SALINAS

Stormwater Development Standards for New and Redevelopment Projects

August 2021

Stormwater Development Standards for New and Redevelopment Projects

For

City of Salinas

August 2021

REVIEW AND APPROVAL

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ACRONYMS AND ABBREVIATIONS

BFE	Base Flood Elevation
BMP	Best Management Practice
CASQA	California Stormwater Quality Association
CBSC	California Building Standards Commission
CCRWQB	Central Coast Regional Water Quality Control Board
CFR	Code of Federal Regulations
City	City of Salinas
CO	Certificate of Occupancy
CWA	Clean Water Act
DMA	Drainage Management Area
DWR	Department of Water Resources
EISA	Energy Independence and Security Act
EIR	Environmental Impact Report
FEP	Functionally Equivalent Plan
FIRM	Federal Insurance Rate Map
HSG	Hydrologic Soil Group
IPM	Integrated Pest Management
ISWEBE Plan	Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California
LID	Low Impact Development
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NFIP	National Flood Insurance Program
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Poly-chlorinated Biphenyl
PCR	Post-Construction Stormwater Management Requirement
POTW	Publicly Owned Treatment Works
PR	Performance Requirement
SCM	Stormwater Control Measure
State Board	State Water Resources Control Board (also known as “Water Board”)
SWCP	Stormwater Control Plan
SWDS	Stormwater Development Standards
TCO	Temporary Certificate of Occupancy
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
WQF	Water Quality Flow

GLOSSARY

85th percentile rainfall event – The measure of precipitation depth accumulated over a day for the period of record that ranks as the 85th percentile rainfall depth, after all events of 0.1 inch of rainfall and less are removed, based on daily event occurrences.

95th percentile rainfall event – A precipitation amount not exceeded during 95 percent of all rainfall events (daily rainfall depths greater than 0.1 inch) for the period of record. In more technical terms, the 95th percentile rainfall event is defined as the measured precipitation depth accumulated over a 24-hour period for the period of record that ranks as the 95th percentile rainfall depth based on the range of all daily event occurrences during this period (from Energy Independence and Security Act [EISA] Section 438 Technical Guidance).

Base Flood – The flood with a 1 percent chance of being equaled or exceeded in volume of water in any given year. This regulatory standard is also referred to as the "100-year flood." The base flood is the national standard used by the National Flood Insurance Program (NFIP) and all federal agencies for requiring the purchase of flood insurance and regulating new development.

Base Flood Elevation (BFE) – The computed elevation to which floodwater is anticipated to rise during the base flood. BFEs are shown on Flood Insurance Rate Maps (FIRMs) and on flood profiles.

Best Management Practices (BMP) – Physical structures, activities, prohibitions of practices, maintenance procedures, and other management practices or control measures to prevent or reduce the pollution of receiving waters and hydrologic processes and beneficial use impacts on watersheds.

Biofiltration – Any structural or non-structural method, technique, or process that relies on biological and biochemical processes in soil media and vegetation to remove pollutants and/or solids from polluted stormwater runoff.

Bioretention – A stormwater control measure designed to retain stormwater runoff using vegetated depressions and soils engineered to collect, store, treat, and infiltrate runoff.

Biotreatment or Biofiltration Treatment – A stormwater control measure designed to detain stormwater runoff, filter stormwater through soil media and plant roots, and release the treated stormwater runoff to the storm drain system. Biotreatment systems include an underdrain.

Class V Injection Well – Any bored, drilled, or driven shaft, or dug hole, that is deeper than its widest surface dimension and is used to promote infiltration.

Detention – The temporary storage of storm runoff in a stormwater management practice with the goals of controlling peak discharge rates and providing gravity settling of pollutants.

Detention Facility – A basin or alternative structure designed for temporary storage of stream flow or surface runoff and gradual release of stored water at controlled rates.

Development Project – New development or redevelopment of any public or private project with land-disturbing activities (e.g., structural development, including construction or installation of a building or structure, creation of impervious surfaces, public agency projects, or land subdivision).

Direct Infiltration BMP – Any structure that is designed to infiltrate stormwater into the subsurface and, by design, bypasses the natural groundwater protection afforded by surface or near-surface soils. These systems can negatively impact groundwater quality if improperly sited. Direct stormwater infiltration systems include infiltration trenches, infiltration basins, and dry wells.

Drainage Management Area (DMA) – Designated individual drainage area within a Regulated Project that typically follows grade breaks and roof ridge lines and accounts for each surface type (e.g., landscaping, pervious paving, or roofs). DMAs follow the low-impact development principle of managing stormwater through small-scale, decentralized measures. Stormwater control measures for runoff reduction and structural facilities are designed for each DMA.

Equivalent Impervious Surface Area – The sum of *Impervious Tributary Surface Area* + *Pervious Tributary Surface Area*, where *Impervious Tributary Surface Area* is defined as the sum of all of the site's conventional impervious surfaces, and *Pervious Tributary Surface Area* is defined as the sum of all of the site's pervious surfaces, corrected by a factor equal to the surface's runoff coefficient.

Evapotranspiration – The return of water to the atmosphere from the soil and soil surface by direct drying and plant respiration.

Flow Control BMP – Any structural or non-structural method, technique, or process designed to detain and/or retain stormwater runoff flow.

Future Growth Area (FGA) – An area identified by the Permittee in its General Plan to plan for and manage future growth. In the City of Salinas (City), these areas include the areas north and northeast of the City in the sphere of influence amendment and annexation identified in the November 19, 2007, Final Supplement for the Salinas General Plan Final Program Environmental Impact Report (EIR).

Hardscape – The man-made features used in landscape architecture, e.g. paths or walls, as contrasted with vegetation.

Impervious Surface – Coverings over, or pavement of, land that prevents the land's natural ability to absorb and infiltrate precipitation/stormwater. Building footprints and conventional pavement are impervious. Locations where an impermeable barrier is placed under pervious pavement are impervious.

Indirect Infiltration BMP – System that promotes infiltration into subsurface soils via maintaining natural process for protecting groundwater by filtration through surface or near-surface soils or including adequate amended or engineered soils to protect groundwater. Indirect stormwater infiltration systems include bioretention and biofiltration systems (e.g., vegetated swales, filter strips, rain gardens, bioretention systems, pervious pavements, etc.).

Infiltration – Absorption of water at the ground surface into the soil. It is the process by which stormwater percolates downward into subsurface soils.

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 onsite natural features, site planning, and distributed stormwater management practices that are integrated into a project design. This collection of stormwater management design strategies and BMP techniques is used to address new development or redevelopment. The goal of LID is to mimic the pre-development natural hydrologic conditions of the site.

Maximum Extent Practicable (MEP) – The minimum required performance standard for implementation of municipal stormwater management programs to reduce pollutants in stormwater. Clean Water Act (CWA) 402(p)(3)(B)(iii) requires that municipal stormwater permits "shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering

methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." MEP is the cumulative effect of implementing, evaluating, and making corresponding changes to a variety of technically appropriate and economically feasible BMPs, ensuring that the most appropriate controls are implemented in the most effective manner. This process of implementing, evaluating, revising, or adding new BMPs is commonly referred to as the iterative process.

Municipal Separate Storm Sewer System (MS4) – A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains), as defined in 40 Code of Federal Regulations (CFR) 122.26(b)(8) as (1) owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law), including special districts under state law such as a sewer district, flood control district, drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization or a designated and approved management agency under section 208 of the CWA) that discharges into waters of the United States; (2) designed or used for collecting or conveying stormwater; (3) not a combined sewer; and (4) not part of a publicly owned treatment works (POTW), as defined in 40 CFR 122.26. When used without qualification, the term means the MS4 owned or operated by the Permittee.

National Pollutant Discharge Elimination System (NPDES) – A national program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pre-treatment requirements, under sections 307, 402, 318, and 405 of the CWA.

Net Impervious Area – The sum of new and replaced post-project impervious area, minus any reduction in total imperviousness from the pre-project to post-project condition: *Net Impervious Area = (New and Replaced Impervious Area) – (Reduced Impervious Area Credit),* where *Reduced Impervious Area Credit* is the total pre-project reduction in impervious area, if any.

New Development – Land-disturbing activities (e.g., structural development, including construction or installation of a building or structure, creation of impervious surfaces, public agency projects, or land subdivision). Development projects with pre-existing impervious surfaces are not considered new development. Projects meeting the definition of redevelopment are not considered new development projects.

Non-Retention-Based Treatment Systems – Proprietary structural filtration systems such as tree box filters.

Permeable or Pervious Surface – A surface that allows varying amounts of stormwater to infiltrate into the ground. Pervious areas include locations where infiltration is being promoted, such as under pervious pavement or infiltration basins (even those under conventional pavement). Examples include pasture, native vegetation, bioretention and biofiltration systems, and permeable pavements designed to infiltrate. Areas with decks or solar panels where runoff can readily spread over the entire area and infiltrate are considered pervious. Open, uncovered retention/detention facilities are considered pervious surfaces for determining applicable Stormwater Development Standard (SWDS) Requirements, even though these facilities are evaluated using a runoff coefficient of one (1.0) to properly account for rainfall directly on the facility. Artificial turf with non-permeable backing is not considered a pervious surface. Turf with flow-through backing and an aggregate permeable base drainage layer underneath is considered pervious.

Pervious Pavement – A surface designed to support some vehicular activities or to serve as a sidewalk or patio through which stormwater can pass and have an opportunity to infiltrate into

underlying soils. Pervious surfaces that are placed over impermeable barriers are considered to be detention facilities within a pavement section.

Pervious Tributary Surface Area – The sum of all of the site's pervious surfaces, corrected by a factor equal to the surface's runoff coefficient.

Post-Development – The conditions of a development site after completion of the proposed project.

Pre-Development – The native vegetation and soil conditions of a development site that existed prior to modern human influence (e.g., urbanization, agriculture, grazing, timber harvest).

Pre-Project – The condition of a development site immediately prior to the proposed project. The condition includes, but is not limited to, soil type, vegetation, and amount of impervious surface. This definition is not intended to be interpreted as the period before any human-induced land activities occurred. This definition pertains to redevelopment as well as initial development.

Project Site – The area of land within which the new development or redevelopment takes place and is subject to Post- Construction Stormwater Management Requirements.

Redevelopment – Land-disturbing activity that results in the creation, addition, or replacement of exterior impervious surface area on an already developed site. On a site that has already been developed, construction or installation of a building or other structure subject to the Permittee's planning and building authority, including (1) creation or addition of impervious surfaces; (2) expansion of a building footprint or addition or replacement of a structure; (3) structural development, including construction, installation, or expansion of a building or other structure; or (4) land-disturbing activities related to structural, impervious, or turf surfaces. It does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility, 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. Projects that maintain original line and grade, and hydraulic capacity of the road or parking lot are not considered to be replaced impervious surface.

Retention – The act of keeping or holding runoff in a particular place, condition, or position without discharging to surface waters or municipal storm sewer systems.

Runoff – All flows that consist of stormwater or non-stormwater that drain from the subject area.

Self-Retaining Areas – (also called "zero discharge areas), are designed to retain some amount of rainfall (by ponding and infiltration and/or evapotranspiration) without producing stormwater runoff. Self-retaining areas may include graded depressions with landscaping or pervious pavement.

Self-Treating Areas – are a portion of a Regulated Project in which infiltration, evapotranspiration and other natural processes remove pollutants from stormwater. The self-treating areas may include conserved natural open areas and areas planted with native, drought-tolerant, or LID-appropriate vegetation. The self-treating area only treats the rain falling on itself and does not receive stormwater runoff from other areas.

Single-Family Residence – The building of one single new house or the addition and/or replacement of impervious surface associated with one single existing house, which is not part of a larger plan of development. This includes accessory dwelling units (ADUs).

Stormwater – Runoff generated during and following precipitation or snowmelt events, including surface runoff, drainage, and interflow.

Stormwater Control Measure (SCM) – A stormwater management measure integrated into a project design that emphasizes protection of watershed processes through replication of pre-development runoff patterns (rate, volume, duration). Physical control measures include, but are not limited to, bioretention and biofiltration systems, permeable pavements, roof downspout controls, dispersion, soil quality and depth, minimal excavation foundations, vegetated roofs, and water use. Design control measures include, but are not limited to, conserving and protecting the function of existing natural areas, maintaining or creating riparian buffers, using onsite natural drainage features, directing runoff from impervious surfaces toward pervious areas, and distributing physical control measures to maximize infiltration, filtration, storage, evaporation, and transpiration of stormwater before it becomes runoff.

Stormwater Control Plan (SWCP) – A plan, developed by the applicant or the applicant's qualified design professional, detailing how the project will achieve the applicable post-construction stormwater management requirements (for both onsite and offsite systems).

Stormwater Development Standard (SWDS) – A written document containing the Permittee's (City's) stormwater management requirements and guidance for meeting post-construction requirements for development and redevelopment projects pursuant to requirements in Resolution No. R3-2013-0032 (Central Coast Post-Construction Management Requirements).

Structural BMP – A physical structure used to manage flow and reduce pollutants in stormwater. See Stormwater Control Measure (SCM).

Surface Runoff – Flow over the ground surface, characterized by volume, rate, and duration.

Synthetic Turf – Any of various synthetic, carpetlike materials made to resemble turf and used as a playing surface for football or baseball field, to cover patios, etc. Not all synthetic turf is permeable.

Time of Concentration – The time needed for water to flow from the most remote point in a catchment to the catchment outlet.

Top of Bank – The elevation at which water overflows the natural contour and begins to inundate upland areas. If there are no distinguishable features to locate the contour or where the natural contour has been destroyed or altered, the determination of the top of bank shall be based on mean high water.

Turf – A planting material composed of grass and the surface layer of soil held together by the plant roots. It includes grass-covered areas established from seed or sod. Native grasses within structural BMPs are not turf. Artificial turf with non-permeable backing is not considered a pervious surface. Artificial turf with flow-through backing is considered pervious.

Urban Sustainability Area (USA) – An area encompassing high density urban centers (but not limited to incorporated jurisdictional areas) where the Permittee's documented objective is to preserve or enhance an existing pedestrian-oriented and/or public transit-oriented type of urban design through the promotion of high density redevelopment and infill.

Water Quality Standards – State-adopted and United States Environmental Protection Agency (U.S. EPA)-approved water quality standards for waterbodies. The standards prescribe the use of the waterbody and establish the water quality criteria that must be met to protect designated uses. Water quality standards also include the federal and state antidegradation policy.

Wet (Rainy) Season – From October 1st to April 30th.

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1 INTRODUCTION

The purpose of the Stormwater Development Standards (SWDSs) is to help applicants for new and redevelopment projects comply with stormwater management requirements based on the State of California Waste Discharge Requirements for City of Salinas Municipal Stormwater Discharges (City Stormwater Permit, Order No. R3-2019-0073) and the Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast Region (Resolution No. R3-2013-0032) adopted by the Central Coast Regional Water Quality Control Board (CCRWQB, 2013). The Post-Construction Requirements emphasize protecting and, where degraded, restoring key watershed processes through low impact development design to create and sustain linkages between hydrology, channel geomorphology, and biological health necessary for healthy watersheds.

This document contains both stormwater design requirements and LID design guidance. LID features are intended to minimize the impacts of urban runoff on receiving waters; promote healthy watersheds, and capture and treat runoff from frequent rainfall events and are designed to promote infiltration where feasible.

1.1 ORGANIZATION OF SWDS

The SWDSs are separated into sections that provide requirements and guidance and is intended to be used by designers, planners, and regulators with varying levels of experience.

Stormwater Development Standards	
Section 1	**Introduction** provides policy and technical background to the SWDs.
Section 2	**Regulated Project Requirements** specified by the City Stormwater Permit and the CCRWQB's Post-Construction Stormwater Management Requirements (PCRs).
Section 3	**SCM Sizing Guidance** procedures and calculations for sizing stormwater control measures (SCMs) based on Performance Requirement.
Section 4	**SCM Design Guidance** on SCM selection to treat stormwater and meet permit requirements based on land uses, pollutants, and soil common to the City.
Section 5	**Operation and Maintenance Plan** requirements and guidelines for each SCM.
Section 6	**Retrofit Requirements** guidance for incorporating low-impact development SCMs into existing stormwater drainage infrastructure on City-owned property.
Appendix A	**Performance Requirement Worksheet and SCM Sizing**
Appendix B	**Stormwater Control Plan Guidance**
Appendix C	**Infiltration Feasibility Worksheet**
Appendix D	**LID Planting Zones and Plant List**
Appendix E	**Sample Maintenance Declaration and O&M Plan Template**
Appendix F	**Stormwater Control Measure Design Requirements**
Appendix G	**Approved Trash Full-Capture Devices**
Appendix H	**Stormwater Control Measure Operation and Maintenance**

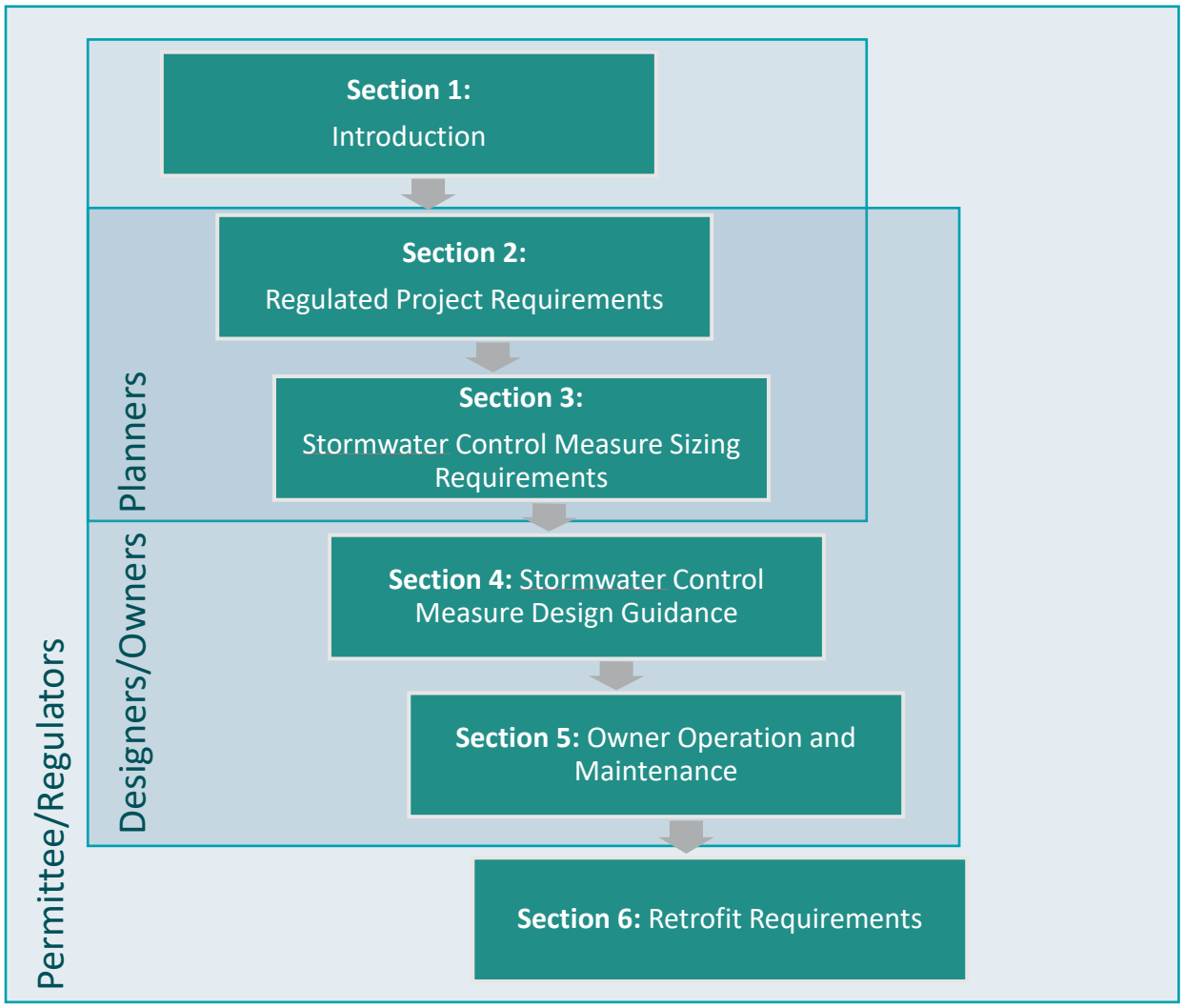


Figure 1. Document Organization and Intended Audience

1.2 PROJECT DEVELOPMENT REVIEW PROCESS

The process to determine applicable requirements and to conduct site design as well as SCM selection to comply with those requirements follow these general steps:

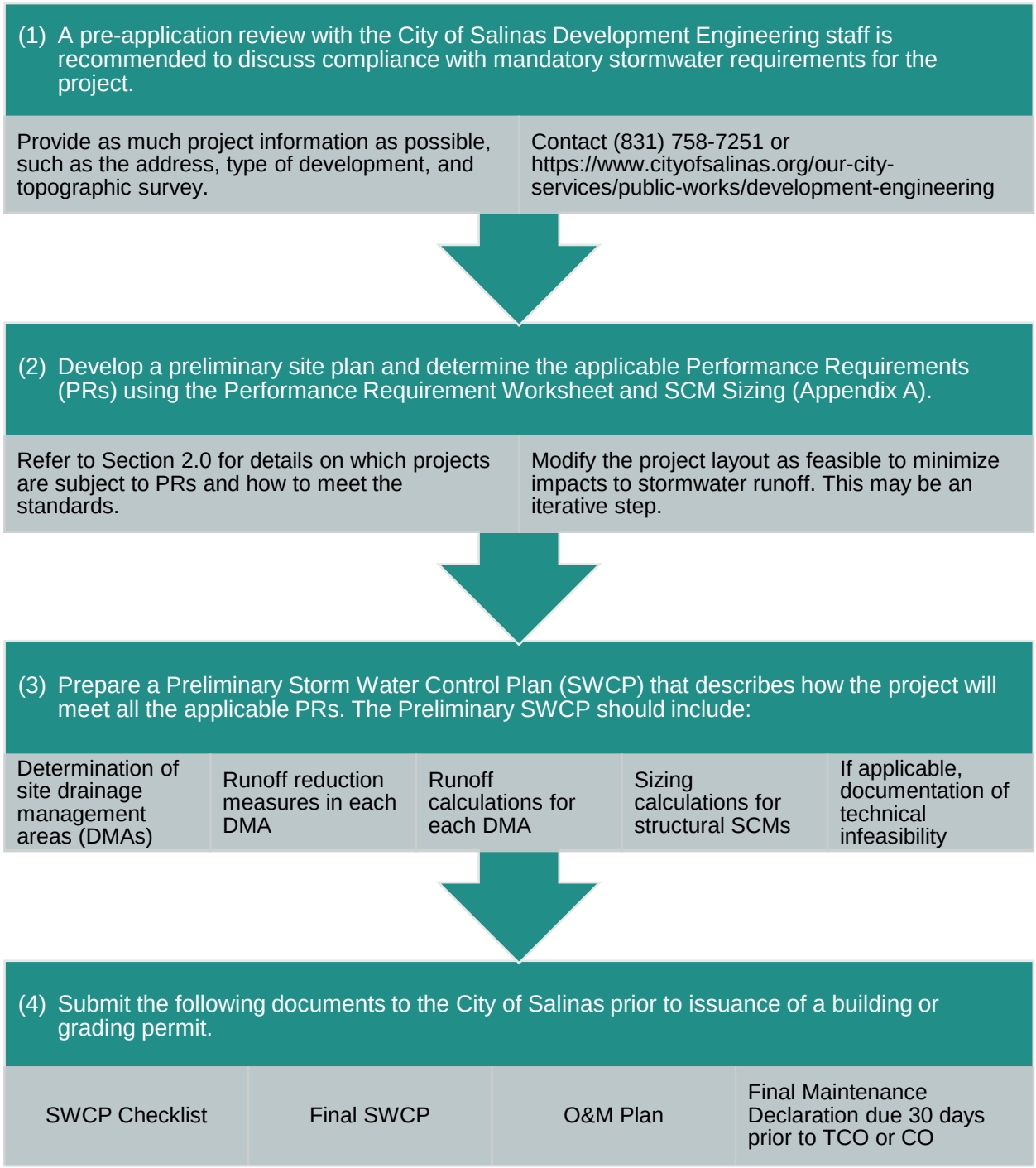


Figure 2. Project Development Review Process

1.3 PURPOSE OF LOW IMPACT DEVELOPMENT DESIGN AND BMPS

Pre-urban Watershed Processes

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 storm water runoff.

Urban Development Impacts

Today our urban landscape has more impervious surfaces such as roofs, streets, sidewalks and parking areas. The increase in impervious surface areas has significantly increased the amount and rate of stormwater runoff. These increased stormwater 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: Reduces Stormwater Flows, Improved Water Quality, and Improved Ecosystem Health

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

2 REGULATED PROJECT REQUIREMENTS

A project must first determine whether it is a Regulated Project. Regulated Projects are subject to Project Requirements (PRs), which are discussed in Section 2.3. The project designer must complete the Performance Requirement Worksheet and SCM Sizing (Appendix A) to help determine which PRs apply to the Regulated Project. To do so, the designer must calculate the impervious area that will be created and/or replaced in a manner consistent with the terms of the City's Stormwater Permit (CCRWQB, 2019). This section guides the designer through these initial steps.

2.1 REGULATED PROJECTS

According to the City's Stormwater Permit, Regulated Projects include all new development and redevelopment projects that create and/or replace more than 2,500 square feet of impervious surface (collectively over the entire project site). These projects include single-family homes and the following road projects:

- Removing and replacing a paved surface, resulting in alteration of the original line and grade, hydraulic capacity, or overall footprint of the surface
- Extending the edge of pavement, paving graveled shoulders
- Resurfacing by changing from a pervious to an impervious surface

2.2 EXEMPTED PROJECTS

Exempted projects are not regulated, and therefore are not required to meet the PRs described in this manual; however, requirements for construction best management practices (BMPs) and/or other City permits may apply. Contact the Development Engineering Division of Public Works at (831) 758-7251 or visit https://www.cityofsalinas.org/our-city-services/public-works/development-engineering for more information.

The following standalone projects are exempt from the PRs in this manual if they do not create or replace impervious surfaces other than those described here:

- Projects not creating and/or replacing 2500 sf or more of impervious surfaces over the entire project site
- Road and parking lot maintenance:
  - Road surface repair, including slurry sealing, fog sealing, and pothole and square cut patching
  - Overlay of existing asphalt or concrete pavement with asphalt or concrete without expanding the area of coverage
  - Shoulder grading
  - Cleaning, repair, maintenance, reshaping, or regrading of drainage systems
  - Crack sealing
  - Resurfacing with in-kind material without expanding the road or parking lot
  - Practices that maintain original line and grade, hydraulic capacity, and overall footprint of the road or parking lot

- Repair or reconstruction because of slope failures, natural disasters, acts of God, or other manmade disasters

- Sidewalk and bicycle path or lane projects built to direct runoff to adjacent vegetated areas, where no other impervious surfaces are replaced or created
- Trails and pathways built to direct runoff to adjacent vegetated areas, where no other impervious surfaces are replaced or created
- Underground utility projects that replace ground surface with in-kind materials or materials with similar runoff characteristics
- Curb and gutter improvement and replacement projects that do not result in any additional creation or replacement of impervious surface area (e.g., sidewalks, roadway)
- Second-story additions that do not increase the building footprint
- Raised (not built directly on the ground) decks, stairs, or walkways designed with spaces to allow for water drainage
- Photovoltaic systems installed on/over existing roof or other impervious surfaces, and panels located over pervious surfaces with well-maintained grass or vegetated groundcover, or panel arrays with a buffer strip at the most down gradient row of panels
- Temporary structures (in place for less than six months)
- Electrical and utility vaults, sewer and water lift stations, backflows, and other utility devices
- Aboveground fuel storage tanks and fuel farms with spill containment systems

Exempted projects that are not subject to the PRs must still follow the standard permitting process and are required to use LID principles by:

- Minimizing impervious surfaces
- Minimizing directly connected impervious surfaces
- Designing efficient landscaping to reduce runoff and irrigation discharges and promote surface infiltration
- Treating stormwater by incorporating BMPs to collect, detain, and infiltrate runoff

2.3 PERFORMANCE REQUIREMENTS

Regulated Projects must meet various PRs, depending on the location and type of project, as well the amount of impervious surface area created and/or replaced:

- PR-1: Site Design and Runoff Reduction
- PR-2: Water Quality Treatment
- PR-3: Runoff Retention
- PR-4: Peak Management

All Regulated Projects are subject to PR-1, Site Design and Runoff Reduction.

The most important considerations are project type, total new and replaced impervious area, and net impervious area. The requirements are discussed in detail in Section 3 and reflect the applicable requirements of both the City's Stormwater Permit and PCRs. Table 1 provides a matrix to determine which PRs apply to each Regulated Project.

Table 1. Post-Construction Performance Requirements by Project Category

Post-Construction Performance Requirements[1, 2]				
Project Impervious Area	**PR-1** ***Site Design and Runoff Reduction***	**PR-2** ***Water Quality Treatment***	**PR-3** ***Runoff Retention***	**PR-4** ***Peak Management***
Project Type: Detached Single-Family Homes[3]				
≥2,500 ft² Total New and/or Replaced Impervious Area; <15,000 ft² *of Net Impervious Area*	Required			
≥15,000 ft² and <22,500 ft² *Net Impervious Area*	Required	Required	Required	
≥22,500 ft² Total New and Replaced Impervious Area	Required	Required	Required	Required
Project Type: All Other Regulated Projects				
≥2,500 ft² Total New and/or Replaced Impervious Area; <5,000 ft² *of Net Impervious Area*	Required			
≥5,000 ft² and <15,000 ft² *Net Impervious Area*	Required	Required		
≥15,000 ft² and <22,500 ft² Total New and Replaced Impervious Area	Required	Required	Required	
≥22,500 ft² Total New and Replaced Impervious Area	Required	Required	Required	Required

ft² = square feet; PR = performance requirement

1. These requirements exclude PR-5, Special Circumstances, which is discussed in Section 2.5.
2. Projects five (5) acres or more are required to mitigate peak flow discharges up to the 100-year storm event per the City's Development Standards.
3. Includes ADUs and part of SFR project sites.

2.4 IMPERVIOUS SURFACE AREA CALCULATION PROCESS

This section presents the calculation process to determine the total new and replaced impervious area of a project.

Site Layout

The designer shall create an exhibit based on the site plan that shows the various project surface features both pre- and post-construction. Site surface areas shall then be categorized as impervious or pervious. Table 2 provides examples of impervious and pervious surfaces.

Table 2. Examples of Impervious and Pervious Surfaces

Impervious Surfaces	Pervious Surfaces
•Building Footprint •Roadway •Parking Lots •Driveways •Patios •Sidewalks •Impervious Barriers***	•Turf* •Landscaping •Undisturbed/Disturbed Soil •Gravel •Water Features**

* Turf surfaces are grassy areas intended to be mowed and maintained within residential, commercial, industrial, and institutional settings.
** For the purposes of determining the applicability of Performance Requirements, water features are considered pervious surfaces.
*** Plastic liners or other impervious barriers used beneath pervious areas

Using this information, the designer shall delineate the total impervious surface area created and/or replaced by the project as:

- New impervious area, which includes impervious surfaces placed on existing pervious surfaces.
- Replaced impervious area, which includes impervious surfaces that modify existing impervious surfaces.

As shown in Figure 3, Regulated Projects consist of all projects with greater than 2,500 square feet (ft^2) of total new and replaced impervious area, and the applicability of the PRs requirements is based on this value.

Figure 3. Total New and Replaced Impervious Area Equation

If the total impervious area is ≥ 2,500 ft^2, then it is also necessary to calculate the project's net impervious area (Figure 4). This value considers credits earned for areas of a project that convert pre-project impervious area into pervious area, called reduced impervious area credit. This value also helps determine the applicability of the PRs.

Figure 4. Net Impervious Area Equation

An example of net impervious area calculation is as follows:

Proposed Project: ***A developer is redeveloping an 100,000-square-foot shopping center. The project engineer has proposed to convert 40,000 square feet of existing building and parking lot to 30,000 square feet of green roof and 10,000 square feet of parking lot bioretention and landscaping.***

The Reduced Impervious Area Credit is:

30,000 square feet + 10,000 square feet = 40,000 square feet

The Net Impervious Area is:

100,000 square feet – 40,000 square feet = 60,000 square feet.

The designer shall use the Performance Requirement Worksheet and SCM Sizing (Appendix A) to determine which PRs apply to the project by inputting project site area information, such as pervious and impervious areas.

2.5 PERFORMANCE REQUIREMENTS FOR PROJECTS WITH SPECIAL CIRCUMSTANCES

Under special circumstances, different PRs may apply to a Regulated Project. These Special Circumstances are for projects that apply for and receive designation as:

- Highly Altered Channels
- Intermediate Flow Control Facilities
- Historic Lakes and Wetlands

All Regulated Projects that meet the conditions for Special Circumstances must, at a minimum, meet PR-2, Water Quality Treatment. Additional PRs depend on project size, impervious area, and circumstance. Figure 5 outlines which PRs apply to a Special Circumstances project.

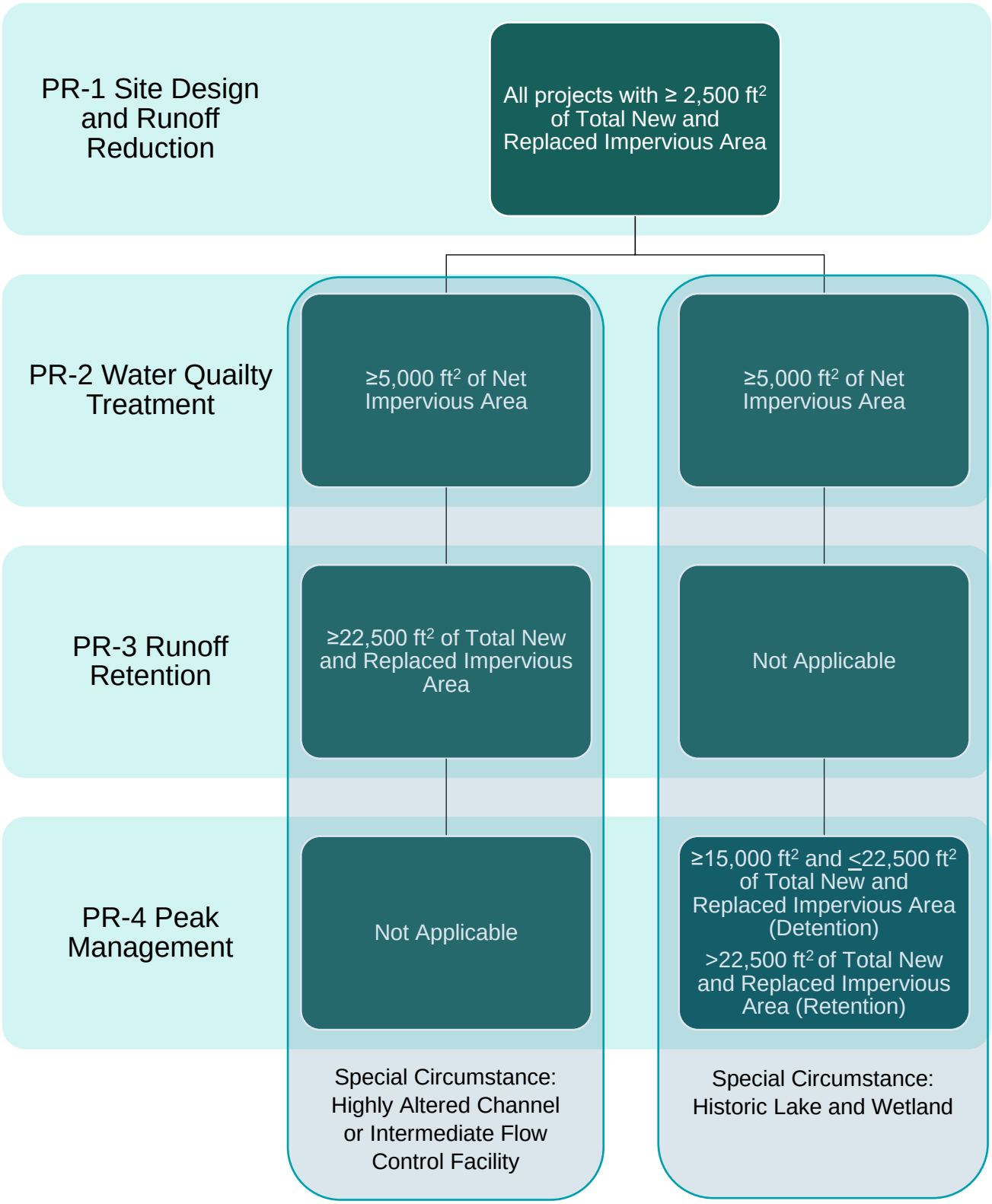


Figure 5. Special Circumstances Performance Requirements

A Regulated Project may apply for status as a Special Circumstance for Highly Altered Channels under the following conditions:

(1) Project runoff discharges to:

(a) Stream channels that are concrete-lined or otherwise continuously armored from the discharge point to the channel's confluence with a lake, large river (>200-square-mile drainage area).

(b) A continuous underground storm drain system that discharges directly to a lake, large river (>200 square-mile drainage area), or marine nearshore waters.

(c) Other areas identified by the CCRWQCB.

(2) Under no circumstance can runoff from the Regulated Project result in adverse impacts on downstream receiving waters.

A Regulated Project may apply for status as a Special Circumstance for Intermediate Flow Control Facilities under the following conditions:

(1) Project runoff discharges to an existing (as of the date when the CCRWQCB approved Order R3-2012-0025) flow control facility that regulates flow volumes and durations to levels that have been demonstrated to be protective of beneficial uses of the receiving water downstream of the facility.

(2) The flow control facility must have the capacity to accept the Regulated Project's runoff.

(3) Demonstration of the facility's capacity to accept runoff and to regulate flow volumes and durations must include a quantitative analysis based on numeric, hydraulic modeling of facility performance.

(4) Under no circumstance can runoff from the Regulated Project result in adverse impacts on downstream receiving waters

A Regulated Project may apply for status as a Special Circumstance for Historic Lakes and Wetlands under the following conditions:

(1) The project is located where there was once a historic lake or wetland where pre-development hydrologic processes included filtration and storage but no significant infiltration to support downstream receiving water.

(2) Establishment of the Special Circumstance has been based on a delineation of the historic lake or wetland approved by the CCRWQCB Executive Officer.

The designer must provide reasonable documentation to justify that a Regulated Project is more appropriately categorized under the Special Circumstances category. For the Historic Lake or Wetland Special Circumstance, a proposal must be submitted to the CCRWQCB Executive Officer for review and approval. The proposal should state, at a minimum, the delineation of historic lakes and wetlands, any supporting technical information to supplement the Special Circumstances claim, and documentation that the proposal was completed by a registered professional engineer, architect, and/or landscape architect in the State of California.

2.6 ALTERNATIVE COMPLIANCE

Offsite, or Alternative Compliance with PRs 2, 3, and 4 may be approved when technical infeasibility limits or prevents the use of SCMs (Resolution No. R3-2013-0032, Section C). An application for approval for Alternative Compliance must be based on a site-specific hydrologic design analysis conducted and endorsed by a registered professional engineer, geologist, and/or landscape architect, demonstrating that compliance with the applicable PRs is technically infeasible. Technical infeasibility may be caused by site conditions, including the following:

- Depth to the seasonal high groundwater is within 10 feet of the base of a direct infiltration device, or within 5 feet of the base of an indirect infiltration device
- Depth to an impervious layer such as bedrock limits infiltration
- Sites where soil types significantly limit infiltration and where a professional geologist or geotechnical engineer does not recommend infiltration
- Sites where pollutant mobilization in the soil or groundwater is a documented concern
- Space constraints (e.g., infill projects, some redevelopment projects, high-density development)
- Geotechnical hazards
- SCMs located within 100 feet of a groundwater well used for drinking water
- Incompatibility with surrounding drainage system (e.g., project drains to an existing stormwater collection system whose elevation or location precludes connection to a properly functioning treatment or flow control facility)

The proposed Alternative Compliance projects may be existing facilities and/or prospective offsite projects that are as effective in maintaining watershed processes as implementation of applicable PRs onsite. The location of the proposed offsite project(s) must be within the same watershed as the Regulated Project. Alternative Compliance project sites located outside the watershed may be approved by the CCRWQCB Executive Officer on a case-by-case basis.

An offsite equivalent treatment project provides LID treatment for a surface area or volume and pollutant loading of stormwater runoff, equivalent to that of the proposed new development or redevelopment project for which alternative compliance is sought. Examples of acceptable equivalent treatment projects include the installation of LID treatment measures in a nearby parking lot, or other development where LID treatment measures are not previously installed (i.e. retrofit). The offsite LID measures must remain for the life of the project that uses them for alternative compliance.

The Regulated Project applicant must submit a description of the project(s) that will provide offsite mitigation. The project description must include a schedule for completion with milestone dates to identify funding, design, and construction of the offsite projects. For City projects, the Alternative Compliance project(s) must be completed as soon as practicable and no longer than four years from the date of completion of the project for which the offsite mitigation is required, unless authorized by the CCRWQCB Executive Officer. Authorization by the CCRWQCB Executive Officer will be granted contingent upon a demonstration of good faith efforts to implement an Alternative Compliance project, such as having funds encumbered and applying for the appropriate permits. Project completion time may be extended for up to five years.

For private projects, the project owner must obtain building/grading permits for the Alternative Compliance project prior to issuance of the Certificate of Occupancy, or TCO, for which the off-site mitigation is required. Projects must be completed as soon as practicable and no longer than four years from the date of the certificate of occupancy for the project for which the offsite mitigation is required, unless authorized by the CCRWQCB Executive Officer. Authorization by the CCRWQCB Executive Officer will be granted contingent upon a demonstration of good faith efforts to implement an Alternative Compliance project, such as having funds encumbered and applying for the appropriate permits. Project completion time may be extended for up to five years. Offsite projects on public property must be fully funded by the private developer. Offsite projects on private property must transfer sufficient funding to a Permittee-controlled escrow account (in-lieu fee) or provide the project owner with appropriate project bonding within one year of initiation of construction of the Regulated Project.

3 STORMWATER CONTROL MEASURE SIZING GUIDANCE

This section provides the procedures and calculations for sizing SCMs based on the determined PR. Section 2.3 describes the steps to determine the PR for a Regulated Project.

3.1 PERFORMANCE REQUIREMENT #1 SITE DESIGN AND RUNOFF REDUCTION

PR-1 does not require the designer to implement a structural SCM; rather, it focuses on controlling stormwater runoff through site design and implementation of LID practices. Projects that fall under PR-1 are required to implement the following measures, at a minimum:

- Limit disturbance of creeks and natural drainage features.
- Minimize compaction of highly permeable soils. Reserve areas with high permeability soils for either open space or infiltration BMPs
- Limit clearing and grading of native vegetation at the site to the minimum area needed. Conserve natural areas, including existing trees, other vegetation, and soils.
- Set back development from creeks, wetlands, and riparian habitats. For creeks: 100-foot setback long Gabilan and Natividad Creeks; 30-foot setback for all other streams. The setback shall be measured from the top of the bank, or from the outside edge of riparian vegetation, whichever is furthest from the centerline of the stream. For wetlands: 100-foot setback along wetlands not associated with streams; 30-foot setback for all other wetlands. The setback shall be measured from the outside edge of the wetland.
- Minimize impervious surfaces and direct runoff from impervious areas to adjacent landscaping and vegetated storm water treatment systems.
- Consider the use of alternative building materials, including pervious pavement and green roofs, instead of conventional materials for new construction and renovation.

To minimize stormwater runoff at the site, the designer shall use one or more of the following measures:

- Direct rooftop runoff to cisterns or rain barrels for reuse.
- Direct rooftop runoff onto vegetated areas.
- Direct site runoff away from impervious surfaces (sidewalks, walkways, patios, driveways, and/or uncovered parking lots) onto vegetated areas.
- Construct bike lanes, driveways, uncovered parking lots, sidewalks, walkways, and patios with permeable surfaces.

When directing runoff onto vegetated areas, the project designer should make sure that the runoff is a safe distance from building foundations and footings, pursuant to California Building Code (California Building Standards Commission [CBSC], 2019). The designer must also confirm that the site design complies with these requirements via signed and sealed documentation (e.g., a checklist).

3.2 PERFORMANCE REQUIREMENT #2 WATER QUALITY TREATMENT

PR-2 mandatory requirements are applicable to regulated projects, except single-family homes, with ≥ 5,000 SF of Net Impervious Area and detached single-family homes with ≥ 15,000 SF of Net Impervious Area. The following elements are required:

In addition to PR-1, the Water Quality Treatment requirement must be met using one of the following methods (in order of preference):

- Onsite retention of the 85th percentile 24hr storm event via rainwater harvesting, infiltration, and/or evapotranspiration
- Biofiltration using an SCM designed to filter the runoff produced by a rain event with (a) 0.2 inches/hr intensity or (b) 2x the 85th percentile hourly rainfall intensity
- Non-retention-based treatment system whose primary mode of action depends on volume capacity, designed to treat storm water runoff from the 85th percentile 24hr storm event
- Non-retention-based treatment system whose primary mode of action depends on flow capacity, sized to treat the runoff produced by a rain event with (a) 0.2 inches/hr intensity or (b) 2x the 85th percentile hourly rainfall intensity

A stormwater control plan must be prepared to demonstrate compliance with requirements PR-1 and PR-2. On sites where runoff from existing impervious surfaces cannot be separated from runoff from new and replaced impervious surfaces, the Water Quality Treatment requirement applies to the runoff from existing, new, and replaced impervious surfaces.

Projects that are subject to PR-2 must reduce pollutant loads and concentrations associated with the proposed development through physical, chemical, or biological removal. The designer must also show compliance with requirements for PR-1, Site Design and Runoff Reduction, by submitting proper certification (Section 3.1).

Sizing for PR-2 is driven by calculating the net impervious area, as described in Section 2.4. The onsite SCMs must be applied according to Table 3, in the listed order of priority. Multiple SCMs may be used to achieve the required design criteria. Section 4.6 provides definitions and examples of the water quality treatment measures prescribed for the Central Coast Region.

Table 3. PR-2 Water Quality Treatment Design Criteria

1. LID Treatment System

Harvesting and reuse, infiltration, and evapotranspiration SCMs.

- Retain runoff equal to volume of runoff generated by the 85th percentile 24-hour event

2. Biofiltration Treatment Systems

- Design rain event of 0.2 inch/hour intensity OR twice the 85th percentile hourly rainfall intensity. In addition:
  - Maximum surface area loading rate of 5 inches/hour
  - Minimum volume = surface area x 6 inches depth
  - Minimum soil media depth = 24 inches[1]
  - Plant selection[2]
  - Minimum depth gravel layer = 12 inches
  - Underdrain discharges near top of gravel layer
  - No soil compaction
  - No liners (unless lateral infiltration is not possible)

3. Non-Retention-Based Treatment Systems

Lined bioretention, flow-through planters, high-rate tree well filters and media filters, and permeable pavement.

- Volume hydraulic design basis:
  - 85th percentile 24-hour event
- Flow hydraulic design basis:
  - 0.2 inch/hour intensity OR twice the 85th percentile hourly rainfall intensity

The soil media must sustain a maximum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of sand (60%–70%) meeting the specification of ASTM C33 (Region 3 Permit ASTM C33 / C33M-18, 2018) and certified compost (30%–40%) shall be used. A Regulated Project may utilize an alternative soil media if it demonstrates that its planting media is at least as or more effective in attenuating pollutants than the specified soil media mixture.
Design specifications for planting lists appropriate for Central Coast climate can be found in Appendix D.

To determine the 85th or 95th percentile rainfall depths, the project designer selects the most accurate value from the sources in Table 4. The commonly used values for Salinas are 0.75 inches in 24 hrs (85th percentile rain event) and 1.10 inches in 24 hrs (95th percentile rain event).

Table 4. Tools for Determining 85th and 95th Percentile Rainfall Depths

Source	Description	Internet Site Address
Central Coast Post-Construction Stormwater Requirements	"85th and 95th Percentile Rainfall Depths" rainfall statistics provided by the CCRWQCB. Includes instructions on reading and downloading maps as shapefiles or pdfs.	https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.html
United States Environmental Protection Agency – Energy Independence and Security Act	Part I.D of the December 2009 Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act	https://www.epa.gov/greeningepa/technical-guidance-implementing-stormwater-runoff-requirements-federal-projects

A Stormwater Control Plan is required to be submitted for Regulated Projects subject to PR-2. The designer must identify which onsite water quality treatment measures are included in the design, and plans should clearly identify the project type (commercial, residential, industrial, etc.), location, and size of all treatment measures. Guidance for development of a Stormwater Control Plan can be found in Appendix B. The Stormwater Control Plan Checklist in Appendix B requires a Statement of Compliance that the PR-1, and PR-2 requirements have been met. If not achievable, the statement shall provide documentation of the volume of runoff for which compliance cannot be achieved onsite, associated offsite compliance requirements, and a statement of intent to comply with PR-1, and PR-2 through Alternative Compliance. Alternative Compliance is discussed in further detail in Section 2.6.

3.3 PERFORMANCE REQUIREMENT #3 RUNOFF RETENTION

PR-3 mandatory requirements are applicable to all regulated projects, except detached single-family homes, that create and/or replace ≥15,000 SF of impervious surface (collectively over the entire site) and detached single-family homes with ≥ 15,000 SF of Net Impervious Area. Compliance for PR-3 requires optimizing infiltration practices and retaining the remaining volume via storage, rainwater harvesting and reuse, or evapotranspiration. PR-1 and PR-2 must also be met (Sections 3.1 and 3.2). A stormwater control plan must be prepared to demonstrate compliance with requirements PR-1, PR-2 and PR-3.

The retention tributary area is the driver for sizing calculations for Regulated Projects subject to PR-3. The retention tributary area is equal to the entire project area except for undisturbed areas, planted areas self-retaining areas) with native, drought-tolerant, or LID-appropriate vegetation that do not receive runoff from other areas, and impervious surface areas that discharge to infiltrating areas that can infiltrate that area's 95th percentile rain event runoff and will not produce runoff or create nuisance ponding. The drainage management areas (DMAs) are smaller areas that cumulatively make up the retention tributary area for the entire site. The retention tributary area should be calculated for each individual DMA to facilitate the design of SCMs. Following the LID principle of managing stormwater through small-scale, decentralized measures, DMAs are designated individual drainage areas within a Regulated Project that typically follow grade break and roof ridge lines and account for each surface type (e.g., landscaping, pervious paving, or roofs).

The following equation (Figure 6) is then used to calculate the retention tributary area:

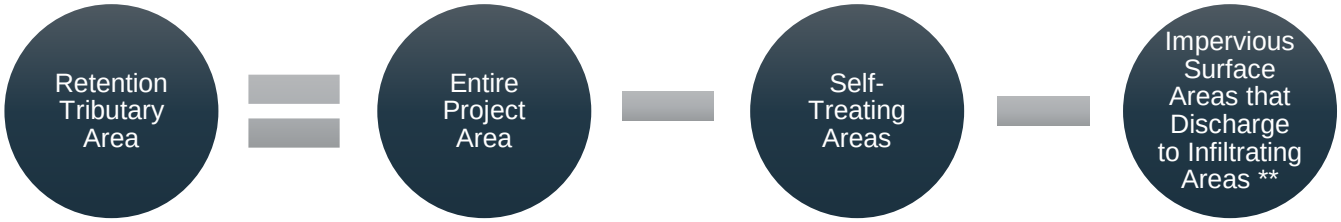


Figure 6. Retention Tributary Area Equation

Self-Treating Areas include undisturbed areas or areas planted with native, drought-tolerant, or LID appropriate vegetation that do not receive runoff from other areas may be considered self-treating and no additional stormwater management is required (Section B.4.d.iv.1 Resolution No. R3-2013-0032 (CCRWQCB, 2013)).

****Impervious Surface Areas that Discharge to Infiltrating Areas** include runoff from impervious surfaces, generated by the rainfall events, that may be directed to undisturbed or natural landscaped areas. When the project designer can demonstrate that runoff generated by the 95th percentile storm event will be infiltrated and will not produce runoff to the storm drain system, or a surface receiving waterbody, or create nuisance ponding that may affect vegetation health or contribute to vector problems, then no additional stormwater management is required for these impervious surfaces (Section B.4.d.iv.2 Resolution No. R3-2013-0032).

PR-3 includes adjustments for Redevelopment Projects when they include *replaced* impervious surfaces. The total amount of replaced impervious area on redevelopment projects shall be multiplied by 0.5 when calculating the volume of runoff required for retention.

The next step is to determine the required runoff retention volume. This volume is calculated for either flow-based or volume-based sizing. Regulated Projects that are subject to PR-3 are required to retain runoff from the 95th percentile rainfall event. The 95th percentile depth can be determined using the information in Table 4. Next, the runoff coefficient "C" is computed for the area tributary to proposed SCMs using the following regression-based equation:

$$"C" = 0.858i^3 - 0.78i^2 + 0.774i + 0.01$$

where i = the fraction of tributary area that is impervious

Figure 7. Runoff Coefficient Calculation

The volume is then calculated using the following equation (Figure 7):

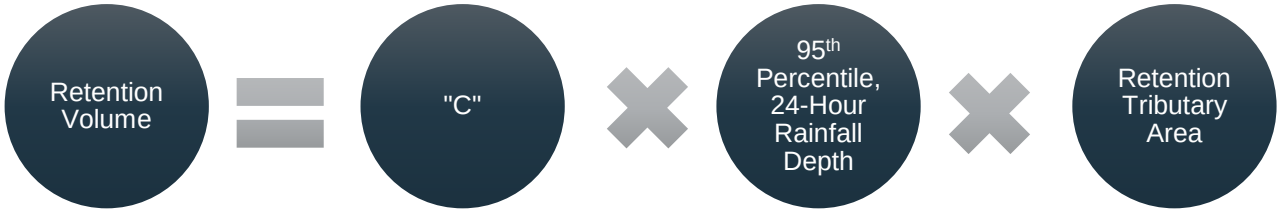


Figure 8. Retention Volume Equation

All rainfall directly incident to each SCM must be considered in determining runoff, including tributary landscaping, impervious areas, pervious pavements, and bioretention features.

The SCM capture volume can be determined with continuous simulation hydrologic modeling. This process uses a historical record of rainfall to size SCMs, but often finding complete continuous records can be difficult. Instead, it is recommended that the capture volume be determined with one of the following methods:

Method 1: Simple Method. This method provides a value equal to the retention volume calculated in the previous step (Figure 8).

Method 2: Routing Method. A hydrograph analysis determines whether the capture volume is enough to retain the retention volume (calculated in the previous step (Figure 8)). The routing analysis must show that the SCM does not overflow. If the retention volume cannot infiltrate within 48 hours, a multiplier of 1.2 is applied to the SCM capture volume calculated with the routing method. Routing methods adhere to the criteria in Table 5.

Table 5. Routing Method Criteria

Parameter	Method
Hydrograph Analysis Method	Natural Resources Conservation Service or Santa Barbara Urban Hydrograph
Pond Routing Method	Storage indication, unless otherwise justified to be more correct, based on site and storage conditions
Infiltration Rate	Underlying soil saturated infiltration rate, as indicated by locally accepted data obtained by the project designer and/or onsite testing, whichever is more accurate
Rainfall Distribution	Natural Resources Conservation Service Type I or based on local rainfall data
Time of Concentration	The time needed for water to flow from the most remote point in a catchment to the catchment outlet. A minimum of 15 minutes is required.
Time Increment	0.10 hour, unless otherwise justified to be more correct based on rainfall distribution

A variety of commonly used computer programs can calculate routing. One example is HydroCAD, which is based on the Natural Resource Conservation Service (NRCS) TR-55 Urban Hydrology for Small Watersheds (United States Department of Agriculture [USDA NRCS], 1986).

An example of a hydrograph with flow and stage storage routing of an SCM is included in Figure 9.

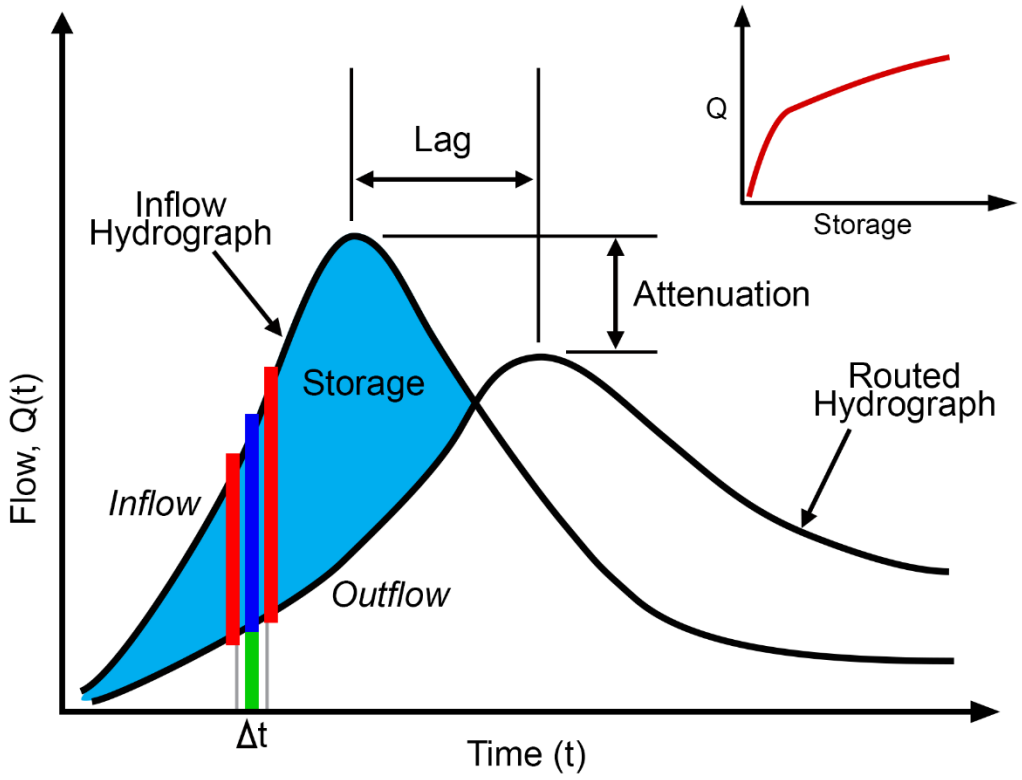
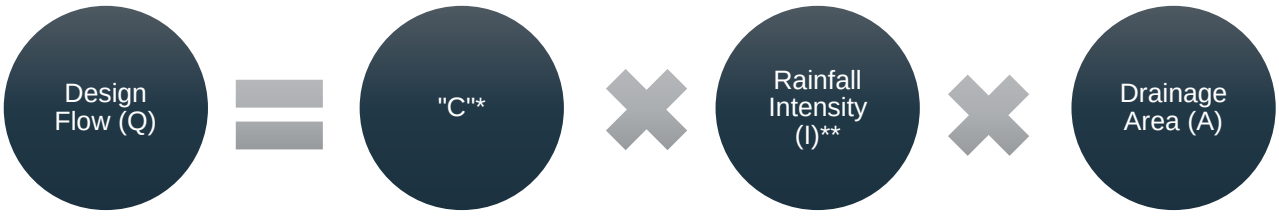


Figure 9. Hydrograph with Flow and Stage Storage

Method 3: Rational Method. Some SCMs are more appropriately sized using flow-based calculations. The Rational Method Equation is used to calculate design flow for a flow-based SCM (Figure 10).



* Runoff coefficient “C computed per the regression-based equation mentioned above.
**Rainfall intensity of 0.2 inch/hour intensity OR twice the 85th percentile hourly rainfall intensity shall be used.

Figure 10. Rational Method Equation

Table 6 lists sizing methods for commonly used SCMs.

Table 6. Sizing Methods for Commonly Used SCMs

Stormwater Control Measure Type	Hydraulic Sizing Criteria
Rainwater Harvesting and Reuse	Volume
Infiltration Trench	Volume
Subsurface Infiltration System	Volume
Bioretention Area	Flow or Volume
Tree Well Filter	Flow
Media Filter	Flow
Extended Detention Basin	Volume

Source: City of Gilroy, 2015

Often, for development projects large enough in size to qualify for PR-3, full compliance is challenging to achieve purely onsite. For sites where full onsite retention is technically infeasible, as defined in Section 2.6 (Alternative Compliance), the Regulated Project must dedicate no less than 10 percent (%) of the equivalent impervious surface area to retention-based SCMs. This is further explained in Attachment E of the Central Coast Post-Construction Requirements.

https://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/docs/lid/hydromod_lid_docs/2013_0032_attach1_post_construction_requirements.pdf

Note that the 10% adjustment is not applicable to the other PRs.

The equivalent impervious surface area is calculated using the following equation (Figure 11):

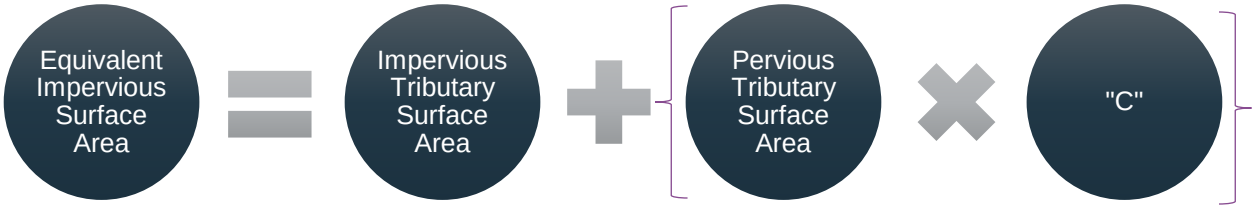


Figure 11. Equivalent Impervious Surface Area Equation

Impervious tributary surface area is the sum of all the site's conventional impervious surface area, such as concrete, asphalt, and rooftop surfaces. It does not include treating surfaces or SCM areas such as green roofs. The pervious tributary surface area is the sum of all the site's pervious area, corrected by a factor equal to the surface's runoff coefficient, which includes permeable pavers, managed turf, disturbed soils, permeable pavement, and conventional landscaped areas. It does not include infiltration SCM surfaces such as bioretention cells, bioswales, natural and undisturbed landscaped areas, or landscaped areas compliant with the Model Water Efficient Landscape Ordinance. The "C" factor is a correction factor equal to the site's runoff coefficient. Table 7 provides examples of "C" coefficients.

Table 7. Correction Factors for Use in Calculating Equivalent Impervious Surface Area

Pervious Surface	Correction Factor ("C")
Disturbed Soils/Managed Turf (dependent on original Hydrologic Soil Group*)	A: 0.15 B: 0.20 C: 0.22 D: 0.25
Pervious Concrete	0.60
Cobbles	0.60
Pervious Asphalt	0.55
Natural Stone (without grout)	0.25
Turf Block	0.15
Brick (without grout)	0.13
Unit Pavers on Sand	0.10
Crushed Aggregate	0.10
Grass	0.10

* Hydrologic Soil Group (HSG) is a letter (A–D) assigned to soils for increasing levels of runoff potential. The Natural Resource Conservation Service (NRCS) has a web resource for determining the HSG for project sites: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (USDA, 2017)
Source: Resolution R3-2013-0032, Attachment 1, Appendix E, Table 1

3.3.1 Offsite Mitigation Retention Volume

If the Regulated Project fails to demonstrate technical infeasibility, or demonstrates technical infeasibility, but fails to dedicate at least 10% of the equivalent impervious surface area to retention-based SCMs, then Offsite Mitigation is required. This is explained in the Central Coast Post-Construction Requirements in Attachment F.

If the project requires offsite mitigation, first use the following equation (Figure 12) to calculate the Potential Offsite Mitigation Retention Volume. This represents the additional volume of runoff that would have been retained onsite if project had applied retention-based SCMs to the full 10% of equivalent impervious surface area.

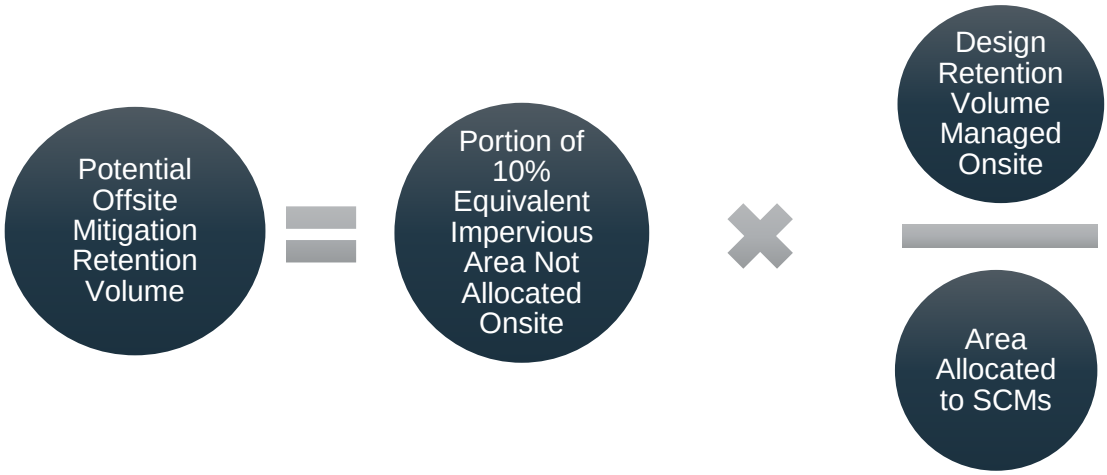


Figure 12. Potential Offsite Mitigation Retention Volume Equation

The portion of 10% equivalent impervious surface area not allocated onsite is that portion not allocated to onsite structural retention-based SCMs. For example, if 10% of the equivalent impervious surface area is 1,000 square feet, and only 700 square feet is allocated to retention-based SCMs, the remaining 300 square feet is the value used in the equation.

The design retention volume managed onsite divided by the value for actual area allocated to SCMs represents the onsite retention feasibility factor. This calculation establishes the site's retained volume to area ratio, expressed as cubic feet of runoff per square foot of area. For example, if the project infiltrates 3,000 cubic feet of runoff over 500 square feet of area, the on-site retention feasibility factor is 6.0.

The following steps determine Actual Offsite Mitigation Retention Volume.

The actual offsite mitigation retention volume is the lesser of the volume calculated in Figure 12 and the remaining portion of the design retention volume, calculated in Figure 7, not controlled onsite. Therefore, there are two possible outcomes when PR-3 is not met onsite AND less than 10% of the site's equivalent impervious surface area is allocated to retention based SCMs:

(1) The actual offsite retention volume is equal to the potential offsite mitigation retention volume, or

(2) The actual offsite retention volume is the remaining design retention volume.

A Stormwater Control Plan is required to be submitted for Regulated Projects subject to PR-3. A Stormwater Control Plan outline with additional guidance is available in Appendix B.

The project designer must identify which onsite water quality treatment measures are included in the design, and plans should clearly identify the project type (commercial, residential, industrial, etc.), location, and size of all treatment measures. The Stormwater Control Plan Checklist in Appendix B requires a Statement of Compliance that the PR-1, PR-2, and PR-3 requirements have been met. If not achievable, the statement shall provide documentation of the volume of runoff for which compliance cannot be achieved onsite, associated offsite compliance volume, and a statement of intent to comply with PR-1, and PR-2, and PR-3 through an Alternative Compliance agreement.

3.4 PERFORMANCE REQUIREMENT #4 PEAK MANAGEMENT

PR-4 mandatory requirements are applicable to all regulated projects that create and/or replace ≥22,500 SF of impervious surface (collectively over the entire project site). PR-1, PR-2, and PR-3 must also be met. Post-development peak flows must not exceed pre-project peak flows for the 2-year through 10-year storm events. Pre-project refers to the stormwater runoff conditions that exist onsite immediately before development occurs. Because PR-4 applies to additional runoff from increased impervious surfaces onsite, redevelopment sites may be exempt from PR-4 if they do not increase the impervious area above the pre-project condition or may be able to meet PR-4 requirements without any additional control measures.

A stormwater control plan must be prepared to demonstrate compliance with requirements PR-1, PR-2, PR-3, and PR-4. For projects over five (5) acres, a hydrology report must be provided in accordance with the City Design Standards. A Stormwater Control Plan outline and checklist are included in Appendix B.

Additional guidance is available on the Central Coast Regional Water Board website:

https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.html

The designer shall identify the onsite water quality treatment measures that are included in the design, and the plans must clearly identify the project type (commercial, residential, industrial, etc.), location, and size of all treatment measures. The Stormwater Control Plan Checklist in Appendix B requires a Statement of Compliance that the PR-1, PR-2, PR-3, and PR-4 requirements have been met. If not achievable, the statement shall provide documentation of the volume of runoff for which compliance cannot be achieved onsite, associated offsite compliance requirements, and a statement of intent to comply with PR-1, PR-2, PR-3, and PR-4 through an Alternative Compliance agreement.

3.5 PERFORMANCE REQUIREMENT #5 SPECIAL CIRCUMSTANCES

As discussed in Section 2.5, Regulated Projects may be designated by the municipality as subject to Special Circumstances based on certain site and/or receiving water conditions. The Special Circumstances designation exempts the Regulated Project from PR-3 and/or PR-4, where those requirements would be ineffective to maintain or restore beneficial uses of receiving waters. Projects subject to Special Circumstances must still comply with PR-2, Water Quality Treatment, based on net impervious area. Special Circumstances include:

- Highly Altered Channel
  - o Project runoff discharges into stream channels that are concrete-lined or otherwise continuously armored from the discharge point to the channel's confluence with a lake or large river (> 200 sq mile drainage area)
  - o Project runoff discharges to a continuous underground storm drain system that discharges directly to a lake or large river (> 200 sq mile drainage area)
  - o Under no circumstances can runoff from a Regulated Project result in adverse impacts to downstream receiving waters.
- Intermediate Flow Control Facility Special Circumstances:
  - o Project runoff discharges to an existing flow control facility that regulates flow volumes and durations to levels that have been demonstrated to be protective of beneficial uses of the receiving water downstream of the facility
  - o Flow control facility must have the capacity to accept the Regulated Project's runoff
  - o Demonstration that the facility has the capacity to accept runoff and regulate flow volumes and durations; quantitative analysis based on numeric, hydraulic modeling of facility performance must be included
  - o Under no circumstances can runoff from a Regulated Project result in adverse impacts to downstream receiving waters.

  Regulated Projects that create and/or replace ≥22,500 ft^2 of impervious surface must also comply with PR-3, Runoff Retention.
- Historic Lake and Wetland Special Circumstances:
  - o Project is located where there was once a historic lake or wetland where predevelopment hydrologic processes included filtration and storage but no significant infiltration to support downstream receiving water.

- Special Circumstance has been established based on a delineation of the historic lake or wetland approved by the Central Coast Water Board Executive Officer

Regulated Projects that that create and/or replace ≥15,000 and <22,500 ft^2 of impervious surface must meet PR-2 requirements (Water Quality Treatment) and detain runoff such that the post-project peak discharge rate does not exceed the pre-project rate for all runoff up to the 95th percentile 24-hour rainfall event, or a more protective rate consistent with the project designer's own development requirements (Detention).

Regulated Projects that create and/or replace ≥22,500 ft^2 of impervious surface must meet PR-2 requirements (Water Quality Treatment) and detain runoff such that the post-project peak discharge rate does not exceed the pre-project rate for the 95th percentile 24-hour rainfall event and the 2-year through 10-year storm events or a more protective rate consistent with the project designer's own development requirements (Peak Management).

The project designer must provide reasonable documentation to justify that a Regulated Project is appropriately categorized as a Special Circumstances project. A Stormwater Control Plan must be provided with any project being considered for the Special Circumstances designation. A Stormwater Control Plan outline and checklist are included in Appendix B. Additional information can be found on the Central Coast Regional Water Board website:

https://www.waterboards.ca.gov/rwqcb3/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.html

4 STORMWATER CONTROL MEASURE DESIGN GUIDANCE

This section provides guidance on SCM selection to treat stormwater and meet Stormwater Permit requirements based on pollutants common to the City. SCMs are ideally selected, designed, and maintained to treat pollutants specific to a particular land use, such as residential, commercial, or industrial facilities. The applicability and sizing requirements for SCMs vary by project given existing site conditions. This section includes land uses, pollutants, soil types, and SCM types to provide context for appropriate SCM selection.

4.1 PRINCIPAL GUIDANCE FOR MEETING PERMIT REQUIREMENTS

The City's Stormwater Permit requires that typical projects include LID measures to retain runoff onsite, generally by employing rainwater harvesting and reuse, infiltration, and evapotranspiration SCMs. The process of selecting an SCM to treat stormwater volumes or flow rates (calculated from Section 3) first involves identification of the land use of the project site as well as adjacent sites (Figure 13). Next, pollutants resulting from these particular land uses are identified. Then, a SCM that adequately treats these pollutants is selected. Finally, using the runoff volume or flow rate derived from Section 3, the SCM is designed, constructed, and subsequently maintained.

Figure 13. Process for Selecting an SCM

4.2 LAND USES

Land uses in the City include commercial, residential, industrial, and public lands. The predominant land use by area is low density residential. The city uniquely features residential, industrial, and commercial land uses in close proximity bordered by agricultural areas larger than the city itself. A land use map for the City is provided below.

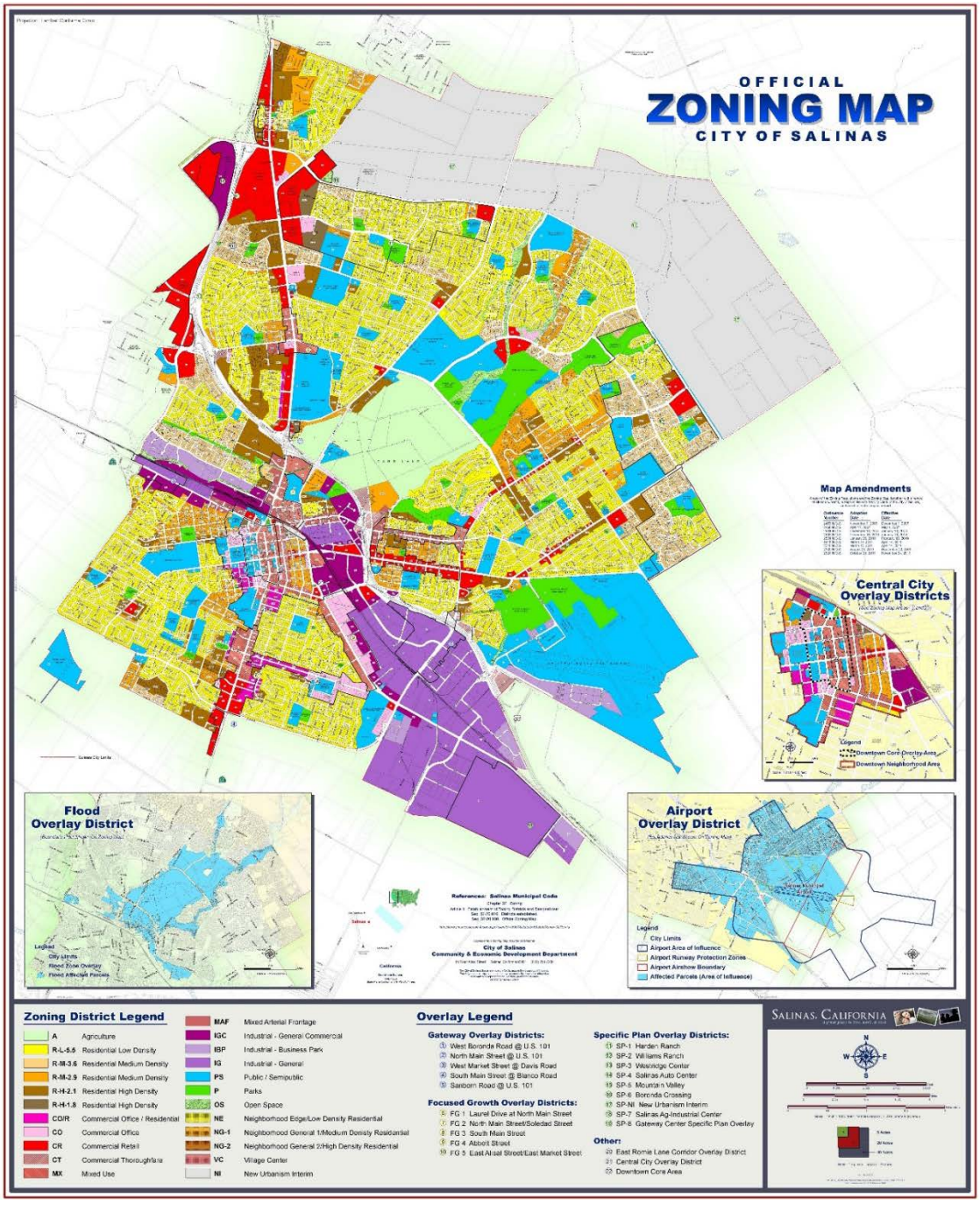


Figure 14. City of Salinas Land Uses

4.3 POLLUTANTS

This section includes descriptions, sources, and impacts of urban, residential, and agricultural pollutants. Table 8 is designed to be used in conjunction with the City land use map referenced in Section 4.2, so that developers are able to identify pollutants specific to their proposed site.

Table 8. Pollutants Commonly Found in Urban Runoff

Pollutant	Associated Land Uses	Major Sources	Potential Effects
Nutrients Nitrogen Phosphorus	Agriculture Residential Industrial Commercial	Fertilizers Animal waste Detergents Atmospheric deposition Leaking sewage pipes	Lowers oxygen levels Destroys habitat Promotes algal blooms Limits recreation Interferes with navigation
Pathogens Bacteria Viruses	Agriculture Residential Commercial	Animal waste Illicit connections between storm sewers and sewage lines Leaking sewage pipes Leaking sewage pipes	Poses human health risks Causes beach closures Causes shellfish harvesting area closures
Hydrocarbons Oil Grease Petroleum-based products Polycyclic aromatic hydrocarbons (PAHs)	Residential Commercial Mixed Arterial Frontage	Parking lots Roads Automobile emissions Improper disposal of used motor oil Illicit connections to drain systems	Lowers levels of dissolved oxygen in receiving waters Causes toxic impacts Damages habitat
Toxic Organics Pesticides Polychlorinated biphenyls (PCBs)	Agriculture Residential Industrial Parks	Lawn care Agricultural landscape Industrial uses Illicit connections to storm drain systems	Causes toxic impacts Leads to human and animal reproductive abnormalities Increases animal mortality rates
Sediments	Residential Agriculture	Construction sites Agricultural lands Logged forest lands Eroded stream banks	Increases water turbidity Alters water flows Destroys benthic habitat Blocks sunlight Attracts particulate forms of metals and nutrients

Pollutant	Associated Land Uses	Major Sources	Potential Effects
Metals Lead Copper Cadmium Zinc Mercury Chromium Selenium Nickel	Industrial Residential Commercial Mixed Arterial Frontage	Illicit storm drain connections Automobile use – emissions; brake pad residues Atmospheric deposition Industrial activities Commercial activities	Increases toxicity of sediment and water column Adds toxins to the food chain Causes genetic defects and reproductive abnormalities; increases mortality rates among fish and wildlife
Litter	Residential Commercial Business Parks Village Centers	Human activities	Affects aesthetics Impairs recreational uses Threatens aquatic life
Chlorides	Agriculture Industrial	Outdoor storage and use of salts on roads, driveways, and sidewalks in cold areas	Causes toxicity in freshwater organisms
Elevated Temperatures	Industrial Residential Commercial	Industrial sources Removal of trees next to streams and rivers Impervious surfaces and conveyances	Threatens insects, fish, and other temperature-sensitive aquatic species

Sources: Terrene Institute (1996); U.S. EPA (1995)

4.4 POLLUTANT REMOVAL EFFECTIVENESS

Table 9 identifies the effectiveness of individual SCMs in treating pollutants identified in the previous section.

Table 9. Pollutant Removal Effectiveness for Each SCM

Treatment Control Measure by Category	Pollutant of Concern[1, 2]		
	Metals	Suspended Sediments	Oil and Grease
Rainwater Harvesting			
Cistern and Rain Barrel	H	H	H
Infiltration			
Infiltration Basin	H	H	H
Infiltration Trench/Dry Well	H	H	H
Bioretention (no underdrain)	H	H	H
Stormwater Planter (no underdrain)	M	H	H
Vegetated Swale (no underdrain)	M	H	H
Tree-well Filter (no underdrain)	M	H	H
Permeable Pavement Filter (no underdrain)	H	H	H
Biofiltration			
Bioretention (with underdrain)	M	H	H
Stormwater Planter (with underdrain)	M	H	H
Vegetated Swale (with underdrain)	M	H	H
Tree-well Filter (with underdrain)	M	H	H
Permeable Pavement Filter (with underdrain)	M	H	H
Grassy Swale	M	M	M
Grassy Filter Strip	M	M	M
Proprietary Biofiltration Device	M	H	H
Flow-through Modular Treatment			
Sand Filter	M	H	H
Extended Detention Basin	M	M	H
Media Filter[3]	M	H	H[4]
Sedimentation Vault[3]	M	H	H[4]
Hydrodynamic Separator[3]	M	M	H[4]
Other Proprietary Device[3]	N/A	N/A	N/A

1. Expected pollutant reduction effectiveness for typical urban stormwater runoff: H = >75%; M = 75% to 25%; L = <25%.
2. If the project is located in a watershed with a Clean Water Act Section 303d-listed waterbody, treatment controls with a low effectiveness for the listed pollutant should be used in combination (e.g., used in a treatment train) with treatment controls with a medium to high reduction effectiveness.
3. Effectiveness of proprietary devices varies depending on the manufacturer and type of device. Limited performance data are available.
4. When oil adsorption media are provided and properly maintained.

H = high removal efficiency; L = low removal efficiency; M = medium removal efficiency;
N/A = not applicable
Source: Port of Long Beach, 2018

4.5 HYDROLOGIC SOIL GROUPS AND INFILTRATION

It is important to consider whether infiltration SCMs are appropriate and viable for a project site. Proper assessment of soil types at a project site is crucial for determining whether an infiltration SCM is possible because some sites contain soils that do not permit infiltration. This section includes descriptions of hydrologic soil groups (HSGs), a map of soil types in the City, and guidance on assessing the feasibility of infiltration SCMs based on existing site conditions. If it is determined that infiltration is not feasible, then another SCM must be selected that adequately retains the stormwater volume.

4.5.1 Hydrologic Soil Groups

The four hydrologic soil groups (A, B, C, and D) are rated for their runoff potential from lowest to highest, respectively. Existing soils with high runoff potential are not favorable for infiltration SCMs, whereas soils with low runoff potential are favorable. The properties of HSGs are summarized in Table 10. Figure 14 displays City soil groups.

Table 10. Classification of Hydrologic Soil Groups

Soil Group	Texture	Composition	Infiltration Rate	Runoff Potential
A	Gravel, Sand	< 10 % Clay, > 90% Sand	High	Low
B	Sandy Loam, Loamy Sand	10 – 20 % Clay, 50 – 90 % Sand	Moderate	Moderately Low
C	Loam, Silt Loam, Sandy Clay Loam, Silty Clay Loam, Clay Loam	20 – 40 % Clay, < 50 % Sand	Slow	High
D	Clay	> 40 % Clay, < 50 % Sand	Very Slow	Very High

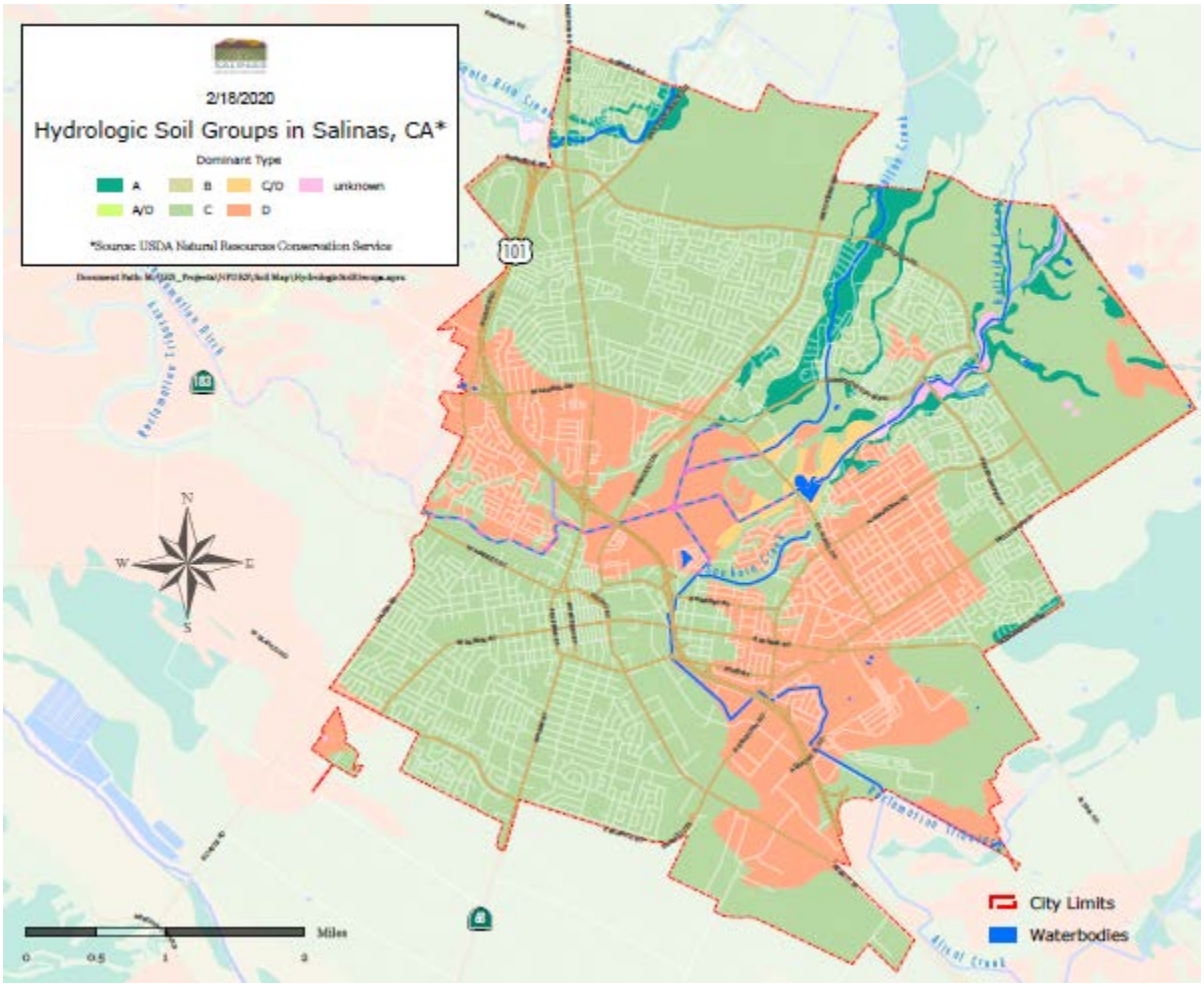


Figure 15. City of Salinas Soil Map

(https://www.cityofsalinas.org/sites/default/files/departments_files/public_works_files/hydrologicsoilgroups2.pdf)

4.5.2 Infiltration Feasibility

The feasibility of using indirect and direct infiltration measures must be determined. For projects where some infiltration is feasible, whether all or just a portion of the treatment and volume reduction requirements can be satisfied using infiltration must be determined. To determine whether infiltration SCMs are appropriate for a project based on existing site conditions, the Infiltration Feasibility Worksheet has been provided in Appendix C. If infiltration feasibility varies among DMAs, the Infiltration Feasibility Worksheet should be completed for each infiltration condition. If it is determined that at least some infiltration on the site is feasible, a design infiltration rate must be established for each infiltration system (though testing of each system location may not be necessary) and expected performance of proposed configurations must be evaluated following the requirements of these stormwater development standards.

Infiltration Guidelines

Infiltration is a preferred LID treatment measure and a cost-effective method to manage stormwater – if the conditions on the site allow. Site design and treatment measures that accomplish stormwater infiltration can be categorized as follows:

- ***Site design measures*** – clustering development or otherwise laying out the site to reduce the overall impervious area, routing drainage from building roofs to landscaped areas for infiltration and using pervious pavement.
- ***Indirect infiltration*** – methods which allow stormwater runoff to percolate ***through surface soils***. Runoff may reach groundwater indirectly, following treatment by surface soils. Bioretention is an example of an indirect infiltration method.
- ***Direct infiltration*** – methods which are designed to ***bypass surface soils*** and transmit runoff directly to subsurface soils, which allows infiltration to groundwater. These types of devices must be located and designed to limit the potential for stormwater pollutants to reach groundwater. Infiltration basins and trenches are examples of a direct infiltration method.

When selecting design and stormwater treatment measures that promote onsite infiltration, be sure to ***follow the geotechnical engineer's recommendations*** based on soil boring data, percolation tests, drainage patterns, and conditions needed for slope stability. The geotechnical engineer's input will be critical to prevent infiltrating water from damaging building foundations, surrounding properties, public improvements, and sloped banks. Appendix C provides guidelines to help you determine whether your project site is suitable for infiltration measures or devices.

Limitations on the Use of Infiltration Systems

The proximity of infiltration systems to constraints, listed in Table 11, preclude the use of infiltration. Some factors listed in the table provide constraints on specific SCM location configurations, but do not preclude infiltration on the site.

The following more general conditions preclude the use of any infiltration systems:

1. Water wells are present within 100 feet of the potential infiltration system location.
2. Septic systems are present within 100 feet of the potential infiltration system location.
3. Less than 5 feet of separation between the base of any infiltration device and the seasonally high groundwater level unless the applicant has demonstrated to the satisfaction of the City Engineer that sufficient measures will be in-place to ensure that risk of groundwater contamination will be insignificant.
4. Underground fuel tanks that contain fuels or other hazardous material are present, or are allowed based on zoning, within 500 feet of the potential infiltration system location
5. Certification by a geotechnical engineer that infiltration anywhere on the site is incompatible with geological constraints and demonstration to the satisfaction of the City Engineer that no alternative onsite configuration with an infiltration system would be feasible.
6. Geotechnical hazards present, such as steep slopes, areas with landslide potential, soils subject to liquefaction, or locating an infiltration facility near a building foundation or other improvements subject to undermining by saturated soils, preclude potential infiltration systems at that particular location.

The following conditions preclude the use of direct infiltration systems (infiltration trenches, infiltration basins and drywells):

1. Less than 10 feet of separation between the base of any imported permeable material in any direct infiltration device and the seasonally high groundwater level unless the applicant has demonstrated that sufficient measures will be in-place to ensure that risk of groundwater contamination will be insignificant.
2. Location receives runoff from roadways subject to high vehicular traffic. (See Table 1 and associated notes.)
3. There is a significant potential for spills or highly polluted runoff to be conveyed to the infiltration system, unless the applicant has demonstrated to the satisfaction of the City Engineer that sufficient measures will be in place to ensure that the risk of groundwater contamination will be insignificant.

Infiltration Rate Determination

Soils underlying the City of Salinas have a wide range of infiltration characteristics. There are locations where near surface soils are conducive to infiltration, but subsurface layers of clay impede the downward flow of water. Other locations have nearly impervious soils near the surface but have more favorable conditions at reasonable depths that make infiltration feasible. There are project locations with constraints making infiltration infeasible, and locations where infiltration rates are too low to consider in design. However, low to moderate infiltration rates can be used in the design of projects in many locations, and even designs based on low infiltration rates can provide significant runoff reduction benefits.

Infiltration rate assessment is important for decisions about whether to include an underdrain or pre-treatment, such as biofiltration, in infiltration SCMs. To determine the infiltration rates of underlying soils, the minimum infiltration testing methods acceptable for use in the City are the constant-head double-ring infiltrometer or Monterey County's Soil Percolation Test (https://www.co.monterey.ca.us/home/showdocument?id=57520). The infiltration test must be conducted in accordance with standard procedures by qualified personnel using appropriate data collection forms. For any other tests to be deemed acceptable, other means must be used to correctly account for lateral flow. Soil infiltration rates must be evaluated and approved for use in the design of stormwater infiltration systems by a California registered professional engineer, geotechnical engineer, geologist, hydrogeologist, or other qualified professional approved by the City Engineer.

Site infiltration rate testing is required whenever a design infiltration rate is used. If the geotechnical engineer certifies that the design infiltration rate is less than 0.02 inches per hour based on analysis of soil samples, no infiltration testing is required. If infiltration is occurring on the site in an underground location or where the surface of the infiltration SCM is not maintainable, the system shall include measures to protect the long-term infiltration capacity from significant degradation over time. Concentrations of tributary runoff, such as roof drains, onto some pervious pavement configurations could be expected to deliver pollutants to the permeable sub-base under which the pollutants could settle and reduce infiltration.

Design infiltration rates shall be established using methods that are appropriate for the configuration of infiltration system being proposed. The maximum design infiltration rate shall be

no more than half of the lowest infiltration test result. For relatively large areas of infiltration, such as from under areas of pervious pavement or infiltration basins, lateral flow from the device must be considered to be insignificant and only vertical outflow shall be considered. For other infiltration system configurations, such as infiltration trenches, lateral flows may be significant and can be considered.

For 10 acre or greater project sites, additional testing is required. A boring or test pit shall be drilled where it is expected to be a representation of the location of each proposed direct and indirect infiltration SCMs. The City Engineer may approve one test being acceptable for multiple proximate SCMs. The boring shall advance to a minimum of 15 feet or a minimum of 10 feet below the depth of the lowest SCM. The boring will be used to identify seasonally high groundwater and potential shallow restrictive soil layers and/or bedrock.

Seasonally high groundwater levels, depth to bedrock and depth and thickness of shallow restrictive layers shall be evaluated, verified and certified by a California registered professional engineer, geotechnical engineer, geologist, hydrogeologist, or other qualified professional as approved by the City Engineer.

Infiltration SCM Design Requirements

Stormwater infiltration SCMs include practices designed to directly and indirectly infiltrate urban runoff through surface soils into groundwater to minimize pollutants from entering surface waters while also protecting groundwater. Table 11 presents allowable infiltration rates, limits on standing water, and separation and setback standards established to protect groundwater quality, assist with vector control, protect underground infrastructure, and prevent potential slope failures from stormwater infiltration SCMs.

Table 11: City of Salinas Stormwater Infiltration System Design Standards

Recommended Design Standards	Direct Infiltration Practices (a)	Indirect Infiltration Practices (b)
Allowable Infiltration Rates	Min 1.0 in/hr Max 3.0 in/hr (c)	Min 0.5 in/hr (d) Max 3.0 in/hr
Standing Water (e)	< 48 hrs	< 48 hrs
Groundwater Separation	≥ 10 ft	≥ 5 ft
Bedrock Separation	≥ 10 ft	≥ 5 ft
Water Well Setback	≥ 150 ft	≥ 100 ft (f)
Surface Water Setback	≥ 100 ft	≥ 50 ft (f)
Septic System Setback (g)	≥ 150 ft	≥ 100 ft (f)
Groundwater Contamination Setback (h)	≥ 500 ft	≥ 500 ft (f)
Underground Fuel Tank Setback	≥ 500 ft(i)	≥ 500 ft (f)(i)
Building Basement and Bridge Foundation Setback	≥ 100 ft up slope and ≥ 20 ft down slope	≥ 100 ft up slope and ≥ 20 ft down slope (g)
Property Line Setback (j)	≥ 2 in	≥ 2 in
Slope Setback (k)	100 ft from the top of slopes >15%	50 ft from the top of slopes >15%

Notes:

(a) Direct infiltration practices include infiltration trenches; infiltration basins; and any structure designed to infiltrate stormwater into the subsurface and bypass the natural groundwater protection afforded by surface or near-surface soils.

(b) Indirect infiltration practices include unlined vegetated swales, biofiltration systems, and pervious pavements. Vegetated systems may require supplemental irrigation during extended dry periods.

(c) Where measured infiltration rates exceed 3.0 in/hr, treatment SCMs must be used upstream of direct infiltration SCMs.

(d) Indirect infiltration may be used when measured infiltration rates are less than 0.5 in/hr with the inclusion of an underdrain to ensure water quality treatment is provided.

(e) Additional design standards and maintenance requirements apply for mosquito and vector control (see Monterey County Code for Mosquito Abatement and Vector Control).

(f) Indirect infiltration practices may be placed within the setback limits or directly adjacent to the structures noted above if an impermeable surface and underdrain system prevent infiltration to the underlying soils within the setback limits.

(g) Setback applies to septic system leach fields.

(h) Setback applies to areas of known groundwater contamination. Any known groundwater contamination plume that could be further dispersed by infiltration at the subject location. If known contaminated plume is present within 500 feet of potential infiltration site, evaluate to determine mobilization concern.

(i) The setback may be potentially reduced to 250 feet if the UST is located down gradient of the proposed stormwater infiltration device, the infiltration flow patterns would not influence a pollution plume, and there are no utility conduits or trenches in the vicinity that could influence the pathway of UST contaminants or infiltration water.

(j) Setback applies to biofiltration systems with at least six (6) inch ponding.

(k) A qualified geotechnical and/or structural engineer shall determine site-specific requirements whenever site slopes exceed 7 percent.

Infiltration Rate Evaluation

Infiltration rates shall be used to determine the need for underdrain or pre-treatment as follows:

- For project sites with design infiltration rates that are less than 0.5 inch per hour, infiltration SCM designs must incorporate an underdrain system to ensure that minimum water quality requirements are met while promoting infiltration to the maximum extent practicable and preventing standing water as required to meet vector control requirements.
- Project sites with design infiltration rates that are greater than 0.5 inch per hour are expected to discharge no runoff from the site during any 95th percentile rainfall event for projects subject to PR-3 or any 95th percentile rainfall and event and 10 year peak flow for projects subject to PR-4.
- For project sites with measured infiltration rates that are greater than 3.0 inches per hour, stormwater must be adequately pre-treated prior to direct infiltration to protect ground water quality.

4.6 STORMWATER CONTROL MEASURE DESCRIPTIONS

This section includes descriptions and resources for design, construction, and maintenance for SCMs that may be used for stormwater treatment, including rainwater harvesting and reuse systems, infiltration systems, bioretention and biofiltration systems, and pervious pavements. The project designer may utilize the City of Salinas Stormwater Standard Plans for design and construction of SCMs. The Plans include standard specifications for public work construction and provides detailed construction, design, and O&M notes for the SCMs described below. SCM designs that deviate from the City Stormwater Standard Plans shall be stamped and signed by a California licensed professional engineer. Additional stormwater control measure design requirements are included in Appendix F. The CASQA-LIDI Bioretention Standard Details may also be used.

4.6.1 Rainwater Harvesting and Reuse Systems

Rainwater capture and reuse systems provide stormwater management benefits such as reducing rate, volume, and pollutant loading of urban runoff from developed sites. Stormwater from roofs, paved terraces, and patios is conveyed through gutters, downspouts, and a screening device to remove leaves and other debris before discharging to above- or below-ground storage tanks or cisterns.

The water collected by these systems may be reused for non-potable water uses within a house or building, or for exterior landscape irrigation purposes. Uses can include water for toilets and irrigation at exterior hose bibs.

Rainwater capture and reuse systems must be required to meet plumbing and health department codes prior to use. Any reuse that ties into a system that also uses potable water must also be reviewed by the Monterey County Health Department.

Rainwater Harvesting (Cistern)
Source: City of Salinas

4.6.2 Infiltration Systems

Infiltration Trench
Source: Contech Engineered Solutions

Infiltration involves percolation, or the downward movement of water through soil. As water percolates, the pollutants are removed by natural processes such as physical filtering, ion exchange, adsorption, biological processing, conversion, and uptake by plants. Stormwater eventually infiltrates into groundwater aquifers.

Infiltration SCMs include infiltration trenches, infiltration basins, injection wells, dry wells, and any structure designed to infiltrate stormwater into the subsurface and bypass the natural groundwater protection afforded by surface or near-surface soils. If used improperly, infiltration SCMs, such as infiltration basins and dry wells, can allow stormwater runoff to infiltrate into the ground without adequate treatment to protect groundwater quality. Other SCMs, such as biofiltration and pervious pavement, generally provide treatment of stormwater runoff to protect groundwater quality. Therefore, sites with potential pollutants that could threaten groundwater quality must pre-treat stormwater runoff upstream of any infiltration SCMs by incorporating another flow-through SCM or must otherwise demonstrate to the satisfaction of the City Engineer that the proposed configuration provides adequate protection and is maintainable. Flow-through SCMs are described in Section 4.6.3.

4.6.3 Bioretention and Biofiltration Systems

Bioretention systems are shallow earthen areas designed to collect, retain, and eventually infiltrate stormwater. Examples of bioretention systems include bioretention basins and stormwater planters. Biofiltration systems, which collect and filter stormwater through plants and soil using natural processes, are similar but feature an underdrain. Examples of biofiltration systems include bioswales, vegetated filter strips, green roofs, and biofiltration basins. Biofiltration can be used to fulfill water quality treatment requirements where treatment is needed upstream of infiltration systems or where treatment but not runoff reduction is required.

Biofiltration systems are sized to be either flow-through or retention-based. Biofiltration basins, vegetated filter strips, and green roofs are examples of volume-based SCMs, while bioswales are flow-through devices. Bioswales are essentially vegetated channels designed to convey water during rain events. Guidance on plant selection for swales is presented in Appendix D.

Bioretention Areas

For further design guidance:

https://www.casqa.org/sites/default/files/downloads/2._20170831_generic_drawing_combined_bioretention_details_and_specs.pdf

Green Roof
Source: County of San Diego

4.6.4 Pervious Pavements

Pervious pavement SCMs are typically one of the most feasible methods for reducing a site's impervious footprint and can also be used to detain or retain runoff from impervious surfaces. A variety of pervious pavements are available, including open-celled block pavers, open-jointed block pavers, porous concrete pavement, porous asphalt pavement, porous turf pavement, and porous gravel pavement. Where pervious pavement is configured to receive runoff from impervious surfaces with more than twice the area where infiltration is being promoted, or has storage configured as a direct infiltration SCM, infiltration requirements must be met if the design infiltration rate is 1.0 inch per hour or more.

Vegetated Open Cell Unit Pavers
Source: County of San Diego

Pervious Pavers

4.7 GETTING RUNOFF INTO TREATMENT MEASURES

Stormwater may be routed into stormwater control measures using ***sheet flow or curb cuts***.

4.7.1 Standard Curb Cut: Design Guidance

- Openings should be at least 18 inches wide; for smaller facilities, 12" width may be allowed subject to municipal approval.
- Curb cut can have vertical sides or have tapered sides at 45 degrees (shown).
- Slope the bottom of the concrete curb into the SCM.
- Allow a change in elevation of 4 – 6 inches between the paved surface and the biotreatment soil elevation.
- Provide cobbles or other energy dissipaters for 4 ft to prevent erosion below the drop.
- Provide a minimum 2-inch drop in grade between the impervious surface and the finish grade of the SCM; a 4 to 6-inch drop is recommended so that vegetation or mulch buildup does not obstruct flow.
- Do not place a curb cut within two feet of an overflow drain or a storm drain.

Figure 4-1: Cobbles in this stormwater treatment measure in San José help prevent erosion.

Figure 4-2: This standard curb cut at parking lot rain garden has 45 degree chamfered sides.

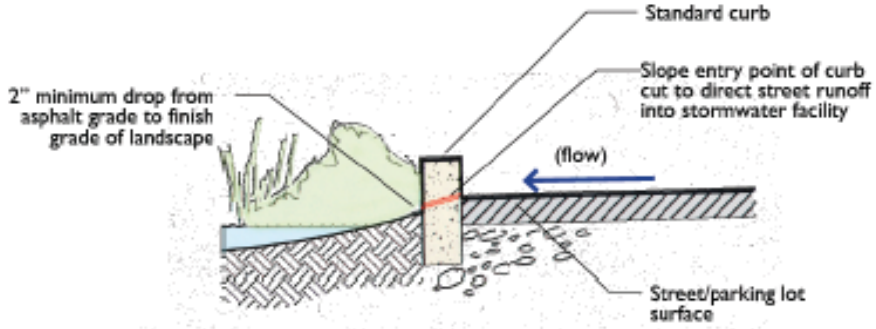


Figure 4-3: Standard curb cut: section view (Source: San Mateo Countywide Water Pollution Prevention Program [SMCWPPP] 2009)

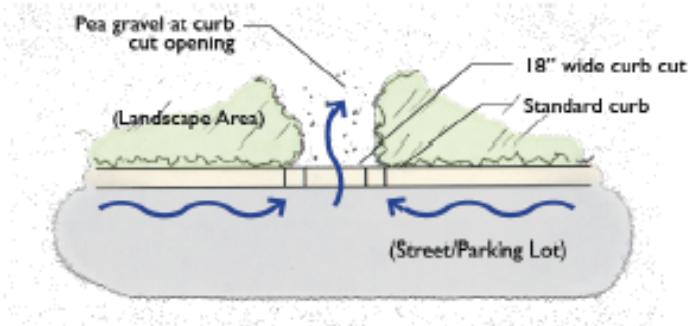


Figure 4-4: Standard curb cut: plan view (Source: SMCWPPP 2009)

4.7.2 Standard Curb Cut with Side Wings: Design Guidance

- Opening should be at least 18 inches wide; for smaller facilities, 12" width may be allowed subject to municipal approval.
- Works well with stormwater facilities that have steeper side slope conditions.
- Slope the bottom of the concrete curb toward the stormwater facility.
- Allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- Provide cobbles or other energy dissipater to prevent erosion below the drop.
- Do not place a curb cut within two feet of a storm drain.

Figure 4-5: The side wings of this standard curb cut help retain the side slope grade on each side of the curb cut opening.

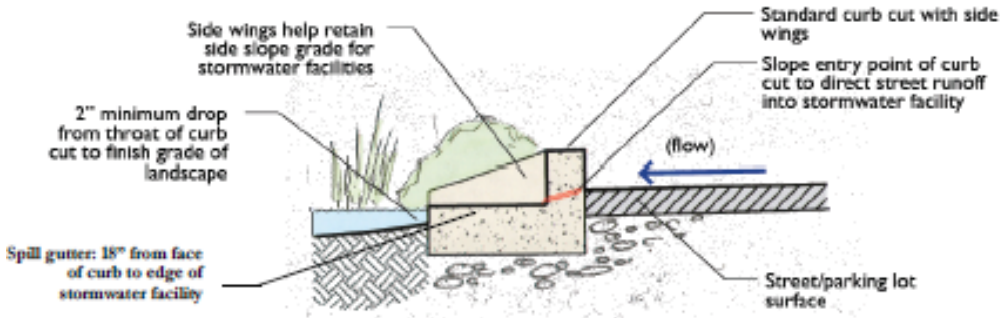


Figure 4-6: Standard curb cut with side wings: cut section view (Source: SMCWPPP 2009)

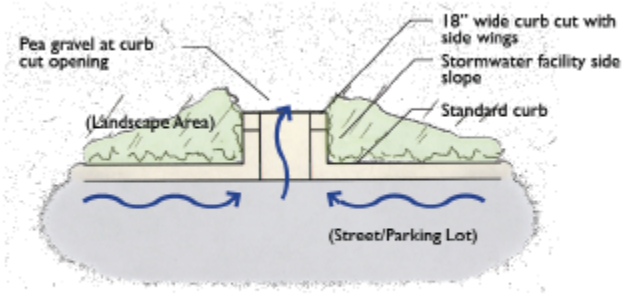


Figure 4-7: Standard curb cut with side wings: plan view (Source: SMCWPPP 2009)

4.7.3 Wheelstop Curbs: Design Guidance

- Wheelstops allow water to flow through frequently spaced openings.
- Wheelstops are most common in parking lot applications, but they may also be applied to certain street conditions.
- Provide a minimum of 6 inches of paved area between the wheelstop edge and the edge of paving.
- Allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- Provide cobbles or other energy dissipater at wheelstop openings to prevent erosion.

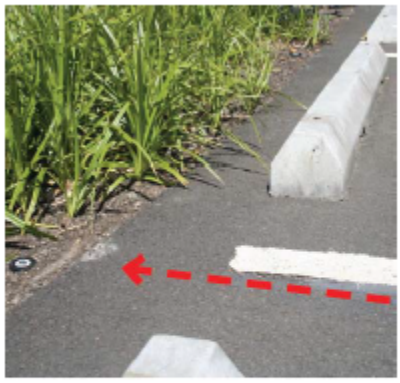


Figure 4-8: Stormwater runoff enters the stormwater facility through the 3-foot space between these wheelstops. The design could be improved by providing more of a drop in grade between the asphalt and landscape area.

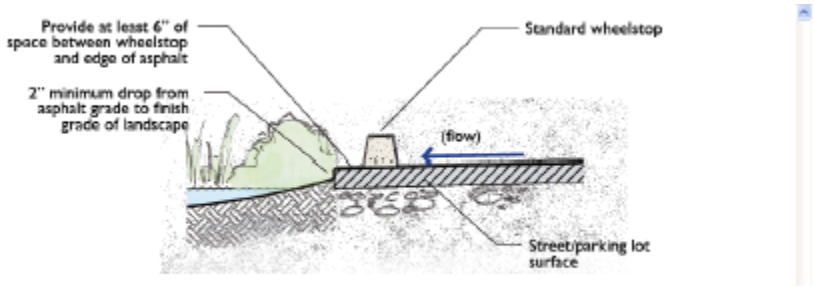


Figure 4-9:Opening between wheelstop curbs: section view (Source: SMCWPPP 2009)

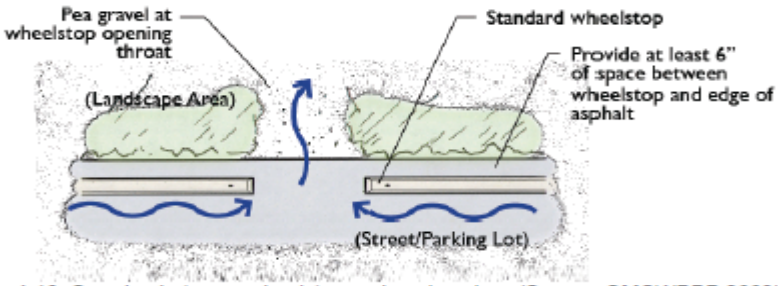


Figure 4-10: Opening between wheelstop curbs: plan view (Source: SMCWPPP 2009)

4.7.4 Grated Curb Cut: Design Guidance

Figure 4-11: A grated curb cut allows stormwater to pass under a pedestrian walkway to the stormwater facility.

- Grated curb cuts allow stormwater to be conveyed under a pedestrian walkway. The curb cut opening should be at least 18 inches wide; 12" may be allow for smaller stormwater facilities subject to municipal approval.
- Grates need to be heel and ADA compliant and have sufficient slip resistance.
- Allow a change in elevation of 4 to 6 inches between the paved surface and biotreatment soil elevation, so that vegetation or mulch build-up does not obstruct flow.
- Do not place a curb cut within two feet of an overflow drain or upstream storm drain.

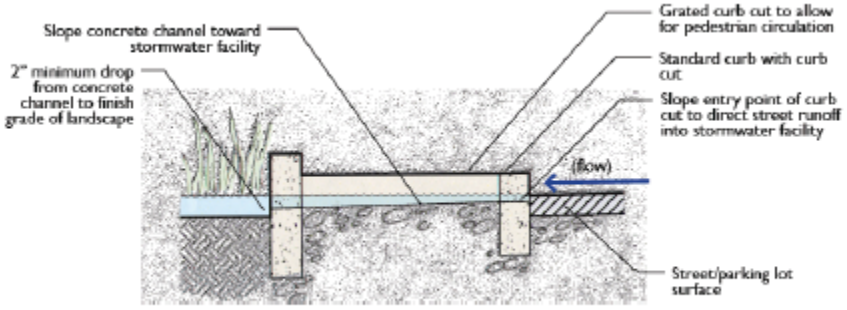


Figure 4-12: Grated curb cut: section view (Source: SMCWPPP 2009)

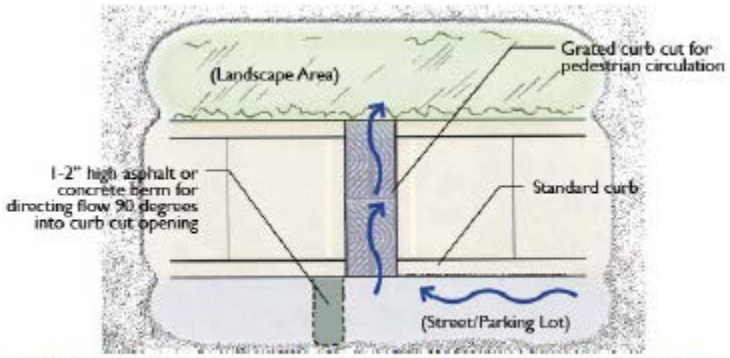


Figure 4-13: Grated curb cut: plan view (Source: SMCWPPP 2009)

4.8 UNDERDRAINS

Where the existing soils have a lower infiltration rate than soils specified for a landscape-based stormwater treatment measure, it may be necessary to install an underdrain to allow the treatment measure to function as designed and ***prevent the accumulation of standing water.*** Underdrains are required throughout most of Salinas. Underdrains are perforated pipes that allow water to enter the pipe and flow to the storm drain system. To help prevent clogging, two rows of perforation may be used along the underside of the pipe. Cleanouts should be installed to allow access to underdrains to remove debris. ***Underdrains should NOT be wrapped in filter fabric,*** to avoid clogging. Underdrains are typically installed in a layer of washed drain rock or Class 2 permeable aggregate, beneath more permeable stormwater biotreatment soils. The nominal rock diameter size used in the rock layer should be larger than the diameter of the perforations in the subdrain to prohibit drain rock from entering the subdrain pipe.

When designing a bioretention facility and infiltration is permitted onsite, the underdrain should be placed near the top of the drain rock layer to allow as much water to infiltrate into native soils as possible before entering the underdrain and discharging to a storm drain. If infiltration is not permitted due to site conditions such as high groundwater, contaminated soils, proximity to structures, etc., the bioretention facility should be lined and the underdrain placed near the bottom of the drain rock layer.

4.9 BYPASSING HIGH FLOWS

Although stormwater treatment measures are sized to remove pollutants from flows resulting from frequent, small storms, projects must also be designed to bypass drainage from large, infrequent flows to ***prevent flooding and potential damage*** to the treatment measure. The safe conveyance of high flows through or around the treatment measure may be accomplished in one of two ways, which are described below.

One option is to have the flows that are larger than those required by the hydraulic sizing criteria handled ***within the stormwater treatment measure***. This includes making sure that landscape-based stormwater treatment measures do not erode during flows that will be experienced during larger storms. Infiltrating vegetated swales and extended detention basins can be designed to handle higher flows, although they would not be providing much treatment during these flows.

Bioretention areas, flow-through planter boxes, and other treatment systems that rely on filtering or infiltrating stormwater through soils much have ***overflow systems*** that allow high flows larger than the water quality design flow or volume to bypass the stormwater treatment measure. These systems have to include an alternative flow path for high flows, otherwise stormwater would back up and flood the project area.

The second option for stormwater treatment measures designed as low-flow systems is to restrict stormwater flows to the treatment measure and ***bypass excess flows around the facility.*** Bypassing larger flows helps prevent hydraulic overload and resuspension of sediment, and it can protect stormwater treatment measures from erosion. In some designs, the ponding depth in the bioretention facility may prevent the excess runoff from entering the facility, causing it to flow to a separate grate system or downstream inlet.

Flow Splitter devices may be used to direct the initial flows of runoff, or “first flush”, into a stormwater treatment measure, and bypass excess flows from larger storm events around the

facility into a bypass pipe or channel. The bypass may connect directly to the storm drain system, or to another stormwater control measure that is designed to handle high flows. This can be accomplished using a stepped manhole (Figure 4-14) or a proprietary flow splitter (Figure 4-15). The proprietary flow splitter works in the following manner: runoff enters the device by way of the inlet at the left side of the figure; low flows are conveyed to the stormwater treatment measure by way of the outlet pipe at the lower right. Once the treatment measure reaches its design capacity, water backs up in the low-flow outlet pipe and into the flow splitter. When the water level in the slow splitter reaches the bypass weir elevation, stormwater begins to flow out the overflow pipe, shown at the upper right of the figure, bypassing the stormwater treatment measure.

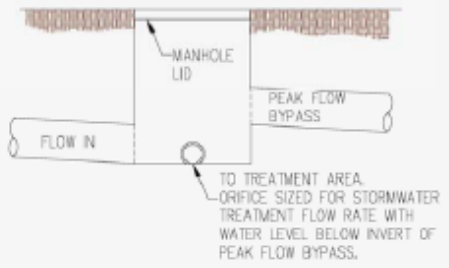


Figure 4-14: Stepped manhole design directs low-flows to treatment measure and diverts high flows to storm drain system. (BKF Engineers)

Figure 4-15: StormGate™ flow splitter structure. Source: Contech Construction Products Use of this illustration is for general information only and is not an endorsement of this or any other proprietary device.

4.10 PLANT SELECTION AND MAINTENANCE

4.10.1 Plant Selection Guidance

Selecting the appropriate plants and using sustainable, horticulturally sound landscape design and maintenance practices are essential components of a successful landscape-based stormwater treatment measure. Appendix D provides a list of plants that can be used for stormwater treatment. Plant selection must consider the type of development and location, uses on the site and an appropriate design aesthetic. Ideally, a Landscape Architect will be involved as an active member osf the design team ***early in the site design phase*** to review proposed stormwater measures and coordinate development of an integrated solution that responds to all of the various site goals and constraints. In some cases, one professional will design the stormwater control measure while another designs the rest of the landscaping. In these situations, it is critical for the professionals to work together very early in the process to integrate their designs.

4.10.2 Water Efficient Landscaping requirements

The California Water Conservation in Landscaping Act of 2006 requires municipalities to adopt by January 1, 2010, landscape water conservation ordinances that are at least as effective in conserving water as the Model Water Efficient Landscape Ordinance (MWELO) prepared by the Department of Water Resources (DWR). The MWELO automatically went into effect on January 1, 2010 in municipalities that had not adopted a local Water Efficient Landscape Ordinance (WELO).

Governor Brown's Drought Executive Order of April 1. 2015 (EO B-29-15) directed the DWR to update the States MWELO through expedited regulation. The California Water Commission approved the revised MWELO on July 15, 2015. The deadline for local agencies to adopt the MWELO was December 1, 2015. The City of Salinas adopted the MWELO in 2010. The MWELO applies to the following public landscapes and private development projects:

- New construction projects with an aggregate landscape area equal to or greater than 500 square feet requiring a building or landscape permit, plan check, or design review;
- Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 2,500 square feet requiring a building or landscape permit, plan check, or design review.

Water conserving, drought tolerant plants that are suitable for use in stormwater treatment measures are listed in Appendix D. The MWELO can be found at:

https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency/Model-Water-Efficient-Landscape-Ordinance

4.10.3 Integrated Pest Management

Integrated Pest Management (IPM) is a holistic approach to mitigating insects, plant diseases, weeds, and other pests. Projects that require a landscaping plan as part of a development project will be required to use IPM practices. ***Avoiding pesticides and quick release synthetic fertilizers,*** covering exposed earth with appropriate mulch material, and nourishing the soil with compost are particularly important when maintaining stormwater treatment measures to protect water quality.

IPM encourages the use of many strategies for preventing and controlling pests. It places priority on fostering a healthy environment in which plants have the strength to resist diseases and inset infestations, and out-compete weeds. Using IPM requires an understanding of the life cycles of pests and beneficial organisms, as well as regular monitoring of their populations. When pest problems are identified, IPM considers all viable solutions and uses a combination of strategies to control pests, rather than relying on pesticides alone. The least toxic pesticides are used only as a last resort. The use of pyrethroid pesticides is prohibited within the City of Salinas.

4.11 DESIGN AND CONSTRUCTION RESOURCES

The following resources provide comprehensive descriptions and design guidelines for SCMs:

City of Salinas Stormwater Standard Plans (Sourced from CASQA and City of Salinas Standard Plans). The Plans are found on the City of Salina's website: City of Salinas Stormwater Standard Plans

California Stormwater Quality Association (CASQA). 2009. Stormwater Best Management Practice Handbook – New Development and Redevelopment. https://www.casqa.org/sites/default/files/BMPHandbooks/BMP_NewDevRedev_Complete.pdf

United States Department of Transportation, Federal Highway Administration. Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring. http://www.fhwa.dot.gov/environment/ultraurb/3fs3.htm

United States Environmental Protection Agency (U.S. EPA). 2009. Technical Guidance on Implementing the Stormwater Runoff Requirement for Federal Projects under Section 438 of the Energy Independence and Security Act. https://www.epa.gov/sites/production/files/2015-08/documents/epa_swm_guidance.pdf

CASQA – LIDI Bioretention Details. https://www.casqa.org/sites/default/files/downloads/2._20170831_generic_drawing_combined_bioretention_details_and_specs.pdf

C.3 Stormwater Handbook, Santa Clara Valley Urban Runoff Pollution Prevention Program, June 2016. http://scvurppp.org/pdfs/1516/c3_handbook_2016/SCVURPPP_C.3_Technical_Guidance_Handbook_2016_Chapters.pdf

4.12 CALIFORNIA TRASH AMENDMENTS

To address water quality issues caused by trash, the State Water Resources Control Board (State Board) adopted (1) an amendment to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan, 2015a) to control trash, and (2) Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California (ISWEBE Plan) (State Board, 2015b). Together, these plans are collectively referred to as "the Trash Amendments." Currently, the Trash Amendments apply to all surface waters of the state, including ocean waters, enclosed bays and estuaries, and inland surface waters. The Trash Amendments require Permittees to focus trash control efforts on priority land uses, specifically areas that have high trash generation rates. Permittees may choose either of two tracks to address trash in their jurisdictions:

- Track 1: "Permittees must install, operate, and maintain a full-capture system for storm drains that capture runoff from priority land uses in their respective jurisdictions."

- Track 2: “Permittees must develop and implement a plan that uses any combination of controls, such as full-capture systems, their treatment controls (e.g., partial capture devices and green infrastructure and low-impact development [LID] controls), institutional controls, and/or multi-benefit projects to achieve the same performance results as Track 1, referred to and defined as “full-capture system equivalency.”

  Certain approved manufactured SCMs meet State Board requirements for certification as full-capture systems. In accordance with the Trash Amendments (State Board, 2015), most recently authorized on August 4, 2017, these devices must follow three basic requirements:

- Be properly sized to treat the region specific one-year, one-hour storm event (design storm);
- Do not bypass the design storm under fully loaded conditions; and
- Do not have a diversion structure present upstream such that a portion of the design storm is not treated to trap all particles sized at 5 millimeters or larger.

  Trash full-capture devices are also advantageous because of their add-on capabilities and potential for use as pre-treatment devices for other volume control SCMs. Rainwater harvesting and reuse systems benefit from adding trash-capture devices to screen for particles before more robust treatment from ultraviolet and chlorine disinfections. Infiltration systems also require trash capture to increase the efficiency of the system and prevent clogging. A summary of approved trash full-capture devices and a description of their performance for removing selected pollutants are included in Appendix G. An updated list of State approved trash full capture devices can be found at the link below.

  https://www.waterboards.ca.gov/water_issues/programs/stormwater/trash_implementation.html

4.13 EROSION AND SEDIMENT CONTROL PLAN

This section provides several requirements and guidelines for sediment and erosion control. The City of Salinas Stormwater Permit requires SCMs to reduce pollutants in stormwater discharges to the maximum extent practicable through erosion control and sediment control. These BMPs are used to stabilize exposed areas and contain stormwater runoff using structural and/or non-structural BMPs to minimize onsite erosion and sedimentation and the resulting discharge of pollutants.

The following SCMs help reduce erosion and sediment deposition:

- **Vegetated Swales and Buffer Strips** – Vegetation in the swales prevent erosion if seeded and graded with suitable erosion control materials.
- **Biofiltration Treatment Systems** – A maximum surface loading rate of 5 inches per hour prevents erosion, scouring, and channeling within the system.
- **Urban Curb/Swale System** – A forebay for ease of debris removal provides erosion control because the concentration of flow is highest at the curb opening.
- **General** – Landscaping or other cover materials minimize erosion from graded surfaces. Natural vegetation is effective in parking lot islands and other landscaped areas. Use of native and drought-tolerant plant materials is recommended because native plants require less maintenance and irrigation. Because native plants take longer to cover slopes, during the first few years, supplemental protection (erosion blanket, mulch, etc.) may be necessary.

During construction, physical stabilization BMPs, vegetation stabilization BMPs, or both are required to prevent erosion and sediment runoff from exposed graded areas. BMPs for physical and vegetation stabilization include:

(1) Physical Stabilization:

(a) Geotextiles

(b) Mats

(c) Fiber blankets

(d) Hydraulic mulch, bonded fiber matrix

(e) Sprayed-on binders

(f) Mulch on flat areas

(g) Energy dissipaters

(h) Other material approved by the City for use in specific circumstances

If physical stabilization is selected, materials must be appropriate to the circumstances in which they are deployed, and sufficient material must be deployed.

(2) Vegetation Stabilization:

(a) Preservation of existing vegetation

(b) Established interim vegetation (via hydroseed, seeded mats, etc.)

(c) Established permanent landscaping

If vegetation stabilization is selected, the stabilizing vegetation must be installed, irrigated, and established (uniform vegetative coverage with 70% coverage established) prior to October 1 (the start of the wet season). In the event that stabilizing vegetation has not been established by October 1, other forms of physical stabilization must be employed to prevent erosion until the stabilizing vegetation is established.

Sediment control includes protecting water quality sensitive areas and watercourses from sediment in sheet flows by using:

(1) Sediment Control Devices:

(a) Silt fencing

(b) Gravel bag barriers

(c) Fiber rolls

(d) Compost terms

(e) Compost blankets

(2) Sediment Capture:

(a) Storm-drain inlet protection measures for capturing sediments in channeled stormwater

(3) Velocity Reduction:

(a) Outlet protection (energy dissipater)

(b) Equalization basins

(c) Check dams

General erosion and sediment control maintenance requires periodically inspecting flow entrances, ponding areas, and surface overflow areas, and replacing soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly designed facilities with appropriate flow velocities must not have erosion problems, except perhaps in extreme events. If erosion problems occur the following must be reassessed: (1) flow velocities and gradients, and (2) flow dissipation and erosion protection strategies in the pre-treatment area and flow entrance.

5 OWNER OPERATION AND MAINTENANCE

Long-term maintenance is critical for proper functioning of SCMs. Regulated Projects with structural SCMs (i.e., meeting PR-2, PR-3, and/or PR-4 requirements) are required to have an Operation and Maintenance (O&M) Plan and Maintenance Declaration that clearly establishes responsibility for all structural SCMs. This section includes O&M Plan requirements and guidelines for each SCM. A Maintenance Declaration, including an O&M Plan template is included in Appendix E. Standard plans for each SCM, which include O&M guidelines, can be found on the City of Salina's website (City of Salinas Stormwater Standard Plans).

5.1 OPERATION AND MAINTENANCE PLAN

The owner of the Regulated Project must develop and implement a written O&M Plan that, at a minimum, includes each component listed below. If desired, the O&M Plan may be included in the Stormwater Control Plan rather than in a separate document (see Appendix B and a Stormwater Control Plan template on the Central Coast Regional Water Board website). The O&M Plan must be approved by the City prior to final approval/occupancy. Sample O&M plans are located in Appendix E. The O&M Plan must include, at minimum:

- A site map identifying all structural SCMs requiring O&M practices to function as designed.
- O&M procedures for each SCM, including.

o Short-and long-term maintenance requirements, recommended frequency of maintenance, and estimated cost for maintenance

o A statement signed by the property owner accepting responsibility for the on-going maintenance of SCMs until such responsibility is legally transferred to another entity when the property is sold (Maintenance Declaration). Appendix E provides a Maintenance Declaration template.

5.2 GENERAL O&M REQUIREMENTS

The following O&M requirements apply to all SCMs. Keep in mind that the use of pyrethroid pesticides is not allowed within the City limits. The owner/operator of the property must:

- Take responsibility for maintaining vegetation included in the SCM.
- Make sure that irrigation operations comply with local water conservation ordinances in effect.
- Routinely (no less than quarterly or upon discovery) remove trash, debris, and dead vegetation that inhibits proper operation.

5.2.1 Rainwater Harvesting and Reuse Systems

The following are O&M requirements for rainwater harvesting and reuse systems:

- Clean out gutters and inflow and outflow pipes of leaves and debris as needed.
- Ensure that gutters and downspouts are free of debris prior to the wet season. The "first flush," or the runoff created by the first rainfall event after a long dry spell, shall be carefully monitored to ensure that the system is working properly.
- Inspect water tanks periodically and any remove debris and sediment that may interfere with the proper functioning of the system.

- Screen inlet and outlet pipes to keep the system closed to mosquitoes. No opening shall be greater than 1/16” on systems where water will be retained for more than 72 hours.
- Cap and lock tanks for safety. Caps should have access ports for interior inspection and maintenance.

5.2.2 Infiltration Basins

The following are O&M requirements for infiltration basins:

- Inspect the basin following major rainfall events during the first year after installation.
- Inspect the basin annually for settling, cracking, erosion, leakage, condition of the riprap, state of the turf vegetation, and amount of sedimentation. If issues are observed, make repairs immediately.
- If the drawdown time is more than 72 hours, maintain and replace the filter media.
- Periodically remove debris and litter from the infiltration basin and mow vegetation when growth exceeds 12 inches high.
- If bare and eroded areas are present in the drainage area directly adjacent to the infiltration basin, use vegetation and/or additional stabilization methods to minimize premature clogging.
- Every 5 to 10 years, till the area, remove fine materials, and regrade the base of the basin.
- Join infiltration basins with detention basins to improve water quality.
- Install vegetation within the infiltration basin to decrease the rate of clogging.
- Install a pre-treatment device, such as an oil and water separator, in areas where petroleum hydrocarbons in stormwater are anticipated, if necessary.
- If a spill occurs and hazardous materials contaminate soils, sands, or gravels in an infiltration basin, remove the affected areas immediately, and replace the appropriate soils and materials as soon as possible.
- Remove and replace invasive vegetation contributing up to 25% of vegetation of all species.
- Replace vegetation immediately to control erosion where soils are exposed and within three months to maintain cover density.

5.2.3 Infiltration Trenches

The following are O&M requirements for infiltration trenches:

- Keep infiltration trenches free of vegetation.
- Include a 4 to 6-inch-diameter perforated pipe anchored vertically to serve as a monitoring well, if required by the City. Include a monitoring plan for this well in the O&M Plan.

5.2.4 Bioretention and Biofiltration Basins

The following are O&M requirements for bioretention and biofiltration basins:

- Conduct semi-annual inspections as follows:
  - Evaluate the health of the vegetation and remove and replace any dead or dying plants.
  - Inspect the outlet, embankments, dikes, berms, and side slopes for structural integrity and signs of erosion or rodent burrows. Fill in any holes detected in the side slopes.
  - Examine outlets and overflow structures and remove any debris plugging the outlets.
  - Identify and minimize any sources of sediment and debris. Check rocks or other erosion control and replace, if necessary.
  - Check inlets to make sure that piping is intact and not plugged. Remove accumulated sediment and debris near the inlet. Ensure that engineered energy dissipation is functioning adequately by checking for evidence of local scour around the inlet.
  - Inspect the basin for standing water and correct any problems that prevent the extended detention basin from draining as designed.
  - Confirm that any fences around the facility are secure.
- Do NOT perform maintenance activities at the bottom of the basin with heavy equipment, which would compact the soil and limit infiltration.
- Harvest vegetation annually, during the summer.
- Trim vegetation at the beginning and end of the wet season and inspect monthly to prevent establishment of woody vegetation. Trimming is also conducted for aesthetic and mosquito/vector control reasons.
- Remove and replace invasive vegetation contributing up to 25% of vegetation of all species.
- Remove dead vegetation to maintain less than 10% of area coverage or when the vegetative filter strip function is impaired. Replace vegetation immediately to control erosion where soils are exposed and within three months to maintain cover density.
- Avoid use of pesticides and quick-release synthetic fertilizers and follow the principles of integrated pest management (IPM). Check with the local jurisdiction for any local policies regarding the use of pesticides and fertilizers.
- Remove sediment from the forebay when the sediment level reaches the level shown on the fixed vertical sediment marker.
- Remove accumulated sediment and regrade approximately every 10 years or when the accumulated sediment volume exceeds 10% of the basin volume.

5.2.5 Vegetated Swales and Bioswales

The following are O&M requirements for vegetated swales and bioswales:

- Perform mowing, weed control, watering during the dry season, and reseeding of non-vegetated areas.

- When mowing grass, never cut shorter than the design flow (water quality flow [WQF]) depth and remove grass cuttings.
- Prune vegetation, large shrubs, or trees that interfere with landscape swale operation.
- Remove and replace invasive vegetation contributing up to 25% of vegetation of all species.
- Inspect swales at least twice annually for damage to vegetation, erosion, sediment accumulation, and ponding water standing longer than 72 hours. If issues are observed, make repairs immediately.
- Remove sediments when their depths exceed 3 inches.
- Maintain side slopes to prevent erosion that introduces sediment into the swale.
- Ensure that the swale outlet maintains sheet flow of water exiting the swale unless using a collection drain.
- If a spill occurs and hazardous materials contaminate soils in vegetated swales, remove the affected areas immediately, and replace the appropriate soils and materials as soon as possible.
- Do not allow insects and rodents to be harbored in the vegetated swales. Implement pest control measures when insects/rodents are observed.
- If sprays are considered, then apply a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations, only if absolutely necessary; use a licensed individual or contractor to apply the spray.

5.2.6 Vegetated Filter Strips

The following are O&M requirements for vegetated filter strips:

- Perform required maintenance, including weed removal as well as mowing and irrigation of grasses.
- Maintain grasses or turf at a desired height of 4 to 6 inches or at a minimum height of 2 inches.
- If turf is used, irrigate filter strips during the dry season.
- Remove dead vegetation to maintain less than 10% of area coverage or when the vegetative filter strip function is impaired. Replace vegetation immediately to control erosion where soils are exposed and within three months to maintain cover density.
- Rake and remove fallen leaves and debris from deciduous plant foliage.
- Remove and replace invasive vegetation contributing up to 25% of vegetation of all species.
- Routinely (no less than quarterly or upon discovery) remove debris in quantities more than 2 inches deep or sufficient to inhibit operation.
- Regularly inspect filter strips for pools of standing water that may serve as mosquito breeding habitats.
- Inspect filter strips at least twice per year, preferably before and after the winter/wet season.

- Collect and remove sediments that accumulate along the upstream edge of filter strips and/or in level spreaders at least once a year.
- If a spill occurs and hazardous materials contaminate soils in vegetated filter strips, remove the affected areas immediately and replace the appropriate soils and materials as soon as possible.
- Do not allow insects and rodents to be harbored in the vegetated filter strips. Implement pest control measures when insects/rodents are observed.
- If sprays are considered, then apply a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations, only if absolutely necessary; use a licensed individual or contractor to apply the spray.
- Filled and compact holes in the ground in and around the pervious pavement.

5.2.7 Green Roofs

The following are O&M requirements for green roofs:

- Upon installation, inspect the green roof system monthly for the first year and after each large rainfall event for erosion, plant survival, proper drainage, and waterproofing.
- Reduce the inspection schedule to quarterly once the green roof system has been proven to work properly and vegetation is established.
- If necessary, irrigate in short bursts only (3 to 5 minutes) to minimize runoff. Irrigation frequencies shall be established by the designer using an automated system.
- Maintain vegetation to provide 90% plant cover.
- Clean out drain inlets as needed.
- Remove debris and litter to prevent clogging of drain inlets and interference with plant growth.
- Weed and mulch as necessary during the establishment period, depending on the planting design.
- Replace or fill in vegetation as needed.
- Because fertilization is not necessary, do not apply fertilizers.
- Inspect the soil substrate/growing medium for evidence of erosion from wind or water. Stabilize erosion channels with additional soil substrate/growth medium and cover them with additional plants.
- Inspect soil levels semiannually to improve plant survival and rainfall absorption.
- If the vegetation used is flammable during the dry season, mow or water it as needed to minimize fire potential.
- If the soil compacts over time, add more to increase the seismic load of the supporting structure.
- Do not allow insects to be harbored on the green roof. Eliminate standing water by manual means.

- Exercise spill prevention measures from mechanical systems located on the roofs when handling substances that can contaminate stormwater. Correct releases of pollutants as soon as they are identified.

5.2.8 Porous Concrete and Porous Asphalt Pavement

The following are O&M requirements for porous concrete and porous asphalt pavers:

- Inspect porous asphalt and concrete several times during the first few storms to ensure proper infiltration and drainage. After the first year, inspect at least once per year.
- Clean permeable pavements and materials with a vacuum-type street cleaner at least twice per year (before and after the wet season).
- Use hand-held pressure washers to clean the void spaces of small areas. Use these pressure washers after vacuum cleaning.
- Instruct maintenance personnel not to seal or pave with non-porous materials.
- Do not sand pervious pavements in the winter to avoid clogging the void spaces.

5.2.9 Porous Turf Pavement

The following are O&M requirements for porous turf pavement:

- Regularly maintain porous turf (which requires the same regular maintenance as regular lawns), including irrigation, mowing, fertilization, aeration, topdressing, reseeding, disease control, insect control, and weed management.
- Conduct soil testing at least once every other year to determine proper fertilization and maintain turf stress tolerance.
- Routine mow the turf in the growing season. Mow grass to less than 4 inches and bag and remove grass clippings.
- Because above-ground biomass is important in wear tolerance, and therefore high mowing can increase grass resistance to traffic stress, alter mowing patterns regularly to limit wear from repetitive wheel action.
- Reseed if required to maintain a uniform turf cover.
- Ensure that topdressing material is at least as coarse and open-graded as the root zone.
- Spread out traffic routes or rotate them to give the turf time to recover between uses. Traffic control can also divert traffic away from areas that are showing signs of wear.
- Do not locate vegetation, such as trees and shrubs, in or around the pervious pavement because roots from trees can penetrate the placement and leaves from deciduous trees and shrubs can increase the risk of clogging the surface.

5.2.10 Porous Gravel Pavement

The following are O&M requirements for porous gravel pavement:

- Conduct maintenance to minimize clogging of the pervious surface.

- Perform occasional weed suppression, if required.
- Periodically replenish and/or rake displaced gravel, if required.
- Inspect the sand filter routinely and after rainfall events to ensure proper infiltration and drainage.
- Inspect the pavement frequently to ensure proper infiltration and drainage during the first wet season, and then once per year after that time.
- Replace the surface sand filter layer when runoff does not infiltrate readily into the surface.
- Inspect surface gravels once per year. When inspections show accumulation of sediment and debris on top of gravel or slow infiltration, remove and replace the top few inches of gravel.

6 RETROFIT REQUIREMENTS

This section provides guidance for retrofit projects on City-owned land. Retrofit projects involve SCMs that are designed and incorporated into existing infrastructure that was not initially constructed to meet stormwater performance requirements. Examples of retrofit projects include installation of rainwater harvesting measures and replacement of impervious areas with areas that infiltrate stormwater or areas that provide evapotranspiration. In retrofit projects, LID measures are incorporated to restore degraded watershed processes affected by urban stormwater discharges and to protect water quality.

6.1 Siting and Setback Considerations

By nature, retrofit projects are difficult to implement because they are designed around existing structures such as buildings, foundations, retaining walls, and underground utilities. All the same siting and setback considerations for new development projects must be accounted for in retrofit projects as well. SCMs to be employed in retrofit projects must be adequately separated from building foundations, underground utilities, and retaining walls to prevent damage. Specific siting and setback requirements for SCMs can be found in the City of Salinas Stormwater Standard Plans and the resources listed in Section 4.7. Furthermore, hydraulic restriction layers may be used to prevent damage to these structures from the infiltration of stormwater. If infiltration of stormwater can potentially damage building foundations or retaining walls, then an underdrain may also be required. Guidelines for installing underdrains can also be found in the resources provided in Section 4.7.

6.2 Site Considerations

The infiltration analysis utilized for retrofit projects elected for the use of infiltration SCMs will be the same as the new development projects considering infiltration SCMs. The infiltration feasibility discussion can be found in Section 4.5.2 and the Infiltration Feasibility Worksheet can be found Appendix C. If existing soils are not permissive for infiltration due to compaction or past development, then the soil can be reconditioned to improve infiltration characteristics. Furthermore, engineered media with enhanced infiltration characteristics may be utilized.

Existing site conditions may also be limiting due to the amount of paved or impervious area or lack of available pervious area. In such cases, the City staff shall minimize the amount of impervious surfaces and convert them to pervious surfaces as much as the site allows. If such conversion is not feasible, the City shall design the retrofit SCM to drain stormwater runoff to existing or new pervious areas on site.

6.3 Retrofit SCM Selection and Sizing

Proper selection of SCMs to be employed in retrofit projects is difficult due to setback and siting requirements as well as existing site conditions. As with new development projects, some SCMs may be permissible for some site conditions but not for others. The sizing and design guidelines for retrofit projects are identical to new development projects. Guidelines for sizing can be found in Section 3 of this manual. Design resources can be found in Section 4, and operations and maintenance guidelines for SCMs can be found in Section 5. However, due to limited workable space and setback requirements, SCMs for retrofit projects may have to be sized and fitted differently than SCMs for new development projects.

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Appendix A
Performance Requirement Worksheet and SCM Sizing

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Performance Requirement Worksheet and SCM Sizing

Provide accompanying documentation, figures, exhibits, as appropriate, for all calculations.

Step 1 – Complete Threshold Determination Worksheet, which can be found at:

https://www.cityofsalinas.org/our-city-services/public-works/development-engineering

Step 2 – Determine the applicable Performance Requirement(s)

Table 1. Post-Construction Performance Requirements by Project Category

Post-Construction Performance Requirements[1]				
Project Impervious Area	**PR-1** ***Site Design and Runoff Reduction***	**PR-2** ***Water Quality Treatment***	**PR-3** ***Runoff Retention***	**PR-4** ***Peak Management***
Project Type: Detached Single-Family Homes				
≥2,500 ft^2 Total New and Replaced Impervious Area	Required			
≥15,000 ft^2 and <22,500 ft^2 *Net Impervious Area*	Required	Required	Required	
≥22,500 ft^2 Total New and Replaced Impervious Area	Required	Required	Required	Required
Project Type: All Other Regulated Projects				
≥2,500 ft^2 Total New and Replaced Impervious Area	Required			
≥5,000 ft^2 and <15,000 ft^2 *Net Impervious Area*	Required	Required		
≥15,000 ft^2 and <22,500 ft^2 Total New and Replaced Impervious Area	Required	Required	Required	
≥22,500 ft^2 Total New and Replaced Impervious Area	Required	Required	Required	Required

ft^2 = square feet; PR = performance requirement

1. These requirements exclude PR-5, Special Circumstances, which is discussed in Section 2.5. of the SWDS

Step 3 – Calculate the SCM Sizing Criteria for each PR

Calculate the SCM Sizing Criteria that corresponds to the project's applicable PR(s). For more details, see Section 3 of the Stormwater Development Standards (SWDS).

Step 3.1 – PR-1 Site Design and Runoff Reduction

PR-1 has no SCM Sizing Criteria. Check applicable boxes and provide short description of measure being taken and location:

☐ Conserve Natural Areas, Riparian Areas, and Wetlands; Minimize Clearing and Grading of Native Vegetation; Set Back Development from Creeks, Wetlands, and Riparian Habitats

Description: _____

_____

☐ Minimize Compaction of Highly Permeable Soils; Reserve Areas with High Permeability Soils for Either Open Space or Infiltration BMPs

Description: _____

_____

☐ Direct Roof Runoff into Vegetated Areas or Cisterns or Rain Barrels for Re-Use

Description: _____

_____

☐ Minimize Impervious Surfaces and Direct Runoff from Impervious Areas to Adjacent Landscaping and Vegetated Stormwater Treatment Systems

Description: _____

_____

☐ Use Pervious Pavement (Pervious Concrete or Asphalt, Turf Block, Crushed Aggregates, etc) for New Construction and Renovation

Description: _____

_____

☐ Construct Bike Lanes, Driveways, Uncovered Parking Lots, Sidewalks, Walkways, and Patios with Permeable Surfaces

Description: _____

_____

Step 3.2 – PR-2 Water Quality Treatment and PR-3 Runoff Reduction

For PR-2 and PR-3, the SCM Sizing Calculator may be used. The calculator and instructions for its use can be found at the following link:

https://www.countyofsb.org/2324/New-Redevelopment

When sizing an SCM, always use "Site-Specific" in the SCM SOIL TYPE drop-down box and use the average infiltration rate indicated in the Monterey County Soil Report indicated at the link below. When sizing a bioretention SCM, the infiltration rate to be used must be half of the average infiltration rate indicated in the Monterey County Soil Report:

https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA053/0/monterey.pdf

Step 3.3 – PR-4 Peak Management

Calculate the Change in Impervious Area from Pre- to Post-Project.
PR-4 = (Post-Project Impervious Area) – (Pre-Project Impervious Area)

Change in Impervious Area: _____ ft^2

Include all design calculations for each SCM in an attachment.

DMA Name	2-yr Pre-Project Peak Flow (cfs)	2-yr Post-Project Peak Flow (cfs)	10-yr Pre-Project Peak Flow (cfs)	10-yr Post-Project Peak Flow (cfs)	100-yr Pre-Project Peak Flow * (cfs)	100-yr Post-Project Peak Flow * (cfs)
DMA 1						
DMA 2						
DMA 3						
DMA 4						
DMA 5						

* These are only required for projects 5 acres or more in size

Step 4 – Determine whether each PR is met

Step 4.1 – Compliance with PR-1

1. LID principles and strategies are incorporated into the project design, as described in Section 3.1 of the SWDS.	Performance Requirement 1 is met.
2. LID principles and strategies are NOT incorporated into the project design, as described in Section 3.1 of the SWDS.	Performance Requirement 1 is NOT met. Project must meet PR-1 to receive approval by the City of Salinas.

Step 4.2 – Compliance with PR-2

1. Total Area Treated by SCMs ≥ PR-2 DMA Sizing Criteria	Performance Requirement 2 is met.
2. Total Area Treated by SCMs < PR-2 DMA Sizing Criteria	Meeting the Performance Requirements is an iterative process. If the PR has not been met, return to prior design steps to explore alternative combinations of LID practices. If PR-2 cannot be met because of technical infeasibility, see Alternative Compliance (Section 2.6 of the SWDS).

Step 4.3 – Compliance with PR-3

1. Sum of SCM Design Treatment Volume for each DMA ≥ Retention Volume	Performance Requirement 3 is met.
2. Sum of SCM Design Treatment Volume for each DMA < Retention Volume	Meeting the Performance Requirements is an iterative process. If the PR has not been met, return to prior design steps to explore alternative combinations of LID practices. If PR-3 cannot be met because of technical infeasibility, see Alternative Compliance (Section 2.6 of the SWDS).

Step 4.4 – Compliance with PR-4

1. Pre-Development 2-10 yr Peak Flows $\geq$ Post-Development 2-10 yr Peak Flows	Performance Requirement 4 is met, no further action necessary.
2. Pre-Development 2-10 yr Peak Flows < Post-Development 2-10 yr Peak Flows	If PR-4 cannot be met because of technical infeasibility, see Alternative Compliance (Section 2.6 of the SWDS).

3. Project is ≥ 5 acres in size	A hydrology report must be prepared that (1) demonstrates calculations used to comply with applicable PR-1, PR-2, and PR-3, and (2) meets the flood control standards. Post-development peak flows must not exceed pre-development peak flows for the 2-year through 100-year storm events. If any PR-4 requirements cannot be met because of technical infeasibility, see Alternative Compliance (Section 2.6 of the SWDS).

Step 5 – Provide a Stormwater Control Plan for PR-2, PR-3, and PR-4 Requirements (See Appendix B)

Appendix B
Stormwater Control Plan (SWCP) Guidance
(SWCP Outline and SWCP Checklist)

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Preliminary Stormwater Control Plan

Applicant shall provide a Preliminary Stormwater Control Plan for any regulated projects (PR 2-4) subject to a Development (Planning) Permit. Preliminary Stormwater Control Plan shall include the following information:

I. Project Information

A. Project name, development application number, address, and assessor's parcel number
B. Name and contact information of applicant, owner, and design engineer
C. Project phase number (if project is being constructed in phases)
D. Project Type (e.g., commercial, industrial, residential, mixed-use, public)
E. Project description

II. Site and Design

A. Topographic Map and Geology – Indicate wetlands or water courses, soil types, biologically sensitive areas.
B. Project Layout and Design showing Drainage Management Areas (DMAs)

III. Stormwater Performance Criteria and Drainage Management

A. Development Area and Performance Requirement
- Threshold Determination Worksheet (on City's website): https://www.cityofsalinas.org/our-city-services/public-works/development-engineering

B. Drainage Management Areas - Map and tabulation of DMAs including:
- DMA type and area (SF)

IV. SCM sizing and Calculations

A. Calculations for each DMA to meet the requirements of Resolution No. R3-2013-0032, including:
- PR-2 Water Quality Treatment Calculations
- PR-3 Runoff Retention Calculations (if applicable)
- SCM sizing calculations to meet the water quality requirement and runoff retention requirement (if applicable)
- PR-4 Peak Management Calculations (if applicable)
- Flood Control Measure Calculations (applicable for project >5 ac.)
- (if applicable) Documentation of runoff retention technical infeasibility where retention of the full volume is not practicable
- (if applicable) Where technical infeasibility is documented, calculations for dedicating 10% of the project's equivalent impervious area to SCMs

Stormwater Control Plan Outline

Stormwater Control Plan (report) and exhibits shall be provided for regulated projects (PR 2–4) prior to issuance of a grading or building permit.

I. Project Information

A. Project name, Stormwater Quality Permit number, address, and assessor's parcel number
B. Name and contact information of applicant, owner, and design engineer
C. Project phase number (if project is being constructed in phases)
D. Project Type (e.g., commercial, industrial, residential, mixed-use, public)
E. Comprehensive project description

II. Site Assessment Summary

A. Site topography.
B. Geology and soil types - Description of site soil conditions based on geotechnical analysis, hydrological soil groups, and presence of unique geology (e.g., karst), geotechnical hazards
C. Hydrologic Conditions – Description and map of wetlands, watercourses, seeps, and springs, depth to seasonal high groundwater, depth to an impervious layer such as bedrock, location of nearby drinking water wells
D. Natural Areas – Description and map of protected undisturbed natural areas and trees
E. Other Site Features and Constraints – Including existing drainage infrastructure for the site and nearby areas, run-on characteristics (source and estimated runoff from offsite which discharges to project area), documented soil and/or groundwater contamination, structures including retaining walls, other utilities, easements and setbacks, zoning/land use and covenants.

III. Stormwater Performance Criteria and Drainage Management Areas

A. Development Area and Performance Requirement
   - Total project site area and project type
   - From Threshold Determination Worksheet (on City's website): https://www.cityofsalinas.org/our-city-services/public-works/development-engineering
   - Performance Requirement and Special Circumstances (including Urban Sustainability Areas, drainage to highly altered channel) applicable to the project
B. Drainage Management Areas - Map and tabulation of DMAs including:
   - DMA Identification number
   - DMA type (self-treating areas, self-retaining areas, areas that drain to self-retaining areas, areas that drain to SCMs)
   - DMA area (SF) and surface type

- For DMAs that are not self-treating or self-retaining, provide runoff coefficient and receiving SCMs

IV. Site Design and SCMs

A. Summary of Site Design and Stormwater Control Measures included in the project

B. Description of each SCM, including:
   - Tributary DMAs and total tributary area
   - PR-2 (Water Quality) Treatment Volume calculations
   - For onsite retention and volume capture-based treatment systems:
     Water Quality Treatment Volume = C x 24hr Rainfall Depth$_{85th\ or\ 95th}$ x SCM Tributary Area
   - PR-2 (Water Quality) runoff calculations
   - For biofiltration and flow-based treatment systems:
     Runoff treatment capacity = C x 0.2 inches/hr x SCM Tributary Area
   - PR-3 (Runoff Retention) runoff volume calculations (if applicable)
   - SCM sizing calculations to meet the water quality requirement and runoff retention requirement (if applicable)
   - (if applicable) Documentation of runoff retention technical infeasibility where retention of the full volume is not practicable
   - (if applicable) Where technical infeasibility is documented, calculations for dedicating 10% of the project's equivalent impervious area to SCMs
   - PR-4 (Peak management) calculations (if applicable)
   - Certification that the selection, sizing, and design of the Stormwater Control Measures meet the Performance Requirements

C. Source control measures included in the project

V. SCM Operation and Maintenance (O&M) Plan

(30 days prior to Certificate of Occupancy)

A. Site plan indicating location and type of SCM constructed
B. SCM details
C. Planting and Plant List
D. Integrated Pest Management (IPM) plan
E. O&M procedures for each structural SCM, onsite drainage system, LID facilities, self-retaining areas, and source control measures
F. Short- and long-term maintenance requirements, recommended frequency of maintenance, and estimated cost for maintenance
G. Signed, notarized, and recorded Maintenance Declaration (see Appendix E)

VI. Appendices Required for Stormwater Control Plan

A. Threshold Determination Worksheet
B. WMZ and 85th or 95th Percentile Map (https://www.waterboards.ca.gov/centralcoast/water_issues/programs/stormwater/docs/lid/lid_hydromod_charette_index.html#percentile_rainfall)
C. Map of Groundwater Depth (https://wdl.water.ca.gov/waterdatalibrary/)
D. Map of Nearby USTS, Hazardous Waste Site and Cleanup Sites (https://geotracker.waterboards.ca.gov/)
E. Map of Domestic Water Wells (https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/default.asp)
F. Infiltration Feasibility Worksheet
G. Topographic Map
H. Site Plan
I. DMA Map
J. Improvement Plans (Grading and Drainage Plan and Details pertaining to SCM design)
K. NOAA Precipitation Data (https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca)
L. SCM Sizing Calculations
M. Geotechnical Report and Infiltration Testing or NRCS Soil Map (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) & (https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA053/0/monterey.pdf)
N. Owner's Certification
O. Engineer's Certification
P. Hydrology Report for Flood Control
Q. Alternative Compliance Agreement
R. Other Project Specific Reports

Stormwater Control Plan Checklist

Instructions: Applicant to complete 1-5 for ALL Regulated Projects, and all other sections as appropriate for the project's Performance Requirement(s).

	1. Project Information	Check
A	Project Name	
B	Permit Number	
C	Address and Assessors' Parcel Number	
D	Name of and Contact Information of Applicant, Owner, and Design Engineer	
E	Project Phase Number (if constructed in phases)	
F	Project Type	
G	Project Description	
	2. Project Areas	**Check**
A	Total Project Site Area	
B	Total New Impervious Area	
C	Total Replaced Impervious Area	
D	Total New Pervious Area	
E	Net Impervious Area	
	3. Statement of Applicable Performance Requirement(s)	**Check**
A	PR-1 Site Design and Runoff Reduction	
B	PR-2 Water Quality Treatment	
C	PR-3 Runoff Retention	
D	PR-4 Peak Management	
E	PR-5 Special Circumstances	
F	Flood Control Measures (For Projects > 5 acres); provide hydrology report	
	4. Delineation of Drainage Management Areas	**Check**
A	Table of Areas	
B	DMA Map	
	5. PR-1 Site Design and Runoff Reduction	**Check**
A	Conserve natural areas, riparian areas and wetlands	
B	Limit clearing and grading of native vegetation at the site to the minimum area needed to build the project, allow access, and provide fire protection	
C	Set back development from creeks, wetlands, and riparian habitats	
D	Minimize compaction of highly permeable soils; Reserve areas with high permeability soils for either open space or infiltration BMPs	
E	Use pervious pavement (pervious concrete or asphalt, turf block, crushed aggregates, etc) for New Construction and Renovation	

F	Minimize impervious surfaces by concentrating improvements on the least-sensitive portions of the site, while leaving the remaining land in a natural undisturbed state	
G	Provide infiltration rate of synthetic turf (if applicable). Turf with infiltration rates < 0.5 in/hr is considered to be impervious.	
H	Minimize stormwater runoff by implementing one or more of the following site design measures: *check one or more that apply:*	
	• Direct roof runoff into cisterns or rain barrels for reuse	
	• Direct roof downspouts onto vegetated areas safely away from building foundations and footings, consistent with California building code	
	• Direct runoff from sidewalks, walkways, driveways, uncovered parking lots, and/or patios onto vegetated areas safely away from building foundations and footings, consistent with California building code	
	• Construct bike lanes, driveways, uncovered parking lots, sidewalks, walkways, and patios with permeable surfaces	
I	Provide location & type of trash full-capture device.	
J	Provide documentation demonstrating that trash full-capture device is on the State's approved list.	
K	Provide Landscaping Plan	
	6. PR-2 Water Quality Treatment	Check
A	Description of all post-construction structural SCMs	
B	Supporting calculations used to comply with PR2	
C	Documentation certifying that the selection, sizing, and design of the SCMs meet the full or partial PR2	
D	Water Quality Treatment calculations used to comply with Water Quality Treatment Performance Requirement and any analysis to support infeasibility documentation	
	6a. Statement of Compliance for PR-2 – Water Quality Treatment	Check
A	Water Quality Treatment Performance has been met on-site, or, if not achievable:	
B	Documentation of the area/volume of runoff for which compliance cannot be achieved on-site and the associated off-site compliance requirements	
C	Statement of intent to comply with Water Quality Treatment Performance Requirement through an Alternative Compliance Agreement	
	7. PR-3 Runoff Retention	Check
A	Site topography	
B	Hydrologic features including contiguous natural areas, wetlands, watercourses, seeps, or springs	
C	Depth to seasonal high groundwater	
D	Locations of groundwater wells used for drinking water	
E	Depth to an impervious layer such as bedrock	
F	Presence of unique geology (e.g., karst)	
G	Geotechnical hazards	
H	Documented soil and/or groundwater contamination	
I	Soil types and hydrologic soil groups	
J	Vegetative cover/trees	

K	Run-on characteristics (source and estimated runoff from offsite which discharges to the project area)	
L	Existing drainage infrastructure for the site and nearby areas including the location of municipal storm drains	
M	Structures including retaining walls	
N	Utilities	
O	Easements	
P	Covenants	
Q	Zoning/Land Use	
R	Setbacks	
S	Open space requirements	
T	Other pertinent overlay(s)	
U	Supporting calculations used to comply with PR3	
V	Documentation demonstrating infeasibility where Site Design and Runoff Reduction measures cannot retain required runoff volume	
W	Documentation demonstrating infeasibility where retention-based SCMs cannot retain and/or treat the required runoff volume	
X	Documentation demonstrating infeasibility where on-site compliance cannot be achieved	
Y	Documentation demonstrating percentage of the projects' Equivalent Impervious Surface Area dedicated to retention-based SCMs	
Z	Documentation of certification that the selection, sizing, and design of the SCM meets the applicable Water Quality Treatment and Runoff Retention Performance Requirement	
	7a. Statement of Compliance for PR-3 - Runoff Retention	Check
A	Statement of Intent to Comply with Water Quality Treatment and Runoff Retention Performance Requirements have been met on-site, or if not achievable:	
B	Documentation of the volume of runoff for which compliance cannot be achieved on-site and the associated off-site compliance volume	
C	Statement of Intent to Comply with Water Quality Treatment and Runoff Retention Performance Requirements through an Alternative Compliance Agreement	
	8. PR-4 Peak Management	Check
A	Summary of Runoff Reduction Measures and structural SCMs, by Drainage Management Area, as well as for the entire site	
B	Supporting calculations used to comply with the applicable Water Quality Treatment, Runoff Retention, and Peak Management Performance Requirements	
C	Documentation of certification that the selection, sizing, and design of the SCM meets the applicable Water Quality Treatment, Runoff Retention, and Peak Management Performance Requirement	
	8a. Statement of Compliance for PR-4 - Peak Management	Check
A	Statement that the Water Quality Treatment, Runoff Retention, and Peak Management Performance Requirements have been met on-site, or, if not achievable:	

B	Documentation of the volume of runoff for which compliance cannot be achieved on-site and the associated off-site compliance requirements	
C	Statement of Intent to Comply with Water Quality Treatment, Runoff Retention, and Peak Management Performance Requirements through an Alternative Compliance Agreement	
	9. Statement of Compliance for PR-5 - Special Circumstances	Check
A	Statement that the Special Circumstances Performance Requirements have been met, and there will be no adverse impacts downstream as a result of runoff from the Regulated Project	
B	Documentation that the project was approved by the Central Coast Water Board Executive Officer as a Special Circumstances Regulated Project	
	10. Operation and Maintenance Plan (All Projects)	Check
A	O&M Plan for all structural SCMs to ensure long-term performance	
B	Owner's Information for SCMs	
	11. Flood Control Measures (Projects > 5 ac)	Check
A	Summary of Flood Control Measures for the entire site	
B	Supporting calculations used to comply with the 100-year Peak Flow Requirements	
	12. Appendices (All Projects)	Check
	Appendices	

Example template:

https://countyofsb.org/uploadedFiles/pwd/Content/sbpcw/Development/Stormwater%20Control%20Plan%20Template%202019%20ccg.pdf

For small Tier 1 projects,

https://salinasca-my.sharepoint.com/:b:/g/personal/heidin_ci_salinas_ca_us/ET5fkpMkEttPucy7ofjUalEBs-Rc6H3Zh0eAticYSJ-Tpw?e=a2eKIl

Appendix C
Infiltration Feasibility Worksheet

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Infiltration Feasibility Worksheet

City of Salinas
Stormwater Development Standards

Complete this worksheet for projects subject to Performance Requirement 2 to determine the feasibility of treating the stormwater runoff generated by the 85th percentile storm event through either direct or indirect infiltration best management practices (BMPs).

Complete this worksheet for projects subject to Performance Requirement 3 to determine the feasibility of treating and retaining the stormwater runoff generated by the 95th percentile storm event by employing direct or indirect infiltration BMPs. Size BMP(s) selected by following the procedures in Section 4 of the City of Salinas Stormwater Development Standards for New Development and Redevelopment Projects.

If infiltration feasibility differs among the project Drainage Management Areas (DMAs), this worksheet shall be filled out for each condition.

This Infiltration Feasibility worksheet identifies conditions on project sites, other than infiltration rates, that would prohibit infiltration. For projects with low design infiltration rates, where infiltration is deemed feasible by this worksheet, the project will be designed to permit incidental disposal but shall not be intended for total infiltration of stormwater runoff.

1. Enter Project Data

1.1 Project Name: _____

1.2 Project Address: _____

1.3 Applicant/Agent Name: _____

1.4 Applicant/Agent Address _____

1.5 Applicant/Agent Email _____ Applicant/Agent Phone: _____

1.6 Evaluated DMA(s): _____

2. Evaluate infiltration feasibility

Check "Yes" or "No" to indicate whether the following conditions apply to the project. If "Yes" is checked for any question, then infiltration is infeasible, and you can continue to Item 3.1 without answering any further questions in Section 2. If all of the answers in Section 2 are "No," then infiltration is feasible. If infiltration is infeasible, STOP after Section 3. If infiltration is feasible, proceed to Section 4 to determine direct infiltration feasibility. If all of the answers in Section 4 are "No," then direct infiltration is feasible.

		Yes	No
2.1	Would infiltration facilities at this site conflict with the location of existing or proposed underground utilities or easements, or would the siting of infiltration facilities at this site result in their placement on top of underground utilities, or otherwise oriented to underground utilities, such that they would discharge to the utility trench, restrict access, or cause stability concerns? (If yes, attach evidence documenting this condition.)	☐	☐
2.2	Is there a water well within 100 feet of the location where an infiltration device would be constructed? (If yes, attach map showing the well.)	☐	☐
2.3	Would construction of an infiltration device require that it be located less than 100 feet away from a septic system, or other potential underground source of pollution, or less than 500 feet away from an underground fuel tank with hazardous materials? (If yes, attach evidence documenting this claim.)	☐	☐
2.4	Is there a seasonal high groundwater that would be within 5 feet of the base of an infiltration device constructed on the site? (If yes, attach documentation of high groundwater.	☐	☐
2.5	Is there a documented concern that there is a potential on the site for soil or groundwater pollutants to be mobilized or is there any known groundwater contamination plume that could be further dispersed by infiltration at the subject location? If known contaminated plume is within 500 feet, evaluate to determine mobilization concern. (If yes, attach documentation of mobilization concerns.)	☐	☐

Infiltration Feasibility Worksheet

		Yes	No
2.6	Do local water district or other agency policies or guidelines regarding the locations where infiltration may occur, the separation from seasonal high groundwater, or setbacks from potential sources of pollution prevent infiltration devices from being implemented at this site? (If yes, attach evidence documenting this condition.)	☐	☐
2.7	Do the soils present on the site (or DMA) preclude infiltration at design infiltration rates less than 0.02 inches per hour? (Include documentation from Geotechnical Engineer)	☐	☐

2

3. Results of Feasibility Determination

		Infeasible	Feasible
3.1	Based on the results of the Section 2 feasibility analysis, infiltration is (check one):	☐	☐

If infiltration is feasible, proceed to Section 4 to determine if direct infiltration is feasible. If infiltration is infeasible, stop here.

4. Is Direct Infiltration Feasible?

		Yes	No
4.1	Is there a seasonal high groundwater that would be within 10 feet of the base of an infiltration device constructed on the site? (If yes, attach documentation of high groundwater.)	☐	☐
4.2	Are there land uses that pose a high threat to water quality, including, but not limited to, industrial and light industrial activities, high vehicular traffic (i.e., 25,000 or greater average daily traffic on a main roadway or 15,000 or more average daily traffic on any intersecting roadway), automotive repair shops, car washes, fleet storage areas, or nurseries? (If yes, attach evidence documenting this claim.)	☐	☐
4.3	Is there a significant potential for spills or highly polluted runoff to be conveyed to the infiltration system?	☐	☐
4.4	Is there a water well within 150 feet of the location where an infiltration device would be constructed? (If yes, attach map showing the well.)	☐	☐
4.5	Would construction of an infiltration device require that it be located less than 150 feet away from a septic system, other potential underground source of pollution? (If yes, attach evidence documenting this claim.)	☐	☐

5. Results of Direct Infiltration Feasibility Determination

		Infeasible	Feasible
5.1	Based on the results of the Section 4 feasibility analysis, direct infiltration is (check one):	☐	☐

Name of Applicant (Print)

Name of Applicant (Sign)

Date

Appendix D
LID Planting Zones and Plant List

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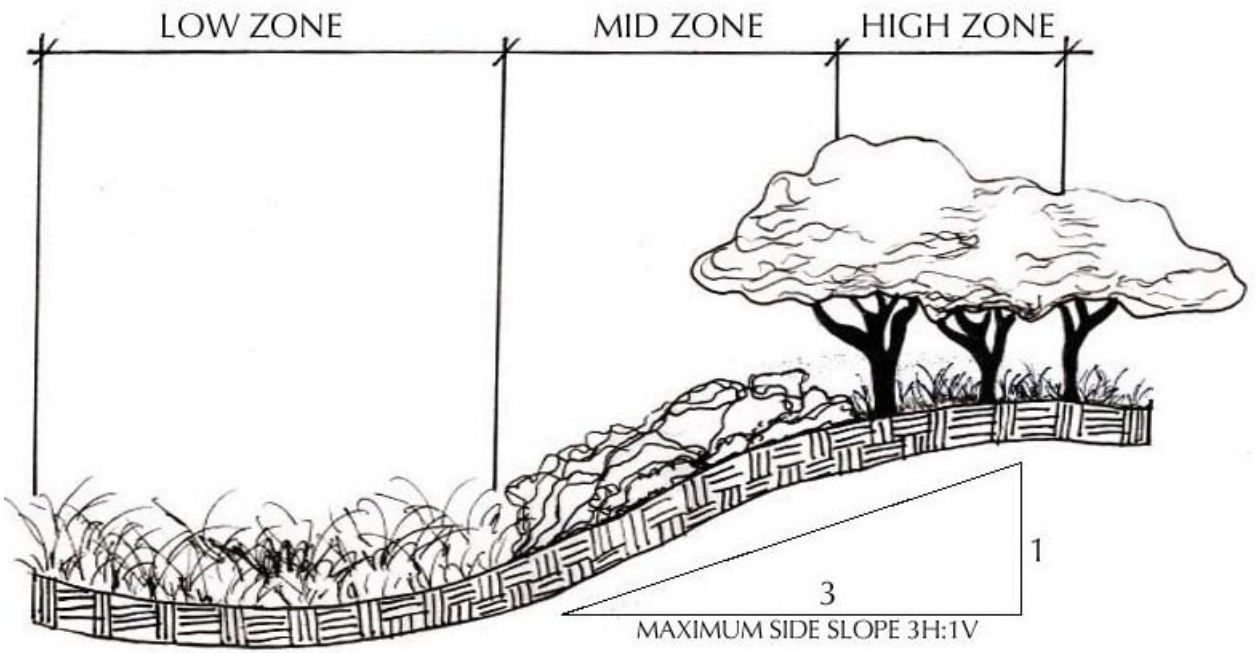
Low-Impact Development Planting Zones

Planting zones refer to the planted areas in drainage features of low impact development (LID) practices and flood control detention basins. LID practices include vegetated swales and bioretention basins. Plants are an integral element of their function.
The plants in these zones facilitate natural infiltration of surface runoff, increase evapotranspiration, reduce the heat-island effect of urbanized areas, and reduce the rate, volume, and pollutant loading of urban runoff that ultimately ends up in local streams, rivers, estuaries, and the Monterey Bay.
For the drainage features to function optimally, numerous plant characteristics have been considered in indicating the appropriate plant species for the three plant zones, such as water requirements, tolerance for inundation, root and leaf structure, and a species' ability to filter pollutants. The plant zone guidelines and planting list can also be utilized for the revegetation, restoration, and bank stabilization of local streams, rivers, and estuaries.

In all instances, native plant species are recommended because they are adapted to the Central Coast climate and generally require less water and fertilization.

Non-native invasive plant species are discouraged because water can quickly spread their occurrence and alter downstream habitats. Likewise, turf grasses are discouraged for LID drainage features because they require large amounts of supplemental water, fertilizers, and regular maintenance.



Low Impact Development Planting Zones

LOW ZONE – The low zone is an area where runoff temporarily ponds in response to a rain event or dry weather flows such as upgradient washing or irrigation activities The low zone should be designed to drain and not hold standing water for more than 72 hours. However, it may be inundated for extended periods of time during the rainy season.

Water-tolerant plants with dense root structure and/or vegetative cover provide maximum pollutant filtration, discourage erosion, and slow water runoff velocities (in drainage features that cross-drain, such as bioswales). Native grasses and groundcovers are recommended for these areas.

MID ZONE – The mid zone is an area that slows the storm water runoff as it flows into the drainage feature. Water passes through and saturates this area but will not stand there for extended periods of time during typical storm events. The plants for this zone must tolerate periods without water *and* periodic inundation. The plants in the mid zone should provide a root structure to prevent erosion of the side slope.

HIGH ZONE – The high zone is an area that creates the top of the bank of the drainage facility. Water will not stand in this zone. Deep roots give natural base structure to the edge of the drainage facility.
These plants must be tolerant of extended periods without water and occasional saturation

Prepared by Joni L. Janecki & Associates, Inc

Low Impact Development (LID) Plant List

Developed for the City of Salinas, California

Botanical Name	Common Name	Low Zone**	Mid Zone**	High Zone**	Swale or Filter Strip	Planting Strips (<	Large Planting Areas (>	Large Detention Basins	Green Roof	Tolerates Prolonged Saturation	Tolerates Periodic Flooding	Tolerates Prolonged Dry Periods	Requires Good Drainage	Tolerates Mowing	Wind Tolerant	Notes
TREES																
Acer circinatum	vine maple		X	X	X	X	X				X	X				Needs some shade
Acer macrophyllum	big-leaf maple		X	X			X	X		X	X				X	
Aesculus californica	California buckeye			X			X	X		X	X	X			X	
Alnus rhombifolia	white alder		X	X			X	X		X	X					Keep protected from prevailing winds
Alnus rubra	red alder		X	X			X	X		X	X					
Cercis occidentalis	Western redbud		X	X		X	X				X	X	X			
Fraxinus latifolia	Oregon Ash		X	X			X	X			X					
Juglans californica var. hindsii	Northern California black walnut			X		X	X			X	X	X				
Populus fremontii	Fremont cottonwood			X			X	X		X					X	Water loving, aggressive roots, “fast growing”
Prunus lyonii	Catalina cherry			X		X	X			X	X	X			X	
Pseudotsuga menziesii	Douglas-fir			X			X				X	X			X	
Salix coulteri	Coulter willow	X	X	X			X	X		X	X				X	
Salix laevigata	red willow	X	X	X			X	X		X	X				X	
Salix lasiolepis	arroyo willow	X	X	X			X	X		X	X				X	
Sambucus mexicana	blue elderberry		X	X		X	X			X	X	X			X	
Umbellularia californica	California bay			X			X			X	X				X	
SHRUBS																
Baccharis douglasii	marsh baccharis	X	X	X		X	X	X		X	X	X				
Baccharis pilularis	coyote brush					X	X				X				X	
Baccharis salicifolia	mule fat		X	X			X	X			X	X				
Cornus stolonifera	red twig dogwood	X	X	X		X	X			X	X				X	
Fremontodendron californicum	flannelbush			X			X						X			High zone, needs to dry between waterings
Garrya elliptica	coast silk tassle			X		X	X					X				
Gaultheria shallon	salal					X	X				X					Prefers shade
Mimulus aurantiacus	sticky monkeyflower		X		X	X			X			X				
Mimulus cardinalis	scarlet monkeyflower	X	X		X	X		X	X	X	X				X	
Rhamnus californica	California coffeeberry		X	X			X	X				X	X		X	Low water requirements
Ribes sanguineum	red flowering currant		X			X	X	X		X					X	
Ribes speciosum	fuchsia-flowered gooseberry		X			X		X		X	X				X	
Ribes viburnifolium	evergreen currant		X	X			X			X	X	X			X	
Rosa californica	California rose		X	X		X	X			X	X	X				Can be invasive
Rubus parviflorus	thimbleberry					X	X	X			X	X			X	

** Plant species are considered native to California. California native selections are suggested to limit impact on native habitats downstream.*

***Refer section drawing for planting zones.*

Prepared by Joni L. Janecki & Associates, Inc.

Low Impact Development (LID) Plant List

Developed for the City of Salinas, California

Botanical Name	Common Name	Low Zone**	Mid Zone**	High Zone**	Swale or Filter Strip	Planting Strips (< 5')	Large Planting Areas (> 5')	Large Detention Basins	Green Roofs	Tolerates Prolonged Saturation	Tolerates Periodic Flooding	Tolerates Prolonged Dry Periods	Requires Good Drainage	Tolerates Mowing	Wind Tolerant	Notes
GRASSES, GROUNDCOVERS, FERNS																
Achillea millefolium	yarrow		X	X	X	X	X	X	X				X		X	
Aquilegia formosa	Western columbine	X			X	X	X			X	X	X				
Bromus carinatus	California brome		X	X	X	X			X			X				
Calamagrostis nutkaensis	Pacific reed grass		X			X	X		X		X	X			X	
Calochortus albus	white globe lily		X		X	X	X	X			X	X			X	
Carex globosa	globe sedge	X	X		X	X	X	X	X	X	X				X	
Carex obnupta	slough sedge	X	X					X		X	X				X	
Carex pansa	California meadow sedge	X	X		X		X	X	X		X		X		X	
Carex tumulicola/ Carex divulsa	Berkeley sedge/ gray sedge	X	X	X	X	X	X	X	X	X	X	X		X	X	
Castilleja miniata	Indian paintbrush		X	X		X	X		X			X	X		X	
Deschampsia cespitosa	tufted hairgrass		X		X		X	X	X		X	X	X		X	Needs irrigation
Dudleya caespitosa	dudleya		X													
Eleocharis macrostachya	common spikerush	X	X		X	X		X	X	X	X				X	
Eschscholzia californica	California poppy		X	X	X	X	X		X			X	X		X	
Festuca californica	California fescue		X	X	X	X					X	X			X	Do not plant in low zone
Festuca idahoensis	Idaho fescue		X	X	X	X	X		X		X	X			X	Do not plant in low zone
Festuca rubra	red fescue	X	X		X	X	X	X	X	X	X			X	X	Needs irrigation
Fragaria chiloensis	beach strawberry		X		X	X		X	X		X	X	X		X	
Heuchera micrantha	alum root		X	X	X	X	X		X		X	X	X			
Iris douglasiana	Douglas iris		X			X	X				X		X		X	
Juncus effusus	common rush	X	X		X	X	X	X		X	X				X	
Juncus patens	California gray rush	X	X		X	X	X	X		X	X				X	
Leymus triticoides	Creeping wild rye		X		X	X	X	X	X		X	X			X	Fast spreading
Melica imperfecta	melic, onion grass		X	X	X	X			X		X				X	
Muhlenbergia rigens	deergrass					X	X		X		X	X			X	
Polystichum munitum	Western sword fern				X	X	X				X					Prefers shade
Rhamnus californica	California coffeeberry															
Salvia ssp.	sage(s)															High zone, predominantly dry zones
Scirpus cernuus	fiber optic grass	X			X	X	X	X	X	X	X	X			X	
Sedum	stonecrop		X						X							
Sisyrinchium idahoense bellum	blue-eyed grass		X	X	X				X							
Satureja douglasii	Yerba buena	X	X		X	X										
VINES																
Clematis ligusticifolia	virgin's bower	X	X				X				X	X				
Lonicera involucrata	twinberry honeysuckle		X	X		X					X					
Vitis californica	California wild grape	X	X	X		X	X				X	X	X		X	Needs partial sun, do not plant at low point

** Plant species are considered native to California. California native selections are suggested to limit impact on native habitats downstream.*

***Refer section drawing for planting zones.*

Prepared by Joni L. Janecki & Associates, Inc.

Low Impact Development Planting Guidelines

DESIGN CRITERIA

There are numerous conditions to consider when choosing plant species to be used in LID drainage features. Many of the criteria are found in species that tolerate the various and (sometimes) disparate conditions in their native habitats. For example, the plant species need to tolerate periods of flooding, as well as extended dry periods without supplemental irrigation. California native plant species are highly recommended because they are best adapted to the local climate.

The LID plant palette is intended to serve as a baseline for plant species selection for LID drainage features. Other plant species may be proposed for use in LID drainage features; the City will have the right to permit or deny their use. The following planting criteria and characteristics are to be considered when proposing other species for LID drainage features:

- The planting zones where the plant species are to be planted (Low, Mid, High; see Planting Zones)
- The size of the planting area and the size of the plant species at maturity
- Preference for California native or easily naturalized plant species
- Non-native invasive species should not be used
- Drought-tolerant/low-supplemental irrigation requirements
- Tolerant of season flooding/inundation
- Low maintenance requirements
- Adaptability

As an element of a drainage feature, LID plant selections should aim to control erosion and wick water from soils. Accordingly, groundcovers and grasses that quickly cover exposed soils are the best choices for the low zone (see Planting Zones). Trees and large shrubs are best planted in the high zone where their roots can absorb the infiltration. Low shrubs, grasses, and groundcovers may be used in the mid zone, depending on the slope, soil type, and drainage patterns (sheet flow vs. concentrated flow, or flooding).

If a planted LID drainage feature receives a concentrated flow, energy dispersion devices will be required at the entry point to deter damage or erosion to the planted areas. Examples of erosion protection/energy dissipation designs include cobblestones, gabions, small hardscaped areas, or other approved devices.

Gabbion for Energy Dispersion (i.e., erosion control)

PLANTING AND LAYOUT

The following should be considered when planting LID drainage features:

- The smallest practical area of land should be exposed at any one-time during development. Mulching or other protective erosion control measures should be used temporarily to protect exposed areas.
- Vegetation should be installed as soon as possible in the development after the land is exposed.
- Plants should be planted in staggered rows to ensure that plants grow together for maximum soil coverage.

Soils for bioretention area must meet the following objectives:

- Be sufficiently permeable to infiltrate runoff at a minimum of 5" per hour during the life of the facility;
- Have sufficient moisture retention to support healthy vegetation;
- Be a mixture of fine sand and compost measured on a volume basis:
    - 60 - 70% clean sand
    - 30 - 40% certified compost
    - Sand shall be clean washed ASTM-33 fine sand free of deleterious material.
    - Recycled wash water from concrete ready-mix operations and other sources shall not be used to wash the sand because it typically has a high pH
    - Organic matter content 35-75% by dry weight
    - C:N < 25.1 **and C:N > 15.1**
    - pH shall be between 6.5 and 8.2

For further information:
https://www.casqa.org/sites/default/files/downloads/basma_bioretention_soil_mix.pdf

Low Impact Development Planting Guidelines

SOIL TESTING

A soils report must be prepared prior to planting. The report will be prepared by a qualified soils specialist or laboratory. The report will be submitted to the City as part of the landscape and irrigation plans for final approval. Soil samples should be collected after grading operations are complete. Because surface soils are highly variable in the alluvial plain of the Salinas Valley, a sufficient number of soils samples must be collected to account for variations that may be present in the areas to be planted. The report should include:

- Native soil composition
- Infiltration rates
- A texture test
- Cation exchange capacity
- An agricultural suitability analysis
- Recommended amendments for planted species to thrive

The following list includes some qualified soil testing laboratories in the region:

Perry Soil Laboratory, 424 Airport Blvd., Watsonville, CA 95076, T: (831) 722-7606

Soil and Plant Laboratory, Inc., 352 Matthew Street, Santa Clara, CA 95052, T: (408) 727-0330

AMENDMENTS

Prior to planting, the recommended amendments must be added, as described in the soils report. A copy of the soils report should be attached to the irrigation schedule provided to the owner and/or operator of the project.

MULCH

After planting, exposed soils must be covered with non-floatable mulch to discourage erosion. Mulch should be maintained only until plant growth has covered the majority of the exposed soil. Biodegradable erosion control blankets may also be used to provide protection from erosion.

Mulch should be large enough in size to be easily cleaned away from drain inlets and not fit through the openings of drain grates. Mulch should be free of sticks and other debris. Always hold mulch away from root crown. Acceptable mulch types include:

- Nitrogen fortified bark (1" to 2" diameter)
- Redwood bark (1" to 2" diameter)
- Chipped gravel, crushed stone, or cobbles (1/2" – 2 1/2" diameter)
- 50/50 blend of top-soil and aged compost

HYDROSEEDING

Hydroseeding is to be used on slopes and areas that have not already been landscaped.

The hydroseed blend to be used is:

- 35% Annual Ryegrass
- 15% Blando Brome
- 15% Rose Clover
- 15% Crimson Clover
- 20% Gala Brome
- 1 oz per 1000 sf of California wildflower mix (poppies and lupins)

The mix should be applied at a minimum of 30 lbs/ac.

"Gorilla Hair" (shredded redwood bark) will not be permitted by the City of Salinas because it causes an impervious layer that encourages mold growth in Salinas's soils.

MAINTENANCE

Native plant species naturally reduce the need for maintenance. These species will minimize pests and disease problems, require less fertilizer, reduce the need for excessive pruning, and conserve water. Woody plants require less maintenance once established, while perennials adjust to their new environment quickly but may require more care over the long run.

Care requirements should be considered when choosing plant species for LID drainage features. Trash and debris should be cleaned out of LID planting areas periodically, especially after large storm events. Drain inlets should be cleaned out periodically.

Bioretention basin along an urban roadway

Low Impact Development Planting Guidelines

PROCESS

The LID plant list was developed through a research process. Characteristics of LID drainage features such as bioswales, bioretention basins, rain gardens, and tree filters were considered. Key local factors such as the climate, soils, and biodiversity of Salinas, California, provided further parameters for development of appropriate plants. Preference was given to plants native to the Central Coast region for their compatibility with sensitive downstream habitats and to keep exotics form spreading and invading those habitats.

Documents and conversations with other municipalities such as the Cities of Livermore, Oakland, and Santa Monica, California, the City of Seattle, Washington, and the City of Portland, Oregon, provided valuable guidance and insight toward successful implementation, operations, and maintenance of LID drainage features.

References:

Brenzel Norris, Kathleen. Sunset Western Garden Book. Menlo Park: Sunset Publishing Corporation, 2001.

The City of Livermore California. *Bioswale Design Compliance – Standard Details*. May 2005.

The City of Livermore California. *South Livermore Valley Specific Plan Residential Street Swales and Parkway Areas Planting Policies and Standards*. December 2003.

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The City of Portland, Oregon. *2005 Portland Watershed Management Plan*. Available at: www.portlandonline.com/bes

The City of Santa Monica, California- Urban Watershed Management Program. Public Outreach and Education Brochure. *Working for a Cleaner Bay- Design Regulations, Construction Practices, and Good Housekeeping Requirements for new building projects and existing properties to reduce urban runoff water pollution*. No date.

Creative Environmental Conservation and Moss Landing Marine Laboratories. *Natividad Creek Wetland and Upland Habitat Restoration Plan*. Prepared for the City of Salinas. No Date.

East Bay Municipal Utility District. Oakland: East Bay Municipal Utility District, *Plants and Landscapes for Summer- Dry Climates of the San Francisco Bay Region*. 2004.

Keator, Glenn. Complete Guide to the Native Shrubs of California. San Francisco: Chronicle Books, 2004.

Las Pilitas Nursery. Online native plants information resource. Available at: www.laspilitas.com.

Low Impact Development Center, Inc. General information about LID principles. Available at: www.lid-stormwater.net

Turnbull, Jenny. The City of Livermore California, Planner. Telephone Conversation. August 10, 2006.

Yronwode, Cathleen, and Eileen Smith. The California Gardener's Book of Lists. Dallas: Taylor Publishing Company, 1998.

Appendix E
Sample Maintenance Declaration and O&M Plan Template

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Recording requested by
and when recorded return to:

CITY OF SALINAS
Permit Center
65 West Alisal Street, Suite 101
Salinas, CA 93901
Attn: Development Engineering

APN NUMBER Above space for Recorder's use

STORMWATER TREATMENT FACILITY MAINTENANCE DECLARATION
(Device Maintenance and Access)

THIS STORMWATER TREATMENT FACILITY MAINTENANCE DECLARATION ("Declaration") is executed as of _____ by property owner(s) name as listed in Title (hereafter the "Declarant") with reference to the following facts:

A. The Declarant is the owner of that certain property, located within the City of Salinas, California (hereinafter, "Salinas"), commonly referred to as property address, Monterey County, California APN number and more particularly described in Exhibit A and the plat thereof on Exhibit B, attached hereto and incorporated herein by reference (hereinafter the "Subject Property").

B. At the time of Salinas's initial approval of the development project known as Project Name wherein the Subject Property is located, Salinas required installation of onsite control measures to minimize pollutants in urban runoff.

C. The Declarant has chosen to install **LID Facility(ies) Name(s)**, hereinafter referred to as the "Device(s)," as the onsite control measure to minimize pollutants in urban runoff.

D. The Device(s) have been installed in accordance with plans and specifications accepted by Salinas.

E. The maintenance of the Device(s) is essential to its ability to function as it was designed.

F. The Device(s), being installed on private property and draining only private property, is/are private facility/ies, and all maintenance or replacement of the Device(s) is the sole responsibility of the Declarant in accordance with the terms of this Declaration.

G. The Declarant is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to ensure peak performance of the Device(s) in accordance with the maintenance procedures prepared for each Device, which are attached hereto as Exhibit C and incorporated herein.

H. Maintenance of the Device(s) will require compliance with all local, state, or federal regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

NOW, THEREFORE, in consideration of the foregoing benefits, as well as the benefits obtained by the Declarant and other valuable consideration, the receipt and adequacy of which is hereby acknowledged, the Declarant hereby declares, covenants, and agrees as follows:

1. **Covenant Running with Land**. The Declarant does hereby covenant that the burdens and benefits herein made and undertaken shall constitute covenants running with the Subject Property and constitute an encumbrance on said Subject Property that shall bind all successors, heirs, and assigns and Salinas is hereby specifically given the right to enforce this Declaration.

2. **Declarant Responsibility to Maintain**. The Declarant, its successors and assigns, shall at all times maintain the Device(s) in accordance with the requirements stated in Exhibit C and the Declarant shall use its best efforts to maintain the Device(s) to operate and function in the manner in which it/they/was/were intended. All reasonable precautions shall be exercised by the Declarant and the Declarant's representatives in a manner consistent with all relevant laws and regulations in effect at the time of removal and consistent with the direction of the City Engineer. The Declarant shall not destroy, remove, or otherwise modify the Device(s) in a manner that lessens its/their effectiveness and shall, at its sole cost and expense, adequately maintain the Device(s) in good working order and repair acceptable to Salinas. At its sole expense, the Declarant shall make changes or modifications to the Device(s) as may be determined as reasonably necessary by Salinas to ensure that the Device(s) are properly maintained and continue to operate as originally designed and approved.

a. Routine and Preventative Maintenance. The Declarant shall be responsible for all routine and preventive maintenance necessary to ensure the Device(s) operate and function in the manner in which it/they/was/were intended, in accordance with all applicable federal, state, and local laws and regulations. The Declarant's obligations under this section shall include the removal of all litter and debris within the Device(s) and the regular mowing and seeding of the Device(s) to promote growth and pollutant uptake. The Declarant shall properly dispose of any cuttings or vegetative waste that result from such maintenance or repair.

The Declarant shall be responsible for the management of any erosion or slope failure that occurs within the Device(s). The Declarant shall provide for the repair of any areas of erosion or slope failure as soon as possible after discovery. Any damage to the vegetation within the Device(s) shall be promptly repaired by the Declarant and any invasive species or weeds shall be promptly removed by the Declarant to ensure the proper operation and functioning of the Device(s). If necessary, flow through the Device(s) shall be redirected to avoid deterioration or erosion while such maintenance or repair is being completed. An inspection report stating when the Device(s) was/were inspected and an itemization of what maintenance was performed is required to be sent to the City, NPDES Division, by September 1 of each year. Maintenance needs to be complete prior to the start of rainy season, 1 October.

b. Vector Control. The Device(s) shall be properly inspected, maintained, and repaired by the Declarant to ensure uniform percolation throughout and to prevent the accumulation of standing water or debris or other harborages for vectors. The Declarant shall promptly abate any vectors

or potential vectors that occur within the Device(s). The Northern Salinas Valley Mosquito Abatement District shall be contacted, as needed, for assistance should any mosquito issues arise.

c. Sediment Management. Sediment accumulation from the normal operation of the Device(s) will be managed appropriately by the Declarant. The Declarant will provide for the removal and disposal of accumulated sediments. Disposal of accumulated sediments shall not occur on the Subject Property. Any disposal or removal of accumulated sediments or debris shall be in compliance with federal, state, and local laws and regulations.

d. Pesticide and Herbicide Use. Application of any pesticides or herbicides by the Declarant to meet the obligations of this Declaration shall be minimal and in accordance with all applicable federal, state, and local laws and regulations and in accordance with any restrictions imposed upon such use or application by the City Engineer or his designee. Pyrethroid pesticides may not be used.

3. **Retention of Records**. For a time period of the most recent three (3) years, the Declarant shall maintain written documentation verifying all material(s) removed from the Device(s), including identifying the material(s) removed, quantity, and manner and place of disposal thereof. The Declarant shall also retain records of all periodic maintenance and inspection of the Device for a time period of the most recent three (3) years (twice yearly minimum inspections, one immediately prior to the beginning of rainfall). Such documentation is subject to review by Salinas from time to time upon request.

4. **Failure to Maintain**. In the event the Declarant, or its successors or assigns, fails to maintain and repair the Device(s) as required by this Declaration, after thirty (30) days written notice thereof, Salinas may and is hereby authorized to cause, at the Declarant's sole cost and expense, any and all maintenance to the Device(s) necessary under the requirements specified in Exhibit C. In addition to the actual costs of such maintenance, the Declarant shall reimburse Salinas for an additional fifteen percent (15%) thereof to cover costs of administration. All such actual and administrative costs shall accrue interest from the date incurred by Salinas at the maximum rate authorized by law until paid in full. The notice provided herein shall be effective on the date sent by U.S. Mail, first class postage prepaid to the record owner of the Subject Property as shown on the most recent tax roll. If such costs are not paid within the time frame established by Salinas, the unpaid costs shall be assessed against the Subject Property. Said assessment shall be a lien against the Subject Property and may be collected as ordinary taxes by Salinas. The actions described in this section are in addition to and not in lieu of any and all legal remedies as provided by law, available to Salinas as a result of the Declarant's failure to maintain the Device(s).

5. **Security**. The Declarant, at the Declarant's sole cost and expense, shall post a security in a form and manner satisfactory to Salinas to guarantee the Declarant's performance of the obligations set forth herein. Should the Declarant fail to perform the obligations under this Declaration, then Salinas may realize against said security, and in the case of a cash bond, act for the Declarant using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of this Declaration. Said security shall be available to Salinas to satisfy the Declarant's reimbursement obligation under paragraph 4 hereof.

6. **Access by Salinas**. The Declarant grants Salinas or Salinas's designee and all other responsible government agencies and their agents or designees the unrestricted right of access to the Device(s), including its immediate vicinity, and including ingress and egress to and from said Device(s), at any time of any duration for the purpose of inspection, sampling, and testing of the Device(s). Salinas personnel with proper identification will be permitted to enter the Subject Property without delay for the purpose of performing their duties. Salinas shall indemnify and hold the Declarant harmless from anything arising from their agents being on the above said property. Salinas shall make reasonable efforts at all times to maintain or avoid interference with the Declarant's use of the Subject Property. It is specifically understood and agreed that Salinas is under no obligation to maintain or repair the Device(s) and in no event shall the Devices be considered to impose any such obligation on Salinas.

7. **Indemnification**. The Declarant and its successors, heirs, and assigns shall indemnify, defend, and hold Salinas, its officers, employees, agents, and representatives, harmless from and against any and all liability, claims, demands, suits, damages, loss, and causes of action arising out of or asserted against Salinas by reason of the Declarant's design, construction, maintenance, repair, and care of the Device(s). The Declarant shall also have the obligation to indemnify, defend against any claims, demands, causes of action, liability, or loss arising from, connected with, caused by or claimed to be caused by the active or passive negligence of Salinas, its officers, employees, agents, or representatives that may be in combination with the negligence of the Declarant, its employees, agents or officers, or any third party. It is understood that the duty of the Declarant to indemnify and hold harmless includes the duty to defend as set forth in Section 2778 of the California Civil Code, and that the Declarant shall at its own expense, upon written request by Salinas, defend any such suit or action brought against Salinas, its officers, agents, employees, or representatives.

The Declarant shall reimburse the Salinas for all costs and expenses (including, but not limited to, reasonable fees and charges of architects, engineers, attorneys, and other professionals, and court costs) incurred by Salinas in enforcing the provisions of this section.

8. **Successors and Assigns Bound**. The Declarant hereby agrees and acknowledges that maintenance of the Device(s) as herein above set forth and the costs of maintenance, Salinas's access to the device(s), and Salinas's right of ingress and egress to the Device(s) and recovery of costs if the Declarant fails to maintain the Device(s) as herein set forth, are a burden and restriction on the use of the Subject Property. The provisions of this Declaration shall be enforceable as an equitable servitude and as conditions, restrictions and covenants running with the land, and shall be binding upon the Declarant and upon each and all of its respective heirs, devisees, successors, and assigns, officers, directors, employees, agents, representatives, executors, trustees, successor trustees, beneficiaries, and administrators, and upon any future owners of the Subject Property and each of them. Whenever the Subject Property is sold, conveyed or otherwise transferred, the Declarant shall provide Salinas with no less than thirty (30) days written notice identifying the new owner who shall be subject to this Declaration which shall apply to, bind and be obligatory to all present and subsequent owners of the Subject Property.

9. **Enforcement**. It is the express intent of the Declarant that the terms and provisions of this Declaration shall be enforceable as an equitable servitude by the Declarant. To the extent necessary to do so, Declarant and its successors and assigns hereby confer and assign rights to enforce the terms and conditions of this Declaration to Salinas and this Declaration may be enforced by any proceedings at law or in equity by or against the Declarant and its successors and assigns.

10. **Recording of Declaration**. This Declaration shall be recorded in the Office of the Recorder of Monterey County, California, and shall constitute notice to all successors and assigns of the title to the Subject Property of the rights and obligations herein set forth.

11. **Amendment**. This Declaration may be amended by the Declarant, but only if in writing, and only after written approval of Salinas.

12. **Attorney's Fees**. In case suit shall be brought to interpret or to enforce this Declaration, or because of the breach of any other covenant or provision herein contained, the prevailing party in such action shall be entitled to recover their reasonable attorneys' fees in addition to such costs as may be allowed by the Court. City's attorneys' fees, if awarded, shall be calculated at the market rate.

13. **Taxes**. The Declarant shall pay all real estate taxes and any other charges or fees that may be assessed against the Subject Property and the Device(s).

IN WITNESS WHEREOF, the Declarant has executed this Declaration as of the day and year written above.

DECLARANT

_____ _____

By: Name of property owner or other person(s) signing for property owner
Its: Title of person signing document/how do/does the person represent property owner?
For: Property owner name as listed in Title (add more lines if more than one owner listed)

Date

GENERAL ACKNOWLEDGEMENT

STATE OF CALIFORNIA

COUNTY OF _____

On_____, 20__ before me, Notary Public, personally appeared, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_____

(Seal) Signature

EXHIBIT A

[Legal description of project property boundaries - as per County record information (e.g. record map, record deed(s), certificate of compliance, etc.) - to be provided by developer/architect/engineer]

EXHIBIT B

[Site Plan identifying LID/IMP device(s) to be provided by developer/architect/engineer]

EXHIBIT C

STORMWATER TREATMENT FACILITY NAME MAINTENANCE PLAN
[to be provided by developer/architect/engineer, as per the engineer's/manufacturer's recommendations]

Facility maintenance personnel in responsible charge for the following maintenance activities:

By: Name of property owner or other person(s) signing for property owner
Its: Title of person signing document and relationship to property owner
For: Property owner name as listed in Title (add more lines if more than one owner listed)

At a minimum, provide an O&M plan listing the activities that must occur to properly maintain the stormwater treatment facility. Include a schedule of the activity as number of occurrences per year (e.g., inspect outlet structure after each rainfall event or once per month, whichever is more frequent). Example O&M Plans are included in Appendix H for non-proprietary stormwater BMPs. Manufacturer's recommended maintenance activities and intervals shall be provided for all proprietary BMPs. For more information, see Section 5, Operation and Maintenance.

Exhibit D

O&M Plan Contact Information

Operation and Maintenance Plan

Contact Information Form

Designation of Individuals Responsible for Stormwater Treatment BMP Operation and Maintenance	
Date Completed	
Facility Name	
Facility Address	
Designated Contact for Operation and Maintenance	
Name:	Title or Position
Telephone:	Alternate Telephone:
Email:	
Off-Hours or Emergency Contact	
Name:	Title or Position
Telephone:	Alternate Telephone:
Email:	
Corporate Officer (authorized to execute contracts with the City)	
Name:	Title or Position
Address	
Telephone:	Alternate Telephone:
Email:	

Exhibit E

Annual SCM Inspection Report Format

I. General
   a. Data and time of site visit
   b. Reason for inspection (routine/annual, follow-up, by City request, or response to complaint)
   c. Weather and rainfall
   d. Personnel participating
   e. Ability to obtain access to site

II. Review of Operation and Maintenance Plan
   a. Ability to obtain and review on-site copy of O&M Plan
   b. Date of last update to plan
   c. Information required to be updated
      i. Contact information for site personnel
      ii. Information on SCMs
      iii. Records of previous inspections
      iv. Maintenance schedule
   d. Review of maintenance logs
      i. Comparison to maintenance schedule

III. Results of Site Inspection
   a. Overall condition of site and any exceptional circumstances
   b. For SCMs listed in the O&M Plan
      i. Items inspected
      ii. Exceptions noted
      iii. Deficiencies notes
         1. Identify deficiencies that affect SCM performance
         2. Identify deficiencies that do not affect SCM performance
      iv. Corrective actions needed
      v. When corrective actions will be implemented

IV. Compliance Status
   a. In compliance – no corrective action required
   b. Minor non-compliant – implement corrective actions and re-inspect in one year
   c. Non-compliant – Implement corrective actions and re-inspect

V. Summary and Recommendations
   a. Note any required follow-ups and schedule re-inspection if necessary

Exhibit F

SCM Maintenance Log

Operation and Maintenance Plan

Stormwater BMP Inspection and Maintenance Log

Facility Name						
Address						
Begin Date				End Date		
Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Take

Instructions: Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the annual independent inspectors' report to the City, and start a new log at that time.

- BMP ID# — Always use ID# from the Operation and Maintenance Manual.
- Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
- Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
- Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
- Comments and actions taken — Describe any maintenance done and need for follow-up.

Appendix F
Stormwater Control Measure Design

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Stormwater Control Measure Design Requirements

F.1 Infiltration (Detention) Basin Design

- Subsurface infiltration basins that include vaults, chambers or proprietary devices designed to capture and infiltrate runoff are considered Class V wells.
- Registered professional civil engineers shall design infiltration basins using sufficient technical knowledge of the vertical and lateral movement of infiltrated runoff through soil and the interaction with groundwater established through a geotechnical investigation.
- Shall not be installed on slopes greater than 15%.
- Size the basin to capture and infiltrate the design volume
- The basin shall be designed to drain the above ground volume within 72 hours.
- Basin side slopes shall be 3H:1V or flatter.
- The slope of the floor of the basin shall not exceed 5%.
- Inlet energy dissipation structure shall be used where inflow velocities may cause erosion of the filter media.
- Runoff from storm flows will be detained and released at pre-developed rates for the following storms:
    - 2-yr, 24-hr post-project peak flow (discharge) rate $\leq$ 2-year, 24-hr pre-developed peak flow;
    - 5-yr, 24-hr post-project peak flow rate = 5-yr, 24-hr pre-developed peak flow rate
    - 10-yr, 24-hr post-project peak flow rate = 10-yr, 24-hr pre-developed peak flow rate
    - 25-yr, 24-hr post-project peak flow rate = 25-yr, 24-hr pre-developed peak flow rate
    - 50-yr, 24-hr post-project peak flow rate = 50-yr, 24-hr pre-developed peak flow rate
    - 100-yr, 24-hr post-project peak flow rate = 100-yr, 24-hr pre-developed peak flow rate

F.2 Infiltration Trench Design (from C.3 Stormwater Handbook)

- Subsurface infiltration trenches that include vaults, chambers or proprietary devices designed to capture and infiltrate runoff are considered Class V wells.
- If trench is deeper than it is wide, then it is considered a Class V injection well.
- Pretreatment shall occur upstream of the infiltration trench through a vegetated buffer strip or

other system. If a vegetated buffer strip is used, the strip must be at least 5-feet wide.

- Upgradient slope shall not be greater than 5%.
- Down gradient slope shall not be greater than 15%.
- In-situ/undisturbed soils shall have infiltration rates greater than 0.5 in/hr.
- Place permeable filter fabric around the walls and bottom of the trench and 1 foot below the trench surface. The filter fabric should overlap each side of the trench in order to cover the top of the stone aggregate layer. The filter fabric prevents sediment in the runoff and soil particles from the sides of the trench from clogging the aggregate.
- Place a layer of filter fabric at the bottom of the trench to keep the rock matrix from settling into the subgrade over time.
- Runoff shall enter trench via sheet flow.

□ F.3 Dry Well and Class V Injection Well Design

- Shall be designed by a Professional Engineer
- Provide adequate treatment of stormwater runoff upstream of wells
- Meet requirements set forth by the U.S. EPA and the Safe Drinking Water Act for Class V injection wells. This requires registration of the facility using the online form at https://www.epa.gov/uic/forms/underground-injection-well-registration-pacific-southwest-region-9. See https://www.epa.gov/uic/federal-requirements-class-v-wells for additional information.
- Methodology to evaluate outflow from each specific configuration needs to be submitted to the City for approval.
- Dry wells that are not deeper than they are wide are not considered Class V injection wells and are not required to meet EPA requirements. Components considered to be subsurface fluid distribution systems are included

□ F.4 Pervious Pavement Design

Pervious pavement includes, but is not limited to, the following types: Pervious pavement detention, open-celled block pavers, open-jointed block pavers, porous concrete and porous asphalt, porous turf pavement, porous gravel pavement, and open-celled plastic grids.

- Registered professional civil engineers shall design pervious pavement.

- Follow pavement manufacturer's design and installation recommendations.
- Sub-base layers shall be capable of bearing an appropriate load without deforming.
- Appropriate gradations of aggregate material must be used to minimize the migration of particles from one layer to the next. If this cannot be achieved, a woven geotextile shall be used under the bedding layer above the base course to minimize migration. A woven geotextile fabric layer such as SI Corporation Geotex 117F or equal can be used.
- Filter fabrics shall be placed on the bottom and sides of the sub-base layer. To allow infiltration and minimize clogging, the filter fabric shall be woven geotextile fabric layer such as SI Corporation Geotex 117F or an approved equivalent.
- Pervious pavement shall not be used in areas where there is outdoor storage or use of chemicals or materials within the drainage area that could threaten groundwater quality if a spill were to occur.
- Where infiltration of stormwater may result in slope failure, foundation settlement, pavement failure or a negative impact to existing underground infrastructure, an impermeable barrier is required and the configuration is considered to be a detention facility, not pervious pavement.
- Edge restraints are required around the perimeter and shall be installed on compacted subgrade or base material, not on the bedding.
- A concrete perimeter wall shall be installed to confine the edges of block installations. The perimeter wall shall be 6 inches thick and to extend 6 inches deeper than the base course, bedding layer, and block depth combined.

□ F.5 Bioretention Basin, Biofiltration Basin and Stormwater Planter Design

For projects where treatment upstream from direct infiltration is needed, or treatment, but not runoff reduction is required, biofiltration SCMs can be used to fulfill water quality treatment requirements. Biofiltration SCMs include, but are not limited to, the following treatment systems: biofiltration basins, cisterns, green roofs, landscape detention, and vegetated filter strips and swales.

Note that bioretention basins provide water quality treatment without the underdrain used in biofiltration basins. Biofiltration basins and stormwater planters include underdrains and can contain an impermeable barrier at the base of the systems. Stormwater planters are used in areas

where infiltration is infeasible. Biofiltration basins can be used both when infiltration is feasible and when infiltration is infeasible. The location of the underdrain in the biofiltration facility changes depending on the amount of infiltration that is feasible.

The following two conditions preclude the use of biofiltration SCMs:

1. High groundwater table within 5 feet of the bottom of the biofiltration SCM (unless enclosed within an impermeable liner or a concrete box with an underdrain or the City Engineer has approved the specific application based on there not being a significant risk to ground water quality).

2. On sites prone to runoff with high sediment loads (unless an additional sedimentation basin is installed upstream of the biofiltration/bioretention basin).

□ *SCM Design Requirements:*

- Shall be designed by a Professional Engineer
- Shall be designed to have a stormwater surface loading rate not exceeding 5 in/hr at the peak flow rate based on the surface area at the overflow elevation.
- Shall be designed to retain runoff from the 85th percentile rainfall event on-site. This is effectively equivalent to the County's current retention standard of the 25-year, 1-hour storm.
- If the design infiltration rate is less than 0.3 inch/hr, an underdrain system consisting of a perforated pipe in a gravel layer shall be included in the design. The slotted PVC underdrain pipe shall be located at a height to provide the minimum storage necessary.
- Shall have 3:1 maximum side slope on all biofiltration/bioretention basins.
- Overflow must have a grate to prevent trash from entering the storm drain system.
- Biofiltration/bioretention basins must have adequate access for maintenance.
- When infiltration is not feasible, one inch of dead storage shall be provided beneath the underdrain.
- Where required, orifice sizing shall be in accordance with the following recommended sizing procedures.

  Establish the size of the orifice opening using the following equation:

$$Q = C_d A(2gh_d)^{1/2}$$

Where:

Q = design flow rate (cfs)

C_d = orifice coefficient = 0.6[18] (dimensionless)

A = orifice area (sq ft)

g = gravitational constant (32.2 ft/sec^2)

h_d = height of water above mid=point of orifice (feet)

- If an underdrain system is required, it shall consist of a minimum 4-inch diameter perforated pipe surrounded by 12 inches of drain rock (or functionally equivalent configuration).
- Biofiltration systems shall include an engineered soil mix consisting of a well-mixed combination of 60-70% clean sand and 30-40% certified compost (see Appendix D) installed to a minimum depth of 24 inches topped with 3 inches of non-floatable mulch beneath the temporary ponding area.
- Sod shall not be used in the design of biofiltration basins as it typically contains a high percentage of clay that inhibits infiltration.
- The drain rock sub-base shall consist of clean coarse aggregate (3/4" drain rock and/or ¾" Class II permeable aggregate pea gravel) or alternative storage configuration. Recycled wash water shall not be used to wash the aggregate because it typically has a high pH. The aggregate shall be rinsed with potable water prior to installation and construction of the biofiltration system.
- Erosion control/energy dissipation features shall be provided where runoff enters biofiltration systems (e.g., cobbles or riprap beneath a curb cut opening or a splash block beneath a roof drain downspout).
- Weirs or grade control structures shall be included in the design to divert excess runoff from large events away from (or out of) the facility and towards the conventional storm drain system. The controls can be configured to provide for detention of runoff from less frequent rainfall events above the design volume based on more frequent storms.

□ *Construction Inspection Requirements:*

- The Engineer of Record shall provide construction observations. The Contractor shall coordinate the biofiltration basin/planter construction and inspection schedule with the Engineer to ensure the Engineer is able to perform the required inspections. The following inspections are anticipated:

- Basin Excavation – Measure excavation area and elevation and observe subgrade condition structures;
- Structures - Measure structure elevations and observe all structures and pipes and appurtenances related to the LID systems;
- Bioretention Soil Mix/Finished Grade – Measure basin area and slopes and observe BSM condition and placement;
- Final Inspection - Observe condition of completed basin/planter, including finished grades, mulch, irrigation, and plants.

- Bioretention basins/planters may be rough graded and used as temporary sedimentation basins during construction. The bottom of the temporary sedimentation basins must be at least six (6) inches above the bottom of the final bioretention basin soil layer to allow from final excavation as described below or rough grade to full depth with fiber roll around the basin.
- Final basin excavation and placement of drain rock and bioretention soil mix shall occur ***after*** construction of surrounding embankments, pavements and curbs and ***after*** stabilization of the surrounding landscape area, and not more than two (2) weeks prior to mulching and landscaping the basins.
  - Final basin excavation must be to a depth of at least six (6) inches into undisturbed native soil, to ensure fine-grained sediments deposited during the course of construction are removed from the basin footprint.
  - If construction site runoff enters the basin after final excavation (i.e. due to storm or irrigation runoff), and prior to placement of BSM, the City may require removal of an additional two (2) inches of undisturbed native soil.
- The Contractor is responsible for basin maintenance during construction until project acceptance by the City. This includes removal of all sediments which are deposited in the basins.
  - Immediately prior to acceptance by the City, Contractor must remove all trash, debris, and accumulated sediment.
- The Operation & Maintenance (O&M) Plan shall be prepared and submitted as part of the Maintenance Declaration to be recorded prior to final inspection by the City. The O&M Plan shall outline the operation and maintenance requirements of the LID features after acceptance by the City.

□ *Example Bioretention Construction Inspection Checklist:*

Layout (to be confirmed prior to beginning excavation)

- ❒ Square footage of the facility meets or exceeds minimum shown in Stormwater Control Plan
- ❒ Site grading and grade breaks are consistent with the boundaries of the tributary Drainage Management Area(s) (DMAs) shown in the Stormwater Control Plan
- ❒ Inlet elevation of the facility is low enough to receive drainage from the entire tributary DMA
- ❒ Locations and elevations of overland flow or piping, including roof leaders, from impervious areas to the facility have been laid out and any conflicts resolved
- ❒ Rim elevation of the facility is laid out to be level all the way around, or elevations are consistent with a detailed cross-section showing location and height of interior dams
- ❒ Locations for vaults, utility boxes, and light standards have been identified so that they will not conflict with the facility
- ❒ Location for signage is identified
- ❒ Facility is protected as needed from construction-phase runoff and sediment

Excavation (to be confirmed prior to backfilling or pipe installation)

- ❒ Excavation conducted with materials and techniques to minimize compaction of soils within the facility area
- ❒ Excavation is to accurate area and depth
- ❒ Slopes or side walls protect from sloughing of native soils into the facility
- ❒ Vertical moisture barrier, if specified, has been added to protect adjacent pavement or structures.
- ❒ Native soils at bottom of excavation are ripped or loosened to promote infiltration

Overflow or Surface Connection to Storm Drainage
(to be confirmed prior to backfilling with any materials)

- ❒ Overflow is at specified elevation
- ❒ No knockouts or side inlets are in overflow riser
- ❒ Overflow location selected to minimize surface flow velocity (near, but offset from, inlet recommended)
- ❒ Grating excludes mulch and litter (beehive or atrium-style grates with ¼" openings recommended)
- ❒ Overflow is connected to storm drain via appropriately sized piping

Underground connection to storm drain/outlet orifice
(to be confirmed prior to backfilling with any materials)

- ❒ Perforated pipe underdrain (PVC SDR 35 or approved equivalent) is installed with holes facing down
- ❒ Perforated pipe is connected to storm drain at specified elevation (typ. bottom of soil elevation)
- ❒ Cleanouts are in accessible locations and connected via sweep bends
- ❒ Monitoring well, if required, is installed.
- ❒ Structures (arches or large diameter pipes) for additional surface storage are installed as shown in plans and specifications and have the specified volume

□

Drain Rock/Subdrain (to be confirmed prior to installation of soil mix)

- ❒ Rock is installed as specified. Class 2 permeable, Caltrans specification 68-2.02(F)(3) recommended, or 4"-6" depth of pea gravel is installed at the top of the crushed rock layer to prevent migration of fines into gravel layer
- ❒ Rock is smoothed to a level top elevation. Depth and top elevation are as shown in plans
- ❒ Slopes or side walls protect from sloughing of native soils into the facility
- ❒ No filter fabric is placed between the subdrain and soil mix layers

Soil Mix

- ❒ Soil mix is as specified.
- ❒ Mix installed in lifts not exceeding 12"
- ❒ Mix is not compacted during installation but may be thoroughly wetted to encourage consolidation
- ❒ Mix is smoothed to a level top elevation. Depth of mix (24" min.) and top elevation are as shown in plans, accounting for depth of mulch to follow and required reservoir depth

Irrigation

- ❒ Irrigation system is installed so it can be controlled separately from other landscaped areas. Smart irrigation controllers and drip emitters are recommended
- ❒ Spray heads, if any, are positioned to avoid direct spray into outlet structures

Planting

- ❒ Plants are installed consistent with approved planting plan
- ❒ Any trees and large shrubs are staked securely
- ❒ No fertilizer is added; compost tea may be used
- ❒ No native soil or clayey material are imported into the facility with plantings
- ❒ 1"-2" mulch may be applied following planting; mulch selected to avoid floating
- ❒ Final elevation of soil mix maintained following planting
- ❒ Curb openings are free of obstructions

Final Engineering Inspection

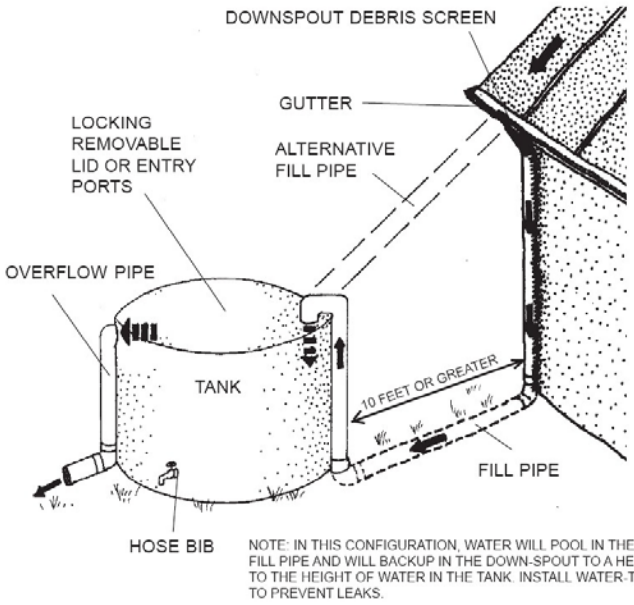
- ❒ Drainage Management Area(s) are free of construction sediment and landscaped areas are stabilized
- ❒ Inlets are installed to ensure entry of runoff from adjoining pavement, have sufficient reveal (drop from the adjoining pavement to the top of the mulch or soil mix, and are not blocked
- ❒ Rock or other energy dissipation at piped or surface inlets is adequate
- ❒ Inflows from roof leaders and pipes are connected and operable
- ❒ Temporary flow diversions are removed
- ❒ Overflow outlets are configured to allow the facility to flood and fill to near rim before overflow
- ❒ Plantings are healthy and becoming established
- ❒ Irrigation is operable
- ❒ Facility drains rapidly; no surface ponding is evident
- ❒ Any accumulated construction debris, trash, or sediment is removed from facility
- ❒ Permanent signage is installed and is visible to site users and maintenance personnel

□ F.6 Rain Barrels, Cisterns, and Rainwater Harvesting System Design

Cisterns are used to collect and store stormwater runoff from impervious surfaces such as roofs, paved terraces and patios. Cisterns can be used by projects with less than 5,000 square feet of new and/or replaced impervious area, turf, or detached-single family homes (not part of a larger plan of development) that create or replace less than 20,000 square feet of impervious and/or turf surfaces. Larger projects can use cisterns to meet design requirements if infiltration is determined to be infeasible.

- Cisterns are required to have a filter system at entrance of tank and be adequately covered to prevent mosquito breeding
- Tanks shall be sized based on area of impervious surface
- Tanks shall be sized to drain in 48 to 72 hours over a landscaped area equal to at least 25% of the impervious tributary area.
- Outflow from the tanks shall be distributed relatively uniformly over the receiving pervious area over the drawdown period.
- Tanks shall be placed on level pads.
- Tanks located within 10 feet of the structure need to be restrained to prevent damage in the event of an earthquake.
- Rainwater may be collected from roof areas that drain to downspouts that have minimal leaf drop from overhanging tree branches
- All non-potable irrigation/industrial water lines (pressure/non-pressure) shall be identified by continuous lettering on 3” minimum width yellow tape with 1” black lettering bearing the wording “Non-Potable Water” permanently affixed at 5’ intervals atop all piping. Identification tape shall extend to all valve boxes and/or vaults, exposing piping, hydrants, and quick couplers.
- Maintain clear access to rain barrel outlets and cleaning access points
- For further information: https://cityofpacificgrove.org/living/community-economic-development/planning/stormwater/lid-techniques/design-guidelines/rainwater

Figure 1: Rainwater capture and reuse system schematic with an above ground storage tank.

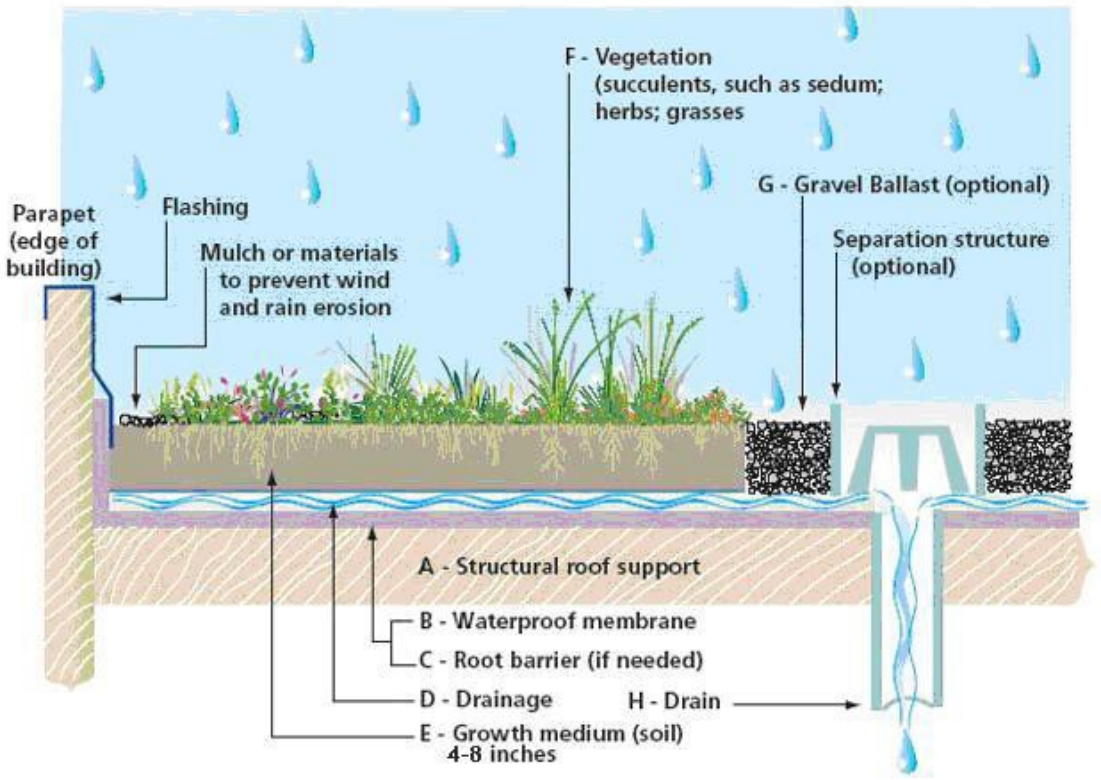


Source: City of Tucson,

□ F.7 Green Roof Design

- Green roofs shall be constructed on flat or pitched roof structures with a maximum slope of 40% (or 5 in 12 pitch).
- Shall be constructed with 4 to 8 inches of growth media (or soil).
- Shall be planted with hardy, drought-tolerant species to minimize additional irrigation, maintenance, cost and weight.
- A building's structure must be able to support at least an additional 10-25 pounds per square foot of saturated weight, depending on the growth media and vegetation used.
- For further information: https:/www.epa.gov/sites/production/files/documents/GreenRoofsSemiAridAridWest.pdf

Figure 2: Green roof Construction Detail Schematic



□ F.8 Vegetated Swale Design

- Length of vegetated swale shall be greater than or equal to 100 feet and detain stormwater for a least 9 minutes for treatment.
- Maximum swale tributary area is 10 acres.
- Longitudinal slopes are to be between 0.5% and 2.5%.
- Longitudinal slopes between 2.5% and 5% may be allowed if check dams are installed to reduce runoff velocity to 2.0 feet per second or less.
- If swale bottom slope is less than 1%, install underdrain system to prevent standing water.
- Swale side slopes in the treatment area shall not be steeper than 4H:1V (25%). Side slopes of the freeboard area above the treatment zone are 2.5H:1V (40%) or less. The swale's slope end to end must be at least 0.5%.
- Do not apply in areas with adjacent slopes of 5% or greater or in areas with highly erodible soils.
- If a swale is to be designed to both convey and treat the Water Quality Flow (WQF) rate and to convey the flows produced by larger storm flows, the swale shall be designed to safely convey flows produced by the 5-, 20- and 100-year rainfall events.
- The maximum bottom width of treatment area of swale shall be 6 feet minimum not exceed 10 feet. The minimum bottom width shall not be less than two feet. The swale shall be no more than ½ foot deep. The freeboard area has at least one foot of vertical height.
- To size the bottom width, use the Manning's equation at the WQF with a roughness coefficient (n) value of 0.25 for grass and 0.40 for mixed vegetation and rocks.
- Improved pollutant removal efficiency occurs with a minimum 10-minute hydraulic residence time at the WQF. Swales shall be configured so that 90 % of the tributary runoff will have a residence time of at least 9 minutes.
- The swale must not hold standing water for more than 72 hours to prevent vector problems.
- To provide proper drainage, a minimum 4-inch diameter perforated PVC underdrain pipe shall be provided where underlying soils have infiltration rates less than 0.5 in/hr.
- Design vegetation height of 4 - 6 inches is required.
- Design with flow height one inch below design grass height for WQF.
- All swales shall have an energy dissipater at the entrance to reduce velocities and spread flow across the treatment area. The minimum length of the energy dissipater shall be four feet.

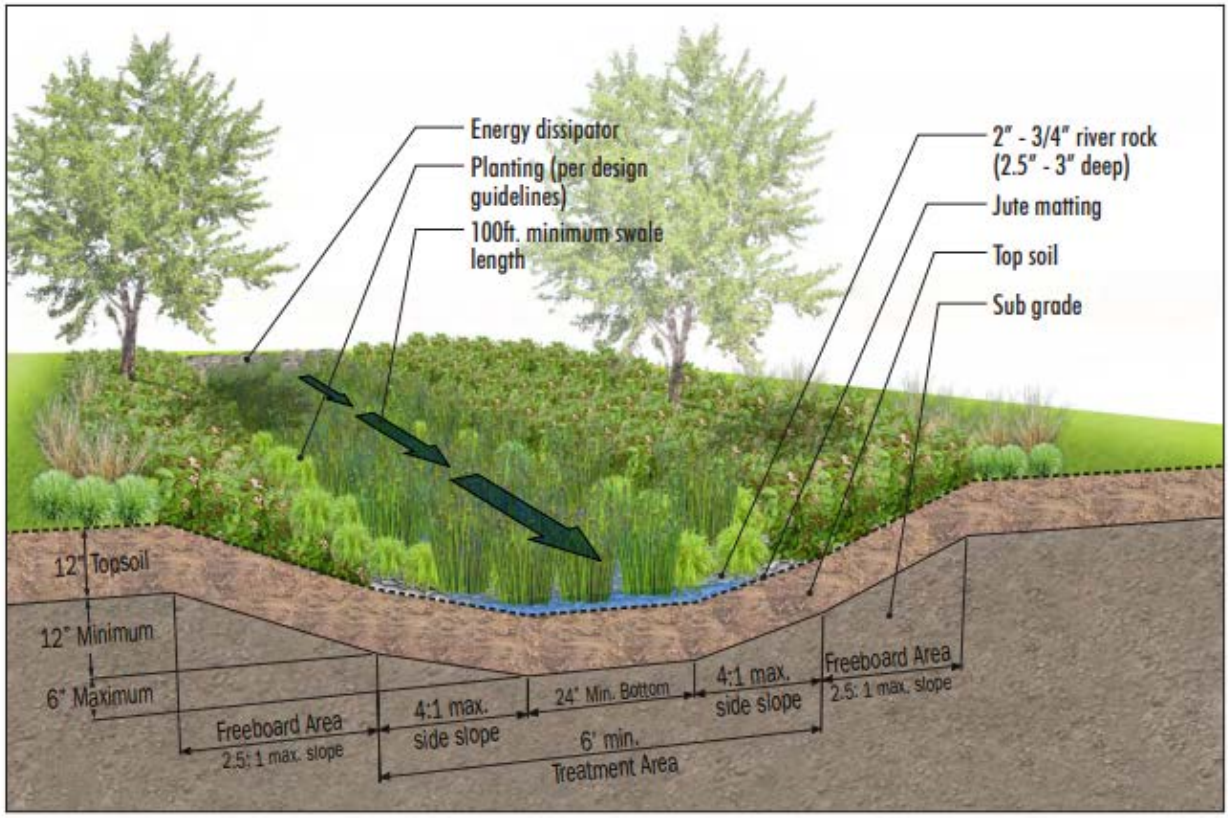


Figure 3: Typical Design and Structure of a Vegetated Swale (from Clean Water Services)

F.9 Vegetated Filter Strip Design

Limitations on Use of Vegetated Filter Strips:

- Drainage area is limited due to the sizing requirements for a filter strip.
- Cannot be applied in areas with highly erodible soils.
- Typically requires supplemental irrigation.
- A uniformly graded thick vegetative cover is required to function properly.
- May not be applicable adjacent to industrial sites or locations where spills may occur.
- Avoid siting in areas of high traffic, both by automobiles and people.
- Place only in areas with gently sloping surfaces where vegetation is hearty and shallow sheet flow occurs.
- Vegetated filter strips are impractical in highly urban areas with little pervious ground.

Design Requirements:

- Slopes shall not be greater than 4% (2% to 4% is preferred).
- Sheet flow must be maintained across filter strips.
- Channelized flow across filter strips shall not be permitted.
- Sod shall not be used in the design of filter strips.
- If seeds are used to plant the vegetated filter strip, they shall be protected with mulch for a minimum of 75 days.
- The top of the vegetated filter strip shall be installed 2 – 5 inches lower than the impervious surface that is being drained.

Sizing Vegetated Filter Strips:

The hydraulic load shall not exceed 0.05 cfs/linear foot of the vegetated filter strip during based off runoff generated as a result of a rainfall intensity of 0.2 in/hr.

The minimum length of a vegetated filter strip (normal to flow) shall be determined using the following equation:

LG = WQF / 0.05

Where:

LG = minimum design length (feet)

WQF = water quality flow (cfs)

For a sheet flow control level spreader, use the following equation:

WG = 0.2LL or 8 feet (whichever is greater)

Where:

WG = width of the filter strip

LL = the length of the flow path over the upstream impervious drainage area (feet)

For a concentrated flow control level spreader, use the following equation:

WG = 0.15(A t / L t) or 8 feet (whichever is greater)

Where:

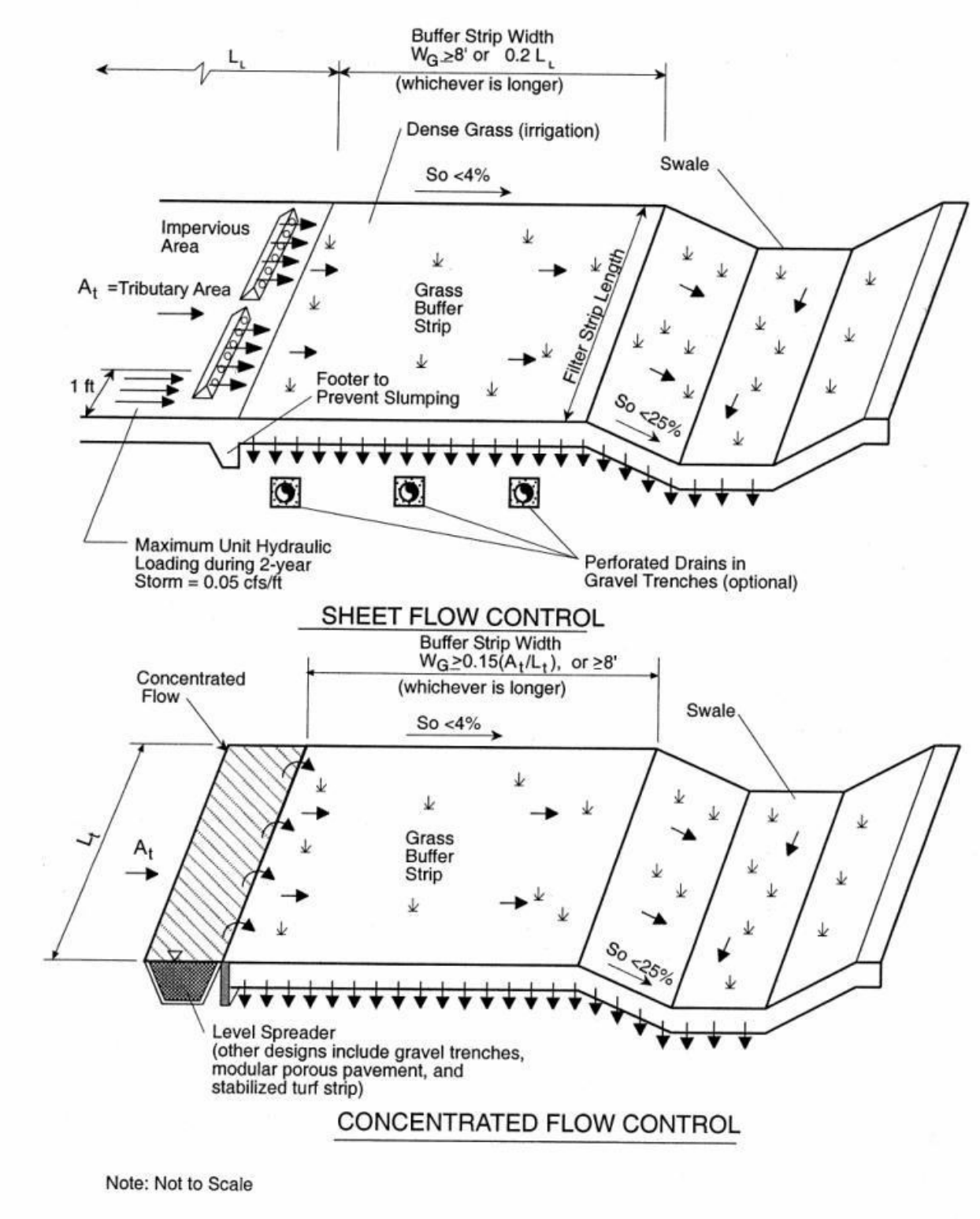
A t= the drainage area (square feet)

L t = the length of the drainage area (normal to flow) adjacent to the filter strip (feet)

(See Figure next page)

Figure 4: General Design Guidelines for a Typical Vegetated Filter Strip

(Modified from UDFCD 1999)



F.10 Technical Criteria for Non-LID Treatment Facilities

Non-LID Treatment Facilities may be either tree-box-type high-flowrate biofilters or vault-based high-flowrate media filters.

General:

- Design inflow rate is that generated by a continuous rainfall intensity of 0.2 inches per hour.
- Landscape and non-impervious surfaces should be made self-treating or self-retaining and not drain to treatment facilities, if feasible.
- Use the runoff factors in the table below:

Roofs and paving	1.0
Landscaped areas	0.1
Bricks or solid pavers on sand base	0.5
Pervious concrete or asphalt	0.0
Turfblock or gravel—total section min. 6"	0.0

- The applicant's Stormwater Control Plan (SWCP) must include, as an attachment, a letter from the manufacturer stating the manufacturer has review the SWCP, the proposed device meeting these technical criteria, and the manufacturer will provide a warranty for two years following activation of the facility.

High-Flowrate Tree-Box-Type Biofilters

- Precast concrete construction
- Inlet design to capture flows at least up to the maximum design surface loading rate to bypass high flows
- Minimum media depth of 1.8 feet
- Media and facility configuration support a healthy tree or other vegetation

Vault-Based High-Flowrate Media Filters

- Replaceable cartridge filters
- Maximum design filter surface loading rate (to cartridge filters) of 1 gpm/ft^2
- Storage volume detains runoff and allows settling of coarse solids prior to filtration
- Flow through the cartridge filters is controlled by an orifice or other device so that the design surface loading rate is not exceeded

Alternatively, applicants may specify treatment systems that have received a General Use Level Designation (GULD) for Basic Treatment from the Washington State Dept. of Ecology based on independently verified field testing following the Technical Assessment Protocol – Ecology (TAPE). Treatment systems must be sized to treat the water quality flow rate at the design operating rate for which they receive the TAPE GULD certification for Basic Treatment.

Media filters and high-flowrate tree filters currently holding this certification can be found at the following link:
http://www.ecy.wa.gov/programs/wq/stormwater/newtech/technologies.html

Appendix G
Approved Trash Full-Capture Devices

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G1.1 INTRODUCTION

The State of California requires that all new development and redevelopment projects include certified Trash Full-Capture Devices for storm drains within the project area to comply with the California Trash Amendments (State Water Resources Control Board [State Board], 2015). This appendix contains guidance and an inventory of Trash Full-Capture Devices, in accordance with the California Trash Amendments last authorized on April 30, 2018. The definition of a "full capture system" is defined as follows: "A full capture system is any single device, or series of devices, that traps all particles retained by a 5-mm mesh screen and has a design treatment capacity of no less than the peak flow rate resulting from a one-year, one-hour storm in the subdrainage area" (State Board, 2015).

The devices approved and certified by the State Board can be placed in three categories: catch basin inserts, high-flow capture devices, and multi-benefit treatment systems: **Section G1.2**, **Section G1.3**, and **Section G1.4**, respectively.

G1.2 CATCH BASIN INSERTS

Catch basin inserts are designed to be installed in standard catch basins. They are effective for removing trash and large sediment by filtration through insert basket filters and may be designed to include sorbent media to remove floating oils and grease. Trapped sediment and debris must be removed periodically manually or by vacuum truck. Long-term costs are typically higher for devices that require manual cleaning because frequent cleanings and maintenance are more labor-intensive. The advantages and disadvantages of catch basin inserts are summarized in **Table G-1**.

Table G-1. Catch Basin Inserts Advantages and Disadvantages

Advantages	Disadvantages
• Located underground; limited lot size is not a deterrent • Compatible with subsurface storm drain systems • Can be used for retrofitting small urban lots when larger SCMs are not feasible • Provide pretreatment of runoff before it is delivered to other SCMs • Easily accessed for maintenance • Long life-span, if properly maintained	• Limited pollutant removal • Expensive to install and maintain, resulting in high cost per unit area treated • No ability to control volume of stormwater runoff • Frequent maintenance is essential • Requires proper disposal of trapped sediment and oil and grease • Entrapment hazard for amphibians and other small animals

Catch basin inserts are often used in combination with catch basin inlet screens. Catch basin inlet screens provide a first line of defense against trash but must be installed in-line with catch basin inserts to be considered compliant as a Trash Full-Capture Device. Catch Basin Insert Full-Capture Trash Device certified by the State Board (as of April 30, 2018) are listed in **Table G-2**. An updated list of State approved Trash Full Capture Systems may be found at the following link:

https://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/trash_implementation/a1_certified_fcsdevicelist_05aug19.pdf

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Debris Dam Connector Pipe Screen  American Stormwater	• High floatables reduction	• Easy to clean and maintain. • A 12”x12” maintenance hatch is attached to the lower portion of the Debris Dam to allow cleaning and maintenance crews to access the storm drain outlet. • Low capital cost.	• Maintenance before and after the rainy season. • Warranty is limited compared to other systems (1 year workmanship/3 years parts and material).	CA Water Boards Fact Sheet - PG 30
Square Grate Inlet Skimmer Box  Bio Clean Environmental	• Fine Total Suspended Solids (TSS) 85% • Dissolved Phosphorus 69% • Copper 95% • Lead 87% • Zinc 95% • Fecal Coliform 68% • Oils & Grease 95%	• Time to clean is approximated at 10-15 minutes. • Comes with 5-year warranty.	• Maintenance before and after the rainy season. • System needs to be inspected every 6 months. • Maintenance can be provided only by supplier or a supplier approved contractor. • Disposal of exposed filter must be in accordance with local, state and federal agency requirements. • High capital cost.	Los Angeles Approval Brochure Operations & Maintenance Specifications Drawing Details CA Water Boards Fact Sheet - PG 42
Round Curb Inlet Basket  Bio Clean Environmental	• Fine TSS 85% • Dissolved Phosphorus 69% • Copper 95% • Lead 87% • Zinc 95% • Oils & Grease 95% • Fecal Coliform 68%	• Filters can be cleaned and vacuumed from the manhole-opening. • Catch basin entry not required. Cleaning can be completed with a vacuum truck - approximately 15-minute service time. • Cleaning can be done manually by lifting the basket from the shelf and dumping out collected debris. • Comes with 5-year warranty. • Evaluated as the easiest system to clean by the City and County of Honolulu.	• Disposal of exposed filter must be in accordance with local, state, and federal agency requirements. • High capital cost.	Brochure Maintenance Specifications Drawing Details CA Water Boards Fact Sheet - PG 39 Approved for trash capture by San Francisco Estuary and County of San Diego

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

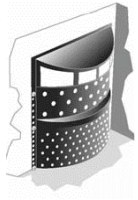
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Modular Connector Pipe Screen (MCPS)  Bio Clean Environmental	• Captures 100% of trash and debris.	• Modular design allows it to be adapted to any pipe size and quickly assembled inside the catch basin. • Maintenance of the catch basin can be performed using a standard vacuum truck or manually. • The center piece can be easily removed to allow for access to the outlet pipe for jetting and other activities. • Low capital cost. • Comes with 5-year warranty.	• Maintenance before and after the rainy season.	Brochure CA Water Boards Fact Sheet - PG 36
Catch Basin Connector Pipe Screen (Trash Guard)  Bio Clean Environmental	• Captures 100% of trash and debris.	• Modular design allows it to be adapted to any pipe size and quickly assembled inside the catch basin. • Maintenance of the catch basin can be performed using a standard vacuum truck or removed by hand. • The center piece can be easily removed to allow for access to the outlet pipe for jetting and other activities. • Low capital cost.	• Maintenance before and after the rainy season. • Warranty is limited compared to other systems (1 year).	CA Water Boards Fact Sheet - PG 33

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

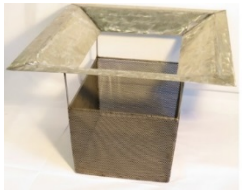
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Curb Inlet and Grate Inlet Filters  Bio Clean Environmental	• 100% capture of all particles 5 mm in size or larger.	• Easy installation. • No confined space entry required for cleaning. • Estimated design life is 25 to 50 years • Made with high strength, durable materials	• Limited trash storage capacity. • Requires frequent maintenance to prevent trapped trash from being introduced into effluent.	CA Water Boards Fact Sheet APPLICATION 4
Collector Pipe Screen - Drop-in  G2 Construction	• Captures 100% of trash and debris 5 mm or larger.	• Filter can be cleaned and vacuumed from the manhole-opening. • Low capital cost.	• Maintenance before and after the rainy season. • Warranty is limited compared to other systems (1 year workmanship/3 years parts and material).	Drop-In CPS Screen CA Water Boards Fact Sheet - PG 27

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

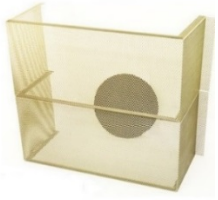
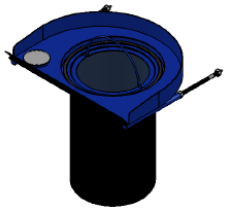
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Collector Pipe Screen – Mod Series  G2 Construction	• Captures 100% of trash and debris 5 mm or larger.	• Filter can be cleaned manually and/or vacuumed. Estimated cleaning time is 5-10 minutes. • Low capital cost. • Fits all catch basins.	• Maintenance before and after the rainy season. • Warranty is limited compared to other systems (1 year workmanship/3 years parts and material).	CPS-Mod 3S CA Water Boards Fact Sheet – PG 27
CleanWay Curb Inlet Filtration System  Cleanway USA	• Captures 100% of trash and debris 5 mm or larger.	• Easy installation. No special tools required. • Modular support pan and sliding basket conform to the existing vault specifications.	• Limited to a minimum depth of 12” and a manhole size of 16”. • Monthly inspection and maintenance recommended • Curb inlets products have a 10-year design life.	CA Water Boards Fact Sheet APPLICATION 7

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
CleanWay Drop Inlet Filtration Insert  Cleanway USA	• Captures 100% of trash and debris 5 mm or larger.	• Easy installation and easy maintenance of StormClean® components. • Modular support pan conforms to the existing vault specifications and support the strainer. • Optional filter fabric available for water quality treatment.	• Monthly inspection and maintenance recommended • Drop Inlet Filtration products have design lives varying from 1 month to 10 years.	CA Water Boards Fact Sheet APPLICATION 8
COANDA Curb Inlet Filter with Trash Screen and Debris Fence  Coanda	• Captures debris, nutrients, heavy metals, and organic matter. • Removes everything larger than fine sand.	• No moving parts and rarely needs servicing. • Debris is easily accessible for cleaning whenever necessary. • Due to the design enabling debris to remain dry, vector control is not an issue, and bacterial growth is impeded. • Self-cleaning stainless steel screen. • Handles fast moving water without clogging. • Captured debris dries quickly, enabling easy removal.	• Maintenance before and after the rainy season. • Warranty is limited compared to other systems (1 year). • Fact sheet and costs not provided by State Water Board.	Brochure Drawing Details Approved by for trash capture by Los Angeles River Total Maximum Daily Load (TMDL) and also meets Caltrans definition of Gross Solid Removal Device (GSRD).
FloGard Catch Basin Insert – Combination Inlet Style	• TSS 86% • Oils & Grease 80% • Gross solids 100%	• Filters can be cleaned and vacuumed from the grate opening. • Catch basin entry not required. • Low capital cost. • Comes with 5-year warranty.	• It is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. • Disposal of exposed filter must be in accordance with local, state, and federal agency requirements.	Product Overview Maintenance Drawing Details CA Water Boards Fact Sheet – PG 18

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

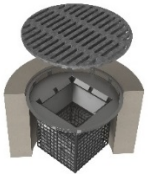
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
 Oldcastle Precast				
FloGard Catch Basin Insert – Flat Grated Inlet Style  Oldcastle Precast	• TSS 86% • Oils & Grease 80% • Gross solids 100%	• Filters can be cleaned and vacuumed from the grate opening. • Catch basin entry not required. • Low capital cost. • Comes with 5-year warranty.	• It is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. • Disposal of exposed filter must be in accordance with local, state and federal agency requirements.	Product Overview Maintenance Drawing Details CA Water Boards Fact Sheet – PG 13
FloGard Catch Basin Outlet Insert – Connector Pipe Screen  Oldcastle Precast	• Captures 100% of trash and debris.	• Maintenance of the catch basin can be performed using a standard vacuum truck or manually. • The center piece can be easily removed to allow for access to the outlet pipe for jetting and other activities. • Comes with 5-year warranty.	• Maintenance before and after the rainy season.	CA Water Boards Fact Sheet – PG 9
United Storm Water Connector Pipe Screen	• 100% removal of debris greater than 5 mm in diameter.	• Filter can be cleaned manually and/or vacuumed. • Provides overflow bypass for larger storm events. • Low capital cost. • Comes with 3-year warranty.	• Maintenance before and after the rainy season.	CPS – Brochure Drawing Details CA Water Boards Fact Sheet – PG 4

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
 United Stormwater				
Drop-in Grate Inlet  United Stormwater	• Filters heavy metals, petroleum hydrocarbons, sediments, trash and debris.	• Self-supported on the lip of the catch basin under traffic grate. • Filters can be cleaned and vacuumed from the grate opening. • Catch basin entry not required. • Filtration devices are installed in a manner that does not interfere with lateral line water flow. • Low capital cost. • Comes with 3-year warranty.	• Maintenance before and after the rainy season. • System need to be inspected every 6 months. • Disposal of exposed filter must be in accordance with local, state and federal agency requirements.	Drawing Details CA Water Boards Fact Sheet – PG 5
Flexstorm Connector Pipe Screen  Inlet Filters	• Connector Pipe Screens retain large volumes of trash and sediment inside the catch basin instead of the debris being conveyed through the stormwater system.	• Quick and easy install. No assembly required. • Optional Quick Release Brackets allow device to be removed for easy line or jet cleaning. • Good for retrofits or new applications. • Low capital cost. • Comes with 3-year warranty.	• High maintenance frequency (every 3-6 months depending on loading).	Product Overview CA Water Boards Fact Sheet – PG 83

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Flexstorm Full Trash Capture (FTC) Inserts  Inlet Filters	• The steel basket is uniformly punched with 3/16" diameter holes (4.8 mm) in such a pattern that the basket has 50% open area and retains any particles 5 mm or larger.	• Easy to install, with lift handles and adjustable flanges. • Dual cleaning options. Cleaning can be performed using vacuum truck or by lifting basket out of inlet. • Low capital cost.	• Three inspections recommended per year (minimum).	CA Water Boards Fact Sheet APPLICATION 2
ST3 & ST3G – Catch Basin Connector Pipe  Stormtek	• Connector Pipe Screens retain large volumes of trash and sediment inside the catch basin instead of the debris being conveyed through the stormwater system.	• The StormTek connector pipe screen maximizes use of up to 90% of the available storage capacity. • Prevents flooding of the catch basin during large rain events by providing overflow. • Can be completely removed from the catch basin/storm drain wall in seconds.	• High maintenance frequency (every 3-6 months depending on loading). • Warranty is limited compared to other systems (2 years) • High capital cost.	CA Water Boards Fact Sheet – PG 45

Table G-2. State Board Certified Full-Capture Catch Basin Inserts

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Water Decontaminator  Inventive Resources	• Trash capture screen captures particles 5mm and larger. • Oil and contaminants captured in a disposable cartridge.	• Can be used for new and existing catch basins of various sizes. • Easy cleaning. • Has provisions for vector control accessibility.	• High maintenance frequency to ensure optimal performance. • Inspections recommended twice annually. • Housing should be cleaned out once a year. • Filter cartridge needs replacement when slow flow is observed.	CA Water Boards Fact Sheet APPLICATION 3
Triton Bioflex Inlet Trash Guard  Revel Environmental	• Treats liquefied petroleum hydrocarbons and variety of TSS.	• Reduced occlusion and increased flow over a range of rainfall intensities. • Stainless steel media cartridge cam-locks in place onto the filter basin floor allowing quick and easy removal for maintenance. • Low capital cost.	• It is recommended that each installation be serviced a minimum of 3 times per year, with a change of filter medium once per year. • Disposal of exposed filter must be in accordance with local, state and federal agency requirements. • Warranty is limited compared to other systems (1 year, or 6 years if REM contracts to do maintenance).	CA Water Boards Fact Sheet - PG 6

G1.3 HIGH-FLOW DEVICES

High-Flow Trash Capture Devices are typically designed to decrease the velocity of stormwater runoff, therefore allowing trash and sediment to settle into internal storage zones. The four main categories of High-Flow Trash Capture Devices are described in **Table G-3** and their respective advantages and disadvantages are presented in successive tables.

Table G-3. High-Flow Trash Full-Capture Devices

High-Flow Trash Capture Device	Description
Hydrodynamic Separator (**Table G-4**)	These devices can remove trash, debris, and coarse sediment from incoming flows using screening, gravity settling, and centrifugal forces generated by forcing the influent into a circular motion. As water moves through the system circularly, rather than in a straight line, it is possible to obtain significant removal of coarse sediments and attached pollutants with less space compared with other traditional gravity settling devices.
Nutrient Separating Baffle Box (**Table G-5**)	These structures contain a series of sediment settling chambers. Nutrients, vegetation, and litter are captured in a filtration screen system and sediments settle to the bottom.
Netting Trash Trap (**Table G-6**)	These devices can be installed in-line and in end-of-the-line pipe. They use the natural energy of the stormwater flow to capture trash.
1. Media Filtration System 2. (**Table G-7**)	3. These devices are designed to capture sediment, metals, nutrients, and petroleum hydrocarbons, as well as gross solids and trash, to significantly reduce the total pollutant discharge load in stormwater runoff.

Source: Port of Long Beach, 2018.

Table G-4. Hydrodynamic Separator System Advantages and Disadvantages

Advantages	Disadvantages
• Can be easily installed as retrofits • Smaller footprint required • Ideal for redevelopment	• Significant maintenance requirements • Prone to sediment resuspension during high-flow storm events • Performance must be verified by third party

Table G-5. Nutrient Separating Baffle Box Advantages and Disadvantages

Advantages	Disadvantages
• Can be easily installed as retrofits • Good for densely populated urban areas or parking lots • Relatively small footprint	• Significant maintenance requirements • Can re-suspend settled sediment in subsequent storms • Not effective in removing finer sediment

Table G-6. Netting Trash Trap Advantages and Disadvantages

Advantages	Disadvantages
• Quick installation • Simple and inexpensive • No confined space entry required	• Significant maintenance requirements • Can detach easily if not well installed • Not effective for removing finer sediment and oils/grease

Table G-7. Media Filtration Systems Advantages and Disadvantages

Advantages	Disadvantages
• Flexible configurations • Can treat for high flow rates • High TSS and phosphorus removal rates	• Significant maintenance requirements • Some systems require confined space entry • Mosquito breeding if not regularly cleaned and maintained

High Flow Devices Full-Capture Trash Devices certified by the State Board (as of April 30, 2018) are listed in **Table G-8**.

An updated list of State certified Trash Full Capture Devices can be found at the following link:

https://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/trash_implementation/a1_certified_fcsdevicelist_05aug19.pdf

Table G-8. State Board Certified Full-Capture High Flow Devices

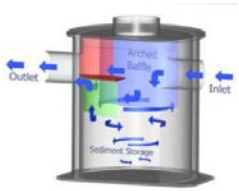
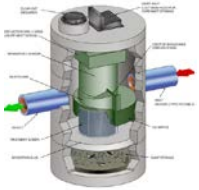
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Aqua-Swirl Stormwater Treatment System  Aqua Shield, Inc.	• 85% sediment (net annual) • 80% TSS (net annual), gaining one LEED 2009 Credit for Sustainable Sites (SS) 6.2, Stormwater Design - Quality Control • Captures sediment, oil, and debris 5 mm or greater	• Utilizes lightweight and durable construction materials. • Inspection and maintenance activities can be performed from the surface without confined space entry or specialized equipment. • Requires minimal routine maintenance. • Damage to the system is unlikely as there are no fragile internal parts.	• System inspections recommended every 3 months during the first year after installation. • Cleaning must be performed with a vacuum truck. • Organic matter may decompose and release nitrogen (nitrogen gas or nitrate) to the downstream environment. • Sensitivity to heavy loads of sediment. • Design incorporates standing water, which may lead to mosquito breeding in the system.	Brochure Specifications Inspection and Maintenance Field Testing Report NJCAT Technology Verification CA Water Boards Full Capture System Application - PG 84
Continuous Deflective Separator (CDS)  Contech Engineered Solutions	• Captures and retains 100% of floatables and neutrally buoyant debris 2.4 mm or larger.	• Easy to inspect, clean and maintain through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen • Self-cleaning screen. Isolated storage sump eliminates scour potential. • Internal bypass.	• Inspections and maintenance at least twice per year. • Warranty is limited compared to other systems (2 years). • Multiple pipe inlets and 90-180º angles.	Brochure CA Water Boards Fact Sheet - PG 77

Table G-8. State Board Certified Full-Capture High Flow Devices (continued)

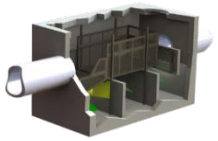
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Nutrient Separating Baffle Box  Bio Clean Environmental	• TSS 87% • Turbidity 71% • Oils & Grease 99% • Copper 40% • Bacteria 47%	• No Confined Space Entry is required for servicing. • Device can be accessed for maintenance through manhole or hatch above ground with vacuum truck. • Separating pollutants minimizes costs – screen system allows gross solids to be removed without vacuuming out water or sediment chambers. • Comes with 5-year warranty.	• High frequency of service; checking and cleaning of the baffle boxes every 2 to 3 months during dry season and every month during wet season recommended. • Baffle Boxes are more effective at removing larger particles and less effective at removing smaller particles.	Brochure Specifications Maintenance Water Boards Approval MASTEP Approval CA Water Boards Fact Sheet - PG 80
End of Pipe Netting Trash Trap  Storm Trap	• 97% removal efficiencies recorded by United States Environmental Protection Agency (U.S. EPA) sponsored projects.	• Easily accessible for inspection and maintenance. • No confined space entry is required, as net change-out is done at the surface. • Scales can be attached to lifting equipment for easy measurement of debris to meet environmental permit requirements. • Remote monitoring available through Telnet.	• High frequency of net replacement (when net appears 1/2-2/3 full). • Failure to replace nets and/or remove floatables from bypass screening (if applicable) will lead to hydraulic relief, drain down deficiencies, and decrease the long-term functionality of the system. • Warranty is limited compared to other systems (2 years). • High capital cost.	Brochure CA Water Boards Fact Sheet - PG 71 Approved for trash capture by Los Angeles Regional Water Quality Control Board
Inline Netting Trash Trap  Storm Trap	• U.S. EPA-sponsored netting projects recorded 97% removal efficiencies. • Performance has been verified by the New Jersey Corporation for Advanced Technology (NJCAT), and is approved by the New Jersey Department of Environmental Protection (NJDEP).	• Three-dimensional netting technology removes floatables, trash, and debris while providing a larger surface area than traditional two-dimensional screens. • Easily accessible for inspection and maintenance. • No confined space entry is required, as net change-out is done at the surface. • Long service life, with cost-effective maintenance. • Scales can be attached to lifting equipment for easy debris	• High frequency of net replacement (when net appears 1/2 - 2/3 full). • Recommended inspections every 6 months to determine the rate of pollutant accumulation. • Failure to replace nets and/or remove floatables from bypass screening (if applicable) will lead to hydraulic relief, drain down deficiencies, and decrease the long-term functionality of the system. • Warranty is limited compared to other systems (2 years). • High capital cost.	Brochure Maintenance CA Water Boards Fact Sheet - PG 74 Approved for trash capture by Los Angeles Regional Water Quality Control Board and NJCAT Verified / NJDEP Certified

Table G-8. State Board Certified Full-Capture High Flow Devices (continued)

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
		measurements required for environmental permits. • Remote monitoring available through Telnet.		
Jensen Deflective Separator (JDS)  Jensen Precast	• Captures 100% of particles greater than or equal to 5 mm. • 98% solids removal efficiency for small scale models.	• Physical separation of previously captured solids from bypass flows. • 50-year design life • Variety of access options (frame and covers, hatch access, etc.) • HDPE insert for mosquito access control.	• Larger units subjected to frequent low flows that are a very low percentage of their peak treatment capacity may not develop the balanced hydraulic conditions for a non-blocking screen. • Limited warranty (12 months).	CA Water Boards Fact Sheet APPLICATION 5

Table G-8. State Board Certified Full-Capture High Flow Devices (continued)

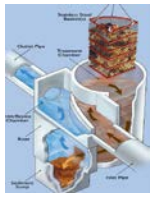
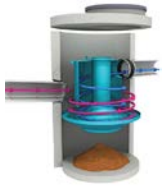
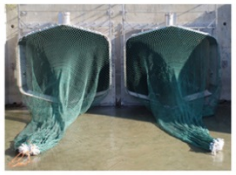
Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Site Saver  Storm Trap	• Full capture of all particles greater than or equal to 5 mm • U.S. EPA-sponsored netting projects recorded 97% removal efficiencies.	• Quick installation. • Low capital and installation costs. • Accessible for inspection and maintenance. • Remote monitoring available through Telnet. • 5-year warranty.	• Quarterly inspections within the first year of installation are recommended. • Influent pipe velocities should not exceed 7 ft/s.	CA Water Boards Fact Sheet APPLICATION 9
CleansAll - Gross Pollutant Trap  Oldcastle Precast	• High sediment removal. • CleansAll® GPT is capable of removing in excess of 98% of gross pollutants (>2 mm) and oils, as well as approximately 70% of sediment (75 µm – 2.36 mm) at design flows.	• Stormwater enters the inlet chamber, where it is diverted by a by-pass weir into the treatment chamber. • Long service life. • Low head loss. • Effective overflow system for larger flows. • Comes with 5-year warranty.	• Requires inspection on a regular basis and maintenance as necessary to ensure performance. • Crane Truck is needed to remove and empty trash baskets. • Disposal of collected debris must be conducted in accordance with relevant regulations.	CA Water Boards Fact Sheet - PG 68
Downstream Defender  Oldcastle Precast	• Tests conducted under simulated oil spill conditions showed that Downstream Defender® maintains greater than 80% removal efficiency for a range of loading rates. Field testing on an urban mixed-use site showed effective control of oil and grease, limiting the average effluent concentration to 16 mg/L (manufacturer reference).	• Offers long maintenance intervals and consolidates pollutant removal to a single point in the drainage system. • Comes with 5-year warranty.	• The frequency of the sump vacuum procedure is determined in the field after installation. • During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation.	Brochure CA Water Boards Fact Sheet - PG 65

Table G-8. State Board Certified Full-Capture High Flow Devices (continued)

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Dual Vortex Separator (DVS)  Oldcastle Precast	• Removes solids, trash, debris, and petroleum hydrocarbons. • Performance has been verified by the NJCAT, and is approved by the NJDEP.	• Dual access to sediment storage areas. • Easy access to floatable collection areas. • Modular construction of components. • Large interior work areas. • Low capital cost. • Comes with 5-year warranty.	• Confined space required for maintenance. • Recommended inspection twice per year. • All material removed from the DVS during maintenance must be disposed of in accordance with local regulations.	Product Overview Maintenance CA Water Boards Fact Sheet - PG 62
FloGard Perk Filter  Oldcastle Precast	• TSS >80% • Total Phosphorus >60% • High TSS and phosphorus removal rates	• Offers a wide variety of media filters to address the specific pollutants of concern. • Pretreatment chamber prolongs media lifespan by removing gross pollutants. • Integrated bypass system reduces construction costs by eliminating the need for a separate bypass structure. • Retrofit options in vaults, manholes, and catch basins with variable inlet/outlet locations. • Low capital cost. • Comes with 5-year warranty.	• System requires inspection on a regular basis and maintenance as necessary to ensure performance. • Confined space required for maintenance.	Product Overview Maintenance Drawing Details CA Water Boards Fact Sheet - PG 59 Approved for trash capture by the San Francisco Bay Regional Water Quality Control Board.
Nettech Gross Pollutant Trap - In Line  Oldcastle Precast	• Captures and retains more than 99% of pollutants larger than 2 mm.	• Nets are light and malleable for easy inspection and installation. • Lack of human contact with interceptor pollutants. • Custom sizes available for retrofit applications. • Low capital cost. • Can be fitted to conduits of almost any size and shape. • Low capital cost. • Comes with 5-year warranty.	• Maintenance depends on the amount of runoff, pollutant loading, and interference from debris.	CA Water Boards Fact Sheet - PG 53

Table G-8. State Board Certified Full-Capture High Flow Devices (continued)

Devices	Pollutant Removal and Performance	Product and Maintenance		Specification Links/Brochures
		PROS	CONS	
Nettech Gross Pollutant Trap - End of the Line  Oldcastle Precast	• Captures sediment and debris 5 mm or greater.	• Ease of installation and maintenance. • Lack of human contact with interceptor pollutants. • Water drains completely from the device, so there is no likelihood of odor, infection, or mosquito breeding. • Debris cannot be reactivated, as overtopping is not possible. • Litter is stored dry, preventing anaerobic decomposition. • Custom sizes available for retrofit applications. • Low capital cost. • 25-year warranty for stainless steel, 10-year warranty for netting.	• It is recommended that installed Net Tech be systematically and periodically checked to make sure the net has not become full and detached itself. • Susceptible to tearing and detaches easily depending on weight and types of debris.	Product Overview Drawing Details CA Water Boards Fact Sheet - PG 50
Storm Flo Trash Screen  Roscoe Moss	• Captures sediment and debris 5 mm or greater.	• System removes solids from stormwater and is manufactured in diameters and lengths to treat a wide range of hydraulic conditions and debris loads. • The captured debris is accessed through large hatchways that are located on top of the screen. • There is no maintenance required on the device itself other than cleaning of the interior. • Low capital cost.	• It is recommended that the device be cleaned when half full. • Cleaning the interior is best accomplished with a vacuum truck. • Warranty is limited compared to other systems (2 years).	CA Water Boards Fact Sheet - PG 47

G1.4 MULTI-BENEFIT TREATMENT SYSTEMS

Multi-Benefit Treatment Systems include many of the Stormwater Control Measures (SCMs) that are discussed in the Stormwater Development Standards. To qualify as a Trash Full-Capture Device, the design and plan must be approved with the following requirements:

Prohibits the discharge of particles sized at 5 mm or larger to surface waters offsite;

Contains a capacity greater than the volume collected during the region specific one-year, one-hour storm event from the applicable drainage area, or a capacity to carry at least the same flows as the corresponding storm drain;

Incorporates an operation and maintenance plan sufficient to ensure that the captured trash does not migrate from the site; and

Has stamped and signed design plans by a registered California-licensed professional civil engineer (see Business and Professional Code Section 6700, et seq.).

Table G-9 provides a brief description of how these devices function, and successive tables provide information on the advantages and disadvantages of each treatment system.

Please see the State Board Guidance for each Multi-Benefit Treatment System described.

Table G-9. Multi-Benefit Treatment System Trash Full-Capture Summary

Multi-Benefit Treatment System	Description
Rainwater Harvesting (**Table G-10**)	Rainwater harvesting cisterns and rain barrels store rooftop runoff and reuse it for landscaping and other nonpotable uses.
Infiltration Basins (**Table G-11**)	Infiltration basins are stormwater impoundments over permeable soils with vegetated bottoms and side slopes. Infiltration basins are designed to reduce stormwater volumes through exfiltration and groundwater recharge.
Biofiltration (**Table G-12**)	Biofiltration SCMs use soils, plants, and microbes to treat stormwater before it is infiltrated and/or discharged. Biofiltration areas are shallow depressions filled with sandy soil topped with a thick layer of mulch and planted with dense native vegetation.
Detention Basins (**Table G-13**)	Detention basins are excavated basins for the short-term retention of stormwater runoff that allows a controlled release from the structure at downstream, predevelopment flow rates. These basins are not designed to provide extended dewatering times, wet pools, or groundwater recharge.
Media Filters (**Table G-14**)	Media filters use a bed of sand, peat, zeolite, anionic, and/or cationic media, granite, or other fine-grained materials or fabrics to physically separate sediment and sediment-bound pollutants and/or electrochemically remove dissolved constituents from stormwater.

Source: Port of Long Beach, 2018.

Table G-10. Rainwater Harvesting Advantages and Disadvantages

Advantages	Disadvantages
• Reduced water demand • Can decrease water utility costs • Reduced stormwater runoff	• Mosquito breeding if not regularly maintained • May need to disconnect and drain in winter

Table G-11. Infiltration Basin Advantages and Disadvantages

Advantages	Disadvantages
• Groundwater recharge • Volume reduction • Peak flow attenuation	• Requires pretreatment • Large pervious area required • Clogging potential is high

Table G-12. Biofiltration Advantages and Disadvantages

Advantages	Disadvantages
• Can contribute to groundwater recharge • Can be used on small lots with space constrains • Little or no hazard for amphibians or other small animals • Suitable for stormwater retrofit projects	• Requires careful landscaping and maintenance • Not suitable for large landscape areas.

Table G-13. Detention Basin Advantages and Disadvantages

Advantages	Disadvantages
• Controls peak runoff flows • Low cost	• Large land area • Susceptible to resuspension of settled materials by subsequent storms • Negligible removal of total suspended solids

Table G-14. Media Filters Advantages and Disadvantages

Advantages	Disadvantages
• Good sediment removal • Suitable for industrial sites for specific target pollutants. • Peak flow attenuation	• Filter maintenance regularly • Severe clogging potential • Performance varies upon media

Trash Full-Capture SCMs are also useful as pretreatment devices for other volume control measures. Rainwater Harvesting SCMs benefit from trash-capture to screen for particles before more robust treatment. Infiltration SCMs also require trash capture to prevent clogging and increase their overall efficiency.

Appendix H
Stormwater Control Measure Operations and Maintenance

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Infiltration Basin

Figure 1: Infiltration Basin
(Source: CASQA Stormwater BMP Handbook)

Inspection and Maintenance Guidance Requirements

□ All routine inspections and maintenance are required to be performed before September of each year.
□ Conduct regular inspections and routine maintenance on pretreatment devices such as vegetated swales, sediment forebays, detention basins, etc. A pretreatment device, such as an oil and water separator, may be required in areas where petroleum hydrocarbons in stormwater are anticipated.
□ Inspect following major rainfall events during the first year after installation.
□ Inspect annually for settling, cracking, erosion, leakage, condition of the riprap, state of the turf vegetation, and amount of sedimentation. If necessary, repair immediately.
□ If the drawdown time is more than 72 hours, maintenance and replacement of the filter media is required.
□ Debris and litter shall be removed from the infiltration basin as needed, but at least prior to the beginning of the wet season.
□ Eliminate standing water to prevent vector breeding. No pyrethroid pesticides may be used.
□ If bare and eroded areas are present in the drainage area directly adjacent to the infiltration basin, vegetation and/or additional stabilization methods may be required to minimize premature clogging.
□ Vegetation installed within the infiltration basin tends to decrease the rate of clogging.
□ Vegetation shall be mowed when growth exceeds 6 inches in height. Remove grass clippings, litter, and debris.
□ Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
□ Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
□ Do not use herbicides or other chemicals to control vegetation.
□ Every 5 to 10 years the area shall be tilled, fine materials removed, and the base of the basin regraded.
□ If a spill occurs and hazardous materials contaminate soils, sands or gravels in an infiltration basin, the affected areas shall be removed immediately, and the appropriate soils and materials replaced as soon as possible.
□ Inspect overflow devices for obstructions or damaged pipes. Remove debris or replace damaged pipes upon discovery.
□ Maintain access to the basin for regular maintenance activities.

Infiltration Trench

Figure 2: Infiltration Trench (Source: LA LID Manual)

Inspection and Maintenance Guidance Requirements

- □ Conduct regular inspections and routine maintenance on pretreatment devices such as vegetated swales, detention basins, etc. A pretreatment device, such as an oil and water separator, may be required in areas where petroleum hydrocarbons in stormwater are anticipated.
- □ Inspect infiltration trench and observation well following major rainfall events.
- □ If the drawdown time is more than 72 hours, maintenance and replacement of the filter media is required.
- □ Check for debris/sedimentation accumulation, rake surface and remove debris/sediment.
- □ Assess the condition of the top aggregate layer for sediment buildup and crusting. Remove the top layer of pea gravel and replace. If slow draining conditions persist, the entire trench may need to be excavated and removed.
- □ Eliminate standing water to prevent vector breeding. Do not use pyrethroid pesticides.
- □ Debris and litter shall be removed from the infiltration basin prior to the beginning of the wet season, and as needed.
- □ If a spill occurs and hazardous materials contaminate infiltration media, the affected areas shall be removed immediately, and the appropriate materials replaced as soon as possible.
- □ Inspect overflow devices for obstructions or damaged pipes. Remove debris or replace damaged pipes upon discovery.
- □ The City may require the inclusion of a 4 to 6-inch diameter perforated pipe anchored vertically to serve as a monitoring well. A monitoring plan for this well shall be included into the O&M Plan.

Pervious Pavers

Inspection and Maintenance Guidance Requirements

Figure 3: Open Jointed Block Pavers

- □ All facility components, vegetation, and source controls should be inspected for proper operations and structural stability, at least quarterly for the first two years from the date of installation, twice per year thereafter, and within 48 hours after each major storm event.
- □ Blocks shall not be washed to remove debris and sediment in the openings between pavers. Sweep pervious pavers as needed to clean them of leaves, debris, and sediment. Sweeping with suction shall be utilized at least annually. Replace lost ASTM No. 8 aggregate infill.
- □ Joints between pavers may require occasional weed suppression. No pesticide or herbicide use.
- □ Pavers can be removed individually and replaced when utility work is needed.
- □ Replace surface filter layer by vacuuming out aggregate media from blocks to reduce potential pollutant runoff if it becomes evident that runoff does not rapidly infiltrate into the surface.
- □ If vacuuming does not adequately remove fill, blocks can be lifted and reset with new joint fill material.
- □ If soils swell or subside, blocks can be removed individually, the base leveled, and blocks reset.
- □ For pavers planted with turf, regular turf maintenance will be necessary. Provide irrigation as needed. Limit and control.
- □ Insects and rodents shall not be harbored at the pervious pavement. Pest control measures shall be taken when insects/rodents are found to be present. No pyrethroid pesticides may be used.
- □ If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if necessary, and only by a licensed individual or contractor. No pyrethroid pesticides may be used.
- □ Holes in the ground located in and around the pervious pavement shall be filled and compacted.
- □ Exercise spill prevention measures when handling substances that can contaminate stormwater runoff. Implement a spill prevention plan at all nonresidential sites and in areas where there is likelihood of spills.
- □ Eliminate standing water to prevent vector breeding.
- □ Provide safe and efficient access to permeable pavement. Egress and ingress routes must be maintained to design standards. Roadways must be maintained to accommodate size and weight of vehicles if applicable.

Porous Concrete and Porous Asphalt

Figure 4: Example of Porous Concrete (Source: LA LID Manual)

Inspection and Maintenance Guidance Requirements

□ Accumulated debris and litter shall be routinely removed as a source control measure.
□ Inspect porous asphalt and concrete to determine if stormwater runoff is infiltrating properly at least twice during the wet season and after significant storms.
□ Permeable pavements and materials shall be cleaned with a vacuum-type street cleaner a minimum of twice a year (before and after the rainy season). If infiltration is significantly reduced, remove surface aggregate with vacuum. Dispose and replace old aggregate with fresh aggregate as needed.
□ Handheld pressure washers can be effective for cleaning the void spaces of small areas and shall follow vacuum cleaning.
□ Sweep permeable pavement as needed to clean it of leaves, debris, and sediment.
□ Prune vegetation and large shrubs/trees that limit access or interfere with permeable pavement operation. Rake and remove fallen leaves and debris from deciduous plant foliage. Remove poisonous, nuisance, dead, or odor-producing vegetation immediately. Mow grass to less than four inches and bag and remove grass clippings.
□ Maintenance personnel must be instructed not to seal or pave with non-porous materials.
□ Exercise spill prevention measures when handling substances that can contaminate stormwater runoff. Implement a spill prevention plan at all nonresidential sites and in areas where there is likelihood of spills.
□ Eliminate standing water to prevent vector breeding.
□ Provide safe and efficient access to permeable pavement. Egress and ingress routes must be maintained to design standards. Roadways must be maintained to accommodate size and weight of vehicles if applicable.
□ Minimize the use of fertilizers and herbicides as they can have adverse effects on concrete products and to reduce potential pollutant runoff.
□ Insects and rodents shall not be harbored at the pervious pavement. Pest control measures shall be taken when insects/rodents are found to be present. No pyrethroid pesticides may be used.
□ If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if necessary, and only by a licensed individual or contractor.
□ Holes in the ground located in and around the pervious pavement shall be filled and compacted.
□ Identify and control sources of erosion damage when native soil is exposed near the overflow device.
□ Add gravel or ground cover if erosion occurs due to vehicular or pedestrian traffic.

Biofiltration Basin

Figure 6: Biofiltration Basin (Source: Austin WPD)

Inspection and Maintenance Guidance Requirements

Primary maintenance activities include vegetation management and sediment removal. Mosquito control is also a concern in extended detention basins that are designed to include pools of standing water. All inspections and maintenance activities shall be performed prior to September of each year.

- □ Conduct annual inspections as follows:
  - □ Evaluate the health of the vegetation and remove and replace any dead or dying plants.
  - □ Remove any trash and debris
  - □ Inspect the outlet, embankments, dikes, berms, and side slopes for structural integrity and signs of erosion or rodent burrows. Fill any holes detected in the side slopes.
  - □ Examine outlets and overflow structures and remove any debris plugging the outlets.
  - □ Identify and minimize the sources of sediment and debris. Check rocks or other erosion control and replace, if necessary.
  - □ Check inlets to make sure piping is intact and not plugged. Remove accumulated sediment and debris near the inlet. Ensure that engineered energy dissipation is functioning adequately by checking for evidence of local scour near the inlet.
  - □ Inspect for standing water and correct any problems that prevent the extended detention basin from draining as designed.
  - □ Confirm that any fences around the facility are secure.
- □ Maintenance activities at the bottom of the basin shall NOT be performed with heavy equipment, which would compact the soil and limit infiltration.
- □ Debris and litter shall be removed from the infiltration basin as needed, but at least prior to the beginning of the wet season.
- □ If bare and eroded areas are present in the drainage area directly adjacent to the infiltration basin, vegetation and/or additional stabilization methods may be required to minimize premature clogging.
- □ Vegetation shall be mowed when growth exceeds 6 inches in height to prevent establishment of woody vegetation and for aesthetic and mosquito control reasons. Remove grass clippings, litter, and debris.
- □ Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- □ Dead vegetation shall be removed to maintain less than 10% of area coverage or when infiltration basin function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- □ Do not use herbicides or other chemicals to control vegetation. No pyrethroid pesticides may be used. Follow the principles of integrated pest management (IPM).
- □ Remove sediment from the forebay when the sediment level reaches the level shown on the fixed vertical sediment marker (if present).
- □ Remove accumulated sediment and regrade every 10 years or when the accumulated sediment volume exceeds 10% of basin volume.

Stormwater Planters

Inspection and Maintenance Guidance Requirements

Figure 7: Stormwater Planter (Source: Portland BES)

□ Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the stormwater planter and flow dissipation and erosion protection strategies in the flow entrance should be reassessed. If sediment is deposited in the stormwater planter, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.

□ A health evaluation of trees and shrubs shall be conducted biannually.

□ Pruning, weeding and trash removal shall be conducted as necessary.

□ Debris should be removed routinely (no less than every 6 months) and upon discovery.

□ Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.

□ Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter strip function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.

□ Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, stormwater planters are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters. No pyrethroid pesticides may be used.

□ Sediment accumulation shall be hand removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4 inches thick

□ Mulch replacement is generally required every 2 to 3 years.

□ If a spill occurs and hazardous materials contaminate soils in landscape detention areas, the affected materials shall be removed immediately, and the appropriate soils and materials replaced as soon as possible.

□ Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.

□ Key inspection/maintenance areas include inlet and overflow areas for potential erosion, the ponding area in basin for trash and debris, and the monitoring well/clean out port for potential early signs of stagnant water in the system if an underdrain system is included.

□ If ponding is observed to exceed 72 hours, particularly during the primary mosquito breeding season (June through October), the cause may be clogged filter fabric (if used, which is not recommend), compacted soils from construction activities, improper placement and compaction of the engineered soil mix, or surface clogging with fines from a heavy loading source in the drainage area (e.g., an upgradient dirt lot or a construction site without BMPs). The reason for the extended ponding shall be determined and mitigated (e.g., removal of filter fabric, cleaning of the underdrain

system, replacement of engineered soils, and/or ripping of underlying native soils to re-establish permeability).

□ Structural deficiencies in the planter including rot, cracks and failure shall be repaired.

□ Insects and rodents shall not be harbored at in stormwater planters. Pest control measures shall be taken when insects/rodents are found to be present. No pyrethroid pesticides may be used.

□ If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor.

□ Holes in the ground located in and around the pervious pavement shall be filled and compacted.

□ Provide training and/or written guidance to all property owners and tenants. Provide a copy of the Maintenance Plan to all property owners and tenants.

Cistern/Rainwater Capture

Inspection and Maintenance Guidance Requirements

- □ Clean out gutters, inflow and outflow pipes of leaves and debris as needed.
- □ Make sure gutters and downspouts are free of debris prior to the rainy season. The "first flush", or the runoff created by the first rainfall event after a long dry spell, will need to be carefully monitored to ensure that the system is working properly.
- □ Inspect water tanks periodically and any remove debris and sediment that may interfere with the proper function of the system.
- □ Screen inlet and outlet pipes to keep the system closed to mosquitoes. No opening shall be greater the 1/16" on systems where water will be retained for more than 72 hours.
- □ Cap and lock tanks for safety. Caps should have access ports for interior inspection and maintenance.
- □ Eliminate standing water to prevent vector breeding.

Figure 8: A rainwater capture and reuse system on a residential home. (Photo: Kennedy/Jenks Consultants)

Green Roofs

Inspection and Maintenance Guidance Requirements

Figure 9: Green roof on Carmel Valley, CA Residence (Photo: Jonathan Feldman Architecture)

- □ Upon installation, the green roof system should be inspected monthly for the first year and after each large rainfall event for erosion, plant survival, proper drainage and water proofing.
- □ Inspections can be reduced to a quarterly schedule once the green roof system has proven to work properly and vegetation is established.
- □ Inspect soil for evidence of erosion from wind or water. If erosion channels are evident, stabilize them with additional soil substrate/growth medium and cover with additional plants.
- □ If necessary, irrigate in short bursts only (3-5 minutes) to minimize runoff. Irrigation frequencies shall be established by the designer using an automated system.
- □ Irrigate green roof either through hand watering or automatic sprinkler systems. If automatic sprinklers are used, follow manufacturer's instructions for operations and maintenance. During the establishment period (one to three years), provide sufficient irrigation to assure plant establishment. Following the establishment period (after three years), provide sufficient irrigation to maintain plant cover.
- □ Vegetation shall be maintained to provide 90% plant cover. During the establishment period, replace plants once per month as needed. After the establishment period, replace dead plants as needed. Remove plant litter and nuisance and prohibited vegetation regularly. Remove weeds manually without herbicides or pesticides.

□ Clean out drain inlets as needed.
□ Remove debris and litter to prevent clogging of drain inlets and interference with plant growth
□ Weeding and mulching may be necessary during the establishment period, depending on the planting design.
□ During drought conditions, mulch or shade cloth may be applied to prevent excess solar damage and water loss.
□ Replace or fill in vegetation as needed.
□ Fertilization is not necessary, and fertilizers shall not be applied.
□ Inspect soil levels semi-annually to improve plant survival and rainfall absorption.
□ If the vegetation used is flammable during the dry season, it shall be mowed or watered as needed to minimize fire potential.
□ If soil compacts over time and more is added, it will increase the seismic load of the supporting structure.

- □ Insects shall not be harbored on the green roof. Standing water shall be eliminated by manual means. No pyrethroid pesticides may be used.
- □ Spill prevention measures from mechanical systems located on the roofs shall be exercised when handling substances that can contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.
- □ Provide training and/or written guidance information for operating and maintaining green roofs to all property owners and tenants. Provide a copy of the Maintenance Plan to all property owners and tenants.
- □ Provide safe and efficient access to the green roof. Maintain egress and ingress routes to design specifications. Clear walkways of obstructions and maintain them to design specifications.
- □ Eliminate standing water to prevent vector breeding.

Vegetated Swales

Inspection and Maintenance Guidance Requirements

Figure 10: Grassy Swale

- □ Proper maintenance includes mowing, weed control, removal of trash and debris, watering during the dry season, and reseeding of non-vegetated areas.
- □ When mowing grass, never cut shorter than the design flow (WQF) depth and remove grass cuttings.
- □ Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- □ Prune vegetation, large shrubs, or trees that interfere with swale operation.
- □ Fallen leaves and debris from deciduous plant foliage shall be removed.
- □ Inspect swales at least twice annually and after every storm greater than 0.75 inches for damage to vegetation, erosion, sediment accumulation and ponding water standing longer than 72 hours.
- □ If the swale is does not drain in 72 hours, till the swale if compaction or clogging occurs and revegetate.
- □ Eliminate standing water to prevent vector breeding.
- □ Debris in quantities that inhibit operation shall be removed routinely (no less than quarterly), or upon discovery.
- □ Periodic litter collection and removal will be necessary if the swale is located adjacent to a main road.
- □ Sediments shall be removed when depths exceed 3 inches, if vegetation growth is inhibited in more than ten percent of the swale, or if sediment is blocking even distribution and entry of water. Re-plant and/or re-seed vegetation, as needed, following sediment removal activities to reestablish vegetation.
- □ Stabilize slopes with appropriate erosion control measures when native soil is exposed, or erosion channels are forming.
- □ Swale outlet shall maintain sheet flow of water exiting the swale unless a collection drain is used.
- □ If a spill occurs and hazardous materials contaminate soils in vegetated swales, the affected areas shall be removed immediately and the appropriate soils and materials replaced as soon as possible.
- □ Insects and rodents shall not be harbored in the vegetated swales. Pest control measures shall be taken when insects/rodents are found to be present. Pyrethroid pesticides may not be used.
- □ If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor. No pyrethroid pesticides may be used.
- □ Holes in the ground located in and around the pervious pavement shall be filled and compacted.

Vegetated Filter Strips

Inspection and Maintenance Guidance Requirements

Figure 11: Vegetated Filter Strip (Source: 3 Rivers Wet Weather)

- □ The owner/operator of the property must be responsible for maintaining vegetated filter strips.
- □ Inspect vegetated filter strip for erosion or damage to vegetation at least two times a year (preferably before and after the winter/wet season), and after every storm greater than 0.75 inches. Vegetated filter strips should be checked for debris and litter and areas of sediment accumulation.
- □ Remove sediment, as needed, if vegetation growth is inhibited in more than ten percent of the swale, or if sediment is blocking even distribution and entry of water. Re-plant and/or re-seed vegetation, as needed, following sediment removal activities to reestablish vegetation.
- □ Grasses or turf shall be maintained at a desired height of 4 - 6 inches and remove grass clippings.
- □ If turf is used, filter strips shall be irrigated during the dry season.
- □ Prune vegetation, large shrubs, or trees that interfere with filter strip swale operation.
- □ Dead vegetation shall be removed to maintain less than 10% of area coverage or when vegetative filter strip function is impaired. Vegetation shall be replaced immediately to control erosion where soils are exposed and within 3 months to maintain cover density.
- □ Trash, litter, rocks, and branches shall be frequently collected from filter strips, especially those located along highways.
- □ Fallen leaves and debris from deciduous plant foliage shall be ranked and removed.
- □ Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
- □ Debris in quantities more than 2” deep or sufficient to inhibit operation shall be removed routinely (no less than quarterly) or upon discovery.
- □ Eliminate standing water to prevent vector breeding.
- □ Sediments that accumulate along the upstream edge of filter strips and/or in level spreaders shall be collected and removed at least once a year.
- □ If a spill occurs and hazardous materials contaminate soils in vegetated filter strips, the affected areas shall be removed immediately and the appropriate soils and materials replaced as soon as possible.
- □ Insects and rodents shall not be harbored in the vegetated filter strips. Pest control measures shall be taken when insects/rodents are found to be present.
- □ If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor.
- □ Holes in the ground located in and around the pervious pavement shall be filled and compacted.