What Are We Inspecting? Stormwater Treatment Measure Type, Design, and Maintenance Required

Jill Bicknell, P.E.
EOA, Inc.

December 4, 2013

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Outline of Presentation

- Types of Treatment Measures in Use
- Low Impact Development (LID) Treatment
- Vault-Based Treatment Measures
- Other "Pre-LID" Treatment Measures
- Hydromodification Management Measures
- References

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Types of Treatment Measures

- "Pre-LID" Era
  - C.3 treatment requirements took effect in 2003 and HM requirements in 2005
  - First treatment measures installed ~2005
  - Projects had wide range of treatment choices
- "LID" Era
  - LID Treatment requirements took effect December 1, 2011
  - Projects now have more limited choices
  - Projects may include trash capture devices

SAN MATEO COUNTYWIDE Water Pollution Prevention Program

Pre-LID Treatment Options

- Landscape-based measures
  - Vegetated swales
  - Vegetated filter strips
  - Bioretention and flow-through planters
- Proprietary systems (vaults and filters)
  - Catch basin inlet filters
  - Hydrodynamic separators
  - Media filters in vaults (including tree well filters)
- Detention basins

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

LID Treatment Requirement

- "LID treatment" is defined as:
  - Rainwater harvesting and use,
  - Infiltration,
  - Evapotranspiration,
  - Or, if these are infeasible, biotreatment.

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

LID Treatment Options

LID Technique	Category
Rainwater cisterns	**Harvest and use**
Pervious paving*	**Infiltration**
Infiltration basin	**Infiltration**
Infiltration trenches	**Infiltration**
Bioretention areas (unlined, no underdrain)	**Evapotranspiration, infiltration**
Bioretention areas (lined or unlined, with underdrain)	**Biotreatment**
Planter boxes (lined, with underdrain)	**Biotreatment**

*Pervious paving is a "site design" measure but may be combined with infiltration trenches

SAN MATEO COUNTYWIDE Water Pollution Prevention Program

Special Projects

- Special Projects are high density and transit oriented development projects that may receive LID treatment reduction credit
- Regional Water Board adopted Special Projects criteria on November 28, 2011
- Some projects with certain characteristics may use media filters and tree box filters for treatment

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

LID Treatment Measures

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Bioretention

What Are Biotreatment Measures?

- Landscaped-based treatment system that filters stormwater through "biotreatment soil"
  - Designed for long-term infiltration rate of 5 in/hr
  - Pollutants removed via filtration, adsorption, chemical and biological transformation, and uptake by plants
  - Soil must be suitable to support healthy plants
  - Typically have an under-drain that conveys filtered stormwater to the storm drain system

Bioretention Area, Brisbane City Hall

SAN MATEO COUNTYWIDE Water Pollution Prevention Program

Biotreatment Soil Specifications

- Specified in Attachment L of the MRP and included in Appendix L of C3 Technical Guidance
- Designed to sustain healthy, vigorous plant growth and maximize stormwater runoff retention & pollutant removal
- Consists of following mixture:
  - 60%-70% Sand
  - 30%-40% Compost
- Specifications for sand and compost are included
- List of soil vendors available

Bioretention Area,
Serramonte Library, Daly City

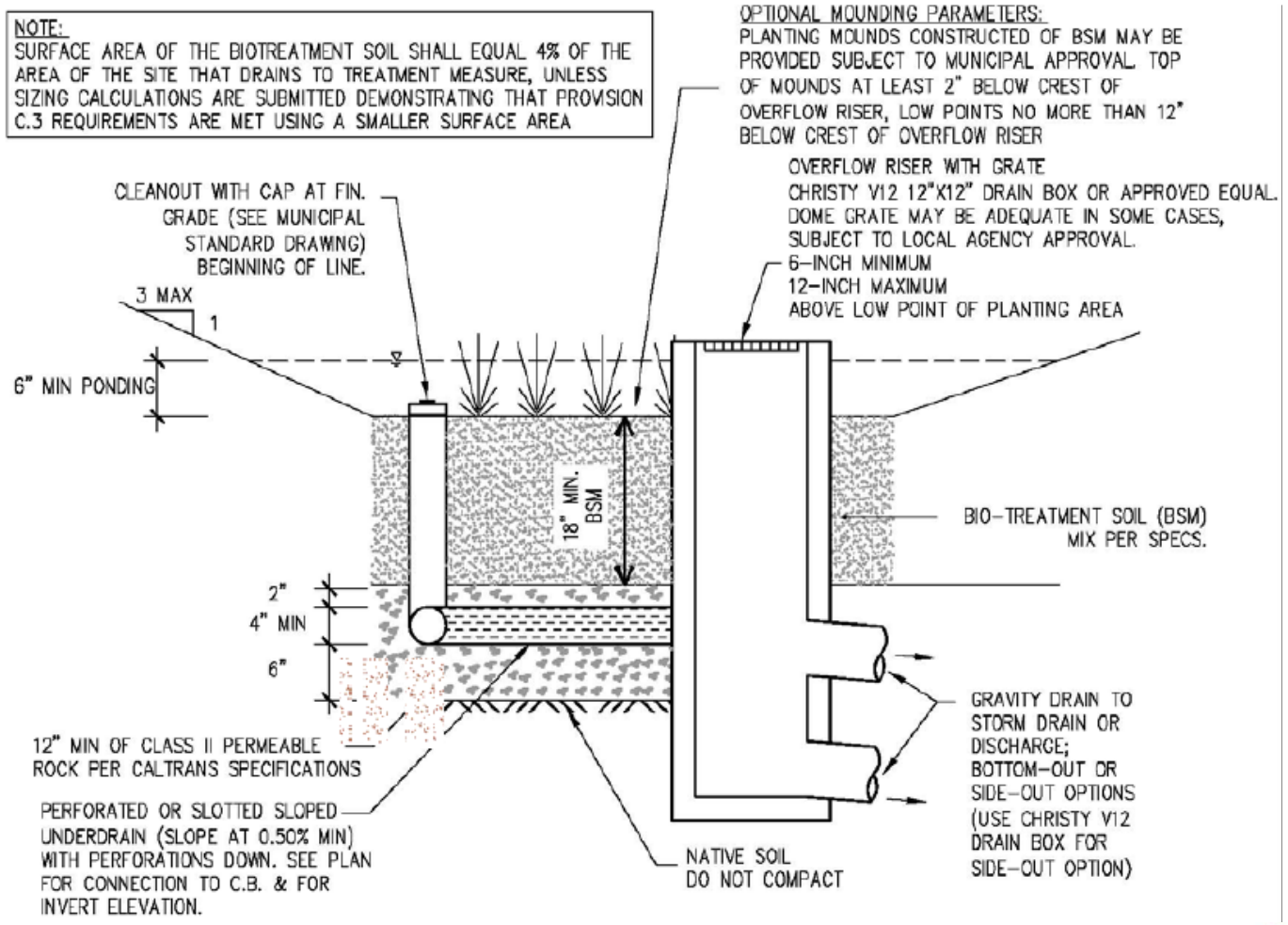
SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

When Is a Bioretention Area Considered "Biotreatment"?

- It is BIOTREATMENT when:
  - It is infeasible to infiltrate the design runoff volume
  - An underdrain is provided that conveys treated runoff to the storm drain system
- It is BIOINFILTRATION when:
  - There is no underdrain and the design runoff volume can be fully infiltrated, or
  - An underdrain is placed above a storage area (drain rock) that can contain the design runoff volume and conveys excess treated runoff to the storm drain
- Both are called BIORETENTION – important to know what the design configuration is

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

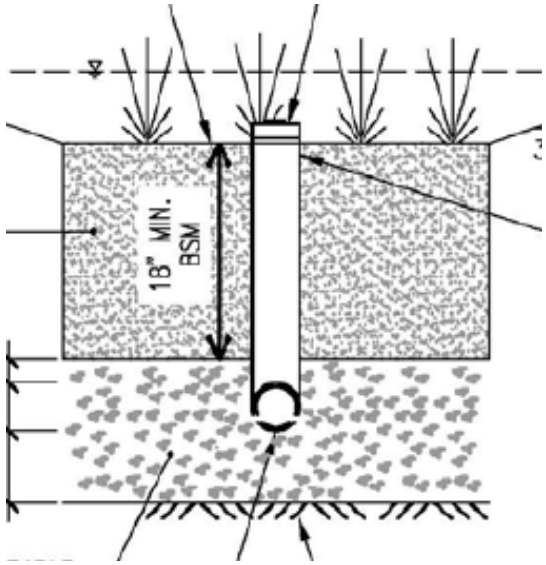
Bioretention Cross Section



SAN MATEO COUNTYWIDE
Water Pollution Prevention Program

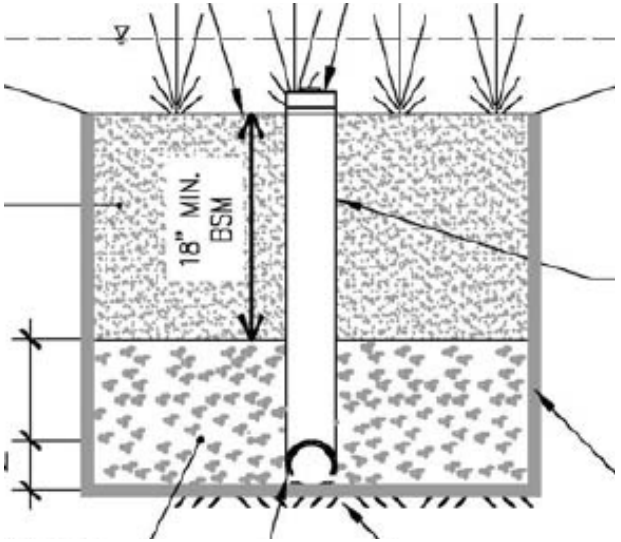
Bioretention Cross Section

"Bioinfiltration"



Unlined, with underdrain near top of drain rock

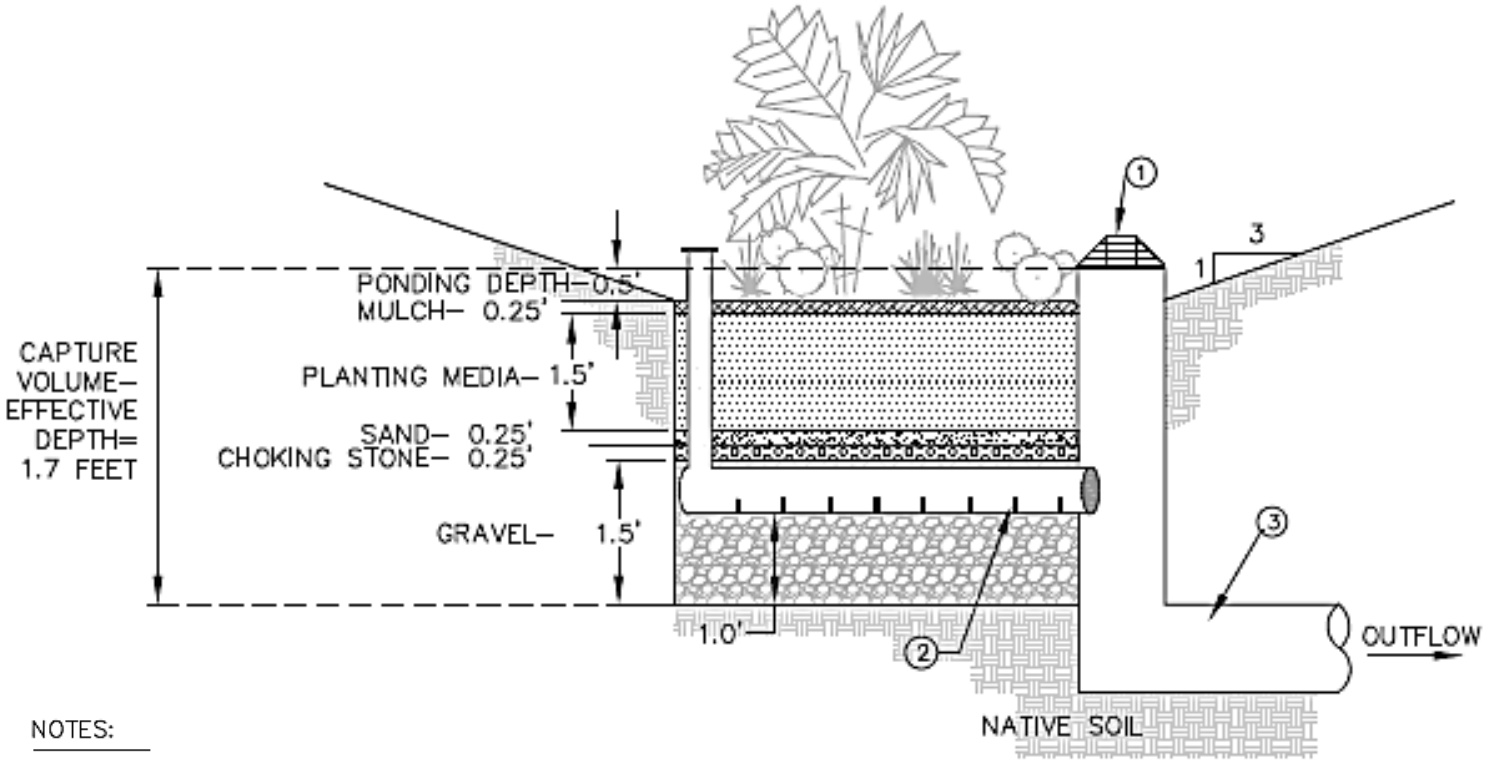
"Biotreatment"



Lined, with underdrain at bottom of drain rock

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

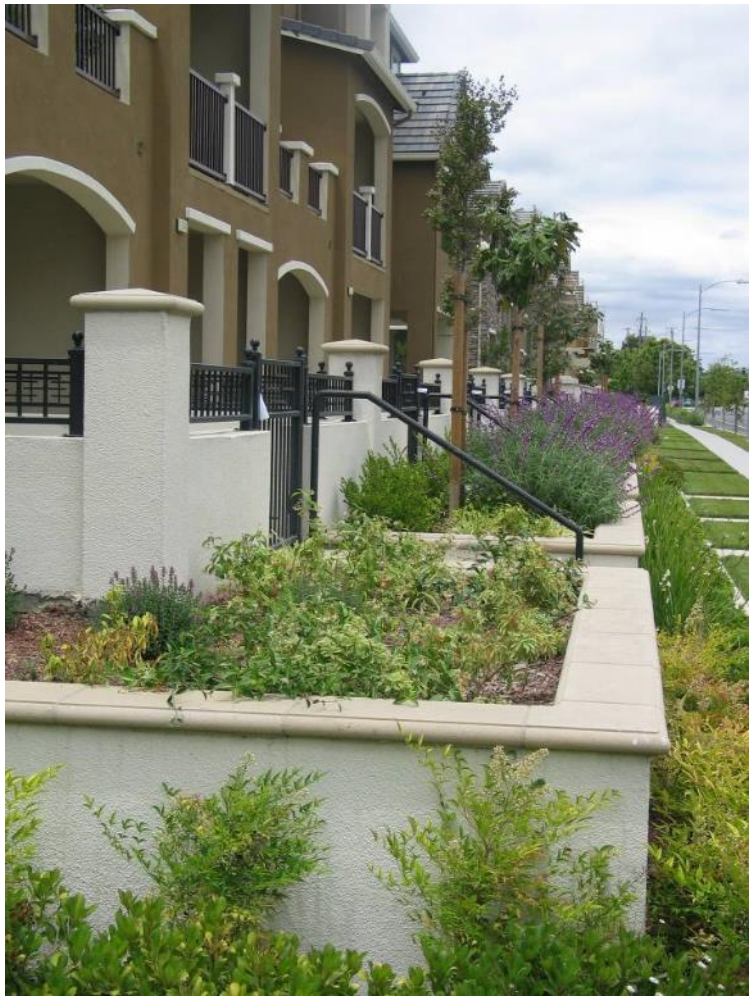
Bioretention



Credit: Geosyntec Consultants

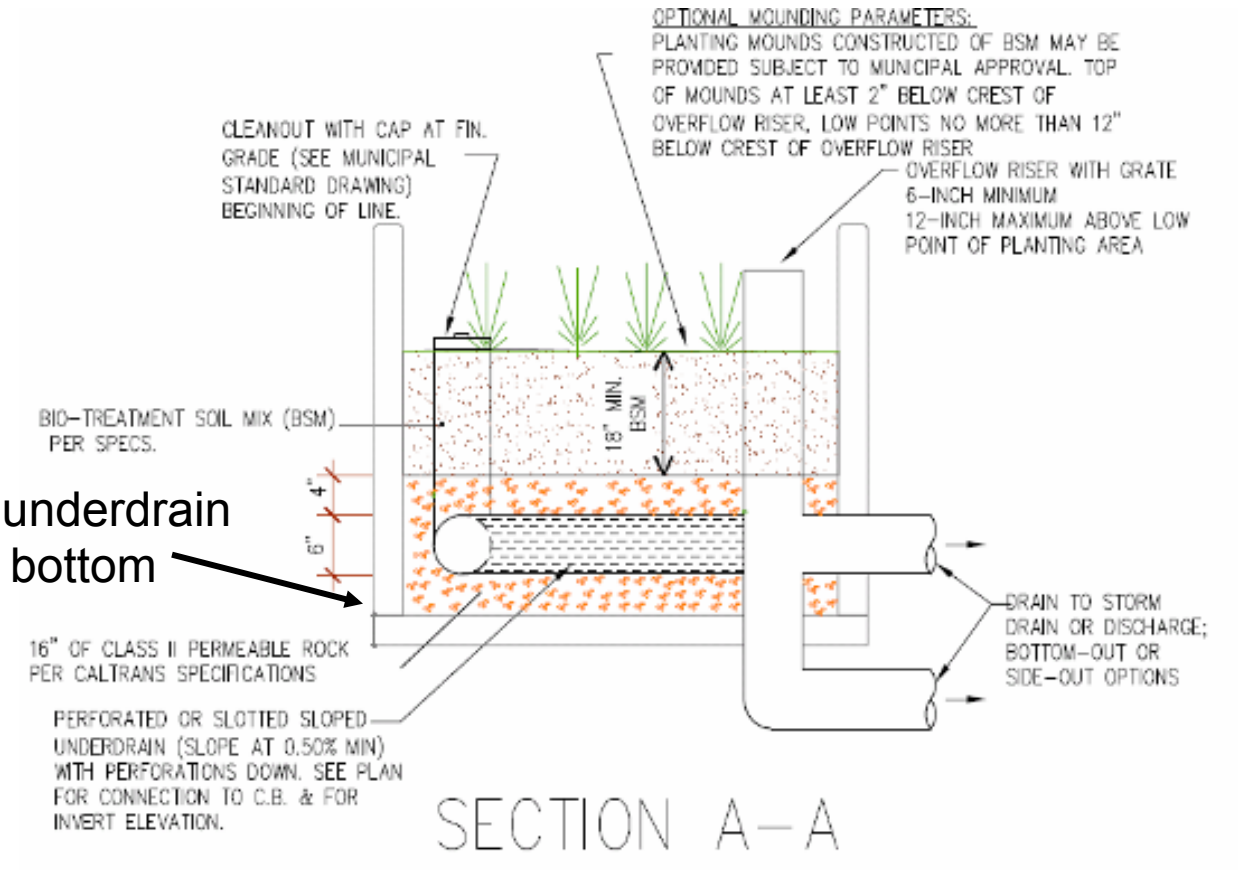
SAN MATEO COUNTYWIDE Water Pollution Prevention Program

Flow-through Planters



SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Flow-through Planter

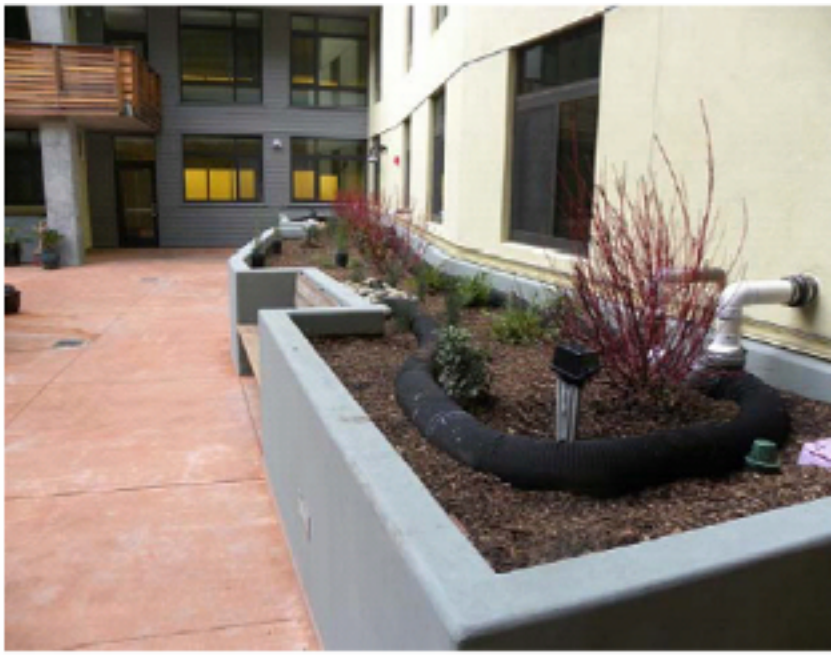


Place underdrain at bottom

SAN MATEO COUNTYWIDE
Water Pollution Prevention Program

Flow-through Planter

Use of a flow spreader helps distribute flow over the length of the planter

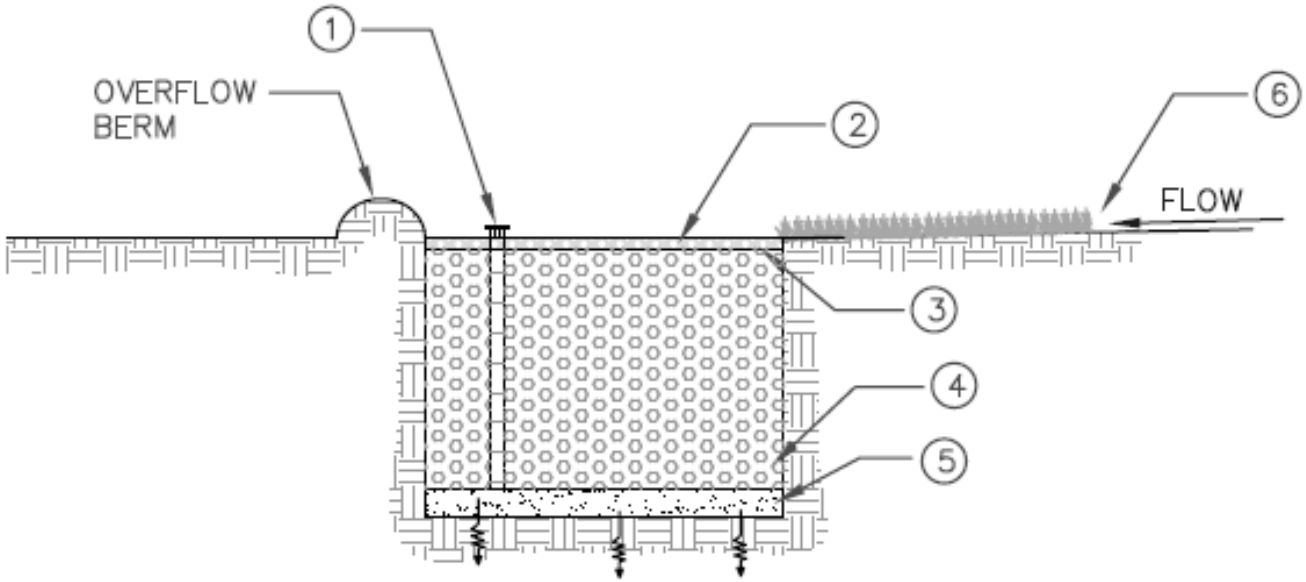


SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Infiltration Trenches

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Infiltration Trench



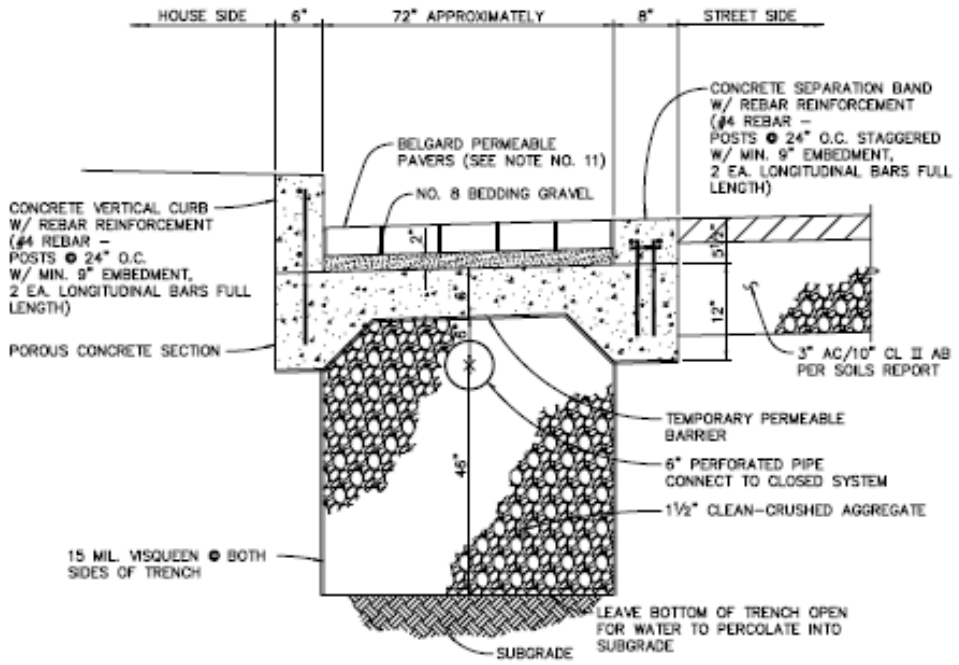
1 = Observation well
2 = Pea gravel filter layer (optional)
3 = Filter fabric on sides and bottom
4 = 3’ - 5’ deep trench with 2” – 6” diam. stone
5 = 6” deep sand filter layer or filter fabric
6 = Pretreatment in vegetated filter strip

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Permeable Pavement

Permeable Pavement

- Considered a site design measure so not included on inspection list; may inspect while on site
- May be combined with an infiltration trench



MEDIA INFILTRATION TRENCH W/ PAVERS

SCALE: N.T.S.

SAN MATEO COUNTYWIDE Water Pollution Prevention Program

Rainwater Harvesting

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Rainwater Harvesting

- Few large scale systems have been installed to date in the Bay Area
- Most systems have not been designed to meet stormwater treatment requirements (so do not need to be inspected for compliance with C.3.h)
- New rainwater harvesting system plumbing codes take effect January 1, 2014
- 2013 California Plumbing Code (Chapter 17) has information on maintenance and inspection:

  http://www.iapmo.org/Pages/2013CaliforniaPlumbingCode.aspx

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

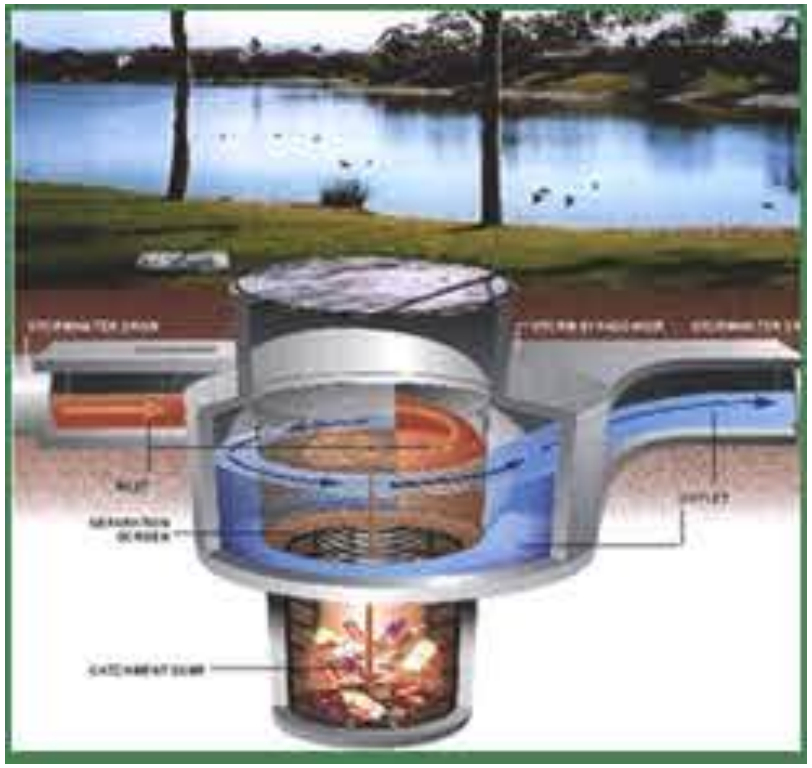
Vault-Based Treatment Measures

- Facilities are below grade
- "Out of sight, out of mind"
- More likely to have standing water
- May require confined space entry
- Manufacturers offer maintenance services

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Hydrodynamic Separators

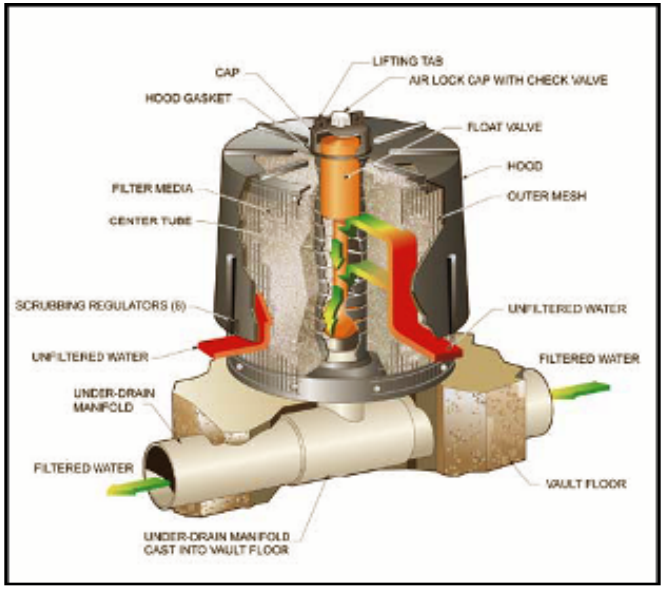
- Removes gross solids (e.g., trash) and large particles via centrifugal force
- Often contains standing water

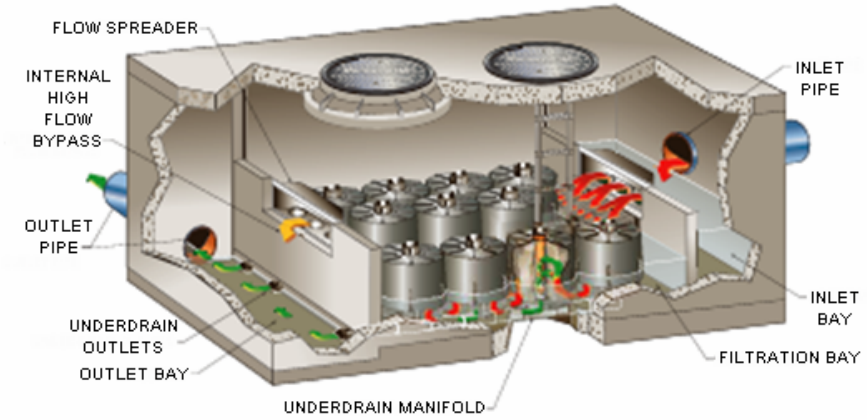


SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Media Filters

- Removes small particles and adsorbs pollutants (depending on media)
- Can have standing water in vaults if no underdrain
- Cannisters need replacement at specified intervals
- Since 12/1/11, allowed for use at Special Projects only





SAN MATEO COUNTYWIDE
Water Pollution Prevention Program

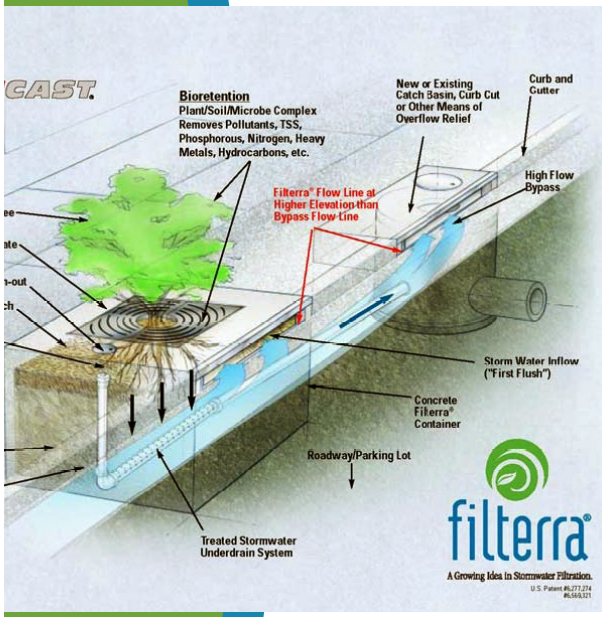
Inlet Filters

- Media filter trays that fit around the edge of a storm drain inlet
- Tendency to clog easily; need frequent maintenance
- Not approved for treatment by Regional Water Board

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Proprietary Tree Box Filters

- Infiltration rate of media exceeds biotreatment requirement
- Use may be allowed for Special Projects
- Tree box filters with bioretention soil media are considered LID



Other "Pre-LID" Treatment Measures

- Vegetated swales
- Detention basins

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Vegetated Swales

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Vegetated Swales

- Treat runoff via filtration through plants as water moves across the surface
- Treatment depends on detention time in swale
- Some swales have amended soil and underdrains

How do you know whether it is a swale or bioretention?

- Swales generally have inlet at one end and flush outlet at the other
- Swales have to have linear shape and slope
- Check the plan and detail! ("bioswale" may be either)

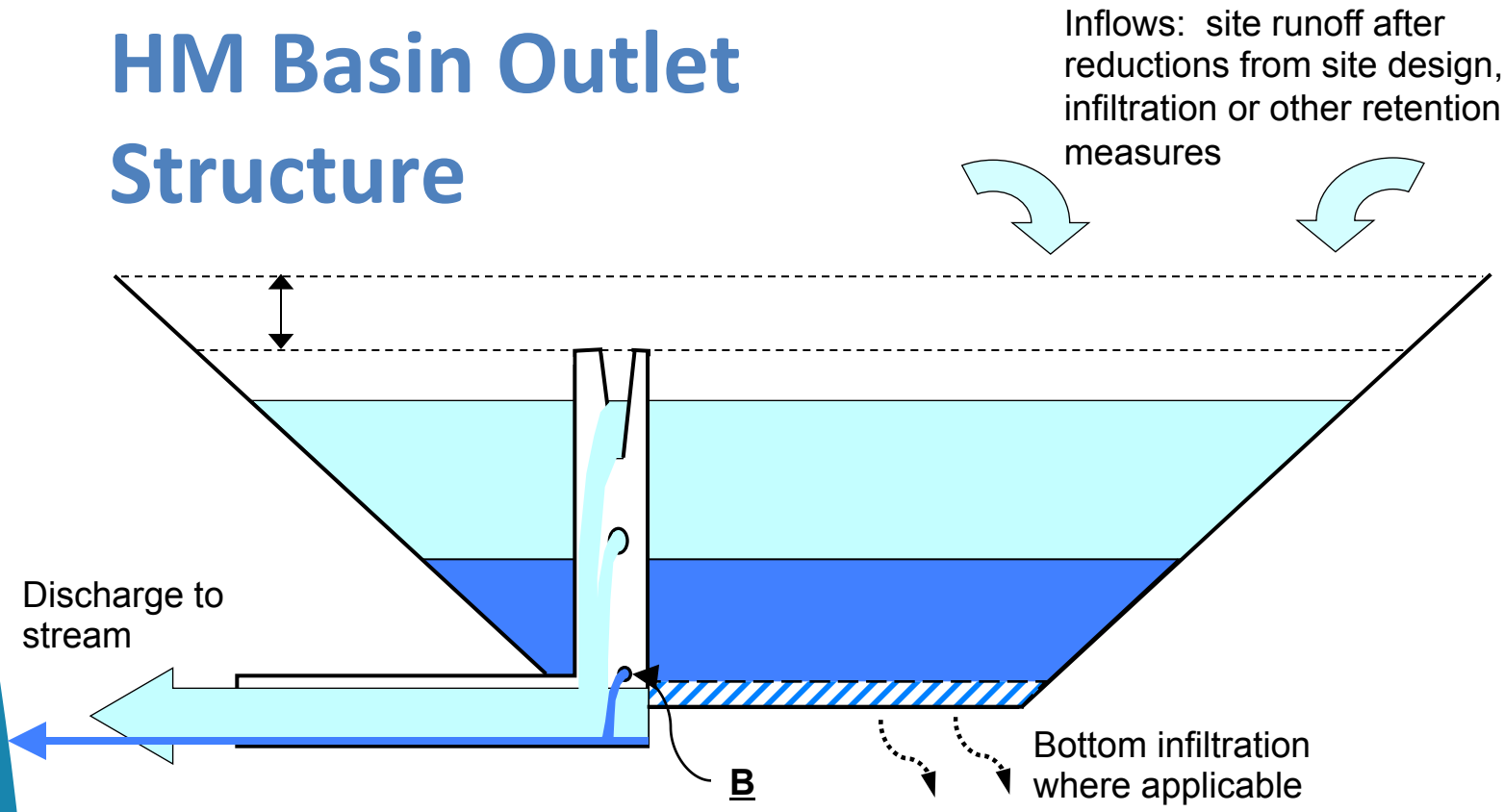
Detention Basins

- Treat runoff by detaining and allowing particle-bound pollutants to settle
- Some infiltration may occur through the bottom
- Can be designed for multi-purpose flood control, water quality and/or hydromodification

Hydromodification Management (HM) Facilities

- Provide detention and controlled outflow to meet pre-project flow conditions
- Detention can be in surface basins, subsurface vaults or large diameter pipes
- Outlet structures are key to proper performance; need to avoid clogging

HM Basin Outlet Structure



- Most outlet structures have a combination of weirs and orifices to achieve the pre- vs. post-project flow matching criteria

SAN MATEO COUNTYWIDE Water Pollution Prevention Program

For More Information…

- C.3 Technical Guidance Manual
  www.flowstobay.org
  (click on "Business", then "C.3")
  - Chapter 6 – Treatment Measures
  - Chapter 7 – HM Measures
  - Chapter 8 – Operation and Maintenance
  - Appendix G – Maintenance Plan Templates

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Questions?

Jill Bicknell

408-720-8811 x1

jcbicknell@eoainc.com

Peter Schultze-Allen

510-832-2852 x128

pschultze-allen@eoainc.com

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program