Stormwater Controls for Development Projects

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Outline of Presentation

- Introduction: why include stormwater controls in development projects?
- Regulatory background
- Types of post-construction controls
  - Source control measures
  - Site design measures
  - Treatment measures
- Hydromodification management
- Green infrastructure requirements
Why include stormwater controls in development projects?

- Uses of San Francisco Bay and many local creeks are impaired for numerous pollutants
- Stormwater runoff is the largest pollutant conveyance
- Stormwater discharge regulations require pollutant and flow controls
What happens during land development?

- Natural land forms changed
- Soil moved and compacted
- Vegetation removed
- Impervious surface created
- Structures create barriers in floodplain
- Land uses generate pollutants
The Biggest Culprit – Impervious Surface
How does land development affect the hydrologic cycle?

Lots of runoff after development
Effects of increased runoff on a creek
Concrete Lining with Floodwall in Lower Matadero Creek
Regulatory Background: Municipal Stormwater Permits

- Since 1987 the federal Clean Water Act has required municipalities to obtain permits to discharge stormwater from municipal storm drain systems.
- These are National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permits.
- EPA has also established construction and industrial discharge standards.
NPDES Permitting Authority

U.S. EPA

State Water Resources Control Board

Regional Water Quality Control Board (9 regions)

MS4s

MS4 = Municipal separate storm sewer system
Regulatory Framework for NPDES Permits in CA

- State Water Resources Control Board
  - Construction General Permit
  - Industrial General Permit
  - Municipal Phase II General Permit (Small MS4s)

- Regional Water Quality Control Boards
  - Municipal Phase I Stormwater Permits
  - Wastewater Treatment Plant Permits
  - Individual Industrial Permits
Bay Area Municipal Regional Permit (MRP)

- One regional permit for urbanized areas (total of 76 permittees):
  - San Mateo, Santa Clara, Alameda, and Contra Costa Counties, Fairfield-Suisun, and Vallejo

- MRP reissued 11/19/15; effective 1/1/16

- Key requirements:
  - Low Impact Development (LID); Green Infrastructure
  - Monitoring and control measures for pollutants of concern: Trash, Mercury, PCBs, Pesticides
MRP Provisions

- Municipal Operations
- New Development and Redevelopment ("C.3")
- Industrial/Commercial Site Controls
- Illicit Discharge Controls
- Construction Site Controls
- Public Education/Outreach
- Water Quality Monitoring
- Pollutant of Concern Controls
  - Pesticides
  - Trash
  - Mercury
  - PCBs
  - Copper
- Exempted/Conditionally Exempted Non-Stormwater Discharges
Provision C.3 Requirements

- Regulated Projects
  - Public and private
  - Projects above certain thresholds
  - Small projects
  - “Special Projects”

- Non-regulated Projects
  - Green infrastructure
  - Primarily public retrofit projects
Post-Construction Controls

- Permanent features of the project design, maintained for the life of the Project
- Types of post-construction controls required by Provision C.3
- Low Impact Development
  - Source control measures
  - Site design measures
  - Stormwater treatment
- Hydromodification management (HM)
Low Impact Development (LID)

- Approach to reduce runoff and mimic a site’s predevelopment hydrology:
  - Minimize disturbed areas and impervious surfaces
  - Retain and treat stormwater runoff using infiltration, evapotranspiration, rainwater harvesting/use or biotreatment
Source Control Measures

- Structural Source Controls are permanent design features that reduce pollutant sources.
- Examples include:
  - Covered trash enclosures
  - Non-stormwater discharges that drain to landscaping or to sanitary sewer
  - Drought-tolerant native or adapted plants
- Required in projects that must implement stormwater treatment
- Encouraged in all other projects
Source Control Measures

- **Operational Source Controls** are practices to be conducted on an ongoing basis after construction is completed.

- Examples:
  - Integrated pest management (reduced pesticide use)
  - Street sweeping

- Required in projects that must implement stormwater treatment

- Encouraged in all other projects.
Site Design Measures

■ Permanent design features that:
  • Reduce impervious surfaces
  • Disconnect impervious surfaces
  • Preserve/protect natural features

■ Examples include:
  • Runoff directed to landscaping
  • Pervious pavement

“Disconnected” downspout

Pervious walkway
Site Design Measures

- Required in projects that must implement stormwater treatment
- Required in certain small projects not subject to treatment requirements
- Encouraged in all other projects
Treatment Measures

- Engineered systems that remove pollutants from stormwater
- Sized to treat stormwater runoff from **frequent, small storm events**
- Provision C.3.d of the MRP specifies numeric sizing criteria for water quality design
- Maintenance agreement required
LID Treatment Requirements

- LID treatment methods required since 12/1/11
- LID treatment defined as:
  - Infiltration
  - Evapotranspiration
  - Rainwater harvesting/use
  - Biotreatment
- No longer have to show infeasibility of first 3 before selecting biotreatment
How Much Runoff Must Be Treated?

- Must treat 100% of project but not 100% of runoff:
  - 80% of average annual runoff (for volume-based treatment measures)
  - Flow of runoff from a rain event of 0.2 inches per hour intensity (flow-based treatment measure)
- This is in Provision C.3.d of the MRP, so it’s called the “C.3.d amount of runoff”

OR “water quality design volume or flow”
Stormwater Treatment Measures
When are they required? (“Regulated Projects”)

- Required for projects that create and/or replace 10,000 sq. ft. or more of impervious surface

- Required for the following types of projects that create and/or replace 5,000 sq. ft. or more of impervious surface:
  - Restaurants
  - Retail gasoline outlets
  - Auto service facilities
  - Parking lots
Other C.3 Regulated Projects

- Road and trail projects that create and/or replace 10,000 sq. ft. of contiguous impervious surface
  - New roads, and sidewalks and bike lanes built as part of new roads
  - Widening of existing roads with traffic lane(s)
  - Trails >10 feet wide or < 50 feet from creek bank
The following are NOT Regulated Projects (do not require treatment):

- Detached single family home;
- Roadway reconstruction within same footprint;
- Road widening that does not add a travel lane;
- Sidewalks and bike lanes along existing roads;
- Impervious trails <10’ wide and >50’ from creek;
- Sidewalks, bike lanes and trails that drain to vegetated areas or made of pervious paving;
- Interior remodels;
- Routine maintenance and repair;
- Pavement resurfacing within existing footprint.
Small Project and Single Family Home Requirements

- Single family homes (>2,500 sq. ft. of impervious area) and small projects (between 2,500 and 10,000 sq. ft. of impervious area) must implement one of six site design measures:
  - Direct roof runoff into cisterns or rain barrels
  - Direct roof runoff onto vegetated areas
  - Direct sidewalk and patio runoff onto vegetated areas
  - Direct driveway and parking lot runoff onto vegetated areas
  - Construct sidewalks and patios with pervious surfaces
  - Construct bike lanes, driveways, and parking lots with pervious surfaces
Stormwater Treatment Measures
What are the different types?

- LID Treatment Measures (required since 12/1/11)
  - Infiltration
  - Evapotranspiration
  - Rainwater harvesting/use
  - Biotreatment

- Non-LID Treatment Measures
  - High rate media filters and tree well filters
  - Allowed only for “Special Projects”
“Special Projects”

- Special Projects are high density and transit oriented development projects that may receive LID treatment reduction credit, i.e., allowed limited use of “non-LID” treatment measures.
- Amount of credit based on size of project, lot coverage, location, density, and amount of surface parking.
- Non-LID measures are limited to tree box filters and media filters.
Biotreatment Measures

- Most Common
  - Bioretention areas/rain gardens
  - Linear bioretention areas (bioretention swales)
  - Flow-through planters

Bioretention Area in Burlingame
Bioretention Area/Rain Garden

- Concave landscaped area of any shape, with sloped sides
- Engineered biotreatment soil mix with specified long term infiltration rate (5 in/hr)
- Underdrain required if clayey underlying soils
- Raise underdrain to maximize infiltration, if conditions allow
Bioretention Areas
Flow-through Planter

- Lined planter box with vertical sides
- No infiltration to underlying soils
- Stormwater filters through specified biotreatment soil mix and released through underdrain
- OK to place next to building or on podium if waterproofed

Source: Dan Cloak Environmental Consulting, 2010, with modifications
Biotreatment in Tree Trench

- Evapotranspiration
- Precipitation
- Water Uptake
- Filtration Detention Retention
Rainwater Harvesting and Use

- Captured stormwater used for non-potable uses, such as:
  - Toilet flushing
  - Irrigation

Cisterns installed underground
Rainwater Harvesting
Infiltration Trench

- Store water in void space of rocks, allowing it to infiltrate to surrounding soils
- Requires well-draining soils
Infiltration Trenches

A schematic of an infiltration trench (Source: MDE, 2000)
Pervious Pavement
Green Roofs

- Green roofs are considered site design measures that remove runoff largely through plant evapotranspiration processes.
- Planting media needs to be sufficiently deep to:
  - Provide capacity within the pore space of the media for the water quality design volume (typically < 3”)
  - Support the long term health of the vegetation selected for the green roof, as specified by a landscape architect or other professional.
Green Roofs
Non-LID: Media Filters

(Limited use ONLY in “Special Projects”)

- Media cartridges installed in manholes or in vaults
- Vaults designed to allow settling of large particles before water enters the filter

- Fine particles are filtered by filter media (see example cartridge at right)
Non-LID Tree Well Filters
(Limited use ONLY in “Special Projects”)

- Manufactured tree well filter with proprietary planting media
- Planting media has extremely high infiltration rate (50-100 in/hr)
- Unit now available with biotreatment soil to meet LID requirements (but treats smaller area).
Non-LID: Hydrodynamic Separators
(NOT a stand-alone treatment measure)

- Vault system
- Settling or separation unit to remove sediments
- Effective for trash and large particles
- Not designed to remove finer particles
Non-LID: Vegetated Swale
(NOT a stand-alone treatment measure)

- Linear, shallow, vegetated channel
- Filters stormwater as it flows through dense vegetation on the surface
- Relatively short detention time prior to discharge into storm drain inlet
- Not as effective as a linear bioretention system
Non-LID: Detention Basin
(NOT a stand-alone treatment measure)

- Basin with specially designed outlet to detain stormwater for at least 48 hours
- Used to be allowed to treat stormwater by settling out solids/sediments
- OK if used for storage upstream of LID measure or hydromodification control.
Hydromodification Management

- **Purpose:** Reduce erosive flows in creeks.

- **Goal:** Match post-project runoff rates, volumes and durations to pre-project condition for a range of storms.

- Required for projects that:
  - Create/replace 1 acre or more of impervious area,
  - Increase impervious area over pre-project condition, AND
  - Drain to creeks susceptible to erosion.
Areas susceptible to HM shown in green
Hydromodification Management Control Measures

- Hydrologic source controls
  - Site design measures to reduce imperviousness
  - LID treatment measures

- Flow duration controls
  - Pond, detention basin, tank or vault
  - Specialized outlet to control rate and duration of flow
For More Information:

- SMCWPPP C.3 Stormwater Technical Guidance (Updated in 2016)
  www.flowstobay.org/newdevelopment

- Municipal Regional Stormwater Permit
  (Google “SF Bay Municipal Regional Permit”)

(San Mateo County Water Pollution Prevention Program)
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