

A photograph of a stream flowing through a wooded area. The water is turbulent and white with foam as it flows over a small waterfall or drop-off. The surrounding area is lush with green foliage and trees. The text is overlaid on the top left of the image.

**Post-Construction Storm Water Management
Program:
Planning, Design, Construction, and Operation**

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Learning Objectives

- Identify the new Municipal Separate Sewer System (MS4) Phase II permit regulations for new development and redevelopment projects.
- Identify your role and the roles of other campus staff in meeting post-construction storm water permit requirements and in reducing storm water pollution.
- Prevent storm water pollution and impacts to the watershed.
- Learn how to effectively reduce risk of litigation or fines.

Training Outline

- Phase II Small MS4 Storm Water Permit Overview
- Post Construction Storm Water Management Requirements
- Example Projects
- Alternative Post-Construction Storm Water Management Program
- Campus Staff Roles and Responsibilities
- Connection with LRDPs and CEQA
- Campus Construction Design Standards
- Operation and Maintenance Requirements
- Campus Discussion

Introduction

- Changes in storm water regulations
- Urban storm water runoff is a source of impairment in CA
- How can we treat storm water as a resource and also protect water quality of receiving water bodies?
- What are the consequences of not managing storm water runoff?

Phase II Small Municipal Separate Storm Sewer System (MS4) Permit

Purpose: **Prevent storm water pollution**
 Utilize storm water as a resource



Components of the Phase II Small MS4 Permit:

- Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Pollution Prevention/Good Housekeeping
- Construction Site Runoff Control
- **Post-Construction Storm Water Management Program**
- Program Effectiveness Assessment and Improvement

Post-Construction vs. Construction

Post-Construction Storm Water Management:



Post-construction storm water management requires:

- Planning
- Design
- Construction
- Operation & Maintenance

Construction Storm Water Management:



This presentation does not cover SWPPPs and construction BMPs.

Post Construction Storm Water Design Management Program

Section F.5.g. of the Small Non-Traditional MS4 Permit Requirements

- Planning for storm water for new construction
- Designing and constructing storm water features in accordance with MS4 permit requirements
- Operating and maintaining storm water features in accordance with their design

Post Construction Storm Water Design Standards Applicability

Applies to: **projects that create and/or replace 2,500 square feet or more of impervious surface**

Effective: **July 1, 2014**

July 2014						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		



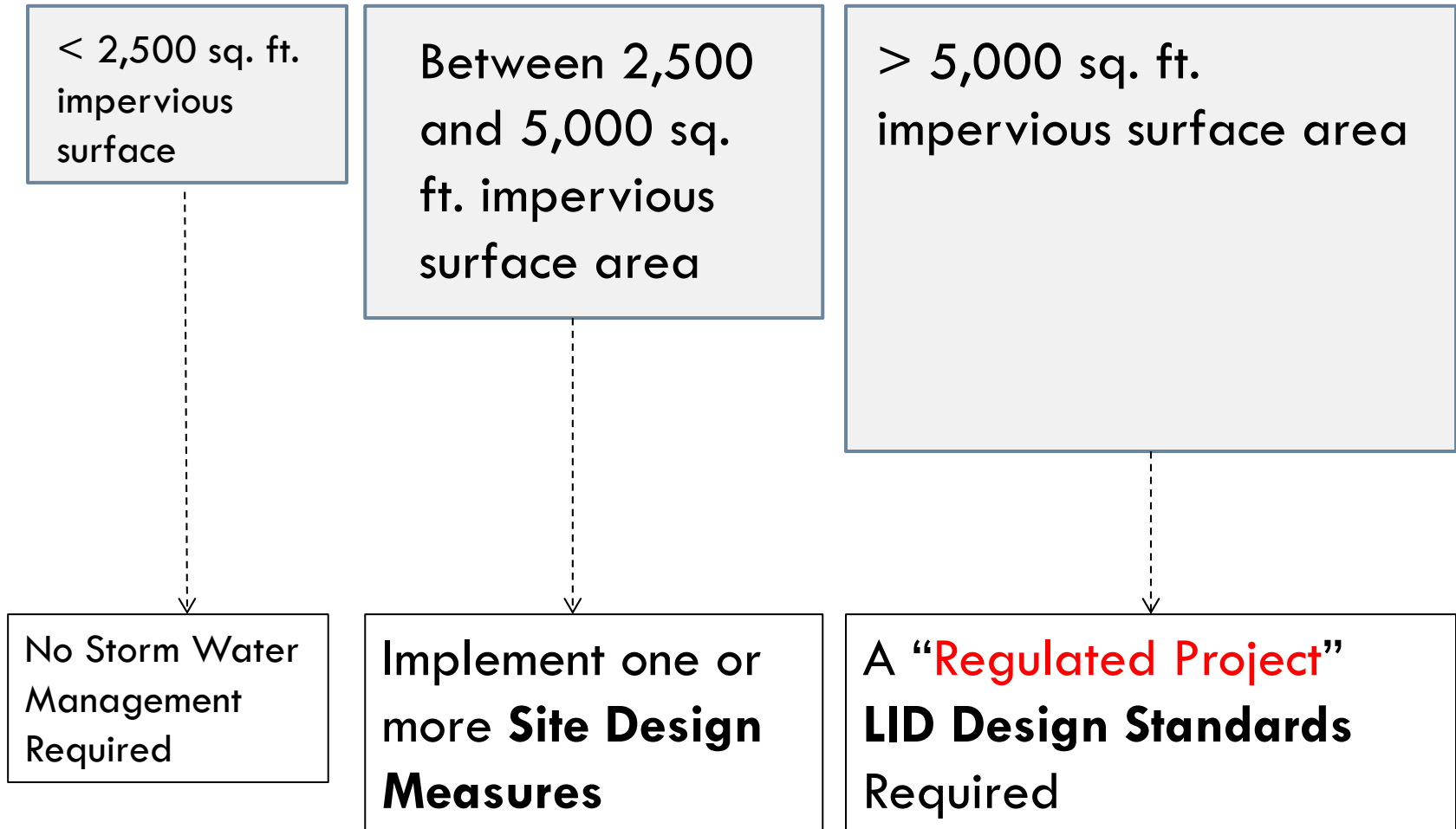
Photo source:

<https://www.flickr.com/photos/lowercolumbiacollege/4543921429/>

Project Exemptions

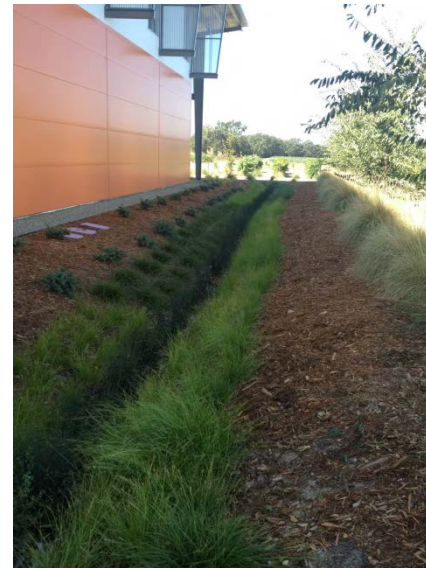
- Regulated projects that have been designed, approved, and funded prior to July 1, 2014
- Interior remodels
- Routine maintenance or repair projects such as:
 - Maintenance, repair, and replacement work on existing underground utilities
 - Building roof or exterior wall surface replacement
 - Pavement or asphalt resurfacing within the existing footprint
 - Sidewalk replacement within an existing footprint
 - Routine replacement/repair of damaged pavement/asphalt

For Projects that create and/or replace:



Site Design Measures and Low Impact Development

- **Site Design Measures** reduce project site runoff
- **Low Impact Development (LID)** is a land development approach that manages storm water by preserving or re-creating landscape features that treat storm water as a resource.



Jess S Jackson
Sustainable
Winery Building
grassy swale
allows storm
water to
infiltrate.



Disconnection of
drain spouts at
Veterinary
Medicine
Instructional
Facility.

Site Design Measures

Projects that create and/or replace between 2,500 and 5,000 sq. ft. of impervious surface must implement one or more of the following:

- 1) Stream Setbacks and Buffers
- 2) Soil Quality Improvement and Maintenance
- 3) Tree Planting and Preservation
- 4) Rooftop and Impervious Area Disconnections
- 5) Porous Pavement
- 6) Green Roofs
- 7) Vegetated Swales
- 8) Rain Barrels and Cisterns

Site Design Measures

OPTION 1
On project site

OPTION 2
Off project site but
within campus and in
same watershed

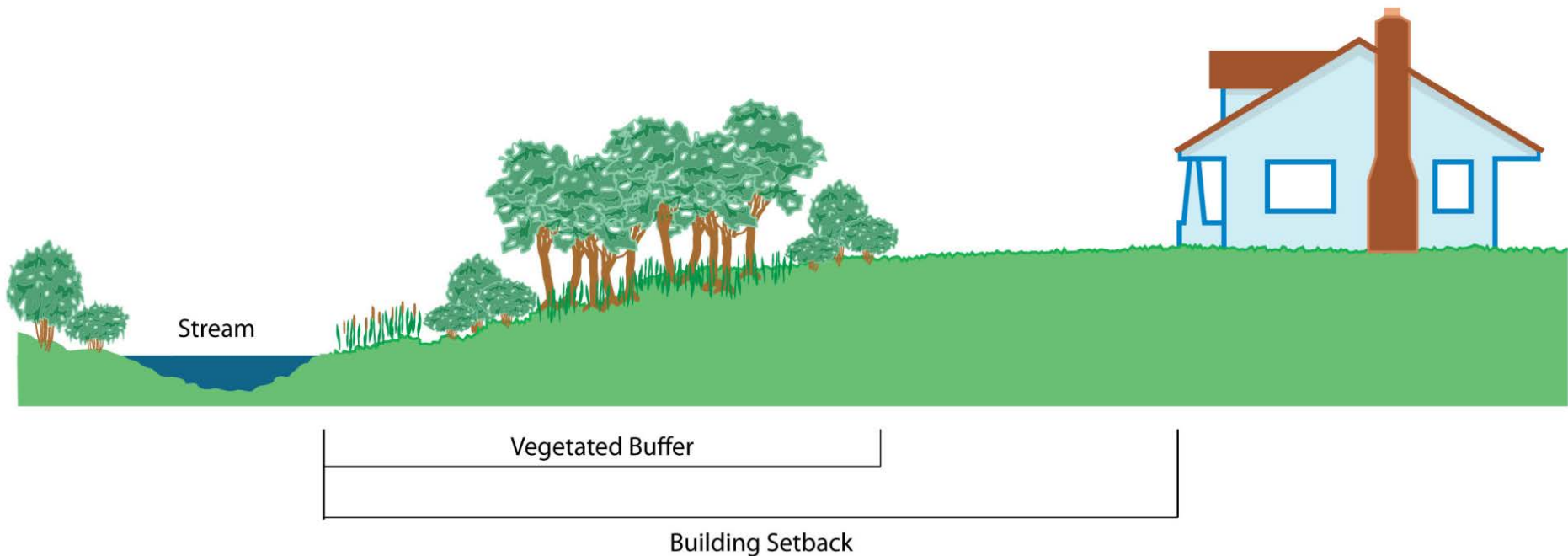
OPTION 3
Combination of on-site
and off-site

Options for implementing site design measures on project site or at another location on campus within the same watershed varies from campus to campus. Please work with your campus storm water manager.

Site Design Measures

1) Stream Setbacks and Buffers

A vegetated area that exists or is established to protect a natural water system



Site Design Measures

2) Soil Quality Improvement

Improvement and maintenance of soil through soil amendments and creation of microbial communities



Photo source: Wikipedia "compost"

<http://en.wikipedia.org/wiki/Compost>

Site Design Measures

3) Tree Planting and Preservation

Planting and preservation of healthy, established trees (deciduous and evergreen)



Photo from Flickr- user "woodleywonderworks"
<https://www.flickr.com/photos/wwworks/441505709/>

Site Design Measures

4) Rooftop and Impervious Area Disconnection

Rerouting of rooftop/impervious areas from storm drainage system and into rain barrels, cisterns or permeable areas



UC San Diego



Photo source: <http://www.lowimpactdevelopment.org/lidphase2/images/policy2.jpg>

Site Design Measures

5) Porous or Pervious Pavement

Pavement that allows runoff to pass through it, thereby reducing runoff and filtering pollutants, and slowing storm water flow



Photo source: ja.wikipedia.org
"pervious pavement"

Site Design Measures

6) Green Roofs

Vegetative layer growing on a roof (rooftop garden) that absorbs rain, filters pollutants, and decreases storm water runoff



Green roof on Keeling Apartments at UC San Diego

Site Design Measures

7) Vegetated Swales

Vegetated, open channel designed to treat and attenuate storm water



Photo taken by UCB

Site Design Measures

8) Rain Barrels and Cisterns

System that collects and stores storm water runoff from roofs or other impervious surfaces for reuse



Rain barrel and planter box system at Scripps Institution of Oceanography



Photo source:
<http://www.pinterest.com/pin/70720656623622864/>

LID Design Standards (Low Impact Development)

Required for “**Regulated Projects**” defined as projects that create and/or replace 5,000 sq. ft. or more of impervious surface:

- ❑ **Site Design Measures**
- ❑ **Source Control Measures**
- ❑ **Numeric Sizing Criteria for Storm Water Retention and Treatment**
- ❑ **Storm Water Treatment and Hydromodification Management Measures**

LID Design Standards

Source Control Measures

Source control measures should be **designed, constructed, inspected, and operated** to control pollution-generating activities and sources, such as:

- ❑ **Spills or leaks**
- ❑ **Floor drains**
- ❑ **Building and grounds maintenance**
- ❑ **Fuel dispensing areas**
- ❑ **Food service operations**
- ❑ **Storage of solid waste**
- ❑ **Vehicle and equipment cleaning**
- ❑ **Vehicle and equipment maintenance**
- ❑ **Indoor/outdoor pest control**
- ❑ **Fire Sprinkler Test Water**

Source control measures should be designed consistent with California Stormwater Quality Association's (CASQA) *Stormwater BMP Handbook for New Development/ Redevelopment*. For O&M procedures, consult CASQA's *Stormwater BMP Handbook for Municipalities*.

LID Design Standards

Source Control Measures (continued)

Source control measures should be **designed, constructed, inspected, and operated** to control pollution-generating activities and sources, such as:

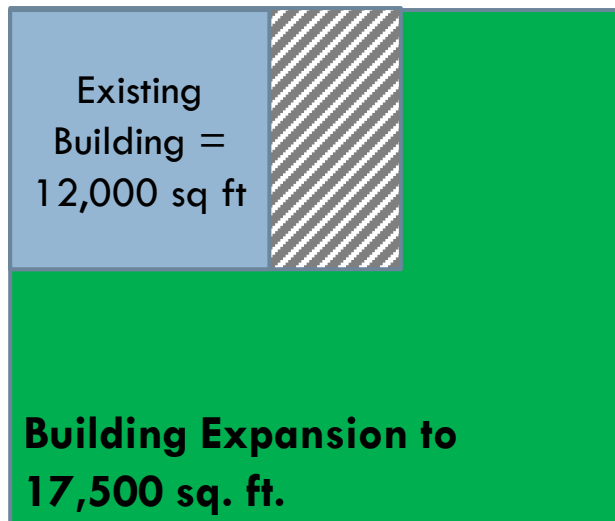
- ❑ **Pools, decorative fountains, and other water features**
- ❑ **Parking/storage area maintenance**
- ❑ **Loading docks**
- ❑ **Outdoor storage of equipment or materials**
- ❑ **Drain or wash water from boiler drain lines, condensate drain lines, rooftop equipment, drainage sumps, and other sources**
- ❑ **Non-storm water discharges**

Source control measures should be designed consistent with California Stormwater Quality Association's (CASQA) *Stormwater BMP Handbook for New Development/ Redevelopment*. For O&M procedures, consult CASQA's *Stormwater BMP Handbook for Municipalities*.

For projects that create and/or replace $>5,000$ sq. ft.

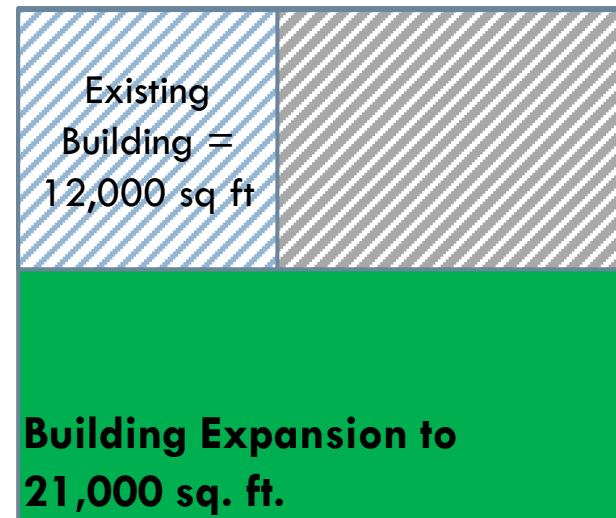
For all “**Regulated Projects**”, **Low Impact Development Design Standards** required. If impervious surfaces increase by

....less than 50%



Runoff from **NEW** impervious area must be treated

....greater than 50%



Runoff from existing and new impervious area must be treated

LID Design Standards

Site Design Measures

Infiltrate the 85th percentile rainfall event as determined in the Numeric Sizing Criteria methods using **Site Design Measures**.

Use the **Post-Construction Water Balance Calculator** to verify that the 85th percentile event has been captured

Determine if there is remaining runoff to be addressed.

If remaining runoff needs to be addressed, then **SW Treatment/ Hydromodification** is required through bioretention or equivalent

Post-Construction Water Balance Calculator

<small>User may make changes from any call that is orange or brown in color (similar to the calls to the immediate right). Calls in green are calculated for you.</small>		<small>(Step 1a) If you know the 85th percentile storm event for your location enter it in the box below</small>	<small>(Step 1b) If you can not answer for then select the county where the project is located (click on the call 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.</small>	COUNTY
			<small>(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.</small>	LOCATION
Project Information		Runoff Calculations		
Project Name:	Optional	<small>(Step 2) Indicate the Soil Type (drop-down menu to right):</small>	Soil Type	
Waste Discharge Identification (WDI):	Optional	<small>(Step 3) Indicate the existing dominant non-built land Use Type (drop-down menu to right):</small>	Non-Built Land Use Type Pre Development	
Date:	Optional	<small>(Step 4) Indicate the proposed dominant non-built land Use Type (drop-down menu to right):</small>	Non-Built Land Use Type Post Development	
Sub Drainage Area Name (from map):	Optional		Complete Either	
Runoff Curve Numbers			Sq Ft	Acres
Existing Runoff Curve Number		<small>(Step 5) Total Project Site Area:</small>	0.00	0.00
Proposed Development Runoff Curve Number		<small>(Step 6) Sub-watershed Area:</small>	0.00	0.00
Design Storm		Percent of total project:		
Based on the County you indicated above, we have included the 85 percentile average 24 hr event - P85 (in)" for your area.		in		
runoff to occur (Existing runoff curve number - P from existing RCN (in)"		in		
P used for calculations (in) (the greater of the above two criteria)		in		
Available at www.cobplandbooks.com				
		<small>(Step 7) Sub-watershed Condition</small>	Complete Either	Calculated Acres
		Sub-watershed Area (acres)	Sq Ft	Acres
		Existing Rooftop Impervious Coverage:	0	0.00
		Existing Non-Rooftop Impervious Coverage:	0	0.00
		Proposed Rooftop Impervious Coverage:	0	0.00
		Proposed Non-Rooftop Impervious Coverage:	0	0.00

LID Design Standards

Storm Water Treatment and Retention

Storm water treatment and retention must be designed to evapotranspire, infiltrate, harvest/use and/or biotreat storm water using one of the following sizing criteria :

- **Volumetric criteria:**
For detention basins, retention basins, and infiltration areas

- **Flow-based criteria:**
For swales, sand filters, and screening devices

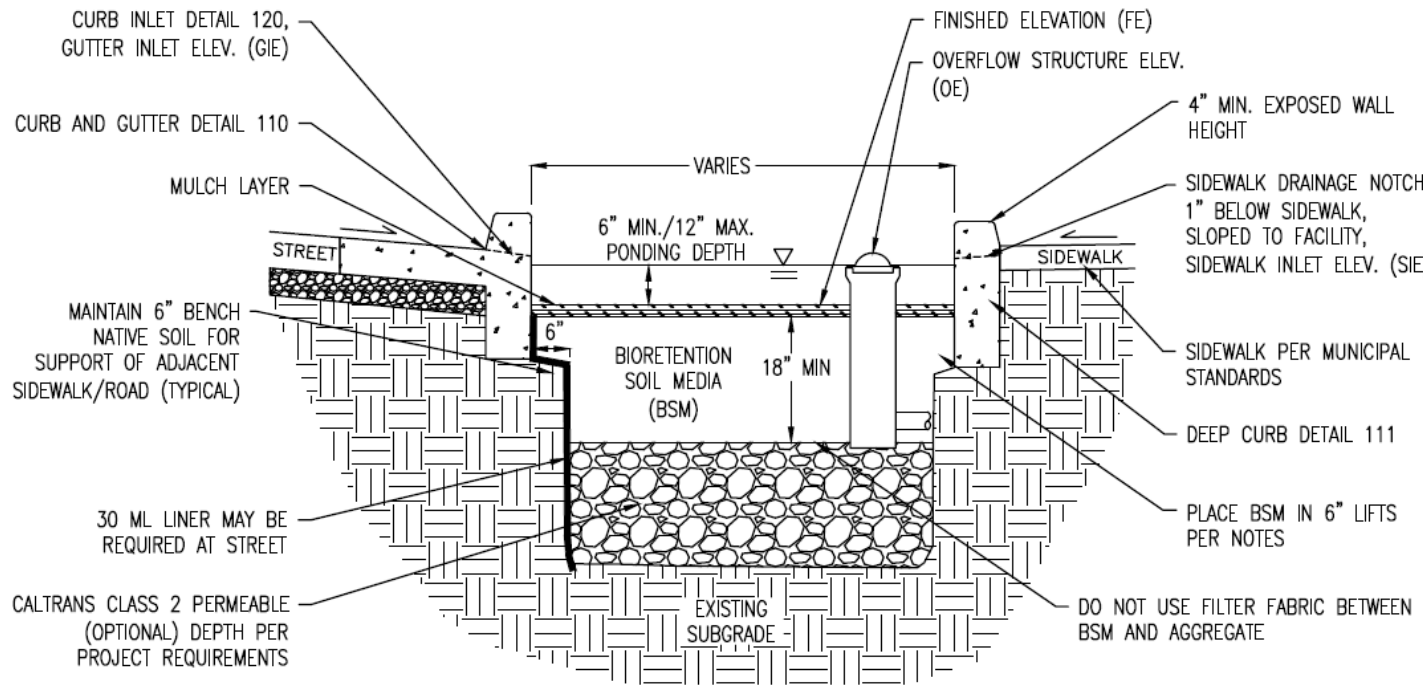


LID Design Standards

SW Treatment/ Hydromodification

Bioretention:

Facilities designed to infiltrate, evapotranspire, and/or biotreat runoff.



Specific guidelines outlined in MS4 permit Section F.5.g.2.d.

CASQA's BMP Stormwater Handbooks and the Central Coast Low Impact Development Initiative are great resources!

Bioretention Examples



Parking structure bioretention



Parking lot bioretention

UC San Diego Medical Center

Bioretention Examples



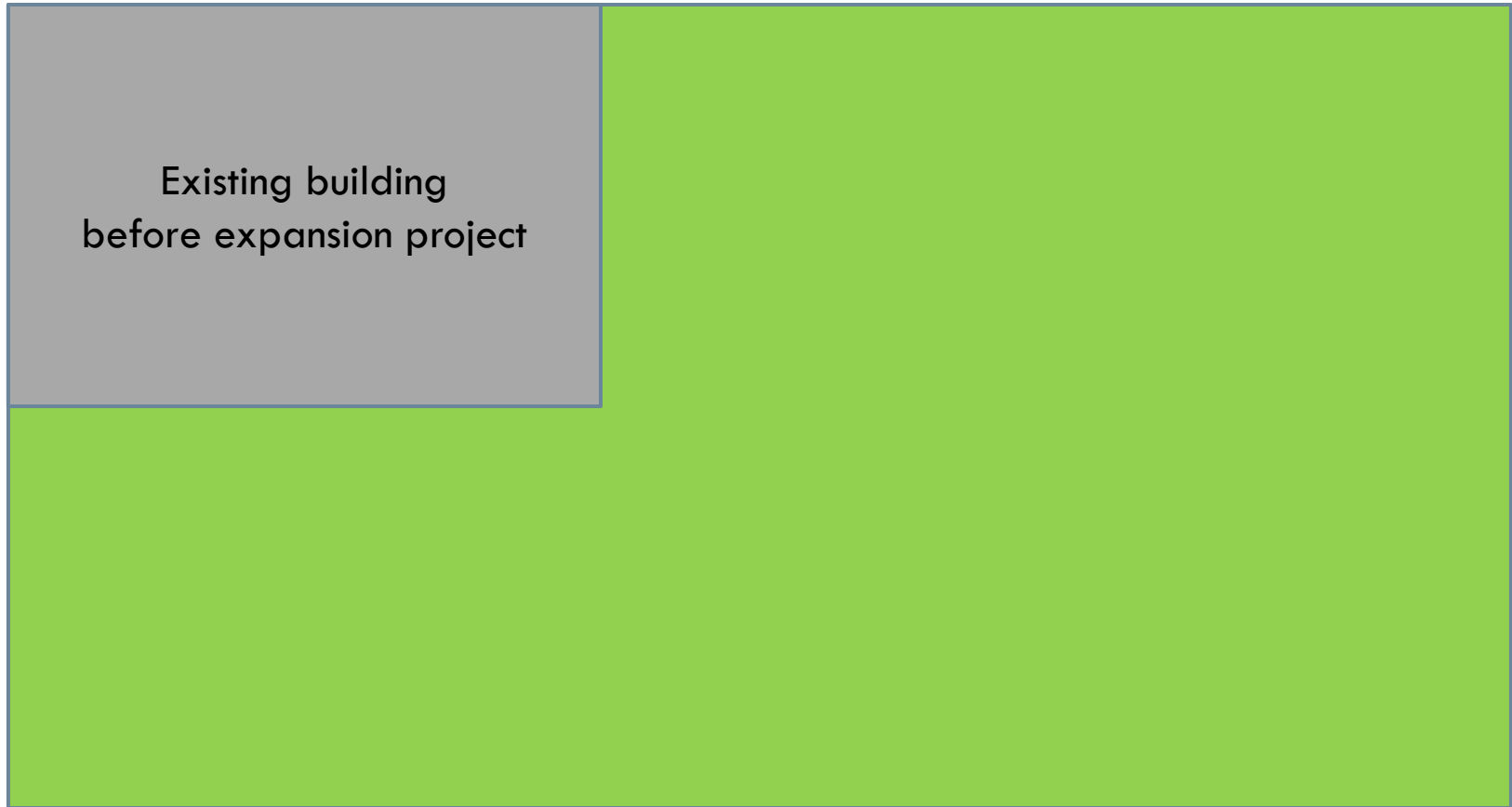
Housing Area at Eleanor Roosevelt College, UC San Diego

Alternatives to Bioretention

- Planter Boxes/Tree Wells
- Proprietary Devices such as Modular Wetland Systems

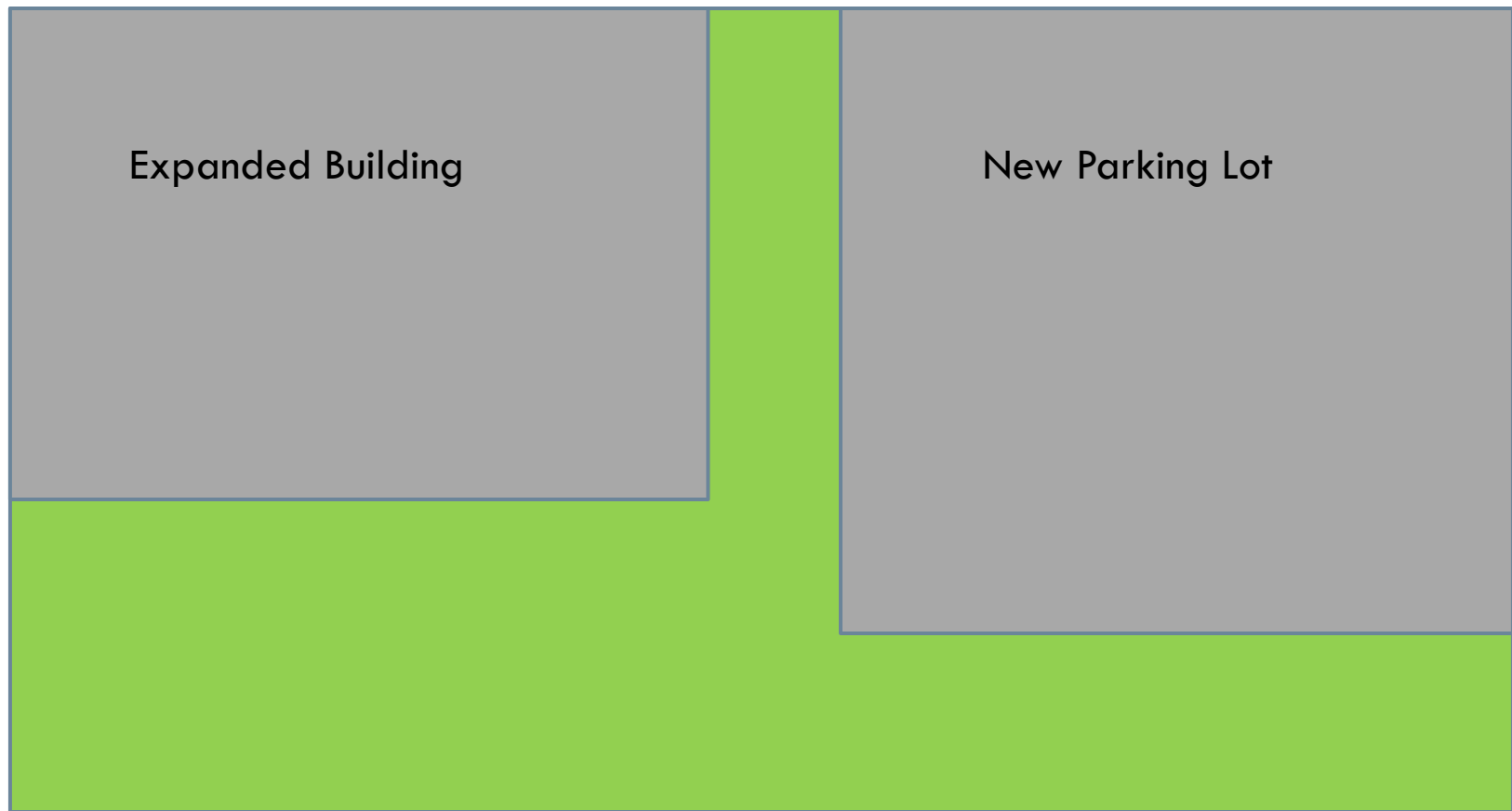


Sample Projects (>5,000 sq. ft.)



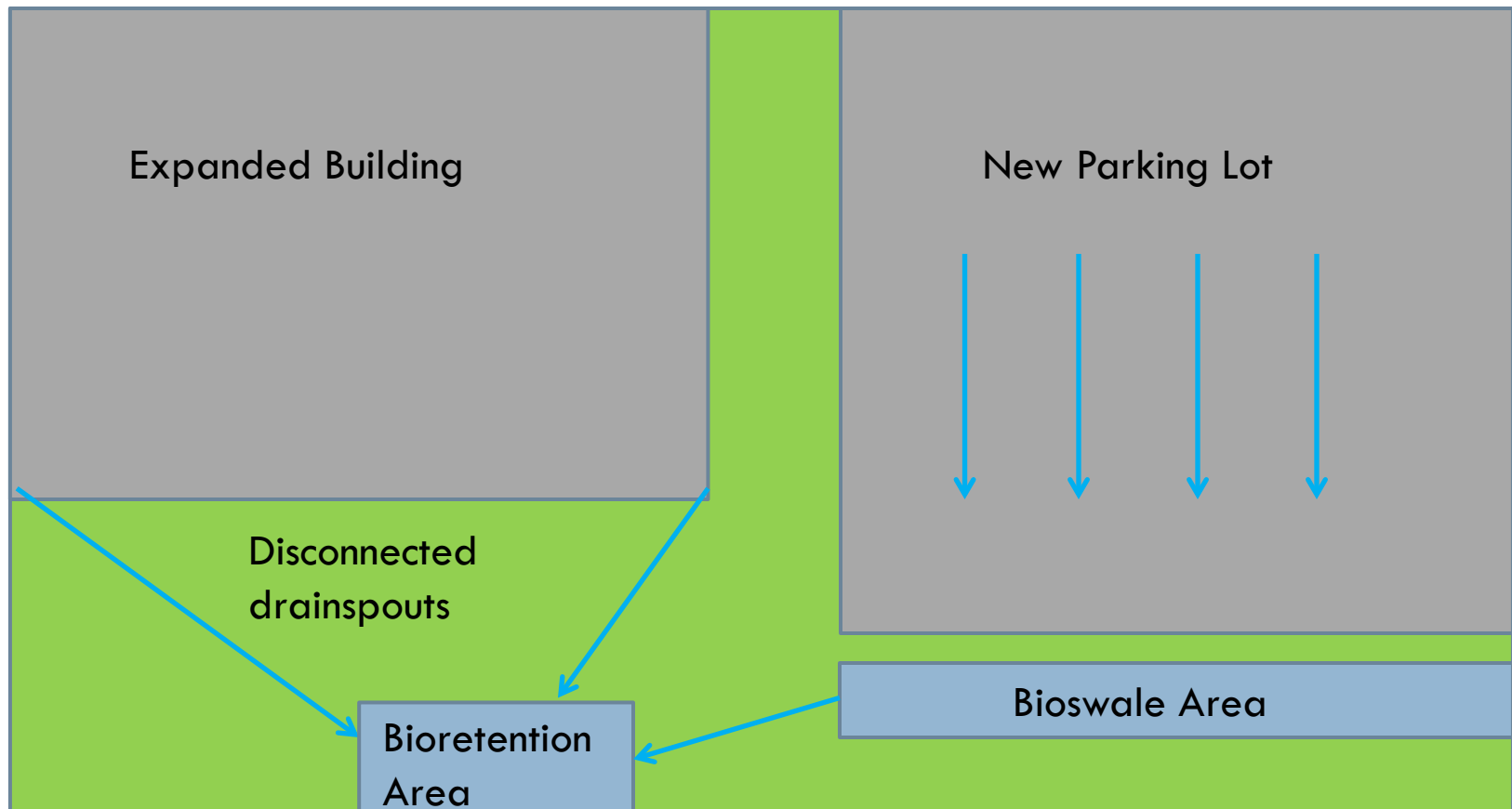
Prior to construction: 5,000 sq. ft. impervious surface

Sample Projects (>5,000 sq. ft.) > 50% increase of Impervious Area



New construction: 12,000 sq. ft. impervious surface

Sample Projects (>5,000 sq. ft.) > 50% increase of Impervious Area



New construction: 12,000 sq. ft. impervious surface

Sample Projects: Parking Lot Retrofits

Before:



After:



Alternative Post-Construction Storm Water Management Program

Multi-benefit projects can propose alternative plans...

...if they address water quality as well as one or more of the following:

Water supply

Flood control

Habitat enhancement

Open space preservation

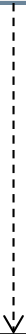
Recreation

Climate change

Requires public comment period and approval of RWQCB.

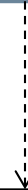
Post-Construction Requirements Summary

Between 2,500 and
5,000 sq. ft. impervious
surface area



Implement one or more
Site Design Measures

> 5,000 sq. ft.
impervious surface area



A “**Regulated Project**”
LID Design Standards
Required

Roles and Responsibilities

- **Capital Planners/Project proponents** - Include \$ in project budget for storm water solution (may be equipment, landscape materials)
- **Physical Planners** - Anticipate space needs of storm water solutions for campus as a whole, and individual projects.
- **Environmental Planners** - Reflect storm water regulations in environmental document analysis. Provide campus wide and project hydrologic info.

Roles and Responsibilities

- **Design Team** - Do project specific calculations of storm water runoff. Design projects to meet storm water regs. Consult with and inform Operations and Maintenance as to maintenance requirements of any proposed solution.
- **Project managers, construction managers and inspectors** Verify requirements are incorporated into specifications for project design and into construction specifications. Transmit design and relevant documentation to campus storm water manager. Inform environmental & campus planners of storm water solutions. Verify storm water solutions are built in accordance with specifications. Communicate maintenance requirements to grounds or facility manager.

Roles and Responsibilities

- **Facility Managers** - Participate in the design review process; Budget for maintenance of storm water system
- **Grounds/Operations/Maintenance** - Participate in the design review process. Coordinate with project managers on O&M issues related to optional storm water solutions. Maintain storm water system solutions
- **Campus Storm Water Manager**- Document requirements are met. Train staff. Update campus standards and design guidelines and Division I/II specifications. Verify project designs and implemented measures meet requirements

Storm Water Connection to LRDPs and CEQA

- Long Range Development Plan (LRDP) – land use plan for the campus contains 4 required elements:
 - ▣ Land Use
 - ▣ Circulation
 - ▣ Open Space
 - ▣ Utilities



Storm Water Connection to LRDPs and CEQA

- Long Range Development Plan incorporates overall campus hydrology:
 - Flood Management
 - Water Use
 - Water Flow
 - Watershed Management



Storm Water Connection to LRDPs and CEQA

- LRDP EIRs – Environmental Impact Reports evaluate impact of projected development for 10+ years
 - ▣ Hydromodification
 - ▣ Pollutant Sources/ Water Quality



Soil & Water Conservation . Shoreline Erosion Advisory Service.

<http://www.dcr.virginia.gov/soil & water/seas.shtml>

Storm Water Connection to LRDPs and CEQA

CEQA Hydrology and Water Quality questions:

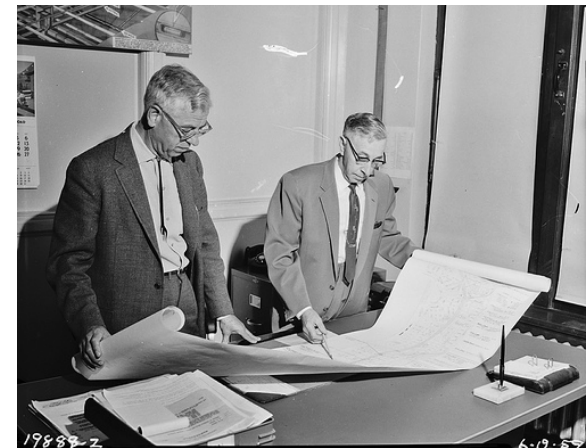
Will the project:

- a) Violate any water quality standards
- b) Substantially deplete groundwater
- c) Alter drainage pattern such that erosion would occur
- d) Alter drainage pattern such that flooding would occur on or off site?
- e) Create or contribute to runoff water which would exceed existing or planned stormwater system or create polluted runoff?
- f) Otherwise degrade water quality?
- g) Relation to flood plain etc.

Incorporating LID into Facility Design Construction Management Process

- Project Design/Contracting
 - ▣ RFQ/RFP
 - ▣ Contract Documents
 - ▣ Construction Design Standards Guidelines
- Post-Construction Operation & Maintenance

Make sure your **designers and engineers** are aware of the new MS4 permit requirements.



A Well Designed Project Starts With a Good Design Team

- Request for Proposal (RFP)- Request for Qualifications (RFQ)
 - ▣ Ad for Architectural Services
 - ▣ Preliminary Selection Criteria



Contract Documents

- Scope of Services
 - ▣ Must meet MS4 post-construction requirements
- Executive Design Professional Agreement
 - ▣ 1.1.8 – General Requirements
 - Design Professional shall perform all services in compliance with applicable laws, codes, rules, regulations, ordinances, University policies, and Facility standards....
 - ▣ 12.2.1 – Exhibits
 - Supplemental Requirements Article 2, 3, 4
 - Deliverables: Post-Construction Checklist, Calculations, and SMARTS Calculator, Operation and Maintenance Manual

Construction Design Standards

- Required documentation to demonstrate compliance with MS4 post-construction requirements Section F.5.g
 - ▣ Calculations for existing, total new and replaced impervious surface area, total new pervious area, and calculation of Net Impervious Area
 - ▣ Description of Source Control Measures, Site Design Measures, and Storm Water Treatment/Hydromodification Management Measures including calculations (sizing and flow)
 - ▣ Designs for Stormwater Retention or Infiltration
 - ▣ SMARTS Post Construction Calculator or equivalent

Construction Design Standards

- **Statement of Compliance:**
 - Statement that Water Quality Treatment Performance Requirement has been met on-site, or if not achievable document how it has been met off-site
- Confirm information on campus-specific checklists or templates matches final project design

Post-Construction Operation and Maintenance

- O&M responsibility must be assigned through a “legally enforceable agreement or mechanism”
- Permittee must “verify that systems and hydromodification controls installed are properly operated and maintained for the life of the project”



Operations and Maintenance Verification Program

O&M Manual:

- Specify routine maintenance, such as:
 - ▣ Removing accumulated sediment and debris
 - ▣ Replacing dead vegetation
 - ▣ Vacuuming permeable pavers
- Design expectations:
 - ▣ No standing water after 72 hours
 - ▣ Infiltration of storm water from design storm events



Essential Resources

California Stormwater Quality Association (CASQA)

- BMP Handbooks online
- <http://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook>
- Annual CASQA conference for AIA credit (mid Sep.)

State Water Quality Control Board

- Phase II Small MS4 Permit
- SMARTS database - Post-Construction Water Balance Calculator

Campus Storm Water Specialists Contact Information

Campus	Contact Name	Email Address
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Thank you for your time!

QUESTIONS??

**This concludes The American Institute of Architects
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