DEVELOPMENT AND REMODELING PROJECTS

Storm Water Best Management Practices for Single-Family Homes on Small Lots

Chapter 6A of the Best Management Practices Manual for the City's Storm Water Management Program

Planning Department

Public Works Department

809 Center Street, Santa Cruz, CA 95060

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APPENDICES

DEFINITIONS

Best Management Practice (BMP) - Any program, technology, process, operational methods or measures, or engineered systems, which when implemented prevent, control, remove, or reduce pollution.

Impervious Surface – A hard, non-vegetated surface area that prevents or significantly limits the entry of water into the soil mantle, as would occur under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater.

Low Impact Development (LID) – A stormwater and land use management strategy that strives to mimic pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation, and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design.

New Development – Land disturbing activities that include the construction or installation of buildings, roads, driveways and other impervious surfaces. Development projects with pre-existing impervious surfaces are not considered New Development.

Permeable or Pervious Surface – A surface that allows varying amounts of stormwater to infiltrate into the ground. Examples include pasture, native vegetation areas, landscape areas, and permeable pavements.

Redevelopment/Remodel – On a site that has already been developed, construction or installation of a building or other structure subject to planning and building authority including: 1) the creation or addition of impervious surfaces; 2) the expansion of a building footprint or addition or replacement of a structure; or 3) structural development including construction, installation or expansion of a building or other structure. It does not include routine road maintenance, nor does it include emergency construction activities required to immediately protect public health and safety.

Replaced Impervious Surface – The removal of existing impervious surfaces down to bare soil or base course, and replacement with new impervious surface. Replacement of impervious surfaces that are part of routine road maintenance activities are not considered replaced impervious surfaces.

CHAPTER 1.

Why Low-Impact Development?

Pre-urban Conditions

Before urban development in the Central Coast, as much as 50% of rainwater was infiltrated into the soil, replenishing groundwater supplies, contributing to stream flows and sustaining vegetation; another 40% was released into the atmosphere through evapotranspiration. Only about 10% of rainwater contributed to stormwater runoff (rainwater that flows over the land surface).

Urban Development Impacts

Today, our urban landscape has more impervious surfaces (hard surfaces that do not allow water to pass through) such as roofs, streets, sidewalks and parking areas. The increase in impervious surface areas has significantly increased the amount and rate of storm water runoff. These increased storm water flows can cause flooding and increase soil and stream channel erosion. Additionally, runoff from urban areas also carries other pollutants such as pesticides, bacteria, oils, metals, and trash that can impact aquatic habitats and make waters unsafe for recreational use and wildlife.

Low-Impact Development Goals: Reduced Storm Water Flows, Improved Water quality and Ecosystem Health

The use of Low Impact Development (LID) strategies can help to protect and enhance the environmental quality of our rivers, creeks and watersheds. LID is a site design approach that uses techniques to slow and infiltrate storm water, mimicking the natural, pre-development hydrology. LID design strategies can be applied to most new or redevelopment projects to meet storm water regulations reduce downstream flooding and protect natural resources.

How does LID Work?

In low-impact development, the management of rain water is considered and incorporated in the initial design of a project. Hydrology, existing site topography, and natural features that influence water movement on the site are considered in the layout of structures on the property so as to slow, store, and infiltrate rain water onsite.

LID strategies focus on intercepting, evaporating, and infiltrating stormwater onsite through areas of native vegetation and soils, and through practices such as directing runoff to landscaped areas, bioswales and raingardens, using rain barrels, or installing pervious pavement or green roofs.

Benefits of LID for the Home-owner

- Reduced irrigation water use
- Low maintenance and attractive landscaping that uses native plants able to survive in wet and dry soils
- Increased aesthetics of neighborhoods

Benefits of LID for the Community

- Reduced pollution in storm water runoff to our rivers and the Monterey Bay
- Reduced amount of trash washed into drainage systems and into our rivers and the Bay
- Reduced flooding and erosion in creeks

CHAPTER 2.

Mandatory BMP Requirements

State and federal storm water regulations require new development and remodeling projects in the City to incorporate design standards and Best Management Practices (BMPs) in order to ensure that pollutant discharges are reduced to the Maximum Extent Practicable and storm water discharges are prevented from causing or contributing to a violation of receiving water quality standards. The City developed these mandatory BMPs for single-family home projects on small lots based on the Post-Construction Storm Water Management Requirements for Development Projects in the Central Coast Region adopted by the Regional Water Quality Control Board in Resolution No. R3-2013-0032.

This document also provides guidance on how to meet the mandatory BMP requirements through site planning and Low-Impact Development (LID) design.

Please contact the Public Works Environmental Project Analyst at 420-5160 if you have questions on how to meet these requirements.

2.1. APPLICABILITY

These mandatory BMPs apply to all single-family home development and remodeling projects that create or replace less than 15,000 square feet of impervious area. Single-family home projects that create or replace over 15,000 square feet of impervious area and other development or redevelopment projects are covered under Chapter 6B, BMP Requirements for Private and Public Development Projects.

2.2. REQUIREMENT: SITE DESIGN AND RUNOFF REDUCTION

A. Site Planning

LID design principles must be incorporated in the site planning and design process from the beginning and should include the steps below:

1) Conserve natural areas and preserve riparian areas and wetlands. All development and remodeling projects adjacent to a river, creek or wetland shall comply with the requirements specified in the **City-wide Creeks and Wetlands Management Plan**.

2) Concentrate improvements on the least-sensitive portions of the site, while leaving the remaining land in a natural undisturbed state.

3) Minimize storm water runoff. One or more of the following site design measures may be used to minimize storm water runoff where appropriate:

   a) Direct roof runoff into cisterns or rain barrels for reuse.

   b) Use pervious pavements such as crushed aggregate, turf block, unit pavers, pervious concrete or pervious asphalt in place of impervious concrete or asphalt paving. Pervious pavements may be used to construct driveways, uncovered parking areas, walkways, and patios.

B. Disperse and Infiltrate Runoff

Disperse runoff to adjacent pervious areas to the extent slopes, soils, and available area allow.

Generally the impervious: pervious ratio should not exceed 2:1.

1) Use drainage as a design element. Vegetated buffers and rain gardens can serve as both effective LID measures and attractive site amenities or focal points. Direct roof downspouts to landscaped areas or raingardens in lieu of hard piping to the street or storm drain system. Downspouts should be directed onto vegetated areas safely away from building foundations and footings, consistent with California building code.

2) Grade paved areas to sheet flow to adjacent landscaped areas or rain gardens where appropriate.

C. Drainage and Landscape Planning

1) Maintain existing topography to encourage dispersed flow.

2) Convey runoff safely from the tops of slopes and stabilize disturbed slopes.

3) Plant slopes with native or drought tolerant vegetation, as appropriate.

4) Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, or conduits that enter unlined channels to minimize erosion

D. Low-Impact Development Checklist

Sites creating or replacing over 2,500 SF of impervious surface are required to fill out and submit the Site Design Checklist in Appendix A with Building Permit applications.

2.3. LID DESIGN GUIDE

The "Slow it. Spread it. Sink it! A Homeowner's Guide to Greening Stormwater Runoff" booklet published by the Resource Conservation District of Santa Cruz County has been designed to provide information on practical and eco-friendly ways to protect homeowners' property and the environment from the effects of storm water runoff.

Specific design guidance for pervious pavement and rain gardens is also provided on the following pages.

PERVIOUS PAVEMENTS

STORM WATER BENEFITS:
- ✓ Runoff Reduction
- ✓ Runoff Retention

ADVANTAGES:
- Can be used in areas with limited landscaping

LIMITATIONS:
- Potential geotechnical concerns in clay soils
- Pavement strength and surface integrity considerations

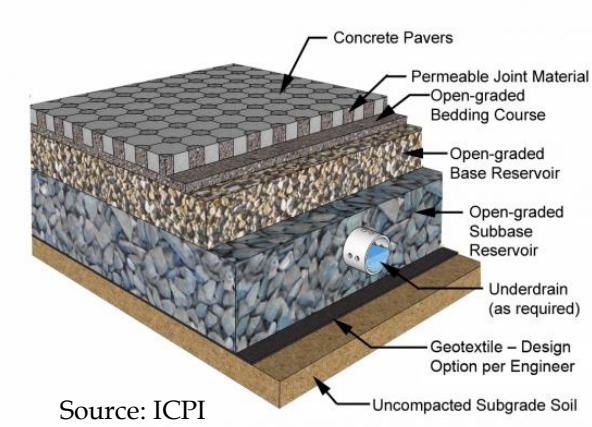
Purpose and Applications:

Impervious roadways, driveways, and parking lots account for much of the hydrologic impact of land development. In contrast, pervious pavements allow rainfall to collect in a gravel or sand base course and infiltrate into native soil. Pervious pavements include pervious asphalt/concrete, porous pavers, open pavers, or crushed aggregate.

Permeable pavements are best used on grades from flat to approximately 2%. Permeable pavements can be used in clay soils; however, special design considerations, including an increased depth of base course, typically apply and will increase the cost of this option.

Design Checklist for pervious pavements:

- ❑ No erodible areas drain on to pavement.
- ❑ Subgrade is uniform. Compaction is minimal.



Source: ICPI

- ❑ Reservoir base course is of open-graded crushed stone. Base depth is adequate to retain rainfall and support design loads.
- ❑ If a subdrain is provided, outlet elevation is a minimum of 3 inches above bottom of base course.
- ❑ Use on grades from flat to 2% to the extent possible.
- ❑ Rigid edge is provided to retain granular pavements and unit pavers.
- ❑ Joints between solid unit pavers are filled with an open-graded aggregate free of fines.
- ❑ Permeable pavements are installed by industry-certified professionals according to vendor's recommendations.

RAIN GARDENS

STORM WATER BENEFITS:
- ✓ Water Quality Treatment
- ✓ Runoff Retention

ADVANTAGES:
- Various shapes and sizes possible
- Can be incorporated in landscape design

Purpose and Applications:

Rain gardens detain runoff in a surface reservoir, filter it through 6 to 12 inches of amended soil and plant roots, and then infiltrate it into the ground.

Rain gardens can be placed in a variety of landscape configurations, including front yard and side yard setbacks. On slopes, rain gardens require check dams or stair-stepping.

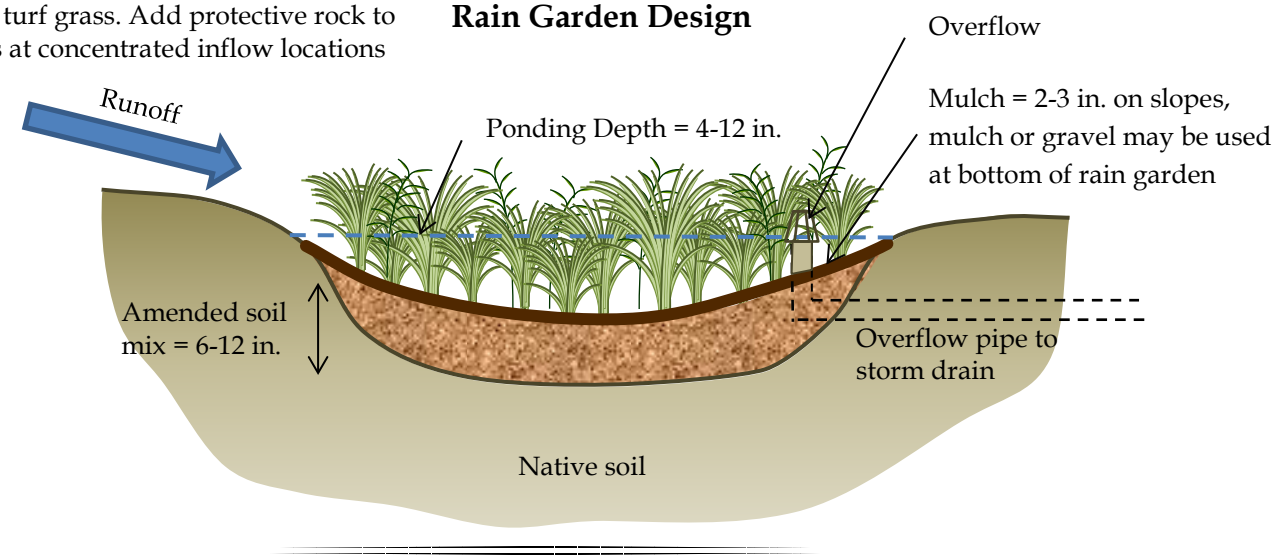
Design Checklist for Rain Gardens:

- ❑ Amended soil mix depth: minimum 6 inches, preferred 12 inches. For additional storm water storage, a subsurface gravel layer may be placed beneath the soil mix.
- ❑ Design facility to prevent erosion, scour and channeling within the rain garden
- ❑ Ponding depth – Minimum 6 inches, maximum 12 inches
- ❑ Longitudinal slope – Maximum 6% longitudinal slope of bottom. Use stair-stepping planters on a slope to provide flat bottomed cells separated by check dam/weir overflows.

- ❑ See Appendix B for recommended plants for rain gardens.
- ❑ Side slope - 4:1 preferred. Maximum 3:1 allowed.
- ❑ No compaction of soils beneath the rain garden (ripping/loosening of soils required if compacted)
- ❑ No liners or other barriers interfering with infiltration.
- ❑ Sizing guidance: minimum 4% of tributary impervious area.
- ❑ Provide overflow to the curb or approved discharge point.

Rain water runoff from an impervious surface (e.g. roof or driveway) can be routed to the rain garden via a vegetated or rock swale, through a pipe, or across turf grass. Add protective rock to dissipate flows at concentrated inflow locations as needed

Rain Garden Design



APPENDIX A

Storm Water & LID Checklist

Building Permit No: _____

Appendix A

Storm Water and Low Impact Development Assessment (LID) Checklist
Single-Family Home Projects

SECTION 1. Project Information

Project Address: _____ APN#: _____

Project is a:

☐ New development ☐ Remodel

Proposed Development Area and Impervious Area:

Parcel Area: _____ acres

Existing impervious surface area (pavement and buildings): _____ sq ft

Amount of new impervious surface area that will be **created**: _____ sq ft

Amount of impervious surface area that will be **replaced**: _____ sq ft

Post-project impervious surface area: _____ **sq ft**

SECTION 2. Site planning and LID design measures

LID design measures shall be clearly marked on site plans

Check applicable box and provide short description of measure and location

☐ Conserve natural areas, riparian areas and wetlands

Description: _____

☐ Concentrate improvements on the least-sensitive portions of the site and minimize grading

Description: _____

☐ Direct roof runoff into cisterns or rain barrels

Description: _____

☐ Direct roof downspouts to landscaped areas or rain gardens

Description: _____

☐ Use pervious pavement (pervious concrete or asphalt, turf block, crushed aggregate, etc.)

Description: _____

☐ Disperse runoff from paved areas to adjacent pervious areas

Description: _____

APPENDIX B

LID Plant Guidance for Bioretention

Central California Coast

Technical Assistance Memo (TAM)

LID Plant Guidance for Bioretention

Low Impact Development

This Technical Assistance Memo (TAM) provides plant selection guidance for the most common bioretention features, such as bioretention swales, stormwater planters and rain gardens. Bioretention systems are low impact development (LID) features that use landscaped areas to slow, treat, retain and infiltrate stormwater runoff, mimicking the natural, pre-development hydrology of a site.

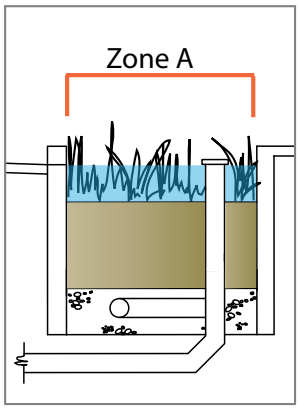
The intent of this TAM is to offer designers, municipalities, developers and homeowners with guidelines for selecting plants for bioretention areas, including a list of appropriate species for the Central Coast. Bioretention systems look like regular landscaped areas, but are designed (engineered) to manage stormwater runoff created by urbanization. Specifying the appropriate plants and soil mix for a bioretention system is critical to its function.

This step-by-step guidance is specific to LID landscapes and will take you from plant selection and layout to installation and on-going maintenance. This guidance is intended to accompany standard landscape methods and point out areas where LID methods may differ.

Step 1: LID Type and Plant Selection

Surface grade and **ponding area** of a bioretention structure are the first factors to consider when choosing which plants to specify. Is the soil surface of the structure sloped or uniform? Stormwater planters and some rain gardens have uniform surface grades. In these designs, ponding will be equal across the structure and all plants will have the same conditions (Zone A). In bioretention swales and some rain gardens, soil surface is sloped, resulting in differing planting conditions across the structure (Zones A and B). Plants located at the bottom where ponding occurs, will have different requirements than those placed on the sideslopes, which receive runoff, but not ponding. A third planting area may occur outside of Zones A and B, on the upper edges of rain gardens and bioswales. This area is not a functional component of the bioretention area, and therefore can be treated as a traditional landscape area.

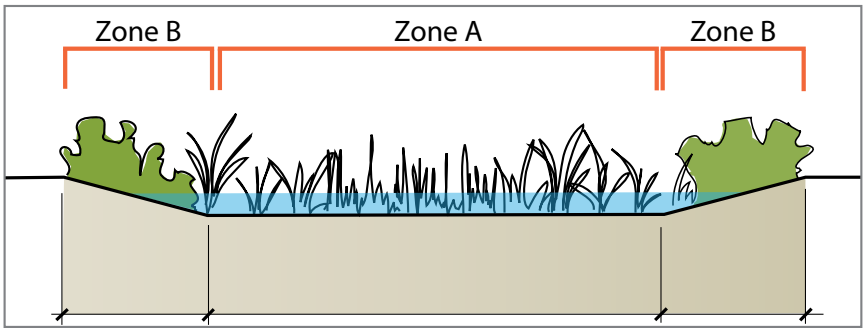
Source: AHBE Landscape Architects



Uniform surface grade: This stormwater planter has a flat bottom with consistent depth of ponding across the structure. All of the plants selected for this design must be tolerant of periodic inundation (**Zone A**).

Varying slope and ponding levels: Varying slope and ponding levels: This bioretention planting area has sloped edges. Plants in the bottom area will be inundated during storms (**Zone A**). Those planted on the sideslopes are above the level of ponding, but will experience seasonally wet conditions (**Zone B**).

Source: Rana Creek



Step 2: Plant Species Selection

Once the plant zones are identified (Zone A only or both Zone A and Zone B) for a structure, the plants may be selected. This TAM includes a plant list for bioretention areas (Table 1). There exist other LID plant lists for California and the Central Coast, but this "short list" was refined based on the following criteria: 1) Tolerant of varied moisture conditions (wet and dry), 2) tolerant of varied soil types and growing conditions, 3) available in Central Coast plant nurseries, 4) low maintenance requirements, 5) are not invasive weeds, 6) do not have aggressive/invasive root systems, and 6) exhibit an attractive appearance. When selecting plants from a list, additional site-specific information, such as tolerance to high and low temperatures, coastal conditions and prevailing winds should be considered. In addition, project specific aspects of the design, for example right-of-way vegetation height limits, approved street and parking lot tree lists and fire hazard landscape requirements may further influence selection. Although this plant list includes some non natives, using native plants is highly recommended because of the wide range of benefits they offer (food and forage for native wildlife, adaptation to local climate, low/no water use once established). Knowledge of invasive species is constantly evolving. To avoid specifying noxious plants on a project, check the California inventory at www.cal-ipc.org. Local agencies may also track potential invasives for your area.

Leymus condensatus 'Canyon Prince': This selection grows to 3' and is tolerant of a wide range of conditions, including drought, seasonal wet conditions, poor soils and some shade.

Achillea millefolium: A native perennial that attracts polinators and is tolerant of poor soils, seasonal flooding and deer. Available in many flower colors.

Source : Native Sons Nursery

Muhlenbergia rigens: A native grass with dense bright, grey-green, evergreen foliage. It tolerates a range of soils, sun to part-shade, seasonal flooding and drought.

Source unless noted: Las Pilitas Nursery

Juncus patens: An easy to grow native rush. It tolerates poor drainage, flooding, drought and shade. A strong performer in bioretention areas, more drought tolerant than J. effusus.

Step 3: Soil Specification for Biofiltration

Specifying the correct soils for bioretention areas is critical in order to achieve stormwater objectives and plant health. Soils must balance three primary design objectives: 1) High enough infiltration rates to meet surface water draw down requirements, 2) infiltration rates that are not so high that they preclude pollutant removal function of soils and 3) soil composition that supports plant establishment and long-term health.

Landscape design documents for LID projects must include a bioretention soil specification that specifies the exact materials to be used in the mix (aggregates and compost), the percent of each material included in the mix, how they are to be placed (i.e. in 8" to 12" lifts) and the soil mix depth. Sample bioretention soil specifications and detailed information on BMP design and construction may be found in the LID documents listed under Additional Resources in this TAM.

Organic Compost: A main ingredient of biofiltration soil mixes, compost is the product of natural decomposition of organic wastes by bacteria, fungi, worms and other beneficial organisms. Compost increases the soil's water holding capacity and improves soil structure, nutrient levels and biology, all of which support plant health.

► GENERAL BIORETENTION SOIL SPECIFICATION

Bioretention soils should meet the following criteria.

1. General Requirements

Bioretention soil shall achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Bioretention soil shall also support vigorous plant growth.

Bioretention Soil shall be a well-blended mixture of mineral aggregate and compost, measured on a volume basis. Bioretention soil shall consist of two parts compost (approximately 35 to 40 percent) by volume and three parts Mineral Aggregate (approximately 60 to 65 percent), by volume. The mixture shall be well blended to produce a homogeneous mix.

Bioretention Soil Mix: Construction documents for any LID project should include specifications for the bioretention soil mix that define the ratio of materials in the mix, and the content, gradation, quality analysis and other requirements for each of the materials. Specifications will also provide guidelines for blending and placement of the soil mix.

Table 1. Plants for Bioretention Areas[1]

Zone A: Periodic inundation, area ponds following storm events (24 - 72 hours).
Zone B: Above area of ponding, side slope areas receive runoff, but are never inundated.

Common Name	Scientific Name	Zone(s)	Height/ Width	Light	Notes:	Climate Zones[2]
Trees						
Western Redbud	*Cercis occidentalis*	B	20'/20'	sun	small tree or large shrub, tolerates clay, winter wet, drought, flowers stronger with frost	all but coastal
Desert Willow	*Chilopsis linearis*	B	25'/30'	sun	tolerates alkaline soil, sand, clay, seasonal flooding and drought, not coastal condition	all, but 1A-3A
Western Sycamore	*Platanus racemosa*	B	40'-80'/40'-70'	sun	tolerates sand and clay soils, seasonal flooding, needs space to grow, avoid underground water/sewer pipes	all, but 1A-3A
Coast Live Oak	*Quercus agrifolia*	B	25'-60'/40'-70'	sun - shade	tolerates drought and winter wet conditions, mature trees produce significant litter limiting understory plantings, need space to grow	all, but 1A-3A
Large Shrubs						
Toyon, Christmas Berry	*Heteromeles arbutifolia*	B	8'-20'/8'-20'	sun-pt shade	tolerates sand, clay and serpentine soils, seasonal water with good drainage	all, but 1A-3A
Pacific Wax Myrtle	*Myrica californica*	B	10'-30'/10'-30'	sun-pt shade	large shrub or small tree, tolerates coastal conditions, sand, clay and seasonal inundation	all, but 1A-3A
Western Elderberry	*Sambucus mexicana*	B	10'-30'/8'-20'	sun-pt shade	large shrub to tree, tolerates clay, seasonal flooding and drought, good wildlife food source	all, but 1A-3A
Shrubs and Subshrubs						
Coyote Brush	*Baccharis pilularis*	B	wide variation	sun	adaptable evergreen shrub, provides quick cover and bank stabilization, tolerant of coastal conditions, alkaline soil, sand, clay and seasonal wet	all, but 1A-3A
California Wild Rose	*Rosa californica*	A,B	3'-6'/spreads	sun-pt shade	tolerates a wide variety of soils, seasonal flooding and some drought, spreads aggresively, avoid edges of walkways because of thorns	all
Perennials						
Yarrow	*Achillea millefolium*	B	1'-3'/2'	sun-pt shade	tolerates alkaline soil, sand, clay, seasonal wet conditions, foot traffic and deer, will self sow	all
Beach Strawberry	*Fragaria chiloensis*	B	2-4"/spreads	sun-pt shade	vigorous spreading groundcover, tolerates sand, clay, wet conditions, prefers good drainage	all, but 1A-3A
Douglas Iris	*Iris douglasiana*	B	1.5'-3'/spreads	sun - shade	tolerates sand, clay and serpentine soils, seasonal wet (but not soggy) soils and drought	all, but 1A-3A
Hummingbird Sage	*Salvia spathacea*	B	1'-3'/4'-5'	pt sun-pt shade	low growing perennial, tolerates clay, winter wet, summer drought, prefers light shade, provides nectar for birds and insects, does well under oaks	all, but 1A-3A
Bog Sage	*Salvia uliginosa**	B	3'-6'/spreads	sun	quick growing, spreading perennial, tolerates wet to dry, cut back winter, divide rhizomes	all, but 1A-3A
Blue-eyed Grass	*Sisyrinchium bellum*	B	6"-1'/6"-1'	sun	a semi-evergreen perennial, tolerates sand, clay, seasonal wet soils and deer, dormant in summer, but can be delayed with supplemental irrigation	all, but 1A-3A
California Goldenrod	*Solidago californica*	B	1'-4'/1'-4'	sun-pt shade	tolerates poor soils, seasonal wet and drought, can spread aggressively if over irrigated	all, but 24
Grasses and Grass-like Plants						
Berkeley Sedge, Grey Sedge	*Carex divulsa**	A,B	12"-18"/12"-18"	sun-pt shade	tolerates foot traffic, some drought and boggy soils	all, but 1A-3A
California Meadow Sedge	*Carex pansa*	A,B	6"-12"/spreads	sun - shade	good lawn substitute, tolerates wide range of growing conditions, seasonal inundation, drought, foot traffic and mowing	all, but 1A-3A
Clustered Field Sedge	*Carex praegracilis*	A	1'/spreads	sun-pt shade	useful lawn substitute and bank stabilizer, good planted in masses, tolerates wide range of growing conditions, foot traffic and mowing, may look weedy when mixed with other plants	all, but 1A-3A
San Diego Sedge	*Carex spissa*	A	3'-6'/2'-5'	pt sun-shade	a large grass, tolerates alkaline soil, clay, serpentine, seasonal inundation, and deer	all, but 1A-3A
Small Cape Rush	*Chondropetalum tectorum**	A,B	2'-3'/3'-4'	sun-pt shade	A tough, attractive reed-like plant, tolerates boggy or clay soils and drought once established, Chondropetalum elephantinum is a much larger species	all, but 1A, 2A, 3A, 7
Molate Red Fescue	*Festuca rubra 'Molate'*	A,B	8"-12" /spreads	pt sun-shade	a tufted, spreading bunchgrass, good lawn substitute, provides erosion control, tolerates wet conditions, but looks best with regular water, tolerates drought once established	all
Soft Rush	*Juncus effusus*	A	2'-3'/2'-3'	sun-pt shade	tolerates poor drainage, heavy soils, needs more supplemental water than Juncus patens	all
Wire Grass, Blue Rush	*Juncus patens*	A	1'-2'/1'-2'	sun - shade	strong performance in bioretention ares, tolerates poor drainage, seasonal inundation, drought, shade	all, but 1A-3A
Canyon Prince Wild Rye	*Leymus condensatus 'Canyon Prince'*	B	2'-3'/spreads	sun-pt shade	tolerates drought, wet, but not soggy soils, looks best with supplemental irrigation, spreads by rhizomes	all, but 1A-3A
Deer Grass	*Muhlenbergia rigens*	B	4'-5'/4'-6'	sun-pt shade	a large grass, tolerates sandy and clay soils, seasonal inundation, best when cut back annually to remove old thatch	all, but 1A-3A

[1] See: **www.centralcoastlidi.org** for a photo gallery of the plants in this list.
[2] Refers to Sunset Western Garden Book Climate Zones. The Central Coast includes Zones 1A, 2A, 3A, 7, 9, and 14-24. www.sunset.com/garden/climate-zones
* Indicates non native species. Non natives are only recommended for use in urbanized settings and should not be used on sites in proximity to natura areas.

Step 4: Plant Establishment and Care

Like traditional landscapes, LID planting areas require care and ongoing maintenance for optimal health. Due to the functional nature of LID landscapes and their connectivity to natural receiving water bodies, there are some differences between conventional landscape maintenance and LID maintenance.

Irrigation is an important aspect of any landscape establishment. Typically new plantings need two to three years of irrigation to become established. After that period, native plants will need little to no supplemental irrigation to survive. Plants may enter a dry season dormancy, which affects their appearance. Where this "dry look" is not desired, summer irrigation may be utilized. Systems should include a weather-based controller to avoid watering during wet weather. Because bioretention soils are formulated to infiltrate, irrigation application rates must be properly designed to avoid overwatering and prevent potential discharges via underdrains.

Compost Mulch (1" - 2") should be applied to bioretention areas to retain moisture, prevent erosion and suppress weed growth. Reapply annually as the mulch breaks down. Use a specified compost mulch and avoid bark mulches that can float during storm events.

Fertilizer should not be used in bioretention areas. Instead, a compost top dressing or application of compost tea can be used to introduce nutrients and beneficial microorganisms to the soil. Apply compost mulch once per year in spring or fall or spray apply compost tea once per year between March and June.

Synthetic herbicides and pesticides should not be used in bioretention areas because of their potential toxicity risk to aquatic organisms. There are a variety of natural methods and products that can be used to control weeds and pests. See the technical manuals included under Additional Resources.

Plant Establishment and Care (cont.)

Source: SVR Design Company

Provide extra support to trees planted in bioretention areas, especially in high wind areas. They should be securely staked during establishment and inspected once or twice a year and following storm events. Stakes should be removed as soon as they are no longer needed to stabilize the tree (between one and two years).

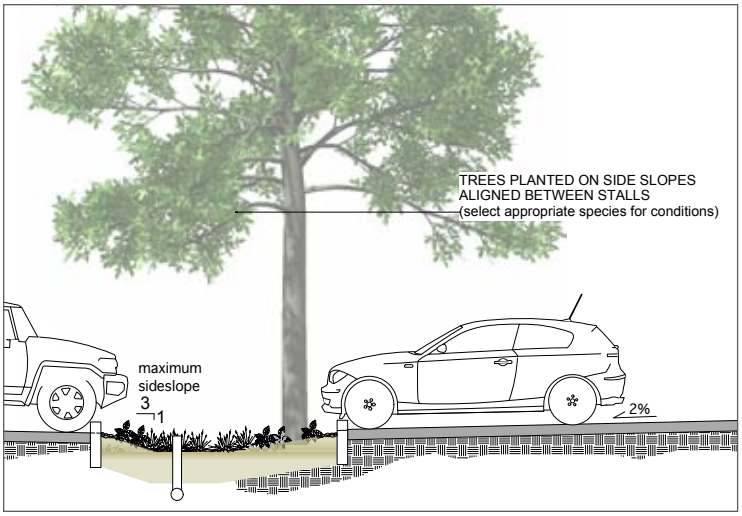
Weeds compete with plants for nutrients, water and sunlight. They should be regularly removed, with their roots, by hand pulling or with manual pincer-type weeding tools. Care should be given to avoid unnecessary compaction of soils while weeding.

Replace plants that die due to unsuitable plant conditions, disease, underwatering or other unforeseen issues. Dead and dying plants must be removed and replaced to avoid spreading disease, establishment of weeds in bare areas and reduced LID function. Before replacing with the same species, determine if another species may be better suited to the conditions.

Tree Placement Guidance

Including trees in bioretention areas provides additional aesthetic and performance benefits. Following these guidelines will maximize their success and survival:

- Provide sufficient landscape width (a rule of thumb is 8' min.)
- Locate trees on the side slopes (Zone B), not in areas that pond (Zone A). Trees improperly located, in narrow planters that pond, are unlikely to thrive and may eventually fail.
- Select trees that will tolerate seasonally wet soils.
- Do not specify trees with invasive roots.



Guidelines for Municipalities

Project managers who are preparing RFPs or bid packages for public projects that include bioretention systems should clearly define expectations for the following:

- Bioretention soil mix specification
- Guidance for plant species selection
- Appropriate plant zone placement
- Operations and maintenance protocols

To assist in defining vegetative requirements for LID projects, Central Coast municipalities may use this TAM as a reference or attachment to their project description.

Plant Nurseries

This is a partial list of Central Coast nurseries who regularly stock the plants included in this TAM.

Source: Las Pilitas Nursery

- Central Coast Wilds, Santa Cruz
  831-459-0656
  www.centralcoastwilds.com
- Last Pilitas, Santa Margarita
  805-438-5992
  www.laspilitas.com
- Native Sons, Arroyo Grande
  805-481-5996
  www.nativesonsnursery.com
- Rana Creek, Carmel Valley
  831-659-3820
  www.ranacreeknursery.com
- San Marcos Growers, Santa Barbara
  805-683-1561
  www.sanmarcosgrowers.com
- Santa Barbara Natives, Santa Barbara
  805-698-4994
  www.sbnatives.com

Additional Resources

- The Low Impact Development Manual for Southern California: Technical Guidance and Site Planning Strategies
  http://www.casqa.org/LID/tabid/186/Default.aspx
- The California Stormwater Quality Association (CASQA) BMP Handbook for New Development and Redevelopment
  http://www.cabmphandbooks.com/
- Contra Costa Clean Water Program (C3 Guidebook)
  http://www.cccleanwater.org/c3.html
- City of Santa Barbara: Storm Water BMP Guidance Manual
  http://www.santabarbaraca.gov/Resident/Major_Planning_Efforts/Storm_Water_Management_Program/

For additional resources on bioretention plant guidance:

www.centralcoastlidi.org

For questions or to contact the
Central Coast Low Impact Development Initiative:

info@centralcoastlidi.org

Central Coast Water Board

UC Davis LID Initiative