- (a) Prevention of illicit discharges into the MS4;
- (b) Storm drain system stenciling or signage;
- (c) Protection of outdoor material storage areas from rainfall, run-on, runoff, and wind dispersal;
- (d) Protection of materials stored in outdoor work areas from rainfall, run-on, runoff, and wind dispersal;
- (e) Protection of trash storage areas from rainfall, run-on, runoff, and wind dispersal; and
- (f) Use of any additional BMPs determined to be necessary by the City to minimize pollutant generation at each project.

Further guidance is provided in Section 2.1.2, Chapter 4, and Appendix E.

2.1.1.3 Site Design Requirements

Site design requirements are qualitative requirements that apply to the layout and design of ALL development project sites (Standard Projects and PDPs).

Site design performance standards define minimum requirements for how a site must incorporate LID BMPs, including the location of BMPs and the use of integrated site design practices. The following site design practices must be implemented at all development projects, where applicable and technically feasible:

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

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. Projects proposing any disturbance to water bodies are responsible for obtaining all applicable environmental permits and approvals required by agencies other than the City of Lemon Grove.

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- (f) Minimization of soil compaction to landscaped areas;
- (g) Disconnection of impervious surfaces through distributed pervious areas;
- (h) Landscaped or other pervious areas designed and constructed to effectively receive and infiltrate, retain and/or treat runoff from impervious areas, prior to discharging to the MS4;
- (i) Small collection strategies located at, or as close as possible to, the source (i.e. the point where stormwater initially meets the ground) to minimize the transport of runoff and pollutants to the MS4 and receiving waters;
- (j) Use of permeable materials for projects with low traffic areas and appropriate soil conditions;
- (k) Landscaping with native or drought tolerant species; and
- (l) Harvesting and using precipitation.

A key aspect of this performance standard is that these design features must be used where applicable and feasible. Responsible implementation of this performance standard depends on evaluating applicability and feasibility. Further guidance is provided in Section 2.1.2 and Chapter 4.

Additional site design requirements may apply to PDPs.

Site design decisions may influence the ability of a PDP to meet applicable performance standards for pollutant control and hydromodification management BMPs (as defined in Section 2.2 and 2.3). For example, the layout of the site drainage and reservation of areas for BMPs relative to areas of infiltrative soils may influence the feasibility of capturing and managing stormwater to meet stormwater pollutant control and/or hydromodification management requirements. As such, the Copermittee may require additional site design practices, beyond those listed above, to be considered and documented as part of demonstrating conformance to stormwater pollutant control and hydromodification management requirements.

2.1.2 Concepts and References

Land development tends to increase the amount of pollutants in stormwater 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 stormwater 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 stormwater runoff to take place. Instead, stormwater runoff from impervious surfaces is typically and has traditionally been directed through pipes, curbs, gutters, and other hardscape into receiving waters, with little treatment, at significantly increased volumes and accelerated flow rates over what would occur naturally. The increased pollutant loads, stormwater volume, discharge rates and velocities, and discharge durations

from the MS4 adversely impact stream habitat by causing accelerated, unnatural erosion and scouring within creek beds and banks. Compaction of pervious areas can have a similar effect to impervious surfaces on natural hydrology.

Site Design LID involves attempting to maintain or restore the predevelopment hydrologic regime.

Low impact development (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. Low impact development designs seeks to control stormwater at the source, using small-scale integrated site design and management practices to mimic the natural hydrology of a site, retain stormwater runoff by minimizing soil compaction and impervious surfaces, and disconnecting stormwater runoff from conveyances to the storm drain system. Site Design LID BMPs may utilize interception, storage, evaporation, evapotranspiration, infiltration, and filtration processes to retain and/or treat pollutants in stormwater before it is discharged from a site. Examples of site design LID BMPs include using permeable pavements, rain gardens, rain barrels, grassy swales, soil amendments, and native plants.

Site design must be considered early in the design process.

Site designs tend to be more flexible in the early stages of project planning than later on when plans become more detailed. Because of the importance of the location of BMPs, site design shall be considered as early as the planning/tentative design stage (check with City requirements. Site design is critical for feasibility of stormwater pollutant control BMPs (Section 2.2) as well as coarse sediment supply considerations associated with hydromodification management (introduced in Section 2.3).

Source control and site design (LID) requirements help avoid impacts by controlling pollutant sources and changes in hydrology.

Source control and site design practices prescribed by the MS4 Permit are the minimum management practices, control techniques and system, design and engineering methods to be included in the planning procedures to reduce the discharge of pollutants from development projects, regardless of size or purpose of the development. In contrast to stormwater 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 stormwater runoff generated by the site. Methods to estimate effective runoff coefficients and the stormwater runoff produced by the site after site design BMPs are implemented are presented in Appendix B.2. This methodology is applicable for PDPs that are required to estimate runoff produced from the site with site design BMPs implemented so that they can appropriately size stormwater pollutant control BMPs and hydromodification control BMPs.

The location of BMPs matters.

The site design BMPs listed in the performance standard include practices that either prevent runoff from occurring or manage runoff as close to the source as possible. This helps create a more hydrologically effective site and reduces the requirements that pollutant control and hydromodification control BMPs must meet, where required. Additionally, because sites may have

spatially-variable conditions, the locations reserved for structural BMPs within the site can influence whether these BMPs can feasibly retain, treat, and/or detain stormwater to comply with structural pollutant control and hydromodification control requirements, where applicable. Finally, the performance standard specifies that onsite BMPs must remove pollutants from runoff prior to discharge to any receiving waters or the MS4, be located/constructed as close to the pollutant generating source as possible and must not be constructed within waters of the U.S.

The selection of BMPs also matters.

The lists of source control and site design BMPs specified in the performance standard must be used “where applicable and feasible.” This is an important concept – BMPs should be selected to meet the R9-2013-0001 permit requirements and are feasible with consideration of site conditions and project type. By using BMPs that are applicable and feasible, the project can achieve benefits of these practices, while not incurring unnecessary expenses (associated with using practices that do not apply or would not be effective) or creating undesirable conditions (for example, infiltration-related issues, vector concerns including mosquito breeding, etc.).

Methods to select and design BMPs and demonstrate compliance with source control and site design requirements are presented in Chapter 4 of this manual.

2.2 Stormwater Pollutant Control Requirements for PDPs

2.2.1 Stormwater Pollutant Control Performance Standard

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

Stormwater 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 stormwater runoff produced from a 24-hour, 85th percentile storm event (Design Capture Volume (DCV)). The 24-hour, 85th percentile storm event shall be based on Figure B.1-1 in Appendix B or an approved site-specific rainfall analysis.
 - (i) If it is not technically feasible to implement retention BMPs for the full DCV onsite for a PDP, then the PDP shall utilize biofiltration BMPs for the remaining volume not reliably retained. Biofiltration BMPs must be designed as described in Appendix F to have an appropriate hydraulic loading rate to maximize stormwater retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP, and must be sized to:
 - [a]. Treat 1.5 times the DCV not reliably retained onsite, OR
 - [b]. Treat the DCV not reliably retained onsite with a flow-thru design that has a total volume, including pore spaces and pre-filter detention volume, sized to hold at least 0.75 times the portion of the DCV not reliably retained onsite.
 - (ii) If biofiltration BMPs are not technically feasible, then the PDP shall utilize flow-thru treatment control BMPs (selected and designed per Appendix B.6) to treat runoff

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leaving the site, AND participate in alternative compliance⁸ to mitigate for the pollutants from the DCV not reliably retained onsite pursuant to Section 2.2.1.(b). Flow-thru treatment control BMPs must be sized and designed to:

- [a]. Remove pollutants from stormwater to the MEP (defined by the MS4 Permit) by following the guidance in Appendix B.6; and
 - [b]. Filter or treat either: 1) the maximum flow rate of runoff produced from a rainfall intensity of 0.2 inch of rainfall per hour, for each hour of a storm event, or 2) the maximum flow rate of runoff produced by the 85th percentile hourly rainfall intensity (for each hour of a storm event), as determined from the local historical rainfall record, multiplied by a factor of two (both methods may be adjusted for the portion of the DCV retained onsite as described in Appendix B.6) and
 - [c]. Meet the flow-thru treatment control BMP treatment performance standard described in Appendix B.6.
- (b) A PDP may be allowed to participate in an alternative compliance⁹ program in lieu of fully complying with the performance standards for stormwater 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-thru treatment control BMPs must be implemented to treat the portion of the DCV that is not reliably retained onsite. Flow-thru treatment control BMPs must be selected and sized in accordance with Appendix B.6.
 - (iii) A PDP may be allowed to propose an alternative compliance project not identified in the WMAA of the WQIP if the requirements in Section 1.8 are met at the discretion of the Development Services Director.

Demonstrations of feasibility findings and calculations to justify BMP selection and design shall be provided by the project applicant in the SWQMP or other equivalent document(s) to the satisfaction of the Development Services Director. Methodology to demonstrate compliance with the performance standards, described above, applicable to stormwater pollutant control BMPs for PDPs is detailed in Chapter 5.

2.2.2 Concepts and References

Retention BMPs are the most effective type of BMPs to reduce pollutants discharging to MS4s when they are sited and designed appropriately.

Retention of the required DCV will achieve 100 percent pollutant removal efficiency (i.e. prevent pollutants from discharging directly to the MS4). Thus, retention of as much stormwater onsite as technically feasible is the most effective way to reduce pollutants in stormwater discharges to, and consequently from the MS4, and remove pollutants in stormwater discharges from a site to the

⁸ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

⁹ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

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 and Appendix F. These sizing and design criteria are intended to provide a level of long term pollutant removal that is reasonably equivalent to retention of the DCV.

Flow-thru treatment BMPs are required to treat the pollutant loads in the DCV not retained or biofiltered onsite to the MEP.

If the pollutant loads from the full DCV cannot feasibly be retained or biofiltered onsite, then PDPs are required to implement flow-thru treatment control BMPs to remove the pollutants to the MEP for the portion of the DCV that could not be feasibly retained or biofiltered. Flow-thru treatment BMPs may only be implemented at sites that use alternative compliance¹⁰.

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

2.2.2.1 Best Management Practices

To minimize confusion, this manual considers all references to “facilities,” “features,” or “controls” to be incorporated into development projects as BMPs.

2.2.2.2 DCV

The MS4 Permit requires pollutants be addressed for the runoff from the 24-hour 85th percentile storm event (“DCV”) as the design standard to which PDPs must comply.

The 85th percentile, 24-hour storm event is the event that has a precipitation total greater than or equal to 85 percent of all storm events over a given period of record in a specific area or location. For example, to determine what the 85th percentile storm event is in a specific location, the following steps would be followed:

- Obtain representative precipitation data, preferably no less than 30-years period if possible.
- Divide the recorded precipitation into 24-hour precipitation totals.

¹⁰ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

- 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 stormwater pollutant control BMPs. An exhibit showing the 85th percentile, 24-hour storm depth across San Diego County and the methodology used to develop this exhibit is included in Appendix B.1.3. Guidance to estimate the DCV is presented in Appendix B.1.

2.2.2.3 Implementation of Stormwater Pollutant Control BMPs

The MS4 Permit requires that the PDP applicants proposing to meet the performance standards onsite implement stormwater pollutant control BMPs (also referred to as “treatment control BMPs”) in the order listed below. That is, the PDP applicant first needs to implement **all** feasible onsite retention BMPs needed to meet the stormwater pollutant control BMP requirements prior to installing onsite biofiltration BMPs. If allowed to participate in alternative compliance, a PDP may install onsite flow-thru treatment control BMPs as part of the overall approach to meeting the stormwater pollutant control BMP requirements of this manual. Refer to Section 1.8 for additional guidance.

Retention BMPs: Structural measures that provide retention (i.e. intercept, store, infiltrate, evaporate and evapotranspire) of stormwater as part of pollutant control strategy. Examples include infiltration BMPs and cisterns, bioretention BMPs (bioretention BMPs do not have underdrains but otherwise are designed similarly to biofiltration BMPs), and biofiltration BMPs with partial retention (biofiltration BMPs with an underdrain but designed to allow some retention).

Biofiltration BMPs: Structural measures that provide biofiltration of stormwater as part of the pollutant control strategy.

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

For example, if the DCV from a site is 10,000 cubic feet (ft³) and it is technically feasible to implement 2,000 ft³ of retention BMPs and 9,000 ft³ of biofiltration BMPs sized per Section 2.2.1.(a)(i)[a], and the jurisdiction has established an alternative compliance¹¹ pathway (see Section 1.8), the project applicant should:

1. First, design retention BMPs for 2,000 ft³.
2. Then complete a technical feasibility form for retention BMPs (included in Appendix C and D) demonstrating that it's only technically feasible to implement retention BMPs for 2,000 ft³.
3. Then design biofiltration BMPs for 9,000 ft³ (calculate equivalent volume for which the pollutants are retained = 9,000/1.5 = 6,000 ft³).
4. Then complete a technical feasibility for biofiltration BMPs demonstrating that its only

¹¹ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

technically feasible to implement biofiltration BMPs for 9,000 ft³.

5. Estimate the DCV that could not be retained or biofiltered = 10,000 ft³ – (2,000 ft³ + 6,000 ft³) = 2,000 ft³.
6. Implement flow-thru treatment control BMPs to treat the pollutants in the remaining 2,000 ft³. Refer to Appendix B.6 for guidance for designing flow-thru treatment control BMPs.
7. Also participate in an alternative compliance project for 2,000 ft³. Refer to Section 1.8 for additional guidance on participation in an alternative compliance program.

2.2.2.4 Technical Feasibility

MS4 Permit Requirement E.3.c.(5)

Analysis of technical feasibility is necessary to select the appropriate BMPs for a site.

PDPs are required to implement pollutant control BMPs in the order of priority in Section 2.2.2.3 based on determinations of technical feasibility. In order to assist the project applicant in selecting BMPs, this manual includes a defined process for evaluating feasibility. Conceptually, the feasibility criteria contained in this manual are intended to:

- Promote reliable and effective long term operations of BMPs by providing a BMP selection process that eliminates the use of BMPs that are not suitable for site conditions, project type or other factors;
- Minimize significant risks to property, human health, and/or environmental degradation (e.g. geotechnical stability, groundwater quality) as a result of selection of BMPs that are undesirable for a given site; and
- Describe circumstances under which regional and watershed-based strategies, as part of an approved WMAA **and** an alternative compliance program developed by City, 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 stormwater infiltration and groundwater quality and water balance factors is provided in Appendices C and D, respectively.

2.2.2.5 Biofiltration BMPs

The MS4 Permit requires Biofiltration BMPs be designed to have an appropriate hydraulic loading rate to maximize stormwater retention and pollutant removal, as well as to prevent erosion, scour, and channeling within the BMP. Appendix F of this manual has guidance for hydraulic loading rates and other biofiltration design criteria to meet these required goals. Appendix F also has a checklist that will need to be completed by the project SWQMP preparer during plan submittal. Guidance for sizing Biofiltration BMPs is included in Chapter 5 and Appendices B.5 and F.

2.2.2.6 Flow-thru Treatment Control BMPs (for use with Alternative Compliance)

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

Flow-thru BMPs are only allowable for sites that use alternative compliance. See Section 1.8 for more details about alternative compliance.

The MS4 Permit requires that the flow-thru treatment control BMP selected by the PDP applicant be ranked with high or medium pollutant removal efficiency for the most significant pollutant of concern. Steps to select the flow-thru treatment control BMP include:

- Step 1: Identify the pollutant(s) of concern by considering the following at a minimum a) Receiving water quality; b) Highest priority water quality conditions identified in the San Diego Bay WMA WQIP; c) Land use type of the project and pollutants associated with that land use type and d) Pollutants expected to be present onsite
- Step 2: Identify the most significant pollutant of concern. A project could have multiple most significant pollutants of concerns and shall include the highest priority water quality condition identified in the watershed WQIP and pollutants expected to be presented onsite/from land use.
- Step 3: Effectiveness of the flow-thru treatment control BMP for the identified most significant pollutant of concern

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

2.3 Hydromodification Management Requirements for PDPs

2.3.1 Hydromodification Management Performance Standards

MS4 Permit Provision E.3.c.(2)

This section defines performance standards for hydromodification management, including flow control of post-project stormwater runoff and protection of critical coarse 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 stormwater 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.

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- (b) Each PDP must avoid critical coarse 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.
- (i) Critical coarse sediment yield areas are identified in the WMAA. See Section 1.9 of this manual for additional details and links to maps of critical coarse sediment yield areas.
- (c) A PDP may be allowed to utilize alternative compliance¹² 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. See Section 1.8 for additional information on alternative compliance.

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" (hereafter, "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 Development Services Director; or
- 0.5Q2 to Q10 for streams with low susceptibility to erosion and which has a stream susceptibility study prepared and approved by the Development Services Director.

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.

¹² Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

The March 2011 Final HMP does not provide criteria for protection of critical sediment yield areas. The standard as presented in the MS4 Permit and shown above is: avoid critical sediment yield areas or implement measures that allow critical coarse sediment to be discharged to receiving waters, such that there is no net impact to the receiving water.

Methods to demonstrate compliance with hydromodification management requirements, including protection of critical coarse sediment yield areas and flow control for post-project runoff from the project site, are presented in Chapter 6 of this manual. Hydromodification management concepts, theories, and references are described below.

2.3.2 Hydromodification Management Concepts and References

2.3.2.1 What is Hydromodification?

The MS4 Permit defines hydromodification as the change in the natural watershed hydrologic processes and runoff characteristics (i.e. interception, infiltration, overland flow, and groundwater flow) caused by urbanization or other land use changes that result in increased stream flows and sediment transport. In addition, alteration of stream and river channels, such as stream channelization, concrete lining, installation of dams and water impoundments, and excessive streambank and shoreline erosion are also considered hydromodification, due to their disruption of natural watershed hydrologic processes.

Typical impacts to natural watershed hydrologic processes and runoff characteristics resulting from new development and redevelopment include:

- Decreased interception and infiltration of rainfall at the project site due to removal of native vegetation, compaction of pervious area soils, and the addition of impervious area;
- Increased connectivity and efficiency of drainage systems serving the project site, including concentration of project-site runoff to discrete outfalls;
- Increased runoff volume, flow rate, and duration from the project site due to addition of impervious area, removal of native vegetation, and compaction of pervious area soils;
- Reduction of critical coarse sediment supply from the project site to downstream natural systems (e.g. streams) due to stabilization of developed areas, stabilization of streams, and addition of basins that trap sediment (either by design as a permanent desilting basin or stormwater quality treatment basin that settles sediment, or incidentally as a peak flow management basin); and
- Interruption of critical coarse sediment transport in streams due to stream crossings such as culverts or ford crossings that incidentally slow stream flow and allow coarse sediment to settle upstream of the crossing.

Any of these changes can result in increased potential for erosion, or degraded instream habitat downstream of PDPs. The changes to delivery of runoff to streams typically modify the timing, frequency, magnitude, and duration of both storm flows and baseflow. Changes to delivery of coarse sediment and transport of coarse sediment result in increased transport capacity and the potential for adverse channel erosion.

Note that this manual is intended for design of permanent, post-construction BMPs, therefore this

discussion is focused on the permanent, post-construction effects of development. The process of construction also has impacts, such as a temporary increase in sediment load produced from surfaces exposed by vegetation removal and grading, which is often deposited within stream channels, initiating aggradation and/or channel widening. Temporary construction BMPs to mitigate the sediment delivery are outside the purview of this manual.

Channel erosion resulting from PDP stormwater 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 stormwater discharge.

2.3.2.2 How Can Hydromodification be Controlled?

In the big picture, watershed-scale solutions are necessary to address hydromodification. Factors causing hydromodification are watershed-wide, and all of San Diego's major watersheds include some degree of legacy hydromodification effects from existing development and existing channel modifications, which cannot be reversed by onsite measures implemented at new development and redevelopment projects alone. As recommended by SCCWRP in Technical Report 667, "Hydromodification Assessment and Management in California," dated April 2012, "management strategies should be tailored to meet the objectives, desired future conditions, and constraints of the specific channel reach being addressed," and "potential objectives for specific stream reaches may include: protect, restore, or manage as a new channel form."

Development of such management strategies and objectives for San Diego watersheds will evolve over successive MS4 Permit cycles. The current MS4 Permit requires the Copermittees in the San Diego Bay Watershed Management Area, including the City of Lemon Grove, to prepare a WQIP. The WQIP includes a WMAA that assesses watershed-wide hydrologic processes and evaluates watershed-specific hydromodification exemptions.

This manual addresses development and redevelopment project-level hydromodification management measures currently required for PDPs by the MS4 Permit. Until optional watershed-specific performance recommendations or alternative compliance programs are developed, hydromodification management strategies for new development and redevelopment projects will consist of onsite measures designed to meet the performance requirements of Provisions E.3.c.(2).(a) and (b) of the MS4 Permit shown in Section 2.3.1. While development project-level measures alone will not reverse hydromodification of major streams, onsite measures are a necessary component of a watershed-wide solution, particularly while watershed-wide management strategies are still being developed. Also, development project-level measures are necessary to protect a project's specific stormwater discharge points, which are typically discharging in smaller tributaries not studied in detail in larger watershed studies. Typical measures for development projects include:

- Protecting critical sediment yield areas by designing the project to avoid them or implementing measures that would allow coarse sediment to be discharged to receiving waters, such that the natural sediment supply is unaffected by the project;
- Using site design/LID measures to minimize impervious areas onsite and reduce post-project runoff; and

- Providing structural BMPs designed using continuous simulation hydrologic modeling to provide flow control of post-project runoff (e.g. BMPs that store post-project runoff and infiltrate, evaporate, harvest and use, or discharge excess runoff at a rate below the critical flow rate).

Structural BMPs for hydromodification management provide volume to control a range of flows from a fraction of Q2 to Q10. The volume determined for hydromodification management is different from the DCV for pollutant control. Methodology to demonstrate compliance with hydromodification management requirements are presented in Chapter 6 of this BMP Design manual. See Section 2.4 regarding the relationship between pollutant control and hydromodification management performance standards.

2.4 Relationship between Performance Standards

An integrated approach can provide significant cost savings by utilizing design features that meet multiple standards.

Site design/LID, stormwater pollutant control, and hydromodification management are separate requirements to be addressed in development project design. Each has its own purpose and each has separate performance standards that must be met. However, effective project planning involves understanding the ways in which these standards are related and how single suites of design features can meet more than one standard.

Site design features (aka LID) can be effective at reducing the runoff to downstream BMPs.

Site design BMPs serve the purpose of minimizing impervious areas and therefore reducing post-project runoff, and reducing the potential transport of pollutants offsite and reducing the potential for downstream erosion caused by increased flow rates and durations. By reducing post-project runoff through, site design BMPs, the amount of runoff that must be managed for pollutant control and hydromodification flow control can be reduced.

Single structural BMPs, particularly retention BMPs, can meet or contribute to both pollutant control and hydromodification management objectives.

The objective of structural BMPs for pollutant control is to reduce offsite transport of pollutants, and the objective of structural BMPs for hydromodification management is to control flow rates and durations for control of downstream erosion. In either case, the most effective structural BMP to meet the objective are BMPs that are based on retention of stormwater runoff where feasible. Both stormwater 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

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expected to require the largest volume of stormwater to be retained, (2) checking whether the initial design incidentally meets the second performance standard, and (3) adjusting the design as necessary until it can be demonstrated that both performance standards are met.

Chapter
3

Development Project Planning and Design

Compliance with source control/site design, pollutant control, and hydromodification management BMPs, as applicable, requires coordination of site, landscape, and project stormwater plans. It also involves provisions for O&M of structural BMPs. In order to effectively comply with applicable requirements, a step-wise approach is recommended. This chapter outlines a step-wise, systematic approach (Figure 3-1) to preparing a comprehensive stormwater management design for Standard Projects and PDPs.

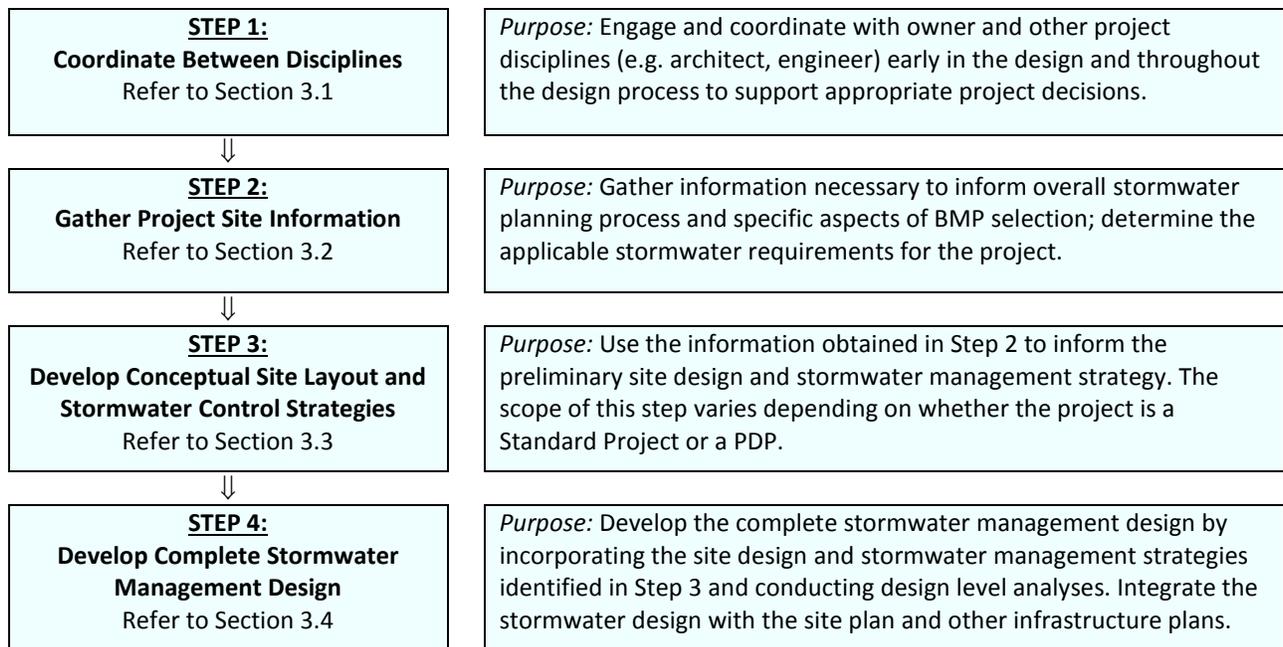


FIGURE 3-1. Approach for Developing a Comprehensive Stormwater Management Design

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 stormwater 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.

Lemon Grove-specific special requirements are listed in Section 3.5 and requirements for phased projects are in Section 3.6.

3.1 Coordination Between Disciplines

Stormwater management design requires close coordination between multiple disciplines, as stormwater 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 stormwater 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 stormwater management features, and initiate maintenance agreements when applicable.
- Ensure that whole lifecycle costs are considered in the selection and design of stormwater management features and a source of funding is provided for long term maintenance.
- Identify the party responsible to inspect structural BMPs at each significant construction stage and at completion in order to provide certification of structural BMPs following construction.

Planner:

- Communicate overall project planning criteria to the team, such as planned development density, parking requirements, project-specific planning conditions, conditions of approval from prior entitlement actions (e.g. CEQA, 401 certifications), etc. and locations of open space and conservation easements and environmentally sensitive areas that are protected from disturbance), etc.
- Consider location of stormwater facilities early in the conceptual site layout process.
- Assist in developing the site plan.

Architect:

- Participate in siting and design (architectural elements) of stormwater BMPs.

Civil Engineer:

- Determine stormwater requirements applicable to the site (e.g. Standard Project vs. PDP).
- Obtain site-specific information (e.g. watershed information, infiltration rates) and develop viable stormwater management options that meet project requirements.
- Reconcile stormwater management requirements with other site requirements (e.g. fire access, Americans with Disabilities Act accessibility, parking, open space).
- Develop site layout and site design including preliminary and final design documents or plans.

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- Select and design BMPs; conduct and document associated analyses; prepare BMP design sheets, details, and specifications.
- Prepare project SWQMP submittals.

Landscape Architect and/or Horticulturist/Agronomist:

- Select appropriate plants for vegetated stormwater 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-stormwater 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 stormwater management BMPs, it is necessary to gather relevant project site information. This could include physical site information, proposed uses of the site, level of stormwater management requirements (i.e. is it a Standard Project or a PDP?), proposed stormwater discharge locations, potential/anticipated stormwater 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 stormwater 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 stormwater management design. In other cases, some information will not be applicable. For example, on an existing development site, there may be no natural hydrologic features remaining, therefore these features do not need to be characterized. The lack of natural hydrologic features can be simply noted without further effort required.

Checklists (in Appendix I) and submittal templates (in Appendix A) are provided to facilitate gathering information about the project site for BMP selection and design. As part of planning for site investigation, it is helpful to review the subsequent steps (Section 3.3 and 3.4) to gain familiarity with how the site information will be used in making decisions about site layout and stormwater BMP selection and design. This can help prioritize the data that are collected.

3.3 Developing Conceptual Site Layout and Stormwater Control Strategies

Once preliminary site information has been obtained, the site can be assessed for stormwater 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 stormwater management features at a conceptual level during the site planning phase. Stormwater management requirements must be considered as a key factor in laying out the overall site. Preliminary design of permanent stormwater 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

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- 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 Section 1.9 and 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 stormwater management system configuration. BMP selection, sizing, and feasibility determinations must be made at the DMA level; therefore delineation of DMAs is highly recommended at the conceptual site planning phase and is mandatory for completing the project design and meeting submittal requirements. This section provides guidance on delineating DMAs that is intended to be used as part of Section 3.3 and 3.4.

DMAs are defined based on the proposed drainage patterns of the site and the BMPs to which they drain. During the early phases of the project, DMAs shall be delineated based onsite drainage patterns and possible BMP locations identified in the site planning process. DMAs should not overlap and should be similar with respect to BMP opportunities and feasibility constraints. More than one DMA can drain to the same BMP. However, because the BMP sizes are determined by the runoff from the DMA, a single DMA may not drain to more than one BMP. See Figure 3-2.

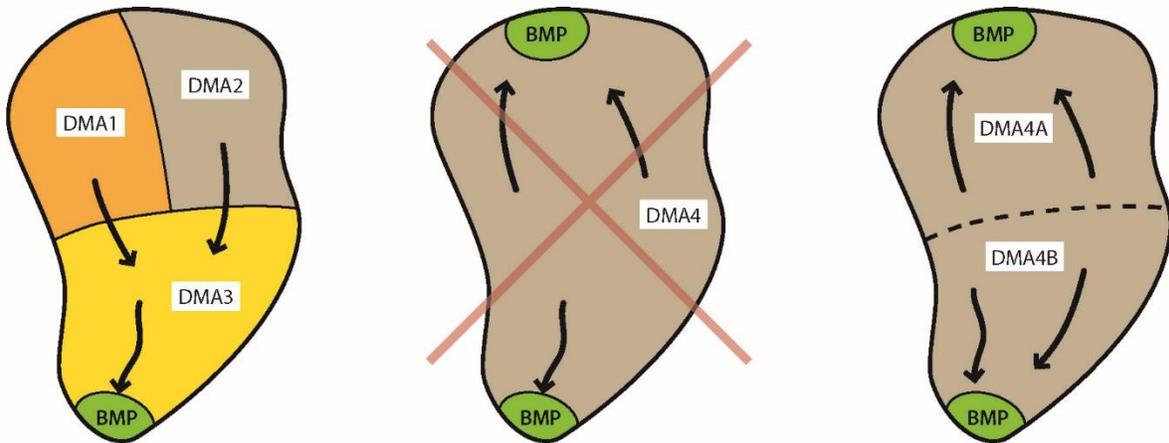


FIGURE 3-2. DMA Delineation

In some cases, in early planning phases, it may be appropriate to generalize the proposed treatment plan by simply assigning a certain BMP type to an entire planning area (e.g. Parking lot X will be treated with bioretention) and calculating the total sizing requirement without identifying the specific BMP locations at that time. This planning area would be later subdivided for design-level calculations. Section 5.2 provides additional guidance on DMA delineation. A runoff factor (similar to a “C” factor used in the rational method) should be used to estimate the runoff draining to the BMP. Appendix B.1 provides guidance in estimating the runoff factor for the drainage area draining to a BMP.

BMPs must be sized to treat the DCV from the total area draining to the BMP, including any offsite or onsite areas that comeingle 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.

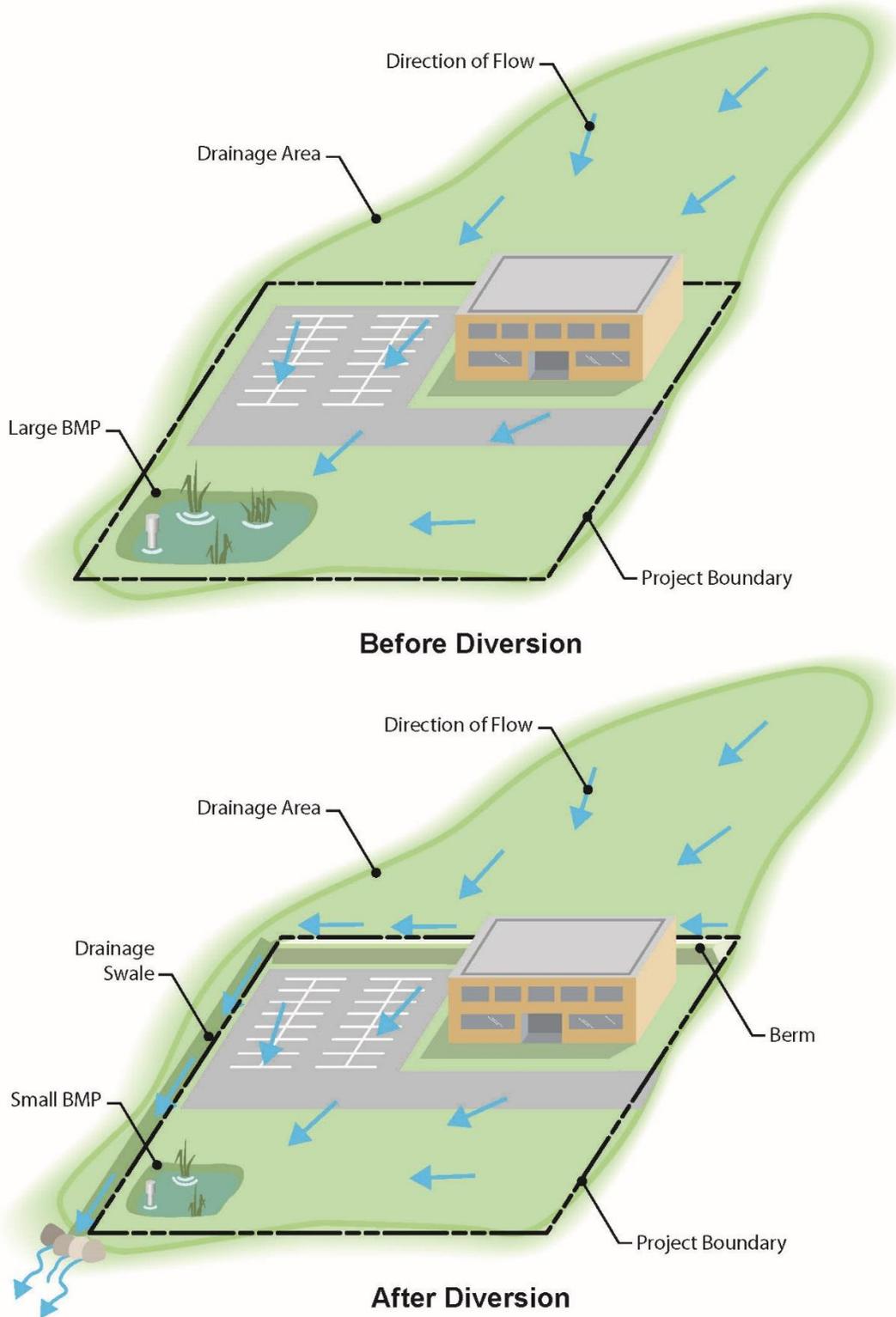


FIGURE 3-3. Tributary Area for BMP Sizing

3.3.4 Developing Conceptual Stormwater Control Strategies

This step applies to PDPs only. The goal of this step is to develop conceptual stormwater 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 stormwater considerations to influence the site layout to better accommodate stormwater design requirements. The end product of this step should be a general, but concrete understanding of the stormwater 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 stormwater 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.
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 stormwater 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. stormwater 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

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h. Safety and accessibility considerations

This assessment is not intended to be final or account for all potential factors. Rather, it is intended to help in identifying site opportunities and constraints as they relate to site planning. After potential BMP locations are established, a more detailed feasibility analysis is necessary (see Section 3.4 and 5.4.2). Additionally, Appendix C and D provide methods for geotechnical and groundwater assessment applicable for screening at the planning level and design-level requirements. The City may allow alternate assessment methods with appropriate documentation at the discretion of the Development Services Director.

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 stormwater management BMPs will be accessed for inspection and maintenance and provide necessary site planning allowances (access roads, inspection openings, setbacks, etc.) and coordinate with City maintenance staff 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 stormwater management plan. The SWQMP primarily shows the complete design rather than the preliminary steps in the process. However, to comply with the requirements of this manual, the applicant is required to describe how stormwater 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 Stormwater Management Design

The complete stormwater 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 stormwater 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 stormwater 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 stormwater pollutant treatment BMPs are provided in Chapter 5.

1. Select locations for stormwater 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).

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6. Evaluate if the required BMP footprints will fit within the site considering the site constraints; if not, then document infeasibility and move to the next step.
7. If using biofiltration BMPs, document conformance with the criteria for biofiltration BMPs found in Appendix F, including Appendix F.1, as applicable.
8. If needed, implement flow-thru treatment control BMPs (for use with Alternative Compliance¹³) for the remaining DCV. See Section 5.5.4 and Appendix B.6 for additional guidance.
9. If flow-thru treatment control BMPs (for use with Alternative Compliance) were implemented refer to Section 1.8.
10. Prepare SWQMP documenting site planning and opportunity assessment activities, final site layout and stormwater 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 stormwater 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 stormwater 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 stormwater pollutant treatment and hydromodification control. The same location(s) can serve both functions (e.g. a biofiltration area that provides both pollutant control and flow control), or separate pollutant control and flow control locations may be identified (e.g. several dispersed retention areas for pollutant control, with overflow directed to a single location of additional storage for flow control).
7. Calculate BMP sizing requirements for pollutant control and flow control. See Appendix B (sizing methods) and Appendix E (design criteria).

¹³ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

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- a. When the same BMP will serve both functions, Section 6.3.6 of this manual provides recommendations for assessing the controlling design factor and initiating the design process.
8. Evaluate if the required BMP footprints will fit within the site considering the site constraints:
 - a. If they fit within the site, design BMPs to meet applicable sizing and design criteria. Document sizing and design separately for pollutant control and hydromodification management even when the same BMP is serving both functions.
 - b. If they do not fit the site then document infeasibility and move to the next step.
9. Implement flow-thru treatment control BMPs (for use with Alternative Compliance¹⁴) for the remaining DCV. See Section 5.5.4 and Appendix B.6 for additional guidance.
10. If flow-thru treatment control BMPs (for use with Alternative Compliance) were implemented refer to Section 1.8.
11. Prepare a SWQMP documenting site planning and opportunity assessment activities, final site layout, stormwater pollutant control design and hydromodification management design. See Chapter 8.
12. Determine and document O&M requirements. See Chapters 7 and 8.

3.5 Project Planning and Design Requirements Specific to the City of Lemon Grove

Projects within the City of Lemon Grove shall satisfy the following requirement regarding planning for eventual ownership of facilities:

The SWQMP shall clearly identify how final land ownership mapping relates to ownership and location of stormwater pollutant treatment and hydromodification control BMPs and their corresponding DMAs. The City reserves the right to reject any proposed SWQMP that is likely to create future conflicts in enforcing the maintenance and effectiveness of BMPs once legally defined land parcels are sold to separate owners.

3.6 Phased Projects

Phased projects typically require a conceptual or master PDP SWQMP followed by more detailed submittals.

The City reserves the right to require a conceptual SWQMP early in the approval process for a proposed phased development. The level of detail in the conceptual SWQMP shall correspond to the level of detail provided in the approval being sought. The conceptual SWQMP shall also state

¹⁴ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

Chapter 3: Development Project Planning and Design

that a more detailed SWQMP will be prepared and submitted for each phase or portion of the project as part of subsequent discretionary approvals for those phases or portions.

Source Control and Site Design Requirements for All Development Projects

This chapter presents the source control and site design requirements to be met by all projects, inclusive of Standard Projects and PDPs. Checklists I.4 for source control and I.5 for site design included in Appendix I can be used by both Standard Projects and PDPs to document conformance with the requirements.

4.1 General Requirements (GR)

GR-1: Onsite BMPs must be located so as to remove pollutants from runoff prior to its discharge to any receiving waters, and as close to the source as possible.

The location of the BMP affects the ability of the BMP to retain, and/or treat, the pollutants from the contributing drainage area. BMPs must remove pollutants from runoff and should be placed as close to the pollutant source as possible.

How to comply: Projects shall comply with this requirement by implementing source control (Section 4.2) and site design BMPs (Section 4.3) that are applicable to their project and site conditions.

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 compliance¹⁵ opportunities involving restoration of areas within Waters of the U.S. may be identified by the City.

How to comply: Projects shall comply with this requirement by preparing project plans that illustrate the location of all stormwater BMPs demonstrate compliance with this requirement by showing the location of BMPs on project plans and describing or depicting the location of receiving waters.

¹⁵ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

Chapter 4: Source Control and Site Design Requirements for All Development Projects

GR-3: Onsite BMPs must be designed and implemented with measures to avoid the creation of nuisances or pollutions associated with vectors (e.g. mosquitoes, rodents, or flies).

According to the California Department of Health, structural BMPs that retain standing water for over 96 hours are particularly concerning for facilitating mosquito breeding. Certain site design features that hold standing water may similarly produce mosquitoes.

How to comply: Projects shall comply with this requirement by incorporating design, construction, and maintenance principles to drain retained water within **96 hours** and minimize standing water. Design calculations shall be provided to demonstrate the potential for standing water ponding at surface level and accessible to mosquitoes has been addressed. For water retained in biofiltration facilities that are not accessible to mosquitoes this criteria is not applicable (i.e. water ponding in the gravel layer, water retained in the amended soil, etc.).

4.2 Source Control (SC) BMP Requirements

Source control BMPs avoid and reduce pollutants in stormwater runoff. Everyday activities, such as recycling, trash disposal and irrigation, generate pollutants that have the potential to drain to the stormwater conveyance system. Source control BMPs are defined as an activity that reduces the potential for stormwater runoff to come into contact with pollutants. An activity could include an administrative action, design of a structural facility, usage of alternative materials, and operation, maintenance and inspection of an area. Where applicable and feasible, all development projects are required to implement source control BMPs. Source control BMPs (SC-1 through SC-6) are discussed below.

How to comply: Projects shall comply with this requirement by implementing source control BMPs listed in this section that are applicable to their project. Applicability shall be determined through consideration of the development project's features and anticipated pollutant sources. Appendix E provides guidance for identifying source control BMPs applicable to a project. PDPs document compliance with source control BMP requirements by completing the source control BMP checklist in the SWQMP template (Appendix A.2) and submitting it as part of the SWQMP. Standard (non-priority) projects document compliance with source control BMP requirements by including the City's Standard Project Stormwater BMP Notes (see the attachment to Form I-2 in Appendix I) on their site plans.

SC-1: Prevent illicit discharges into the MS4

An illicit discharge is any discharge to the MS4 that is not composed entirely of stormwater except discharges pursuant to a National Pollutant Discharge Elimination System permit and discharges resulting from firefighting activities. Projects must effectively eliminate discharges of non-stormwater into the MS4. This may involve a suite of housekeeping BMPs which could include effective irrigation, dispersion of non-stormwater 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 stormwater conveyance system inlets and catch basins within the project area. Inlet stenciling may include concrete stamping, concrete painting, placards, or other

Chapter 4: Source Control and Site Design Requirements for All Development Projects

methods approved by the local municipality. In addition to storm drain stenciling, projects are encouraged to post signs and prohibitive language (with graphical icons) which prohibit illegal dumping at trailheads, parks, building entrances and public access points along channels and creeks within the project area.

SC-3: Protect outdoor material storage areas from rainfall, run-on, runoff, and wind dispersal

Materials with the potential to pollute stormwater runoff shall be stored in a manner that prevents contact with rainfall and stormwater 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 stormwater 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 stormwater conveyance system; or
 - Protected by secondary containment structures such as berms, dikes, or curbs.
- The storage areas shall be paved and sufficiently impervious to contain leaks and spills, where necessary.
- The storage area shall be sloped towards a sump or another equivalent measure that is effective to contain spills.
- Runoff from downspouts/roofs shall be directed away from storage areas.
- The storage area shall have a roof or awning that extends beyond the storage area to minimize collection of stormwater 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.

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SC-5: Protect trash storage areas from rainfall, run-on, runoff, and wind dispersal

Stormwater 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 stormwater.
- Ensure trash container areas are screened or walled to prevent offsite transport of trash.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Locate storm drains away from immediate vicinity of the trash storage area and vice versa.
- Post signs on all dumpsters informing users that hazardous material are not to be disposed.

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

Appendix E provides guidance on permanent controls and operational BMPs that are applicable at a project site based on potential sources of runoff pollutants at the project site. 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 LID BMPs) are intended to reduce the rate and volume of stormwater runoff and associated pollutant loads. Site design BMPs include practices that reduce the rate and/or volume of stormwater 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 stormwater 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.

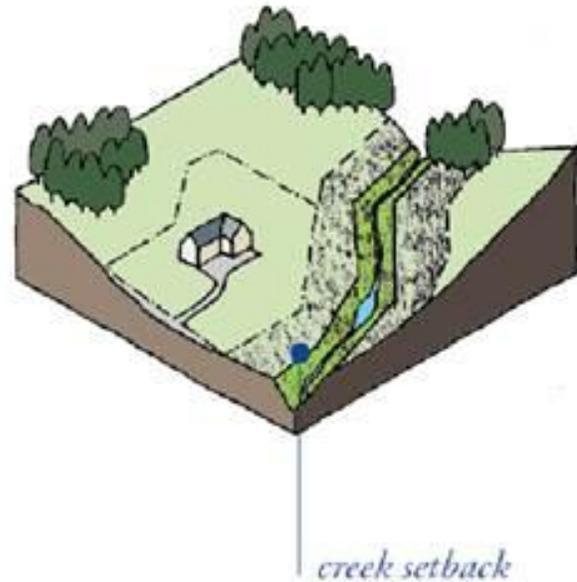
How to comply: Projects shall comply with this requirement by using all of the site design BMPs listed in this section that are applicable and practicable to their project type and site conditions. Applicability of a given site design BMP shall be determined based on project type, soil conditions, presence 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. PDPs document compliance with site design BMP requirements by completing the site design BMP checklist in the SWQMP template (Appendix A.2) and submitting it as part of the SWQMP. Standard (non-priority) projects document compliance with site design BMP requirements by including the City’s Standard Project Stormwater BMP Notes (see the attachment to Form I-2 in Appendix I) on their site plans.

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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 stormwater management as the soils and habitat already function as a natural filtering/infiltrating swale. When determining the development footprint of the site, altering natural drainages should be avoided. By providing a development envelope set back from natural drainages, the drainage can retain some water quality benefits to the watershed. In some situations, site constraints, regulations, economics, or other factors may not allow avoidance of drainages and sensitive areas. Projects proposing to dredge or fill materials in Waters of the U.S. must obtain Clean Water Act Section 401 Water Quality Certification. Projects proposing to dredge or fill waters of the State must obtain waste discharge requirements. Both the 401 Certification and the Waste Discharge Requirements are administered by the RWQCB. Additional permits from other regulatory agencies, such as the U.S. Army Corps of Engineers and the California Department of Fish and Wildlife, may also be required. 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:

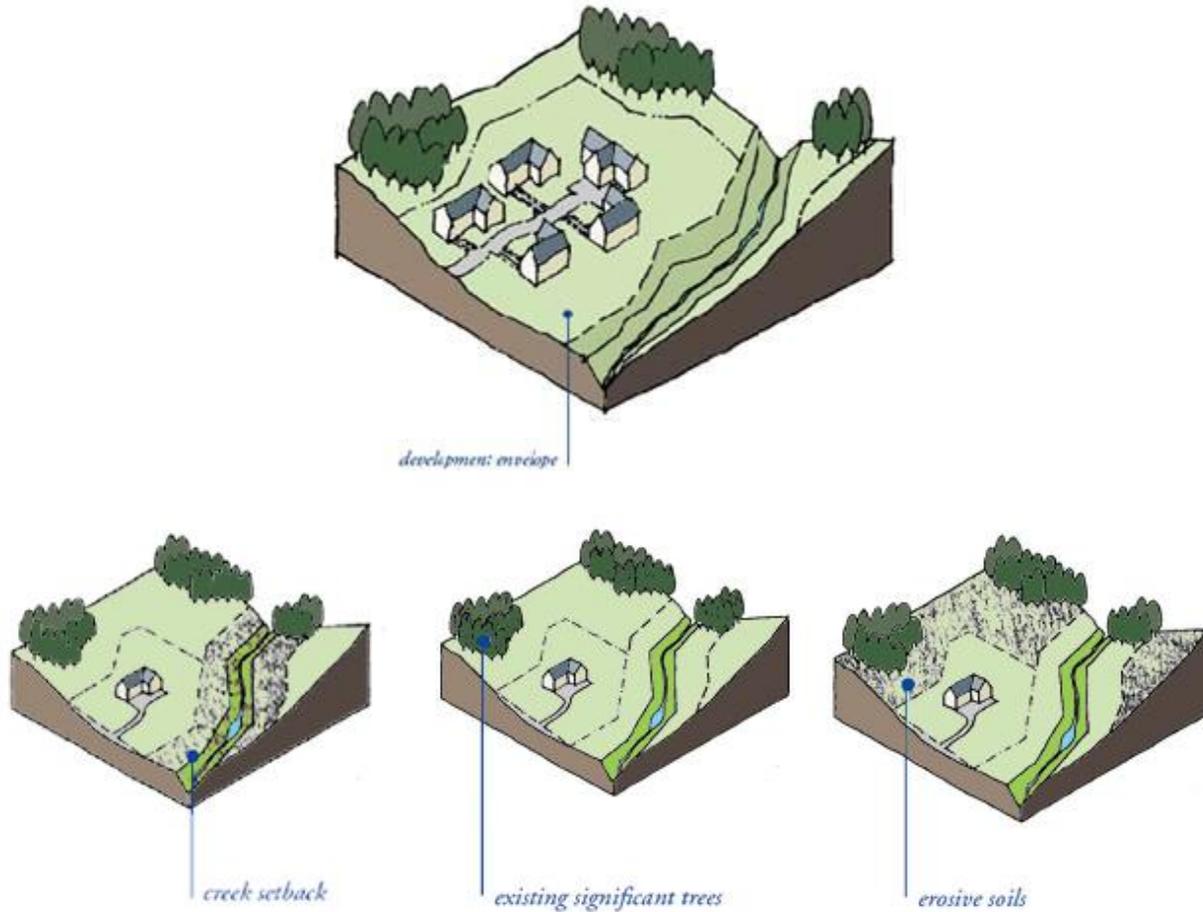
- Evaluate surface drainage and topography in considering selection of site design BMPs that will be most beneficial for a given project site. Where feasible, maintain topographic depressions for infiltration.
- Optimize the site layout and reduce the need for grading. Where possible, conform the site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

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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 stormwater, thereby reducing the amount of runoff.



Source: County of San Diego LID Handbook

The upper soil layers of a natural area contain organic material, soil biota, vegetation, and a configuration favorable for storing and slowly conveying stormwater 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 stormwater, 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, stormwater 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.

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Project applicant shall consult the City for City-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.

LEAST SENSITIVE



MOST SENSITIVE

1. AREAS DEVOID OF VEGETATION, INCLUDING PREVIOUSLY GRADED AREAS AND AGRICULTURAL FIELDS
2. AREAS OF NON-NATIVE VEGETATION, DISTURBED HABITATS AND EUCALYPTUS WOODLANDS WHERE RECEIVING WATERS ARE NOT PRESENT
3. AREAS OF CHAMISE OR MIXED CHAPARRAL, AND NON-NATIVE GRASSLANDS.
4. AREAS CONTAINING COASTAL SCRUB COMMUNITIES
5. ALL OTHER UPLAND COMMUNITIES
6. OCCUPIED HABITAT OF SENSITIVE SPECIES AND ALL WETLANDS (AS BOTH ARE DEFINED BY THE LOCAL JURISDICTION)

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

Chapter 4: Source Control and Site Design Requirements for All Development Projects

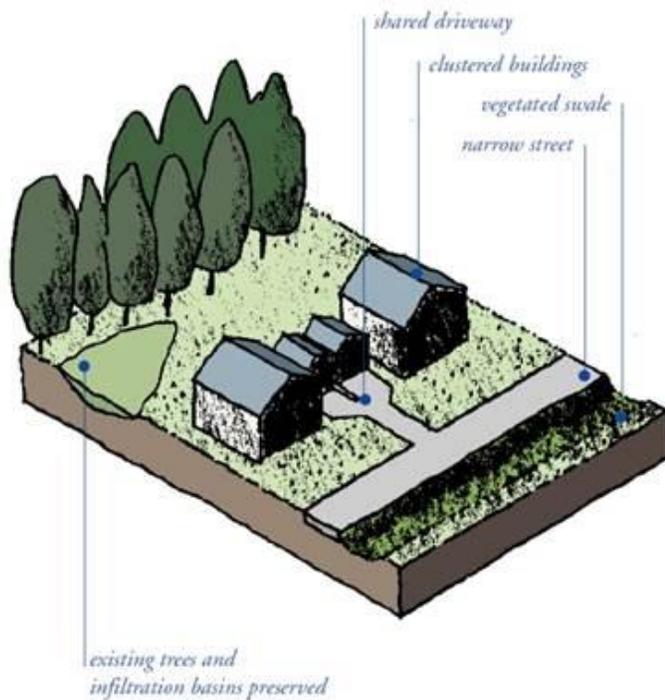
pollutants may originate as airborne dust, be washed from the atmosphere during rains, or may be generated by automobiles and outdoor work activities.

- Second, increased peak flows and runoff durations typically cause erosion of stream banks and beds, transport of fine sediments, and disruption of aquatic habitat. Measures taken to control stream erosion, such as hardening banks with riprap or concrete, may permanently eliminate habitat.

Impervious cover can be minimized through identification of the smallest possible land area that can be practically impacted or disturbed during site development. Reducing impervious surfaces retains the permeability of the project site, allowing natural processes to filter and reduce sources of pollution.

Projects can incorporate 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.
- 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.



Source: County of San Diego LID Handbook

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 stormwater 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 MS4

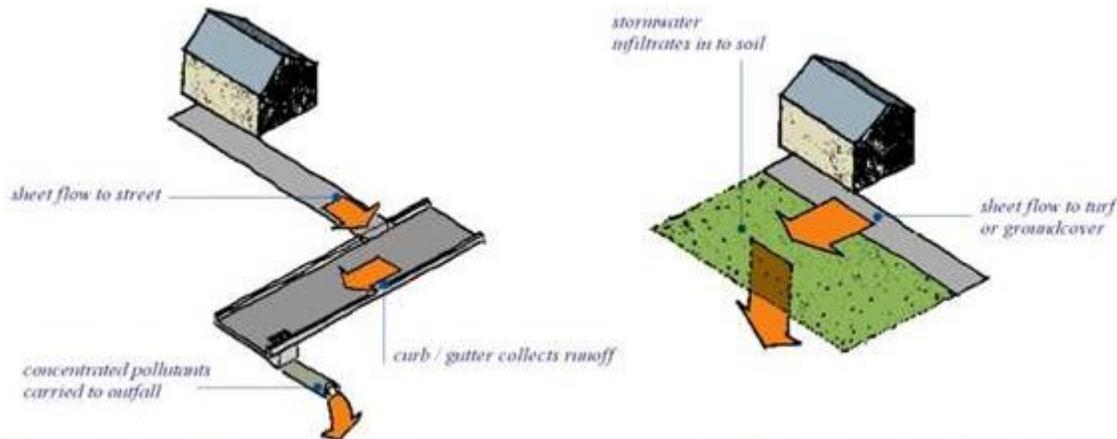
Impervious area dispersion (dispersion) refers to the practice of essentially disconnecting impervious areas from directly draining to the storm drain system by routing runoff from impervious areas such as rooftops, walkways, and driveways onto the surface of adjacent pervious areas. The intent is to slow runoff discharges, and reduce volumes while achieving incidental treatment. Volume reduction from dispersion is dependent on the infiltration characteristics of the pervious area and the amount of impervious area draining to the pervious area. Treatment is achieved through filtration, shallow sedimentation, sorption, infiltration, evapotranspiration, biochemical processes and plant uptake.

The effects of imperviousness can be mitigated by disconnecting impervious areas from the drainage system and by encouraging detention and retention of runoff near the point where it is generated. Detention and retention of runoff reduces peak flows and volumes and allows pollutants to settle out or adhere to soils before they can be transported downstream. Disconnection practices may be applied in almost any location, but impervious surfaces must discharge into a suitable receiving area for the practices to be effective. Information gathered during the site assessment will help determine appropriate receiving areas.

Project designs should direct runoff from impervious areas to adjacent landscaping areas that have higher potential for infiltration and surface water storage. This will limit the amount of runoff

Chapter 4: Source Control and Site Design Requirements for All Development Projects

generated, and therefore the size of the mitigation BMPs downstream. The design, including consideration of slopes and soils, must reflect a reasonable expectation that runoff will soak into the soil and produce no runoff of the DCV. On hillside sites, drainage from upper areas may be collected in conventional catch basins and piped to landscaped areas that have higher potential for infiltration. Or use low retaining walls to create terraces that can accommodate BMPs.



Source: County of San Diego LID Handbook

Projects can incorporate 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 stormwater 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 runoff from impervious surfaces shall have a minimum width of 10 feet and a maximum slope of 5%.

Chapter 4: Source Control and Site Design Requirements for All Development Projects

SD-6: Collect runoff

- Use small collection strategies located at, or as close to as possible to the sources (i.e. the point where stormwater initially meets the ground) to minimize the transport of runoff and pollutants to the MS4 and receiving waters
- Use permeable material for projects with low traffic areas and appropriate soil conditions

Distributed control of stormwater runoff from the site 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 provide a much greater range of control practices. Integration of stormwater management into landscape design and natural features of the site, reduce site development and long-term maintenance costs, and provide redundancy if one technique fails. On flatter sites, it typically works best to intersperse landscaped areas and integrate small scale retention practices among the buildings and paving.

Permeable pavements contain small voids that allow water to pass through to a gravel base. They come in a variety of forms; they may be a modular paving system (concrete pavers, grass-pave, or gravel-pave) or poured in place pavement (porous concrete, permeable asphalt). Project applicants should identify locations where permeable pavements could be substituted for impervious concrete or asphalt paving. The O&M of the site must ensure that permeable pavements will not be sealed in the future. In areas where infiltration is not appropriate, permeable paving systems can be fitted with an under drain to allow filtration, storage, and evaporation, prior to drainage into the storm drain system.

Projects can incorporate SD-6 by implementing the following planning and design phase techniques as applicable and practicable:

- Implementing distributed small collection techniques to collect and retain runoff
- Installing permeable pavements (see SD-6B in Appendix E)

SD-7: Landscape with native or drought tolerant species

All development projects are required to select a landscape design and plant palette that minimizes required resources (irrigation, fertilizers and pesticides) and pollutants generated from landscape areas. Native plants require less fertilizers and pesticides because they are already adapted to the rainfall patterns and soils conditions. Plants should be selected to be drought tolerant and not require watering after establishment (2 to 3 years). Watering should only be required during prolonged dry periods after plants are established. Final selection of plant material needs to be made by a landscape architect experienced with LID techniques. Microclimates vary significantly throughout the region and consulting local municipal resources will help to select plant material suitable for a specific geographic location.

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

SD-8: Harvest and use precipitation

Harvest and use BMPs capture and stores stormwater runoff for later use. Harvest and use can be applied at smaller scales (Standard Projects) using rain barrels or at larger scales (PDPs) using cisterns. This harvest and use technique has been successful in reducing runoff discharged to the storm drain system conserving potable water and recharging groundwater.

Rain barrels are above ground storage vessels that capture runoff from roof downspouts during rain events and detain that runoff for later reuse for irrigating landscaped areas. The temporary storage of roof runoff reduces the runoff volume from a property and may reduce the peak runoff velocity for small, frequently occurring storms. In addition, by reducing the amount of stormwater runoff that flows overland into a stormwater conveyance system (storm drain inlets and drain pipes), less pollutants are transported through the conveyance system into local creeks and the ocean. The reuse of the detained water for irrigation purposes leads to the conservation of potable water and the recharge of groundwater. SD-8 fact sheet in Appendix E provides additional detail for designing Harvest and Use BMPs. Projects can incorporate SD-8 by installing rain barrels or cisterns, as applicable.

Photograph Courtesy of Arid Solutions, Inc.



Stormwater Pollutant Control Requirements for PDPs

In addition to the site design and source control BMPs discussed in Chapter 4, PDPs are required to implement stormwater pollutant control BMPs to reduce the quantity of pollutants in stormwater discharges. Stormwater pollutant control BMPs are engineered facilities that are designed to retain (i.e. intercept, store, infiltrate, evaporate and evapotranspire), biofilter and/or provide flow-thru treatment of stormwater runoff generated on the project site.

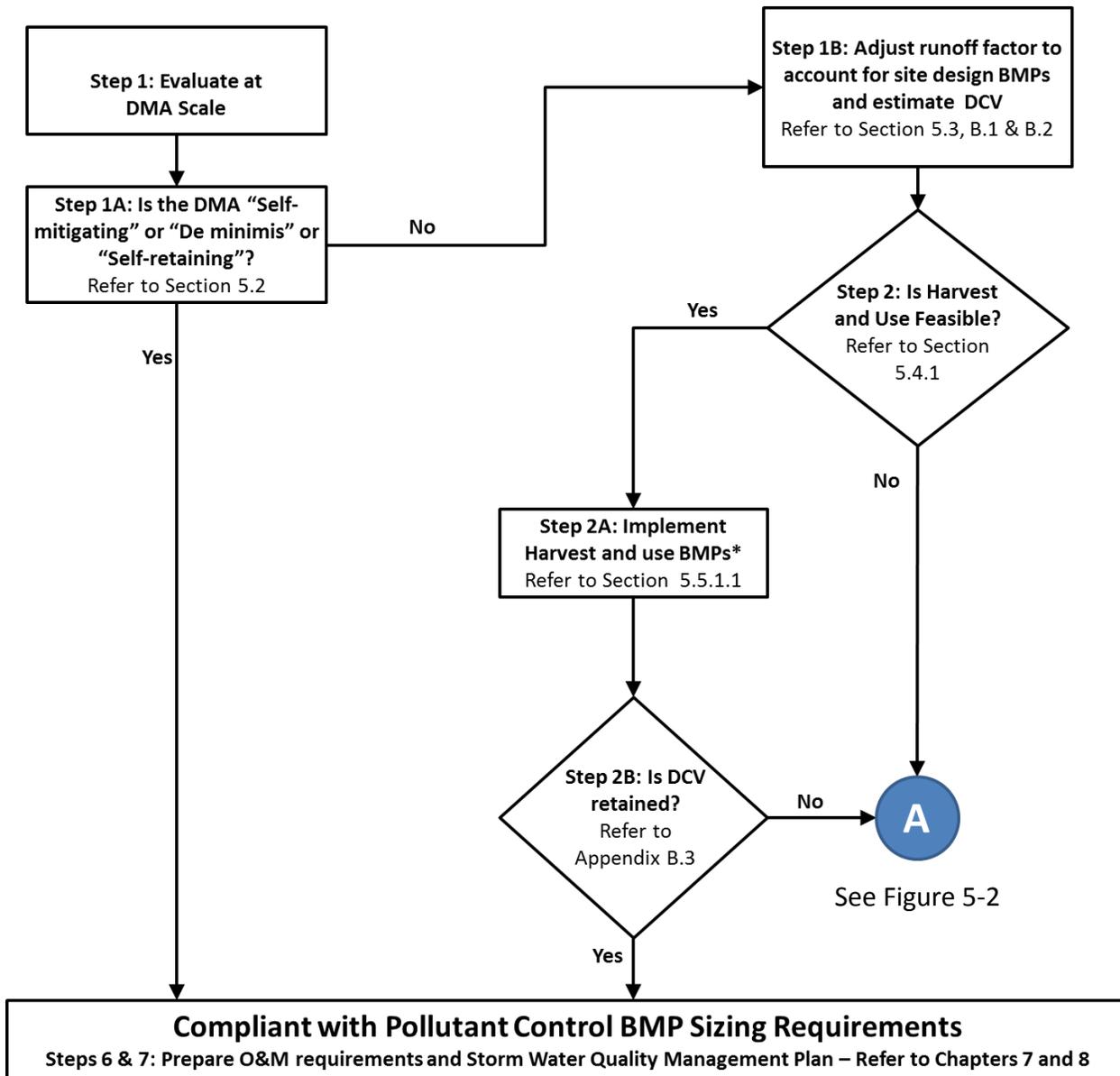
This chapter describes the specific process for determining which category of pollutant control BMP, or combination of BMPs, is most appropriate for the PDP site and how to design the BMP to meet the stormwater pollutant control performance standard (per Section 2.2).

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

- This chapter should be followed after having conducted site planning that maximizes opportunities for stormwater retention and biofiltration as discussed in Chapter 3.
- The steps in this chapter pertain specifically to stormwater pollutant control BMPs. These criteria must be met regardless of whether or not hydromodification management applies, however the overall sequencing of project development may be different if hydromodification management applies. For guidance on how to integrate both hydromodification management and pollutant control BMPs (in cases where both requirements apply), see Sections 3.4.3, 5.6 and Chapter 6.

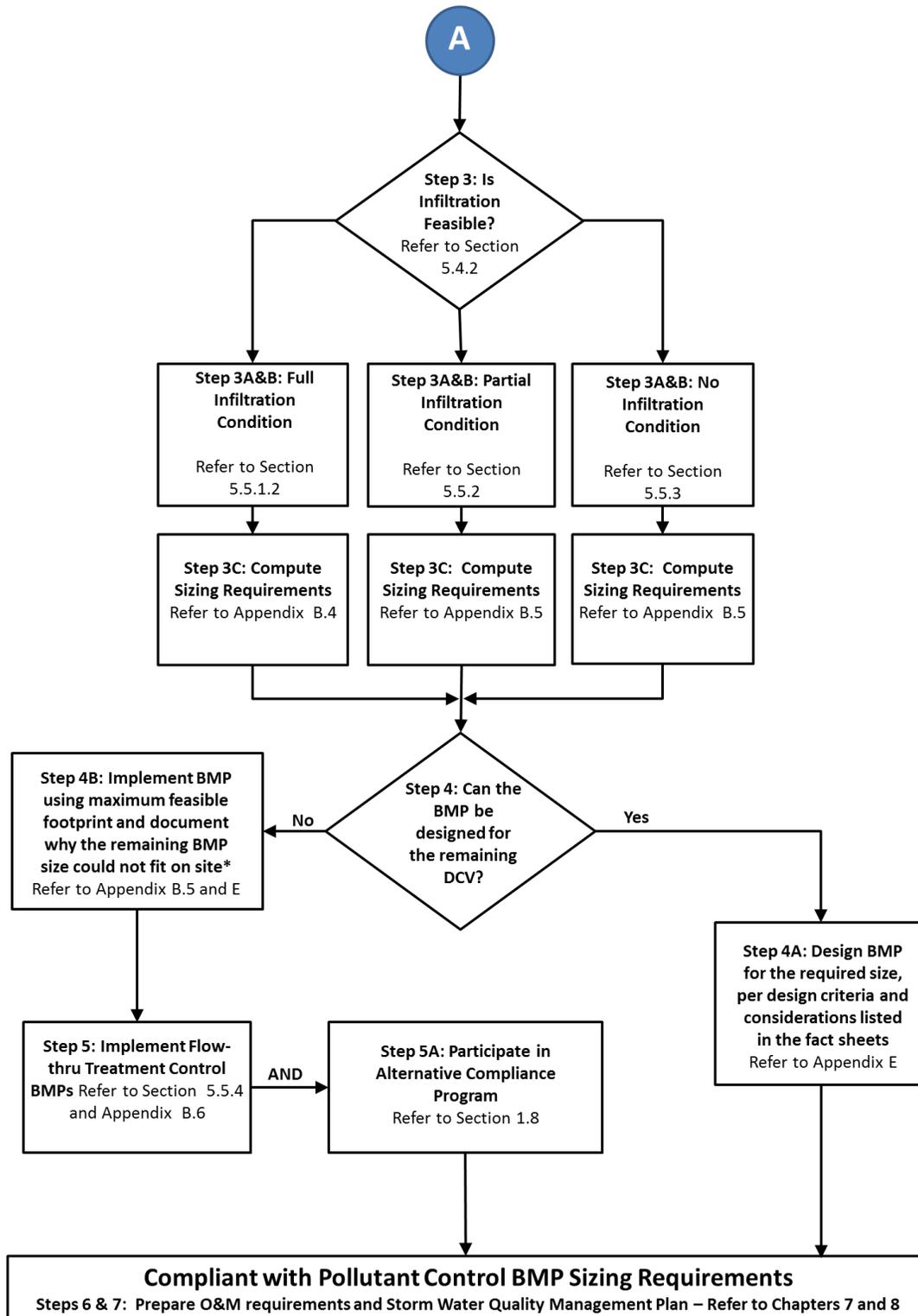
5.1 Steps for Selecting and Designing Stormwater Pollutant Control BMPs

Figures 5-1 and 5-2 present the flow chart for complying with stormwater pollutant control BMP requirements. The steps associated with this flow chart are described below. A project is considered to be in compliance with stormwater 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. Stormwater Pollutant Control BMP Selection Flow Chart



*The City's alternative compliance program does not allow for the use of offsite BMPs. Therefore, this compliance pathway is not currently available. However, after additional resources, such as a regional crediting system, have been developed the City may allow for the use of offsite BMPs in its alternative compliance program.

FIGURE 5-2. Stormwater Pollutant Control BMP Selection Flow Chart

Chapter 5: Stormwater Pollutant Control Requirements for PDPs

Description of Steps:

- Step 1. Based on the locations for stormwater pollutant control BMPs and the DMA delineations developed during the site planning phase (See Section 3.3.3), calculate the DCV.
 - A. Identify DMAs that meet the criteria in Section 5.2 (self-mitigating and/or de minimis areas and/or self-retaining via qualifying site design BMPs).
 - B. Estimate DCV for each remaining DMA. See Section 5.3.
- Step 2. Conduct feasibility screening analysis for harvest and use BMPs. See Section 5.4.1.
 - A. If it is feasible, implement harvest and use BMPs (See Section 5.5.1.1) or go to Step 3.
 - B. Evaluate if the DCV can be retained onsite using harvest and use BMPs. See Appendix B.3. If the DCV can be retained onsite then the pollutant control performance standards are met.
 - C. The applicant has an option to also conduct a feasibility analysis for infiltration and if infiltration is feasible has an option to choose between infiltration and harvest and use BMPs. But if infiltration is not feasible and harvest and use is feasible, the applicant must implement harvest and use BMPs.
- Step 3. Conduct feasibility analysis for infiltration for the BMP locations selected. See Section 5.4.2.
 - A. Determine the preliminary feasibility categories of BMP locations based on available site information. Determine the additional information needed to conclusively support findings. Use the "Categorization of Infiltration Feasibility Condition" checklist located in the City's SWQMP template (Appendix A.2) to document preliminary feasibility screening.
 - B. Select the stormwater 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 stormwater retention and develop design parameters (e.g. infiltration rates, elevations). Document findings to substantiate BMP selection, feasibility, and design in the SWQMP. See Appendix C and D for additional guidance.
- Step 4. Evaluate if the required BMP footprint will fit considering the site design and constraints.
 - A. If the calculated footprint fits, then size and design the selected BMPs accordingly

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using design criteria and considerations from fact sheets presented in Appendix E. The project has met the pollutant control performance standards.

- B. If the calculated BMP footprint does not fit, evaluate additional options to make space for BMPs. Examples include potential design revisions, reconfiguring DMAs, evaluating other or additional BMP locations and evaluating other BMP types. If no additional options are practicable for making adequate space for the BMPs, then document why the remaining DCV could not be treated onsite and then implement the BMP using the maximum feasible footprint, design criteria and considerations from fact sheets presented in Appendix E then continue to the next step. Project approval if the entire DCV could not be treated because the BMP size could not fit within the project footprint is at the discretion of the Development Services Director.
- Step 5. Implement flow-thru treatment control BMPs for the remaining DCV. See Section 5.5.4 and B.6 for additional guidance.
 - A. When flow-thru treatment control BMPs are implemented the project applicant must also participate in an alternative compliance¹⁶ program. See Section 1.8.
 - Step 6. Prepare a SWQMP documenting site planning and opportunity assessment activities, final site layout and stormwater management design. See Chapter 8.
 - Step 7. Identify and document O&M requirements and confirm acceptable to the responsible party. See Chapters 7 and Chapter 8.

5.2 DMAs Excluded from DCV Calculation

This manual provides project applicants the option to exclude DMAs from DCV calculations if they meet the criteria specified below. These DMAs must implement source control and site design BMPs from Chapter 4 as applicable and feasible. These exclusions will be evaluated on a case-by-case basis and approvals of these exclusions are at the discretion of the Development Services Director.

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.

¹⁶ Offsite alternative compliance is not available at this time. See Section 1.8 for more information.

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- Impervious area within the self-mitigated area should not be hydraulically connected to other impervious areas unless it is a stormwater conveyance system (such as brow ditches).
- The self-mitigating area is hydraulically separate from DMAs that contain permanent stormwater pollutant control BMPs.

Figure 5.3 illustrates the concept of self-mitigating DMAs.

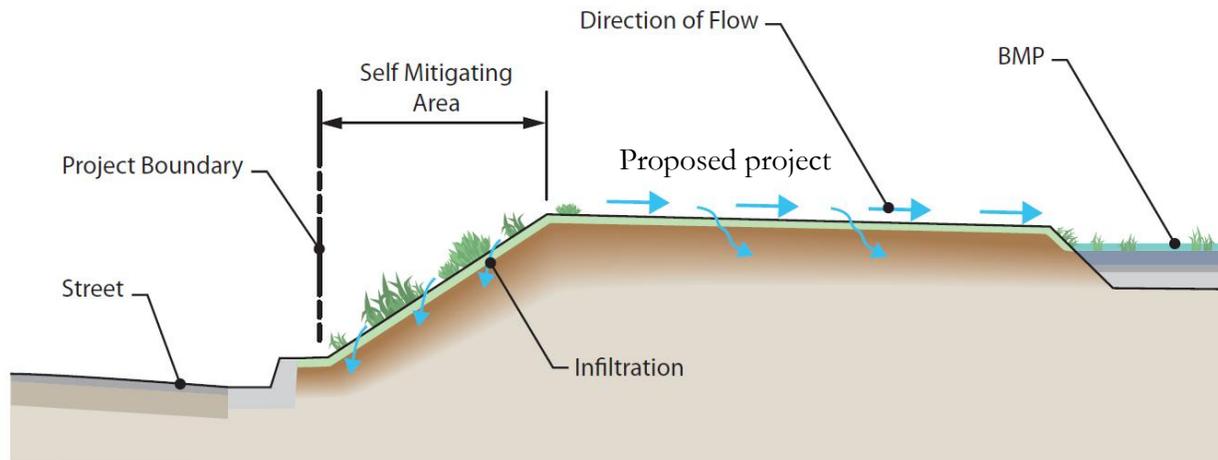


FIGURE 5-3. Self Mitigating Area

5.2.2 De Minimis DMAs

De minimis DMAs consist of areas that are very small, and therefore are not considered to be significant contributors of pollutants, and are considered by the owner and the Development Services Director not practicable to drain to a BMP. It is anticipated that only a small subset of projects will qualify for de minimis DMA exclusion. Examples include driveway aprons connecting to existing streets, portions of sidewalks, retaining walls at the external boundaries of a project, and similar features. De minimis DMAs must include **ALL** of the following characteristics to be eligible for exclusion:

- Areas about the perimeter of the development site.
- Topography and land ownership constraints make BMP construction to reasonably capture runoff technically infeasible.
- The portion of the site falling into this category is minimized through effective site design
- Each DMA should be less than 250 square feet and the sum of all de minimis DMAs should represent less than 2 percent of the total added or replaced impervious surface of the project. Except for projects where 2 percent of the total added or replaced impervious surface of the project is less than 250 square feet, a de minimis DMA of 250 square feet or less is allowed.
- Two de minimis DMAs cannot be adjacent to each other and hydraulically connected.
- The SWQMP must document the reason that each de minimis area could not be addressed

otherwise.

5.2.3 Self-retaining DMAs via Qualifying Site Design BMPs

Self-retaining DMAs are areas that are designed with site design BMPs to retain runoff to a level equivalent to pervious land. BMP Fact Sheets for impervious area dispersion (SD-5 in Appendix E) and permeable pavement (SD-6B in Appendix E) describe the design criteria by which BMPs can be considered self-retaining. DMAs that are categorized as self-retaining DMAs are considered to **only** meet the stormwater pollutant control obligations.

Requirements for utilizing this category of DMA:

- Site design BMPs such as impervious area dispersion and permeable pavement may be used individually or in combination to reduce or eliminate runoff from a portion of a PDP.
- If a site design BMP is used to create a self-retaining DMA, then the site design BMPs must be designed and implemented per the criteria in the applicable fact sheet. These criteria are conservatively developed to anticipate potential changes in DMA characteristics with time. The fact sheet criteria for impervious area dispersion and permeable pavement for meeting pollutant control requirement developed using continuous simulation are summarized below:
 - SD-5 Impervious Area Dispersion: a DMA is considered self-retaining if the impervious to pervious ratio is:
 - 2:1 when the pervious area is composed of Hydrologic Soil Group A
 - 1:1 when the pervious area is composed of Hydrologic Soil Group B
 - SD-6B Self-retaining permeable pavement: a DMA is considered self-retaining if the ratio of total drainage area (including permeable pavement) to area of permeable pavement of 1.5:1 or less.
 - Note: Left side of ratios presented above represents the portion of the site that receives volume reduction and the right side of the ratio represents the site design BMP that promotes the achieved volume reduction.
- Site design BMPs used as part of a self-retaining DMA or as part of reducing runoff coefficients from a DMA must be clearly called out on project plans and in the SWQMP.
- The Development Services Director may accept or reject a proposed self-retaining DMA meeting these criteria at its discretion. Examples of rationale for rejection may include the potential for negative impacts (such as infiltration or vector issues), potential for significant future alteration of this feature, inability to visually inspect and confirm the feature, etc.
- PDPs subject to hydromodification requirements should note that Self-retaining DMAs must be included in hydromodification analysis. Reductions in DCV realized through site design BMPs are applicable to treatment control only and do not relax hydromodification requirements.

Other site design BMPs can be considered self-retaining for meeting stormwater pollutant control obligations if the long term annual runoff volume (estimated using continuous simulation following guidelines listed in Appendix G) from the DMA is reduced to a level equivalent to pervious land and

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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 Development Services Director. Figure 5.4 illustrates the concept of self-retaining DMAs.

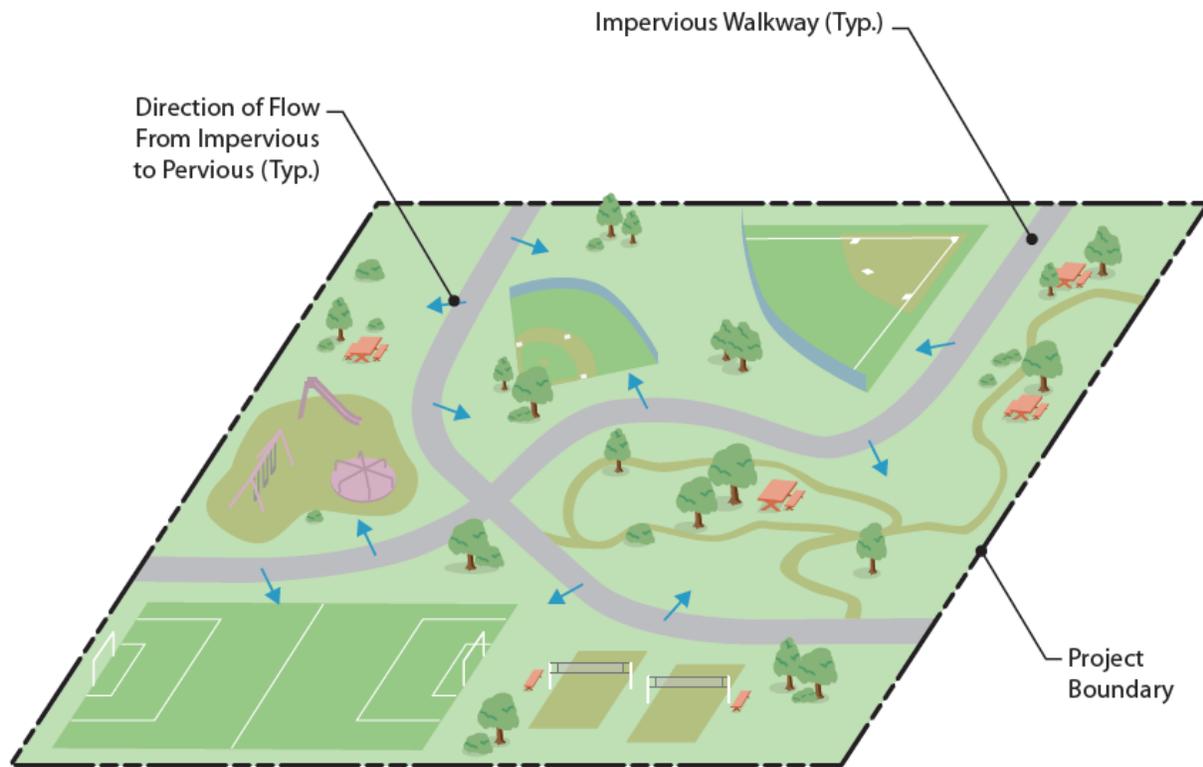


FIGURE 5-4. Self-retaining Site

5.3 DCV Reduction through Site Design BMPs

Site design BMPs as discussed in Chapter 4 reduce the rate and volume of stormwater runoff from the project site. This manual provides adjustments to runoff factors for the following site design BMPs that may be incorporated into the project as part of an effective site design so that the downstream structural BMPs can be sized appropriately:

- SD-1 Street trees
- SD-5 Impervious area dispersion
- SD-6A Green roofs
- SD-6B Permeable pavement
- SD-8 Rain barrels

Methods for adjusting runoff factors for the above listed site design BMPs are presented in Appendix B.2. Site design BMPs used for reducing runoff coefficients from a DMA must be clearly called out on project plans and in the SWQMP. Approval of the claimed reduction of runoff factors is at the discretion of the Development Services Director.

5.4 Evaluating Feasibility of Stormwater 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 stormwater runoff for later use. The primary question to be evaluated is:

- Is there a demand for harvested water within the project or project vicinity that can be met or partially met with rainwater harvesting in a practical manner?

Appendix B.3 provides guidance for determining the feasibility for using harvested stormwater 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 stormwater, the next step is to evaluate how much stormwater can be retained onsite primarily through infiltration of the DCV. Infiltration of stormwater is dependent on many important factors that must be evaluated as part of infiltration feasibility screening. The key questions to determining the degree of infiltration that can be accomplished onsite are:

- Is infiltration potentially feasible and desirable?
- If so, what quantity of infiltration is potentially feasible and desirable?

These questions must be addressed in a systematic fashion to determine if full infiltration of the DCV is potentially feasible. If when answering these questions it is determined that full infiltration is not feasible, then the portion of the DCV that could be infiltrated must be quantified, or a determination that infiltration in any appreciable quantity is infeasible or must be avoided. **This process is illustrated in Figure 5-5.** As a result of this process, conditions can be characterized as one of the three categories listed and defined below.

- **Full Infiltration Condition:** Infiltration of the full DCV is potentially feasible and desirable. More rigorous design-level analyses should be used to confirm this classification and establish specific design parameters such as infiltration rate and factor of safety. BMPs in this category may include bioretention and infiltration basins. See Section 5.5.1.2.
- **Partial Infiltration Condition:** Infiltration of a significant portion of the DCV may be possible, but site factors may indicate that infiltration of the full DCV is either infeasible or not desirable. Select BMPs that provide opportunity for partial infiltration, e.g. biofiltration with partial retention. See Section 5.5.2.

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- **No Infiltration Condition:** Infiltration of any appreciable volume should be avoided. Some incidental volume losses may still be possible, but any appreciable quantity of infiltration would introduce undesirable conditions. Other pollutant control BMPs should be considered e.g. biofiltration or flow-thru treatment control BMPs and participation in alternative compliance (Section 1.8) for the portion of the DCV that is not retained or biofiltered onsite. See Section 5.5.3 and 5.5.4.

The "Categorization of Infiltration Feasibility Condition" checklist located in Appendix I must be used to document the findings of the infiltration feasibility assessment and must be supported by all associated information used in the feasibility findings. Appendix C and D in this manual provides additional guidance and criteria for performing feasibility analysis for infiltration. All PDPs are required to complete this worksheet. At the site planning phase, this worksheet can help guide the design process by influencing project layout and selection of infiltration BMPs, and identifying whether more detailed studies are needed. At the design and final report submittal phase, planning level categorizations related to infiltration must be confirmed or revised and rigorously documented and supported based on design-level investigations and analyses, as needed. A Geological Investigation Report must be prepared for all PDPs implementing onsite structural BMPs. This report should be attached to the SWQMP. Geotechnical and groundwater investigation report requirements are listed in Appendix C.

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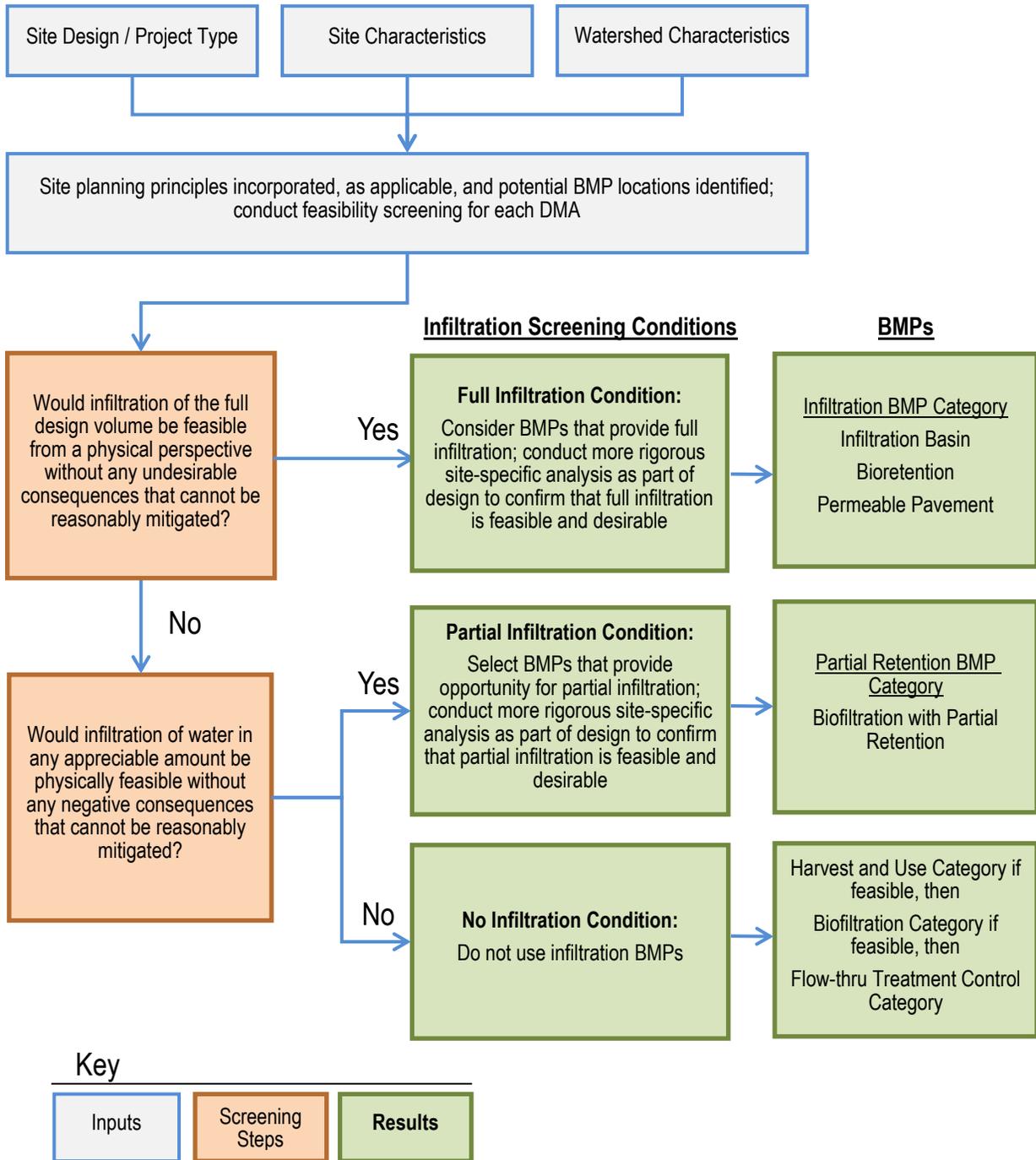


FIGURE 5-5. Infiltration Feasibility and Desirability Screening Flow Chart

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 stormwater pollutant control BMPs for the purpose of meeting stormwater management requirements. Other BMP types and variations on these designs may be approved at the discretion of the Development Services Director if documentation is provided demonstrating that the BMP is functionally equivalent or better than those described in this manual.

This section provides an introduction to each category of BMP and provides links to fact sheets that contain recommended criteria for the design and implementation of BMPs. Table 5-1 maps the BMP category to the fact sheets provided in Appendix E. Criteria specifically described in these fact sheets override guidance contained in outside referenced source documents. Where criteria are not specified, the applicant and the project review staff should use best professional judgment based on the recommendations of the referenced guidance material or other published and generally accepted sources. When an outside source is used, the preparer must document the source in the SWQMP.

TABLE 5-1. Permanent Structural BMPs for PDPs

MS4 Permit Category	Manual Category	BMPs
Retention	Harvest and Use (HU)	HU-1: Cistern
Retention	Infiltration (INF)	INF-1: Infiltration basin INF-2: Bioretention INF-3: Permeable pavement
NA	Partial Retention (PR)	PR-1: Biofiltration with partial retention
Biofiltration	Biofiltration (BF)	BF-1: Biofiltration BF-2: Nutrient Sensitive Media Design BF-3: Proprietary Biofiltration
Flow-thru treatment control ¹⁷	Flow-thru treatment control with Alternative Compliance (FT)	FT-1: Vegetated swales FT-2: Media filters FT-3: Sand filters FT-4: Dry extended detention basins FT-5: Proprietary flow-thru treatment control

¹⁷ Flow-thru BMPs may only be used as part of an alternative compliance approach. Offsite alternative compliance is not available at this time. See Section 1.8 for more information. Projects not pursuing alternative compliance may not use flow-thru treatment control BMPs as part of the project’s approach to satisfying the requirement to treat the DCV.

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 stormwater runoff for later use. These BMPs are engineered to store a specified volume of water and have no design surface discharge until this volume is exceeded. Uses of captured water shall not result in runoff to storm drains or receiving waters. Potential uses of captured water may include irrigation demand, indoor non-potable demand, industrial process water demand, or other demands.

Selection: Harvest and use BMPs shall be selected after performing a feasibility analysis per Section 5.4.1. Based on findings from Section 5.4 if both harvest and use and full infiltration of the DCV is feasible onsite the project applicant has an option to implement either harvest and use BMPs and/or infiltration BMPs to meet the stormwater 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

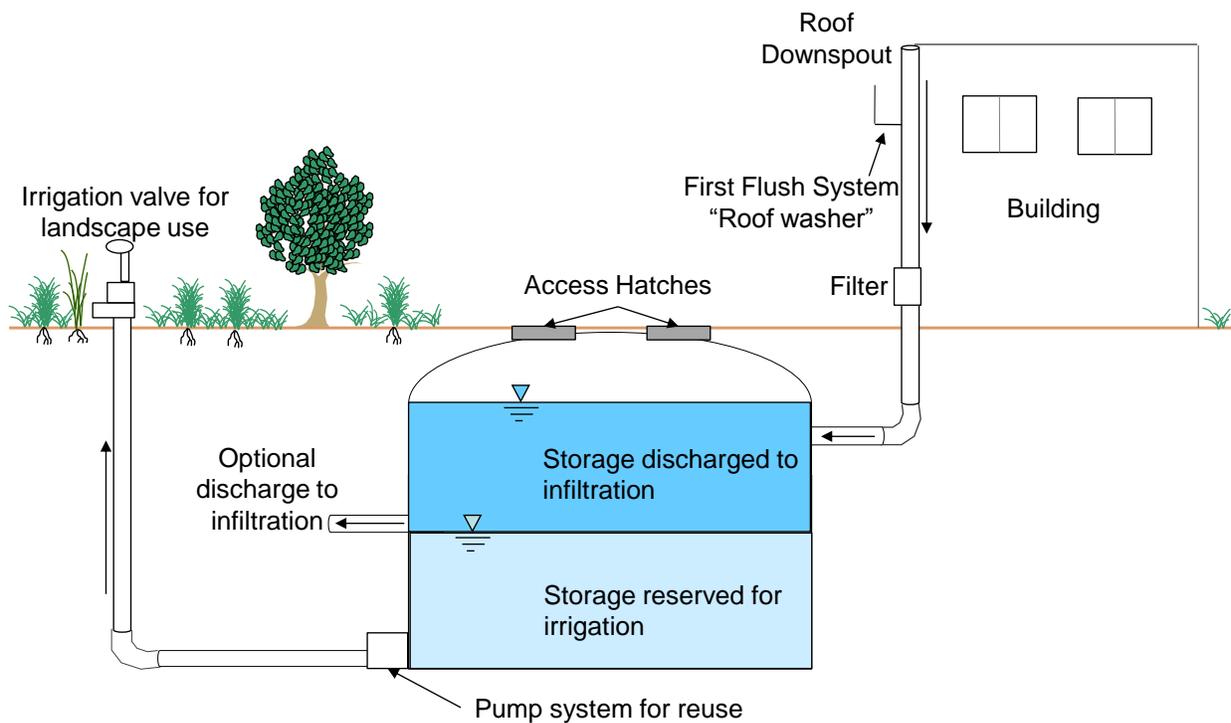


FIGURE 5-6. Schematic of a Typical Cistern

5.5.1.2 Infiltration BMP Category

Infiltration BMPs are structural measures that capture, store and infiltrate stormwater 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.

Design: Appendix B.4 has a worksheet for sizing infiltration BMPs, Appendix D has guidance for estimating infiltration rates for use in design the BMP and Appendix E provides fact sheets to design the infiltration BMPs. Appendices B.6.2.1, B.6.2.2 and D.5.3 have guidance for selecting appropriate pretreatment for infiltration BMPs. Figure 5-7 shows a schematic of an infiltration basin.

BMP options under this category:

- INF-1: Infiltration basins
- INF-2: Bioretention
- INF-3: Permeable pavement.

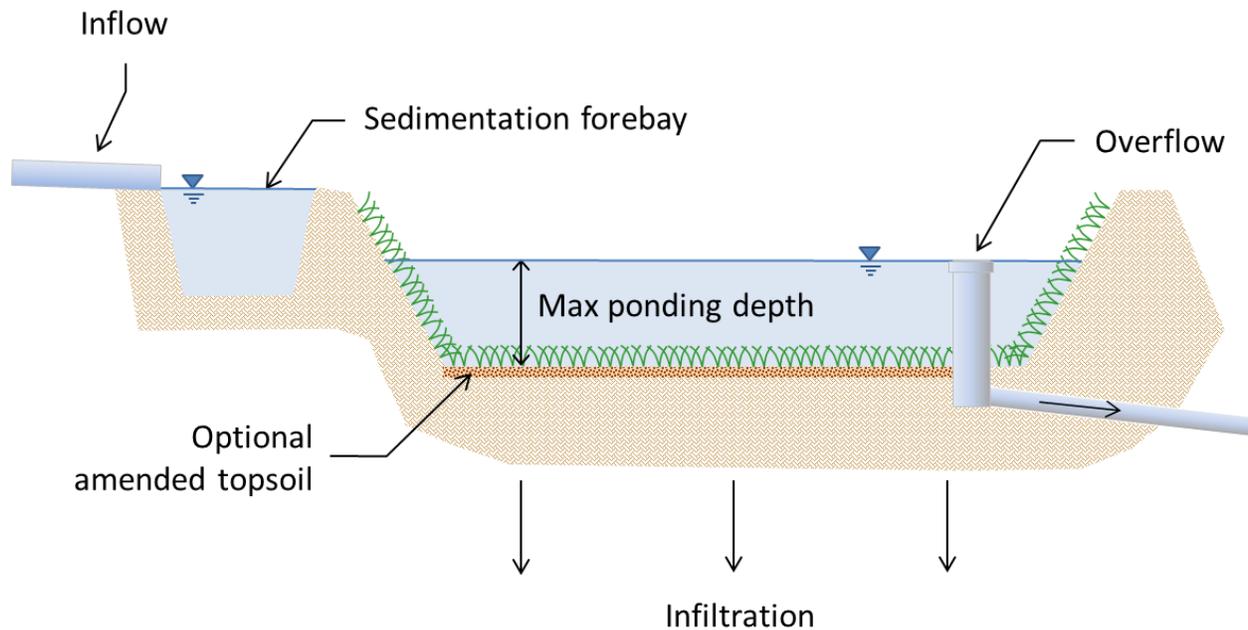


FIGURE 5-7. Schematic of a Typical Infiltration Basin

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 stormwater runoff through infiltration, evapotranspiration, and biofiltration. These BMPs are characterized by a subsurface stone infiltration storage zone in the bottom of the BMP below the elevation of the discharge from the underdrains. The discharge of biofiltered water from the underdrain occurs when the water level in the infiltration storage zone exceeds the elevation of the underdrain outlet. The storage volume can be controlled by the elevation of the underdrain outlet (shown in Figure 5-8), or other configurations. Other typical biofiltration with partial retention components include a media layer and associated filtration rates, drainage layer with associated in-situ soil infiltration rates, vegetation.

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

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

BMP option under this category:

- PR-1: Biofiltration with partial retention

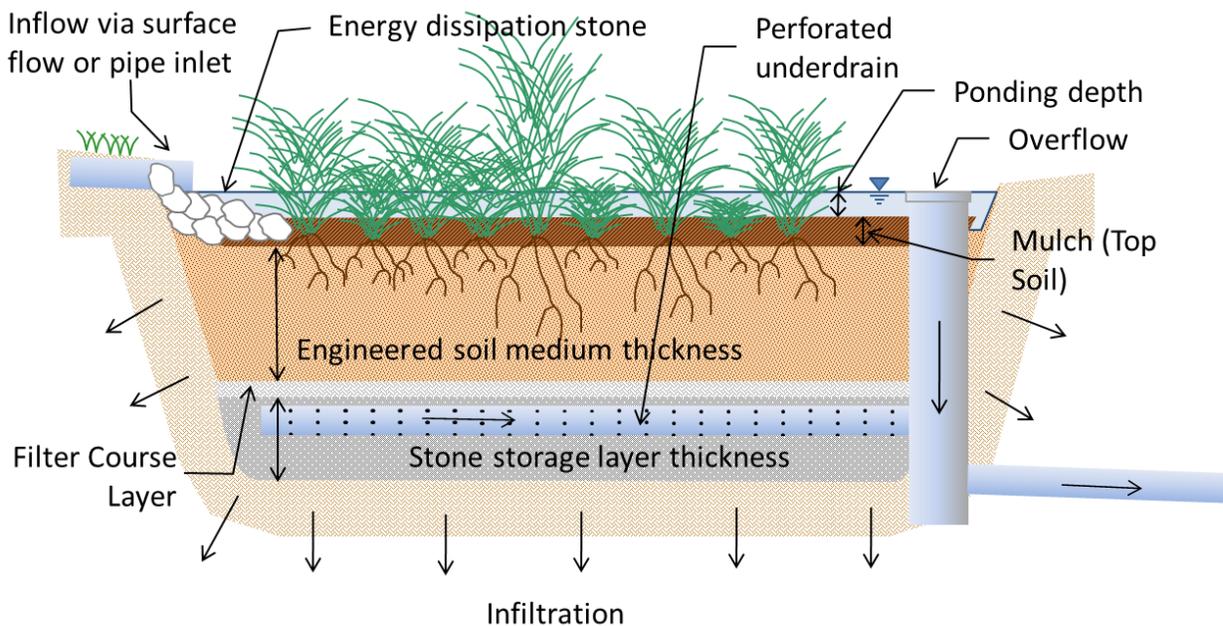


FIGURE 5-8. Schematic of a Typical Biofiltration with Partial Retention BMP

5.5.3 Biofiltration BMP Category

Biofiltration BMPs are shallow basins filled with treatment media and drainage rock that treat stormwater 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 Development Services Director, that effective biological treatment process will be maintained without vegetation. Typical biofiltration components include a media layer with associated filtration rates, drainage layer with associated in-situ soil infiltration rates, underdrain, inflow and outflow control structures, and vegetation, with an optional impermeable liner installed on an as needed basis due to site constraints.

Selection: Biofiltration BMPs shall be selected if the project site feasibility analysis performed according to Section 5.4.2 determines a No Infiltration Feasibility Condition.

Design: Appendix B.5 has a worksheet for sizing biofiltration BMPs and Appendix E provides fact sheets to design the biofiltration BMP. Figure 5-9 shows the schematic of a biofiltration Basin.

BMP option under this category:

- BF-1: Biofiltration
- BF-2: Nutrient Sensitive Media Design
- BF-3: Proprietary Biofiltration

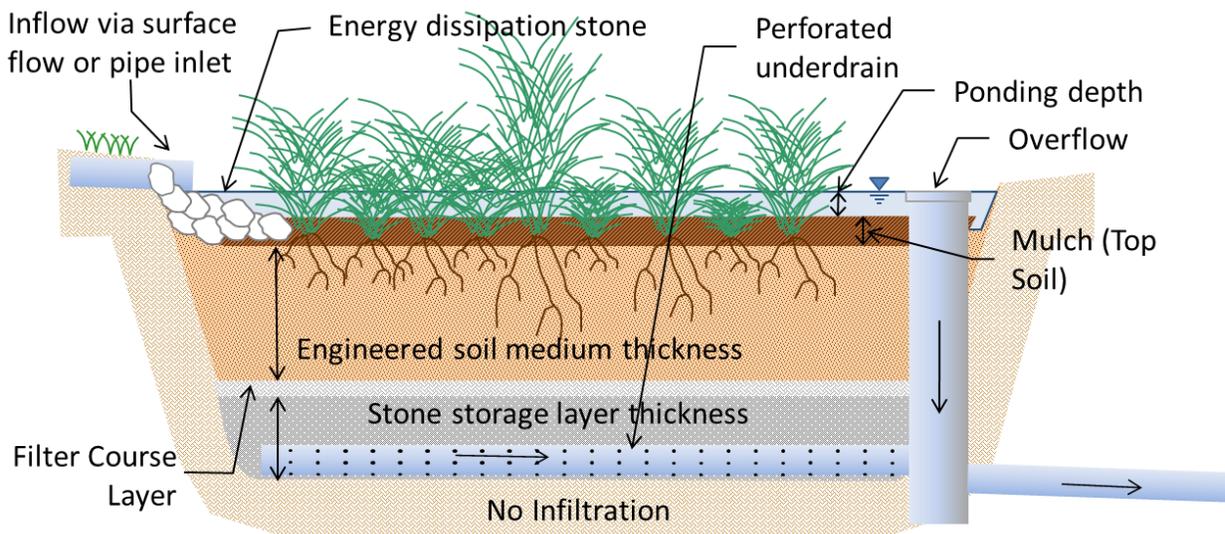


FIGURE 5-9. Schematic of a Typical Biofiltration Basin

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, 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 Development Services Director. 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.

5.5.4 Flow-thru Treatment Control BMPs (for use with Alternative Compliance) Category

Flow-thru BMPs are only allowable for sites that use alternative compliance. Offsite alternative compliance is not available at this time. See Section 1.8 for more details about alternative compliance.

Flow-thru treatment control BMPs are structural, engineered facilities that are designed to remove pollutants from stormwater runoff using treatment processes that do not incorporate significant biological methods.

Selection: Flow-thru treatment control BMPs shall be selected based on the criteria in Appendix B.6. Flow-thru treatment control BMPs may only be implemented to satisfy PDP structural BMP performance requirements if the project is participating in an approved alternative compliance program(See Section 1.8).

Design: Appendix B.6 provides the methodology, required tables and worksheet for sizing flow-thru treatment control BMPs and Appendix E provides fact sheets to design the following flow-thru treatment control BMPs. Figure 5-10 shows a schematic of a Vegetated Swale as an example of a flow-thru treatment control BMP.

BMP options under this category:

- FT-1: Vegetated swales
- FT-2: Media filters
- FT-3: Sand filters
- FT-4: Dry extended detention basin
- FT-5: Proprietary flow-thru treatment control

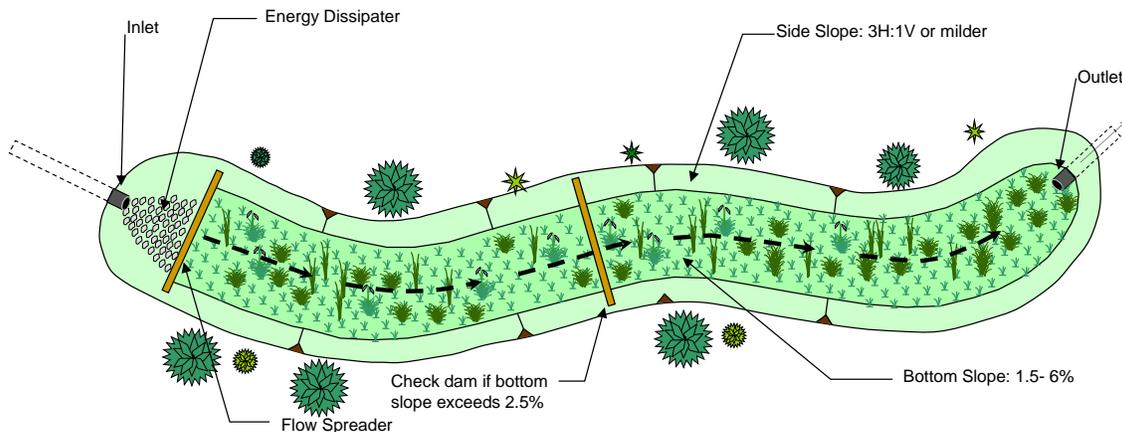


FIGURE 5-10. Schematic of a Vegetated Swale

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Use of Proprietary BMP Options: A proprietary BMP (see fact sheet FT-5) can be classified as a flow-thru treatment control BMP if (1) it is demonstrated to meet the flow-thru treatment performance criteria in Appendix B.6, (2) is designed and maintained in a manner consistently with applicable performance certifications, and (3) is acceptable at the discretion of the Development Services Director. The applicant may be required to provide additional studies and/or required to meet additional design criteria beyond the scope of this document in order to justify the use of a proprietary flow-thru treatment control BMP.

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 Development Services Director. Alternate BMPs must meet the standards for biofiltration BMPs or flow-thru BMPs (depending on how they are used), as described in Appendix F and Appendix B.6, respectively.

5.6 Documenting Stormwater Pollutant Control BMP Compliance when Hydromodification Management Applies

The steps and guidance presented in Chapter 5 apply to all PDPs for demonstrating conformance to stormwater pollutant control requirements regardless of whether hydromodification management applies. However, when hydromodification management applies, the approach for project design may be different. The following process can be used to document compliance with stormwater pollutant control BMPs in cases when hydromodification management also applies:

1. Develop a combined BMP or treatment train (BMPs constructed in series) based on both stormwater pollutant control and hydromodification management requirements. Appendix E provides specific examples of how stormwater 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 stormwater 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 stormwater pollutant control criteria.
4. Check BMP design criteria in Appendix E and F to ensure that the hydromodification management design features (additional footprint, additional depth, modified outlet structure, lower discharge rates, etc.) do not compromise the treatment function of the BMP.
5. On project plans and in the O&M manual, clearly denote the portion of the BMP that serves the stormwater pollutant control function.

Alternative approaches that meet both the stormwater pollutant control and hydromodification management requirements may be acceptable at the discretion of the Development Services Director and shall be documented in the SWQMP. Also refer to Section 6.3.6 for additional guidance.

Hydromodification Management Requirements for PDPs

The purpose of hydromodification management requirements for PDPs is to minimize the potential of stormwater discharges from the MS4 from causing altered flow regimes and excessive downstream erosion in receiving waters. Hydromodification management implementation for PDPs includes two components: protection of critical coarse sediment yield areas and flow control for post-project runoff from the project site. For PDPs subject to hydromodification management requirements, this Chapter provides guidance to meet the performance standards for the two components of hydromodification management.

The civil engineer preparing the hydromodification management study for a project will find within this Chapter and Appendix G of this manual, along with watershed-specific information in the WMAA, all necessary information to meet the MS4 Permit standards. Should unique project circumstances require an understanding beyond what is provided in this manual, then consult the March 2011 Final HMP, which documents the historical development of the hydromodification management requirements.

Guidance for flow control of post-project runoff is based on the March 2011 Final HMP, with modifications in this manual based on updated requirements in the MS4 Permit. The March 2011 Final HMP was prepared based on the 2007 MS4 Permit, not the MS4 Permit that drives this manual. In instances where there are changes to hydromodification management criteria or procedures based on the MS4 Permit, the criteria and procedures presented in this manual supersede the March 2011 Final HMP.

Protection of critical coarse sediment yield areas is a new requirement of the MS4 Permit and is not covered in the March 2011 Final HMP. The standards and management practices for protection of critical coarse sediment yield areas are presented here in the manual.

6.1 Hydromodification Management Applicability and Exemptions

As noted in Chapter 1, Section 1.6 a project may be exempt from hydromodification management requirements if it meets any one of the following conditions:

1. The project is not a PDP;

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2. 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;
3. 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
4. The proposed project will discharge runoff directly to an area identified by the Copermittees as appropriate for an exemption by the WMAA for the San Diego Bay WMA. No projects within the City of Lemon Grove will qualify for exemptions described in the WMAA for the San Diego Bay WMA. See Section 1.6 for additional details.

The above criteria reflect the latest list of exemptions that are allowed under the MS4 Permit and therefore supersedes criteria found in earlier publications. There are no concrete channels or underground storm drain systems extending from Lemon Grove to reservoirs, lakes, enclosed embayments, or the Pacific Ocean. Therefore, as currently defined, exemptions 2 and 3 cannot be claimed by any projects in the City of Lemon Grove. Furthermore, there are currently no areas of the City that have been identified as directly discharging to river reaches identified as appropriate for exemption by the WMAA. Therefore, exemption 4 cannot be claimed unless it can be demonstrated that a site directly discharges to an exempt river reach, as described in Section 1.6.

6.2 Protection of Critical Coarse Sediment Yield Areas

When hydromodification management requirements are applicable according to Section 6.1, 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. Section 1.9 provides instructions about how to obtain the maps of critical coarse sediment yield areas that are included in the WMAA. Mapping files are available in pdf, GIS shapefile, and Google Earth formats.

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 either: (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).

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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 Development Services Director 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 may conduct one or further analyses 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.
- If it is determined that the project will impact critical coarse sediment yield areas after the applicant has exercised all elected options for further analyses, 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 Area maps in the WMAAs identify 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% 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 may be performed to verify the presence or absence of potential critical coarse sediment yield areas within the project site.

The following data are needed to verify the GLUs onsite:

- Project boundary
- Classification of pre-project slopes within the project boundary into four (4) categories defined in Appendix H
- 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

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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%
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 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 MS4 systems that cannot convey coarse sediment and become clogged, resulting in urban flood hazards and on-going

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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 I. 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 MS4 system or discharge to an un-lined channel?
- Figure 6-1, Node 2 – If the project discharges runoff to an existing hardened MS4 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) 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 MS4 system are not recommended. Consult the Development Services Department to determine if existing MS4 systems are impacted by sediment, and identify any other criteria defined by the City.
- Figure 6-1, Node 3 – If the existing MS4 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 City maintenance records as impacted by deposition of sediment, or based on other criteria defined by the Development Services Director that demonstrates that protection is not needed.

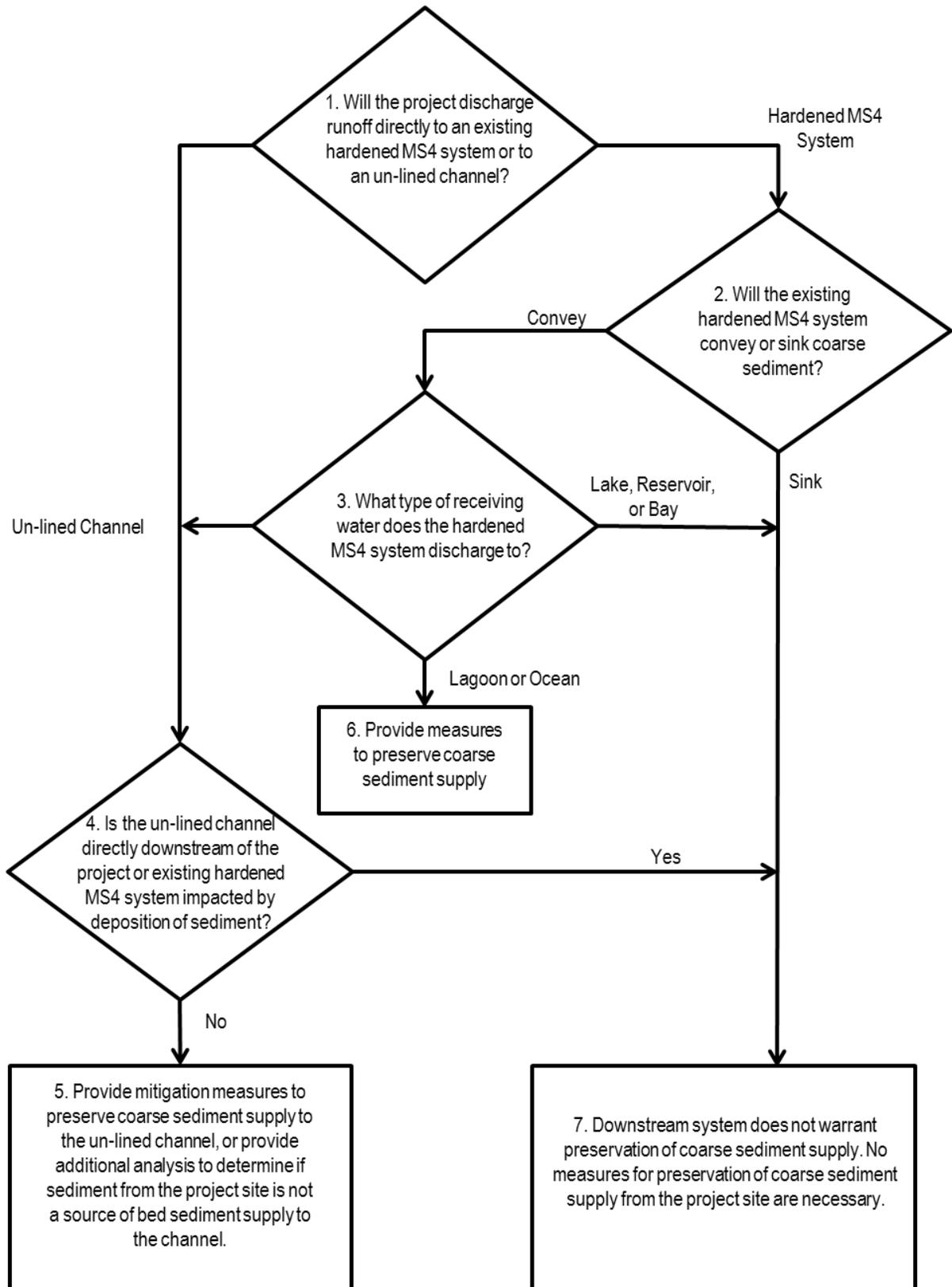


FIGURE 6-1. Evaluation of Downstream Systems Requirements for Preservation of Coarse Sediment Supply

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. 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 City 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

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basins or other facilities with restricted outlets that will trap sediment. The project stormwater 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. These two approaches are described below. Alternative management measures developed in accordance with procedures or policies adopted by the County of San Diego or other Copermittees may be used as management measures instead of or together with these measures at the discretion of the Director of Development Services.

6.2.4.2 Project-Specific Onsite Measures

If it is determined that avoidance of critical coarse sediment yield areas is infeasible, the Development Services Director 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% from the natural condition. Bledsoe (2002) introduced the index of stream erosion potential (E_p), which compares the erosive power of pre- and post-development streamflows. 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 E_p 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%). The User should determine, using best professional judgment, if the alternative modeling approach is applicable."

"The alternative modeling approach must include the following:

1. Continuous hydrologic simulation for the project baseline condition and proposed condition over the range of flow values up to the pre-project 10-year event;
2. Sediment transport model of the receiving channel for the PDP baseline condition and proposed condition;
3. Analysis of the change in Bed Sediment Supply from the PDP baseline condition to the proposed condition;
4. Explanation of method used to control the discharge from the PDP to account for changes in the delivered Bed Sediment Supply; and
5. Summary report."

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"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 Copermittee with jurisdiction over the project site. Some of the considerations in assessing the need for a long-term monitoring program are:

3. Total area of the watershed at the PDP discharge point vs. the PDP area;
4. Condition and type of receiving channel;
5. Magnitude of change in Bed Sediment Supply to the receiving channel;
6. Relief of the land on the project site;
7. Number of channels (density) potentially delivering Bed Sediment Supply to the receiving channel, and the delivery ratio; and
8. Soil characteristics on the project site."

The project-specific onsite measures described above may be approved subject to the discretion of the Development Services Director. Applicants considering such measures should consult the Development Services Director 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 stormwater 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. Alternative management measures developed in accordance with procedures or policies adopted by the County of San Diego or other Copermittees may be used as management measures instead of or together with the measures described above at the discretion of the Director of Development Services.

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.

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This is typically accomplished using structural BMPs that may include any combination of infiltration basins; bioretention, biofiltration with partial retention, or biofiltration basins; or detention basins. This Section will discuss design of flow control measures for hydromodification management. This Section is intended to be used following the source control and site design processes described in Chapter 4 and the stormwater pollutant control design process described in Chapter 5.

The flow control performance standard is as follows:

1. For flow rates ranging from low flow threshold (i.e., 10 percent, 30 percent or 50 percent of the pre-development 2-year runoff event, as applicable; referred to as $0.1Q_2$, $0.3Q_2$, or $0.5Q_2$) to the pre-development 10-year runoff event (Q_{10}), the post-project discharge rates and durations shall not deviate above 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).
2. For flow rates ranging from the lower flow threshold to Q_{10} , the post-project peak flows shall not exceed pre-development peak flows by more than 10 percent.

In this context, Q_2 and Q_{10} refer to flow rates determined based on continuous simulation hydrologic modeling. 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 stormwater pollutant control and flow control for hydromodification management can be achieved within the same structural BMPs. For example, a full infiltration BMP that infiltrates the DCV for pollutant control could include additional storage volume above or below ground to provide either additional infiltration of stormwater or control of outflow for hydromodification management. If possible, the structural BMPs for pollutant control should be modified to meet flow control performance standards in addition to the pollutant control performance standards. See Section 6.3.6 for further discussion of integrating structural BMPs for pollutant control and flow control.

6.3.1 Point(s) of Compliance

For PDPs subject to hydromodification management requirements, the flow control performance standard must be met for each natural or un-lined channel that will receive runoff from the project.

This may require multiple structural BMPs within the project site if the project site discharges to multiple discrete outfalls. When runoff is discharged to multiple natural or un-lined channels within a project site, each natural or un-lined channel must be considered separately and points of compliance (POCs) for flow control must be provided for each natural or un-lined channel, including situations where the channels will confluence before leaving the project boundary. When

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runoff from the project site does not meet a natural or un-lined channel onsite, instead traveling some distance downstream of the project in storm drain systems or lined channels prior to discharge to natural or un-lined channels, the POC(s) for flow control analysis shall be placed at the project boundary (i.e., comparing the pre-development and post-project flows from the project area only, not analyzing the total watershed draining to the offsite POC), unless the project is draining to and accommodated by an approved master planned or regional flow control BMP.

For individual projects draining to approved master planned or regional flow control BMPs, the POC for flow control analysis may be offsite of the specific project application.

In these instances, the individual project draining to a master planned or regional flow control BMP shall reference the approved design documents for the BMP, and shall demonstrate that either (a) the individual project design is consistent with assumptions made for imperviousness and features of the project area when the master planned or regional BMP was designed, or (b) the master planned or regional BMP still meets performance standards when the actual proposed imperviousness and features of the project area are considered.

6.3.2 Offsite Area Restrictions

Runoff from offsite undeveloped areas should be routed around structural BMPs for flow control whenever feasible.

Methods to route flows around structural BMPs include designing the site to avoid natural drainage courses, or using parallel storm drain systems. If geometric constraints prohibit the rerouting of flows from undeveloped areas around a structural BMP, a detailed description of the constraints must be submitted to the Development Services Director.

Structural BMPs for flow control must be designed to avoid trapping sediment from natural areas regardless of whether the natural areas are critical coarse sediment yield areas or not.

Reduction in coarse sediment supply contributes to downstream channel instability. Capture and removal of natural sediment from the downstream watercourse can create "hungry water" conditions and the increased potential for downstream erosion. Additionally, coarse or fine sediment from natural areas can quickly fill the available storage volume in the structural BMP and/or clog a small flow control outlet, which can cause the structural BMP to overflow during events that should have been controlled, and will require frequent maintenance. Failure to prevent clogging of the principal control orifice defeats the purpose of a flow control BMP, since basin inflows would simply overtop the control structure and flow unattenuated downstream, potentially worsening downstream erosion.

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

The MS4 Permit requires that post-project runoff must be controlled to match pre-development runoff conditions, not pre-project conditions, for the range of flow rates to be controlled.

Pre-development runoff conditions are defined in the MS4 Permit as "approximate flow rates and durations that exist or existed onsite before land development occurs."

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- **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.
- **New development PDPs:** The pre-development condition typically equates to runoff conditions immediately before project construction. However if there is existing impervious area onsite, as with redevelopment, the new development project must not use runoff parameters for concrete or asphalt to estimate pre-development runoff conditions.

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 stormwater from offsite. This also means that for redevelopment projects not subject to the 50% rule (i.e., redevelopment projects that result in the creation or replacement of impervious surface in an amount of less than 50% of the area of impervious surface of the previously existing development), comingled runoff from undisturbed portions of the previously existing development (i.e., areas that are not a part of the project) will not require flow control. Flow control facilities for comingled offsite and onsite runoff would be designed to process the total volume of the comingled runoff through the facility, but would provide mitigation for the excess runoff (difference of developed to pre-developed condition) based on onsite impervious areas only. The project applicant must clearly explain why it was not feasible or practical to provide a bypass system for stormwater from offsite. The Development Services Director may request that the project applicant provide a supplemental analysis of onsite runoff only (i.e., supplemental model of the project area only).

6.3.4 Determining the Low Flow Threshold for Hydromodification Flow Control

The range of flows to control for hydromodification management depends on the erosion susceptibility of the receiving stream.

The range of flows to control is either:

- $0.1Q_2$ to Q_{10} for projects discharging to streams with high susceptibility to erosion (and this is the default range of flows to control when a stream susceptibility study has not been prepared),
- $0.3Q_2$ to Q_{10} for projects discharging to streams with medium susceptibility to erosion as determined by a stream susceptibility study approved by the Development Services Director, 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 Development Services Director.

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.

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Use of a higher low flow threshold of 0.3Q2 or 0.5Q2 must be supported by a channel screening report. Channel screening is based on a tool developed by the Southern California Coastal Water Research Project (SCCWRP), documented in SCCWRP's Technical Report 606 dated March 2010, "Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility." The SCCWRP channel screening tool considers channel conditions including channel braiding, mass wasting, and proximity to the erosion threshold. SCCWRP's Technical Report 606 is included in Appendix B of the March 2011 Final HMP, and can also be accessed through SCCWRP's website. The result of applying the channel screening tool will be classification of high, medium, or low susceptibility to erosion, corresponding to low flow thresholds of 0.1Q2, 0.3Q2, and 0.5Q2, respectively, for the receiving stream.

Note that the Development Services Director may require that the channel screening study has been completed within a specific time frame prior to their review, and/or may apply a sunset date to their approval of a channel screening study.

The receiving stream is the location where runoff from the project is discharged to natural or un-lined channels.

The receiving stream may be onsite or offsite. The POC for channel screening is the point where runoff initially meets an un-lined or natural channel, regardless of whether the POC for flow control facility sizing is at or within the project boundary or is offsite. A project may have a different POC for channel screening vs. POC for flow control facility sizing if runoff from the project site is conveyed in hardened systems from the project site to the un-lined or natural channel. The erosion susceptibility of the receiving stream must be evaluated at the POC for channel screening, and for an additional distance known as the domain of analysis, defined in SCCWRP's Technical Report 606.

6.3.5 Designing a Flow Control Facility

Flow control facilities for hydromodification management must be designed based on continuous simulation hydrologic modeling.

Continuous simulation hydrologic modeling uses an extended time series of recorded precipitation data and evapotranspiration data as input and generates hydrologic output, such as surface runoff, groundwater recharge, and evapotranspiration, for each model time step. Using the continuous flow output, peak flow frequency and duration statistics can be generated for the pre-development and post-project conditions for the purpose of matching pre-development hydrologic conditions in the range of geomorphically significant flow rates.

Flow control facilities may be designed using either sizing factors presented in Appendix B of this manual, or using project-specific continuous simulation modeling. The sizing factors were developed based on unit-area continuous simulation models. This means the continuous simulation hydrologic modeling has already been done and the project applicant needs only to apply the sizing factors to the project's effective impervious area to size a facility that meets flow control performance standards. The sizing factor method is intended for simple studies that do not include diversion, do not include significant offsite area draining through the project from upstream, and do not include offsite area downstream of the project area. Use of the sizing factors is limited to the specific structural BMPs for which sizing factors were prepared. Project-specific continuous simulation modeling offers the most flexibility in the design, but requires the project applicant to prepare and submit a complete continuous simulation hydrologic model for review.

6.3.5.1 Sizing Factor Method

A project applicant may use sizing factors that were created to facilitate sizing of certain specific BMPs for hydromodification management.

Unit runoff ratios for determination of pre-development Q_2 and sizing factors for certain specific structural BMPs were previously developed based on continuous simulation hydrologic modeling of hypothetical unit watersheds. Details and descriptions for the sizing factors and specific BMPs are presented in the "San Diego BMP Sizing Calculator Methodology," dated January 2012, prepared by Brown and Caldwell (herein "BMP Sizing Calculator Methodology"). Although the sizing factors were developed under the 2007 MS4 Permit, the unit runoff ratios and some sizing factors developed for flow control facility sizing may still be applied. Users should note that due to the MS4 Permit requirement to control flow rates to pre-development condition instead of pre-project condition, unit runoff ratios for "impervious" soil cover categories from Table 1-6 of the BMP Sizing Calculator Methodology shall not be used when determining pre-development Q_2 . Sizing factors are to be applied to the effective impervious area draining to the facility. Calculations may be prepared using either the BMP Sizing Spreadsheet that was developed by the County of San Diego and is available on the Project Clean Water website, or using hand calculations. Refer to Appendix G.2 of this manual for guidance to use the sizing factor method.

6.3.5.2 Project-Specific Continuous Simulation Modeling

A project applicant may prepare a project-specific continuous simulation model to demonstrate compliance with hydromodification management performance standards.

This option offers the most flexibility in the design. In this case, the project applicant shall prepare continuous simulation hydrologic models for pre-development and post-project conditions, and compare the pre-development and post-project (with hydromodification flow control BMPs) runoff 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 for guidance for continuous simulation hydrologic modeling.

6.3.6 Integrating HMP Flow Control Measures with Pollutant Control BMPs

Both stormwater 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 stormwater 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:

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- **Full infiltration condition:** retention for pollutant control performance standard is the controlling design factor. For a system that is based on full retention for stormwater pollutant control, first design an initial retention area to meet stormwater pollutant control standards for retention, then check whether the facility meets flow control performance standards. If the initial retention facility does not meet flow control performance standards: increase the volume of the facility, increasing retention if feasible or employing outflow control for runoff to be discharged from the facility; as needed to meet the flow control performance standards.
- **Partial infiltration condition:** retention for pollutant control performance standard is the controlling design factor. For a system that is based on partial retention for stormwater 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 stormwater 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 stormwater pollutant control, first design the facility to meet flow control performance standards, then check whether the facility meets biofiltration design standards for stormwater pollutant control. If the flow control biofiltration facility does not meet performance standards for stormwater pollutant control by biofiltration, increase the volume of the biofiltration facility as needed to meet pollutant control performance standards, or identify other methods to address pollutant control needs for the portion of the stormwater pollutant control DCV that could not be processed with biofiltration onsite.

When an integrated structural BMP or series of BMPs is used for both stormwater pollutant control and flow control for hydromodification management, separate calculations are required to demonstrate that pollutant control performance standards and hydromodification management standards are met.

When an integrated structural BMP or series of BMPs is proposed to meet the stormwater pollutant control and flow control for hydromodification management obligations, the applicant shall either:

- Perform separate calculations to show that both hydromodification management and pollutant control performance standards are met independently by using guidance from Appendices B and G. Calculations performed shall be documented in the SQWMP. **or**
- Develop an integrated design that meets the separate performance standards presented in Chapter 2 for both hydromodification management and pollutant control. In this option the BMP requirements to meet the pollutant control performance standard are optimized to account for the BMP storage provided for flow control, and vice versa. Calculations performed to develop an integrated design shall be documented in the SQWMP. Project approval when this option is selected is at the discretion of the Development Services Director.

Additional Guidance on Sizing for Pollutant Control and Hydromodification Control

A common design scenario for projects that must implement both pollutant and hydromodification control includes combinations of flow duration control (FDC) upstream and biofiltration downstream. Guidance for this scenario is provided below.

Design Concepts:

- 1) Biofiltration must treat more water in order to be equivalent to retention as required by the MS4 Permit. In conventional designs, this is done by upsizing the system compared to the DCV/80% capture baseline (i.e., 1.5 x DCV).
- 2) Most FDC systems are much larger than the DCV and control a much greater fraction of long term runoff volume, but do not necessarily result in volume losses (e.g., a closed bottom cistern has no volume losses).
- 3) Incidental volume reduction, where feasible, is a fundamental process of biofiltration and is required for equivalency to retention.
- 4) Therefore, volume reduction must be promoted in any non-standard design. However, there is a sliding scale based on site conditions regarding how much retention is associated with standard biofiltration.

Design Guidance

- 1) Determine peak controlled/non-overflow discharge rate to meet hydromodification control requirements and design FDC feature (e.g., cistern or detention basin) first.
- 2) Multiply peak controlled/non-overflow discharge rate from FDC feature by 1.5 and use as the design Q for biofiltration sizing.
- 3) Calculate 1.5 x DCV.
- 4) Check that storage provided by the FDC feature, calculated as storage below the overflow, is $\geq 1.5 \times \text{DCV}$.
- 5) In cases where some infiltration at the site is feasible, the FDC feature and the biofilter must be designed with permeable bottoms to allow for incidental infiltration.
- 6) Drawdown times must meet the standards specified in this BMP Design Manual. While facilities designed solely for hydromodification management may have a drawdown time of up to 96 hours, most pollutant control BMPs must have a drawdown time of 36 hours. Surface ponding drawdown time for biofiltration BMPs is typically limited to 24 hours for plant health. Combined hydromodification control and pollutant control BMP systems must be designed to meet the shorter (pollutant control) drawdown times. See the BMP Design Manual appendices for additional guidance on drawdown times for pollutant control BMPs.

Designs prepared in accordance with standards adopted by other San Diego Region Copermittees may also be considered at the discretion of the Development Services Director.

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.

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This is based on instruction from the County of San Diego Department of Environmental Health (DEH) for mitigation of potential vector breeding issues and the subsequent risk to human health. This standard applies to, but is not limited to, detention basins, underground storage vaults, and the above-ground storage portion of LID facilities. When this standard cannot be met due to large stored runoff volumes with limited maximum release rates, a vector management plan may be an acceptable solution if approved by the City of Lemon Grove based on consultation with the County of San Diego DEH.

In cases where a Vector Management Plan is necessary, it shall be incorporated into the SWQMP as an attachment. A Vector Management Plan will only be accepted after the applicant has proven infeasibility of meeting the required drawdown time using any and all allowable BMPs. The information included in the plan will vary based on the nature, extent and variety of potential vector sources. It is recommended that preparers consult with the Department of Environmental Health Vector Control Program for technical guidance. Plans should include the following information at a minimum:

- Project identification information;
- A description of the project, purpose of the report, and existing environmental conditions;
- A description of the management practices that will be employed to minimize vector breeding sources and any associated employee education required to run facilities and operations;
- A discussion of long term maintenance requirements;
- A summary of mitigation measures;
- References; and
- A list of persons and organizations contacted (project proponents are expected to obtain review and concurrence of proposed management practices from Department of Environmental Health Vector control program staff prior to submission).

The property owner and applicant must include and sign the following statement: “The measures identified herein are considered part of the proposed project design and will be carried out as part of project implementation. I understand the breeding of mosquitoes is unlawful under the State of California Health and Safety Code Section 2060-2067. I will permit the Vector Surveillance and Control program to place adult mosquito monitors and to enforce this document as needed.”

Refer to the sources below for additional guidance:

Report Guidance- http://www.sandiegocounty.gov/dplu/docs/Vector_Report_Formats.pdf

Department of Environmental Health Vector Control Program Department of Environmental Health - http://www.sandiegocounty.gov/deh/pests/vector_disease.html

It should be noted that other design factors may influence the required drawdown when hydromodification management BMPs are integrated with stormwater pollutant control BMPs. Since hydromodification flow control BMPs are designed based on continuous simulation modeling, which is based on a continuous rainfall record and analyzes a continuous inflow and outflow of the BMPs, inter-event drawdown time and availability of the BMP for subsequent event inflow has been accounted for in the sizing. Therefore, drawdown recommendations for hydromodification management are based on public safety, not availability of the BMP for the next inflow event. Stormwater pollutant control BMPs are designed on a single-event basis for a DCV (the 85th

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percentile storm event). Some of the design standards presented in Chapter 5 or Appendix B require that the pollutant control portion of the BMP drain within a specific time frame to ensure the pollutant control portion of the BMP is available for subsequent storm events. When hydromodification management BMPs are integrated with stormwater pollutant control BMPs, the designer must evaluate drawdown time based on both standards.

6.4 In-Stream Rehabilitation

At this time, the City of Lemon Grove has not developed an alternative compliance program through which a project applicant may be allowed to participate in an in-stream rehabilitation project in lieu of implementing onsite flow control BMPs.

Long Term Operation & Maintenance

Permanent structural BMPs require on-going inspection and maintenance into perpetuity to preserve the intended pollution control and/or flow control performance.

This Chapter addresses procedural requirements for implementation of long term O&M and the typical maintenance requirements of structural Best Management Practices (BMPs) presented in this BMP Design Manual. Specific requirements for O&M Plan reports will be discussed in Chapter 8 with the Submittal Requirements.

7.1 Need for Permanent Inspection and Maintenance

7.1.1 MS4 Permit Requirements

The MS4 Permit requires the City of Lemon Grove to implement a program that requires and confirms that all structural BMPs on all PDPs are designed, constructed, and maintained to remove pollutants in stormwater runoff to the MEP.

Routine inspection and maintenance of structural BMPs will preserve the design and MS4 Permit objective to remove pollutants in stormwater runoff to the MEP. The MS4 Permit requirement specifically applies to PDP structural BMPs. However, source control, site design, and LID BMPs within a PDP are components in the stormwater management scheme that may influence determine the amount of runoff to be treated by structural BMPs; and when source control, site design, or LID BMPs are not maintained, this can lead to clogging or failure of structural BMPs due to greater delivery of runoff and pollutants than intended. Therefore, the Development Services Director may also require confirmation of maintenance of source control, BMPs and site design, and/or LID BMPs as part of their PDP structural BMP maintenance documentation requirements (see Section 7.4).

7.1.2 Practical Considerations

Why do permanent structural BMPs require on-going inspection and maintenance into perpetuity?

By design, structural BMPs will trap pollutants transported by stormwater runoff. Structural BMPs are subject to deposition of solids such as sediment, trash, and other debris. Some structural BMPs are also subject to growth of vegetation, either by design (e.g. biofiltration) or incidentally. The pollutants and any overgrown vegetation must be removed on a periodic basis for the life of the BMP to maintain the treatment capacity of the structural BMP to process stormwater and capture pollutants from every storm event. Structural BMP components are also subject to clogging from

trapped pollutants and growth of vegetation. Clogged BMPs can result in flooding, standing water and mosquito breeding habitat. Maintenance is critical to ensure the ongoing treatment capacity of the BMP 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, RWQCB, California Department of Fish and Wildlife, or the United States Fish and Wildlife Service. A structural BMP that is constructed in the vicinity of, or connected to, an existing jurisdictional water or wetland could inadvertently result in creation of expanded waters or wetlands. As such, vegetated structural BMPs have the potential to come under the jurisdiction of one or more of the above-mentioned resource agencies. This could result in the need for specific resource agency permits and costly mitigation to perform maintenance of the structural BMP. Along with proper placement of a structural BMP, routine maintenance is key to preventing this scenario.

7.2 Summary of Steps to Maintenance Agreement

Ownership and maintenance responsibility for structural BMPs should be discussed at the beginning of project planning, typically at the pre-application meeting with the planning and zoning agency.

Experience has shown provisions to finance and implement maintenance of BMPs can be a major stumbling block to project approval, particularly for *small residential subdivisions*. Project owners shall be aware of their responsibilities regarding stormwater 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, responsible party for permanent O&M, and maintenance funding mechanism	Prior to first submittal of a project application - discuss with staff at pre-application (entitlement phase) meeting
2	Identify expected maintenance actions	First submittal of a project application – identify in SWQMP
3	Develop detailed O&M Plan	As required by Development Services Director, prior to issuance of construction, grading, building, site development, or other applicable permits
4	Update/finalize O&M Plan to reflect constructed structural BMPs with as-built plans and baseline photos	As required by the Development Services Director, upon completion of construction of structural BMPs

Item	Description	Time Frame
5	Prepare Stormwater Facilities Maintenance Agreement (SWFMA) (legal agreement to be recorded against the property by the San Diego County Assessor)	As required by the Development Services Director
6	Execute and record SWFMA	As required by the Development Services Director

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 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, typically by transfer of a stormwater 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 may be 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 stormwater from storm events), it requires inspection and maintenance to ensure it continues to function as designed. Because of this, the MS4 Permit requires that each jurisdiction, including 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."

In Lemon Grove, structural BMPs may be maintained by a private owner, homeowners' association (HOA), or community facilities district.

All private PDPs are required to submit a completed Stormwater Facilities Maintenance Agreement to assure ongoing long-term maintenance of all structural BMPs.

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 of Lemon Grove's reporting requirements to the RWQCB.

The MS4 Permit requires the City of Lemon Grove to verify that structural BMPs on each PDP "are adequately maintained, and continue to operate effectively to remove pollutants in stormwater to the MEP through inspections, self-certifications, surveys, or other equally effective approaches." The City of Lemon Grove 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 RWQCB annually. Based on these MS4 Permit requirements, the Development Services Director may require property owners to

provide annual self-certification that inspection and maintenance has been performed, provide details of the inspection results and maintenance activities, and confirm or update the contact information for the party responsible to ensure inspection and maintenance is performed.

The City of Lemon Grove typically requests parties responsible for operation and maintenance of structural BMPs to submit a certification form annually that documents the BMP inspection and maintenance activities performed on site. The City may require that the certification form is accompanied by photographs, invoices, and/or other maintenance records that provide evidence that maintenance activities were conducted properly.

7.5 Inspection and Maintenance Frequency

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

The minimum inspection and maintenance frequency is annual and must be reported annually. However, actual maintenance needs are site specific, and maintenance may be needed more frequently than annually. The need for maintenance depends on the amount and quality of runoff delivered to the structural BMP. Maintenance must be performed whenever needed, based on maintenance indicators presented in Section 7.7. The optimum maintenance frequency is each time the maintenance threshold for removal of materials (sediment, trash, debris or overgrown vegetation) is met. If this maintenance threshold has been exceeded by the time the structural BMP is inspected, the BMP has been operating at reduced capacity. This would mean it is necessary to inspect and maintain the structural BMP more frequently. Routine maintenance will also help avoid more costly rehabilitative maintenance to repair damages that may occur when BMPs have not been adequately maintained on a routine basis.

During the first year of normal operation of a structural BMP (i.e. when the project is fully built out and occupied), inspection by the property 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 initial period of frequent inspections, the minimum inspection and maintenance frequency can be determined based on the results of the first year of inspections.

7.6 Measures to Control Maintenance Costs

Because structural BMPs must be maintained into perpetuity, it is essential to include measures to control maintenance costs.

The most effective way to reduce maintenance of structural BMPs is to prevent or reduce pollutants generated onsite and delivered to the structural BMP by implementation of source control and site design BMPs onsite, as required and described in Chapter 4 of this manual. Second, vegetated BMPs should be placed properly to reduce the potential to come under the jurisdiction of one or more resource agencies that could require permits and costly mitigation to perform maintenance of the structural BMP. Third, the structural BMP should include design features to facilitate maintenance, as listed below.

Considerations for placement of vegetated BMPs:

- Locate structural BMPs outside of floodway, floodplain, and other jurisdictional areas.
- Avoid direct connection to a natural surface water body.
- Discuss the location of the structural BMP with a wetland biologist to avoid placing a structural BMP in a location where it could become jurisdictional or be connected to a jurisdictional area.

Measures to facilitate collection of the trapped pollutants:

- Design a forebay to trap gross pollutants in a contained area that is readily accessible for maintenance. A forebay may be a dedicated area at the inlet entrance to an infiltration BMP, biofiltration BMP, or detention basin, or may be a gross pollutant separator installed in the storm drain system that drains to the primary structural BMP.

Measures to access the structural BMP:

- The BMP must be accessible to equipment needed for maintenance. Access requirements for maintenance will vary with the type of facility selected.
- Infiltration BMPs, biofiltration BMPs and most above-ground detention basins and sand filters will typically require routine landscape maintenance using the same equipment that is used for general landscape maintenance. At times these BMPs may require excavation of clogged media (e.g. bioretention soil media, or sand for the sand filter), and should be accessible to appropriate equipment for excavation and removal/replacement of media.
- Above-ground detention basins should include access ramps for trucks to enter the basin to bring equipment and to remove materials.
- Underground BMPs such as detention vaults, media filters, or gross pollutant separators used as forebays to other BMPs, typically require access for a vactor truck to remove materials. Proprietary BMPs such as media filters or gross pollutant separators may require access by a forklift or other truck for delivery and removal of media cartridges or other internal components. Access requirements must be verified with the manufacturer of proprietary BMPs.
- Vactor trucks are large, heavy, and difficult to maneuver. Structural BMPs that are maintained by vactor truck must include a level pad adjacent to the structural BMP, preferably with no vegetation or irrigation system (otherwise vegetation or irrigation system may be destroyed by the vactor truck).
- The sump area of a structural BMP should not exceed 20 feet in depth due to the loss of efficiency of a vactor truck. The water removal rate is three to four times longer when the depth is greater than 20 feet. Deep structures may require additional equipment (stronger vactor trucks, ladders, more vactor pipe segments).
- All manhole access points to underground structural BMPs must include a ladder or steps.

Measures to facilitate inspection of the structural BMP

- Structural BMPs shall include inspection ports for observing all underground components that require inspection and maintenance.
- Silt level posts or other markings shall be included in all BMP components that will trap and store sediment, trash, and/or debris, so that the inspector may determine how full the BMP is, and the maintenance personnel may determine where the bottom of the BMP is. Posts or other markings shall be indicated and described on structural BMP plans.

- Vegetation requirements including plant type, coverage, and minimum height when applicable shall be provided on the structural BMP and/or landscaping plans as appropriate or as required by the Development Services Director.
- Signage indicating the location and boundary of the structural BMP is recommended.

When designing a structural BMP, the engineer should review the typical structural BMP maintenance actions listed in Section 7.7 to determine the potential maintenance equipment and access needs.

When selecting permanent structural BMPs for a project, the engineer and 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 vs. non-proprietary parts), equipment used (e.g. landscape equipment vs. tractor 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 (e.g. bioretention area or biofiltration area)
- Non-vegetated infiltration BMPs (e.g. infiltration basin)
- Non-vegetated filtration BMPs (e.g. media filter or sand filter)
- Detention BMPs (e.g. extended detention basin)

The project civil engineer is responsible for determining which categories are applicable based on the components of the structural BMPs, and identifying the applicable maintenance indicators from within the categories. Maintenance indicators and actions shall be shown be clearly identified within the SWQMP on 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 BMPs will function as designed.

7.7.1 Maintenance of Vegetated Infiltration or Filtration BMPs

"Vegetated infiltration or filtration BMPs" are BMPs that include vegetation as a component of the BMP. Applicable Fact Sheets may include INF-2 (bioretention), PR-1 (biofiltration with partial retention), BF-1 (biofiltration) or FT-1 (vegetated swale). The vegetated BMP may or may not include amended soils, subsurface gravel layer, underdrain, and/or impermeable liner. The project civil engineer is responsible for determining which maintenance indicators and actions shown below

are applicable based on the components of the structural BMP.

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 stormwater runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the Development Services Director 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 Development Services Director shall be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

7.7.2 Maintenance of Non-Vegetated Infiltration BMPs

"Non-vegetated infiltration BMPs" are BMPs that store stormwater runoff until it infiltrates into the ground, and do not include vegetation as a component of the BMP (refer to the "vegetated BMPs" category for infiltration BMPs that include vegetation). Non-vegetated infiltration BMPs generally include non-vegetated infiltration trenches and infiltration basins, dry wells, underground infiltration

galleries, and permeable pavement with underground infiltration gallery. Applicable Fact Sheets may include INF-1 (infiltration basin) or INF-3 (permeable pavement). The non-vegetated infiltration BMP may or may not include a pre-treatment device, and may or may not include above-ground storage of runoff. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

TABLE 7-3. 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 Development Services Director shall be contacted prior to any repairs or reconstruction.
Standing water in permeable paving area	Flush fine sediment from paving and subsurface gravel. Provide routine vacuuming of permeable paving areas to prevent clogging.
Damage to permeable paving surface	Repair or replace damaged surface as appropriate.
Note: When inspection or maintenance indicates sediment is accumulating in an infiltration BMP, the DMA draining to the infiltration BMP should be examined to determine the source of the sediment, and corrective measures should be made as applicable to minimize the sediment supply.	

7.7.3 Maintenance of Non-Vegetated Filtration BMPs

"Non-vegetated filtration BMPs" include media filters (FT-2) and sand filters (FT-3). These BMPs function by passing runoff through the media to remove pollutants. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

TABLE 7-4. Maintenance Indicators and Actions for Filtration BMPs

Typical Maintenance Indicator(s) for Filtration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.

Clogged filter media	Remove and properly dispose filter media, and replace with fresh media.
Damage to components of the filtration system	Repair or replace as applicable.
Note: For proprietary media filters, refer to the manufacturer's maintenance guide.	

7.7.4 Maintenance of Detention BMPs

"Detention BMPs" includes basins, cisterns, vaults, and underground galleries that are primarily designed to store runoff for controlled release to downstream systems. For the purpose of the maintenance discussion, this category does not include an infiltration component (refer to "vegetated infiltration or filtration BMPs" or "non-vegetated infiltration BMPs" above). Applicable Fact Sheets may include HU-1 (cistern) or FT-4 (extended detention basin). There are many possible configurations of above ground and underground detention BMPs, including both proprietary and non-proprietary systems. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

TABLE 7-5. Maintenance Indicators and Actions for Detention BMPs

Typical Maintenance Indicator(s) for	Maintenance Actions
Detention Basins	
Poor vegetation establishment	Repair/re-seed/re-plant or re-establish vegetation per original plans. Apply routine watering and controlled nutrient release to help establish vegetation.
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. Install rock-slope-protection to control concentrated flows.
Erosion due to concentrated stormwater 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, without damage to the basin.
Standing water	Adjust irrigation system, remove any obstructions of debris or invasive vegetation, loosen or replace top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the basin to the original plan and grade, the Development Services Director shall be contacted prior to any additional repairs or reconstruction.

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Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.

Submittal Requirements

It is necessary for the Development Services Director to review project plans for compliance with applicable requirements of this manual and the MS4 Permit.

The review process must verify that stormwater management objectives were considered in the project planning process and that opportunities to incorporate BMPs have been identified. The review process must confirm the site plan, landscape plan, and project stormwater documents are congruent. Therefore, every jurisdiction in San Diego County, including the City of Lemon Grove, requires a submittal documenting the stormwater management design for every project that is subject to the requirements of this manual. Herein this post-construction BMP plan submittal is called a Stormwater Quality Management Plan (SWQMP). In the past these plans have often been referred to as WQTR, SWMP, or WQMP, as described in Section 1. A complete and thorough project submittal will facilitate and expedite the review and approval, and may result in fewer submittals by the applicant. The Sections below discuss submittal requirements. In all cases the project applicant must provide sufficient documentation to demonstrate that applicable requirements of this manual and the MS4 Permit will be met.

8.1 Submittal Requirement for Standard Projects

8.1.1 Standard Project SWQMP

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

The Standard Project SWQMP is a compilation of checklists that document that all permanent source control and site design BMPs have been considered for the project and implemented where feasible. All applicable features shall be shown on site plans and landscaping plans. A template for the Standard Project SWQMP is provided in Appendix A. Projects are encouraged to use the template to facilitate the review process, but submittals with equivalent content may be accepted at the discretion of the Development Services Director.

8.2 Submittal Requirements for PDPs

8.2.1 PDP SWQMP

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

The PDP SWQMP shall document that all permanent source control and site design BMPs have been considered for the project and implemented where feasible; document the planning process

and the decisions that led to the selection of structural BMPs; provide the calculations for design of structural BMPs to demonstrate that applicable performance standards are met by the structural BMP design; identify O&M requirements of the selected structural BMPs; and identify the maintenance mechanism (see Sections 7.2 and 7.3) for long term O&M of structural BMPs. PDPs shall use the PDP SWQMP Template provided in Appendix A, which will include forms and/or checklists included in Appendix I of this manual as well as checklists for documentation of pollutant control and hydromodification management structural BMP design. The PDP SWQMP shall include copies of the relevant plan sheets showing site design, source control, and structural BMPs, and structural BMP maintenance requirements.

A PDP SWQMP must be provided with the first submittal of a project application.

Stormwater requirements will directly affect the layout of the project. Stormwater requirements must be considered from the initial project planning or in project concept stage, and will be reviewed upon each submittal, beginning with the first submittal. The process from initial project application through approval of the project plans often includes design changes to the site layout and features. Changes may be driven by stormwater management requirements or other site requirements. Each time the site layout is adjusted, whether the adjustment is directly due to stormwater management requirements identified during the Development Services Director review of the stormwater submittal, or is driven by other site requirements, the stormwater management design must be revisited to ensure the revised project layout and features meet the requirements of this manual and the MS4 Permit. An updated PDP SWQMP must be provided with each submittal of revised project plans. The updated PDP SWQMP should include documentation of changes to the site layout and features, and reasons for the changes. In the event that other site requirements identified during plan review render certain proposed stormwater 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 stormwater management design.

8.2.1.1 PDP O&M Plan

While the PDP SWQMP must include general O&M requirements for structural BMPs, the PDP SWQMP may not be the final O&M Plan.

The O&M requirements documented in the PDP SWQMP must be sufficient to show that O&M requirements have been considered in the project planning and design. However, a final O&M Plan should reflect actual constructed structural BMPs to be maintained. Requirements may also vary depending on whether long term O&M will be furnished by a public agency or private entity. See Section 8.2.3 for project closeout procedures including local requirements for final O&M Plans, and Section 8.2.4 for additional requirements for private entity O&M of structural BMPs. Contents for an O&M Plan are specified in the City's PDP SWQMP template (see Appendix A).

8.2.2 Requirements for Construction Plans

8.2.2.1 BMP Identification and Display on Construction Plans

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

All post-construction structural BMPs shall be shown on the grading plans or other applicable construction plan sheets. The plans shall clearly indicate the location and type of each structural BMP. The plans shall include a sufficient level of detail to ensure that all required sizing and design elements (i.e. dimensions, configuration, and material composition) of each BMP are clearly communicated to the contractor.

8.2.2.2 Structural BMP Maintenance Information on Construction Plans

Construction plans should provide the following information, which is relevant to long-term operation and maintenance of structural BMPs:

- Features that are provided to facilitate access to and inspection of structural BMPs (e.g. observation ports, cleanouts, or silt posts);
- Manufacturer and model number for proprietary BMPs;

8.2.3 Design Changes During Construction and Project Closeout Procedures

8.2.3.1 Design Changes During Construction

Prior to occupancy and/or intended use of any portion of a PDP, the site must be in compliance with the requirements of this manual and the MS4 Permit.

Therefore during construction, any changes that affect the design of stormwater management features must be reviewed and approved by the Development Services Director. Approved documents and additional design may be required prior to implementation of design changes during construction. This might include changes to drainage patterns that occurred based on actual site grading and construction of stormwater conveyance structures, or substitutions to stormwater management features. Just as during the design phase, when there are changes to the site layout and features, the stormwater management design must be revisited to ensure the revised project layout and features meet the requirements of this manual and the MS4 Permit.

If any changes to structural BMPs are proposed during construction, the project applicant must submit a revised SWQMP to the City for review. Changes to the design of structural BMPs may not be made during construction without the City's approval.

8.2.3.2 Certification of Constructed BMPs

As part of the "Structural BMP Approval and Verification Process" required by the MS4 Permit, each structural BMP must be inspected to verify that it has been constructed and is operating in compliance with all of its specifications, plans, permits, ordinances, and the requirements of the MS4 Permit.

Since some portions of the structural BMP will not be readily visible after completion of construction (e.g. subsurface layers), the Development Services Director will require inspections during construction, photographs taken during construction, and/or other certification that the BMP has been constructed in conformance with the approved plans. The Development Services Director may require forms or other documentation be submitted prior to the inspection in order to facilitate the structural BMP inspection.

City staff verify the final construction and installation of structural BMPs. Projects will not be granted occupancy or otherwise be finalized until satisfactory completion of proposed BMPs has been confirmed to the City's satisfaction.

8.2.3.3 Final O&M Plan

Upon completion of project construction, the local agency may require a final O&M Plan to be submitted.

A final O&M Plan reflects project-specific constructed structural BMPs with project-specific drawings, photographs, and maps, and identifies specific maintenance requirements and actions for the constructed structural BMPs. Specific requirements and review procedures for this process may vary based on the planned maintenance entity (public or private).

8.2.4 Additional Requirements for Private Entity O&M

This Section discusses private structural BMPs to be operated and maintained on private property by the property owner or manager.

8.2.4.1 O&M Agreements for Private Structural BMP Maintenance

For privately owned and operated structural BMPs, the City requires execution of an O&M Agreement document.

An O&M Agreement is a recorded document signed by the City and the property owner committing the property owner to maintain the permanent structural BMPs into perpetuity. The O&M Agreement may provide that, if the property owner fails to maintain the Stormwater facilities, the City may enter the property, restore the Stormwater facilities to operable condition, and obtain reimbursement, including administrative costs, from the property owner.

All private PDPs in the City of Lemon Grove are required to submit a completed SWFMA to assure ongoing long-term maintenance of all structural BMPs

8.2.4.2 Interim Security Period of Maintenance Funding for Private Structural BMP Maintenance

The City of Lemon Grove does not currently collect a security deposit for private structural BMP maintenance. However, the City strongly encourages project engineers to provide estimates of long-term BMP operation and maintenance costs to the future responsible parties. While it is understood that actual future maintenance expenditures will vary based on external factors that the engineer cannot predict, providing a rough estimate of future maintenance costs up front can help the property owner to plan and secure funds ahead of time.

Bibliography

- American Society for Testing and Materials 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. Stormwater 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. Stormwater Standards.
- City of Santa Barbara. 2013. Stormwater BMP Guidance Manual.
- Clear Creek Solutions, Inc. 2012. San Diego Hydrology Model User Manual.
- County of Los Angeles Department of Public Works. 2014. Low Impact Development, Standards Manual.
- County of Orange. 2011. Model Water Quality Management Plan (Model WQMP).
- County of Orange. 2011. Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs).
- County of San Bernardino. 1992. Suitability of Lots and Soils for Use of Leachlines or Seepage Pits, Soil Percolation (PERC) Test Report Standards, Onsite Waste Water Disposal System, August 1992.
- County of San Diego. 2007. Low Impact Development Handbook: Stormwater Management

- Strategies.
- County of San Diego. 2011. Final Hydromodification Management Plan
- County of San Diego. 2012. County of San Diego SUSMP: Standard Urban Stormwater Mitigation Plan Requirements for Development Applications.
- County of San Diego. 2014. Low Impact Development Handbook: Stormwater Management Strategies.
- County of San Diego. 2003. Stormwater Standards Manual.
- County of Ventura. 2011. Ventura County Technical Guidance Manual for Stormwater Quality Control Measures.
- Darcy, H, 1856. Les fontaines publiques de la Ville de Dijon (The public fountains of the City of Dijon). Trans. Patricia Bobeck. Paris: Dalmont. (Kendall/Hunt, 2004) 506 p
- Double Ring Infiltrometer Test (ASTM 3385)-ASTM International. 2009.
- Emerson, C. 2008. Evaluation of Infiltration Practices as a Means to Control Stormwater Runoff. Civil and Environmental Engineering. Villanova University.
- Emerson, C.H. 2008. Evaluation of Infiltration Practices as a Means to Control Stormwater Runoff. Doctoral dissertation, Villanova University. May 2008.
- Galli, J. 1992. Analysis of urban stormwater BMP performance and longevity in Prince George's County, Maryland. Metropolitan Washington Council of Governments, Washington, D.C.
- Gobel, P. et al. 2004. Near-Natural Stormwater Management and its Effects on the Water Budget and Groundwater Surface in Urban Areas Taking Account of the Hydrogeological Conditions. *Journal of Hydrology* 299, 267-283.
- Gulliver, J., Erickson, A., and Weiss, P. 2010. Optimizing Stormwater Treatment Practices: A Handbook of Assessment and Maintenance.
- Hazen, A. 1892. Some Physical Properties of Sands And Gravels, With Special Reference To Their Use In Filtration. 24th Annual Rep., Massachusetts State Board of Health, Pub. Doc. No. 34, 539-556.
- Hazen, A. 1911. Discussion of Dams On Sand Foundations' by A.C. Koenig. Trans. Am. Soc. Civ. Eng., 73, 199-203
- Hazen, A., 1892. Some Physical Properties of Sands and Gravels, With Special Reference to their Use in Filtration. 24th Annual Rep., Massachusetts State Board of Health, Pub. Doc. No. 34, 539-556.
- Hazen, A., 1911. Discussion of Dams on Sand Foundations' by A.C. Koenig. Trans. Am. Soc. Civ. Eng., 73, 199-203
- King County Department of Natural Resources and Parks. 2009. King County, Washington Surface Water Design Manual. Retrieved from <http://your.kingcounty.gov/dnrp/library/water-and-land/stormwater/surface-water-design-manual/SWDM-2009.pdf>

Bibliography

- Lindsey, G., L. Roberts, and W. Page. 1991. Stormwater Management Infiltration. Maryland Department of the Environment, Sediment and Stormwater 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 Stormwater 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).
- Rossmann, Lewis A. 2010. Stormwater Management Model User's Manual Version 5.0. EPA/600/R-05/040.
- San Diego County Copermittees. 2002. Model Standard Urban Stormwater Mitigation Plan for San Diego County, Port of San Diego, and Cities in San Diego County.
- San Diego County Copermittees, 2011. Countywide Model SUSMP
- San Diego County Copermittees. 2012. San Diego BMP Sizing Calculator Methodology

- San Diego County Copermittees. 2014. San Diego County Regional Watershed Management Area Analysis
- San Diego County Copermittees. 2008. Countywide Model SUSMP.
- SCCWRP. 2010. Hydromodification Screening Tools: Field Manual for Assessing Channel Susceptibility. Brian P. Bledsoe; Robert J. Hawley; Eric D. Stein; Derek B. Booth. Technical Report 606.
- SCCWRP. 2012. Hydromodification Assessment and Management in California. Eric D. Stein; Felicia Federico; Derek B. Booth; Brian P. Bledsoe; Chris Bowles; Zan Rubin; G. Mathias Kondolf and Ashmita Sengupta. Technical Report 667.
- Schwab, G., Fangmeier, D., Elliot, W., and Frevert, R. 1993. Soil and Water Conservation Engineering. Fourth Edition. John Wiley & Sons, Inc.
- Scurlock, J., Asner, G., and Gower, S. 2001. Global Leaf Area Index from Field Measurements, 1932-2000. Data set. Available on-line [<http://www.daac.ornl.gov>] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/584.
- U.S. Department of the Interior, Bureau of Reclamation. 1990. "Procedure for Performing Field Permeability Testing by the Well Permeameter Method (USBR 7300-89)" in Earth Manual, Part 2. Materials Engineering Branch Research and Laboratory Services Division, Denver, Colorado.
- U.S. Department of the Interior, Bureau of Reclamation. 1993. Drainage Manual: A Water Resources Technical Publication. Retrieved from http://www.usbr.gov/pmts/wquality_land/DrainMan.pdf
- United States Environmental Protection Agency. 2000. BASINS Technical Note 6 – Estimating Hydrology and Hydraulic Parameters for Hydrologic Simulation Program-FORTRAN. 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 Stormwater 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>