Best Practices for Plant and Tree Care in Bioretention Areas

C.3 Training
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San Mateo Countywide
Water Pollution Prevention Program

Presentation Outline

- Useful Bioretention Resources
- Overview of Bioretention Measures
- Typical Bioretention Maintenance Issues
- Regenerative Landscaping Principles
- Maintenance Projects From the Field
- New Approach for Identifying Plants
- Twelve Commonly Found Plants
- Salt Tolerance (Recycled Water)
- Trees and GI
- Mulch Overview
- Example Maintenance Tasks
- “Cost-Effective” GSI Maintenance

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Useful Bioretention Resources

SMCWPPP C.3 Regulated Projects Guide (2023)

www.flowstobay.org/preventing-stormwater-pollution/with-new-redevelopment/c-3-regulated-projects/#c3

SMCWPPP Green Infrastructure Design Guide (2024)

www.flowstobay.org/wp-content/uploads/2024/05/SMCWPPP_GIDG-3rd-Edition-2024_web.pdf

San Jose GSI Maintenance Field Guide (2019)

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

SCVURPPP GSI Vegetation Guide (2023)

www.scvurppp.org/2023/06/30/green-stormwater-infrastructure-vegetation-guide/

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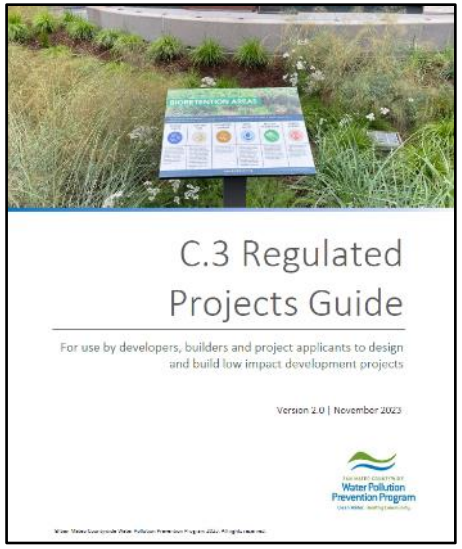

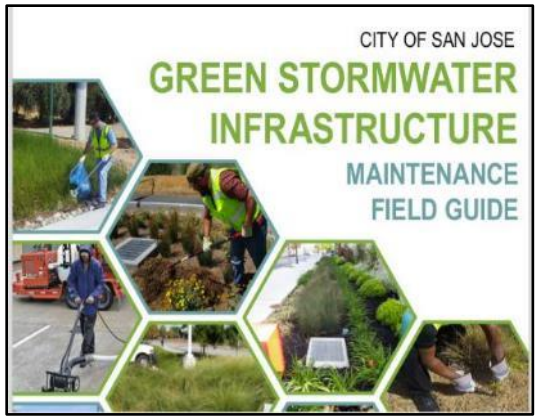

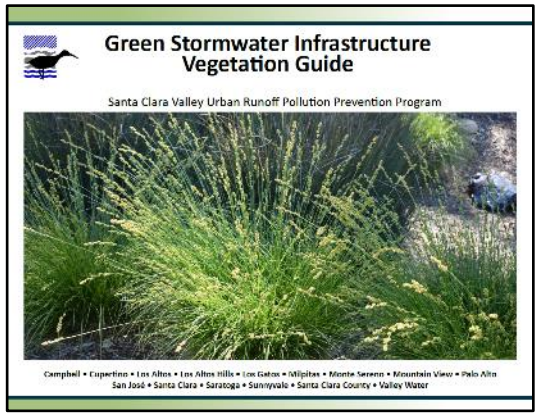

Overview of Bioretention Measures

- **C/CAG Sustainable Streets**
- **Plan view detail**
- **Cross-section detail**
- **Examples**
- **Three types:**
  - Bioretention area (or Rain garden)
  - Flow through planter
  - Tree well filter

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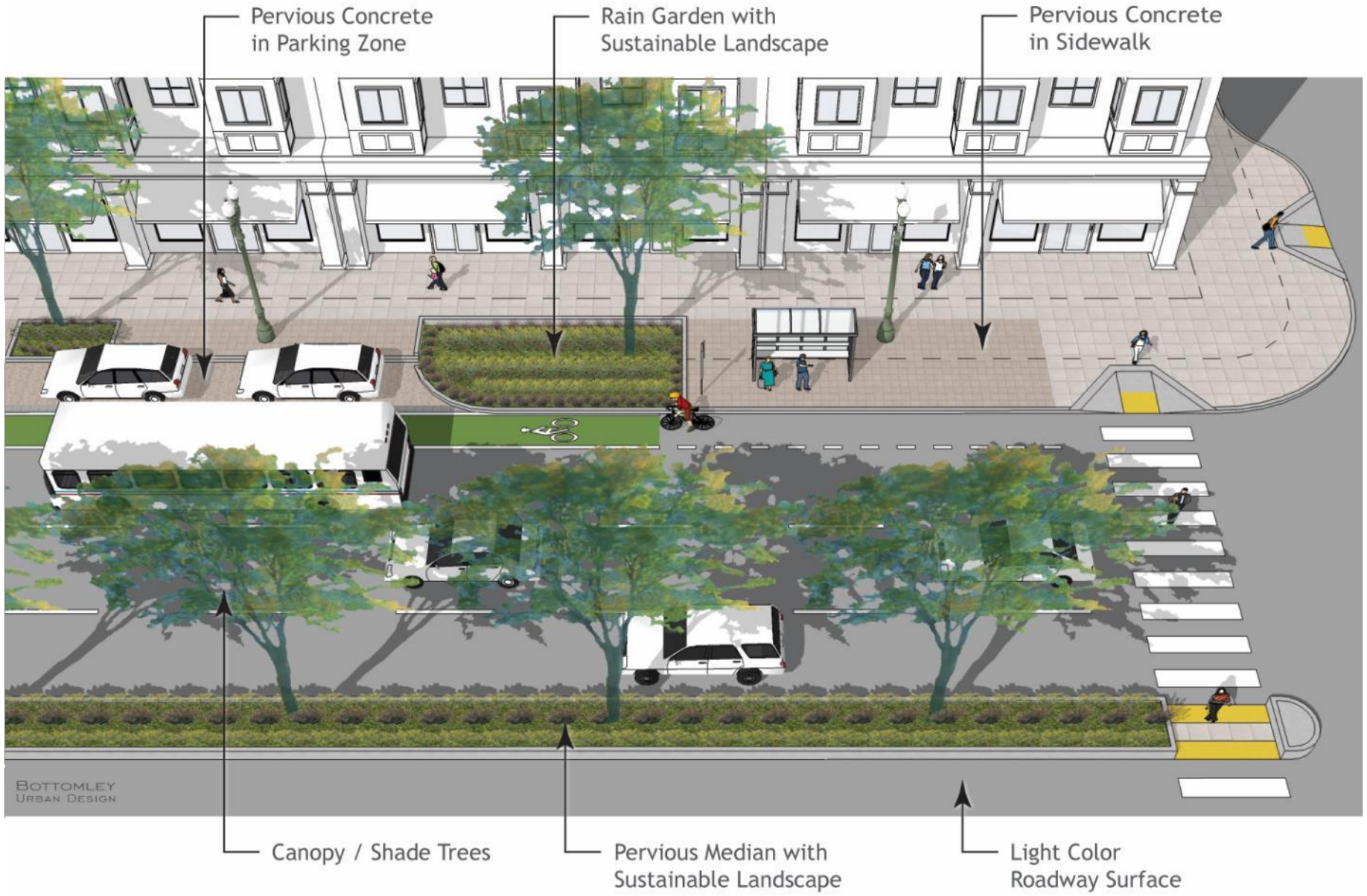
Pervious Concrete
in Parking Zone
Rain Garden with
Sustainable Landscape
Pervious Concrete
in Sidewalk
Bottomley
Urban Design
Canopy / Shade Trees
Pervious Median with
Sustainable Landscape
Light Color
Roadway Surface

Bioretention Design - Overview

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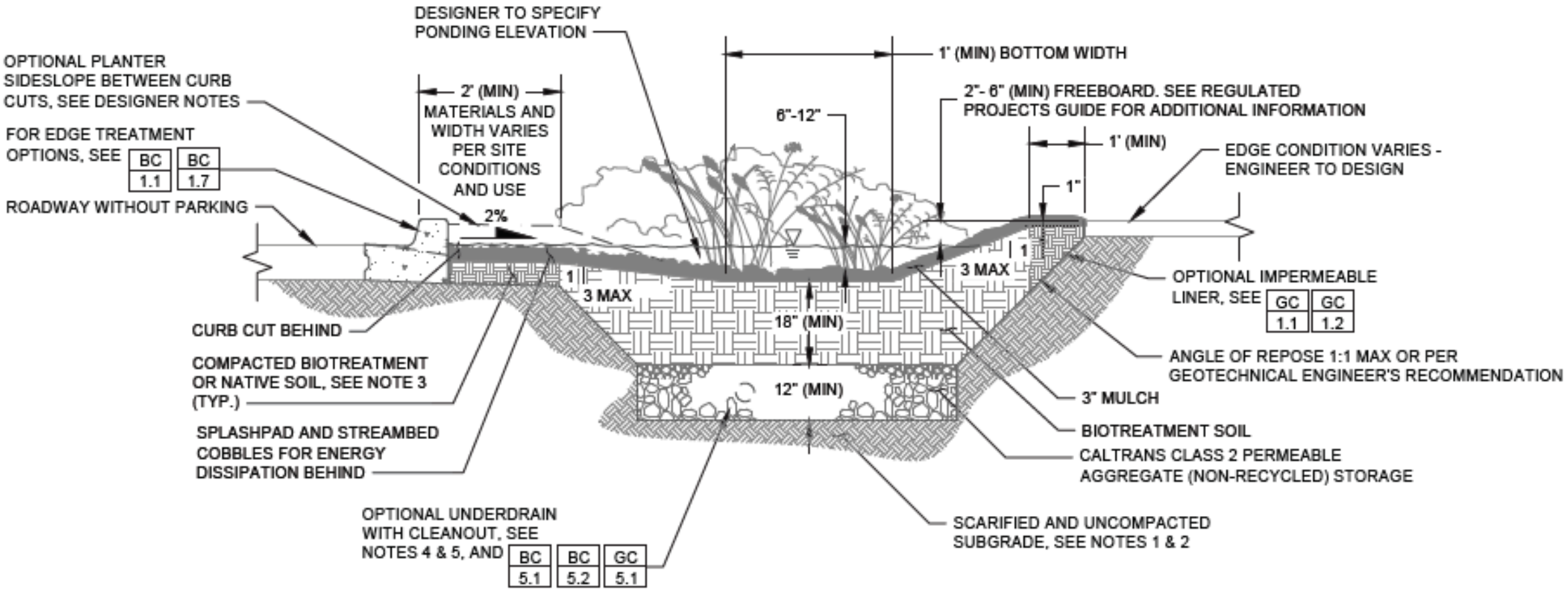
***Source:** Alameda Countywide Clean Water Program*

Typical Bioretention Area Cross-section Detail



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From GIDG Typical Details

Bioretention Area Examples

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Typical Bioretention Maintenance Issues

- Remove trash, blockages & sediment
- Remove weeds
- Maintain minimum 3” biotreatment wood mulch (BWM) or rock mulch
- Replace dead or missing plants
- Look for erosion – replace biotreatment soil media (BSM)
- Check irrigation system
- Prune plants
- Remove flow blockages
- No standing water for more than 1 day

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Biotreatment Soil Media (BSM)

- **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/

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Regenerative Landscaping in Bioretention Measures

ReScape California (Formerly Bay-Friendly)

ReScape California's holistic and regenerative landscaping principles include:

- Using climate-appropriate vegetation and minimizing planting of intensive-resource landscapes such as turfgrass
- Using compost and mulch enhances fertility, soil structure, and improves nutrient and water retention; they inoculate the soil with beneficial organisms, and provide other benefits
- More information at: www.rescapeca.org

Regenerative Bioretention Measure Maintenance

- **Know your plants**
  - Identify the plant or at least know how its maintained
  - Right plant in the right place reduces pruning and waste
  - Know your weeds and what they are telling you
- **Avoid pesticides and synthetic fertilizers**
  - Can kill beneficial insects and soil life
  - Can impact water quality discharges
- **Use compost and wood mulch**
  - Improve soils, reduce water consumption and weeds
  - Inoculate soil and improve plant health

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Maintenance Examples from the Field – San Jose

- **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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Slide courtesy of
City of San Jose DOT

A simple plant palette (3 or less species)

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City of San Jose DOT

Dormant plants in Summer - Emeryville

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Greened up in Winter

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Plant Pruning Example

A newly installed bioretention measure with two types of rushes

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Improper Pruning of Rushes

One year later, improper <u>and unnecessary</u> pruning of rushes leads to poor plant health issues

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Results of Improper Rush Pruning

Two years later, repeated pruning has led to almost complete plant failure

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New Approach to Plant Identification

- **Focus on the most common plants**
- **Three plant "maintenance groups": Rushes, Grasses and Flowers**
  - Rushes stems are round (solid or hollow)
  - Rushes do not respond well to pruning – the whole plant can die
  - Grasses leaves are flat (edges) and have evolved with grazing and regrowth
  - Grasses can turn brown in summer without irrigation
  - Flowers are broadleaved and have bigger colorful flowers
  - Flowers may need to have blooms removed (aka, deadheaded) after they wilt

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*Botanically speaking, all three of these groups of plants have flowers, but for the purposes of our three "maintenance groups", we are using "Flowers" to mean the group with large, very noticeable flowers.

Identify Plants Using “Maintenance Groups”

Rushes

Sedges/Grasses

Flowers

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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. If live growth needs pruning, remove only tips (top 4-6 inches).

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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’

Care: Remove dead stems only. If live growth needs pruning, remove only tips (top 4-6 inches).

If possible – don’t prune at all!

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Common GI Plants and Care - Grasses

Carex tumulicola or Carex divulsa

Berkeley Sedge*

(tumulicola is a California native, divulsa is European)

Perennial, evergreen grass

Height & Width: 2’ x 3’

Care: Dethatch with rubber gloves; greener with more water – can turn brown in summer without irrigation.

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*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.

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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; greener with more water. White flowered variety is native.

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Common GI Plants and Care - Grasses

Festuca idahoensis* or *F. glauca
Blue Fescue

Idaho is native, glauca European

Perennial, evergreen grass

Height & Width: 2’ x 2’

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

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*These plants look very similar in the field and nurseries may misidentify them. Typically, Blue Fescue is F. glauca and Idaho Fescue is F. idahoensis. Only the Idaho Fescue is native.

Common GI Plants and Care - Grasses

Lomandra hystrix

Lomandra/Creek Mat Rush

From Australia

Evergreen perennial

Height & Width: 4’ to 6’

Care: Remove old/dead leaves or shear down to 6” (recovers well from pruning)

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Common GI Plants and Care - Grasses

Elymus condensatus

Giant Wild Rye

CA Native (Southern CA)

Evergreen perennial

Height & Width: 3’ to 3’

Care: Remove dead stems at base.

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Common GI Plants and Care - Flowers

Achillea millefolium

Common 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 is CA native.

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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

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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

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Common GI Plants and Care - Flowers

Ceanothus thyrsiflorus
Creeping Wild Lilac

California native

Perennial herbaceous flower
Height & Width: 10’ x 3’

Care: Deadhead spent flowers; remove dead growth

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Plants to Use with Recycled Water Irrigation (Salt)

Scientific Name	Common Name	Salt Tolerance	WUCOLS	Guide Type	Native
Achillea millefolium	Common Yarrow	High	Low	Flower	Native
Chondropetalum tectorum	Cape reed	High	Low	Rush	-
Elymus condensatus	Giant Wild Rye	High	Low	Grass	Native
Epilobium canum	California fuchsia	High	Low	Flower	Native
Juncus patens	California gray rush	High	Low	Rush	Native
Lomandra longifolia	Lomandra	High	Low	Flower	-
Muhlenbergia capillaris	Hairy awn muhly	High	Low	Grass	-
Muhlenbergia rigens	Deer grass	High	Low	Grass	Native

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Review: Bioretention Plant Maintenance Tips and Questions

- Know your plant - learn the top 12!
- Are more plants needed? 70% minimum coverage
- Is it a “weed” or a desired plant?
- What time of year is best to prune and weed?
- Does it really need to be pruned at all?
- Are plants too close together?
- Should it be divided and replanted?
- How long does it live?
- Is it dormant or dead?

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CHAPTER 6

6.4 Operations and Maintenance

Maintenance Quality Observation Levels

MULCH APPLICATION

Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine
		
Condition: A 3-inch layer of mulch is maintained and kept at proper distances from shrub and tree plantings.	*Condition:* The mulch layer is depleted. Mulch has been knocked or washed out of the landscape	*Condition:* Mulch layer is absent.
Continued Actions: Twice yearly observation for adequate mulch coverage.	*Immediate Actions:* 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.	*Immediate Actions:* Add a 3-inch layer of mulch. If mulch was once present, determine if a new type of mulch is needed to ensure longevity.

HAND WEEDING

Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine
		
Condition: Little to no weeds visible within the planting area, sidewalks, gutters and pavement.	*Condition:* Several weeds can be found throughout the site.	*Condition:* Landscape is overrun with weeds.
Continued Action: Quarterly hand weeding, or as necessary.	*Immediate Actions:* 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.	*Immediate Actions:* 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.

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PLANT COVERAGE

Good, Continue Maintenace 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.

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Design Considerations for Tree Well Filters

- Different from bioretention with small plants
- Involve additional staff – arborists, urban foresters
- Plan for growth of tree and changes over time
- Structural pruning is important – especially in early years
- Provide for root growth and avoid heaving pavement with more soil
- Plan for irrigation needs and droughts
- Consider using a different soil media or access to other soils
- Consider tree species that can handle dry & wet “feet” (roots)
- Limited water-holding capacity of typical Biotreatment Soil Media (Sand/compost)
- Is there native soil (clayey) behind sidewalk that can be accessed
- Tree specie(s) selected
- Depth of curb walls – restricting root growth
- Underground pipes – use a trash capture device at the inlet

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Tree Well Filter Challenges

- Finding, providing and/or accessing sufficient rootable soil volume
- Providing sufficient uncompacted soils
- Helping tree roots access soil with better water-holding capacity (e.g., clayey soils in the Bay Area)
- Water holding capacity in sandy media when tree is mature/large
- Permeability demands of Tree Well Filter and stormwater hydraulic sizing criteria (e.g., system footprint)
- Funding for higher cost of tree well filter installation (Silva Cells)
- Maintenance timing is different from small plant GI maintenance since small plants mature faster (structural pruning is very important in the first ten years)

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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.

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Mulch and O&M

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Problem: Mulch Blocking Outlet/Overflow

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Understanding Mulch

- **Purpose of mulch**
  - Reduces weed growth (IPM!)
  - Conserves water by minimizing soil dehydration
  - Keeps soil cool
  - Inoculates soil with beneficial organisms – fighting soil disease
  - Reduces soil erosion
- **Depth of mulch**
  - 3 inches is required in California for water-efficient landscaping and conservation
- **Mulch considerations**
  - Depends on site and design
  - Wood mulch
    - Improves soil
    - Holds moisture
    - Needs periodic replacement
- **Rock mulch**
  - Prevents erosion
  - Can heat up soil
  - Doesn’t improve soil
  - Can make weeding difficult
  - Potential vandalism (cobble)

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Mulch Types

- **Wood Mulch (recommended):**
  - Uncomposted Wood Mulch
  - Composted Wood Mulch
- **Rock Mulch (only when really needed):**
  - Gravel (small)
  - Medium-sized rock
  - Cobble (large)
- **Combination (option):**
  - Rock mulch can be used in the flow line with wood mulch on the sloped sides
  - Jute netting can also be used to temporarily hold the mulch in place until plants are established

The Bioretention Measure Design Affects the Mulch Choice

Off-line design with trench drains & wood mulch

In-line design with Splash Apron and Cobbles

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Composted Wood Mulch Benefits

The composting process provides benefits:

- Inoculates mulch and soil media with beneficial organisms
- Holds more water
- Floats less (heavier and less resinous)
- Less flammable
- Reduces pathogens that might be in the mulch like Sudden Oak Death (Phytopthora ramorum)

The Biotreatment Wood Mulch (BWM) Specification can be downloaded from the SMCWPPP website:

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

Uncomposted Arbor Mulch

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Composted Arbor Mulch

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Gravel Rock Mulch (Small)

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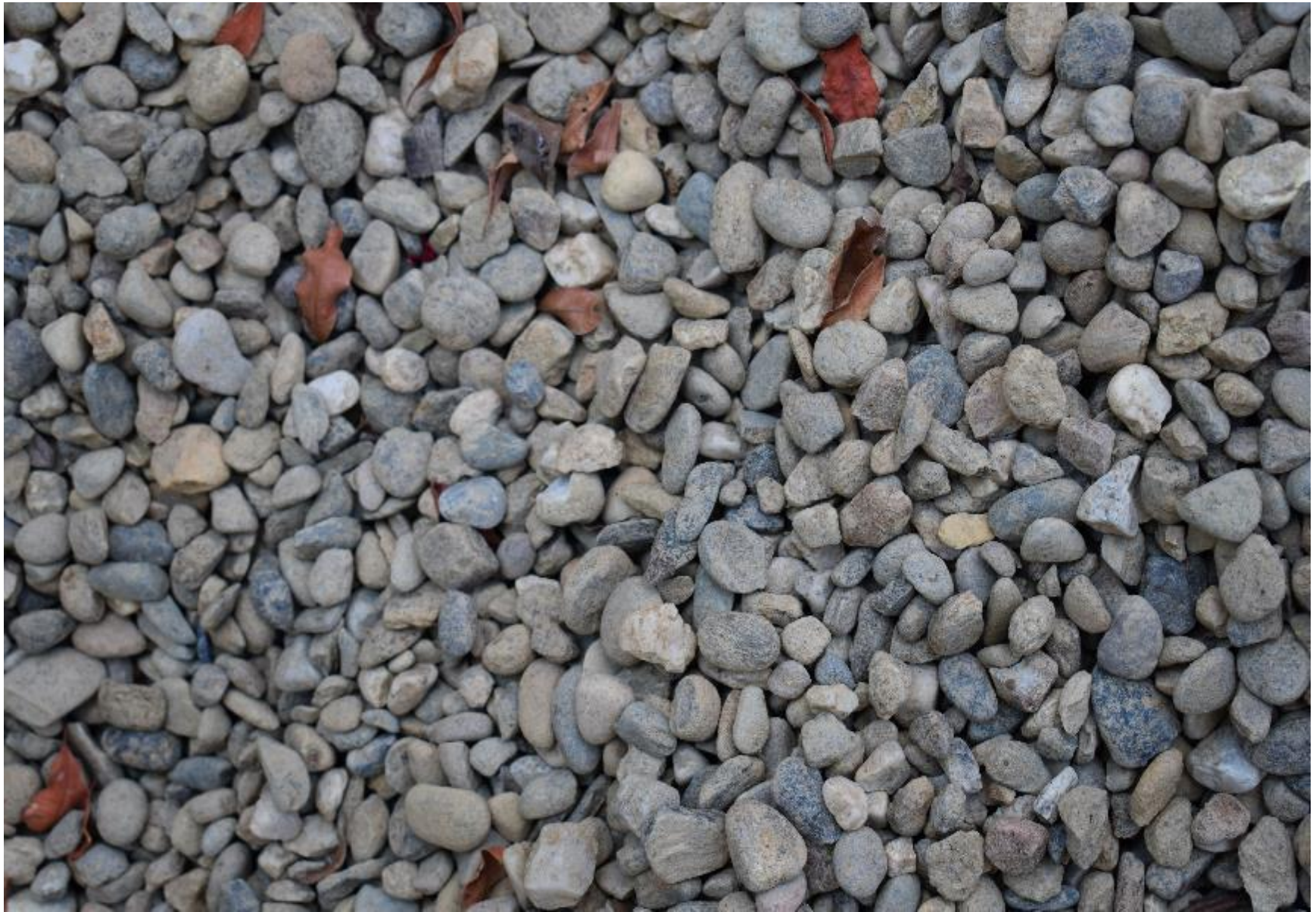
Rock Mulch (Medium)



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Rock Mulch (Medium and Large - Cobble)

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Combination Wood and Rock Mulch Design

Where space allows and when you have sloped sides, a combination of rock mulch in the flow line and wood mulch on the sides can be used

Protecting Plants

Protect system during plant establishment period

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Example of Bioretention Area Maintenance Tasks

County of San Mateo
Maple Street Correctional Center

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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

Compost

Composted
Wood Mulch

Contamination (plastic) in mulch and compost can be an issue, but if you require the composted mulch meet the new BWM spec, that can help.

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Finished project

“Cost-Effective” Bioretention Area Maintenance

Bioretention areas typically use small plants and mulch which can require manual labor. Minimize costs with these tips:

- **Mulch: use more composted wood mulch (3”-6” depth)**
- **Cobble: avoid - use splash blocks instead**
- **Plants: avoid unnecessary plant pruning, right plant in right place, use long-life plants, simple planting plans, remove weeds quickly, use gopher-resistant plants, use mechanized tools if appropriate**
- **Irrigation: place drip emitters carefully and use eco-indicators**
- **Trees: Lower maintenance cost than small plants? Cooling benefits!**

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Mimulus aurantiacus – Sticky Monkey Flower