

Bioretention Measure Operation and Maintenance

IPM Workshop

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San Mateo Countywide
Water Pollution Prevention Program

Presentation Outline

- **Useful Bioretention O&M Resources**
- **IPM and Avoiding Pesticides in Bioretention Areas**
- **Introduction to Bioretention Measures**
- **10 Commonly Found Plants in Bioretention Measures**
- **Operation and Maintenance Defined**
- **Bioretention Operational Issues**
- **Bioretention Maintenance Issues**
- **Mulch and O&M Issues**
- **Example Maintenance Project**

Useful Bioretention O&M Resources

SMCWPPP Green Infrastructure Design Guide (2020)

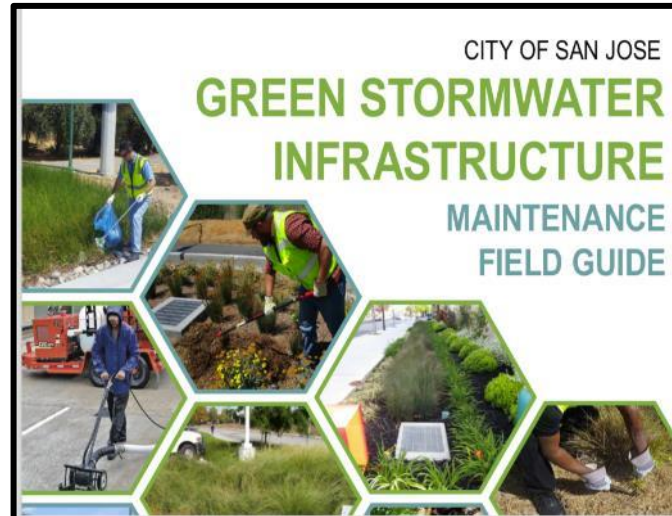
- <https://www.flowstobay.org/data-resources/resources/green-infrastructure-design-guide/>

San Jose GSI Maintenance Field Guide (2019)

- www.sanjoseca.gov/home/showdocument?id=40709

San Francisco GI Maintenance Guide Book (2018)

- <https://sfpuc.sharefile.com/share/view/sb83923c24cb4298a>



IPM & Avoiding Pesticides in Bioretention Areas



IPM Topics for Bioretention Areas

- **Understand how bioretention areas work**
 - Pesticides can exit system through underdrains
 - Pesticides can contribute to water quality issues
 - Pesticides can further dry out already dry soils
- **Know your plants - learn the top 10!**
 - Right plant, right place
 - Know your weeds
- **Pesticides kill beneficial insects and soil life**
- **Use compost and wood mulch to improve soils, reduce weeds, inoculate soil & fight soil disease**

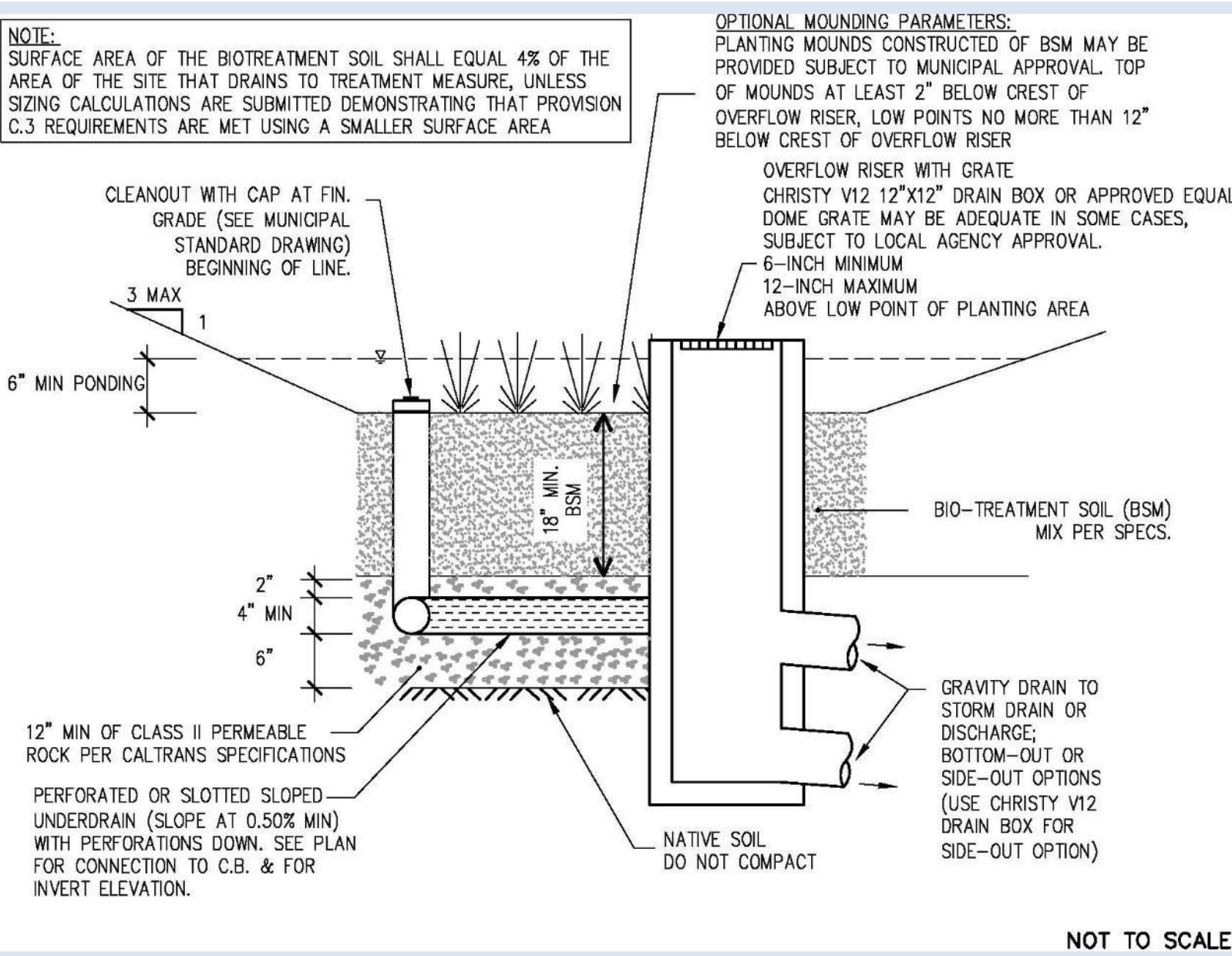
Overview of Bioretention Measures

- **Examples**
- **Cross-section detail**
- **Three types:**
 - Flow through planter
 - Basic bioretention area or Rain garden
 - Tree well filter

Bioretention Area Examples



Typical Bioretention Area Cross-section Detail



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 at bottom
- OK to place next to building or on podium if waterproofed



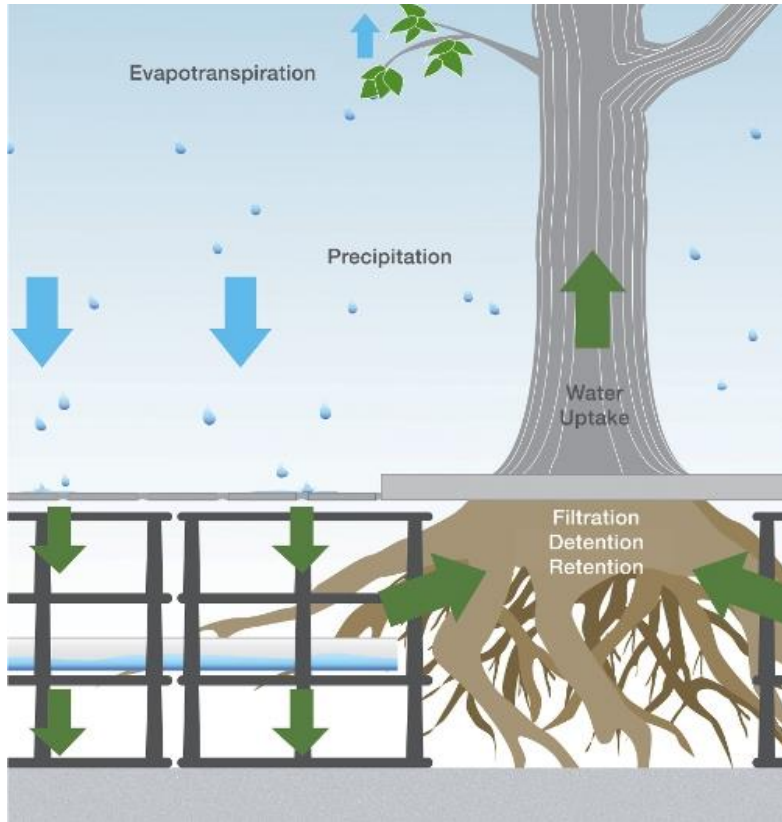
Photo courtesy of City of Burlingame

Bioretention Area/Rain Garden



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

Tree Well Filter



Plant Identification

- **Ten most common plants**
- **Three groups: Rushes, Grasses/Sedges and Flowers**
 - Rushes are round, grasses/sedges have edges, flowers are broadleaved
 - Rushes have hollow stems that easily die off when trimmed low
 - Grasses/sedges have evolved with grazing and regrowth
 - Sedges and bunch grasses can have shorter life spans and some can turn brown in summer without irrigation
 - Flowers have big leaves, big colorful flowers

Plant Identification

Rushes



Grasses/Sedges



Flowers



Common GI Plants and Care - Rushes

Juncus patens

CA Gray Rush

California Native

Evergreen perennial

Height & Width: 2' and spreading

Care: Remove dead stems only by way of dethatching by hand with rubber gloves. If live growth needs pruning, remove only tips (top 4-6 inches) in Spring (will be slow to recover). If plant is too big, lift plant, divide root ball, and plant (may be slow to recover).



Pinterest

Slide courtesy of
City of San Jose DOT

If possible – don't prune at all!

Common GI Plants and Care - Rushes

Chondropetalum tectorum

Cape Reed/Rush

Non-native from South Africa

Evergreen perennial

Height & Width: 3' to 4' H. & spread

Care: Remove dead stems only. If live growth needs pruning, remove only tips (top 4-6 inches) in Spring (will be slow to recover). If plant is too big, lift plant, divide root ball, and plant (may be slow to recover).



If possible – don't prune at all!

Common GI Plants and Care - Grasses

Carex tumulicola or *Carex divulsa*

Berkeley Sedge*

(*tumulicola* is a California native,
divulsa is from Europe)

Perennial, evergreen grass

Height & Width: 2' x 3'

**Care: Dethatch with rubber gloves;
divide larger plants in fall; will be
greener with more water – can turn
brown in summer without irrigation.**



*Nurseries may misidentify these two plants: they may call them both Berkeley Sedge or may refer to them as Foothill Sedge (*tumulicola*) or European Gray Sedge (*divulsa*)

Common GI Plants and Care - Grasses

Muhlenbergia rigens

Deer grass

California Native

Perennial, evergreen grass

Height & Width: 5' x 4'

Care: Deadhead spent flowers;
dethatch with rubber gloves; divide
larger plants in fall; greener with
more water.



Common GI Plants and Care - Grasses

Muhlenbergia capillaris

Hairy Awn Muhly

Some Muhlys are CA Natives

Perennial, evergreen grass

Height & Width: 4' x 3'

Care: Deadhead spent flowers;
dethatch with rubber gloves;
divide larger plants in fall;
greener with more water. White
flowered variety is native.



Shown: Pink Muhly – not native to CA

Common GI Plants and Care - Grasses

Festuca glauca

Blue Fescue

From Europe

Perennial, evergreen grass

Height & Width: 2' x 2'

Care: Deadhead spent flowers;
dethatch with rubber gloves; divide
larger plants in fall; greener with
more water



Common GI Plants and Care - Grasses

Lomandra hystrix 'Katie Belles'

Lomandra/Creek Mat Rush

From Australia

Evergreen perennial

Height & Width: 4' to 6' and spreading (other cultivars are smaller)

Care: Remove old/dead leaves. If plant is too big, lift plant, divide root ball, and plant (recovers well from pruning)



Common GI Plants and Care - Flowers

Achillea millefolium

Yarrow

Some are California natives

Evergreen perennial

Height & Width: 3' x 2' when in bloom & spreading

Care: Deadhead spent flowers, divide clumps as necessary. White flower variety (Common Yarrow) is CA native.



Common GI Plants and Care - Flowers

Penstemon heterophyllus

Foothill Penstemon

California native

Perennial herbaceous flower

Height & Width: 3' x 2'

**Care: Deadhead spent flowers;
remove dead growth**



Common GI Plants and Care - Flowers

Epilobium canum

California Fuchsia

California native

Perennial herbaceous flower

Height & Width: 3' x 2'

Care: Deadhead spent flowers;
remove dead growth



Typical O&M Issues

Remove Debris Blocking Inlets and Flow



Blocked Inlets continued...



Remove Trash/Leaves



Repair Eroded Areas – Add Splash Block



Repair Eroded Areas & Add Biotreatment Wood Mulch



Add BWM – Clear Blocked Outlet/Overflow- Add Plants



If More Biotreatment Soil Media (BSM) is Needed:

- **BSM = 60-70% sand + 30-40% compost**
- **BASMAA BSM Spec. (adopted and revised 2016)**
- **BSM Supplier List on Flowstobay website:**

<https://www.flowstobay.org/preventing-stormwater-pollution/with-new-redevelopment/c-3-regulated-projects/>

Plant Maintenance Tips/Questions

- **Know your plant - learn the top 10!**
- **Are more plants needed? 70% minimum coverage**
- **Is it a “weed” or a desired plant?**
- **What time of year is best to prune?**
- **Does it really need to be pruned?**
- **Are plants too close together?**
- **Should it be divided and replanted?**
- **How long does it live?**
- **Is it dormant or dead?**

6.4 Operations and Maintenance

Maintenance Quality Observation Levels



GIDG

MULCH APPLICATION

Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine
 	 	 
<p><i>Condition:</i> A 3-inch layer of mulch is maintained and kept at proper distances from shrub and tree plantings.</p> <p><i>Continued Action:</i> Twice yearly observation for adequate mulch coverage.</p>	<p><i>Condition:</i> The mulch layer is depleted. Mulch has been knocked or washed out of the landscape</p> <p><i>Immediate Actions:</i> Add or redistribute bark mulch where it has been reduced to less than 3 inches deep. Place mulch that has been knocked or washed out of planters back into place.</p>	<p><i>Condition:</i> Mulch layer is absent.</p> <p><i>Immediate Actions:</i> Add a 3-inch layer of mulch. If mulch was once present, determine if a new type of mulch is needed to ensure longevity.</p>

HAND WEEDING

Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine
 	 	 
<p><i>Condition:</i> Little to no weeds visible within the planting area, sidewalks, gutters and pavement.</p> <p><i>Continued Action:</i> Quarterly hand weeding, or as necessary.</p>	<p><i>Condition:</i> Several weeds can be found throughout the site.</p> <p><i>Immediate Actions:</i> Remove all visible weeds located in planted areas, sidewalks, gutters and pavement. Remove as much of the root system as possible. Dispose of weeds off-site.</p>	<p><i>Condition:</i> Landscape is overrun with weeds.</p> <p><i>Immediate Actions:</i> Remove all visible weeds by hand, if possible. Herbicides should be used only as a last resort. Use only the least toxic herbicides. Develop a plan with the Owner before use.</p>

PLANT COVERAGE

Good, Continue Maintenance Routine



Condition: Landscape achieves 100% plant coverage.

Continued Action: Monthly observation for proper coverage. Twice yearly plant addition in April and October, as necessary.

Mediocre, Modify Maintenance Routine



Condition: Landscape has about 70% plant coverage, achieving the minimum requirement for functionality.

Immediate Actions: If, by visual assessment, the planter is determined to have inadequate plant coverage, schedule the installation of additional plants. Refer to as-built drawings for plant species and size.

Poor, Overhaul Maintenance Routine



Condition: Landscape has less than 70% plant coverage.

Immediate Actions: Schedule the installation of additional plants. Refer to as-built drawings for plant species and size. Replace ill-adapted plants with a species better adapted to permanently altered environmental conditions.

PLANT HEALTH

Good, Continue Maintenance Routine



Condition: All plants are healthy, disease-free and suited to the environmental conditions.

Continued Action: Monthly site inspection for any plants that are dead, damaged, diseased, stressed or missing.

Mediocre, Modify Maintenance Routine



Condition: Few plants show signs of struggle, disease, pest-infestation or are broken.

Immediate Action: Analyze struggling plants for cause of struggle and correct. Remove struggling plants unlikely to recover or plants likely to infect surrounding plants. Replace with a healthy plant.

Poor, Overhaul Maintenance Routine



Condition: Plants are unhealthy, damaged, missing or dead.

Immediate Action: Analyze struggling plants for cause of struggle and correct, if possible. Remove struggling plants unlikely to recover or plants likely to infect surrounding plants. Replace with a healthy plant.

Maintenance Guidance - San Jose

Plant Density



4 Excellent Condition

- » 100% plant coverage at plant maturity*
- » Plants are appropriately spaced
- » No obstruction of inlets, overflow, or irrigation infrastructure

*Newly planted systems may not have full coverage, but systems must have full coverage after plant establishment and maturity

3 Good Condition

- » At least 90% plant coverage at maturity*
- » Some sporadic bare spots present (0-10%)
- » Most plants are appropriately spaced
- » Partial obstruction of one or more inlet, overflow, or irrigation system

2 Moderate Condition

- » At least 50% plant coverage at maturity*
- » Moderate number of small bare spots with no large, continuous bare spots (10-20%)
- » Significant obstruction of one or more inlets, overflows, or irrigation systems

1 Poor Condition

- » Less than 50% plant coverage at maturity*
- » Significant number of bare spots or large, continuous bare spots (more than 20%)
- » Full obstruction of one or more inlets, overflows, or irrigation systems

Maintenance Guidance - San Jose



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Tree Well Filter Maintenance

- Choose tree species appropriate for the space available and site.
- Regular/seasonal pruning should be scheduled.
- Disease/damaged trees, and those with poor structure, should be removed and replaced.
- Check irrigation system/needs during dry season.
- Remove stakes after two years.



Maintenance: 1 x Monthly

- Low traffic area
- Low pedestrian activity
- Single species
- Blends with natural area
- Plants & spray irrigation set back from concrete
- Easy cleanup & plant care
- Irrigation checked monthly
- After 6 years, plants dug up, divided, & replanted: 60% survival of replant



SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Slide courtesy of
City of San Jose
DOT



Maintenance: 2 x Monthly

- Low traffic (cul-de-sac)
- Low pedestrian volumes
- High long-term parking
- Five plant species
- Plants quickly crowded each other, causing greater maintenance
- Drip irrigation set on surface (under mulch)
- Challenging location
 - Adjacent properties are poorly maintained
 - Abandoned vehicles
 - Homelessness
- **Maintenance should be weekly**



SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Slide courtesy of
City of San Jose
DOT

**A bit about
plant
spacing...**

**Crowding =
Frequent
pruning**

Slide courtesy of
City of San Jose
DOT



**Maintenance
Frequency: Twice
Monthly**



Growth within two years

Appropriate spacing

Maintenance Examples from the Field

- Design with a simple palette limited to no more than 3 plant species per treatment area
- Align plants in rows for ease of maintenance
- Select plants with limited need for trimming or pruning



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Water Pollution
Prevention Program

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A simple plant palette (3 or less species)



Dormant plants in Summer



SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Greened up in Winter



Plant Pruning Example



Improper Pruning of Rushes



Results of Improper Rush Pruning



Standing Water in Landscape



Standing Water on Impervious Surfaces



Vector Control District Coordination

- If you see standing water in bioretention areas, you may want to contact the San Mateo County Mosquito & Vector Control District for mosquito control: www.smcmvcd.org
- The District has a list of installed stormwater treatment systems for each jurisdiction



Mulch and O&M

Mulch Topics

- **What's the best kind mulch? – Depends on several factors such as site and design**
- **When to use rock mulch**
- **Keep a 3-inch depth**
- **Reduces weed growth**
- **Wood mulch improve soils, reduce weeds, keeps soil moist, cools plants, helps with SB 1383**
- **Composted wood mulch floats less and inoculates soil**

Best Type: Composted Wood Mulch
New Term:
Biotreatment Wood Mulch (BWM)

**New Specification – posted on C.3 Page of
Flowstobay Website**

**[https://www.flowstobay.org/preventing-
stormwater-pollution/with-new-
redevelopment/c-3-regulated-projects/](https://www.flowstobay.org/preventing-stormwater-pollution/with-new-redevelopment/c-3-regulated-projects/)**

Mulch Types

Wood Mulches:

- Arbor Mulch (uncomposted)
- Composted Wood Mulch (BWM)

Rock Mulches (only when really needed):

- Gravel (small)
- Medium-sized rock
- Cobble (large)

Uncomposted Arbor Mulch



Composted Arbor Mulch



Gravel Rock Mulch (Small)



Cobble (Large) and Medium-sized Rock



Design Types



Off-line design with trench drains



In-line design with Splash Apron and Cobbles

Protecting Plants

Protect system during plant establishment period



ReScape California



Use ReScape's regenerative landscaping principles and related practices such as:

- Use compost and mulch in stormwater bioretention areas
- Compost and mulch should be applied to landscapes to maintain soil organic matter, improve water-holding capacity, inoculate soil biota and provide the other benefits

Example of Bioretention Area Maintenance Tasks

**County of San Mateo
Maple Street Correctional Center**



At a ReScape O&M training, the attendees renovated a bioretention area in the parking lot to remove weeds, check and fix the irrigation system, prune plants, replace dead plants, and replenish compost and mulch

County of San Mateo



Compost



Composted
Wood Mulch

Contamination in mulch and compost can be an issue.





Finished project

Discussion

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