ATTACHMENT A:

Demonstration of Compliance with Part VI.C.4.c.i (1) and Part VI.C.4.c.iv (1) of Order R4-2012-0175

ATTACHMENT A.1:

GWMA LID ORDINANCE AND GREEN STREETS POLICY TEMPLATE PROGRAM

GATEWAY WATER MANAGEMENT AUTHORITY

Los Angeles Gateway Region
Integrated Regional Water Management
Joint Powers Authority

16401 Paramount Blvd., Paramount, CA 90723 • 562.663.6850 phone 562.634.8216 fax • www.gatewayirwmp.org

*****PLEASE FEEL FREE TO DISTRIBUTE TO YOUR CITY MANAGER AND/OR CONSULTANTS*****

SUMMARY OF GWMA SPECIAL BOARD MEETING HELD ON 2/26/13 REGARDING NEW LA COUNTY MS4 PERMIT WMPs/EWMPs

Dear Gateway Region City:

As you know, the new LA County MS4 Permit is now in effect. This new permit comes with certain deadlines which drive how a city will comply with the permit and how long they have to comply. A major component of the new permit is which of three Watershed Management Program options to select. The first deadline was 2/26/2013 which documented a city's intent to begin work on development of a LID Ordinance and Green Streets Policy. By meeting this deadline, cities could then select from three Watershed Management Program options, each with a different deadline as further described below.

On 2/26/13, GWMA held a Special Board Meeting in Paramount to discuss and consider actions that could help Gateway cities with meeting their WMP/EWMP deadlines.

At this Special Board Meeting, two (2) actions were taken to provide assistance to any or all Gateway Region Cities, regardless of JPA membership, acknowledging that participation was completely voluntary.

ACTION #1

- The Board of Directors of the Gateway Water Management Authority "GWMA" unanimously directed the Executive Officer to develop draft templates for an LID Ordinance and a Green Street Policy which could be utilized and customized by any Gateway region city, regardless of JPA membership.

All Gateway cities were given the option to fill out and sign a notice of "Intent to Participate" with GWMA as the fiduciary agent to procure consultant services for these two programs. Many cities have joined the regional effort by submitting the form to GWMA for collection and documentation.

These signed forms serve as documentation of a city's intent to begin looking at the programs. The Permit requires that this decision had to be made no later than 2/26/13 if they wanted additional time to develop a Watershed Management Plan "WMP" (12 months) or a Watershed Management Program which includes early LID and Green Street Actions (18 months) or an Enhanced Water Management Plan "EWMP" (30months). These forms will accompany each Permittee's Notice of Intent to do a WMP or EWMP which is due no later than June 28, 2013.

MINUTES OF THE GATEWAY WATER MANAGEMENT AUTHORITY
LOS ANGELES GATEWAY REGION
INTEGRATED REGIONAL WATER MANAGEMENT JOINT POWERS AUTHORITY
SPECIAL BOARD MEETING
AT PARAMOUNT, CALIFORNIA
THURSDAY, FEBRUARY 26, 2013

A regular meeting of the Board of Directors of the Gateway Water Management Authority was held on Thursday, February 26, 2013 at 9:30 a.m. at the Progress Park Plaza, 15500 Downey Avenue, Paramount, CA 90723.

Chair Chris Cash called the meeting to order at 9:45 a.m. Roll was called through self-introductions and a quorum of the board was declared present. A Sign-In Sheet was provided to all attendees for sign-in.

BOARD MEMBERS PRESENT:

Chair Christopher Cash	Paramount
Vice-Chair Adriana Figueroa	Norwalk
Charlie Honeycutt	Signal Hill
Carlos Alba	Artesia
Young Park (alternate)	Bell
Chau Vu (alternate)	Bell Gardens
Bernardo Iniguez (alternate)	Bellflower
Gina Nila	Commerce
Desi Alvarez (by proxy)	Huntington Park
Lisa Rapp	Lakewood
Anthony Arevalo	Long Beach
Jose Molina (alternate)	Lynwood
Gladis Deros (alternate)	Pico Rivera
Noe Negrete (alternate)	Santa Fe Springs
Steve Myrter (alternate)	Signal Hill
Scott Rigg (alternate)	Vernon
David Pelser	Whittier

BOARD MEMBERS ABSENT:

Terry Rodrigue	Bell
John Oropeza	Bell Gardens
Deborah Chankin	Bellflower
N/A	Central Basin MWD
Vince Brar	Cerritos
John Oskoui	Downey
James Enriquez	Huntington Park
Thomas Robinson	La Mirada
Jim Glancy	Lakewood
Kevin Wattier	Long Beach Water Dept.
N/A	Lynwood
Art Cervantes	Pico Rivera
Frank Beach	Santa Fe Springs
Bill DeWitt	South Gate
Kevin Wilson	Vernon

EX-OFFICIO PARTICIPANTS:

Ernesto Marquez	Hawaiian Gardens

STAFF AND GUESTS ON SIGN-IN SHEET:

Grace Kast	Executive Officer
Claudia Arellano	Vernon
Chris Lapaz	Montebello
Sarah Ho	Paramount
Konya Vivanti	Lakewood
Aaron Hernandez	Cudahy
Victor Ferrer	Cudahy
Rochelle Paras	LAFCD – GLAC IRWM
Blake Whittington	Council for Watershed Health
Sam Kouri	Montebello

ITEM 3 - ADDITIONS TO THE AGENDA

None.

ITEM 4 – ORAL COMMUNICATIONS TO THE BOARD

None.

ITEM 5 – PRESENTATION – LOS ANGELES COUNTY MS4 PERMIT (GATEWAY CITIES AND WATERSHEDS)

Mr. John Hunter of John L. Hunter and Associates gave a presentation summarizing the newly adopted LA County MS4 Permit. He indicated that several deadlines were being imposed that needed the attention of the cities throughout LA County.

After many questions and answers, cities were invited to sign a green sheet "Intent to Participate" that would satisfy the first deadline on February 26, 2013 indicating a cities intent to initiative their review of a Green Streets Policy and Low Impact Development Ordinance. The documents would be held by GWMA for inclusion with an MOU due by June 28, 2013.

ITEM 6 – DISCUSSION/ACTIONS REGARDING COMPLIANCE WITH LA REGIONAL BOARD'S MS4 PERMIT (WMP/EWMP)

Many representatives of cities and existing watershed groups expressed interest in having GWMA take a lead on the formation of an MOU group to develop a WMP or EWMP for the Gateway region. Participation in the MOU would be voluntary and the end-product (WMP/EWMP) would serve as the umbrella Plan with separate chapters for each watershed in the region. The Chair directed staff to work on a follow-up special board meeting date and time to focus solely on the MS4 Permit WMP/EWMP.

On motion made by Director Alvarez and seconded by Director Figueroa, staff was instructed to develop a standard, customizable LID Ordinance and Green Street Policy for Gateway cities to use if they so choose. The motion passed unanimously.

On motion made by Director Rapp and seconded by Negrete, staff was directed to develop an MOU for discussion and action by the GWMA Board. The motion passed unanimously.

ITEM 7 – DIRECTORS' COMMENTS/REPORTS

None.

The special meeting was adjourned at 12:05 p.m. to a regular meeting of the board on Thursday, March 14, 2013 in the Clearwater Building at Paramount, CA.

Charlie Honeycutt, Treasurer

3-14-13
Date

Intent to Participate

The City of Downey is interested in obtaining assistance with implementation efforts related to the new Green Streets and Low Impact Development programs of the National Pollutant Discharge Elimination System's Municipal Separate Sanitary Storm Sewer (MS4 NPDES Permit).

The GWMA will act as the fiduciary agent to procure consultant services to develop draft templates of the above two programs.

☑ Yes, the City intends to participate along with other GWMA agencies in the development of these programs. Check the three boxes below if applicable to your city.

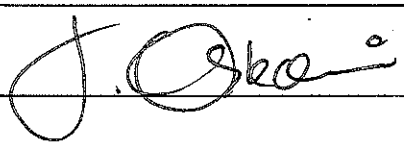
- ☑ The City is already in the process of adopting LID
- ☐ The City is already in the process of adopting Green Streets
- ☐ Already participating in the LA Permit Group effort

☐ No, the City is not interested in participating;

Please sign below and return this form via fax or email to Grace J. Kast, Executive Officer, GWMA (626-485-0338) **no later than Tuesday, February 26th, 2013.**

Name John Oskoui

Title Assistant City Manager/Director of Public Works

Signature 

Date February 26, 2013

Intent to Participate

The City of LAKEWOOD is interested in obtaining assistance with implementation efforts related to the new Green Streets and Low Impact Development programs of the National Pollutant Discharge Elimination System's Municipal Separate Sanitary Storm Sewer (MS4 NPDES Permit).

The GWMA will act as the fiduciary agent to procure consultant services to develop draft templates of the above two programs.

☒ Yes, the City intends to participate along with other GWMA agencies in the development of these programs. Check the three boxes below if applicable to your city.

- ☒ The City is already in the process of adopting LID
- ☒ The City is already in the process of adopting Green Streets
- ☐ Already participating in the LA Permit Group effort

☐ No, the City is not interested in participating;

Please sign below and return this form via fax or email to Grace J. Kast, Executive Officer, GWMA (626-485-0338) **no later than Tuesday, February 26th, 2013.**

Name LISA ANN RAPP

Title DIRECTOR OF PUBLIC WORKS

Signature Lisa Ann Rapp

Date 2/26/13

Intent to Participate

The City of Paramount is interested in obtaining assistance with implementation efforts related to the new Green Streets and Low Impact Development programs of the National Pollutant Discharge Elimination System's Municipal Separate Sanitary Storm Sewer (MS4 NPDES Permit).

The GWMA will act as the fiduciary agent to procure consultant services to develop draft templates of the above two programs.

☑ Yes, the City intends to participate along with other GWMA agencies in the development of these programs. Check the three boxes below if applicable to your city.

- ☐ The City is already in the process of adopting LID
- ☐ The City is already in the process of adopting Green Streets
- ☐ Already participating in the LA Permit Group effort

☐ No, the City is not interested in participating;

Please sign below and return this form via fax or email to Grace J. Kast, Executive Officer, GWMA (626-485-0338) **no later than Tuesday, February 26th, 2013.**

Name Christopher Cash

Title Director of Public Works

Signature

Date 2/26/13

Intent to Participate

The City of Signal Hill is interested in obtaining assistance with implementation efforts related to the new Green Streets and Low Impact Development programs of the National Pollutant Discharge Elimination System's Municipal Separate Sanitary Storm Sewer (MS4 NPDES Permit).

The GWMA will act as the fiduciary agent to procure consultant services to develop draft templates of the above two programs.

☑ Yes, the City intends to participate along with other GWMA agencies in the development of these programs. Check the three boxes below if applicable to your city.

- ☑ The City is already in the process of adopting LID
- ☑ The City is already in the process of adopting Green Streets
- ☐ Already participating in the LA Permit Group effort

☐ No, the City is not interested in participating;

Please sign below and return this form via fax or email to Grace J. Kast, Executive Officer, GWMA (626-485-0338) **no later than Tuesday, February 26th, 2013.**

Name STEVE MYRTER

Title PUBLIC WORKS DIRECTOR

Signature [signature]

Date 2/25/2013

The development of LID Ordinance and Green Streets Policy templates by GWMA was based largely on work done for the City of Signal Hill.

ATTACHMENT A.2:

CITY OF SIGNAL HILL DEVELOPMENT OF LID ORDINANCE AND GREEN STREETS POLICY

CITY OF SIGNAL HILL

2175 Cherry Avenue • Signal Hill, CA 90755-3799

July 10, 2012

AGENDA ITEM

TO: HONORABLE CHAIR
AND MEMBERS OF THE PLANNING COMMISSION

FROM: SCOTT CHARNEY SC
DIRECTOR OF COMMUNITY DEVELOPMENT

SUBJECT: DIRECTOR'S REPORT — DEVELOPMENT OF LOW IMPACT DEVELOPMENT ORDINANCE

Summary:

The Commission will receive a report on the development of an ordinance regarding Low Impact Development (LID).

Recommendation:

Direction as deemed appropriate.

Background:

Stormwater and dry-weather urban runoff from the City of Signal Hill are subject to Waste Discharge Requirements issued by the California Regional Water Quality Control Board. These requirements include numerical effluent limits for pollutants that have been established by Total Maximum Daily Loads (TMDLs) and the Regional Board's Basin Plan. These numerical effluent limits are not likely to be achievable without the installation of stormwater treatment systems that will cumulatively receive drainage from a large portion of the city. Staff is developing new regulations that will be incorporated into the City's existing stormwater and urban runoff regulations contained in Chapter 12.16 of the Signal Hill Municipal Code.

Analysis:

LID is a strategy for improving the quality of runoff by requiring that development projects direct runoff to treatment systems consisting of vegetation and soil. Since 2007, the city has been requiring LID for high priority projects such as:

- Parking lots that are over 5,000 square feet
- Housing development with 10 or more dwelling units

- Auto service facilities
- Retail gasoline outlets and
- Restaurants.

With the establishment and enforceability of TMDLs for metals, bacteria, nutrients and other numerical effluent discharge targets, the number of these treatment systems needs to be increased. These treatment systems, depending upon design, can reduce pollutant levels by as much as 50 to 90 percent from their draining area. The installation of these treatment systems can be low-cost and generally require low-maintenance, often being incorporated into the parcels' landscape theme.

The goals of LID include:

1. Reducing the amounts of pollutants in stormwater and urban runoff
2. Development of specifications for low cost treatment systems that are easy for the property owner to install
3. Encouraging property owners to select treatment systems that are easy to maintain and thus minimizing the need for city enforcement.

Specific elements include:

- Projects under 500 square feet will be exempted from this program

- Residential development for 1-4 units will be able to put city specifications on plans and provide simple calculations showing the treatment surface area is 4 percent of the new impervious area.

- Residential development involving 5 or more dwelling units and those for commercial or industrial development are more likely to have professional engineers and architects involved in the project and will be submit to slightly more complex documentation showing that the treatment system can accommodate runoff for ¾ inch of rainfall.

- Readily approvable treatment systems will include:

    - Flow through planters
    - Bottomless trench drains across driveways
    - Rain Gardens (concave rock and plant areas)
    - Hollywood or other pervious style driveways
    - Vegetative (concave) swales with underdrains

- Where remodeling involves more that 50 percent of the site, runoff from the entire site would have to be treated.

ORDINANCE NO. _____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SIGNAL HILL, CALIFORNIA, AMENDING SIGNAL HILL MUNICIPAL CODE CHAPTER 12.16 ENTITLED STORM WATER/URBAN RUNOFF, TO EXPAND THE APPLICABILITY OF THE EXISTING POLLUTANT SOURCE REDUCTION REQUIREMENTS BY IMPOSING RAINWATER LOW IMPACT DEVELOPMENT (LID) STRATEGIES ON PROJECTS THAT REQUIRE BUILDING, GRADING AND ENCROACHMENT PERMITS.

WHEREAS, the federal Clean Water Act established Regional Water Quality Control Boards in order to prohibit the discharge of pollutants in stormwater runoff to waters of the United States; and

WHEREAS, on December 13, 2001, the California Regional Water Quality Control Board, Los Angeles Region issued Order No. 01-182 (the MS4 permit) establishing Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles and incorporated cities therein; and

WHEREAS, Order No. 01-182 contains requirements for municipalities to establish a development planning program to minimize the impact from stormwater and urban runoff from new development and to maximize the percentage of pervious surfaces to allow percolation into the ground; and

WHEREAS, the Regional Board has adopted Total Maximum Daily Loads (TMDLs) for many pollutants which are effectively numerical limits that cannot be achieved by implementation of the MS4 permit provisions alone.

WHEREAS, the City has the authority under the California Water Code to adopt and enforce ordinances imposing conditions, restrictions and limitations with respect to any activity that might degrade waters of the State.

WHEREAS, the City is committed to a stormwater management program that protects water quality and water supply by employing watershed-based approaches that balance environmental and economic considerations; and

WHEREAS, urbanization has led to increased impervious surface areas resulting in increased water runoff and less percolation to groundwater aquifers causing the transport of pollutants to downstream receiving waters; and

WHEREAS, the City needs to take a new approach on managing rainwater and urban runoff while mitigating the negative impacts of development and urbanization; and

WHEREAS, a strategy of Low Impact Development is widely recognized as a sensible approach to managing the quantity and quality of stormwater runoff by setting standards and practices to maintain or restore the natural hydrology of a development site, reduce off site runoff, improve water quality, and provide groundwater recharge; and

WHEREAS, is it the intent of the City to expand the applicability of the existing Pollutant Source Reduction requirements by providing stormwater and rainwater Low Impact Development strategies for all projects requiring city permits and disturbing more than 500 square feet, but that are not otherwise required to develop a Post Construction Mitigation Plan as defined by the MS4 permit, [and as required under Section 12.16.110(D)].

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF SIGNAL HILL, CALIFORNIA, DOES HEREBY ORDAIN AS FOLLOWS:

SECTION 1. Section 12.16.010 of the Signal Hill Municipal Code shall be amended to add the following definitions in alphabetical order, and to renumber all existing definitions accordingly in alphabetical order:

"Commercial Activity" means any public or private activity involved in the storage, transportation, distribution, exchange or sale of goods and/or commodities or providing professional and/or non-professional services.

"Control" means to minimize, reduce or eliminate by technological, legal, contractual or other means, the discharge or pollutants from an activity or activities.

"Development" means the construction, rehabilitation, or reconstruction of any public or private residential project (whether single-family, multi-unit or planned unit development); industrial, commercial, retail and any other non-residential projects, including public agency projects; or mass grading for future construction.

"Industrial/Commercial Facility" means any facility involved and/or used in either the production, manufacture, storage, transportation, distribution, exchange or sale of goods and /or commodities, and any facility involved and/or used in providing professional and non-professional services. This category of facility includes, but is not limited to, any facility defined by the Standard Industrial Classifications (SIC). Facility ownership (federal, state, municipal, private) and profit motive of the facility are not factors in this Definition.

"Land Disturbing Construction Project" means clearing, grading, or excavating that results in soil disturbance. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or the original purpose of the facility, nor does it include emergency construction activities required to immediately protect public health and/or safety.

"Low Impact Development" ("LID") means a land planning and engineering design approach to managing stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality.

"Low Impact Development Handbook" ("LID Handbook") means such handbook, as may be amended from time to time, adopted by the Director of Public Works and approved by the City Council. It shall set LID standards and practices, as well as standards for stormwater pollution mitigation, including urban and stormwater runoff quantity and quality control development principles and technologies for achieving the LID standards. It shall also include technical feasibility and implementation parameters, alternative compliance for technical infeasibility, as well as other rules, requirements and procedures as the Director of Public Works and City Council deems necessary.

"Storm Drain System" means any facility or any parts of the facility, including streets, gutters, conduits, natural or artificial drains, channels and watercourse that are used for the purpose of collecting, storing, transporting or disposing of stormwater and are located within the City of Signal Hill.

"Urban Runoff" means surface water flow produced by storm and non-storm events. Non-storm events include flow from residential, commercial or industrial activities involving the use of potable and non-potable water.

SECTION 2. Section 12.16.130 of the Signal Hill Municipal Code entitled "Low Impact Development Measures for Development Planning and Construction Activities" is hereby added to read, in its entirety, as follows:

12.16.130 LOW IMPACT DEVELOPMENT MEASURES FOR DEVELOPMENT PLANNING AND CONSTRUCTION ACTIVITIES.

A. Purpose. The purpose of this Section is to establish requirements for construction activities and facility operations of Development projects to integrate LID practices and standards for stormwater pollution mitigation, and to maximize open, green and pervious space on all Developments consistent with the City's LID Handbook.

B. Scope. This Section contains requirements for stormwater pollution control measures in Land Disturbing Construction Projects and authorizes the City to further define and adopt stormwater pollution control measures, and to develop LID principles and requirements, including but not limited to the objectives and specifications for integration of LID strategies.

C. LID Requirements. All Land Disturbing Construction Projects that are not defined as a New Development Project in Section 12.16.110(D) shall be designed to manage and capture stormwater runoff, to the maximum extent feasible and shall comply with the standards and requirements of the LID Handbook. Any applicant submitting a plan or permit applicants for a Land Disturbing Construction Project to the City shall submit a LID Plan to the City to comply with the following:

1. Any Development shall implement LID BMP alternatives identified in the LID Handbook and provide documentation to demonstrate compliance on the plans and permit application submitted to the City; and

a. Stormwater runoff will be infiltrated, evapotranspired, captured and used, biofiltrated/biotreated through high removal efficiency Best Management Practices, onsite, through stormwater management techniques that comply with the provisions of the LID Handbook. To the maximum extent feasible, onsite stormwater management techniques must be properly sized, at a minimum, without any storm water runoff leaving the Site for at least the volume of water produced by the quality designed storm event that results from:

(i) The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area using a 48 to 72-hour draw down time; or

(ii) The volume of runoff produced from a 0.75 inch storm event.

b. Pollutants shall be prevented from leaving the Site for a water quality design storm event as defined in paragraph (a) unless it has been treated through an approved LID strategy

2. For any Land Disturbing Construction Projects resulting in an alteration of at least fifty percent (50%) or more of the impervious surfaces on an existing developed Site, the entire Site must comply with the standards and requirements of this Section and with the LID Handbook;

3. For any Land Disturbing Construction Projects resulting in an alteration of less than fifty percent (50%) of the impervious surfaces of an existing developed Site, only such incremental Development shall comply with the standards and requirements of this Section and with the Development Best Management Practices Handbook; and

4. When, as determined by the Director, the onsite LID requirements are technically infeasible, partially or fully, the infeasibility shall be demonstrated in the submitted LID Plan, shall be consistent with other City requirements, and shall be reviewed in consultation with the Department of Building and Safety. The technical infeasibility may result from conditions that may include, but are not limited to:

a. Locations where seasonal high groundwater is within ten feet of surface grade;

b. Locations within 100 feet of a groundwater well used for drinking water;

c. Brownfield Development sites or other locations where pollutant mobilization is a documented concern;

d. Locations with potential geotechnical hazards;

e. Locations with impermeable soil type as indicated in applicable soils and geotechnical reports; and

5. If partial or complete onsite compliance of any type is technically infeasible, as determined by the Director, the project Site and LID Plan will be granted a waiver from requirements of this Section and the LID Handbook. If a portion of the project site is deemed technically infeasible, the project applicant may propose an equivalent area within the same project area for LID. The

Director may permit substitutions of equivalent areas upon request by the project applicant.

6. The Director shall prepare, maintain, and update, as deemed necessary and appropriate, the LID Handbook to set LID standards and practices and standards for stormwater pollution mitigation, including urban and stormwater runoff quantity and quality control development principals and technologies for achieving the LID standards. The LID Handbook shall also include technical feasibility and implementation parameters, alternative compliance for technical infeasibility, as well as other rules, requirements and procedures as the Director deems necessary for implementing the provisions of this Section of the Signal Hill Municipal Code.

7. Any Development that is exempted from LID requirements under Subsection D of this Section has the option to voluntarily opt in and incorporate into the project the LID requirements set forth herein. In such case, the Best Management Practices plan check fee associated with the project shall be waived and all LID related plan check processes shall be expedited.

D. Exceptions to LID Requirements. The provisions of this Section do not apply to any of the following:

1. A Development that only creates, adds or replaces less than 500 square feet of impervious area;

2. A Development involving only emergency construction activity required to immediately protect public health and safety;

3. Infrastructure projects within the public right-of-way;

4. A Development involving only activity related to gas, water, cable, or electricity services on private property;

5. A Development involving only resurfacing and/or re-striping of permitted parking lots, where the original line and grade is maintained;

6. A project involving only exterior movie or television production sets, or facades on an existing developed site.

7. A project not requiring a City building, grading, demolition or other permit for construction activity.

SECTION 3. Section 12.16.140 of the Signal Hill Municipal Code entitled "Low Impact Development Plan Check Fees" is hereby added to read, in its entirety, as follows:

12.16.140. LOW IMPACT DEVELOPMENT PLAN CHECK FEES.

A. Before review and approval of a set of plans and specifications, the applicant shall pay a LID plan check fee.

B. LID plan check fees will be established by resolution of the City Council.

C. The fee schedule for providing Best Management Practices plan check services for LID Implementation Plan are as follow.

D. All entities, including other public agencies, are required to pay the fees identified in Subsection B of this Section.

SECTION 4. Effective Date. The City Clerk shall certify to the passage and adoption of this ordinance by the City Council of the City of Signal Hill and shall, within 15 days after its final passage, cause the same to be published once in the Signal Hill Tribune, a newspaper of general circulation which is hereby designated for that purpose. This Ordinance shall take effect 180 days after its passage.

SECTION 5. Severability. If any section, subsection, sentence, clause, phrase, or portion of this Ordinance is, for any reason, held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of this Ordinance. The City Council of the City of Signal Hill hereby declares that it would have adopted this Ordinance and each section, subsection, sentence, clause, phrase, or portion thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, phrases, or portions thereof may be declared invalid or unconstitutional.

PASSED, APPROVED, AND ADOPTED at a regular meeting of the City Council of the City of Signal Hill, California, on this _____ day of _____ 2012.

_____
TINA L. HANSEN
MAYOR

ATTEST:

_____
KATHLEEN L. PACHECO
CITY CLERK

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) ss.
CITY OF SIGNAL HILL)

I, KATHLEEN L. PACHECO, City Clerk of the City of Signal Hill, California, hereby certify that Ordinance No. XXXX-XX-XXX was introduced at a regular meeting of the City Council of the City of Signal Hill held on XX of MONTH 2012, and thereafter was adopted by the City Council at a regular meeting held on the _____ day of _____, 2012, and that he same was adopted by the following roll call vote:

AYES:

NOES:

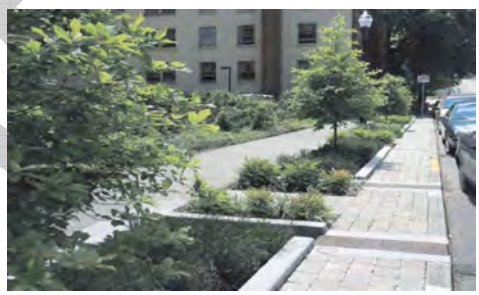
ABSENT:

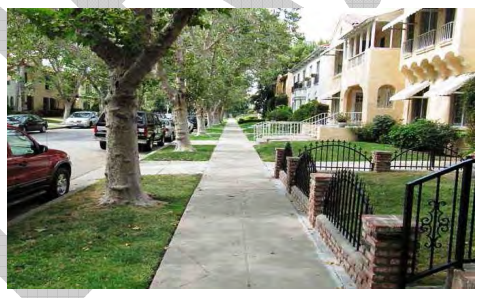
ABSTAIN:

_____
KATHLEEN L. PACHECO
CITY CLERK

Signal Hill

Green Streets Manual





February 2013

TABLE OF CONTENTS

SECTION 1 – INTRODUCTION

1.1 WHAT ARE GREEN STREETS?

Roads present many opportunities for green infrastructure application. One principle of green infrastructure involves reducing and treating stormwater close to its source. Urban transportation right-of-ways integrated with green techniques are often called "green streets." Green streets provide source controls for stormwater runoff and pollutant loads. In addition, green infrastructure approaches complement street facility upgrades, street aesthetic improvements, and urban tree canopy efforts that also make use of the right-of-way and allow it to achieve multiple goals and benefits. Using the right-of-way for treatment of stormwater runoff links green with grey infrastructure by making use of the engineered conveyance of roads and providing connections to conveyance systems when needed.

Green streets are beneficial for new road construction and retrofits. They can provide substantial economic benefits when used in transportation applications. Coordinating green infrastructure installation with broader transportation improvements can reduce the cost of stormwater management by including it within larger infrastructure improvements. A large municipal concern regarding green infrastructure use is maintenance; using roads and right-of-ways as locations for green infrastructure not only addresses a significant pollutant source, but also alleviates access and maintenance concerns by using public space. Also, right-of-way installations allow for easy public maintenance.

Green streets can incorporate a wide variety of design elements including street trees, permeable pavements, bioretention, and swales. Although the design and appearance of green streets will vary, the functional goals are the same; provide source control of stormwater, limit its transport and pollutant conveyance to the collection system, restore pre-development hydrology to the maximum extent practicable, and provide environmentally enhanced roads. Successful application of green techniques will encourage soil and vegetation contact and infiltration and retention of stormwater.

1.2 WHY ARE GREEN STREETS BEING REQUIRED?

This Green Streets Manual provides guidance to comply with the MS4 Permit (Order Number R4-2012-0175) which requires that jurisdictions in Los Angeles County reduce contaminants in runoff to improve water quality in waterways. These requirements stem from the National Pollutant Discharge Elimination System (NPDES) requirements of the Clean Water Act (CWA).

The MS4 Permit requires Green Streets strategies to be implemented for transportation corridors. Transportation corridors represent a large percentage of the impervious area within Los Angeles and therefore generate a substantial amount of runoff from storm events. The altered flow regime from traditional roadways, increased runoff volume, and high runoff peak flows, are damaging to the environment and a risk to property downstream.

Traditionally, street design has focused on removing water from the street as quickly as possible and transferring it to storm drains, channels, and water bodies. Stormwater can contain bacteria and other pollutants, and are thereby regulated at the state and local level (refer to *Table 1* for a list of pollutants typical of roads). Green Streets will help to transform the design of streets from the conventional method of moving water off-site as quickly as possible to a method of storing and treating water on-site for a cleaner discharge into the waters of the U.S.

Projects which are required to follow this Green Streets Guidance Manual include street and road construction of 10,000 square feet or more of impervious surface area or with a cost of $500,000 or

more. Street and road construction applies to standalone streets, roads, highways, and freeway projects, and also applies to streets within larger projects.

Table 1: Examples of Stormwater Pollutants Typical of Roads (*Managing Wet Weather With Green Infrastructure Municipal Handbook: Green Streets, 2008*).

Pollutant	Source	Effects
Trash	Littering	Physical damage to aquatic animals and fish, release of poisonous substances
Sediment/solids	Construction, unpaved areas	Increased turbidity, increased transport of soil bound pollutants, negative effects on aquatic organisms reproduction and function
Metals (Copper, Zinc, Lead, Arsenic)	Vehicle brake pads, vehicle tires, motor oil, vehicle emissions and engines, vehicle emissions, brake linings, automotive fluids	Toxic to aquatic organisms and can accumulate in sediments and fish tissues
Organics associated with petroleum (e.g., PAHs)	Vehicle emissions, automotive fluids, gas stations	Toxic to aquatic organisms
Nutrients	Vehicle emissions, atmospheric deposition	Promotes eutrophication and depleted dissolved oxygen concentrations

1.3 PLANNING AND DEVELOPMENT

Ideally, a site would be designed to capture and use or infiltrate the entire runoff volume of a storm, however site and design constraints make it difficult to achieve that goal. This Green Streets Manual is designed to provide guidance with BMP selection based on site constraints typical to street design. Streetscape geometry, topography, and climate determine the types of controls that can be implemented. The initial step in selecting a stormwater tool is determining the available open space and constraints. Stormwater controls should be selected using the hierarchy represented in *Figure 1*, the site guidelines represented in *Table 2*, and the location opportunities listed in *Table 3*.

1.3.1 Site Considerations

Specific elements which should be given special consideration in the site assessment process for applicable Green Streets include:

- **Ownership of land adjacent to right of ways.** The opportunity to provide stormwater treatment may depend on the ownership of land adjacent to the right-of-way. Acquisition of additional right-of-way and/or access easements may be more feasible if land bordering the project is owned by relatively few land owners.
- **Location of existing utilities.** The location of existing storm drainage utilities can influence the opportunities for Green Streets infrastructure. For example, stormwater planters can be designed to overflow along the curb-line to an existing storm drain inlet, thereby avoiding the infrastructure costs associated with an additional inlet. The location of other utilities may limit the allowable placement of BMPs to only those areas where a clear pathway to the storm drain exists.
- **Grade differential between road surface and storm drain system.** Some BMPs require more head from inlet to outlet than others; therefore, allowable head drop may be an important consideration in BMP selection. Storm drain elevations may be constrained by a variety of factors in a roadway project (utility crossings, outfall elevations, etc.) that cannot be overcome and may override stormwater management considerations.

- **Longitudinal slope.** The suite of BMPs which may be installed on steeper road sections is more limited. Specifically, permeable pavement and swales are more suitable for gentle grades. Other BMPs may be more readily terraced to be used on steeper slopes.
- **Soil suitability.** Infiltration BMPs require specific types of soil. The site assessment should determine the type of soils on the site and the infiltration rate of the soils if infiltration BMPs are proposed.
- **Potential access opportunities.** A significant concern with installation of BMPs in major right of ways is the ability to safely access the BMPs for maintenance considering traffic hazards. The site assessment should identify vehicle travel lanes and areas of specific safety hazards for maintenance crews and subsequent steps of the Project WQMP preparation process should avoid placing BMPs in these areas.

1.3.2 Design Considerations

The drainage patterns of the project should be developed so that drainage can be routed to areas with BMP opportunities before entering storm drains. For example, if a median strip is present, a reverse crown should be considered, where allowed, so that stormwater can drain to a median swale. Likewise, standard peak-flow curb inlets should be located downstream of areas with potential for stormwater planters so that water can first flow into the planter, and then overflow to the downstream inlet if capacity of the planter is exceeded. It is more difficult to apply green infrastructure after water has entered the storm drain.

Green Streets projects are not required to treat off-site runoff; however treatment of comingled off-site runoff may be used to off-set the inability to treat areas within the project for which significant constraints prevent the ability to provide treatment.

Applicable Green Streets projects should apply the following site design measures to the maximum extent practicable and as specified in the local permitting agency's codes:

- Minimize street width to the appropriate minimum width for maintaining traffic flow and public safety.
- Add tree canopy by planting or preserving trees/shrubs.
- Use porous pavement or pavers for low traffic roadways, on-street parking, shoulders or sidewalks.
- Integrate traffic calming measures in the form of bioretention curb extensions.

1.3.3 BMP Sizing for Applicable Green Streets Projects

An 85th percentile standard design storm should be used to determine the appropriate size, slope, and materials of each facility. After identifying the appropriate stormwater facilities for a site, an integrated approach using several BMPs is encouraged. To increase water quality and functional hydrologic benefits, several stormwater management BMPs can be used in succession. This is called a treatment train approach. The control measures should be designed using available topography to take advantage of gravity for conveyance to and through each facility. All Green Streets designs must be based off of a published design standard.

The following steps should be used to size BMPs for applicable Green Streets projects:

1. Delineate drainage areas tributary to BMP locations and compute imperviousness.

2. Look up the recommended sizing method for the BMP selected in each drainage area and calculate target sizing criteria.
3. Design BMPs per a published design standard.
4. Attempt to provide the calculated sizing criteria for the selected BMPs.
5. If sizing criteria cannot be achieved, document the constraints that override the application of BMPs and provide the largest portion of the sizing criteria that can be reasonably provided given constraints. If BMPs cannot be sized to provide the calculated volume for the tributary area, it is still essential to design the BMP inlet, energy dissipation, and overflow capacity for the full tributary area to ensure that flooding and scour is avoided. It is strongly recommended that BMPs which are designed to less than their target design volume be designed to bypass peak flows.

1.3.4 Alternative Compliance Options for Applicable Green Streets Projects

Alternative compliance programs should be considered for applicable Green Streets projects if on-site green infrastructure approaches cannot practicably treat the design volume. The primary alternative compliance option for applicable Green Streets projects is the completion of off-site mitigation projects. The proponent would implement a project to reduce stormwater pollution for other portions of roadway or similar land uses when being reconstructed to the project in the same hydrologic unit, ideally as close to the project as possible and discharging to the same outfall.

1.3.5 Infiltration Considerations

Appropriate soils, infiltration media, and infiltration rates should be used for infiltration BMPs. If infiltration is proposed, a complete geotechnical or soils report should be undertaken to determine infiltration rates, groundwater depth, soil toxicity and stability, and other factors that will affect the ability and the desirability of infiltration. At a minimum, the infiltration capacity of the underlying soils shall be deemed suitable for infiltration (0.3 inches per hour or greater), appropriate media should be used in the BMP itself, the groundwater shall be located at a depth of ten feet or greater.

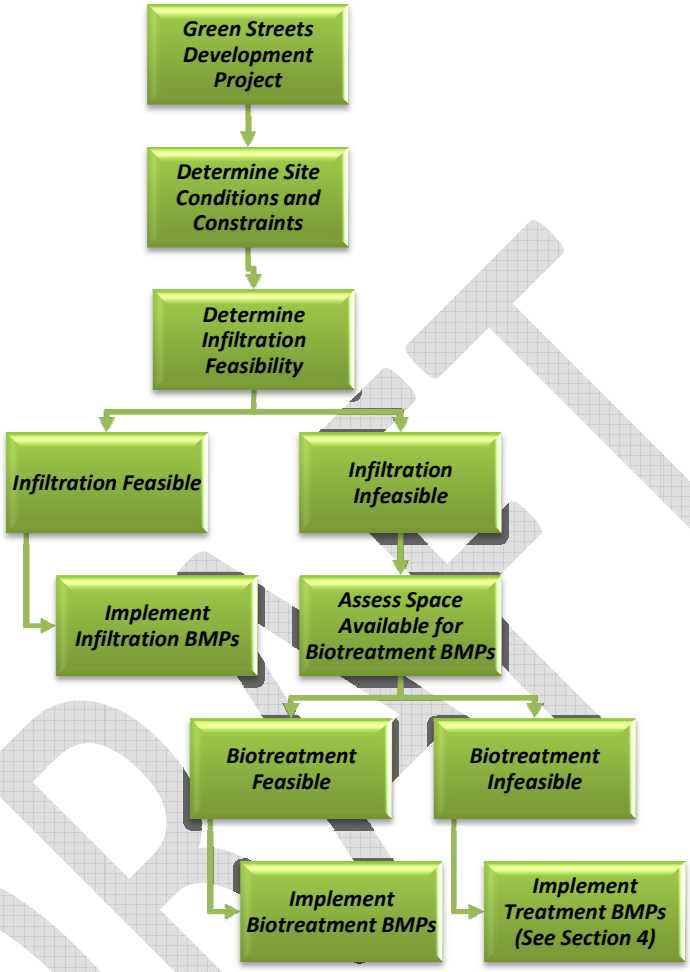


Figure 1: Flow Chart to Determine BMP Selection.

Table 2: BMP Selection by Street Context (*Model for Living Streets Design Manual, 2011*).

	STREET CONTEXT	BIORETENTION			DETENTION		PAVING	INLET PROTECTIONS		
		Swales	Planters	Vegetated Buffer Strips	Rain Gardens	Infiltration Trenches & Dry Wells	Permeable Pavement	Storm Drain Inlet Screens	Storm Drain Filter Inserts	Pipe Filter Inserts
Commercial	Downtown Commercial		✓			✓	✓	✓	✓	✓
	Commercial Throughway		✓	✓		✓	✓	✓	✓	✓
	Neighborhood Commercial		✓	✓	✓	✓	✓	✓	✓	✓
Residential	Downtown Residential	✓	✓		✓	✓	✓	✓	✓	✓
	Residential Throughway	✓	✓		✓	✓	✓	✓	✓	✓
	Neighborhood Residential	✓	✓		✓	✓	✓	✓	✓	✓
Industrial And Mixed-Use	Industrial	✓	✓		✓	✓	✓	✓	✓	✓
	Mixed-Use		✓	✓	✓	✓	✓	✓	✓	✓
Special	Sidewalk Furniture Zone	✓	✓		✓	✓	✓	✓	✓	✓
	Park Edge	✓	✓		✓	✓	✓	✓	✓	✓
	Boulevard	✓	✓		✓	✓	✓	✓	✓	✓
	Ceremonial (Civic)						✓	✓	✓	✓
Small	Alley		✓			✓	✓	✓	✓	✓
	Shared Public Way		✓			✓	✓	✓	✓	✓
	Walk Street		✓	✓		✓	✓	✓	✓	✓

Table 3: BMP Location Opportunity Summary.

BMP	Location Opportunity Summary
Bioretention	• Adjacent to traveled way and in frontage or furniture sidewalk zones • Can be located in curb extensions, medians, traffic circles, roundabouts, and any other landscaped area • Suitable for constrained locations
Infiltration Trench/Dry Well	• Can be located under sidewalks and in sidewalk planting strips, curb extensions, roundabouts, and medians
Rain Gardens	• Can be integrated medians, islands, circles, street ends, chicanes, and curb extensions • Can be located at the terminus of swales in the landscape
Permeable Pavement	• Suitable for parking or emergency access lanes • Can be located in furniture zones of sidewalks especially adjacent to tree wells • Cannot be placed in areas with large traffic volume or heavy load lanes • Avoid steep streets • Cannot be placed within 20 feet of sub-sidewalk basements • Cannot be within 50 feet of domestic water wells
Flow-Through Planters	• Above-grade planters should be structurally separate from adjacent sidewalks • At-grade planter systems can be installed adjacent to curbs within the frontage and/or furniture zones
Vegetated Swales	• Can be located adjacent to roadways, sidewalks, or parking areas • Can be integrated into traffic calming devices such as chicanes and curb extensions • Can be placed in medians where the street drains to the median • Can be placed alongside streets and pathways • Should be designed to work in conjunction with the street slope
Vegetated Buffer Strips	• Can be located in multi-way boulevards, park edge streets, or sidewalk furniture zones • Can serve as pre-treatment
Treatment BMPs	• Can be located in a catch basin, manhole, or vault • Can be installed on an existing outlet pipe or at the bottom of an existing catch basin with an overflow • Can be placed on existing curbside catch basins and flush grate openings • Can be installed on the existing wall of a catch basin and on the curb side wall of a catch basin • Minimum set-backs from foundations and slopes should be observed if the BMP is not lined
Street Trees	• Can be placed on sidewalks, in furniture zones, and on medians • Adequate spacing must be provided between trees and street lights, pedestrian lights, accessible parking spaces, bus shelters, awnings, canopies, balconies, and signs

SECTION 2 – INFILTRATION

Infiltration systems utilize rock, gravel, and other highly permeable materials to on-site infiltration. In these systems, stormwater runoff is directed to the system and allowed to infiltrate into the soils for on-site retention and groundwater recharge. During small storm events, infiltration systems can result in significant or even complete volume reduction of stormwater runoff.

Infiltration should be used to the maximum extent practicable. If infiltration is found to be infeasible due to low infiltration rates, soil instability, high groundwater, or soil contamination biotreatment BMPs can then be considered.

Infiltration BMPs may become damaged by stormwater carrying high levels of sediment, therefore pre-treatment features should be designed to treat street runoff prior to discharging to infiltration features. Media filters, filter inserts, vortex type units, bioretention devices, sumps, and sedimentation basins are several pre-treatment tools effective at removing sediment.

2.1 BIORETENTION

Figure 2: Bioretention system (*Model for Living Streets Design Manual, 2011)*.

Description

Bioretention is a stormwater management process that cleans stormwater by mimicking natural soil filtration processes as water flows through a bioretention BMP. It incorporates mulch, soil pores, microbes, and vegetation to reduce and remove sediment and pollutants from stormwater. Bioretention is designed to slow, spread, and, to some extent, infiltrate water. Each component of the bioretention BMP is designed to assist in retaining water, evapotranspiration, and adsorption of pollutants into the soil matrix. As runoff passes through the vegetation and soil, the combined effects of filtration, absorption, adsorption, and biological uptake of plants remove pollutants.

For areas with low permeability or other soil constraints, bioretention can be designed as a flow-through system with a barrier protecting stormwater from native soils. Bioretention areas can be designed with an underdrain system that directs the treated runoff to infiltration areas, cisterns, or the storm drain system, or may treat the water exclusively through surface flow. Examples of bioretention BMPs include swales, planters, and vegetated buffer strips.

Location and Placement Guidelines

Bioretention facilities can be included in the design of all street components; adjacent to the traveled way and in the frontage or furniture sidewalk zones. They can be designed into curb extensions, medians, traffic circles, roundabouts, and any other landscaped area. Depending on the feature, maintenance and access should always be considered in locating the device. Bioretention systems are also appropriate in constrained locations where other stormwater facilities requiring more extensive subsurface materials are not feasible.

If bioretention devices are designed to include infiltration, native soil should have a minimum permeability rate of 0.3 inches per hour and at least 10 feet to the groundwater table. Sites that have more than a 5 percent slope may require other stormwater management approaches or special engineering.

2.2 INFILTRATION TRENCHES AND DRY WELLS

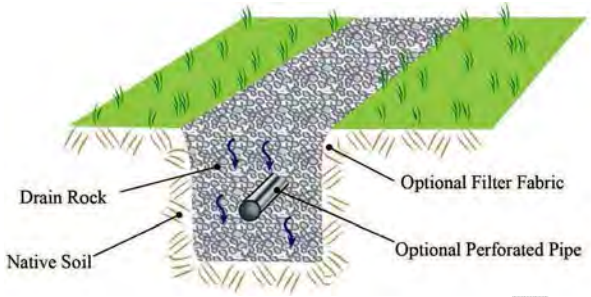


Figure 3: Infiltration Trench (*Model for Living Streets Design Manual, 2011*).

Description

Infiltration trenches are linear, rock-filled features that promote infiltration by providing a high ratio of sub-surface void space in permeable soils. They provide on-site stormwater retention and may contribute to groundwater recharge. Infiltration trenches may accept stormwater from sheet flow, concentrated flow from a swale or other surface feature, or piped flow from a catch basin. Because they are not flow-through BMPs, infiltration trenches do not have outlets but may have overflow outlets for large storm events.

Dry wells are typically distinguished from infiltration trenches by being deeper than they are wide. They are usually circular, resembling a well, and are backfilled with the same materials as infiltration trenches. Dry wells typically accept concentrated flow from surface features or from pipes and do not have outlets.

Infiltration trenches and dry wells are typically designed to infiltrate all flow they receive. In large storm events, partial infiltration of runoff can be achieved by providing an overflow outlet. In these systems, significant or even complete volume reduction is possible in smaller storm events. During large storm events, these systems may function as detention facilities and provide a limited amount of retention and infiltration.

Location and placement guidelines

Infiltration trenches and dry wells typically have small surface footprints so they are potentially some of the most flexible elements of landscape design. However, because they involve sub-surface excavation, these features may interfere with surrounding structures. Care needs to be taken to ensure that

surrounding building foundations, pavement bases, and utilities are not damaged by infiltration features. Once structural soundness is ensured, infiltration features may be located under sidewalks and in sidewalk planting strips, curb extensions, roundabouts, and medians. When located in medians, they are most effective when the street is graded to drain to the median. Dry wells require less surface area than trenches and may be more feasible in densely developed areas.

Infiltration features should be sited on uncompacted soils with acceptable infiltration capacity. They are best used where soil and topography allow for moderate to good infiltration rates (0.3 inches per hour or better) and the depth to groundwater is at least 10 feet. Prior to design of any retention or infiltration system, proper soil investigation and percolation testing shall be conducted to determine appropriate infiltration design rates, depth to groundwater, and if soil will exhibit instability as a result of infiltration. Any site with potential for previous underground contamination shall be investigated. Infiltration trenches and dry wells can be designed as stand-alone systems when water quality is not a concern or may be combined in series with other stormwater tools.

Perforated pipes and piped inlets and outlets may be included in the design of infiltration trenches. Cleanouts should be installed at both ends of any piping and at regular intervals in long sections of piping, to allow access to the system. Monitoring wells are recommended for both trenches and wells and can be combined with clean-outs. If included, the overflow inlet from the infiltration trench should be properly designed for anticipated flows.

2.3 RAIN GARDENS

Figure 4: Rain garden (*Model for Living Streets Design Manual, 2011)*.

Description

Rain gardens are vegetated depressions in the landscape. They have flat bottoms and gently sloping sides. Rain gardens can be similar in appearance to swales, but their footprints may be any shape. Rain gardens hold water on the surface, like a pond, and have overflow outlets. The detained water is infiltrated through the topsoil and subsurface drain rock unless the volume of water is so large that some must overflow. Rain gardens can reduce or eliminate off-site stormwater discharge while increasing on-site recharge.

Location and Placement Guidelines

Rain gardens may be placed where there is sufficient area in the landscape and where soils are suitable for infiltration. Rain gardens can be integrated with traffic calming measures installed along streets, such as medians, islands, circles, street ends, chicanes, and curb extensions. Rain gardens are often used at the terminus of swales in the landscape.

2.4 PERMEABLE PAVEMENT

Figure 5: Permeable pavement during a storm event (*Model for Living Streets Design Manual, 2011)*.

Description

Permeable pavement is a system with the primary purpose of slowing or eliminating direct runoff by absorbing rainfall and allowing it to infiltrate into the soil. Permeable pavement also filters and cleans pollutants such as petroleum deposits on streets, reduces water volumes for existing overtaxed pipe systems, and decreases the cost of offsite or onsite downstream infrastructure. This BMP is impaired by sediment-laden run-on which diminishes its porosity. Care should be taken to avoid flows from landscaped areas reaching permeable pavement. Permeable pavement is, in certain situations, an alternative to standard pavement. Conventional pavement is designed to move stormwater off-site quickly. Permeable pavement, alternatively, accepts the water where it falls, minimizing the need for management facilities downstream.

Location and Placement Guidelines

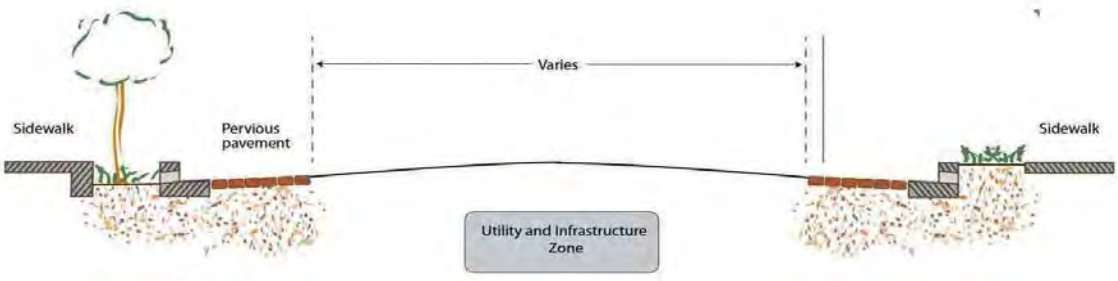


Figure 6: Possible pervious pavement design layout (*Model for Living Streets Design Manual, 2011)*.

Conditions where permeable pavement should be encouraged include:

- Sites where there is limited space in the right-of-way for other BMPs;

- Parking or emergency access lanes; and
- Furniture zones of sidewalks especially adjacent to tree wells

Conditions where permeable pavement should be avoided include:

- Large traffic volume or heavy load lanes;
- Where runoff is already being harvested from an impervious surface for direct use, such as irrigation of bioretention landscape areas;
- Steep streets;
- Gas stations, car washes, auto repair, and other sites/sources of possible chemical contamination;
- Areas with shallow groundwater;
- Within 20 feet of sub-sidewalk basements; and
- Within 50 feet of domestic water wells.

Material and Design Guidelines

A soil or geotechnical report should be conducted to provide information about the permeability rate of the soil, load-bearing capacity of the soil, the depth to groundwater (10 feet or more required), and if soil will exhibit instability as a result of implementation. Infiltration rate and load capacity are key factors in the functionality of this BMP. Permeable pavement generally does not have the same load-bearing capacity as conventional pavement, so this BMP may have limited applications depending on the underlying soil strength and pavement use. Permeable pavement should not be used in general traffic lanes due to the possible variety of vehicles weights and heavy volumes of traffic.

When used as a road paving, permeable pavement that carries light traffic loads typically has a thick drain rock base material. Pavers should be concrete as opposed to brick or other light-duty materials. Other possible permeable paving materials include porous concrete and porous asphalt. These surfaces also have specific base materials that detain infiltrated water and provide structure for the road surface. Base material depths should be specified based on design load and the soils report.

Plazas, emergency roads, and other areas of limited vehicular access can also be paved with permeable pavement. Paving materials for these areas may include open cell paver blocks filled with stones or grass and plastic cell systems. Base material specifications may vary depending on the product used, design load, and underlying soils.

When used for pedestrian paths, sidewalks, and shared-use paths, appropriate materials include those listed above as well as rubber pavers and decomposed granite or something similar (washed or pore-clogging fine material). Pedestrian paths may also use broken concrete pavers as long as ADA requirements are met. Paths should drain into adjoining landscapes and should be higher than adjoining landscapes to prevent run-on. Pavement used for sidewalks and pedestrian paths should be ADA compliant, especially smooth, and not exceed a 2 percent slope or have gaps wider than 0.25 inches. In general, tripping hazards should be avoided.

Design considerations for permeable pavement include:

- The location, slope and load-bearing capacity of the street, and the infiltration rate of the soil;
- The amount of storage capacity of the base course;

- The traffic volume and load from heavy vehicles;
- The design storm volume calculations and the quality of water; and
- Drain rock, filter fabrics, and other subsurface materials.

Maintenance Guidelines

Maintenance of permeable pavement systems is essential to their continued functionality. Regular vacuuming and street sweeping should be performed to remove sediment from the pavement surface. The bedding and base material should be tested to ensure sufficient infiltration rates on a regular basis. Additionally, base material may need to be removed and replaced every several years based upon the material manufacturer's specifications.

SECTION 3 – BIOTREATMENT

Biotreatment BMPs are landscaped, shallow depressions that capture and filter stormwater runoff. These types of BMPs are an increasingly common type of stormwater treatment device that are installed at curb level and filled with a bioretention type soil. They are designed as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. They typically consist of a ponding area, mulch layer, planting soils, and plants. Stormwater is directed to the system and pollutants are treated as the stormwater drains through the planting soil and either infiltrated or collected by an underdrain and directed to a collection system.

Biotreatment should only be used in cases where infiltration has been proven infeasible due to low infiltration rates, soil instability, high groundwater, or soil contamination.

3.1 FLOW-THROUGH PLANTERS

Figure 7: Flow-through planter (*Model for Living Streets Design Manual, 2011*).

Description

Flow-through planters are typically above-grade or at-grade with solid walls and a flow-through bottom. They are contained within an impermeable liner and use an underdrain to direct treated runoff back to the collection system. Where space permits, buildings can direct roof drains first to building-adjacent planters. Both underdrains and surface overflow drains are typically installed with building-adjacent planters.

At-grade street-adjacent planter boxes are systems designed to take street runoff and/or sidewalk runoff and incorporate bioretention processes to treat stormwater. These systems may or may not include underdrains.

Location and Placement Guidelines

Above-grade planters should be structurally separate from adjacent sidewalks to allow for future maintenance and structural stability per local department of public works' standards. At-grade planter systems can be installed adjacent to curbs within the frontage and/or furniture zones.

All planters should be designed to pond water for less than 48 hours after each storm. Flow-through planters designed to detain roof runoff can be integrated into a building's foundation walls, and may be either raised or at grade.

For at-grade planters, small localized depressions may be included in the curb opening to encourage flow into the planter. Following the inlet, a sump (depression) to capture sediment and debris may be integrated into the design to reduce sediment loadings.

3.2 VEGETATED SWALES

Figure 8: Vegetated swale (*Signal hill, CA*).

Description

Swales are linear, vegetated depressions that capture rainfall and runoff from adjacent surfaces. The swale bottom should have a gradual slope to convey water along its length. Swales can reduce off-site stormwater discharge and remove pollutants along the way. In a swale, water is slowed by traveling through vegetation on a relatively flat grade. This gives particulates time to settle out of the water while contaminants are removed by the vegetation. Because the vegetation receives much of its needed moisture through stormwater, the need for irrigation is greatly reduced.

Location and Placement Guidelines

Swales can easily be located adjacent to roadways, sidewalks, or parking areas. Roadway runoff can be directed into swales via flush curbs or small evenly-spaced curb cuts into a raised curb. Swale systems can be integrated into traffic calming devices such as chicanes and curb extensions.

Swales can be placed in medians where the street drains to the median. Placed alongside streets and pathways, vegetated swales can be landscaped with native plants which filter sediment and pollutants and provide habitat for wildlife. Swales should be designed to work in conjunction with the street slope to maximize filtration and slowing of stormwater.

Swales are designed to allow water to slowly flow through the system. Depending on the landscape and design storm, an overflow or bypass for larger storm events may be needed. Curb openings should be designed to direct flow into the swale. Following the inlet, a sump may be built to capture sediment and debris.

3.3 VEGETATED BUFFER STRIPS

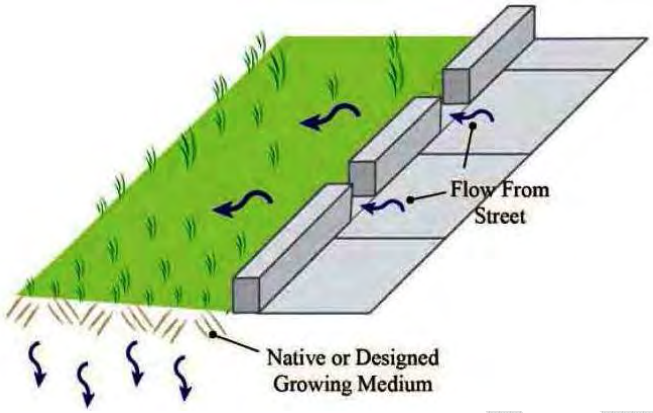


Figure 9: Vegetated buffer strip detail (*Model for Living Streets Design Manual, 2011*).

Description

Vegetated buffer strips are sloping planted areas designed to treat and absorb sheet flow from adjacent impervious surfaces. These strips are not intended to detain or retain water, only to treat it as a flow-through feature. They should not receive concentrated flow from swales or other surface features, or concentrated flow from pipes.

Location and Placement Guidelines

Vegetated buffer strips are well-suited to treating runoff from roads and highways, small parking lots, and pervious surfaces. They may be commonly used on multi-way boulevards, park edge streets, or sidewalk furniture zones with sufficient space. Vegetated buffers can be situated so they serve as pre-treatment for another stormwater management feature, such as an infiltration BMP.

SECTION 4 – TREATMENT BMPS

4.1 STORM DRAIN INLET PROTECTIONS

As described in Section 1 of this Green Streets Manual, it may be infeasible for specific projects to apply infiltration or biotreatment BMPs. In these cases, filter inserts as treatment BMPs can be considered as an alternative. Filter inserts can be designed to prevent particulates, debris, metals, and petroleum-based materials conveyed by stormwater from entering the storm drain system. All treatment BMP units should have an overflow system that allows the storm drain to remain functional if the filtration system becomes clogged during rainstorms.

Typical maintenance of catch basins includes scheduled trash removal if a screen or other debris capturing device is used. Street sweeping should be performed by vacuum sweepers with occasional weed and large debris removal. Maintenance should include keeping a log of the amount of sediment collected and the data of removal.

The following are examples of acceptable treatment BMPs:

- **Sand Filters:** Sand filters are designed to filter stormwater through a constructed media bed and to an underdrain system. As stormwater flows through the media pollutants are filtered out of the water. The filtered water is conveyed through the underdrain to a collection system. Pretreatment is necessary to eliminate significant sediment load or other large particles which would clog the system. Minimum set-backs from foundations and slopes should be observed if the facility is not lined. Filters should be designed and maintained such that ponded water should not persist for longer than 48 hours following a storm event.
- **Cartridge Media Filters:** Cartridge media filters contain multiple modular filters which contain engineered media. The filters can be located in a catch basin, manhole, or vault. The manhole or vault may be divided into multiple chambers so that the first chamber may act as a pre-settling basin for removal of coarse sediment while the next chamber may act as the filter chamber. Cartridge media filters are recommended for drainage area with limited available surface area or where surface BMPs would restrict uses. Depending on the number of cartridges, maintenance events can have long durations. Locations should be chosen so that maintenance events will not significantly disrupt businesses or traffic. Filter media should be selected to target pollutants of concern. A combination of media may be used to remove a variety of pollutants.
- **Storm Drain Filter Inserts:** Filter inserts should be designed to protect curbside catch basins or inlets within the traveled way. Inlet inserts contain filter cartridges that can be easily replaced. Filters inserts can be installed on the existing wall of the catch basin and can be placed on the curb side wall of catch basins so that during storm events water can overflow around the unit. Inlet inserts should be sized to capture all debris and should therefore be selected to match the specific size and shape of each catch basin and inlet. Systems with lower maintenance requirements are preferred.
- **Storm Drain Inlet Screens:** Inlet screens are designed to prevent large litter and trash from entering the storm drain system while allowing smaller particles to pass through. The screens function as the first preventive measure in removing pollutants from the storm water system. The city's street sweeping department should be consulted to ensure compliance with local specifications and to schedule regular maintenance. Annual inspection of the screen is recommended to ensure functionality.
- **Storm Drain Pipe Filter Insert:** The storm drain outlet pipe filter is designed to be installed on an existing outlet pipe or at the bottom of an existing catch basin with an overflow. This filter removes debris, particulates, and other pollutants from stormwater as it leaves the storm drain system. This BMP is less desirable than a protection system that prevents debris from entering the storm drain system because the system may become clogged with debris. Outlet pipe filters can be placed on existing curbside catch basins and flush grate openings. Regular maintenance is required and inspection should be performed rigorously. Because this filter is located at the outlet of a storm drain system, clogging with debris is not as apparent as with filters at street level. This BMP may be used as a supplemental filter with an inlet screen or inlet insert unit.

SECTION 5 – STREET TREES

5.1 STREET TREES

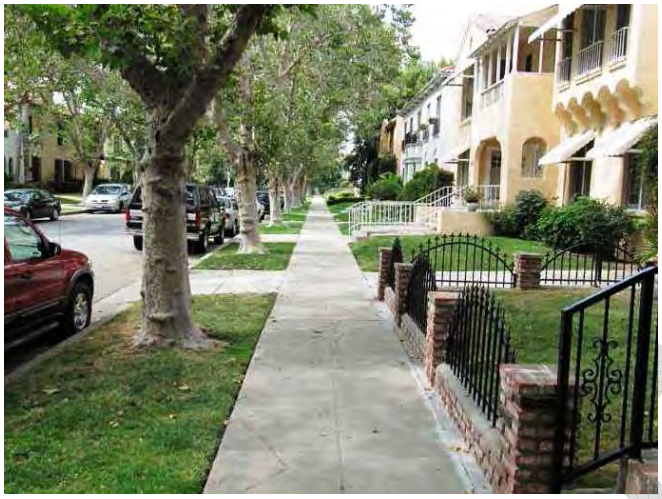


Figure 10: Street trees (*Model for Living Streets Design Manual, 2011)*.

Description

A healthy urban forest is also a powerful stormwater management tool. Leaves and branches catch and slow rain as it falls, helping it to soak into the ground. The plants themselves take up and store large quantities of water that would otherwise contribute to surface runoff. Part of this moisture is then returned to the air through evaporation to further cool the city. As an important element along sidewalks, street trees must be provided with conditions that allow them to thrive, including adequate uncompacted soil, water, and air.

The goal of adding street trees is to increase the canopy cover of the street, the percentage of its surface either covered by or shaded by vegetation. The selection, placement, and management of all elements in the street should enhance the longevity of a city's street trees and healthy, mature plantings should be retained and protected whenever possible.

Benefits to adding street trees include:

- Creation of shade to lower temperatures in a city, reduces energy use, and makes the street a more pleasant place in which to walk and spend time
- Slowing and capture of rainwater, helping it soak into the ground to restore local hydrologic functions and aquifers
- Improving air quality by cooling air, producing oxygen, and absorbing and storing carbon in woody plant tissues

Guidelines

For guidelines on street tree design refer to the Signal Hill Street Tree Ordinance at http://www.cityofsignalhill.org/DocumentCenter/Home/View/774.

SECTION 6 – DEFINITIONS

Best Management Practice (BMP)
Operating methods and/or structural devices used to reduce stormwater volume, peak flows, and/or pollutant concentrations of stormwater runoff through evapotranspiration, infiltration, detention, filtration, and/or biological and chemical treatment.

Bioretention
Soil and plant-based retention practice that captures and biologically degrades pollutants as water infiltrates through sub-surface layers containing microbes that treat pollutants. Treated runoff is then slowly infiltrated and recharges the groundwater.

Conveyance
The process of water moving from one place to another.

Design Storm
A storm whose magnitude, rate, and intensity do not exceed the design load for a storm drainage system or flood protection project.

Detention
Stormwater runoff that is collected at one rate and then released at a controlled rate. The volume difference is held in temporary storage.

Filtration
A treatment process that allows for removal of solid (particulate) matter from water by means of porous media such as sand, soil, vegetation, or a man-made filter. Filtration is used to remove contaminants.

Furniture Zone
The furniture zone is the area which lies between the curb and pedestrian zones and is intended to house utilities and pedestrian amenities.

Hardscape
Impermeable surfaces, such as concrete or stone, used in the landscape environment along sidewalks or in other areas used as public space.

Infiltration
The process by which water penetrates into soil from the ground surface.

Permeability/Impermeability
The quality of a soil or material that enables water to move through it, determining its suitability for infiltration.

Retention
The reduction in total runoff that results when stormwater is diverted and allowed to infiltrate into the ground through existing or engineered soil systems.

Runoff
Water from rainfall that flows over the land surface that is not absorbed into the ground.

Sedimentation
The deposition and/or settling of particles suspended in water as a result of the slowing of the water.

Stormwater
Water runoff from rain or snow resulting from a storm.

Transportation Corridor
A major arterial, state route, highway, or rail line used for the movement of people or goods by means of bus services, trucks, and vehicles.

SECTION 7 – REFERENCES

1. Los Angeles County. *Model for Living Streets Design Manual*. 2011.
2. U.S. Environmental Protection Agency (EPA). *Managing Wet Weather With Green Infrastructure Municipal Handbook: Green Streets*. December 2008.
3. Orange County. *Technical Guidance Document*. May 2011.