DISCUSSIONS ON LOW IMPACT DEVELOPMENT BIOSWALES AND BIORETENTION

4:00 - 4:45
INTRODUCTION:
TIM SMITH

NEW BIOSWALE REGULATIONS:
STEPHANIE GAINES

BIORETENTION DESIGN BMP’S:
JIM KUHLKEN

4:45-5:30
BANNOCK STREET PILOT PROJECT:
MERRILL TAYLOR

HARBOR DRIVE PROJECT CASE STUDY:
MARTY POIRIER

SCE PROJECT CASE STUDY:
MIKE SULLIVAN

5:30-6:00
QUESTIONS AND COMMENTS
PANELISTS AND AUDIENCE PARTICIPATION

6:00-7:00
SOCIAL NETWORKING HOUR
THANK YOU TO THE FOLLOWING EVENT SPONSORS:

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RCP

BLOCK & BRICK

village nurseries

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reproHAUS
Municipal Stormwater Permit
Update & Timeline

Presented by Stephanie Gaines
County of San Diego
Watershed Protection Program
Regulatory Framework

- US EPA
  - Clean Water Act
  - Porter-Cologne Act
  - NPDES Permit

- State Water Resources Control Board

- Regional Water Quality Control Board

- County of SD

- Region 1
- Region 2
- Region 3
- Region 4
- Region 5a - 5c
- Region 6a & 6b
- Region 7
- Region 8
- Region 9

- 1
- 5a
- 5b
- 5c
- 6a
- 6b
- 3
- 8
- 7
- 9
- County of SD
County Regulations and Guidelines

• Watershed Protection Ordinance (WPO)

• Landscape Ordinance & Water Efficient Landscape Design Manual (WELDM)

• LID Handbook and Fact Sheets

• Best Management Practice (BMP) Design Manual

  • Standard Urban Stormwater Mitigation Plan (SUSMP)
Municipal Storm Drains

• Municipal **Separate** Storm Sewer System = MS4
• Not Connected!
New Requirements

- Water Quality Improvement Plan (WQIP)
- Jurisdictional Runoff Management Plan (JRMP)
- Best Management Practice (BMP) Design Manual
- New Requirements & Prohibitions
New Development Regulations

Development Planning

• Priority Development Project Categories

• Retention

• Hydromodification

• Alternative Compliance
## Priority Development Projects (PDPs)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Previous Permit</th>
<th>2013 Permit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>&gt;10-units</td>
<td>10,000 sq. ft.</td>
</tr>
<tr>
<td>Commercial, Industrial</td>
<td>&gt;1 acre</td>
<td>10,000 sq. ft.</td>
</tr>
<tr>
<td>Driveways</td>
<td>Exempt</td>
<td>Added: 5,000 sq. ft.</td>
</tr>
</tbody>
</table>
New PDP Exemptions

• New Sidewalks, Bike Lanes, Trails using LID
• Redevelop Alleys, Roadways as “Green Streets”
Green Street Example: Elmer Avenue
Example: Elmer Avenue & Paseo

**HIGHLIGHTS**
- Demonstrates Low Impact Development strategies on public lands
- Reduces pollution that is sent to the Los Angeles River from urban runoff
- Captures and treats runoff from 40 acres of residential landuse
- Annually deposits 16 acre-feet of groundwater recharge
- The first block in Los Angeles with street lights off the grid.

<table>
<thead>
<tr>
<th>1. SOLAR STREET LIGHTING</th>
<th>2. PARKWAY BIO-SWALE</th>
<th>3. INFILTRATION GALLERY</th>
<th>4. CATCH BASINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The lights are powered by solar panels and use LED technology to save 1,730 kW of power each year.</td>
<td>The parkway bio-swale uses plants and soil to capture urban runoff, breakdown pollutants and provide habitat for animals.</td>
<td>The two underground infiltration galleries capture runoff from the upstream landuses. The galleries are capable of infiltrating 6,575 gallons of water every five minutes for groundwater recharge.</td>
<td>The two catch basins (one on each end of the block) divert water from the street to the infiltration galleries. They reduce pollutants entering the infiltration galleries by settling out sediments and filtering trash.</td>
</tr>
</tbody>
</table>
Example: Elmer Avenue & Paseo
New Retention Standard

- PDP to Retain 85th % storm event
- Retain: Intercept, Store, Infiltrate, Evaporate

Section E.3.c.(1), pg 85-87
Non-Stormwater Discharges

Section E.2.c.(ii), E.5.b.(d) pgs. 75, 102
Offsite Alternative Compliance

Jurisdictional Alternative Compliance Program

• Determine Greater Water Quality Benefit

• Program(s) May Allow Implementation or In-lieu Fee

• Voluntary Agreement Between Jurisdiction/Developer

• Built Within 4 Years Of First PDP Occupancy

Section E.3.c.(1)(b)., (1)(a). and (3).
Regional Example: South Los Angeles Wetlands
Distributed Example: Marsh Park
Public-Private Partnerships

Private Investment in Stormwater Management

**Sustainable Landscapes Program**
- Prop 84 IRWM Grant Project
- Turf Replacement
- Resource Management
  - “Conservation, Permeability, Retention”
  - “New Norm”
Resources

Project Clean Water website:

www.projectcleanwater.org

County of San Diego Watershed Protection Program:

http://www.sandiegocounty.gov/dpw/watersheds.html
Jim Kuhlken
Principal of the Landscape Architecture Division

RICK ENGINEERING COMPANY

(RICK) is a full-service, multi-disciplinary planning, design, and engineering firm with more than 60 years of local San Diego experience.
DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS

BIORETENTION DESIGN BMP

**PICK IT UP!**
The most upstream area is where trash, debris and sediments are allowed to settle out.

**SLOW IT DOWN!**
Slow water will minimize erosion and allow water and pollutants to be filtered as they infiltrate into the ground.

**CLEAN IT UP!**
The vegetation plays a role in treating additional pollutants such as nutrients, metals, viruses and bacteria, oil and organic compounds.
DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS

BIORETENTION DESIGN BMP
Bioretention with Flow Control

Bioretention in Island

Bioretention with Infiltration

Bioretention in Hardscape

DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP
Bioretention Basin Plan

DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS

BIORETENTION DESIGN BMP

Vegetated ground cover per landscape plan

18" Loamy sand soil mix with minimum long-term percolation rate of 5"/hr.

Impermeable membrane per geotechnical specifications. Provide cutout at tree locations see landscape detail.

Class II permeable base per Caltrans Spec 68-1.025

4" Perforated pipe

6" MOD. TYPE G CURB & GUTTER see detail this sheet

2% 7' 5'

TC FL

FL (SWALE)

12" 16" 42"-46"

MATCH TC ELEVATION

1.5% 6"

6" MOD. TYPE G CURB & GUTTER

See detail this sheet
ARCHITECTURE/SITE PLANNING
WATER RESOURCES
CIVIL
LANDSCAPE ARCHITECTURE
GEOTECH
SURVEY

MULTI-DISCIPLINE SITE

BIO-RETENTION

DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP
What have we learned?

Soil Type
- 70% Sand
- 30% Compost/Sandy Loam

Soil Replacement
- long term, in place infiltration rate of at least 5 inch per hour
- Compact 85% - 90%
- Appropriate plant material
- Separate irrigation
What was developed?

Soil Type (by weight)
- 65% Sand
- 20% Sandy Loam
- 15% Compost

Soil Placement
- Long term, in place infiltration rate of at least 5 inch per hour (for Flow-Based design)
- Six (6) to twelve (12) inch lifts and lightly watered. No mechanical compaction.
- Appropriate plant material
- Separate irrigation

COMMON ISSUES, PITFALLS & SOLUTIONS
OPERATIONS & MAINTENANCE

Routine Landscape Maintenance
- Trash removal
- Vegetation pruning
- Mulch replenishment (~annually)
- Visual inspections of inlets/outlets/surface ponding

Storm Water Maintenance Agreements
- Run with the land, between owner (i.e. – HOA, POA, etc.) and public agency

Annual Verification of Treatment Control BMPs (TC-BMPs)
- Notice from City for sign-off that inspection and maintenance has occurred
- Enforcement if not installed or maintained adequately
Load Reductions Through LID Green Streets: Bannock Ave

Merrill Taylor, P.E.
Goals of the Project
- MS4 Compliance
- Pollutant Reduction
  - Bacteria
  - Metals
  - Nutrients
  - Toxicity
  - Turbidity
- Pilot Project
  - Gather valuable information for standardizing LID practices within the City of San Diego
- Streetscape Enhancement
BIOSWALES AND BIORETENTION WORKSHOP, April 30, 2015

Easy:

Possible:

Difficult (Hardscape):

Difficult (Trees):
Landscape Selection Form

Use this form to select plants for the parkway in front of your home. You may submit by mail or email by April 23, 2012. Selections cannot be made by phone.

Mailing Instructions: Please select only one plant from each of the three categories (trees, shrubs, and ornamental grasses) on the back of this form by checking the box next to each. Mail the completed form to:
Andrea Dernich, City of San Diego
9370 Chesapeake Dr, Suite 100
San Diego, CA 92123

Email Instructions: Send an email to admich@sandiego.gov with “Landscape Selection” in the subject line. In the email, include your full name, street address, and one selection from each of the three categories on the back of this form (trees, shrubs, and ornamental grasses).

This rendering gives an idea of how the landscaping will look once the project is complete. This rendering displays the Desert Willow, Western Redbud, Common Yarrow, Deer Grass, California Fuchsia, and California Grey Rush.

Trees
- Desert Willow (Chilopsis Linearis)
  Mature Height: 35 feet / Diameter: 25 feet
- Western Redbud (Cercis Occidentalis)
  Mature Height: 25 feet / Diameter: 25 feet

Shrubs
- Common Yarrow (Achillea Millefolium)
  Mature Height: 2 feet
- California Fuchsia (Epilobium Californica)
  Mature Height: 2-3 feet

Ornamental Grasses
- California Gray Rush (Juncus Patens)
  Mature Height: 2 feet
- Deer Grass (Muhlenbergia Rigens)
  Mature Height: 3-4 feet

Name: ___________________________ Sign: ___________________________ Date: __________
Email: ___________________________ Affix address label here
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BIOSWALES AND BIORETENTION
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BIOSWALE AND BIORETENTION
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- Bannock
Future Monitoring
- What do we hope to learn?
  - Green Street overall load reductions
  - Bioretention soil media impact
  - Validate & update modeling parameters
  - Compare climate region to other regions
Future Monitoring
- What will be monitored?
  - Influent flow
  - Underdrain effluent for each media mix

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
</tr>
<tr>
<td>EC</td>
<td>YSI 6 Series Sonde</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td></td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td></td>
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</tbody>
</table>

Table 2: Composite Sample Analytical Parameters and Methods

<table>
<thead>
<tr>
<th>Analytical Parameter</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Chemistry</td>
<td></td>
</tr>
<tr>
<td>Total Hardness as CaCO₃</td>
<td>SM 2340 B</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>SM 2540-D</td>
</tr>
<tr>
<td>Metals (Total and Dissolved)</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>EPA 200.8(m)</td>
</tr>
<tr>
<td>Copper</td>
<td>EPA 200.8(m)</td>
</tr>
<tr>
<td>Lead</td>
<td>EPA 200.8(m)</td>
</tr>
<tr>
<td>Selenium</td>
<td>EPA 200.8(m)</td>
</tr>
<tr>
<td>Zinc</td>
<td>EPA 200.8(m)</td>
</tr>
<tr>
<td>Nutrients</td>
<td></td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>SM 4500-N</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>SM 4500-P E</td>
</tr>
</tbody>
</table>

Table 3: Grab Samples Analytical Parameters and Methods

<table>
<thead>
<tr>
<th>MICROBIOLOGY</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coliform</td>
<td>SM 9221B</td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>SM 9221E</td>
</tr>
<tr>
<td>Enterococci</td>
<td>EPA 9000-1600</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Future Monitoring

-Where will it be monitored?

BSM A in all other locations

BSM B

BSM C

= Monitoring Locations
Future Monitoring
-How will it be monitored?

- Inlet hydraulic monitoring (fabricated H-flume)
- Pressure transducers to measure BMP water level
- Outlet monitoring of underdrain & overflow (V-notch weir)
- ISCO samplers for flow weighted composite water quality
DISCUSSIONS ON LOW IMPACT DEVELOPMENT
BIOSWALES AND BIORETENTION
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Questions??
DISCUSSIONS ON LOW IMPACT DEVELOPMENT

BIOSWALES AND
required to provide source control and treatment best management practices

treat the volume of runoff produced from an 85th percentile storm event
(2 year storm)

pollutants of concern:

- sediment, nutrients, heavy metals,
- trash and debris, oxygen demanding substances,
- oil, grease, pesticides
- and organic compounds
evapotranspiration bioremediation and phytoremediation

sedimentation and filtration

filtration, absorption nutrient assimilation and biodegradation

soil media
2'-0" recommended 3'-0" to remove phosphorous

perennial
mulch
soil media
bridging stone
pea gravel
conveyance channel
perforated pipe
drain
connection to existing storm
sedimentation and filtration

filtration, absorption, nutrient assimilation, and biodegradation
Preliminary Landscape and Site Design Principles

Reveal Sustainable Features

Understand existing watershed
Preliminary Landscape and Site Design Principles

Reveal Sustainable Features

Create visible infrastructure for storm water capture and treatment

- Biofiltration swale
- Structural treatment
- Collection + Storage Concept

planted roof at dining building
underground tank to reduce peak flow
cleaner water for water fountain or public art opportunities

Scholars Drive South
North Torrey Pines Road
1. Stormwater
2. Vegetated Roof
3. Water Conveyance Channel
4. Weir
5. Rock Swale
6. Bioswale
7. Planter Wall

Stormwater from parking lot
DISCUSSIONS ON LOW IMPACT DEVELOPMENT BIOSWALE AND BIORETENTION

BIOPHILIA
BIOPHILIC DESIGN

MIKE SULLIVAN
BRIAN SO
The Future???????????
Mimicking nature in function and beauty
MOSAIC: MIXED MEADOW
WORKSHOP, April 30th, 2015
SOLAR DECATHALON
WORKSHOP, April 30th, 2015
GATEWAY DESIGN CONCEPT
WORKSHOP, April 30th, 2015
Goal: Net zero / off grid
GATEWAY PROCESS
WORKSHOP, April 30th, 2015

SOLAR CANOPY

BIOSWALE

STORM GARDEN
WATER CAPTURE DIAGRAM

LEGEND:
- INFILTRATION ZONES
- PERMEABLE PAVING
- BIOSWALE
- EXISTING CATCH BASIN
- EXISTING ROOF DRAIN
- LIMIT OF DRAINAGE PER ROOF DRAIN
- EXISTING STORM DRAIN LINE
- EXISTING DRAINAGE PATTERNS

SITE WATER CAPTURE WORKSHOP, April 30th, 2015
RAINWATER HARVESTING DIAGRAM
OPTION 1

ZONE 1 HARVESTING
Roof Watershed = 110,925 Gallons/YR.
Water Storage = 22,480 Gallons
Water Demand = 21,479 Gallons/YR.

ZONE 2 HARVESTING
Roof Watershed = 428,543 Gallons/YR.

LEGEND:
- **WATERSHED**
  (536,468 GALLONS PROVIDED @ 14" PER YEAR)
- **BIOSWALE / WATER INFILTRATION**
- **RAIN FENCE 4' x 6' x 120'**
  (5240 GALLONS STORAGE)
- **STORM GARDEN**
  (21,479 GALLONS DEMAND/YR.)
- **EXISTING ROOF DRAIN**
- **LIMIT OF DRAINAGE PER ROOF DRAIN**
- **SOLAR POWER**
- **WIND POWER**
- **PATH OF WATER**
Sustainable Practice
Ecological Component

- Adapt Regional Character
- Recycle, Reclaim, Restore
- Conserve water with plants
- Establish Native habitat
- Site water Capture
- Bio/Infiltration swales
- Rain Harvest
- Solar Canopy
- Smart Irrigation Control
Sustainable Practice
Human Component

- Adapt Regional Character
- Biophilia Effect
- New Circulation and Wayfinding
- People Places
- Education and Awareness
- Capture Views
During
SOLAR CANOPY WORKSHOP, April 30th, 2015

Before

During

After
STORM GARDEN WORKSHOP, April 30th, 2015
STORM GARDEN: THE RAIN FOUNTAIN
WORKSHOP, April 30th, 2015
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