



# **Mojave River Watershed Technical Guidance Document for Post Construction Measures Plans**

Prepared by  
The County of San Bernardino  
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## Section 1 - Introduction

### 1.1 Purpose of Guidance

The 2013 Phase 2 General Small Municipal Separate Storm Sewer System Permit (Phase 2 MS4 Permit), adopted by the California State Water Resources Control Board (SWRCB), applies statewide, and requires all new development and significant redevelopment projects covered by this Order to incorporate Low Impact Development (LID) Best Management Practices to the maximum extent practicable (MEP). In San Bernardino County, the Phase 2 MS4 Permit is applicable within the Mojave River Watershed. In addition, the Order also requires development of a standard design and post-development best management practice (BMP) guidance for incorporation of site design/LID, source control, and treatment control BMP (where feasible and applicable) and Hydromodification mitigation measures to the MEP to reduce the discharge of pollutants to receiving waters. **The purpose of this Technical Guidance Document (TGD) for) is to provide direction to project proponents on the regulatory requirements applicable to small private or public development activity, from project conception to completion.** This TGD is intended to serve as a living document, which will be updated as needed to remain applicable beyond the current Phase 2 MS4 Permit term. Any non-substantive updates to the TGD and PCMP Template will be provided in the annual report. Future substantive updates shall be submitted to the Lahontan RWQCB for review and approval, prior to implementation.

In an attempt to maintain consistency for project developers, engineers and municipal staff reviewing proposed projects within the County of San Bernardino, this TGD is based on the existing San Bernardino County Areawide Stormwater Program (Phase 1) WQMP Template, approved by the Santa Ana Regional Water Quality Control Board in June 2013. While the overall format and procedure for the documents are similar, **this TGD incorporates the different requirements of the Phase 2 MS4 Permit specifically to the smaller projects (greater than 2500 square feet and less than 5000 square feet) PCMP document. .**

**Important Note:**

Confirm utilization of the correct regional WQMP template for your Project location.

Confirm utilization of the correct template for your project size (PCMP vs. WQMP)

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## 1.2 Regulatory Background

The 1972 Federal Water Pollution Control Act and its amendments comprise what is commonly known as the Clean Water Act (CWA). The CWA provides the basis for the protection of all inland surface waters, estuaries, and coastal waters. The federal Environmental Protection Agency (EPA) is responsible for ensuring the implementation of the CWA and its governing regulations (primarily Title 40 of the Code of Federal Regulations) at the state level.

California's Porter-Cologne Water Quality Control Act of 1970 and its implementing regulations established the SWRCB as the agency responsible for implementing CWA and Porter-Cologne requirements Statewide and the Lahontan Regional Water Quality Control Board (LRWQCB) in the Mojave River Watershed. These requirements include adoption of a Water Quality Control Plan ("Basin Plan") to protect inland freshwaters and estuaries. The Basin Plan identifies the beneficial uses for waterbodies in the Mojave River watershed, establishes the water quality objectives required to protect those uses, and provides an implementation plan to protect water quality in the region (RWQCB 1995 and subsequent amendments).

As part of its responsibility to protect beneficial uses of waters in the Mojave River Watershed in San Bernardino County, the Phase 2 Small MS4 Permit regulates discharges from Phase 2 Small Municipal Separate Storm Sewer System (Phase 2 MS4) facilities within the County.

The jurisdictions covered by this permit include:

- County of San Bernardino
  - Unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville
- City of Hesperia
- City of Victorville
- Town of Apple Valley

The first Phase 2 MS4 Permit for these Permittees was issued by the SWRCB in 2003.

In 2013 a revised permit was approved and adopted by the SWRCB. Under this permit the stormwater management requirements applicable to new development and significant redevelopment projects significantly evolved. Accordingly, this Model PCMP Guidance was developed in 2015-2016 to incorporate increasingly stringent requirements applicable to development activities. This document is specifically for the smaller projects.

## 1.3 Stormwater Management

Development activities typically change pre-development hydrologic conditions by altering drainage patterns and increasing impervious area. Impervious areas include streets, walkways, driveways, rooftops, and parking lots which traditionally not only do not infiltrate stormwater runoff, but instead increase the rate and volume of runoff of precipitation during storm events. The traditional approach to storm drain design associated with a development activity focused on capturing and transporting stormwater runoff off-site in the most efficient manner to protect people and property from potential flood damage. Urban constructed drainage systems, comprised of street gutters, catch basins, belowground storm drain piping, detention basins, and open or closed channels (i.e., the MS4), have functioned to convey runoff from completed developments to the nearest receiving water.

The adopted 2013 Phase 2 MS4 Permit includes significant changes to the requirements for managing the quantity and quality of runoff from urban developments. These requirements include the incorporation of LID practices to maintain the pre-development hydrology for regulated projects to the maximum extent practicable.

### 1.3.1 Low Impact Development

LID principles are increasingly being applied in urban environments as a strategy to reduce receiving water impacts from stormwater runoff. A typical LID definition is:

*“...a stormwater management strategy that emphasizes conservation and the use of existing natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial and industrial setting.”*[Washington State University Puget Sound Action Team as reported in Green Infrastructure for Los Angeles: Addressing Urban Runoff and Water Supply through LID, 2009]

Accordingly, San Bernardino County defines LID as *“a stormwater management and land development strategy that combines a hydrologically functional site design with pollution prevention measures to compensate for land development impacts on hydrology and water quality. LID techniques mimic the site pre-development site hydrology by using site design techniques that store, infiltrate, evapotranspire, bio-filter or detain runoff close to its source”*.

### 1.3.2 Goals of LID

The primary goal of LID is to preserve the pre-development hydrology of a project site. Changes in runoff characteristics that result in increased post-development runoff can be reduced through the use of structural and nonstructural BMPs that store, infiltrate, evaporate, and detain runoff. The desired outcome of the use of these BMPs is to mimic the local watershed’s natural hydrologic functions to the maximum extent practicable. There are

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many site design techniques that may be deployed on a project site to allow the site to function in a manner similar to how it functioned prior to development. With the incorporation of LID practices, downstream waters that ultimately receive stormwater runoff from developed sites will experience fewer negative impacts and have in-stream flows that more closely approximate pre-development runoff conditions.

### 1.3.3 Benefits of LID

The benefits of implementing LID practices can be significant. Examples include:

- *Maintain pre-development hydrology* – Maintaining the pre-development hydrology reduces the volume of water that must be conveyed offsite, which not only reduces erosion and sedimentation impacts, but ultimately reduces downstream flood control requirements.
- *Water quality benefits* – Pollutant loads carried by stormwater runoff can be greatly reduced through retention of stormwater and pollutants onsite and use of BMPs that biofilter pollutants onsite, thus reducing pollutants that would normally be discharged directly to the storm drain system.
- *Groundwater recharge* – LID emphasizes infiltration of runoff onsite which has the potential to increase local water supply availability from groundwater sources.
- *Aesthetic appeal* - LID involves the use of site design practices that minimize the footprint of proposed developments which increases preservation of open space.

## 1.4 Guidance Applicability

All project owners are required to use this TGD and associated Template to obtain the necessary approvals for implementation of proposed small development projects. Project submittal requirements vary depending on the type of project as well as whether the project proponent is a private entity or public agency.

Development includes new and redevelopment projects on public or private land that fall under the planning and permitting authority of a Permittee. Redevelopment is any land-disturbing activity that results in the creation, addition, or replacement of exterior impervious surface area on a site on which some past development has occurred. Redevelopment does not include trenching, excavation and resurfacing associated with linear underground/overhead projects (utility projects); pavement grinding and resurfacing of existing roadways; construction of new sidewalks, pedestrian ramps, or bike lanes on existing roadways; or routine replacement of damaged pavement such as pothole repair or replacement of short, non-contiguous sections of roadway. The following (1.4.1 through

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1.4.2) describes the specific “Non-Regulated” and “Site Design Only” requirements for development and redevelopment

### 1.4.1 Non-Regulated Projects

“Non-Regulated” Projects include those that create and/or replace less than 2,500 square feet of impervious surface. The Phase II MS4 Permittee (approving jurisdiction) should be contacted to confirm if any minimum measures will be required (drought landscaping, flow management). The TGD and associated PCMP Template can be used as guidance for these smaller projects.

### 1.4.2 Site Design Only Projects

“Site Design Only” projects include those that create and/or replace (including projects with no net increase in impervious footprint) between 2,500 square feet and 5,000 square feet of impervious surface, including detached single family homes that create and/or replace 2,500 square feet or more of impervious surface and are not part of a larger plan of development. Site design measures as specified in this section are not applicable to linear underground/overhead projects (LUPs). The Phase II MS4 Permittee shall require implementation of site design measures for all projects meeting these criteria. The PCMP Template and Guidance document should be used for these projects.

Projects shall implement one or more of the following site design measures to reduce project site runoff:

- (a) Stream Setbacks and Buffers - a vegetated area including trees, shrubs, and herbaceous vegetation, that exists or is established to protect a stream system, lake, reservoir, or coastal estuarine area;
- (b) Soil Quality Improvement and Maintenance - improvement and maintenance soil through soil amendments and creation of microbial community;
- (c) Tree Planting and Preservation - planting and preservation of healthy, established trees that include both evergreens and deciduous, as applicable;
- (d) Rooftop and Impervious Area Disconnection - rerouting of rooftop drainage pipes to drain rainwater to rain barrels, cisterns, or permeable areas instead of the storm sewer;
- (e) Porous Pavement - pavement that allows runoff to pass through it, thereby reducing the runoff from a site and surrounding areas and filtering pollutants;
- (f) Green Roofs - a vegetative layer grown on a roof (rooftop garden);
- (g) Vegetated Swales - a vegetated, open-channel management practice designed specifically to treat and attenuate storm water runoff;



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(h) Rain Barrels and Cisterns - system that collects and stores storm water runoff from a roof or other impervious surface.

Project proponents shall use the LID Design criteria in this TGD to quantify the runoff reduction resulting from implementation of site design measures.

### 1.5 How to Use this Guidance

This TGD provides project planning, site design, BMP selection and evaluation, and project implementation guidance for Site Design Only Projects. Given varying site conditions throughout the Mojave River Watershed, it is not practical for this document to address every potential site design issue that may arise during project conception and design. Furthermore, this TGD does not supersede any local regulations that affect local development requirements. While not an all-encompassing document, the TGD does provide detailed discussion of LID BMP selection, evaluation, and feasibility analysis so that project proponents will understand what must be incorporated into Site Design Only Projects to meet Phase 2 MS4 Permit stormwater management requirements.

The TGD includes a PCMP Template (Appendix A) that is to be used by all proponents of Site Design Only Projects. Careful adherence to the methods, calculations, and requirements incorporated into this Template will increase the likelihood that a complete application for project approval is submitted.

Finally, this document and its accompanying appendices should be used to identify the minimum requirements applicable to private or public development activities. The information contained herein should be used to facilitate discussions between the project proponent and responsible agencies for issuing approvals and permits for the proposed development activities.

In addition, each jurisdiction under the Phase 2 MS4 Permit has adopted requirements that provide information specific to the local area where the development activity is planned. Each jurisdiction should be consulted prior to using this TGD to prepare documentation applicable to the proposed project.

# Section 2 – PCMP Development Process

## 2.1 Introduction

Use of this TGD should begin in the earliest possible stages of project conception when a development site is first evaluated to determine the applicability of the Phase 2 MS4 Permit requirements and how to best utilize the site to optimize both its development potential, and to incorporate LID concepts given the location and characteristics of the property and the area. The process for developing a PCMP for a Site Design Only Project requires the systematic completion of a number of steps before a project can receive the necessary approvals and permits for construction. The following sections provide an overview of the key steps applicable to proposed projects. Subsequent sections of this TGD for PCMP describe each step in more detail.

## 2.3 Working with Your Local Jurisdiction

This TGD identifies requirements for completion of a PCMP for Site Design Only Projects that satisfies Phase 2 MS4 Permit requirements. However, nothing in this TGD supersedes any local development requirements.

### 2.3.1 Getting Started

The first step in the approval process for a proposed project is to determine the applicability of PCMP requirements.

If the project is not classified as a Site Design Only Project, the Project Owner shall consult with the local jurisdiction to determine any local requirements for LID or stormwater runoff BMP implementation.

If the project is classified as a Site Design Only Project, only requirements as noted in subsequent sections of this TGD must then be addressed.

Ultimately, the project owner should consult the local jurisdiction and, if needed, local stormwater management personnel to verify project approval requirements. It is the responsibility of the project owner to determine stormwater management requirements applicable to the proposed project.

Once it is determined that a project requires a PCMP, the project owner should work through each step described in this TGD. The PCMP Template provided in Appendix A will guide the process and dictate the types of information and analyses required to complete the PCMP application.

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## 2.3.2 Resource Information

The primary focus of this document is to provide sufficient baseline information for application of site design measures and source control BMPs, for Site Design Only projects. Regardless of the focus, this document is not intended to be an exhaustive source of information about LID BMPs, especially with regards to LID design practices or criteria. Where appropriate in various sections, links to additional specific reference materials are provided. However, prior to starting preparation of the PCMP, it is recommended that the project owner become familiar with the LID literature, especially as it relates to commonly accepted engineering practices.

Key source materials for new development and re-development and transportation projects include:

- Caltrans, Arid Region Non-Vegetative Erosion Control Study Final Report October 2010  
[http://www.dot.ca.gov/hq/LandArch/research/docs/arid\\_region\\_nonveg\\_erosion\\_control.pdf](http://www.dot.ca.gov/hq/LandArch/research/docs/arid_region_nonveg_erosion_control.pdf)
- EPA, Green Infrastructure in Arid and Semi- Arid Climates, 2010  
[http://www.dot.ca.gov/hq/LandArch/research/docs/arid\\_region\\_nonveg\\_erosion\\_control.pdf](http://www.dot.ca.gov/hq/LandArch/research/docs/arid_region_nonveg_erosion_control.pdf)
- Riverside County LID Manual, 2011,  
<http://www.floodcontrol.co.riverside.ca.us/NPDES/LIDBMP.aspx>
- ADOT Post-Construction Best Management Practices Manual for Water Quality, 2013  
[http://azdot.gov/docs/default-source/planning/post-construction-best-management-practices-\(bmp\)-manual.pdf?sfvrsn=0](http://azdot.gov/docs/default-source/planning/post-construction-best-management-practices-(bmp)-manual.pdf?sfvrsn=0)
- San Diego Low Impact Development Manual, 2011 <http://www.aridlid.org/wp-content/uploads/2015/03/San-Diego-LID-Manual.pdf>
- Stormwater Quality Design Manual for Sacramento and South Placer Regions, 2007  
<http://www.sacstormwater.org/ConstructionandNewDevelopment/NewDevelopment/StormwaterQualityDesignManual.pdf>
- Eastern Washington Lid Guidance Manual, June 2013  
[http://www.aridlid.org/wp-content/uploads/2013/10/Eastern-Washington-LID-Guidance-Manual\\_final\\_June-2013.pdf](http://www.aridlid.org/wp-content/uploads/2013/10/Eastern-Washington-LID-Guidance-Manual_final_June-2013.pdf)
- Middle Rio Grande Low Impact Developments: Projects for Storm Water Management, 2014  
<http://xeriscapenm.com/wp-content/uploads/ARIDi-LIDpackage-2nd-Edition.pdf>

### 2.4 Preliminary PCMP Submittal

Local jurisdictions shall require the submittal of a preliminary PCMP application for review early in the project development process to ensure compliance with all jurisdictional requirements applicable to development projects (Permit Section E.12). A Preliminary PCMP may be used by the local jurisdiction during the land use entitlement process or as part of a project application for discretionary project approval. The level of detail and content of the preliminary PCMP submittal depends to a large degree on the nature of the project and local jurisdictional requirements.

### 2.5 Final PCMP Submittal

A completed Final PCMP shall fully address site design measures, LID BMPs, and source control BMPs to address pollutants. The Final PCMP, when prepared for submittal for approval, must be certified by the owner, and must include elements agreed upon at Preliminary PCMP acceptance and any revisions proposed.

The Final PCMP must be consistent with the Preliminary PCMP. If there are any substantial differences, the local jurisdiction must make a determination that the differences do not diminish the effectiveness of the BMPs to mitigate or address the project's potential impacts to water quality. Furthermore, any changes must not result in any new environmental impacts not previously disclosed in the local jurisdiction's circulated environmental document(s). If the changes diminish the project's ability to mitigate or address its water quality impacts, or result in previously undisclosed environmental impacts, the local jurisdiction should require that the project be subject to further environmental review.

The completed PCMP is to be submitted to the local jurisdiction for review and approval. Any changes to PCMP elements agreed upon at the Preliminary PCMP phase shall be noted within the PCMP submitted for final approval. Local jurisdiction staff will review the submittal for acceptance and approval. Reviews will be documented by the local jurisdiction. Additional information and submittals may be necessary for final approval. It is the responsibility of the project owner to provide the additional information for consideration by the local jurisdiction.

# Section 3 – Site and Watershed Description

## 3.1 Introduction

The purpose of this section is to describe the site and project information requirements needed to determine applicable LID performance criteria and select and evaluate site design BMPs. This information includes site-specific data. Project evaluation involves several key steps, including:

- Assess site conditions
- Identifying site drainage areas

## 3.2 Project Location

The project location includes the climatic region of the site. For projects within the Mojave River Watershed, the climatic region factors to use shall be those for “Desert”.

The project location is also the starting point in compiling other information such as topographic, soils, hydrology, and groundwater data, which vary spatially across the Mojave River Watershed. These information types are discussed in the following sections.

### 3.2.2 Site Topography and Hydrography

Site topography needs to be assessed to evaluate surface drainage patterns, high and low points, and identify slopes. Hydrographic calculations necessary for estimating pre- and post-development volumes rely upon two key variables that require understanding of the existing and proposed site topography and drainage patterns: 1) the square feet of drainage area, and 2) understanding the location of discharge (low point) of the site.

The pre- and post- development project site will be divided into distinct Drainage Areas (DA), as necessary. A Drainage Area is the area of the Project site that drains to a specific outlet. If the Project site has two outlets then the site will, by definition, have two DAs. By definition, the sum of the areas of the DA will total the Project site area listed in Item 2 of Form 3-1 of the PCMP Template.

### 3.2.3 Existing Development and Utilities

A clear understanding of site conditions requires knowledge of existing development conditions and utilities since they may limit the placement of LID BMPs and affect site design. For redevelopment projects, existing as-built plans are valuable documents to review to compare against actual site conditions when identifying site features such as buildings and structures, parking lots, roads, landscaped areas, and underground utilities.

## Section 4 – Project-Specific Performance Criteria

“Site Design only” projects are required to implement source and site control BMPs, as determined by the local jurisdiction. The owner will complete the applicable sections and forms in the PCMP template as directed by the local jurisdiction.

### 4.1 Source Control BMPs

Source controls BMPs reduce the potential for stormwater runoff and pollutants from coming into contact with one another. Source control BMPs are defined as any activity action, usage of alternative materials, and site-specific operation, maintenance, inspection, and compliance activities that eliminate or reduce pollutants in stormwater runoff.

Section 4.2 provides descriptions of non-structural (see Table 4-1) and structural (see Table 4-2) source control BMPs that must be considered when selecting BMPs applicable to the proposed project. The BMPs are numbered for purposes of the Mojave River Watershed Model PCMP. The PCMP template includes check off boxes to confirm selected BMPs.

### 4.2 Non-Structural Source Control BMPs

Table 4.1-1 of the Template lists the non-structural source control BMPs that may be required in new development and redevelopment projects. For purposes of the PCMP, each non-structural source control BMP is numbered with a reference identifier (e.g., N1, N2, etc.). A cross reference to the California Stormwater Quality Association (CASQA) BMP Handbooks (2003) reference number is included in parentheses (e.g., SC-73), where applicable.

**Table 4-1. Non-Structural Source Control BMPs**

PCMP Reference Identifier	Non-Structural Source Control BMPs
N1	Education for Property Owners, Tenants, and Occupants
N2	Activity Restrictions
N3	Landscape Management (CASQA BMP Handbook SC-73)
N4	BMP Maintenance
N6	Local Water Quality Ordinance Compliance

The CASQA BMP Handbook for New Development and Redevelopment has source control BMP fact sheets referenced as “SD-##”, while factsheets from the CASQA Industrial and Commercial BMP Handbook are designated as “SC-##”.

- **(N1) Education for Property Owners, Tenants and Occupants** – Property owners should be aware of environmental requirements concerning discharges from their property.

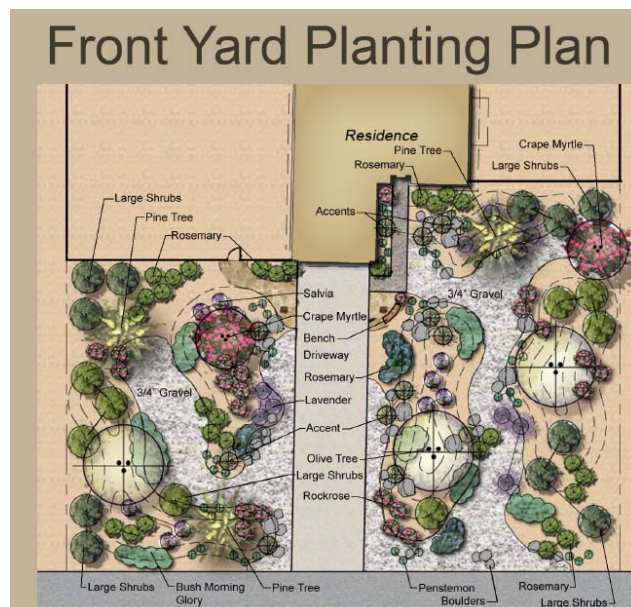
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Awareness education materials are typically made available by the municipalities and local water agencies. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of wastes via hosing or other direct discharge to gutters, catch basins and storm drains. Educational materials available from the San Bernardino Stormwater Program and can be downloaded at: [http://www.sbcountystormwater.org/gov\\_out.html](http://www.sbcountystormwater.org/gov_out.html)

- **(N2) Activity Restrictions** - An example would be not allowing car washing outside of the property and no burying of waste oils on the site.
- **(N3) Landscape Management (CASQA BMP Handbook SC-73)** - Identify on-going landscape maintenance requirements consistent with applicable local ordinances that may include fertilizer and/or pesticide usage. Statements regarding the specific applicable guidelines must be included in the Project PCMP.
- **(N6) Local Water Quality Ordinances** – Comply with any applicable local water quality ordinances. The local jurisdiction, under local water quality ordinances, have authority to ensure clean stormwater discharges from fuel dispensing areas and other areas of concern to public properties.

### 4.2.1 Landscape Management

It is noted that, in the Phase 2 Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:



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San Bernardino County Special Districts:

Guide to High Desert Landscaping -

<http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795>

Recommended High-Desert Plants -

<http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553>



Mojave Water Agency:

Desert Ranch: <http://www.mojavewater.org/files/desertranchgardenprototype.pdf>

Summertree: <http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf>

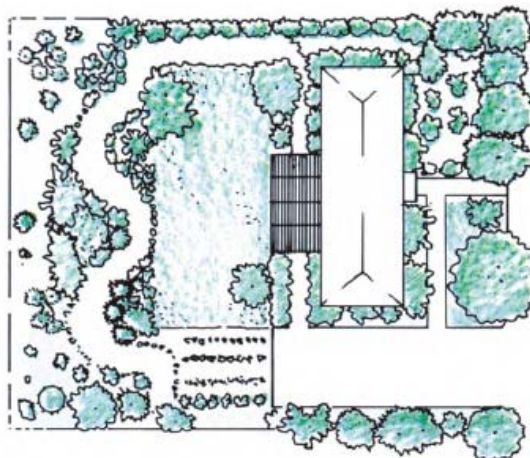
Thornless Garden: <http://www.mojavewater.org/files/thornlessgardenprototype.pdf>

Mediterranean Garden: <http://www.mojavewater.org/files/mediterraneangardenprototype.pdf>

Lush and Efficient Garden:

<http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf>

Alliance for Water Awareness and Conservation (AWAC) outdoor tips -  
<http://hdawac.org/save-outdoors.html>





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## 4.3 Structural Source Control BMPs

Table 4-2 lists the structural source control BMPs that may be required in new development and redevelopment projects. For purposes of the PCMP Guidance, each structural source control BMP is numbered with a PCMP reference identifier (e.g., S1, S2, etc.). A cross reference for the CASQA BMP Handbook Factsheet reference number is included in parentheses, where applicable.

**Table 4-2. Structural Source Control BMPs**

PCMP Reference Identifier	Structural Source Control BMPs
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA BMP Handbook SD-34)
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA BMP Handbook SD-12)
S5	Finished grade of landscaped areas
S6	Protect slopes and channels and provide energy dissipation
S13	Hillside landscaping (CASQA BMP Handbook SD-10)

- **(S2) Design Outdoor Hazardous Material Storage Areas to Reduce Pollutant Introduction (SD-34)** - Improper storage of materials outdoors may increase the potential for toxic compounds, oil and grease, fuels, solvents, coolants, wastes, heavy metals, nutrients, suspended solids, and other pollutants to enter the MS4. Where the plan of development includes outdoor areas for storage of hazardous materials that may contribute pollutants to the MS4, the following stormwater BMPs are required:
  - Hazardous materials with the potential to contaminate urban runoff shall either be: (a) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the MS4; or (b) protected by secondary containment structures (not double wall containers) such as berms, dikes, or curbs.
  - The storage area shall be paved and sufficiently impervious to contain leaks and spills.
  - The storage area shall have a roof or awning to minimize direct precipitation and exposure, and collection of stormwater within the secondary containment area.
  - Any stormwater retained within the containment structure must not be discharged to the street or storm drain system.

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See CASQA Stormwater Handbook Section 3.2.6 and BMP Fact Sheet SD-34 for additional information.

- **(S4) Use Efficient Irrigation Systems and Landscape Design (CASQA BMP Handbook SD-12)** The Water Conservation in Landscaping Act of 2006, Assembly Bill 1881 (AB 1881), requires adoption of the Model Water Efficient Landscape Ordinance designed to improve public and private landscaping and irrigation practices for new development projects or rehabilitation of significant landscape areas. The ordinance reduces outdoor water waste through improvements in irrigation efficiency and selection of plants requiring less water. Employing rain shutoff devices to prevent irrigation after precipitation.
  - Designing irrigation systems to each landscape area's specific water requirements.
  - Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
  - The timing and application methods of irrigation water shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain system.
  - Employing other comparable, equally effective, methods to reduce irrigation water runoff.
  - Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider other design features, such as:
    - Use mulches (such as wood chips or shredded wood products) in planter areas without ground cover to minimize sediment in runoff.
    - Install appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant material where possible and/or as recommended by the landscape architect.
    - Leave a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible.
    - Choose plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth.
- **(S5) Finished Grade of Landscaped Areas** - All landscape pockets, fingers, setback areas, parkway strips, street medians, etc., shall be finish-graded at a minimum of 1-2 inches below top of curb or sidewalk for increased retention/infiltration of stormwater and irrigation water.

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- **(S6) Protect Slopes and Channels** - Project plans should include Source Control BMPs to decrease the potential for erosion of slopes and/or channels. The following design principles should be considered and incorporated and implemented where determined applicable and feasible by the local jurisdiction:
  - Convey runoff safely from the tops of slopes.
  - Avoid disturbing steep or unstable slopes.
  - Avoid disturbing natural channels.
  - Install permanent stabilization BMPs on disturbed slopes as quickly as possible.
  - Vegetate slopes with native or drought tolerant vegetation.

These practices should be implemented, as feasible, consistent with local codes and ordinances. Projects involving an alteration to bed, bank, or channel of a Water of the US may require approval of additional regulatory agencies with jurisdiction over water bodies, (e.g., the U.S. Army Corps of Engineers, the California Regional Water Quality Control Boards and the California Department of Fish and Game).

- **(S13) Site Design and Landscape Planning (Hillside Landscaping), (CASQA BMP Handbook SD-10)** - Hillside areas that are disturbed by project development shall be landscaped with deep-rooted, drought tolerant plant species selected for erosion control, satisfactory to the local jurisdiction.

### 4.3 Site Design

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered for small site, Site Design Only projects. Site design Measures are simple design methods to manage reducing runoff generation.

Form 4.1-3 of the Template is to be completed for those site design elements planned to be included as part of the Project. There are eight possible elements to be included as part of a project. The following explains the types of Site Design criteria and parameters.

#### 4.3.1 Stream Setback Areas

Projects should avoid sensitive areas, including wetlands, streams, floodplains, and intact wooded areas. Not only do federal, state and local laws already limit development in these areas or require compliance with significantly more stringent regulatory requirements, impacts to these areas can greatly impact the pre-development hydrologic characteristics of a site. Owner should contact local municipality or agency concerning requirements and required width of setback.

## Mojave Watershed Post Construction Measures Plan

### 4.3.2 Maximize Natural Infiltration Capacity

Taking advantage of a site's natural infiltration and water storage capacity decreases the volume of stormwater runoff generated and the need for BMPs that mitigate project impacts. Accordingly, when developing the footprint for constructed elements of a proposed project, areas where infiltration could be maximized should be preserved. Typically, these areas include:

- Areas with sandy and high infiltration soils
- Mild slopes or depressions
- Undeveloped portions of an existing site undergoing redevelopment

Selecting areas to maximize infiltration must consider geotechnical hazards that could be created by infiltration in inappropriate locations, such as near structures, which may cause structural failure, or in and around steep slopes, which may cause slope destabilization

This BMP also includes improving existing soils through adding amendments and improving overall infiltration rates.

### 4.3.3 Protect Existing Vegetation

Vegetative cover (extent, depth and density) provides additional storage volume during rainfall events. Soils with undisturbed vegetation have a much higher capacity to store and infiltrate runoff than disturbed soils or vegetation. Every effort should be made to minimize soil and vegetation disturbance (including existing trees) to retain on-site storage capacity.

If vegetation must be removed, replacement of appropriate drought tolerant vegetation is required.

### 4.3.4 Minimize Impervious Areas

Increased imperviousness is associated with increased environmental impacts to downstream receiving waters, including the creation of hydrologic conditions of concern. Accordingly, projects site plans should minimize impervious areas, which will greatly reduce the amount of BMPs needed to mitigate potential downstream impacts.

### 4.3.5 Disconnect Impervious Areas

Disconnection of impervious areas so that stormwater runoff is directed to on-site pervious surfaces rather than off-site streets and storm drains increases the time of concentration, reduces the peak discharge rate from the site, and maximizes opportunities for on-site infiltration. Careful application of this preventive measure can greatly reduce the need for other BMPs. Care must be taken to ensure that runoff to pervious areas for on-site infiltration does not create geotechnical hazards or cause impacts to adjacent properties. The extent to which disconnection practices may be employed on the project site may be dependent on existing codes and ordinances, which should be carefully consulted.

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### 4.3.6 Porous Pavement

Porous or permeable pavement BMPs contain small voids that allow water to pass through to a gravel base. Permeable pavement comes in a variety of forms, including modular paving systems (concrete pavers, grass-pave, or gravel-pave) or poured in place pervious pavement (porous concrete, permeable asphalt). All permeable pavements treat stormwater and remove sediments and metals to some degree within the pavement pore space and gravel base.

While conventional pavement results in increased rates and volumes of stormwater and non-stormwater runoff, properly constructed and maintained porous pavement BMPs allow stormwater to percolate through the pavement and enter the soil below.

### 4.3.7 Rock Lined Swale

In the Phase II Small MS4 Permit it is noted that site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design, the project proponent should utilize locally recommended vegetation types for landscaping.

This Guidance document and template specifically requires rock lined swales with drought tolerant landscaping. Swales are to be designed in accordance “TC-30-Vegetated Swale” from the California Stormwater BMP Handbook, New Development and Redevelopment (available at <https://www.casqa.org/sites/default/files/BMPHandbooks/TC-30.pdf>) and modified for the arid region.

### 4.3.8 Residential Rain Barrels/Cisterns

Rain barrels / cisterns are above ground storage vessels that capture runoff from roof downspouts during rain events and detain that runoff for later uses such as irrigating landscaped areas. The temporary storage of roof runoff reduces the runoff volume from a property and may reduce the peak runoff velocity for small, frequently occurring storms. In addition, by reducing the amount of storm water runoff that flows overland into a storm water conveyance system (storm drain inlets and drain pipes), fewer pollutants are transported through the conveyance system into the offsite storm drain system and receiving waters. The use of the detained water for irrigation purposes leads to the conservation of potable water and the recharge of groundwater.

Retention volume from residential rain barrels/cisterns can be approximately estimated as half of the storage capacity provided, which assumes the storage is half-empty at the beginning of a storm event.

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### 4.3.1 Exceptions to Requirements

Contingent on a demonstration that site design BMPs or a facility of equivalent effectiveness, is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories:

- 1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;
- 2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and
- 3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

### 4.3.2 Site Design BMPs

Section E.12.b.ii of the Small Phase II MS4 Permit lists the required Site Design Low Impact Design preventative measures or BMPs. As this is a Statewide Permit, the State of California Water Resources Control Board (SWRCB) and California State University, Sacramento have developed an on-line program and worksheet set to assist with site design BMP selection and sizing.

The on-line worksheets will require site specific inputs and it will provide the Permit required outputs for the Project's compliance. The goal of the on-line program is to assist the property owner with:

- Correctly calculating the runoff volume from the site;
- Adequately calculating the site design BMPs;
- Providing options for site design; and
- Summarizing the final results.

The calculations are in three main steps:

- 1) Site data is entered to calculate existing and proposed site runoff volumes
- 2) Site design BMPs are selected and criteria entered for sizing
- 3) The compliance criteria is calculated and summarized

The on-line worksheets/programs are found at the following website links:

**Post Construction Calculator for Small Projects:**

[http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/docs/phase\\_ii\\_municipal/120214\\_post\\_const\\_calc.xls](http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/phase_ii_municipal/120214_post_const_calc.xls)

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IMPORTANT: THIS CALCULATOR CAN ONLY BE USED FOR PROJECTS THAT CREATE AND/OR REPLACE BETWEEN 2,500 SQUARE FEET AND 5,000 SQUARE FEET OF IMPERVIOUS SURFACE (OR DETACHED SINGLE FAMILY HOMES THAT CREATE AND/OR REPLACE OVER 2,500

## California Phase II LID Sizing Tool:

<http://owp-web1.saclink.csus.edu/LIDTool/Start.aspx>

Neither of these website links are developed or maintained by the County of San Bernardino

### 4.3.2.1 Using On-line Calculators

The first step to calculating the site specific BMP sizing is to use the SWRCB on-line calculator called “**Post Construction Calculator for Small Projects**” – see link above. This on-line calculator is an interactive Excel worksheet. Please note:

- Changes may be made to cells which show as blue and yellow. You must click on the blue cell to show the dropdown arrow.
- Green cells are calculated for you
- Use the drop-down data where possible
- Please proceed through the worksheets step by step.

#### Part 1 – SITE DATA

**Step 1a** If known, enter the 85<sup>th</sup> percentile storm event for your location. If not, skip this box and go to Step 1b.

**Step 1b “County”** : Choose the County and location for your project. All projects will be in San Bernardino County.

**Step 1c “Location”** will depend on where your project is located within the County. If assistance is needed, go to the “**California Phase II LID Sizing Tool**” (see second link above). This website has all of the locations mapped to help with project placement. Most project submittals of this type will be in the “Victorville Pump Plant” location.

<p>(Step 1b) If you can not answer 1a then select the county where the project is located (click on the cell to the right for drop-down): This will determine the average 85th percentile 24 hr. storm event for your site, which will appear under precipitation to left.</p>	<p><b>SAN_BERNARDINO</b></p>
<p>(Step 1c) If you would like a more precise value select the location closest to your site. If you do not recognize any of these locations, leave this drop-down menu at location. The average value for the County will be used.</p>	<p><b>VICTORVILLE PUMP PLANT</b></p>

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**Step 2 “Soil Type”** will depend on where your project is located within the County. If assistance is needed, go to the **“California Phase II LID Sizing Tool”** (see second link above). This website has the regional soil types mapped. You will click on “Step 2” and then click on the map to show soil type data. Most project submittals will be either Soil Hydrologic Group A or B.

**Step 3 “Non-Built Land Use Type Pre-Development”** Please select the primary type of *current* land use conditions from the drop down menu.

**Step 4 “Non-Built Land Use Type Post-Development”** Please select the primary type of *proposed* land use conditions from the drop down menu.

(Step 2) Indicate the Soil Type (dropdown menu to right):	<i>Group A Soils</i>	High infiltration. Sand, loamy sand, or sandy loam. Infiltration rate > 0.3 inch/hr when wet.
(Step 3) Indicate the existing <b>dominant</b> non-built land Use Type (dropdown menu to right):	<i>Natural Desert</i>	
(Step 4) Indicate the proposed <b>dominant</b> non-built land Use Type (dropdown menu to right):	<i>Natural Desert Landscape</i>	

### Other Project Specifics

**“Project Name”** Please enter the project name. Can be the development name, address of the site, owner’s name, etc.

**“Waste Discharge Identification Number (WDID)”** This is the assigned Construction General Permit Waste Discharge Number for those projects which are over one-acre. If the project is less than one acre, you will not have this WDID number (can state N/A).

**“Date”** Date that calculations were completed

**“Sub Drainage Area Name (from map)”** Most smaller sites will have one primary drainage area, meaning all the site flows go to one location (discharge point). If your site has more than one drainage area (discharge point) then the project will require design calculations for each area. This box allows for noting the name of these areas. For example if the site only has one drainage area this box can be left blank or this area can be named DA-1. However, if the site has two



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drainage areas, then the calculations would be named DA-1 and DA-2. If additional areas are required, the naming would follow as necessary.

**Step 5 “Total Project Site Area”** Please enter the project area. This is only the area of new or additional building, sidewalks, driveways, landscape, etc.

**Step 6 “Sub-watershed Area”** This is the same as “Sub Drainage Area”. For single drainage area sites, Step 6 and Step 5 will be the same number. For multiple drainage area sites, Step 6 is smaller than Step 5. Also, for multiple drainage area sites, the sum of each Step 6 should total to Step 5. This is only the area of new or additional building, sidewalks, driveways, landscape, etc.

*Note that Step 5 and Step 6 can be entered in either square feet or acres. Do not enter in both.*

Notice now that the green boxes, on the left side of the worksheet, have started to auto-calculate and populate.

**Step 7 “Sub-watershed Conditions”** Again this pertains to the sub drainage areas. Please enter data for all four rows.

- Existing Rooftop Impervious Coverage = area of existing rooftop within the total project area (Step 5)
- Existing Non-Rooftop Impervious Coverage= area of existing non-rooftop coverage (meaning sidewalk, patio, driveway, pool deck). ). Only within the Total Project Area (Step 5)
- Proposed Rooftop Impervious Coverage = area of total proposed rooftop within the total project area (Step 5)
- Proposed Non-Rooftop Impervious Coverage= area of total proposed non-rooftop coverage (meaning sidewalk, patio, driveway, pool deck). Only within the Total Project Area (Step 5)

Notice now that remaining green boxes, on the left side of the worksheet, have auto-calculated and populated. These boxes present to the owner/developer the total amount of “Project-related Runoff Volume Increase without Credits”. This number is the goal for the total number of BMP credits the project will provide.

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Pre-Project Runoff Volume (cu ft)	0	Cu.Ft.
Project-Related Runoff Volume Increase w/o credits (cu ft)	82	Cu.Ft.
Project-Related Volume Increase with Credits (cu ft)	82	Cu.Ft.
<u>You need to do more impervious area reduction to meet minimum requirements</u>		

### Part 2 – BMP CREDITS

The calculations associated with Part 2, BMP Credits, will be found on the next nine tabs of the worksheet.

As described in the Phase II permit Section E.12.b Site Design Measures, the definitions of the site design measures to reduce project site runoff include:

- (a) **Stream Setbacks and Buffers** - a vegetated area including trees, shrubs, and herbaceous vegetation, that exists or is established to protect a stream system, lake reservoir, or coastal estuarine area;
- (b) **Soil Quality Improvement and Maintenance** - improvement and maintenance soil through soil amendments and creation of microbial community;
- (c) **Tree Planting and Preservation** - planting and preservation of healthy, established trees that include both evergreens and deciduous, as applicable;
- (d) **Rooftop and Impervious Area Disconnection** - rerouting of rooftop drainage pipes to drain rainwater to rain barrels, cisterns, or permeable areas instead of the storm sewer;
- (e) **Porous Pavement** - pavement that allows runoff to pass through it, thereby reducing the runoff from a site and surrounding areas and filtering pollutants;

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- (f) **Green Roofs** - a vegetative layer grown on a roof (rooftop garden);
- (g) **Vegetated Swales** - a vegetated, open-channel management practice designed specifically to treat and attenuate storm water runoff;
- (h) **Rain Barrels and Cisterns** - system that collects and stores storm water runoff from a roof or other impervious surface.

Please note the following:

- 1) "Stream Buffer" BMP would only be used at those locations directly adjacent to a natural "Stream". Note that in this region, this would include dry washes. It is recommended to discuss this option with the approving agency or someone knowledgeable on stream buffers before including this option.
- 2) Use of "Green Roofs" is not approved in San Bernardino County. This roof type is not appropriate for this arid region.
- 3) In this arid region, the use of "rock swales" instead of vegetated swales is acceptable.
- 4) Use of "Rain barrels and Cisterns" are also not typically functional due to the lack of rain in the region.

The project owner/developer will select the appropriate BMP type for the project and complete the required data. For each BMP worksheet page, you must go to "return to calculator" to confirm the data is fully uploaded.

Additional calculation and sizing guidance for BMPs is also provided in the Sacramento State website "**California Phase II LID Sizing Tool**" ([see link above](#)). This website provides calculations for pavement, swale, capture and basin BMP types.

### Helpful Hints

#### Porous Pavement –

- Note the depth of the subgrade material when selecting the porous pavement type.
- Only enter the area in square feet or acres, not both

#### Tree Planting-

- Evergreen Trees -
- Deciduous Trees –

#### Downspout Disconnection –

- This credit will only be applied if Lines 6,7, and 8 are all "yes"
- Note that double credit is not allowed
- Lines 11 and 12 are in percent. Enter from 0 to 100. No decimals.

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### Impervious Area Disconnect –

- This credit will only be applied if Lines 6,7, and 8 are all “yes”
- Note that double credit is not allowed
- Lines 10 and 11 are in percent. Enter from 0 to 100. No decimals.

**Green Roofs** – not used in this region.

### Stream Buffer –

- This credit will only be applied if Lines 7,8,9 and 10 are all “yes”
- Lines 11 and 12 are in percent. Enter from 0 to 100. No decimals.
- Recommend consulting with local agency concerning this selection prior to submittal

### Vegetative Swale –

- Direct link to the Vegetative Swale Fact Sheet:  
<http://www.casqa.org/sites/default/files/BMPHandbooks/TC-30.pdf>
- Line 8 can only be stated yes if the site is fairly flat or gentle sloping
- Lines 10 and 11 are in percent. Enter from 0 to 100. No decimals.

**Rain Barrel/Cistern** – usually not practical for this region.

### Soil Quality –

- For this region, most sites are “Sands, loamy sands”, “Sandy loams, loams”. Consult the link on the worksheet for additional information.
- Recommend 6 to 12 inches for average depth of soil media management.
- Note that line 12 is in acres.

The following table is to help with converting the square feet area into acres.

Square Feet	Acres
10	0.00023
20	0.000459
30	0.000689
40	0.000918
50	0.001148
60	0.001378
70	0.001607
80	0.001837
90	0.002066
100	0.002296

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125	0.00287
150	0.003444
175	0.004018
200	0.004592
300	0.006888
400	0.009184
500	0.01148
1000	0.02296
1100	0.025256
1200	0.027552
1300	0.029848
1400	0.032144
1500	0.03444
1600	0.036736
1700	0.039032
1800	0.041328
1900	0.043624
2000	0.04592
3000	0.06888
4000	0.09184
5000	0.1148

Part 2 final note.

**Do not make edits to the “No Edit” page**

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## Part 3 – Project Compliance Check

As the BMPs are selected and calculated the total amount of “Project-Related Volume Increase with Credits” number will reduce until it reaches zero. At that time the worksheet will post “You have achieved your minimum requirements”

Project-Related Runoff Volume Increase w/o credits (cu ft)	95	Cu.Ft.
Project-Related Volume Increase with Credits (cu ft)	0	Cu.Ft.
You have achieved your minimum requirements		

***At this point, please print to pdf each of the worksheet pages used for your calculations. You will need to submit all of these pages as part of the PCMP submittal.***

## 4.4 Conformance Summary

This last table meets the requirement to show conformance with the Permit. The owner is required to show that the estimated runoff volume is managed by the selected BMP(s).

The directions present the steps to providing the required information.

### Section 5 – Site Plans

This section describes the requirements for the plan submittal. This information could be included on an erosion control plan. Include a site plan with the drainage and BMP information containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Source Control BMP locations
- Site Design BMP locations
- LID BMP details
- Drainage points and flow direction

#### 5.2 Submittal Package Summary

The PCMP submittal package will include:

- 1) This template with the appropriate sections filled out
- 2) A copy of the “Post Construction Calculator for Small Projects” worksheets:
- 3) Site design and drainage plan

Once approved, a copy of this document should be kept with other important property records. This document would be transferable to future ownership. At the time of writing, this document did not have to be recorded against the property.

## **Appendix A – PCMP Template**