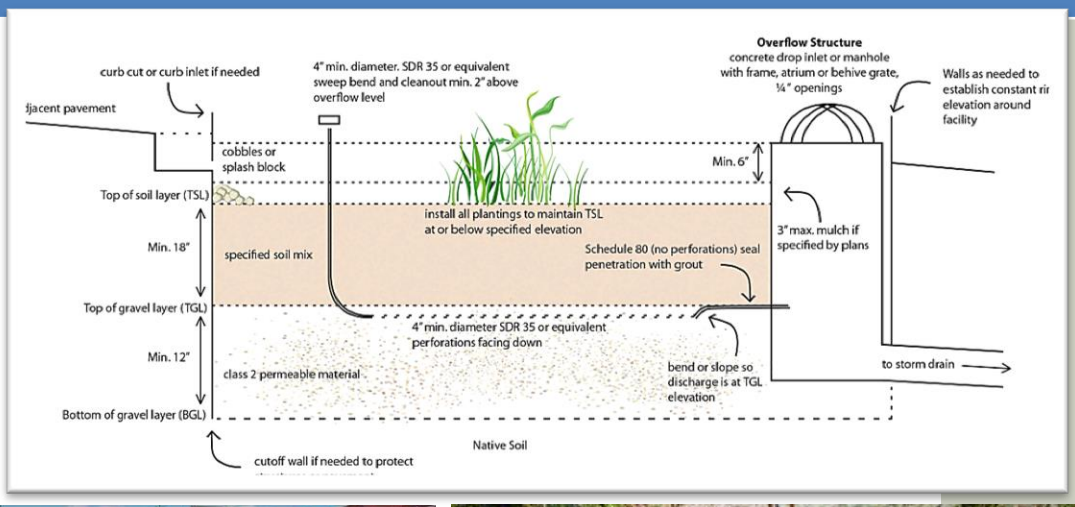
Humboldt Low Impact Development Stormwater Manual



Design Guidance for Stormwater Treatment and Control Projects in Phase II MS4 Permit Areas:

County of Humboldt

City of Arcata

City of Eureka

City of Fortuna

City of Trinidad

MANUAL v3.0 (August 18, 2021)

PREFACE

Portions of unincorporated Humboldt County (McKinleyville, the greater Eureka area, and Shelter Cove) and the Cities of Eureka, Arcata, Fortuna, and Trinidad are subject to the State Water Quality Control Board's general permit for municipal separate storm sewer systems (MS4 General Permit). Condition E.12 of the MS4 General Permit requires local agencies, by June 30, 2015, to require that development projects comply with post-construction stormwater requirements based on "low impact development" (LID) standards. These standards are intended to maintain a site's pre-development runoff characteristics by using design techniques that capture, treat, and infiltrate stormwater on site.

Humboldt County and the affected cities are collaborating to develop a common manual to present technical information, procedures, and guidance for complying with the State's LID design standards. Having a common manual will benefit the public by providing a standardized approach for complying with the LID design standards, rather than multiple approaches that differ by jurisdiction.

Part A Project Applicability

Part B Small Projects

Part C Regulated Projects

List of Acronyms

APN	Assessor's Parcel Number
ASTM	American Society for Testing and Materials
BGL	Bottom of Excavation/Gravel Layer
BMP	Best Management Practices
CASQA	California Stormwater Quality Association
CGP	Construction General Permit
CWA	Clean Water Act
DMA	Drainage Management Area
EPA	Environmental Protection Agency
LID	Low Impact Development
LUP	Linear Underground Project
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NCRWQCB	North Coast Regional Water Quality Control Board
O&M	Operation and Maintenance
PBS	Planning and/or Building Services*
PPPP	Porous asphalt, Pervious concrete, Permeable Pavers
RI	Responsible Individual
SCP	Stormwater Control Plan
SF	Square Feet
SWRCB	State Water Resource Control Board
TGL	Top of Gravel Storage Layer
TSL	Top of Soil Layer

*Determination of applicable project stormwater management requirements and plan review in accordance with this manual will be handled by the applicable City or County departments with project area jurisdiction. Because this manual was developed with the intent of providing a regionally consistent approach to post-construction stormwater management throughout the Humboldt County North Coast area, the application process and plan review process will vary depending on project location. Questions regarding this manual and the submittal process should be directed to the applicable City or County departments processing the building, development, or land use permits associated with your project.

List of Figures

List of Preparers

Christopher Watt, CEG, CHG, Principal Engineering Geologist, LACO Associates
Rebecca Dower, PE, Civil Engineer, LACO Associates
Ryan Wells, AICP, Associate Planner, LACO Associates
Stephen Umbertis, Assistant Planner, LACO Associates
Jordan Blough, Staff Analyst, LACO Associates
Drew Jack, Environmental Scientist, LACO Associates

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Todd Becker, Environmental Analyst, Humboldt County
North Coast Stormwater Coalition
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Dan Cloak, P.E., Dan Cloak Environmental Consulting

Version 3 updates completed in August 2021 were in response to a NCRWQCB letter dated March 26, 2021. Additional updates were made by MS4 managers due to changing ASTM standards and other required corrections. Significant updates can be seen in green throughout the document.

PART A

Project Applicability

1.0 APPLICABILITY

Table 1 provides an overview of the various project types and required submittals for projects within the boundaries of the County of Humboldt's Municipal Separate Storm Sewer System (MS4) permit area and the cities of Arcata, Eureka, Fortuna, and Trinidad, which are subject to the MS4 General Permit. MS4 General Permit Boundary Maps are attached and can also be obtained from the County or City Department with project location jurisdiction. The requirements for stormwater management are determined by the type and scale of the project.

Table 1 - Applicable Post-Construction Standards Based on Project Type

Type of Project	**Required Submittals:**
Exempt Projects Exempt Projects include: • Projects that create or replace less than 2,500 square feet (SF) of impervious surface; • Interior remodels and routine maintenance or repair such as exterior wall surface replacement; • Reroofing of an existing building; • Asphalt or paving overlays and resurfacing of existing surfaces. "Replacement, Development, or Redevelopment" is defined as work that replaces existing surfaces down to subgrade and are not exempt; and • Linear Underground Projects (LUPs) unless the LUP has a discreet location that has greater than or equal to 5,000 SF of newly constructed impervious surface	• Stormwater Information Sheet
Small Projects Small Projects include: • Single-Family Homes, not part of a larger plan of development, that create or replace greater than or equal to 2,500 SF of impervious surface; and • Projects that create or replace greater than or equal to 2,500 SF and less than 5,000 SF of impervious surface	• Stormwater Information Sheet • Follow instructions in Part B of this manual. • Small Project Stormwater Control Plan (SCP)
Regulated Projects Regulated Projects include: • Projects other than Single-Family Homes that create or replace greater than or equal to 5,000 SF of impervious surface.	• Stormwater Information Sheet • Follow instructions in Part C of this manual. • Preliminary SCP (discretionary projects) • Final SCP (all regulated projects)
Regulated Redevelopment, Roads, and Linear Underground Projects Regulated Redevelopment, Roads, and Linear Underground Projects include: • See MS4 Permit, Section E.12.c for additional description and details of applicable Redevelopment, Road, and Linear Underground Project requirements.	• Requirements vary; contact County or City department with project jurisdiction.
Hydromodification Projects: Hydromodification projects are: • Specific Regulated Projects, projects that create and/or replace greater than or equal to 1 acre of impervious surface and create a net increase in impervious surface. • A project that does not increase impervious surface area over the pre-project condition is not a hydromodification management project (MS4 permit Sec. E.12.f). • Projects with greater than or equal to 1 acre of Land Surface Disturbance may be subject to the State Construction General Permit (CGP) Post-Construction Standards and shall comply with theHumboldt Low Impact Development (LID) Stormwater Manual, Regulated Project Post-Construction Standards in lieu of CGP Post-Construction Standards, if project location falls within the MS4 General Permit areas.	• Requirement is: post-project runoff shall not exceed estimated pre-project flow rate for the 2-year, 24-hour storm. • See Regulated Projects above • Follow instructions in Part C of this manual
Definition of Impervious Surface: A surface covering or pavement of a developed parcel of land that prevents the land's natural ability to absorb and infiltrate rainfall/stormwater. Impervious surfaces include, but are not limited to: roof tops, walkways, patios, driveways, parking lots, storage areas, impervious concrete and asphalt, and any other continuous watertight pavement or covering. Landscaped soil and pervious pavement, including pavers with pervious openings and seams, underlain with pervious soil or pervious storage material, such as a gravel layer sufficient to hold the specified volume of rainfall runoff, are not impervious surfaces. **Definition of Land Surface Disturbing Activities**: Any construction or demolition activity, including, but not limited to: clearing of vegetation, grading, grubbing, and disturbance to the ground such as stripping of top soils, soil compaction, excavation, and stockpiling or any other activity that results in a land disturbance that changes the physical condition of land forms, soils, vegetation, and hydrology.	

The following flow chart is designed to aid in determining your project type (Figure 1.).

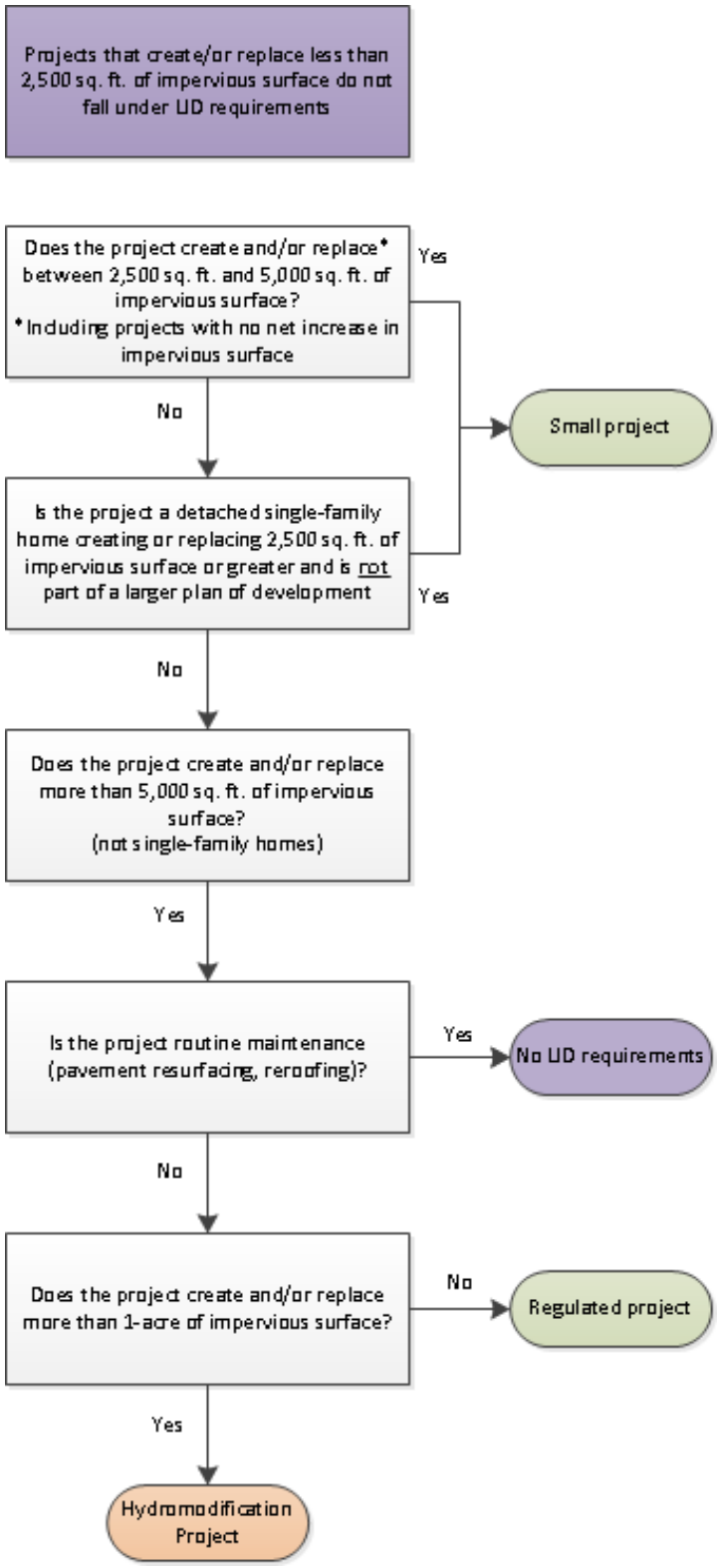


Figure 1. Project Type Identification

STORMWATER INFORMATION SHEET

Instructions

Construction and development projects within portions of unincorporated Humboldt County (McKinleyville, the greater Eureka area, and Shelter Cove) and the Cities of Eureka, Arcata, Fortuna, and Trinidad are subject to stormwater runoff and pollution control requirements of State Water Resources Control Board Water Quality Order No. 2013-0001-DWQ; NPDES General Permit No. CAS0000004 [Municipal Separate Storm Sewer (MS4) General Permit].
The following checklist is to be completed by you (the applicant) to determine which plans and specifications for stormwater runoff control are required as part of a Building or Development Permit application for projects located in areas subject to MS4 requirements.

I. Construction Project Information and Checklist (Completed by Applicant)

Site Location Address:

Assessor Parcel Number (APN):

Anticipated Construction Start Date: _____

Anticipated Construction Completion Date: _____

Total area of Land Surface Disturbance: _____ square ft. or _____ acres

If project disturbs ≥ 1 acre of land surface then provide the State Construction General Permit WDID No.: _____

Check and/or list all applicable permits directly associated with project construction or grading activity:

- ☐ State Construction General Permit (CGP)
- ☐ State 401 Water Quality Certification
- ☐ U.S. Army Corps 404 Permit
- ☐ CA Fish and Wildlife 1600
- ☐ Other (list): _____

Is the construction site part of larger common plan of development or sale (check as applicable)?

☐ YES ☐ NO ☐ Unknown

Name of larger common plan/project (if applicable): _____

Impervious Surface Area:

Pre-Project Impervious Surface: _____ square ft.

New or Replaced Impervious Surface: _____ square ft.

Total Post-Project Impervious Surface: _____ square ft.

Check Project Type as determined from LID Manual Part A, Table 1 - Applicable Post-Construction Standards Based on Project Type

Project Type:	Notes:
☐ Exempt	Sign and Certify this form.
☐ Small Project	Sign and Certify this form. Follow instructions in Part B of LID Manual.
☐ Regulated Project	Sign and Certify this form. Follow instructions in Part C of LID Manual
☐ Regulated Project with ≥ 1 acre of created or replaced impervious surface	Sign and Certify this form. Follow instructions in Part C of LID Manual.
☐ Regulated Redevelopment, Roads, or Linear Underground Project	Sign and Certify this form. Requirements vary; contact County or City Department with project jurisdiction.

Stormwater runoff from the project site discharges to (check as applicable):

☐ Storm Drain System (including road side ditches and other conveyances)

☐ Directly to waters of the State or U.S. (e.g. river, lake, stream, ocean, wetland) Name of Waterbody: _____

Name of nearest waterbody receiving runoff from site: _____

Indicate distance from project site to nearest watercourse: _____ ft.

If your project is covered under the State Water Resources Control Board Construction General Permit (CGP), attach a copy of the submitted Stormwater Pollution Prevention Plan (SWPPP) including the Notice of Intent and WDID Number.

If a CGP is not required for your project, submit appropriate construction site BMP plans as required by County or City Department with project jurisdiction.

II. Certification (Completed by Owner or Authorized Applicant/Agent)

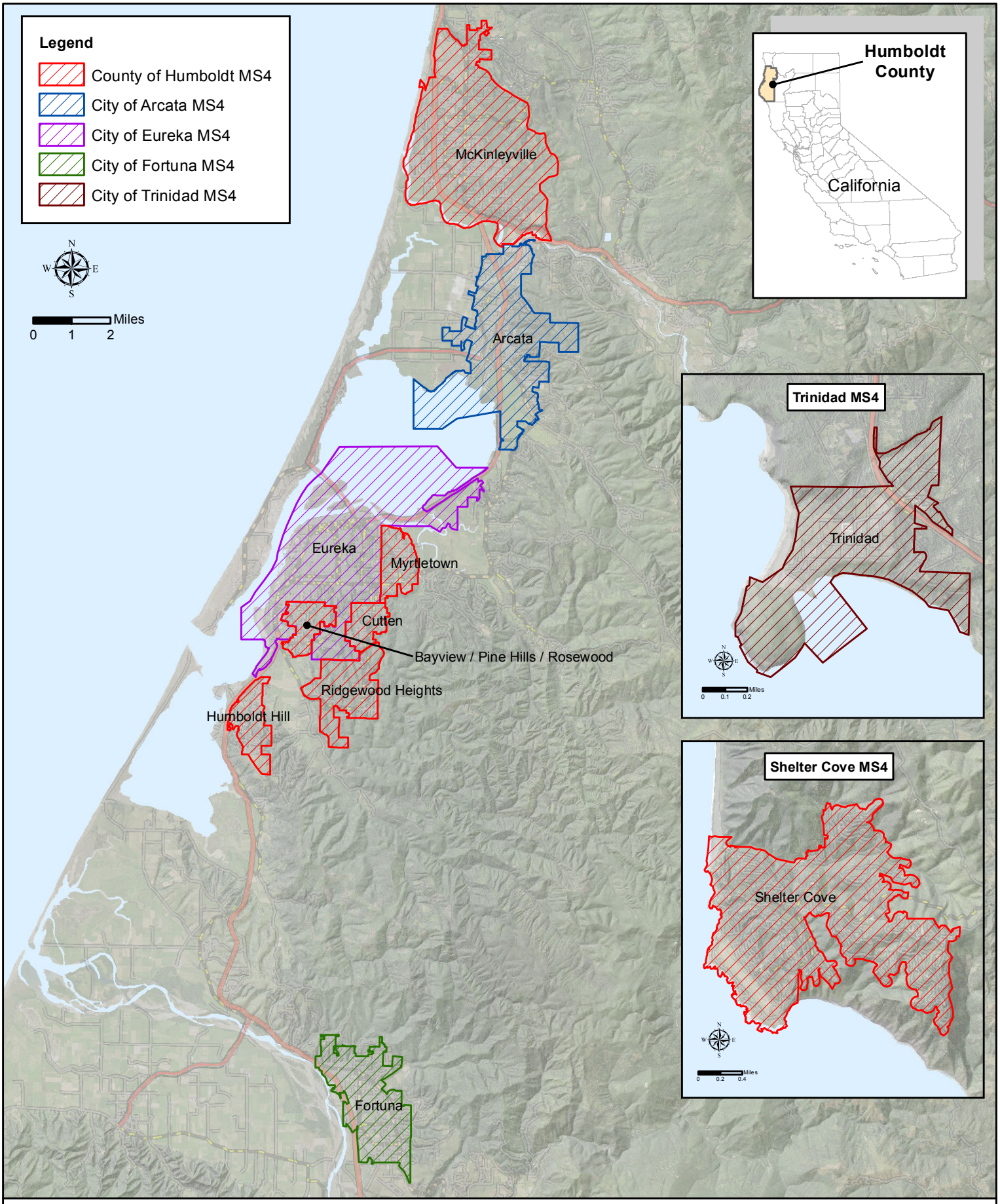
I, the below signed, confirm that I have accurately described my project to the best of my ability, and that I have not purposely omitted any detail affecting my project's classification for stormwater regulation

Printed Name:

Signature: Date:

III. For Official Use Only

Permit No.: Submittal Date: Received By:



Humboldt LID Stormwater Manual - MS4 Boundary Areas Map

This map is intended for planning purposes and should not be used for precise measurement or navigation. All locations are approximate.

Imagery: USDA NAIP (2014)
Map Prepared: May 2016

PART B

Small Projects

Why Do I Need to Complete this Form?

In accordance with the California State Water Resources Control Board (SWRCB) Phase II NPDES Permit for Small Municipal Separate Storm SewerSystems (MS4 General Permit), projects on properties within the boundaries of the County of Humboldt and the Cities of Arcata, Eureka,Fortuna, and Trinidad subject to the MS4 General Permit that create or replace 2,500 square feet or more of impervious surface (e.g. roofsor pavement) must incorporate specified site design measures to reduce stormwater runoff.

Projects that create or replace 5,000 square feet or more of impervious surface require a comprehensive SCP forRegulated Projects, except for detached single-family homes that are not part of a larger common plan of development.

2.0 STORMWATER CONTROL PLAN FOR SMALL PROJECTS/SINGLE-FAMILY HOMES (2,500 – 5,000 SQ. FT.)

Introduction

This form is required to document compliance with MS4 requirements for projects that create or replace between 2,500 and 5,000 square feet of impervious surface. To comply with these regulations, projects must include at least one reduction measure. Examples of reduction measures are shown below in Step 2. You are encouraged to include more reduction measures in your design, but only one is required. You must illustrate the added impervious surface and identify reduction measures on your site plan. While you are required to calculate your project's run-off reductions, there is no numeric standard or target required by the MS4 regulations.

Step-by-Step Instructions Overview

The steps are:

1. Select a minimum of one site design measure.
2. Identify the runoff reduction measures you will use
3. Calculate runoff reduction using the Small Projects Calculator (Attachment 1).
4. Sign and Submit your SCP with your building permit application

Step 1: Project Data

Total Pre-Project Impervious Surface Area (square feet)	
Total New or Replaced Impervious Surface Area (square feet) [Sum of impervious area that will be constructed as part of the project]	
Total Post-Project Impervious Surface Area (square feet)	
To be completed by staff member: **Building Permit #**	

Step 2: Select a minimum of one Site Design Measure & show it on the Plot Plan

Site Design Measures (Select a minimum of one)

The following design strategies, in addition to at least one of the measures to the right, shall be considered applicable for all projects:

- Minimize compaction of highly permeable soils
- 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
- Minimize impervious surfaces by concentrating development on the least-sensitive portions of the site, while leaving the remaining land in a natural, undisturbed state

- ❑ 1. Tree Planting and Preservation
- ❑ 2. Rain Barrels or Cisterns
- ❑ 3. Rooftop/ Impervious Area Disconnection
- ❑ 4. Soil Quality Improvement
- ❑ 5. Green Roof
- ❑ 6. PPPP Alternative engineered hardscaping surfaces (Pervious concrete, Porous asphalt, Permeable Pavers)
- ❑ 7. Vegetated Swales
- ❑ 8. Stream Setbacks and Buffers
- ❑ ~~9. On-site infiltration~~(REMOVED FROM CONSIDERATION)

Step 3: Calculate runoff reduction using small projects calculator

Use *Small Projects Calculator - Humboldt LID Stormwater Manual* (Attachment 1)

Step 4: Delineate impervious areas and locations of runoff reduction measures

On a site plan or sketch, show the impervious area (e.g. a roof, or portion of a roof, or a pavedarea) that will drain to your site design measure such as Rain Barrels or Cisterns, Impervious Area Disconnection, Soil QualityImprovement, PPPP, Vegetated Swales, ~~Infiltration trenches~~, and Stream Setbacks and Buffers. Typically, these delineations follow roof ridge lines or grade breaks. Alternatively, or in addition, show the type and extent of site design measures such as PPPP, Tree Planting and Preservation, Green Roof, or Soil Quality Improvement. An example sketch is included as Attachment 2.

Confirm your design and submittal meet minimum requirements and specifications indicated on the Site Design Measure Sheets included in Attachment 3. Include a copy of the Site Design Measure Sheet or equivalent with your submittal.

Step 5: Sign and submit your plan

Consult with City or County Planning and Building Services (PBS) department staff as applicable about when and how to submit your SCP.

Signature and Certification

I, the below signed, confirm that I have accurately described my project to the best of my ability and that I have not purposely omitted any detail affecting my project's classification for stormwater regulation. I hereby certify that the site design measures identified herein as being incorporated into my project have been designed in accordance with the approved BMP Fact Sheet or equivalent, which is attached to this checklist and is included in the final site plans submitted to the appropriate County or City Department.

_____ _____

Signature Date

_____

Print Name

I am the:

☐ Owner ☐ Representative ☐ Other:_____

Attachments:

Small Projects Calculator
Humboldt Low Impact Development Stormwater Manual

Project Information					*Formulas/Notes*
DMA Name:					
Total Post-Project Impervious Surface Area (square feet)		A		square feet	
24 hour - 85th Percentile Design Storm		B		inch	**B** = Select Design Storm Value (0.65-inch Humboldt Bay Area, 1.3-inch Shelter Cove)
Impervious Surface Runoff Value **(Potential Stormwater Runoff due to impervious surface area and design storm value)**		C		Gallons per 24 hours	**C = A x B x 0.083 x 7.48**
Pervious Self-Retaining Area (SRA) Credit (if applicable, if none enter 0)					
Self-Retaining Area (square feet)			SRA Credit	square feet	**SRA Credit = Self-Retaining Area x Multiplier** Select **Multiplier** (3.5 Humboldt Bay Area, 1.3 Shelter Cove)
Site Design Measure Credits					
Tree Planting and Preservation					
New Trees	# of trees				
100 square feet per deciduous tree	D		E	square feet	**E = D x 100**
200 square feet per evergreen tree	F		G	square feet	**G = F x 200**
Existing Trees (Credit for 50% of existing canopy area)	Canopy diameter (feet)				
Tree #1	H_1		J_1	square feet	$J_1 = 3.14 \times (H_1/2)^2 \times 0.50$
Tree #2	H_2		J_2	square feet	$J_2 = 3.14 \times (H_2/2)^2 \times 0.50$
Tree #3	H_3		J_3	square feet	$J_3 = 3.14 \times (H_3/2)^2 \times 0.50$
Rain Barrel or Cisterns (55 gallon minimum)					
Square foot credit per gallon based on 24-hour, 85th Percentile Design Storm	K				**K** = Select square foot credit per gallon (2.48 Humboldt Bay Area, 1.24 Shelter Cove)
	Gallons				
Rain Barrels	L		M	square feet	**M = L x K**
Cisterns	N		O	square feet	**O = N x K**
~~**Infiltration Trench/Basin (55 gallon minimum = 21 ft^{3**})**~~	~~cubic feet~~				
~~volume(ft^3) = length x width x depth~~	~~P~~		~~Q~~	~~square feet~~	~~**Q = P x R x K x 7.48**~~
~~porosity (approximate %)~~	~~R~~	~~35%~~			
Impervious Area Disconnection Credit per square foot of impervious area feeding into pervious area		S		square feet	**S** = Enter square foot value
Soil Quality Improvement					
Credit per square foot of soil quality improvement		T		square feet	**T** = Enter square foot value
Green Roof					
Credit per square foot of green roof installation		U		square feet	**U** = Enter square foot value
PPPP (Porous Asphalt, Pervious Concrete, Permeable Pavers)					
Credit per square foot installed		V		square feet	**V** = Enter square foot value
Vegetated Swales					
Credit per square foot of vegetated swale		W		square feet	**W** = Enter square foot value
Stream Setbacks and Buffers					
Credit per square foot of stream setback and buffer#		X		square feet	**X** = Enter square foot value
Credits Total		Y		square feet	**Y = SRA Credit + E + G + J_1 + J_2 + J_3 + M + O + Q + S + T + U + V + W + X**
Post-Project Impervious Surface Area minus Site Design Measure Credits		Z		square feet	**Z = A - Y**
NEW Impervious Surface Runoff Value **(Potential Stormwater Runoff due to impervious surface area and design storm after implementation of Site Design Measures)**		AA		Gallons per 24 hours	**AA = Z x B x 0.083 x 7.48**
Percent reduction in Impervious Surface Runoff Value*		BB		%	**BB = ((C - AA) / C) x %100**

***The MS4 General Permit requires a calculation of the project runoff reduction resulting from the use of site design measures. However, there is no numeric standard or target for runoff reduction required for Small Projects.**

~~****Infiltration Trench/Basin calculations are based on porosity (35%). Increased trench dimensions (volume) are required to meet 55 gallon minimum capacity.**~~

Green	Fill In [Enter Value]	Conversions Used:
Red	Calculated Value	1 inch = 0.083 feet
Black	Fixed Value/Selectable Value	1 cubic foot = 7.48 gallons

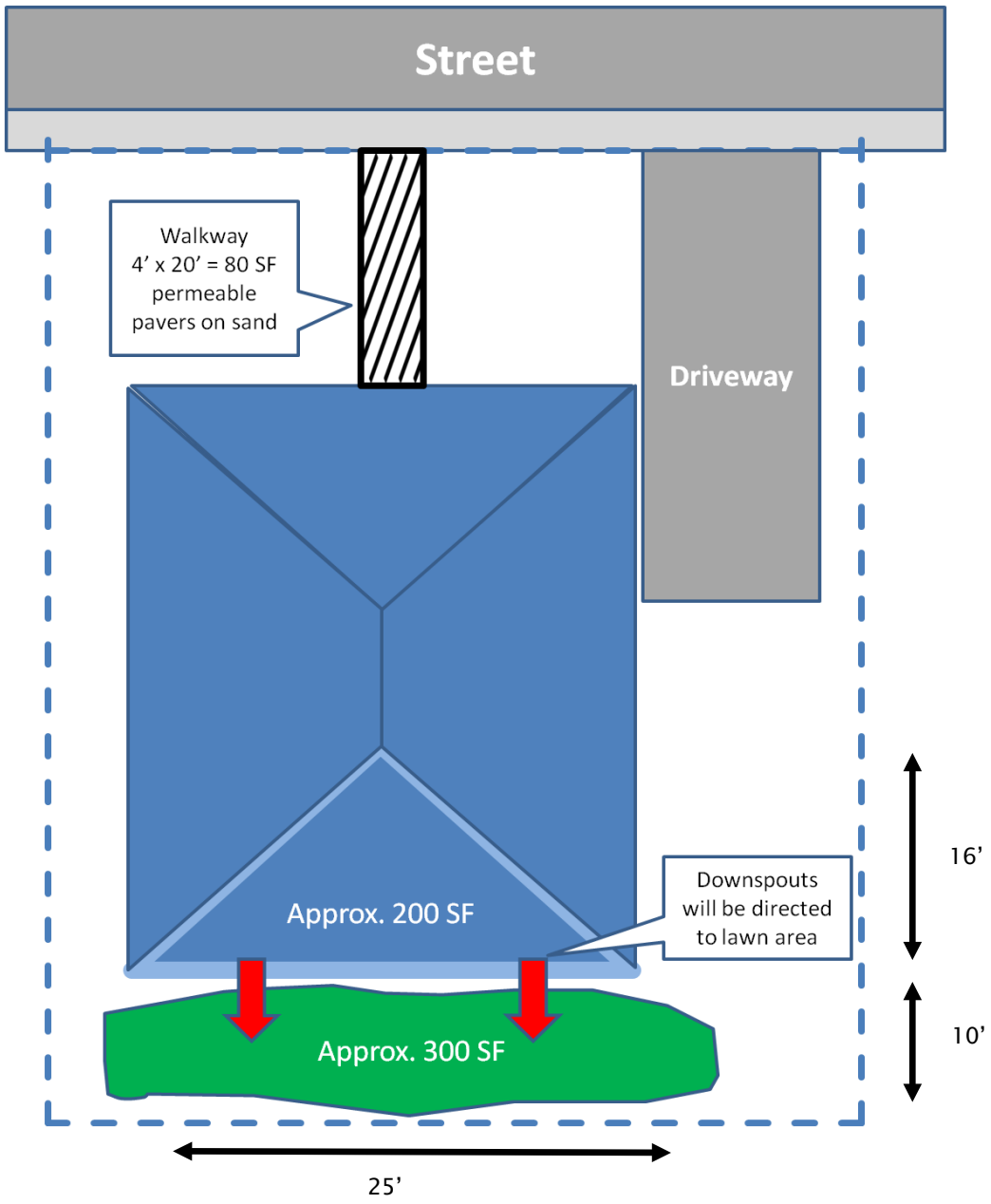
Small Projects Calculator, Version 2.0 - June 29, 2016

check with agency with project area jurisdiction for requirements

Example Plot Plan*

The example below illustrates a Small Project site plan/sketch and the level of detail required.
Note: Not all runoff from new impervious surfaces is retained. Rather, a permeable walkway and a 300 square foot swale are designed into the project, reducing the runoff the project would otherwise generate.

Not to Scale



*** This diagram only shows details on the Plot Plan required for MS4. Refer to the Plot Plan Checklist for a full description of the details required to evaluate your project for compliance with other regulations.**

PART C

Regulated Projects

3.0 INTRODUCTION AND APPLICABILITY

"Urban-related stormwater has been identified as the source of impairment for tens of thousands of miles of rivers, streams, and coastal shorelines, as well as hundreds of thousands of acres of lakes, reservoirs, and ponds in the United States. These impairments are largely due to the expansion of the built environment, which removes vegetation, alters the natural infiltration capability of the land, generates the discharge of pollutants, and leads to stream erosion. "(EPA 833-R14-003, pg. 1, 2014)

According to the SWRCB, "Nonpoint source (NPS) pollution, also known as pollutedrunoff, is the leading cause of water quality impairments in California and in the nation." (SWRCB 2000)

In the U.S., approximately 75% of the population resides in urban areas. This is a dramatic shift from the early twentieth century where a majority of the population lived in rural settings. This shift has resulted in a significant increase in impervious or developed surfaces. "The creation of impervious surfaces that accompanies urbanization profoundly affects how water moves both above and below ground during and following storm events, the quality of that stormwater, and the ultimate condition of nearby rivers, lakes, and estuaries." (National Research Council, pg. 1, 2008)

Stormwater runoff that is not infiltrated directly into the soil and that lands on developed surfaces accumulates pollutants such as: automotive fluids, cleaning solvents, toxic or hazardous chemicals, detergents, metals, bacteria, pesticides, oil and grease, food wastes, and other pollutants found on these surfaces. In urban environments, this polluted runoff eventually finds its way to surface water bodies such as rivers, streams, lakes, bays, or the ocean. Polluted stormwater entering these waters is a significant concern to human health as well as a threat to plants and wildlife that inhabit these environments.

The National Pollutant Discharge Elimination System (NPDES) program under the Clean Water Act (CWA) is the main federal vehicle to regulate the quality of the nation's waters. The County of Humboldt and the Cities of Arcata, Eureka, Fortuna, and Trinidad have prepared this LID Stormwater Manual (LID Manual) to comply with the requirements of the Phase II Small MS4 General Permit, SWRCB Water Quality Order No. 2013-0001-DWQ, and NPDES General Permit No. CAS000004 (MS4 General Permit). The LID Manual provides guidance for the implementation of stormwater quality control measures in new development and redevelopment projects in MS4 General Permit areas of the County of Humboldt and the Cities of Arcata, Eureka, Fortuna, and Trinidad with the intention of improving water quality and mitigating potential water quality impacts from stormwater and non-stormwater discharges.

3.1 Background on Stormwater Regulations

Local stormwater regulations originate from federal regulations that began in 1987, when the CWA, originally passed in 1972, was amended by the Water Quality Act to formally include stormwater runoff. Congress subsequently authorized the NPDES program, authorizing the United States Environmental Protection Agency (EPA) to issue stormwater permits to municipalities regulating stormwater discharges. This authority was then delegated from the EPA to the California State and local Regional Water Quality Control Boards.

In 2003, the SWRCB established standards for local governing agencies toimplement a number of programs to prevent pollution, improve and protect stormwater quality, reduce stormwater runoff, and enhance the ecological function of local waterways in areas served by small Municipal Separate Storm Sewer Systems (aka MS4s). The MS4 General Permit requires local governing agencies, such as the County of Humboldt and Cities of Arcata, Eureka, Fortuna, and Trinidad, to regulate stormwater runoff from new developments projects. In February 2013, the SWRCB renewed and revised the MS4 General Permit. The North Coast Regional Water Quality Control Board (NCRWQCB) is responsible for enforcing the MS4 General Permit in Humboldt County.

3.2 Purpose of This Manual

The purpose of this manual is to provide technical guidance for building permit applicants whose project requires conformance with Section E.12 of the MS4 General Permit. It is meant to guide proper selection, design, and maintenance of post-construction stormwater Best Management Practices (BMPs) to address pollutants generated by land development, minimize post-development stormwater surface flows and velocities, assure long-term functionality of BMPs, and avoid vector breeding. The target audience for this manual includes developers, designers, contractors, homeowners, and staff of County and City departments engaged in plan-checking, permitting, and inspections related to land development activities. This manual contains the necessary forms and worksheets required to be completed by the developer for project approval and long-term maintenance.

This manual includes the following information:

- Basic information on the Phase II Small MS4 General Permit and its objectives.
- Assistance with determining whether a project is subject to the Phase II Small MS4 General Permit regulations.
- Simple ways to reduce the volume of stormwater runoff from a project site using site design measures.
- Methods to reduce stormwater contamination from operations on a project site using source control measures.
- An introduction to LID and resources to assist with site design incorporating LID.
- Explanation of a project applicant's responsibility for the operations and maintenance (O&M) of bioretention features.

During the project planning process, read this manual to understand the principles and design procedures before beginning to design your project. Then, following the steps on the appropriate worksheets, create a stormwater management plan for your project.

3.3 Manual Revision

As this manual is a "living" document, updates may be made as local, regional, state, or federal policies or their applications change. LID is an emerging field and, as such, changes quickly. Thus, revisions and/or amendments may be necessary as new policy is mandated and new research is conducted. Version 3 updates completed in August 2021 were in response to a NCRWQCB letter dated March 26, 2021. Additional updates were made by MS4 managers due to changing ASTM standards and other required corrections. Significant updates can be seen in green throughout the document.

3.4 Relationship of Manual to Local Stormwater Ordinance

This manual provides guidance and requirements for post-construction measures on projects within the MS4 General Permit areas of Humboldt County. Humboldt County Code, Division 3, Title III, Chapter 7, Section 337-13(b) states that development projects shall comply with the post-construction requirements of the MS4 General Permit, which may include measures for site design, source control, runoff reduction, stormwater treatment, or baseline hydromodification management as applicable based on project type and size. Further, Section 337-13(b) states that the County's procedures, standards, and specifications for implementing the post-construction requirements of the MS4 General Permit are contained in the Humboldt LID Manual. Likewise, participating cities (Eureka, Arcata, Fortuna, Trinidad) in the preparation of this manual have enacted ordinances mandating compliance with the standards set forth herein.

3.5 Effective Date

The requirements described herein apply to all development project applications (Building Permits, Coastal Development Permits, Use Permits, Variances, and Minor Subdivision Permits) that are submitted after June 30, 2015, to County of Humboldt or Cities of Arcata, Eureka, Fortuna, or Trinidad PBS departments with project-location jurisdiction. ~~Applications that have been submitted and deemed complete before June 30, 2015, will not be subject to E.12 of the MS4~~

~~General Permit. Applications that have been submitted prior to June 30, 2015, but have been deemed incomplete will not be required to be resubmitted to comply with the MS4 General Permit unless the application is not completed by December 30, 2015. If the application is not completed by December 30, 2015, resubmission will be mandatory to meet the E.12 MS4 General Permit requirements.~~

3.6 Geographic Area

The requirements and standards described in this manual apply to development projects on properties within the boundaries of the County of Humboldt and the Cities of Arcata, Eureka, Fortuna, and Trinidad subject to the MS4 General Permit. Maps depicting areas that are subject to the MS4 General Permit and the LID requirements in this manual are provided in Part A. Maps showing properties within the boundaries subject to the MS4 General Permit requirements may also be obtained from County of Humboldt or Cities of Arcata, Eureka, Fortuna, or Trinidad PBS departments with project location jurisdiction.

3.7 What is Low Impact Development (LID)?

Low impact development, or LID, is a stormwater management practice that aims to capture, treat, and infiltrate stormwater runoff in a way that mimics pre-project site hydrology. This is accomplished through the incorporation of small-scale, landscape-based features throughout a project site. Landscape features intercept stormwater runoff and meter its flow to reduce the detrimental effects of increased peak flows. LID captures runoff, promotes natural infiltration, and processes pollutants through natural biological activity in soil, rendering some pollutants less toxic.

Examples of LID include planting trees to intercept rainfall before it meets impervious developed surfaces; rain barrels at the end of roof gutters to catch water and store for irrigation or release into vegetated areas; vegetated buffer strips to filter surface runoff before it flows to storm drain systems or surface waters; and bioretention facilities to promote natural filtration of stormwater runoff through surface vegetation and soil infiltration. Specific LID features will be discussed in more detail in subsequent sections of this manual.

What isn't LID? LID is not flood control. LID does a great job at moderating small flows, especially those associated with frequent small events. But, LID features are not designed for large flood events. This means that the LID requirements and processes included in this manual, although helpful with treating and attenuating minor flows, are not flood control features. All existing requirements related to flood control will remain relevant and will be required for each project when applicable. See the jurisdictional Planning department for requirements.

3.8 Project Scale

The requirements for stormwater management are determined by the type and scale of the project. The requirements and specifications for implementation of post-construction stormwater measures found in this section of the LID Manual are for Regulated Projects; Regulated Redevelopment, Roads, and LUPs; or Regulated Projects with greater than or equal to 1 acre of created or replaced impervious surface. Use the guidelines in the LID Manual – Part A to ensure you have correctly determined the applicable project type and required submittals for your project. Consult the PBS department with project area jurisdiction for questions or assistance with determining project type.

4.0 STEPS TO COMPLIANCE

Depending on the type of project and the area of impervious surface being created or replaced, varying levels of regulation and design requirements will apply. A combination of site design measures, source control measures, and

treatment/baseline hydromodification facilities (bioretention) should be integrated into the project design at the earliest stage of project development.

Compliance can be met through implementing a variety of LID strategies at your project site. For example, some strategies may include using site design measures exclusively or using a combination of site design measures and bioretention facilities. A clear indication of which LID strategies you are implementing will aid in the plan review process.

When utilizing bioretention features or equivalent in the design, consider, at the earliest stage, who will be responsible for O&M of the facility. In a residential subdivision, these considerations will help facilitate a design that meets compliance and that reduces cost associated with constraints that may occur after a subdivision has already been laid out. For example, O&M responsibilities may be included into the HOA's Covenants Conditions and Restrictions, or an assessment district could be formed to fund ongoing maintenance of LID/stormwater improvements within the subdivision. This would be similar to the permanent road division requirement for all new roads within a subdivision. There are many alternatives that can be used and should be discussed with permit approval staff.

This manual is a guide for compliance. Applicants may choose to use alternative methods to reach compliance. Alternative methods and formats will be accepted if they present all information requested by this manual, fulfill all requirements of the Post-Construction Requirements, section E.12, of the MS4 general permit, and by fulfilling the requirements of the jurisdictional department.

To aid in complying, these key steps should be taken:

1. Pre-application meeting with a PBS department staff member with project location jurisdiction is recommended for *regulated projects.*
2. Follow this manual and use the worksheets to compile site information.
3. Draft a Preliminary SCP (discretionary projects only) using the template in this manual (Appendix 2) and submit to appropriate jurisdictional office for planning review.
4. Draft a SCP using the worksheets and template in this manual.
5. Draft a Stormwater Facilities O&M Plan (bioretention or equivalent facilities only, if required).
6. Provide detailed project designs.
7. Carry out construction.
8. Transfer maintenance responsibility upon transfer of site (bioretention facilities, if required).
9. Submit annual O&M certification (if applicable).

4.1 Pre-application Meeting

A pre-application meeting or consultation with the PBS department with project location jurisdiction is recommended during the early planning stages of your project. This can be helpful in fully understanding the stormwater requirements and the necessary information needed for project submittal and is crucial for discretionary projects. Please make arrangements with PBS staff as applicable to your project location.

4.2 Follow this Manual

Use this manual to understand the principles and the design procedures prior to planning your project. Use Section 5. *Regulated Projects Stormwater Control Plan* to assist in site layout.

4.3 Stormwater Control Plan

Preparation of the Preliminary SCP, when required (see, *Part A Applicability*), and the final SCP, which is submitted with your project application, will be used for the approval process. Be sure all site design measures, source controls, and bioretention facilities (if required) are appropriately sized and thoroughly explained in the SCP narratives and are delineated on the project site map, landscape design plans, andarchitectural designs.

4.4 Operation and Maintenance Plan (Bioretention Facilities or Equivalent)

During the planning phases, an O&M plan should be drafted for each bioretention facility or equivalent associated with the project, if required. The plan should include: a maintenance schedule, costs associated with maintenance, design life and replacement cost, record keeping of performed maintenance, and a legally binding agreement that identifies the responsible party for maintaining the facilities (Appendix 3, 4, and 6).

4.5 Detailed Project Design

Incorporate site design measures and facilities into project construction documents. The site design and landscape design must demonstrate complete integration of site design measures, treatment/baseline hydromodification (bioretention facilities), and other stormwater features into the overall design. Careful calculation and documentation will aid in facilitating the creation of a good design with or without bioretention facilities.

Some typical design elements can include transitions and edges that allow runoff to flow from sidewalks and paved areas to pervious areas and self-retaining areas. The finalized and professionally stamped construction documents should include the *Regulated Project SCP Checklist* to assist the plan-checker with the review process (Appendix 1).

4.6 Construct the Project

Construction of bioretention facilities (if required) in accordance with the guidelines in this manual should help avoid future complications such as flooding or clogging of pervious voids. The following items need to be considered during the construction phase for all projects, as applicable:

- Construction site Erosion and Sediment control BMPs.
- Avoid soil compaction.
- Follow design elevations.
- Grade parking lots, driveways, and streets to promote evenly distributed sheet flow into bioretention facilities.
- Preserve native vegetation to aid in retention and filtration of stormwater.
- Set overflow inlets at the proper elevation so the surface of the bioretention facility floods as intended.
- Follow prescribed inspection schedule to identify and repair any malfunctioning or inadequately designed facilities.

4.7 Transfer Maintenance Responsibility (bioretention facilities, if required)

Transfer the maintenance responsibility of bioretention facilities (if required) to the owner or operator of the project who will maintain the project in perpetuity.

5.0 REGULATED PROJECTS SCP

Stormwater infrastructure and design must be integrated into the planning, design, construction, and operation and maintenance of a project in its earliest stages. All regulated projects will be required to produce a SCP. Some projects will be required to produce a preliminary SCP. The steps of the preliminary and final SCP include a site assessment, delineation of Drainage Management Areas (DMAs), and a calculation quantifying the reduction in stormwater runoff by using site design measures.

Projects may choose to utilize bioretention facilities or an equivalent LID treatment/baseline hydromodification feature to capture and treat excess runoff from the 85th-percentile, 24-hour storm event that is not retained or infiltrated by the site design measures.

Completing the SCP, using the provided template, includes providing the following details:

1. Project Information
2. Opportunities and Constraints
3. Conceptual Site Design
4. Calculations and Documentation
5. Source Controls
6. Maintenance

Appendix 1 contains the SCP that should be used for Regulated Projects. Appendix 2 contains the Preliminary SCP that should be used for certain discretionary projects, including subdivisions.

5.1 Project Information

Enter the project information into the SCP.

- Project location
- Contact information
- Project Type and Description
- Existing project site impervious surface area (square feet)
- Total new or replaced impervious surface areas (square feet)
- Total post-project impervious surface area (square feet)

5.2 Opportunities and Constraints

Prepare a narrative within the SCP that describes opportunities and constraints. Opportunities include: low areas, oddly configured or unbuildable areas, setbacks, easements, or buffers (which may be used to accommodate bioretention facilities, if required). Constraints include: soils with low permeability, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high intensity land use, heavy pedestrian or vehicle traffic, or safety concerns.

5.3 Conceptual Site Design

Optimizing the site layout can be achieved by applying the following design principles:

- Define the development envelope and protected areas, identifying areas that are most suitable for development and areas to be left undisturbed.
- Concentrate development on portions of the site with less permeable soils and preserve areas that can promote infiltration.
- Limit overall impervious coverage of the site from paving and roofs. Design compact, taller structures, narrower and shorter streets and sidewalks, smaller parking lots, and indoor or underground parking (consult with applicable PBS department staff for requirements specific to project location).
- Set back development from creek, wetlands, and riparian habitats to maximize vegetative buffer widths and meet design criteria set-forth by other requirements.
- Preserve significant trees.
- Utilize and conform to site-specific topography when laying out a site design.
- Avoid excessive grading and disturbance of vegetation and soils.
- Replicate the site's natural drainage patterns.
- Detain and retain runoff throughout the site; direct runoff to lawns or landscaping.
    - *Limit the ratio of impervious to pervious area to 3.5:1, if possible,*
    - *Pervious areas must be relatively flat and the surface should be graded to a slightly concave surface to create a "self-retaining" area;*
    - *Route runoff to a bioretention facility (if required). The facility should have a surface area of at least 4% of the tributary impervious area.*

5.3.1 Tips for Conceptual Drainage Design

- Use an underdrain in bioretention facilities (if required) when sited in clay soils. Bioretention facilities require about three to four feet of head from inlet to underdrain outlet.
- On flat sites, intersperse self-retaining areas with bioretention facilities (if required).
- On sloped sites, it may be advantageous to use traditional measures to pipe stormwater from impervious areas to bioretention facilities to prevent erosion of the slopes.
- Use head from the downspouts by connecting leaders all the way to landscaping or bioretention facilities. Utilize drainage bubblers to disperse piped water to pervious and self-retaining areas.
- Use above-ground flow treatment LID features, such as a flow-through planter design, if site is located on an elevated plaza or if infiltration will contribute to a geotechnical hazard
- Comply with all jurisdictional and State requirements for landscape watering (Water Efficient Landscaping Ordinance) when utilizing vegetation as a design component.

5.3.2 Alternative Methods to Compliance

There exist many avenues for compliance with the MS4 LID requirements. This manual is provided as a guide for achieving compliance. However, different techniques are permissible. For example, the use of a scientifically-validated hydrologic model/analysis to calculate the project run-off is acceptable. The model/analysis must calculate pre- and post-development hydrology from each DMA and must show through calculations that total run-off will not be increased for the design storm and/or the rate/volume of run-off to be treated by each site design measure or treatment/baseline hydromodification facility.

5.3.3 Siting Bioretention Facilities (Treatment/Baseline Hydromodification Facilities)

Bioretention facilities (if required) should be easily accessible for inspection and maintenance. Inlets and outlet structures of the facilities should be placed in areas that permit easy access for inspections and maintenance. The shape of the facility is very flexible, which should make accessibility attainable.

In commercial, mixed-use, and multi-family developments, facilities can be located in parking medians, parking islands, street set-backs, side and rear setbacks, and other landscaped areas. In highly urbanized areas where pervious space is limited or non-existent, bioretention facilities may take the form of flow-through-planters. Additionally, tree-box-type biofilters and in-vault media filters may be approved (on a case-by-case basis) if they meet the alternatives criteria found below.

In residential subdivisions, a common technique used in placing bioretention facilities is to drain stormwater to the street and then from the street to a larger bioretention facility located on a common property that can double as a recreation area. The following alternative siting guidelines flowchart should act as a guide when choosing an alternative to the standard bioretention facility design.

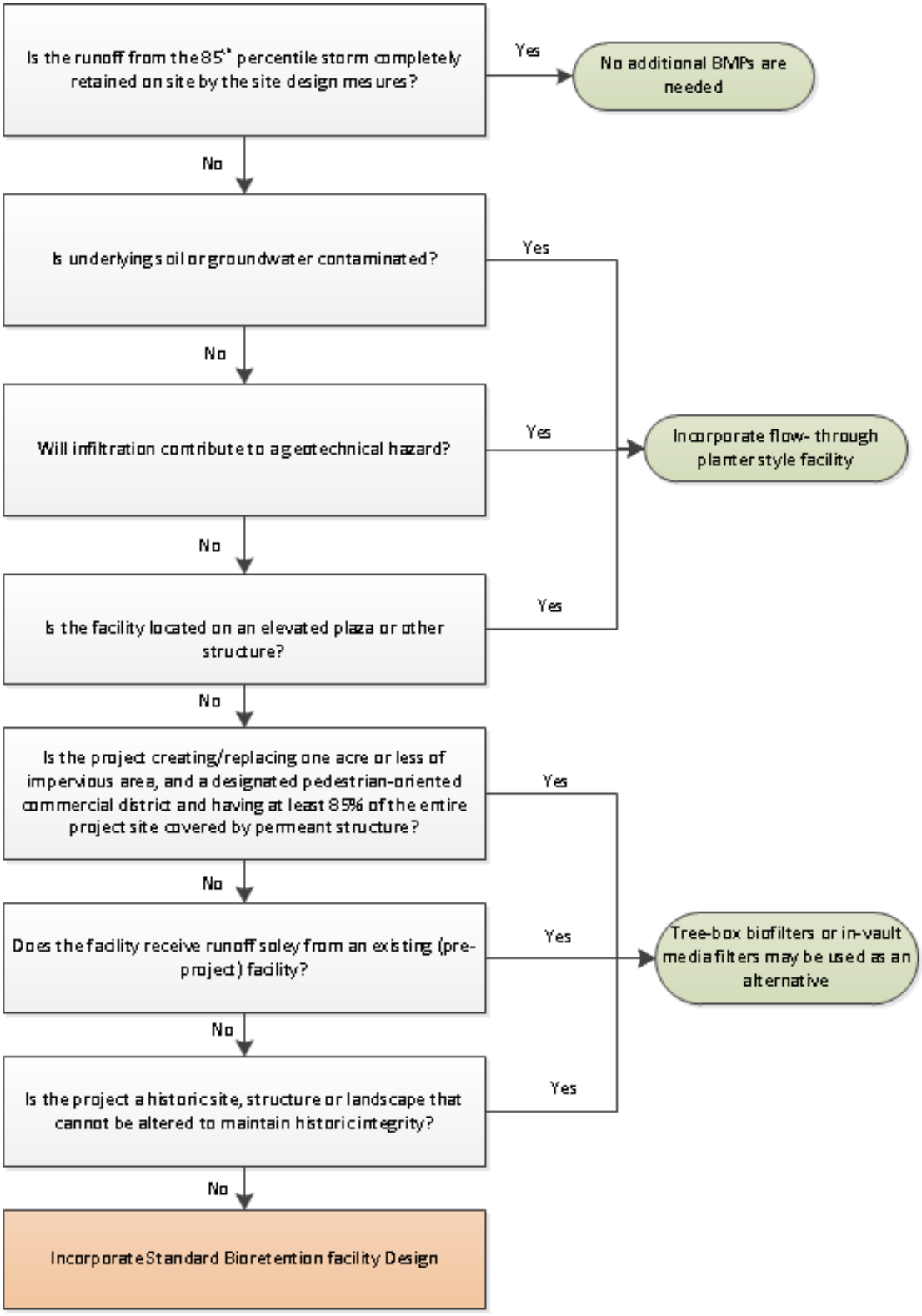


Figure 2. Alternatives to Standard Bioretention Facility

5.3.4 Alternatives to Bioretention Facilities (if required)

The bioretention facility design described in this manual is relatively easy to maintain, aesthetically pleasing, attenuates peak flow, and is effective at removing pollutants. However, alternative stormwater treatment and baseline hydromodification facilities may be proposed by the designer if the designer can demonstrate that the proposed facility meets all of the following measures of equivalent effectiveness criteria when compared to bioretention facilities, found in section E.12.e (ii)(g) of the MS4 General Permit:

- Equal or greater amount of stormwater runoff infiltrated or evapotranspired;
- Equal or lower pollutant concentrations in stormwater runoff that is discharged after biotreatment;
- Equal or greater protection against shock loading and non-stormwater spills;
- Equal or greater accessibility for maintenance and inspection.

Proposed alternative stormwater treatment and baseline hydromodification facilities will be reviewed on a case-by-case basis by the jurisdictional agency.

5.4 Calculations and Documentation

The SCP is the primary document that the plan checker will use to determine if you have met the necessary requirements for the MS4 General Permit. Choosing the site design measures and quantifying the runoff reduction are the major steps to compliance with the MS4 General Permit requirements and may, in some cases, be all that is required of the project. However, prior to selecting site design measures and quantifying the reduction, a site assessment which will identify DMAs must be completed. DMAs are areas, both impervious and pervious, that divide a project site into small drainage units, each unit draining to a common point. Knowing the size of each DMA will allow for easy quantification of runoff reduction using the recommended site design measures and for sizing bioretention facilitiesor equivalent, as applicable.

A site map must be included with the SCP. This map should show the location and name of pertinent features so that it can be easily cross-referenced in the SCP. In Section 6 *Documenting Your Design,* a detailed outline is presented for the development of your SCP.

5.5 Bioretention Design Criteria

The design standards for bioretention facilities are listed in Section 6.3 and Appendix 4. These standards will aid in project design and sizing of the facilities. The criteria that apply to your stormwater facility should be detailed in the SCP.

5.6 Source Controls

Regulated projects with pollutant-generating activities and sources are required to implement standard permanent and/or operation source control measures, as applicable, in addition to the basic requirements for a *Regulated Project*. Some examples of source control include trash enclosures, street or parking lot sweeping, and proper materials storage practices.

Measures to address potential pollutants shall be designed consistent with the recommendations from the California Stormwater Quality Association (CASQA) Stormwater BMP Handbook for New Development and Redevelopment, or equivalent manual. The applicable BMP fact sheets from the CASQA Handbook are located in Appendix 7 and should accompany the SCP.

A Stormwater Pollutant Sources/Source Controls Checklist designed to assist project applicants in identifying which pollutant-generating activities and sources are part of their project and offer guidance on BMP selection is found in Appendix 7. The applicable BMPs must be included in the final project design plans submitted to the applicable PBS department and must be included in the SCP worksheet with a brief narrative describing how they will be implemented. Include the CASQA BMP sheets for the source control BMPs that will be used for the project.

5.7 Maintenance (Bioretention Facilities, if required)

In your SCP, specify the means by which maintenance of your bioretention facilities (if required) will be financed and implemented in perpetuity. The O&M Plan must accompany the SCP. The O&M Plan should include the following sections: BMP maintenance agreement, documentation of the responsible individual for the operation and maintenance, and a schedule for maintenance of the facility (see Appendix 6 for O&M Plan Checklist and Certification template).

5.7.1 Maintenance Agreement

A formal, signed maintenance agreement for bioretention facilities shall be executed between the property owner and the County of Humboldt or Cities of Arcata, Eureka, Fortuna, and Trinidad, as applicable to project location. The maintenance agreement will be recorded among the deed records at the County Recorder's Office so that the agreement will be attached to the title of the land and follow future property ownership transfer.

Upon conveyance of the deed during property transfer, the person acquiring the property must agree to maintain the private, on-site bioretention facilities for the entire duration for which the property is owned. A copy of the BMP maintenance agreement shall be included in any sales and/or lease agreements involving the property.

5.7.2 On-Going Operation and Maintenance

Bioretention facilities must be routinely inspected and maintained by the property owner in order to avoid operational issues. As the functionality of bioretention facilities can have an effect on the functionality of other facilities in the area, continual operation of the bioretention facilities at the level to which they were designed is necessary.

In the event that appropriate maintenance is not carried out and operation of the bioretention facility is compromised, the property owner shall allow County or City staff or their designees the option to enter the property to inspect the affected bioretention facilities and make suggestions on how to restore the facility back into good working order. All expenditures associated with bioretention facility restoration, in addition to any imposed fines or penalties, shall be the responsibility of the property owner, as described in the maintenance agreement.

5.7.3 Maintenance Record Keeping

Bioretention facility inspection and maintenance records must be kept by property owners for a period of at least five years and shall be made available upon request by the County or City, as applicable. These records shall include copies of completed inspection reports and maintenance checklists to document any inspection and maintenance activities that have been conducted within a five-year period. Any corrective actions, repairs, or replacements shall also be documented and kept with the inspection and maintenance records for a minimum of five years.

5.8 Hydromodification (if required)

Hydromodification projects are Regulated Projects creating and/or replacing one acre or more of impervious surface that create a net increase in impervious surface. The required performance standard for hydromodification control consists of maintaining post-project runoff at or below pre-project flow rates for the 2-year, 24-hour storm event.

Compliance with this standard can be met through the use of self-retaining areas (as referenced in Section 6.1.1 Types of Drainage Management Areas). However, soil infiltration rates on-site must be taken into account using *American Society for Testing and Materials (ASTM) D 6913 Standard Test Methods for Particle Size Distribution (Gradation) of Soils Using Sieve Analysis* and *ASTM D 7928 Standard Test Methods for Particle Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis* ~~*ASTM D 422 standard test method for particle size analysis of soils*~~ the hydromodification design storm requirement.

2-year, 24-hour storm (NOAA, 2014):

- Humboldt Bay MS4 Areas, 2.93 inches
- Shelter Cove MS4 Area, 4.11 inches

Sites with infiltration rates less than 1.0 inch per hour do not meet the hydromodification requirements using the self-retaining ratio method; alternatives to the self-retaining area will need to be discussed with the jurisdictional permitting authority.

Follow the chart below to determine the steps necessary for using the self-retaining area to comply with the hydromodification design storm requirements.

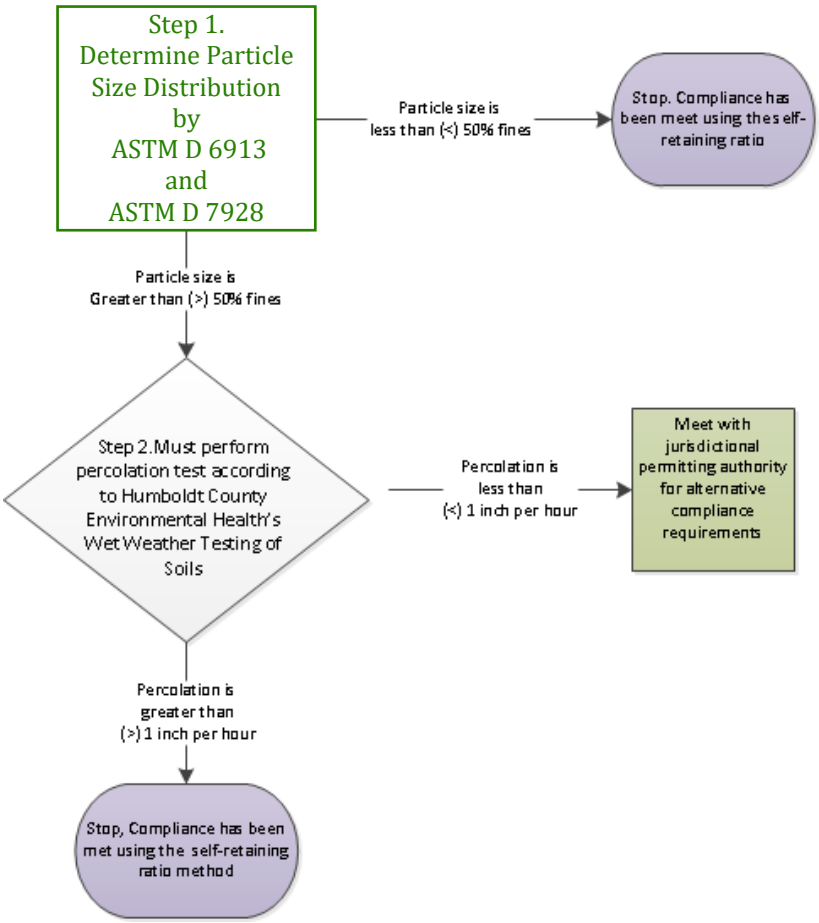


Figure 3. Procedure for Documenting Compliance with Hydromodification Requirements

6.0 DOCUMENTING YOUR DESIGN

The following procedures are to assist in designing and documenting the LID measures used on projects. The SCP form contains a checklist of requirements for the site plan; by signing the SCP, you are indicating that all requirements listed in the checklist have been included on the site plan. In some cases, alternative SCP formats may be accepted. Alternatives must include all information requested in the provided SCP worksheet.

The following procedures outline the basic components of the design and include: delineating DMAs, identifying DMA types and runoff factors, selecting site design measures and calculating runoff reduction, selecting the layout of bioretention facilities, and calculating the size of bioretention facilities.

6.1 Delineating DMAs

For the purposes of this manual and compliance with the MS4 permit, a DMA is the entire area that drains into a specific receiving area or accumulation point. To better understand and mitigate stormwater runoff patterns,the project site must be separated into one or more DMAs based on breaks in slope or other physical obstructions or water flow conduits. Each DMA will then be addressed individually for designing BMPs or other LID features and meeting stormwater capture and treatment requirements.

6.1.1 Types of Drainage Management Areas

DMAs should be designated according to how they relate to the treatment of stormwater runoff. These designations include: self-treating areas, self-retaining areas, areas draining to a self-retaining area, and areas draining to a specific treatment/bioretention facility. The type of DMA will dictate how the runoff reduction calculation is made. Effective site design implementation to reduce impervious area runoff will often lead to projects that do not require the design of bioretention facilities for volume capture/flow treatment or hydromodification analysis.

6.1.1.1 Self-Treating Areas

Landscaped or turf areas that capture and infiltrate stormwater or drain off-site and do not drain to bioretention facilities are self-treating areas. These are pervious areas such as landscaping that do not generally receive drainage from impervious areas. These areas are typically flat or have a very gentle slope that ensures absorption of stormwater by the vegetation and soil.

6.1.1.2 Self-Retaining Areas

Areas that have topography such that stormwater is retained in a concave basin-like depression (capture and retain 0.65-inches of water; *1.3 inches in Shelter Cove MS4 area*) before overflowing and draining into a storm drain system. These areas have high infiltration rates (greater than 1 inch per hour) which quickly dissipate water and have vegetation that allows for efficient use of water. These areas can be enhanced by replacing low-infiltrating native soils with amended soils that have high infiltration ratings.

6.1.1.3 Impervious Areas Draining to a Self-Retaining Area

These areas are similar to the above DMA type except that they receive runoff from impervious areas. The self-retaining area size must adhere to a strict 3.5 parts impervious to 1 part pervious ratio or better (3:1, 2.5:1, etc...). *The Shelter Cove MS4 Area must adhere to a strict 1.3:1 ratio or better*. The entire area must be designed to retain the first 0.65 inches of stormwater, or *1.3 inches in the Shelter Cove MS4 area* (the 85th percentile 24-hour storm event) from the impervious area and the self-retaining area itself without flowing off-site or into the storm drain system. Prolonged ponding is a potential problem at higher impervious to pervious ratios.

It is important to ensure that soils can handle the additional run-on and are sufficiently well drained *(USDA Hydrologic soil Groups A, B, or C or equivalent rates demonstrated by on-site testing)*.

Adhering to the 3.5:1 ratio (impervious to pervious) and the 3-inch retention rule ensures compliance with the MS4 permit. The permit states that "permitees must implement Site Design Measure […], based on the objective of achieving infiltration, evapotranspiration and/or harvesting/reuse of the 85th percentile 24-hour storm runoff event."

> For example, a roof of 350 SF (50,400 square inches) drains to a self-retaining area. This area, using the 3.5:1 ratio, must be at least 100 SF (14,400 square inches), with a retention depth capacity of 3 inches. Three inches is used because 3.5 parts of the runoff will come from the impervious area (50,400 square inches X 0.65 inch = 32,760 cubic inches) and 1 part will come from the self-retaining area itself (14,400 square inches X 0.65 inch = 9,360 cubic inches). In this example, the self-retaining area must be able to hold 42,120 cubic inches of water (approximately 24.4 cubic feet). If the area (self-retaining area) is 100 SF (14,400 square inches) by 3 inches deep or a total of 43,200 cubic inches (25 cubic feet) than the 85th percentile 24-hour storm event, which is a 0.65-inch event, is captured within the self-retaining area.

In the Humboldt Bay area (at Woodley Island), the 85th-percentile, 24-hour storm event is equivalent to approximately 0.65 inches. At a 3.5:1 (impervious to pervious ratio), the self-retaining area must be able to retain the first 0.65 inches of stormwater runoff from the impervious areas and the first 0.65 inches that falls on the self-retaining area itself. The self-retaining area should be depressed approximately 3 inches to achieve this retention requirement.

Note: The 3.5:1 ratio based on the 0.65-inch, 85th percentile, 24-hour storm event for Woodley Island is applicable to Humboldt Bay regional MS4 areas (Trinidad, McKinleyville, Arcata, Eureka, unincorporated Eureka area, and Fortuna), see maps included in Part A. Due to greater rainfall amounts in the Shelter Cove MS4 area (1.3-inch, 85th-percentile 24 – hour storm), a different ratio must be used; 1.3:1 (California Coastal Commission, 2015)

6.1.1.4 Areas Draining to a Bioretention Facility

These areas will be used to calculate the required size of a bioretention facility. For each DMA, calculate the area of the DMA, post-project surface type, and the runoff reduction resulting from the use of site design measures. Use the RegulatedProjects Worksheet 1 and 2 for calculations and to document the use of stormwater runoff reducing site design measures,Appendix 1. Utilizing self-retaining areas as a runoff reduction BMP first will help in reducing the need for other site design measures and will reduce the size needed for a bioretention facility, if applicable.

6.2 Site Design Measures to Reduce Runoff

The next steps in the documentation process are to identify the site design measures that will be utilized within each DMA and quantify reduction achieved by using site design measures for each DMA using Worksheet 1 and 2. Site design measure specifications and siting requirements can be found in Appendix 3, *Site Design Measures*. If reduction targets can be met with self-retaining areas and site design measures, further treatment using bioretention facilities or equivalent is not required. ~~Infiltration systems, galleries, and dry wells can be used as effective Site Design Measures. These devices must meet the criteria found in Appendix 3.~~ However, due to the plethora of design choices and proprietary devices available, they are included in the Site Design Measure Worksheet (Worksheet 2) as general measures only. If these devices will be used for discretionary projects, check with staff for preapproval and runoff reduction credit. Proposed site design measures must meet criteria found in Appendix 3.

6.3 Bioretention Facilities

In accordance with section E.12 of the MS4 General Permit, site design measures shall be implemented based on the objective of capturing (retaining) stormwater runoff from the 85th-percentile, 24-hour storm event to the extent technically feasible. Any remaining runoff, from impervious DMAs, may then be directed to one or more bioretention

facilities or equivalent. The DMA tributary area to the bioretention facility will then be multiplied by a sizing factor of 0.04; this is performed to calculate the minimum footprint of the bioretention facility, assuming that all design specifications outlined in this manual are followed.

> A sizing factor of 0.04 (facility can treat up to 25 times the size of the facility footprint) is used, in conjunction with the other specifications for a bioretention facility (soil/compost infiltration rate (5"/hour), reservoir depth, gravel layer depth, etc…), because these specifications meet the specific requirements in the MS4 permit [E.12.e. ii (f)]

After computing the minimum bioretention facility size, review the site plan to determine if the reserved space for the facility is sufficient. If the area is not sufficient, revise the plan accordingly.

6.3.1 Bioretention Facility Design

Bioretention facilities can be incorporated in a variety of shapes. However, each of the layers within the facility must be designed and built flat and level. The following must have consistent elevations throughout:

- Bottom of excavation/ gravel layer (BGL)
- Top of gravel storage layer (TGL)
- Top of soil layer (TSL)
- Rim of facility reservoir

The surface reservoir should be level and circumscribed by a ridged boundary such as a concrete curb, masonry, or landscape timbers.

6.3.1.1 Gravel Layer

The gravel layer must be a "Class 2" open graded substrate: Caltrans specification 68-2.02F(3) is recommended. Drain rock or other granular material may be used. The depth of the gravel layer must be at least 12 inches. It must also be equivalent in area to the surface area of the facility (Appendix 4).

6.3.1.2 Planting Medium

A mixture of sand (60%-70%) and compost (30%-40%) should be used. The mixture must meet the following requirements: have the ability to sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project; sand mixture must meet the specifications of American Society for Testing and Materials (ASTM) C33. The specific compost and sand combination which meets the above requirements is found in Appendix 4.

6.3.1.3 Underdrain

When using an underdrain, a polyvinyl chloride (PVC) pipe diameter of 4 inches must be used, grade SDR 35 or equivalent. A perforated pipe,installed with perforations facing down, should be embedded into the TGL. The connection with the storm drain must notbe lower than the TGL. A threaded, capped cleanout connected by a sweep bend should be used. For a more detaileddiagram of the requirements, see Appendix 4.

6.3.1.4 Plantings and Mulch

Select an appropriate plant palette or similar for the bioretention facility from Appendix 5.

Aged mulch should be used. Bark mulch has a tendency to float and may flow out of the facility during large events. Aged mulch or compost mulch reduces the chance of weed establishment, keeps soils moist, and replenishes nutrients.

Avoid the following:

- Overly dense plantings that prevent the flow of stormwater into the facility
- Plants with roots that inhibit percolation or block inflow
- Invasive weeds
- Plants that may require fertilizers or high water demands

6.3.1.5 Irrigation

Irrigation controls should be configured for the plant palette selected for the specific facility. Drip emitters are a preferred method for delivering water to the vegetation.

6.3.1.6 Tips for Good Design

Make sure all bioretention facilities are shown in all site plans, architectural drawings, and landscape designs. Be certain that these facilities will not interfere with other site design elements and that all elevations are shown and are consistent with the surrounding grading, drainage, and paving plans. Sharing a bioretention facility with a cable vault, phone vault, electrical boxes, or other utility box should be avoided.

6.4 PPPP - Porous Asphalt, Pervious Concrete, Permeable Pavers (alternative engineered hardscaping surfaces)

Criteria for PPPP utilize standards which are derived from structural construction requirements. Areas that are highly erodible should not drain on to pervious pavement.

A reservoir base course of open-graded crushed stone must be deep enough to retain rainfall (3" minimum) and support design loads (a greater depth may be required). The subgrade must be uniform and slopes must be gentle enough so that the subgrade is not prone to erosion. Sub-drains are not recommended; however, if a subdrain is included, the outlet elevation must be 3 inches or more above the bottom of the base course.

A rigid edge is required if granular pavements and/or unit pavers are used. Solid pavers should be set in sand or gravel with a minimum 3/8-inch gaps between pavers. Joints should be filled with an open-graded aggregate free of fines. Bedding sands shall conform to the grading requirements of ASTM C 33 (Interlocking Concrete Paving Institute).

Pervious concrete and porous asphalt should be installed by certified professionals and according to vendor recommendations. Other considerations when choosing pavements should be the site aesthetics, uses, and requirements (if applicable) of the Americans with Disabilities Act.

7.0 REGULATED REDEVELOPMENT, ROAD PROJECTS, AND LINEAR UNDERGROUND/OVERHEAD PROJECTS

Regulated Redevelopment Projects are any projects, private or public, that result in the creation, addition, or replacement of exterior impervious surface area (5,000 sq. ft. or greater) on a site on which some past development has occurred. The

following is specific MS4 permit language describing the requirements for the two different types of redevelopment projects.

> Where a redevelopment project results in an increase of less than (<) 50 percent of the impervious surface of a previously existing development, only runoff from the new and/or replaced impervious surface, must be treated per the requirements for Regulated Projects.

> Where a development projects results in an increase equal to or greater than (>) 50 percent of the previously existing development, runoff from the entire project, consisting of all existing, new, and/or replaced impervious surfaces, must be treated per the requirements for Regulated Projects.

In both cases, the amount of impervious surface created, replaced, or added must be over 5,000 sq. ft. to qualify as a regulated redevelopment project. Examples of common redevelopment projects are given below to aid in the understanding of these requirements.

Example 1
A project proposes adding 6,000 sq. ft. of impervious area to an existing developed lot. Currently, the lot has a structure and parking lot (total impervious area is 4,500 sq. ft.)

The additional impervious area triggers the regulated project requirements and the 50 percent requirement. Thus, the entire impervious areas, existing and proposed, will be required to comply with the Regulated Project requirements.

Example 2
A project proposes adding a 2,000 sq. ft parking lot on an existing developed lot. Currently, the lot has a structure and small parking pad (total impervious area of 8,000 sq. ft.).

The additional 2,000 sq. ft. does not trigger the Regulated Project or the Small Project requirements because the "new" development is not over 2,500 sq. ft. or 5,000 sq. ft.

Example 3
A project proposes replacing an existing structure, with an impervious area of 3,500 sq. ft., with a building of the same size and amount of impervious area, 3,500 sq. ft.

The project does not meet the 5,000 sf. ft. threshold for regulated projects. It does, however, meet the small project threshold and should comply with the small project requirements.

Example 4
A project proposes adding an addition with an impervious area of 6,500 sq. ft. to an existing building with an impervious area (including parking lot) of 14,000 sq. ft.

The project does not meet the 50 percent threshold but it is considered a Regulated Project. Thus, the new impervious surface will be required to comply with the Regulated Project requirements. The existing impervious area will not need to be included in the calculations.

7.1 Linear Underground/Overhead Projects (LUPs) and Road Projects

LUPs and road projects are exempt from LID requirements unless the LUP has a discrete location that has 5,000 sq. ft. or more of newly constructed contiguous impervious surface. There is not a trigger for LUPs to follow the small project requirements.

A non-exempt LUP or road project is required to follow the regulated project requirements on the specific discrete location that has an area greater than 5,000 square feet. These include:

- Construction of new streets or roads, including sidewalks and bicycle lanes built as part of the new streets or roads
- Widening of existing streets or roads with additional traffic lanes
    - If more than 50 percent of the existing impervious surface is altered, then runoff from the entire project (old surface area and new surface area) must be included in the calculations
    - If less than 50 percent (but 5,000 sq. ft or more) of the impervious surface is altered, only the runoff from the new and/or replaced surface must be included in the calculations

Certain LUPs and road projects with discrete location greater than 5,000 sq. ft. will still be considered exempt despite the contiguous surface area greater than 5,000 sq. ft. These include:

- Sidewalks and/or bicycle lanes built as part of new streets or roads and built to direct stormwater runoff to adjacent vegetated areas
- Impervious trails built to direct stormwater runoff to adjacent vegetated areas or other non-erodible permeable areas, preferably away from creeks or towards the outboard side of levees
- Sidewalk, bicycle lanes, or trails constructed with permeable surfaces
- Trenching, excavation, and resurfacing associated with LUPs; pavement grinding and resurfacing of existing roadways and parking lots; construction of new sidewalks, pedestrian ramps, or bike lanes on existing roadways; or routine replacement of damaged pavement such as pothole repair or replacement of short, non-contiguous sections of roadway.

Contact the PBS department with project location jurisdiction to determine additional project requirements.

8.0 OPERATION AND MAINTENANCE PLAN

An operation and maintenance plan (O&M plan) will be required for bioretention facilities (if required) or equivalent treatment baseline hydromodification facilities. The primary component of an O&M plan is the agreement to maintain the facility, which transfers from owner to owner (stays with the property) in perpetuity. A condition will be recorded with

the County Recorder's office that indicates the presence of a bioretention facility or equivalent. This recording will also serve as a way for the applicable PBS department with project location jurisdiction to notify the owner on an annual basis in order to complete a simple self-certification notice. This notice will serve as verification that the facility is operational and fully maintained according to the original approved specifications.

If, upon inspection of a facility by the applicable PBS department with project location jurisdiction, a facility is found to be nonfunctioning, impaired, or removed, the applicable PBS Department with project location jurisdiction has the authority to request that the deficiencies be fixed and to impose fines if function is not restored.

The O&M plan must address each bioretention facility on-site. This includes development of a maintenance schedule and the physical descriptions of each facility including location and construction specifications. The O&M plan should be kept onsite and updated when changes occur to the contact person/designated individual.

Key components of the O&M plan include:

1. Designate the Responsible Individual (RI)
2. Description of all bioretention facilities
3. Schedule maintenance activities
4. Annual self-certification

8.1 Responsible Individual

The RI is the person accepting all responsibility for the operation and maintenance of the bioretention facilities until the facilities are transferred to another entity. Contact information for the RI should be provided and updated upon transfer to another individual. A written condition will be recorded with the Assessor's office. This will be used to track facilities as well as used as a way for the applicable PBS department with project location jurisdiction to contact the RI on an annual basis for verification of the continued operation of the facility.

8.2 Description of all Bioretention Facilities

A description of all bioretention facilities should be included in the O&M plan. The specific description must include: the location of the facilities (a map can be used), the dates that the facility(s) were installed, and a description of each facility.

The facility description should include: depths of sand or soil compaction, pipe materials and bedding, location and layouts of inflow piping and piping to off-site locations, and native soils encountered beneath the facility.

8.3 Schedule Maintenance Activities

An annual maintenance schedule is needed to be in compliance with the MS4 permit. However, some facilities will need more routine maintenance in the early stages to ensure that the vegetation within the facility is healthy and that the facility is functioning properly. Annual maintenance should include:

- Cleaning debris (trash/refuse) out of the facility; this is very important at the inlets.
- Pruning vegetation and replacing dead vegetation.
- Controlling invasive non-native vegetation (weeds) without the use of synthetic herbicides.
- Adding mulch when needing to control weeds, replenish soil nutrients, and to maintain adequate soil moisture.

8.4 Plan Compilation

A sample O&M plan template can be found in Appendix 6. This O&M plan template is only a sample; a plan that adequately addresses the key components but does not necessary follow the template may be approved. However, it is recommended that the template be used.

8.5 Annual Self-Certification

A letter will be sent on an annual basis by the applicable PBS Department with project location jurisdiction to all RIs with an O&M Plan for a bioretention facility(s) or substituted equivalent. This letter will be used by the RI to certify that all scheduled maintenance on the facility(s) has been completed for the year and that the operation of the facility has not been compromised. It will also be used by the RI to notify the applicable PBS Department with project location jurisdiction and County Recorder's office of any transfers of responsibilities (change in ownership) or other changes to RI contact information.

APPENDIX 1

Stormwater Control Plan for Regulated Projects

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

For Office Use Only
Application No._____
Received By: _____

Instructions
Based on the Stormwater Information Sheet in Humboldt LID Stormwater Manual – Part A, you have determined that your project is classified as a Regulated Project. Use this form to assist you in designing your project to comply with the MS4 General Permit post-construction requirements for Regulated Projects. This completed and signed Stormwater Control Plan for Regulated Projects including additional supporting documents as required, must be submitted with your project application to the applicable PBS department with project location jurisdiction.

A. Project Information and Description

Project Name: _____

Physical Site Address: _____

Assessor's Parcel Number: _____

Project Applicant: _____

Mailing Address: _____

Phone: _____

Email: _____

Name, email and address of project consultant, if any (e.g., engineer, architect, designer):

Name: _____

Firm: _____

Address: _____

Phone: _____

Email: _____

Type of Application/Project:
What type of application is this checklist accompanying?

☐ Grading Permit ☐ Use Permit ☐ Subdivision

☐ Building Permit ☐ Design Review ☐ Other (please specify) _____

Project Type and Description:	
Total Pre-Project Impervious Surface Area (square feet)	
Total New or Replaced Impervious Surface Area (square feet) **[Sum of impervious area that will be constructed as part of the project]**	
Total Post-Project Impervious Surface Area (square feet)	

This Regulated Projects Stormwater Control Plan provides guidelines and methods for assessing site conditions, determining runoff values for site DMAs, implementing site design measures with the goal of reducing stormwater runoff values from impervious surfaces, and determining the size of bioretention facilities (if required). Strategic use of site design measures may enable compliance without the need for bioretention facilities or equivalent.

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

B. Site Assessment (Opportunities and Constraints)

1. Soil Characteristics

I. Soil characterization method_____

II. Were infiltration rates assessed for the site? ☐ Yes ☐ No

If Yes, please attach soils testing report

2. Depth to Groundwater

I. What is the depth (below ground surface) to groundwater (in feet)?_____

II. How was this determined?_____

3. Existing Vegetation and Natural Areas

I. Are there any key natural vegetation areas, sensitive habitats, or mature trees on the site?

☐ Yes ☐ No

If yes, please draw and label these features on the existing conditions site plan map and attach to this document.

4. Drainage and Hydrograph

I. Are there any natural drainage or wet area features such as: natural ponds, springs, vernal pools, marshes, and wet meadows on the site or directly adjacent to the site?

☐ Yes ☐ No

If yes, consult with applicable PBS department staff with jurisdiction for project location as additional project area restrictions may apply.

5. Potential Contamination

I. Is the project site within or near to a registered contaminated site, according to the State Water Resources Control Board Geotracker Website (http://geotracker.waterboards.ca.gov/)?

☐ Yes ☐ No

If yes, please attach the applicable contaminated site report from the Geotracker website, and note the location of the contaminated site on the existing conditions site plan map. Please attach a description explaining how this contamination will affect your project design.

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

C. Project Layout Optimization

Optimizing the site layout can be done through the following methods:

1. Define the development envelope and protected areas, identifying areas that are most suitable for development and areas to be left undisturbed.
2. Concentrate development on portions of the site with less permeable soils and preserve areas that can promote infiltration.
3. Limit overall impervious coverage of the site from paving and roofs.
4. Set back development from creek, wetlands, and riparian habitats, to maximize vegetative buffer widths.
5. Preserve significant trees.
6. Conform the site layout along natural landforms.
7. Avoid excessive grading and disturbance of vegetation and soils.
8. Replicate the site's natural drainage patterns.
9. Detain and retain runoff throughout the site.

Based on the features included in the existing conditions site plan, please ensure your project site plan applies project layout optimization measures to the greatest extent practicable, while still meeting the objectives of your project.

Have you attached a short description of how site optimization techniques have been integrated into the project design?

☐ Yes ☐ No

D. Source Controls

Does your project contain potential pollutant-generating activities or sources?

☐ Yes ☐ No

If Yes, please complete the Source Control Worksheet (Appendix 7) and list and identify the source or treatment control measure and locations and include as an attachment to the SCP document.

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

E. Drainage Management Areas

On the project site plan please delineate and label all drainage management areas (refer to Sec. 6 of the manual).

For each Drainage Management Area identified on the project site plan, complete the Regulated Projects Runoff Worksheets (attached) to document runoff values, implementation of Site Design Measures, and bioretention facility sizing (if required). Every DMA within the project shall be listed in Worksheet 1(attached)

In accordance with section E.12 of the MS4 General Permit, Site Design Measures shall be implemented based on the objective of capturing (retaining) stormwater runoff from the 85th percentile 24-hour storm event, to the extent technically feasible. Any remaining runoff, from impervious DMAs, may then be directed to one or more bioretention facilities or equivalent. Projects over 1 acre must adhere to hydromodification standards if applicable. (refer to Sec. 5.8 of the manual).

F. Runoff Reduction Measures

Worksheet 1 provides a method for project applicants to document compliance with runoff reduction requirements through a site design methodology that directs stormwater runoff from impervious surface areas to pervious self-retaining areas for capture and infiltration (as detailed in LID Manual – Section 6.0). Using this methodology, all stormwater runoff from the 85th percentile 24-hour storm event for each DMA can be captured and retained on site and compliance with the MS4 General Permit runoff reduction requirements can be met.

Capturing stormwater runoff using the site design methodology where runoff from impervious surface areas is directed to pervious self-retaining areas is a convenient alternative for achieving compliance with the MS4 General Permit runoff reduction requirements, while avoiding the need for bioretention facilities. Worksheet 1 provides a simple calculation for determining if stormwater runoff reduction measures have been met using this design methodology.

Due to site constraints, not all projects or project DMAs may be able to achieve compliance with runoff reduction requirements by directing impervious surface stormwater runoff to pervious self-retaining areas. The project applicant will need to complete Worksheet 2 for each DMA (*6.0 Documenting Your Design*) that cannot meet compliance with runoff reduction measures as determined using Worksheet 1.

Worksheet 2 will be used to apply Site Design Measures in addition to any pervious self-retaining areas with the goal of reducing stormwater runoff values from impervious surfaces such that a no net stormwater runoff value (using the design storm) for each DMA is achieved. The worksheet process is an iterative exercise. If compliance cannot be met during the first iteration of calculations alter the site design measures to increase capturing capacity and rerun the calculator.

Site Design Measures include the following:

- ☐ 1. Tree Planting and Preservation
- ☐ 2. Rain Barrels or Cisterns
- ☐ 3. Impervious Area Disconnection
- ☐ 4. Soil Quality Improvement
- ☐ 5. Green Roof
- ☐ 6. PPPP (alternative engineered hardscapes)
- ☐ 7. Vegetated Swales
- ☐ 8. Stream Setbacks and Buffers
- ☐ ~~9. On-site Infiltration (trench, dry well, gallery, or system)~~

Multiple Site Design Measures may be applied to best meet site conditions in order to reduce stormwater runoff values from impervious surface areas.

After application of Site Design Measures, any remaining stormwater runoff from each DMA, must then be directed to one or more bioretention facilities or equivalent in accordance with Section 6.3 of the manual and the MS4 General Permit.

G. Bioretention Facility

Indicate whether a Bioretention Facility or equivalent is required for this project.

☐ Yes ☐ No

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

H. Operation and Maintenance in Perpetuity

Indicate whether an *Operation and Maintenance Plan* is accompanying this document, required for bioretention facilities or equivalent).

☐ Yes ☐ No

I. Signature and Certification:

This Stormwater Control Plan is required for all Regulated Projects. This document will be used by the plan checker to confirm that adequate stormwater control measures are being implemented on the project.

Indicate whether all supporting materials and worksheets are accompanying this document, Stormwater Control *Plan*

☐ Yes ☐ No

I, the below signed, confirm that I have accurately described my project to the best of my ability, and that I have not purposely omitted any detail affecting my project's classification for storm water regulation. I hereby certify that the site design measures and storm water flow treatment measures identified herein as being incorporated into my project have been designed in accordance with the Site Design Measure sheets or equivalent and are included in the final site plans submitted to the applicable Planning and/or Building Services Department with project location jurisdiction. I also hereby certify that my project meets the storm water runoff reduction criteria identified in the SCP, or as determined through other approved means.

_____ _____

Signature Date

_____

Print Name

I am the:

☐ Property Owner ☐ Contractor ☐ Applicant

Stormwater Control Plan for Regulated Projects (≥ 5000 sq. ft.)

J. Checklist:

Items on Site Plan	Items within the SCP
☐ Site Boundary	☐ Narrative of site features and conditions that constrain or provide opportunity for stormwater control
☐ Soil types and areal extents. Test pit/infiltration test locations (if required)	☐ Narrative describing the use of runoff reduction measures (sec. F), building features, pavement selections, etc., that reduce runoff
☐ Environmentally-sensitive areas and areas to be preserved	☐ Completed Worksheet 1 self-retaining area
☐ Existing natural hydrological features (depressions, watercourses, wetlands, riparian areas, undisturbed natural areas)	☐ Completed Worksheet 2 site design runoff reduction measures for each DMA
☐ Existing and proposed sited drainage network and connections to MS4 conveyances off-site	☐ Treatment/Bioretention Operation and Maintenance Plan, including: inspection and , maintenance schedule, checklist and certification form and legally binding agreement
☐ Proposed site design measures used to reduce runoff	☐ Bioretention Checklist (if utilized)
☐ DMA delineation labeled with unique identifier	☐ Narrative describing (treatment/ baseline hydromodification)/bioretention facilities including the calculations and location of each facility.
☐ Proposed locations and footprints of improvements creating new, or replaced, impervious surfaces	☐ Source Control Worksheet (if required)
☐ Locations and footprints of bioretention (treatment/baseline hydromodification) facilities (if required)	☐ Soil percolation/infiltration testing documentation
☐ Areas of soil and/or groundwater contamination	
☐ Existing utilities and easements	
☐ Pollutant generation source areas, including loading docks, food service areas, refuse areas, outdoor processing and storage areas, vehicle cleaning facilities/areas, repair or maintenance areas, fuel dispensing area, equipment washing areas	

Worksheet 1: Must include all DMAs within the Project

Regulated Projects Worksheet 1 - Humboldt Low Impact Development Stormwater Manual				
DMA Name	Total Post Project Impervious Surface Area (square feet)	Pervious Self-Retaining Area[1] (square feet)	Ratio of Impervious Surface Area to Self-Retaining Pervious Surface Area	Does Ratio Achieve 3.5 : 1 ratio or better of Impervious Surface Area to Self-Retaining Pervious Surface Area (Yes or No)[2]
Example A	500	150	3.3 : 1	YES
Example B	500	100	5.0 : 1	NO

1: Self-Retaining Areas where impervious surface runoff is directed to the Pervious Self-Retaining Area in accordance with Humboldt LID Manual - Part C, Section 6.0

2: If "Yes", Ratio of Impervious Surface Area to Self-Retaining Pervious Surface Area is equal to 3.5:1 or better (1.3:1 or better in the Shelter Cove MS4 area), then compliance with runoff reduction measures have been met for DMA.
If "No", Ratio of Impervious Surface Area to Self-Retaining Pervious Surface Area does not achieve 3.5:1 or better (1.3:1 in Shelter Cove), then compliance with runoff reduction measures have not been met for DMA (Complete Worksheet 2).

Worksheet 2: (Use one Worksheet for each DMA as applicable)

Regulated Projects Worksheet 2
Humboldt Low Impact Development Stormwater Manual

Project Information					***Formulas/Notes***
DMA Name:					
Total Post-Project Impervious Surface Area (square feet)		A		square feet	
24 hour - 85th Percentile Design Storm		B		inch	**B** = Select Design Storm Value (0.65-inch Humboldt Bay Area, 1.3-inch Shelter Cove)
Impervious Surface Runoff Value (Potential Stormwater Runoff due to impervious surface area and design storm value)		C		Gallons per 24 hours	**C = A x B x 0.083 x 7.48**
Pervious Self-Retaining Area (SRA) Credit (if applicable, if none enter 0)					
Self-Retaining Area (square feet)			SRA Credit	square feet	SRA Credit = Self-Retaining Area x Multiplier. Select **Multiplier** (3.5 Humboldt Bay Area, 1.3 Shelter Cove)
Site Design Measure Credits					
Tree Planting and Preservation					
New Trees	# of trees				
100 square feet per deciduous tree	D		E	square feet	E = D x 100
200 square feet per evergreen tree	F		G	square feet	G = F x 200
Existing Trees (Credit for 50% of existing canopy area)	Canopy diameter (feet)				
Tree #1	H_1		J_1	square feet	$J_1 = 3.14 \times (H_1/2)^2 \times 0.50$
Tree #2	H_2		J_2	square feet	$J_2 = 3.14 \times (H_2/2)^2 \times 0.50$
Tree #3	H_3		J_3	square feet	$J_3 = 3.14 \times (H_3/2)^2 \times 0.50$
Rain Barrel or Cisterns (55 gallon minimum)					
Square foot credit per gallon based on 24-hour, 85th Percentile Design Storm	K				**K** = Select square foot credit per gallon (2.48 Humboldt Bay Area, 1.24 Shelter Cove)
	Gallons				
Rain Barrels	L		M	square feet	M = L x K
Cisterns	N		O	square feet	O = N x K
~~**Infiltration Trench/Basin (55 gallon minimum - 21 ft^{3**})**~~	~~cubic feet~~				
~~volume(ft^3) = length x width x depth~~	~~P~~		~~Q~~	~~square feet~~	~~Q = P x R x K x 7.48~~
~~porosity (approximate %)~~	~~R~~	~~35%~~			
~~**Subsurface Infiltrators (55 gallon minimum)**~~					
~~Proprietary units vary, insert estimated storage in ft^3~~	~~S~~		~~T~~	~~square feet~~	~~T = S x 7.48~~
Impervious Area Disconnection Credit per square foot of impervious area feeding into pervious area			U	square feet	U = Enter square foot value
Soil Quality Improvement					
Credit per square foot of soil quality improvement			V	square feet	V = Enter square foot value
Green Roof					
Credit per square foot of green roof installation			W	square feet	W = Enter square foot value
PPPP (Porous Asphalt, Pervious Concrete, Permeable Pavers)					
Credit per square foot of PPPP			X	square feet	X = Enter square foot value
Vegetated Swales					
Credit per square foot of vegetated swale			Y	square feet	Y = Enter square foot value
Stream Setbacks and Buffers					
Credit per square foot of stream setback and buffer#			Z	square feet	Z = Enter square foot value
Credits Total			AA	square feet	AA = SRA Credit + E + G + J_1 + J_2 + J_3 + M + O + Q + T + U + V + W + X + Y + Z
Post-Project Impervious Surface Area minus Site Design Measure Credits			BB	square feet	BB = A - AA
NEW Impervious Surface Runoff Value (Potential Stormwater Runoff due to impervious surface area and design storm after implementation of Site Design Measures)			CC	Gallons per 24 hours	CC = BB x B x 0.083 x 7.48
Percent reduction in Impervious Surface Runoff Value*			DD	%	DD = ((C - CC) / C) x %100

***If value for DD is not greater than or equal to %100 then bioretention is required for treating remaining runoff from impervious area indicated by value BB. Design and implement bioretention facility in accordance with Humboldt LID Stormwater Manual - Part C.**

****Infiltration Trench/Basin calculations are based on porosity (35%). Increased trench dimensions (volume) are required to meet 55 gallon minimum capacity.**

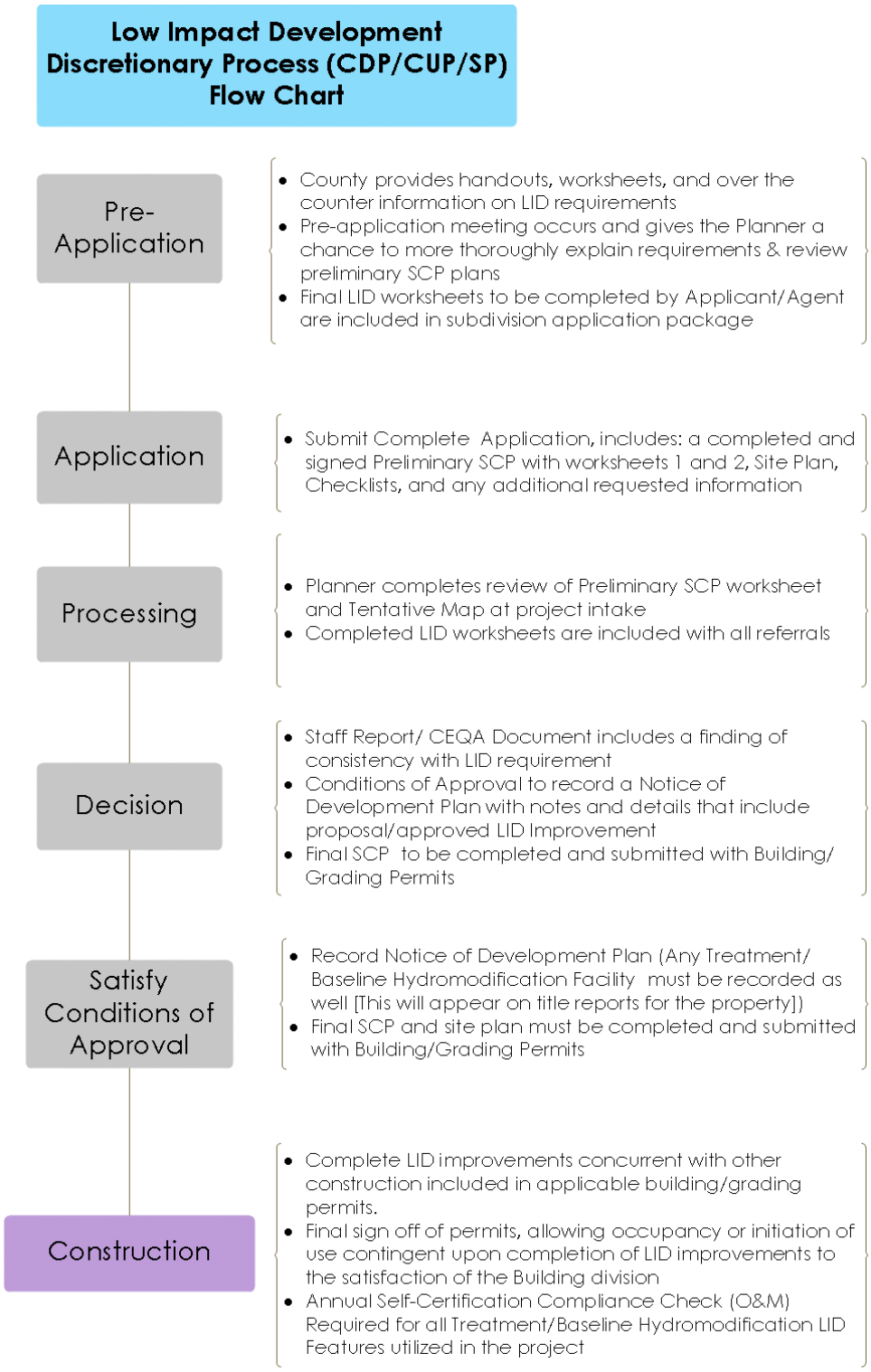
Green — Fill In [Enter Value]	Conversions Used:
Red — Calculated Value	1 inch = 0.083 feet
Black — Fixed Value/Selectable Value	1 cubic foot = 7.48 gallons
Regulated Projects Worksheet 2, Version 2.0 - June 29, 2016	# check with agency with project area jurisdiction for requirements

APPENDIX 2

Preliminary Stormwater Control Plan – Discretionary Projects

Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

The flow chart outlines the basic process for discretionary project and subdivision approvals. This is only a guide; not all projects are the same nor is every department. Check with your jurisdictional office for further details on the exact approval process.



Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

For Office Use Only
Application No._____
Received By: _____

Instructions

The following worksheet is used to demonstrate that for each and every lot, the intended use can be achieved with a design which disperses runoff from the roofs, driveways, sidewalks, streets and other impervious areas to self-retaining pervious areas. It is also used to demonstrate that drainage to treatment and/or flow control facilities is feasible and that the project is in overall compliance with the MS4 permit. Use this form to assist you in designing your project to comply with the design standards for Multi-Parcel Regulated projects. The completed, signed Preliminary SCP for Subdivision Projects, a site map, plus any additional applicable information, must be submitted with your application to the Planning Department.

Project Name:_____

Physical Site Address:_____

Project Applicant:_____

Mailing Address:_____

Phone:_____

Consultant's Information

Name:_____

Firm:_____

Address:_____

Email:_____

Phone:_____

A. Project Information

1a. Does Project create or replace 1-acre or more of impervious surface?	☐ **Yes** (see question below)	☐ **No** (skip question 1b.)
b. If 'Yes' to the above question than does project increase impervious surface from pre-project conditions?	☐ **Yes** (hydromodification requirements must be met)	☐ **No** (regulated project requirements must be met)
Total pre-project Impervious Surface (sf):		
Total new or replaced Impervious Surface Area (square feet) **[Sum of impervious area that will be constructed as part of the project]**		

Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

B. Summary Table of Pervious to Impervious Surface

The following table will be used by staff to ensure that adequate measures have been utilized within the project design to capture, retain, and/or infiltrate the design storm.
Each DMA shown in the table shall be designated with the same name on the site plan. All site design measures used to meet the runoff reduction goals and all treatment facilities utilized to capture remaining runoff volumes must be shown on the site plan at an appropriate scale. Please use the Flowchart as a reference of the process.

1. **Utilize Worksheet 1 to Calculate Impervious to Pervious Ratio to determine if further runoff reduction is needed**
2. **Utilize the Runoff Reduction Calculator (Worksheet 2*) to increase reduction**
3. **Utilize Bioretention or equivalent if reduction cannot be achieved using site design measures**

DMA Name	Does pervious to impervious ratio Achieve 3.5:1 or better, Worksheet 1(Yes or No)	Does runoff reduction with site design measures equal 100% or greater, Box DD (Worksheet 2)	Value from Box BB (worksheet 2) Impervious surface amount that must be treated using additional methods	Bioretention facility name and size (sf) (Use a sizing factor of 0.04 to calculate bioretention facility size or equivalent sizing technique if different treatment/baseline hydromodification facility is proposed)
(A)	(B)	(C)	(D)	
Example A	*Yes*	*Yes*	----------	----------
Example B	*No*	*Yes*	----------	----------
Example C	*No*	*No*	*1350 sf*	*C : (1350 X .04)=54 sf*

*Worksheet 1 and 2 showing calculations for each DMA must be included with the Preliminary SCP
Attach additional sheets as needed for the table above

Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

C. Preliminary Site Plan Checklist –items that must be include on the site plan

- ☐ Topographic lines (2 ft. contours)
- ☐ On-site waterways/drainages, vegetation and areas to be left undisturbed all shown with appropriate buffers
- ☐ DMAs clearly delineated and labeled with name and area (square feet)
- ☐ Location of site design measures used in worksheet 2
- ☐ Location, size, and name of Bioretention/Treatment Facility
- ☐ Flow direction that clearly demonstrates the ability of self-retaining areas, ~~infiltration site design measure~~, and treatment facilities to capture runoff from impervious surfaces
- ☐ Hydrologic soil class

D. Operation and Maintenance Plan Requirements

Each Bioretention facility or equivalent will be required to have an operation and maintenance plan attached to the final SCP and shall include all details found in Appendix 3, 4, and 5 of the LID Manual.

E. Additional Requirements

A detailed final Stormwater Control Plan with narrative sections will need to be submitted prior to issuance of a grading/building permit (see, Appendix 1. However, by completing the Preliminary SCP a more efficient and timely review of the final SCP is enabled.

F. Signature and Certification

I, the below signed, confirm that I have accurately described my project to the best of my ability, and that I have not purposely omitted any detail affecting my project's classification for storm water regulation. I hereby certify that the site design measures and storm water flow treatment measures identified herein as being incorporated into my project have been designed in accordance with the approved BMP Fact Sheet or equivalent, and are included in the final site plans. I also hereby certify that my project meets the storm water runoff reduction criteria identified in Worksheet 2, or as determined through other approved means.

_____ _____

Signature Date

_____

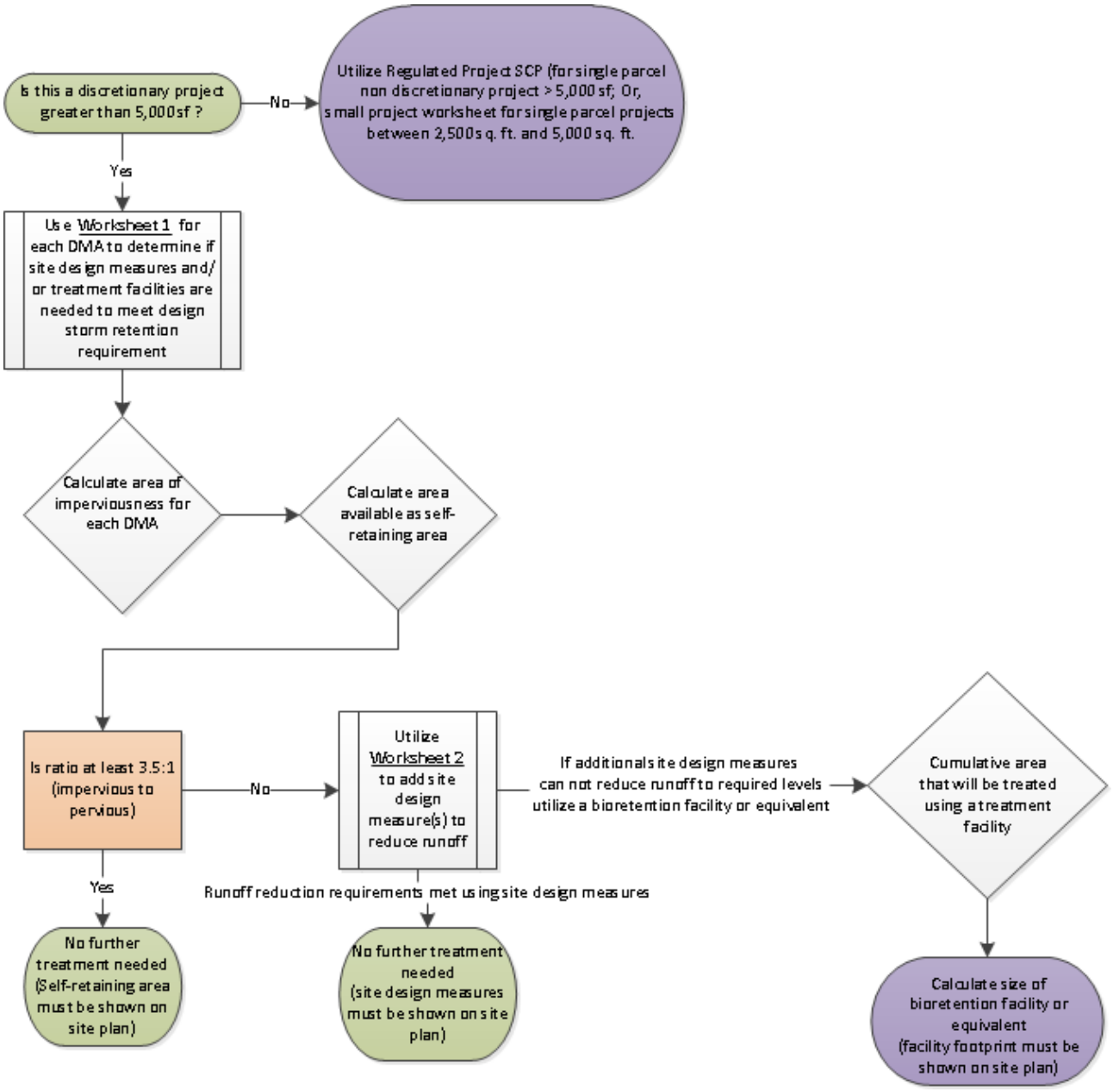
Print Name

I am the:

☐ Property Owner ☐ Applicant ☐ Contractor

Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

The following example illustrates the elements necessary for evaluating a project for compliance with the MS4 permit only. Additional requirements will most likely be needed for compliance with other regulations please consult the full planning submission checklist to make certain all required elements are presented on the preliminary site plan.



Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

Worksheet 1 Example

Regulated Projects Worksheet 1 - Humboldt Low Impact Development Stormwater Manual				
DMA Name	Total Post Project Impervious Surface Area (square feet)	Pervious Self-Retaining Area[1] (square feet)	Ratio of Impervious Surface Area to Self-Retaining Pervious Surface Area	Does Ratio Achieve 3.5 : 1 ratio or better of Impervious Surface Area to Self-Retaining Pervious Surface Area (Yes or No)[2]
Example A	500	150	3.3 : 1	YES
Example B	500	100	5.0 : 1	NO

1: Self-Retaining Areas where impervious surface runoff is directed to the Pervious Self-Retaining Area in accordance with Humboldt LID Manual - Part C, Section 6.0

2: If "Yes", Ratio of Impervious Surface Area to Self-Retaining Pervious Surface Area is equal to 3.5:1 or better (1.3:1 or better in the Shelter Cove MS4 area), then compliance with runoff reduction measures have been met for DMA.
If "No", Ratio of Impervious Surface Area to Self-Retaining Pervious Surface Area does not achieve 3.5:1 or better (1.3:1 in Shelter Cove), then compliance with runoff reduction measures have not been met for DMA (Complete Worksheet 2).

Preliminary Stormwater Control Plan (CDP, CUP, and SP ≥ 5000 sf)

Worksheet 2: (Use one Worksheet for each DMA as applicable)

Regulated Projects Worksheet 2
Humboldt Low Impact Development Stormwater Manual

Project Information						Formulas/Notes
DMA Name:						
Total Post-Project Impervious Surface Area (square feet)			A		square feet	
24 hour - 85th Percentile Design Storm			B		inch	B = Select Design Storm Value (0.65-inch Humboldt Bay Area, 1.3-inch Shelter Cove)
Impervious Surface Runoff Value (Potential Stormwater Runoff due to impervious surface area and design storm value)			C		Gallons per 24 hours	C = A x B x 0.083 x 7.48
Pervious Self-Retaining Area (SRA) Credit (if applicable, if none enter 0)						
Self-Retaining Area (square feet)			SRA Credit		square feet	SRA Credit = Self-Retaining Area x Multiplier. Select Multiplier (3.5 Humboldt Bay Area, 1.3 Shelter Cove)
Site Design Measure Credits						
Tree Planting and Preservation						
New Trees		# of trees				
100 square feet per deciduous tree	D		E		square feet	E = D x 100
200 square feet per evergreen tree	F		G		square feet	G = F x 200
Existing Trees (Credit for 50% of existing canopy area)		Canopy diameter (feet)				
Tree #1	H_1		J_1		square feet	$J_1 = 3.14 \times (H_1/2)^2 \times 0.50$
Tree #2	H_2		J_2		square feet	$J_2 = 3.14 \times (H_2/2)^2 \times 0.50$
Tree #3	H_3		J_3		square feet	$J_3 = 3.14 \times (H_3/2)^2 \times 0.50$
Rain Barrel or Cisterns (55 gallon minimum)						
Square foot credit per gallon based on 24-hour, 85th Percentile Design Storm	K					K = Select square foot credit per gallon (2.48 Humboldt Bay Area, 1.24 Shelter Cove)
		Gallons				
Rain Barrels	L		M		square feet	M = L x K
Cisterns	N		O		square feet	O = N x K
~~**Infiltration Trench/Basin (55 gallon minimum - 21 ft³**)**~~		cubic feet				
~~volume(ft^3) = length x width x depth~~	~~P~~		~~Q~~		~~square feet~~	~~Q = P x R x K x 7.48~~
~~porosity (approximate %)~~	~~R~~	~~35%~~				
~~**Subsurface Infiltrators (55 gallon minimum)**~~						
~~Proprietary units vary, insert estimated storage in ft^3~~	~~S~~		~~T~~		~~square feet~~	~~T = S x 7.48~~
Impervious Area Disconnection Credit per square foot of impervious area feeding into pervious area			U		square feet	U = Enter square foot value
Soil Quality Improvement						
Credit per square foot of soil quality improvement			V		square feet	V = Enter square foot value
Green Roof						
Credit per square foot of green roof installation			W		square feet	W = Enter square foot value
PPPP (Porous Asphalt, Pervious Concrete, Permeable Pavers)						
Credit per square foot of PPPP			X		square feet	X = Enter square foot value
Vegetated Swales						
Credit per square foot of vegetated swale			Y		square feet	Y = Enter square foot value
Stream Setbacks and Buffers						
Credit per square foot of stream setback and buffer#			Z		square feet	Z = Enter square foot value
Credits Total			AA		square feet	AA = SRA Credit + E + G + J_1 + J_2 + J_3 + M + O + Q + T + U + V + W + X + Y + Z
Post-Project Impervious Surface Area minus Site Design Measure Credits			BB		square feet	BB = A - AA
NEW Impervious Surface Runoff Value (Potential Stormwater Runoff due to impervious surface area and design storm after implementation of Site Design Measures)			CC		Gallons per 24 hours	CC = BB x B x 0.083 x 7.48
Percent reduction in Impervious Surface Runoff Value*			DD		%	DD = ((C - CC) / C) x %100

***If value for DD is not greater than or equal to %100 then bioretention is required for treating remaining runoff from impervious area indicated by value BB.**
Design and implement bioretention facility in accordance with Humboldt LID Stormwater Manual - Part C.

****Infiltration Trench/Basin calculations are based on porosity (35%). Increased trench dimensions (volume) are required to meet 55 gallon minimum capacity.**

Green — Fill In [Enter Value]	Conversions Used:
Red — Calculated Value	1 inch = 0.083 feet
Black — Fixed Value/Selectable Value	1 cubic foot = 7.48 gallons
Regulated Projects Worksheet 2, Version 2.0 - June 29, 2016	# check with agency with project area jurisdiction for requirements

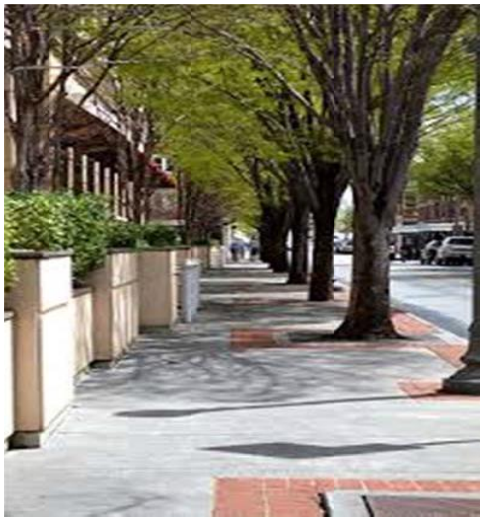
APPENDIX 3

Site Design Measures

Tree Planting and Preservation

Description

Trees intercept rain water on their leaves and branches, allowing water to evaporate or run down the branches and trunk where it readily infiltrates into the soil. Tree roots also increase infiltration of the soil. Runoff reduction credits can be applied for newly planted or preserved trees.



At a minimum inspection and maintenance shall include the following:

- Annual inspection prior to the rainy season.
- Annual proper watering and application of mulch.
- Routine pruning and weeding as needed.
- Replacement of trees as needed.

Technique

At time of planting, newly planted trees must have:

- A trunk measuring at least 1-inch in diameter**,** 6-inches above the soil line
- A height of at least 6-feet for deciduous trees and 4-feet for evergreen trees.

A minimum of <u>two</u> deciduous trees or <u>one</u> evergreen tree must be planted to use this credit, such that a minimum of 200 square feet of runoff reduction credit is achieved for newly planted trees.

Additionally, to use the runoff reduction credit for existing trees, the canopy area must be:

- Equal to, or greater than 300 square feet of existing tree canopy, such that a minimum of 150 square feet (50% credit for existing canopy) of runoff reduction credit is achieved for existing trees.
- Existing trees must be adequately protected during construction

Credits

The following tree credits apply:

- New deciduous trees provide a tributary area reduction credit of 100 ft^2
- New evergreen trees provide a tributary area reduction credit of 200 ft^2
- Existing trees provide a credit equal to <u>half</u> of the existing tree canopy area.

Rain Barrels and Cisterns

Description

Rain Barrels and Cisterns are a system that collects and stores storm water runoff from a roof or other impervious surface. These typically have overflow mechanisms or plugs that drain to a vegetated area or to the storm drain system when the barrel is full.

Use of Rain Barrels and Cisterns must comply with local vector control requirements.

Technique

Show the following on your site plan:

- Impervious area tributary to each Rain Barrel / Cistern
- Location of each Rain Barrel/Cistern

Confirm the Following Standard Specifications have been met:

- Rain Barrels are sited at grade on a sound and level surface at or near the ground.
- Gutters tributary to the Rain Barrels/Cistern are screened with a leaf guard or maximum ½-inch to ¼ inch minimum corrosion resistant metallic hardware fabric.
- Water collected will be used for irrigation purposes only.
- Openings are screened with a corrosion-resistant metallic fine mesh (1/16 inch or smaller) to prevent mosquito harborage.
- Large openings are secured to prevent entry by children.
- Rain Barrels and Cistern are cleaned annually.

Credits

Runoff reduction credits can be applied for rain barrels or cisterns installed.

- A minimum rain barrel or cistern capacity of 55 gallons must be installed to use this credit

Rooftop and Impervious Area Disconnection

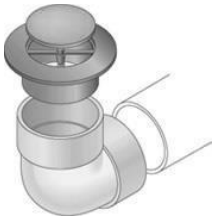
Description

Disconnection of rooftop and impervious areas from the storm drain system helps reduce runoff and provide pollutant removal as the re-directed water travels over and through vegetation and soil instead of being directly piped and discharged into the storm drain. Roof runoff is directed to spread over a pervious area such as a stream setback and buffers, areas of soil quality improvement, or other appropriate infiltration areas.

The following are examples of ways to implement rooftop disconnection:

Splash Block
Splash blocks reduce the velocity and impact of water exiting the roof downspout and direct water to a pervious area.

Pop-up Drainage Emitter
Pop-up drainage emitters are useful in conveying storm water from roof downspouts into vegetated areas. Roof runoff is piped then released through a capped device that opens with water pressure, allowing the storm water to flow out of the emitter and into the vegetated area.



Technique

On Site Plan Show:

- Delineate the impervious tributary area draining to the pervious area
- Show how the runoff will be directed to the pervious area

Confirm that the following specifications will be met:

- Tributary area (impervious area) does not exceed more than twice the pervious area
- Roof areas collect runoff and route to the suitable pervious area
- Paved areas are sloped to direct runoff to suitable pervious area
- Runoff is dispersed across the pervious area (splash block or pop-up emitter)
- Pervious area has vegetation and soils meeting the requirements of stream setbacks and buffers or areas of soil quality improvement and maintenance

Credits

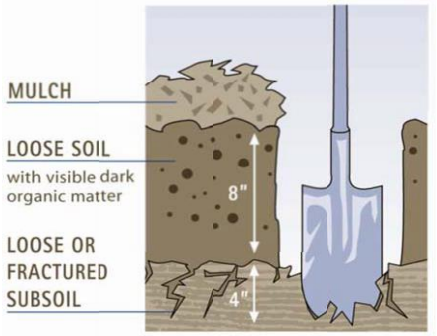
Runoff reduction credits can be applied for the area of rooftop and impervious area disconnection.

- The runoff reduction credits (square feet) will be equal to the area of rooftop and impervious area disconnection and should not exceed more than twice the pervious area receiving runoff.
- A minimum area of 150 square feet of impervious surface tributary area must apply to use this credit.

Soil Quality Improvement and Maintenance

Description

In areas subject to grading/clearing not covered by impervious surface, create/amend pervious areas with a 12" layer of topsoil. Soil quality improvement options include the following:



Technique

Option 1: Leave native vegetation and soil undisturbed and protect from compaction during construction

Identify areas of the site that will not be stripped, logged, graded, or driven on, and fence off those areas to prevent impacts during construction. If neither soils nor vegetation are disturbed, these areas do not require amendment.

Option 2: Amend existing site topsoil or subsoil

Scarify or till subgrade to 8 inch depth (or to depth needed to achieve a total depth of 12 inches of un- compacted soil after calculated amount of amendment is added). Entire surface should be disturbed by scarification. Amend soil to meet desired organic content.

Option 3: Stockpile existing topsoil during grading. Replace topsoil before planting.

Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission. Replace stockpiled topsoil prior to planting and ensure that replaced soil plus additional compost as needed will amount to at least 12 inches of depth.

Compost/amendment shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter.

Credits

Runoff reduction credits can be applied for the area of soil quality improvement.

- The runoff reduction credits (square feet) will be equal to the area of soil quality improvement.
- A minimum area of 150 square feet of soil quality improvement area must apply to use this credit.

Green Roofs

Description

A green roof is a multi-layered, vegetated rooftop system design for filtering, absorbing, and retaining stormwater. A green roof captures stormwater within the pore space of the growth medium and then releases the water slowly via evaporation, transpiration, and discharge to the roof drains.

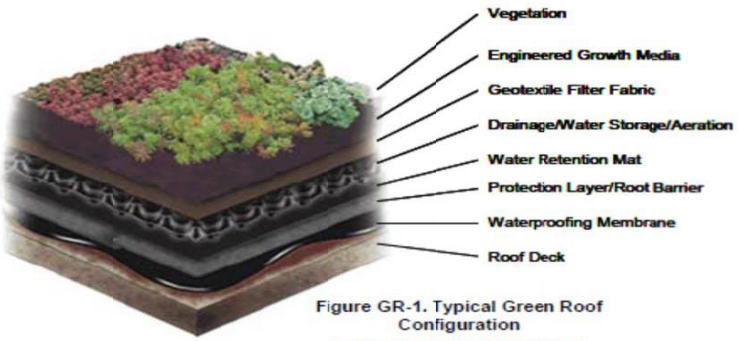


Figure GR-1. Typical Green Roof Configuration

Image source: American Hydrotech, Inc.®, http://www.hydrotechusa.com/. Text detail added.

Technique

Green roof installation should be considered during building design, as green roofs require special structural reinforcements, irrigation provisions, and leak protection elements. Involve the landscape architect, licensed structural engineer, and mechanical engineer early in the design process with the project architect, since architectural roof style, roof structural requirements, building heating/cooling needs, vegetation selection, and irrigation needs go hand in hand.

Routine inspection of the roof membrane, drainage layer flow paths, and irrigation system is needed. Periodic maintenance and replacement of rooftop vegetation and growth media should be expected during the lifespan of the green roof.

Credits

Runoff reduction credits can be applied for area of installed green roof.

- A minimum area of 150 square feet of green roof must be installed to use this credit.

PPPP - Porous Asphalt, Pervious Concrete, Permeable Pavers – (alternative engineered hardscaping surfaces)

Description

This option can be easy to install and maintain, cost effective, and can add aesthetic value to your project. PPPP may include pervious concrete, porous asphalt, porous pavers, crushed aggregate, open pavers with grass or plantings, open pavers with gravel, or solid pavers.

Technique

Show on your site plan:

- Location, extent and types of pervious pavements.

Confirm the following standard specifications are met:

- No erodible areas drain on to permeable pavement.
- Subgrade compaction is minimal.
- Reservoir base course is of open-graded crushed stone. Base depth is adequate to retain rainfall (3 inches is adequate) and support design loads (more depth may be required).
- No subdrain is included or, if a subdrain is included, outlet elevation is a minimum of 3 inches above bottom of base course.
- Subgrade is uniform and slopes are not so steep that subgrade is prone to erosion.
- Rigid edge is provided to retain granular pavements and unit pavers.
- Solid unit pavers, if used, are set in sand or gravel with minimum 3 / 8 inch gaps between the pavers.
- Joints are filled with an open-graded aggregate free of fines.
- Pervious concrete or porous asphalt, if used, are installed by industry-certified professionals according to the vendor's recommendations.
- Selection and location of pavements incorporates Americans with Disabilities Act requirements (if applicable), site aesthetics, and uses.

Credits

Runoff reduction credits can be applied for area of installed porous pavement.

- A minimum area of 150 square feet of pervious pavement must be installed to use this credit.

Vegetated Swales

Description

A vegetated swale is a broad, shallow channel with dense vegetation covering the bottom and side slopes. Vegetation in the channel provides filtration and solids removal and reduces flow velocities as stormwater is conveyed through the system. Depending on soil type, some infiltration may also occur, decreasing runoff volume and providing additional filtration.

Technique

Vegetated swales are suitable for the following conditions:

- Areas with a maximum slope of 5%
- Areas wide enough to provide a bottom width between 2 ft and 10 ft
- Areas wide enough to provide a 3:1 side slope
- Areas long enough to provide at least 100 feet of swale length

Flow depth should be limited to 4 to 6 inches with a maximum velocity of 1 foot per second for water quality treatment. Under higher flow conditions, the maximum velocity should be 3 feet per second to avoid erosion. Swale should discharge to a piped system or can function as a confined channel if sized large enough to do so. If the swale discharges to a slope rather than to a piped system, an energy dissipater should be used at the swale outlet.

Credits

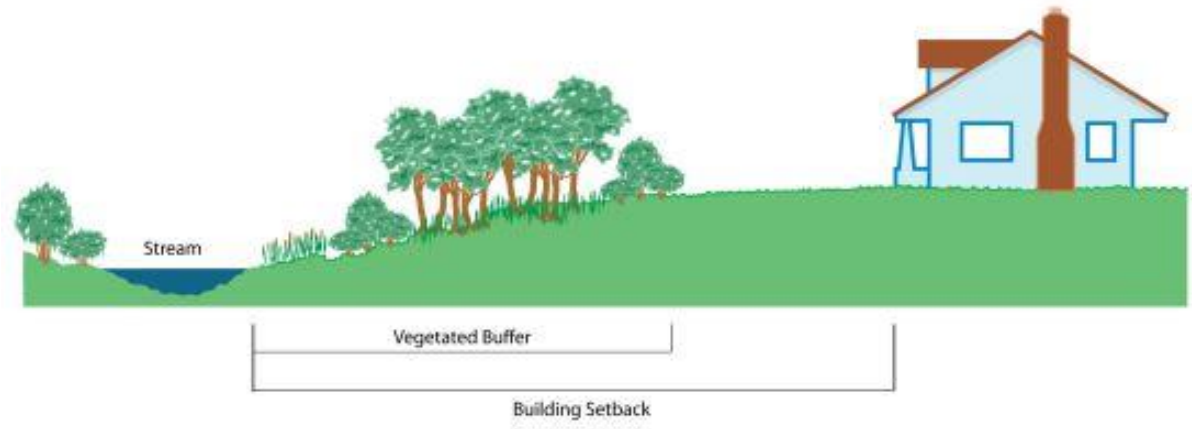
Runoff reduction credits can be applied for area of installed vegetated swale.

- A minimum area of 150 square feet of vegetated swale must be installed to use this credit.

Stream Setbacks and Buffers

Description

A stream setback or buffer is an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of setbacks and buffers is to physically protect and separate a stream, lake or wetland from future disturbance or encroachment. If properly designed, setbacks and buffers can provide stormwater management and act as a right-of-way during floods, sustaining the integrity of stream ecosystems and habitats.



Technique

Stream setbacks and buffers should be considered as part of the initial phases of site design for the project. Provisions should be made to place impervious developments and areas to be impacted or disturbed furthest from the aquatic feature, with a zone of natural, undisturbed vegetation remaining between the stream and the areas impacted by development.

Contact County or City Department with project jurisdiction for stream setback and buffer requirements and design criteria.

Credits

Runoff reduction credits can be applied for the area of stream setback and buffer.

- The runoff reduction credits (square feet) will be equal to the area of stream setback and buffer.
- A minimum area of 150 square feet or more of stream setback and buffer must apply to use this credit.

Infiltration Trench

Description

An infiltration trench is a long, narrow (<25 ft.), rock-filled trench (depth between 3-8 ft.) that receives stormwater runoff and allows it to infiltrate.

Infiltration trenches typically have no outlet. Before entering the trench, runoff should pass through stormwater pretreatment measures, such as pre-settling basins, to remove coarse sediment that can clog the void spaces between the stones and render the trench ineffective. A level spreader may be used to spread concentrated flows.

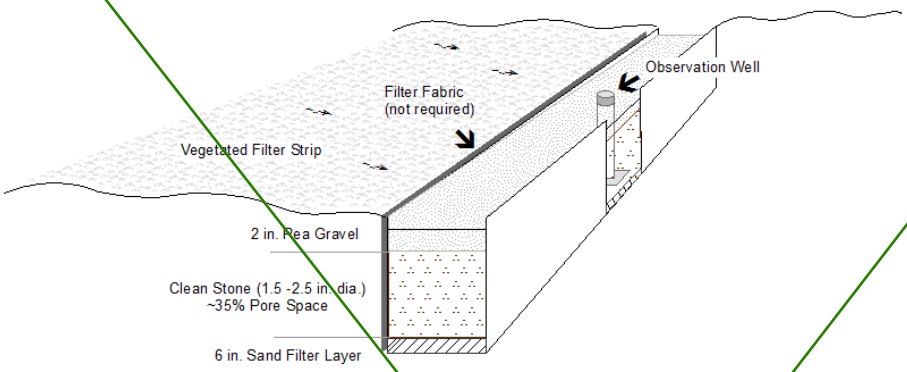
Pretreated runoff is stored in the void spaces and slowly infiltrates through the bottom of the trench into the soil matrix, thus contributing to groundwater recharge. Infiltration trenches should be designed to operate offline, such that only design flows are diverted to the trench and the remainder is bypassed.

⚠ Due to the potential to contaminate groundwater and/or soils, cause slope instability, impact surrounding structures, and the potential for insufficient infiltration capacity, adequate soil infiltration and BMP siting must be demonstrated, please follow the steps below.

Infiltration trenches are generally between 3 (minimum depth) and 8 feet deep and not more than 25 feet wide. They should:

- Have a level surface and bottom to promote uniform infiltration across the trench;
- The top two inches should be a pea gravel filter layer.
- Trench fill material should be double washed locally available rock with a diameter range of 1.5 to 2.5 inches,
- Below the rock layer is a 6-inch deep sand filter layer. The sides of the trench can be lined with filter fabric to prevent adjacent soils from clogging the rock; and,
- An observation well located at the center of the trench is recommended to monitor water drainage from the system. The well can be a capped 4 to 6-inch diameter PVC pipe, which is anchored vertically to a foot plate at the bottom of the trench
- The infiltration trench should be designed to drain within 72 hours.

Infiltration Trench



Overflow: Infiltration trenches should be designed such that only design flows are diverted to the trench and the remainder is bypassed.

☐ Utilize the Small Project or Regulated Project (Worksheet 2) Calculators for documenting runoff reduction achieved based on the size of the proposed infiltration facility.

Requirements for Credit

On Site Plan Show:

☐ Delineate the impervious tributary area draining to the infiltration system

☐ Show how the runoff will be directed to the infiltration system

☐ Show the percent and direction of land slope for the site

☐ Show a cross-section of the proposed trench on the plan with dimensions clearly noted

Confirm that the following specification will be met:

☐ Infiltration trench must be located at least 5 feet from the parcel property lines.

☐ Infiltration Trench must be located at a minimum of 10 feet (down gradient) from building foundations. Exceptions may be granted if a mounding analysis, conducted as part of a geotechnical report, clearly shows that no potential impact to the structure will result from a closer setback, Appendix 8 Mounding Analysis Procedures.

☐ Infiltration trench must be located 100 feet or greater from water wells, monitoring wells, springs and flowing surface water bodies, and from unstable land masses.

Infiltration Trench

- ☐ Infiltration trench must be located 100 feet or greater from the high water mark of vernal pools, wetlands, lakes, ponds, or other surface water bodies.
- ☐ Infiltration trench must be located 1,200 feet or greater from any public water systems' surface water intake point.
- ☐ Pretreatment systems, debris/sediment traps and filter strips, are recommended for all facilities and may be required by the jurisdictional entity on facilities that capture runoff from roofs, roads, and parking areas (check with the jurisdictional entity for minimum filter strip widths).
- ☐ Inspection port is accessible.
- ☐ Slopes are less than 20% unless constructed to the recommendations in a geotechnical report.
- ☐ Infiltration trench must be located at least 25 feet from slope break on slopes greater than 30%. A mounding analysis, conducted as part of a geotechnical report, is required for set backs less than 25 feet
- ☐ The depth to seasonal high groundwater level is greater than 5 feet, measured from the bottom of the trench. If groundwater depth is found to be less than 5 feet, a mounding analysis conducted as part of a geotechnical report will be required. Groundwater level determination shall be made using methods described in Humboldt County's, Wet Weather Testing of Soils, using either soil mottling or direct observation techniques.
- ☐ Must comply with local vector control requirements.
- ☐ There shall be no adverse impact to adjacent properties.
- ☐ No contaminated soils shall be on site.

Infiltration Rate Requirements

Infiltration rates of the soils underlying the proposed infiltration system must be documented; the following is the acceptable method and required documentation:

Soil grain analysis using ASTM D 422D, *Standard Test Method for Particle-Size Analysis of Soils,* shall be performed within the boundaries of the proposed infiltration facility and at the bottom elevation/cut (infiltration surface) of the proposed infiltration facility.

☐ Check if particle size analysis results in less than (<) 50% fines – **Stop** - Compliance has been met.

☐ Check if particle size analysis results in greater than (>) 50% fines – Compliance has not been met. Proceed to percolation testing requirements, below.

Infiltration Trench

A percolation test according to the Humboldt County Environmental Health's *Wet Weather Testing of Soils* must be performed if particle size analysis compliance has not been met.

☐ Percolation is equal to or greater than (≥)1 inch per hour. **Stop** – Compliance has been met. Please include all testing results with submission.

☐ Percolation is less than 1-inch per hour – Compliance has not been met. Please, meet with jurisdictional authority for alternative compliance requirements (Mounding Analysis Procedures)

Meeting all of the criteria on this worksheet does not guarantee approval of these devices. Infiltration facilities proposed in areas with high groundwater and in close proximity to waterbodies impaired for pathogens may not be approved regardless of meeting the above requirements.

Alternatively, areas that may not meet the above requirements have the opportunity to request a waiver. However, it must be demonstrated that groundwater surfacing and impacts to structures will not result from the placement of the facility. Please consult with your jurisdictional permitting authority for additional requirements and considerations.

An infiltration trench that is to be designed to address limitations in the down stream conveyance system may be required to submit percolation and groundwater elevation testing reports to the jurisdictional permitting authority for approval.

☐ An operation and maintenance plan must accompany permit submission (does not need to be recorded against the deed).

Projects that do not meet the above requirements may request a waiver, issued on a case-by-case basis. Please contact jurisdictional entity for the necessary information needed for an alternative compliance waiver.

Please include this sheet with application.

Link to Environmental Health Department's Wet Weather Testing of Soils:

http://www.humboldtgov.org/685/Land-Use-Program

OWTS Policy, Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems, June 19, 2012.

http://www.swrcb.ca.gov/water_issues/programs/owts/docs/owts_policy.pdf

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

Description

A number of underground infiltration systems, including premanufactured pipes, vaults, and modular structures, have been developed as alternatives to infiltration trenches and basins for space-limited sites and stormwater retrofit applications. Similar to traditional infiltration facilities, these systems are designed to capture, temporarily store, and infiltrate stormwater over several days. Performance of underground infiltration systems varies by manufacturer, system design, and site conditions.

The materials of construction, configuration, and lay-out of underground infiltration systems vary considerably depending on the system manufacturer. Specific design criteria and specifications for these systems can be obtained from system manufacturers or vendors.

Sizing and Materials

General design requirements common to most of these systems are summarized below and must be followed if used as a site design measure.

☐ Utilize the Regulated Project Calculator (Worksheet 2) for documenting the runoff reduction achieved based on the size of the proposed infiltration facility.

⚠ Due to the potential to contaminate groundwater and/or soils, cause slope instability, impact surrounding structures, and the potential for insufficient infiltration capacity, adequate soil infiltration and BMP siting must be demonstrated, please follow the steps below

However, meeting all of the criteria on this worksheet does not guarantee approval of these devices. Infiltration facilities proposed in areas with high groundwater and in close proximity to waterbodies impaired for pathogens may not be approved regardless of whether all requirements have been met. Please consult with your jurisdictional permitting authority for additional requirements and considerations.

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

Requirements For Credit

On Site Plan Show:

- ☐ Delineate the impervious tributary area draining to the infiltration system
- ☐ Show how the runoff will be directed to the infiltration system
- ☐ Show the percent and direction of land slope for the site
- ☐ Show a cross-section of the proposed system on the plan with dimensions called out

Confirm that the following specification will be met:

- ☐ Subsurface infiltration facility must be located at least 5 feet from the parcel property lines
- ☐ Subsurface infiltration facility must be located at a minimum of 10 feet (down gradient) from building foundations. Exceptions may be granted if a mounding analysis, conducted as part of a geotechnical report, clearly shows that no potential impact to the structure will result from a closer setback (Appendix 8. Mounding Analysis Procedure).
- ☐ Subsurface infiltration facility must be located 100 feet or greater from water wells, monitoring wells, springs and flowing surface water bodies, and from unstable land masses.
- ☐ Subsurface infiltration facility must be located 100 feet or greater from the high water mark of vernal pools, wetlands, lakes, ponds, or other surface water bodies.
- ☐ Subsurface infiltration facility must be located 1,200 feet or greater from any public water systems' surface water intake point.
- ☐ Subsurface infiltration facility must be located at least 25 feet from slope break on slopes greater than 30%. A mounding analysis, conducted as part of a geotechnical report, is required for set backs less than 25 feet.
- ☐ Pretreatment systems, debris/sediment traps and filter strips, are recommended for all facilities and may be required by the jurisdictional entity on facilities that capture runoff from roofs, roads, and parking areas (check with the jurisdictional entity for minimum filter strip widths).
- ☐ Inspection port is accessible.
- ☐ Slopes are less than 20% unless a geotechnical report is prepared

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

☐ The depth to seasonal high groundwater level is greater than 5 feet, measured from the bottom of the trench. If groundwater depth is found to be less than 5 feet, a mounding analysis will be required. Groundwater level determination shall be made using methods described in Humboldt County's, Wet Weather Testing of Soils, using either soil mottling or direct observation techniques.

☐ No adverse impact to adjacent property

☐ No contaminated soils shall be on site

☐ Overflow: subsurface infiltration facilities shall be designed to operate offline, such that only design flows are diverted to the facility and the remainder is bypassed

Infiltration Rate Requirements

Infiltration rates of the soils underlying the proposed infiltration system must be documented; the following outlines the method for determining infiltration rate compliance.

Soil grain analysis using ASTM D 422D, *Standard Test Method for Particle-Size Analysis of Soils,* shall be performed within the boundaries of the proposed infiltration facility and at the bottom elevation/cut (infiltration surface) of the proposed infiltration facility.

☐ Check box if particle size analysis results in <u>less than</u> (<) 50% fines. **Stop** - Compliance has been met.

☐ Check box if particle size analysis results in <u>greater than</u> (>) 50% fines. <u>Compliance has not been met</u>. Please, procced to percolation testing requirements, below.

A percolation test according to the Humboldt County Environmental Health's *Wet Weather Testing of Soils,* must be performed if particle size analysis compliance has not been met.

☐ Percolation is equal to or greater than (≥) 1-inch per hour. **Stop** - Compliance has been met. Please include all testing results with submission.

☐ Percolation is less than 1-inch per hour – <u>Compliance has not been met.</u> Please meet with jurisdictional authority for alternative compliance requirements.

Meeting all of the criteria on this worksheet does not guarantee approval of these devices. Infiltration facilities proposed in areas with high groundwater and in close proximity to waterbodies impaired for pathogens may not be approved regardless of meeting the above requirements.

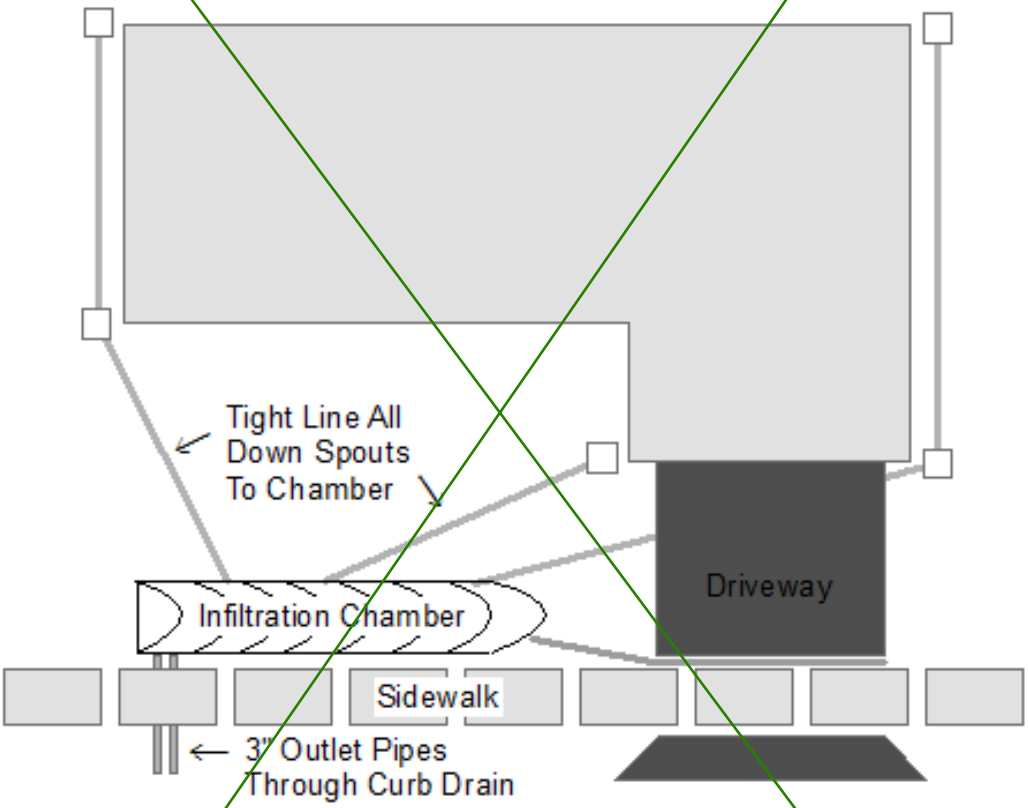
Alternatively, areas that may not meet the above requirements have the opportunity to request a waiver. However, it must be demonstrated that groundwater surfacing and impacts to structures will not result from the placement of the facility. Please consult with your jurisdictional permitting authority for additional requirements and considerations.

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

An infiltration trench that is to be designed to address limitations in the down stream conveyance system may be required to submit percolation and groundwater elevation testing reports to the jurisdictional permitting authority for approval.

☐ An operation and maintenance plan must accompany permit submission (does not need to be recorded against the deed). Operation and Maintenance Plans that are specific to proprietary units and are produced by manufacturer are acceptable. Runoff reduction credits will be proportional to the volume of available storage in infiltration device.

Example Schematic



References

Link to Environmental Health Department's Wet Weather Testing of Soils:

http://www.humboldtgov.org/685/land-use-program

OWTS Policy, Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems, June 19, 2012.

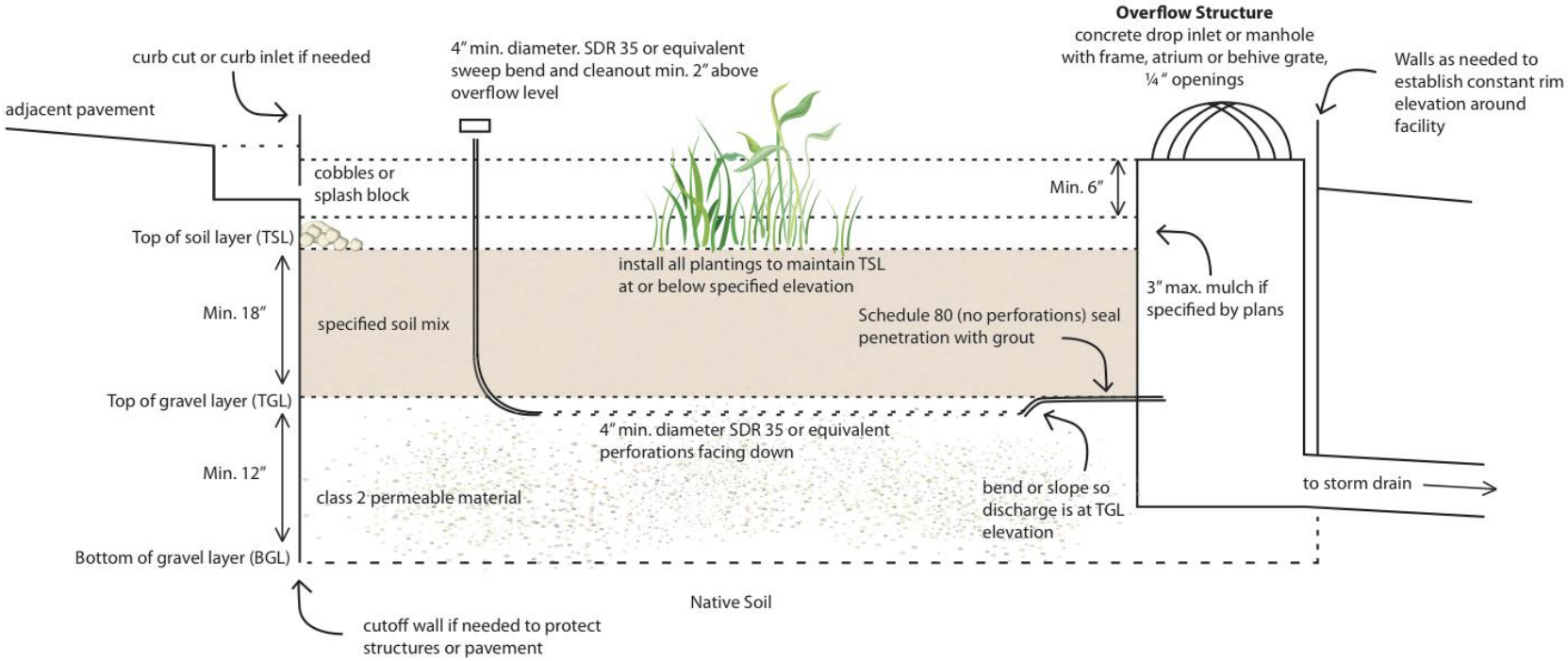
http://www.swrcb.ca.gov/water_issues/programs/owts/docs/owts_policy.pdf

APPENDIX 4

Bioretention Specifications and Checklist

Bioretention Facility

not to scale



Allowed variations for special site conditions:

- Facilities located within 10 feet of structures or other potential geotechnical hazards may incorporate an impervious cutoff wall

- Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner between the native soil and the BGL and locate the underdrain discharge at the BGL (flow-through planter configuration)

- Facilities located in areas of high groundwater, highly infiltrative soils, or where connection of the underdrain to a surface drain or subsurface storm drain are infeasible may omit the underdrain

Notes:

- No liner, no filter fabric, no landscape cloth.

- Maintain BGL, TGL, TSL throughout facility area at elevations to be specified in plan.

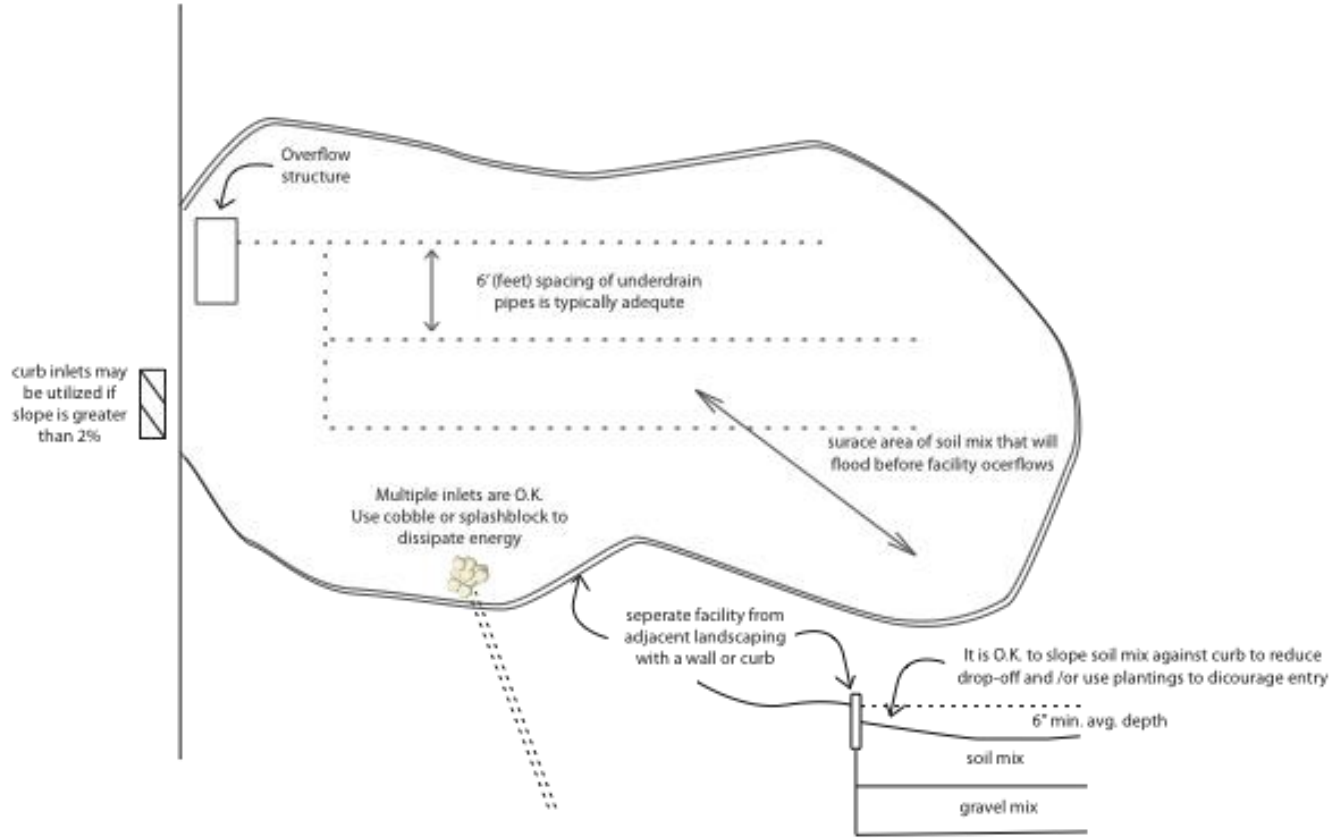
- Class 7 permeable layer may extend below and underneath drop inlet.

- Elevation or underdrain discharge is at top of gravel layer.

- See Section 6.3 for instructions on facility sizing and additional specifications

Bioretention Facility - Overview

not to scale



Note:

Show all elevations of curb, pavement, inlet, top of soil layer (TSL), top of gravel layer (TGL), and bottom of gravel layer (BGL) at all inlets and outlets and at key points along edge of facility.

Soil/Compost and Gravel Specifications for Bioretention Facility

Compost shall be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids, and shall meet the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

Compost Quality Analysis:

Before delivery of the soil, the supplier shall submit a copy of the lab analysis performed by a laboratory that is enrolled in the USCC's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify that the compost parameters are within the limits specified below.

Parameter	Range	Reported as (units)
Organic Matter Content	35-75	%, dry weight basis
Carbon to Nitrogen Ratio	15:1 to 25:1	ratio
Maturity (Seed Emergence and Seedling Vigor)	>80	average % of control
Stability (CO_2 Evolution Rate)	<8	mg $C0_2$-C/g unit OM/day
Soluble Salts (Salinity)	<6.0	mmhos/cm
pH	6.5 - 8.0 May vary with plant species	units
Heavy Metals Content	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.13, tables 1 and 3.
Pathogens		
Fecal coliform	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Salmonella	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Nutrient Content (provide analysis, including):		
Total Nitrogen (N)	≥0.9	%
Boron (Total B)	<80	ppm
Calcium (Ca)	For information only	%
Sodium (Na)	For information only	%
Magnesium (Mg)	For information only	%
Sulfur (S)	For information only	%

Soil/Compost and Gravel Specifications for Bioretention Facility

Gravel Layer

The gravel layer used in the bioretention facility must consist of *Class 2 Permeable Material* as specified in the State of California's Business, Transportation and Housing Agency, Department of Transportation; Standard Specifications 2010, manual (http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_StdSpecs/2010_StdSpec s.pdf).

The specific section, Subsurface Drains, Sec. 68, of the manual is used because it offers specific specifications for subsurface drains. In addition to the standardized permeable layer, a membrane layer of pea gravel or other intermediate-sized material is recommended at the top of the gravel layer to prevent fines from the soil/compost layer from moving downward into the gravel layer.

68-2.02F (1) General
Permeable material for use in backfilling trenches under, around, and over underdrains must consist of hard, durable, clean sand, gravel, or crushed stone and must be free from organic material, clay balls, or other deleterious substances.

Permeable material must have a durability index of not less than 40.

68-2.02F (3) Class 2 Permeable Material
The percentage composition by weight of Class 2 permeable material in place must comply with the grading requirements shown in the following table:

Class 2 Permeable Material* Grading Requirements

Sieve sizes	Percentage passing
1"	100
3/4"	90–100
3/8"	40–100
No. 4	25–40
No. 8	18–33
No. 30	5–15
No. 50	0–7
No. 200	0–3

*Class 2 permeable material must have a sand equivalent value of not less than 75.

Bioretention Facility Construction Checklist

Layout (to be confirmed prior to beginning excavation permit approval stage)	
☐	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
☐	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
☐	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)	
☐	Grating excludes mulch and litter (beehive or atrium-style grates recommended)
☐	Overflow is connected to storm drain via appropriately sized
☐	No knockouts or side inlets are in overflow riser
☐	Overflow is at specified elevation
☐	Overflow location selected to minimize surface flow velocity (near, but offset from, inlet recommended)
☐	Grating excludes mulch and litter (beehive or atrium-style grates recommended)
☐	Overflow is connected to storm drain via appropriately sized

Bioretention Facility Construction Checklist

Underground connection to storm drain/outlet orifice	
☐	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

Drain Rock/Subdrain (to be confirmed prior to installation of soil mix)	
☐	Rock is installed as specified, 12" min. depth. Class 2 permeable, Caltrans specification 68- 2.02F(3) recommended
☐	Rock is smoothed to a consistent 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 consistent top elevation. Depth of mix (18" 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 and may be required by local code or ordinance.
☐	Spray heads, if any, are positioned to avoid direct spray into outlet structures

Bioretention Facility Construction Checklist

Planting	
☐	Plants are installed consistent with approved planting plan, consistent with site water allowance
☐	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 provide smooth 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
☐	Inflows from roof leaders and pipes are connected and operable
☐	Temporary flow diversions are removed
☐	Rock or other energy dissipation at piped or surface inlets is adequate
☐	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

APPENDIX 5

North Coast Stormwater Coalition LID Recommended Plant List

Planting Zone Diagram

Zone A

Species planted in this zone should have the following characteristics:
- Water tolerant;
- Dense root structure and vegetative cover to discourage erosion, slow runoff velocities, and provide maximum pollutant filtration.
- Native grasses and groundcovers are excellent choices for this zone.

Zone B

Species planted in this zone should have the following characteristics:
- Tolerant of periodic inundation;
- Tolerant of periods without water;
- Dense root structure to provide erosion protection of side slopes.

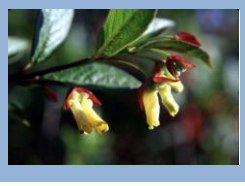
Zone C

Species planted in this zone should have the following characteristics:
- Deep roots to provide structural stability to the drainage feature;
-Tolerant of extended periods without water;
- Tolerant of occasional inundation.

North Coast Stormwater Coalition Low Impact Development Recommended Plant List

Zone A: Area of the LID facility defined as the bottom to the designed high water mark. This area has moist to wet soils and plants located here shall be tolerant of inundation.

Zone B: Area of the LID facility defined as the side slopes from the designed high water line up to the edge of the facility. This area typically has dryer to moist soils, with the moist soils being located further down the side slopes. Plants here should be drought tolerant and help stabilize the slopes.

	Name	Planting Zone		Facility Type			Characteristics					Additional Infomation
	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Shrubs											
	Vine Maple *Acer circinatum*	A/B	wet, moderate	X	X	X	Y	N	15'	10'	shade to partial sun	small multi-stemmed tree, red-orange fall color, excellent soil binder
	American Dogwood *Cornus sericea*	A/B	wet, moderate	X	X	X	Y	N	6'	4'	shade to full sun	red twigs provide winter interest, white flowers in summer
	California Hazelnut *Corylus cornuta*	A/B	wet, moderate	X		X	Y	N	13'		shade to full sun	nuts attract wildlife
	Sala *Gaultheria shallon*	B	dry to moist	X		X	Y	Y	24'	24'	shade to sun	evergreen, produces edible blue berries
	Ocean Spray *Holodiscus discolor*	B	moderate, dry	X		X	Y	N	6'	4'	full to partial sun	flowers in summer, attractive to wildlife, good soil binder
	Twinberry *Lonicera involucrata*	B	dry	X		X	Y	N	5'	4'	preffers shade, sun tolerant	flowers attract humming birds and butterflys

North Coast Stormwater Coalition Low Impact Development Recommended Plant List

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	Name	Planting Zone		Facility Type			Characteristics					Additional Infomation
	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Osoberry *Oemleria cerasiformis*	B	moderate	X		X	Y	N	6'	4'	preferrs full to partial shade, sun tolerant	produces greenish white flowers, berries attract birds
	Wild Mock-orange *Oemleria cerasiformis*	B	dry	X		X	Y	N	6'	4'	partial sun	fragrant flowers attract birds, bees, and butterflies, prune to shape
	Pacific Ninebark *Physocarpus capitatus*	A/B	wet, moderate	X	X	X	Y	N	10'	3'	full to partial sun	unique shredding bark, drought tolerant
	Western Azalea *Rhododendron occidentale*	A/B	wet, moderate	X	X	X	Y	N	15'	12'	full sun to shade	showy flower clusters attract wildlife
	Red-flowering Currant *Ribes sanguineum*	B	wet, moderate, dry	X		X	Y	N	8'	4'	full to partial sun	showy pink flower clusters in spring, attractive to birds
	Wood Rose *Rosa gymnocarpa*	B	wet, moderate	X		X	Y	N	3'	3'	full to partial sun	flowers in summer
	Willow species *Salix spp.*	A/B	wet, moderate	X		X	Y	N	13'+	6'	partial shade to sun	male and female catkins born on separate plants
	Red Elderberry *Sambucus racemosa*	B	moderate	X		X	Y	N	10'	10'	prefers full sun, partial shade	flowers attract pollinators

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	Name	Planting Zone		Facility Type			Characteristics					Additional Infomation
	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Douglas' Spiraea *Spiraea douglasii*	A/B	moderate	X	X	X	Y	N	7'	4'	full to partial sun	pinkish flower clusters in summer ; spreads rapidly ; drought tolerant once established
	Common Snowberry *Symphoricarpos albus*	B	moderate	X		X	Y	N	6'	3'	shade to full sun	flowers in spring, white berries in winter, excellent soil binder
	Evergreen Huckleberry *Vaccinium ovatum*	B/C	moderate, dry	X	X		Y	Y	9'	8'	partial sun	edible berries in late summer, new growth emerges bronze in color, requires acidic soil, prune to shape
	Red Huckleberry *Vaccinium parvifolium*	B	moist, dry	X	X		Y	N	13'	4'	full sun to partial shade	bell-shaped flowers, edible berry attracts wildlife

Acknowledgements:

This guide was put together by Julie Neander and Camden Bruner of the City of Arcata Environmental Services Department and by Jen Kalt of Humboldt Bay Keeper. The information presented here is from the *Portland Stormwater Management Manual; Planting Templates and Lists* , by the City of Portland and *The Oregon Rain Garden Guide* , by Oregon Sea Grant. Used by permission. Photographs are from *A Photographic Guide to the Plants of Humboldt Bay Dunes and Wetlands* , compiled by Gordon Leppig and Andrea J. Pickart and from *Calphotos* , by the University of California, Berkely. Used by permission.

North Coast Stormwater Coalition Low Impact Development Recommended Plant List

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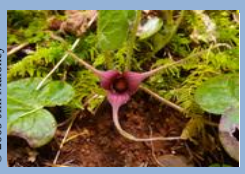
	Name	Planting Zone		Facility Type			Characteristics					Additional Infomation
	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Herbs											
	Common Yarrow *Achillea millefolium*	C	moderate, dry				N	N	36"	24'	full to partial sun	summer flowers, tolerates regular to no watering
	Pearly Everlasting *Anaphalis margaritacea*	C	dry				Y	N	48"	12"	full sun	popular dried flower
	Crimson Columbine *Aquilegia formosa*	B	wet				Y	N	30"	12"	full to partial sun	red and yellow flowers attract hummingbirds, heavy bloomer
	Wild Ginger *Asarum caudatum*	B	moist				Y	Y	10"	20"	shade/ part	bold heart shaped leaves, pleasant fragrance, ornate fowers, evergreen perennial
	Common California Aster *Symphyotrichum chilense*	B	dry to moist				Y	N	40"		full sun to partial shade	attracts native pollinatros including bees, moths and butterflys
	Lady Fern *Athyrium filix-femina*	B	moist	X		X	Y	N	36"	24"	sade	deciduous, low maintenance

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	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
 © 2006 Charles E. Jones	Deer Fern *Blechnum spicant*	B	wet, moderate	X		X	Y	N	24"	24"	shade to partial sun	attracts deer
	California Brome *Bromus carinatus*	A	moderate, dry			X	Y	Y	18"	12"	full to partial sun	native competitor to exotic weeds
 © 2008 Dean Taylow	Dense Sedge *Carex densa*	A	wet, moderate, dry	X			Y	Y	24"	12"	full sun to shade	good errosion control, trapping sediment and slowing the flow of water
 © 2008 Keir Morse	Short-scaled Sedge *Carex leptopoda*	A	wet	X			Y	Y	30"		full	perennial herb
	Tufted Hairgrass *Deschampsia caespitosa*	A/B	moderate	X			Y	N	36"	12"	full/ part	attractive throughout winter
 © 2009 Gary A. Monroe	Pacific Bleeding Heart *Dicentra formosa*	B	moderate, dry				Y	N	2'	2'	shade/ part	delicate foliage with attractive spring flowers
 © 2012 Michael O'Brien	Blue Wildrye *Elymus glaucus*	B	moderate	X		X	Y	Y	24"	12"	full sun to light shade	perrenial, distinct blue to blue-green colored leaves

North Coast Stormwater Coalition Low Impact Development Recommended Plant List

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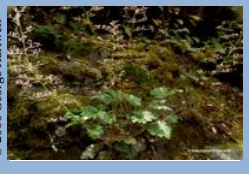
	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Seaside Daisy *Erigeron glaucus*	B	moderate				Y	N	12"		full to partial sun	lavendar colored flowers that attract pollinators
 ©2010 Robert Steers/NPS	California Fescue *Festuca californica*	B/C	moderate				Y	N	4.5'	3.5'	shade to partial sun	drought tollerant, stabilizes soils & prevents errosion,
 ©2008 Keir Morse	Idaho Fescue *Festuca idahoensis*	B/C	moderate				Y	N	30"	24"	shade to full sun	grows in bunches
	Red Fescue *Festuca rubra*	B	moderate	X		X	Y	Y	24"	12"	shade to partial sun	no-mow ground cover
	Beach Strawberry *Fragaria chiloensis*	B	moderate, dry	X		X	Y	Y	6"	12"	full to partial sun	edible red berries, grows well in sandy soils
 © 2002 George Jackson	Wood Strawberry *Fragaria vesca*	B	moderate, dry	X		X	N	Y	10"	12"	shade/ part	edible red berries
	Western Mannagrass *Glyceria occidentalis*	A	wet, moderate			X	Y	Y	18"	12"	full sun to partial shade	does well in detention ponds and swales
 © 2006 George Hartwell	Small-flowered Alumroot *Heuchera micrantha*	B	wet, moderate				Y	N	3.5'		full sun to part shade	distinct green to dark purple colored leaves; can grow on steep slopes

North Coast Stormwater Coalition Low Impact Development Recommended Plant List

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	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Douglas Iris *Iris douglasiana*	B	moist to dry	X		X	Y	N	18"	12"	full to partial sun	cream-purple flowers arise on a 1-2 foot high stem; grows well in run-off ditches
	Common Rush *Juncus effusus var. pacificus*	A	wet, moderate	X	X	X	Y	Y	36"	12"	full sun to part shade	tolerant of polluted conditions, Note that *J. effusus var. effusus* can be invasive, use native Pacific variety
	Dagger-leaf Rush *Juncus ensifolius*	A	wet, moderate	X	X	X	N	N	10"	12"	full/ part	flattebed stems much like an iris ; spreads vigorously
	Spreading Rush *Juncus patens*	A	wet, moderate	X	X	X	N	Y	36"	12"	full/ part	bluish-green foliage ; very little maintanance
	Large-leaved Lupine *Lupinus polyphyllus*	A/B	moderate	X		X	Y	N	36"	12"	full/ part	showy spring flowers, fixes nitrogen
	False Lily-of-the-valley *Maianthemum dilatatum*		wet, moderate				Y		16"		shade	ground cover; can form broad mats
	Gray Beartongue *Penstemon rattanii var. rattanii*	B	moderate				Y	N	48"		full sun to part shade	attracts native pollinators including bumble bees
	Sword Fern *Polystichum munitum*	A/B	wet, moderate	X		X	Y	Y	24"	24"	full/ part	shing, leathery leaves

North Coast Stormwater Coalition Low Impact Development Recommended Plant List

Zone A: Area of the LID facility defined as the bottom to the designed high water mark. This area has moist to wet soils and plants located here shall be tolerant of inundation.

Zone B: Area of the LID facility defined as the side slopes from the designed high water line up to the edge of the facility. This area typically has dryer to moist soils, with the moist soils being located further down the side slopes. Plants here should be drought tolerant and help stabilize the slopes.

	Name	Planting Zone		Facility Type			Characteristics					Additional Infomation
	Common Name *Scientific Name*	Zone	Moisture Zone	Swale	Planter	Basin	NW Native	Evergreen	Height	Width	Sun Requiremen	
	Cinquefoil *Potentilla gracilis*	B/C	moderate, dry				Y	N	40"		full/ part	flowers attract native bees
	Three-squared Bulrush *Schoenoplectus americanus*	A	wet				Y	N	7'		full/ part	native perennial
	Small-flowering Bulrush *Scirpus microcarpus*	A	moderate			X	Y	Y	24"	24"	full/ part	good soil binder
	Golden-eyed-grass *Sisyrinchium californicum*	A/B	moist	X	X	X	N	Y	6"	12"	full to partial sun	produces bright yellow flowers that attract many beneficial insects
	Coast Goldenrod Solidago spathulata	B	moderate				Y	N	20"		full to partial sun	bright yellow flowers attract butterflies and other insects
	Fringe Cups *Tellima grandiflora*	B	moderate				Y	N	12"		shade	flowers age changing rom green to pink
	Youth-on-age *Tolmiea diplomenziesii*	B	wet, moderate				Y	N	15"		shade	perennial herb

Acknowledgements:

This guide was put together by the City of Arcata Environmental Services Department and Humboldt Bay Keeper. The information presented here is from the *Portland Stormwater Management Manual; Planting Templates and Lists* , by the City of Portland and *The Oregon Rain Garden Guide* , by Oregon Sea Grant. Used by permission. Photographs are from *A Photographic Guide to the Plants of Humboldt Bay Dunes and Wetlands* , compiled by Gordon Leppig and Ardrea J. Pickart and from *Calphotos* , by the University of California, Berkely. Used by permission.

APPENDIX 6

O&M Plan Checklist and Certification

O&M Plan Checklist and Certification for Regulated Projects

For Office Use Only
Application No._____
Received By: _____

A. Designate the *Responsible Individual (RI).*

The *RI* is the person that will have direct responsibility for the maintenance of storm water controls, maintain self-inspection records, and sign any correspondence with the PBS departments with project location jurisdiction.

Name of RI:_____

Phone:_____

Project Name:_____

Physical Site Address and/or APN:_____

☐ Include the site plan delineating the DMAs and the locations of the bioretention or equivalent facilities.

☐ Include the final construction drawings of the storm water facilities:

- ☐ Plans, elevations, and details of bioretention facilities.
- ☐ Construction details and specifications, including: depths of sand and soil, compaction, pipe materials, and bedding.
- ☐ Location and layouts of inflow piping and piping to off-site discharge
- ☐ Native soils (lenses beneath the facilities)

B. Scheduled Maintenance Activities

The following activities will need to occur on an annual basis, frequency may need to be adjusted depending on facility.

- **Refuse removal,** remove trash the collects near the inlets or that is trapped by vegetation. Clean out soil and debris blocking inflets or overflows.
- **Control weeds,** manual methods and soil amendments; non-natural (synthetic) pesticides should not be used.
- **Add mulch,** add mulch to maintain a mulch layer thickness of ~ 3 inches.
- **Pruning and replanting vegetation,** it may be necessary to replace or remove vegetation to ensure the proper functioning of the facility.
- **Check irrigation**, if irrigation exists, check to make sure the system is working as intended.

An annual self-certification letter will be mailed to the RI. This letter will serve as verification that all the storm water facilities on the property are being maintained and remain operational. The letter should be signed and returned within 30 days.

O&M Plan Checklist and Certification for Regulated Projects

C. Updates to the O & M Plan

Contact information for the Responsible Individual should be current. If the RI changes, the PBS departments with project location jurisdiction should be notified with the appropriate revisions.

D. O & M plans for other Facility Types

If your project included a non-standard storm water treatment facility that was approved by the Planning and Building Services Department, such as a tree-box type system, than the O & M should reflect the manufacturer's recommended maintenance scheduling.

E. Signature and Certification:

"I, the RI/applicant accept responsibility for operation and maintenance of storm water treatment and flow-control facilities until such time as this responsibility is transferred to a subsequent owner." Furthermore, a condition on the property deed will be recorded with the County Recorder's office indicating that a storm water facility is present on the property and that the maintenance responsibility will transfer with property ownership in perpetuity.

_____ _____

Signature of the RI Date

_____

Print Name

I am the:

☐ Property Owner

☐ Applicant

☐ Contractor

O and M: Inspection and Maintenance Checklist: Bioretention Facility

Example of Inspection Maintenance Document

Responsible Individual:_____

Facility Name:_____

Date of Inspection:_____

Item	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed; and if any needed maintenance was not conducted, note what is needed and when it will be done)	**Results Expected When Maintenance Is Performed**
General				
Trash and Debris	Trash and debris accumulated in basin Visual evidence of dumping			Trash and debris cleared from site.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants			No contaminants or pollutants present.
Vegetation	When the planted vegetation becomes excessively tall. When nuisance weeds and other vegetation start to take over.			Vegetation mowed per specifications or maintenance plan, or nuisance vegetation removed so that flow is not impeded. Vegetation should never be mowed lower than the design flow depth. Remove clippings from the area and dispose appropriately.

This or a similar document should remain with the facility. Inspection and maintenance records should be available upon request from the PBS departments with project location jurisdiction.

O and M: Inspection and Maintenance Checklist: Bioretention Facility

Item	Conditions When Maintenance Is Needed	Maintenance Needed? (Y/N)	**Comments** (Describe maintenance completed; and if any needed maintenance was not conducted, note what is needed and when it will be done)	Results Expected When Maintenance Is Performed
Tree/Brush Growth and Hazard Trees	Growth does not allow maintenance access or interferes with maintenance activity Dead, diseased, or dying trees			
Erosion	Eroded over 2 in. deep where cause of damage is still present or where there is potential for continued erosion.			Cause of erosion is managed appropriately. Areas remulched to fill in void areas.
Sediment	Accumulated sediment affects inletting or outletting condition of the facility.			Sediment removed and area reseeded if necessary to control erosion.
Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.			Pipe repaired or replaced.
Rodent Holes	If facility acts as a dam or berm, any evidence of rodent holes, or any evidence of water piping through dam or berm via rodent holes.			The design specifications are not compromised by holes. Any rodent control activities are in accordance with applicable laws and do not affect any protected species

This or a similar document should remain with the facility. Inspection and maintenance records should be available upon request from the PBS departments with project location jurisdiction.

APPENDIX 7

Pollutant Sources/Source Controls Checklist

Stormwater Pollutant Sources/Source Controls Checklist

How to use this worksheet (also see instructions on Checklist for Regulated Projects):

1 Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.

2 Review Column 2 and incorporate all of the corresponding applicable Structural Source Control BMPs in your Stormwater Control Plan drawings.

3 Review Columns 3 and 4 and incorporate all of the corresponding applicable Structural Source Control BMPs and Operational Source Control BMPs in a table in your Stormwater Control Plan. Use this table and an accompanying narrative in the SCP, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs.

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **A.** On-site storm drain inlets (unauthorized non-stormwater discharges and accidental spills or leaks)	☐ Location of inlets	☐ Mark all inlets with the words "No Dumping! Flows to River/Ocean" or similar.	☐ Maintain and periodically repaint or replace inlet markings. ☐ Provide stormwater pollution prevention information to new site owners, lessees, or operators. See applicable operational BMPs in Fact Sheet SC-74, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook ☐ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **B.** Interior floor drains and elevator shaft sump pumps	☐ Show drain and pump locations	☐ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ **C.** Interior parking garages	☐ Show drain locations	☐ State that parking garage floor drains will be plumbed to the sanitary sewer	☐ Inspect and maintain drains to prevent blockages and overflow.
☐ **D_1.** Need for future indoor & structural pest control		☐ Note building design features that discourage entry of pests	☐ Provide Integrated Pest Management information to owners, lessees, and operators.
☐ **D_2.** Landscape/ Outdoor Pesticide Use/Building and Grounds Maintenance	☐ Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained. ☐ Show self-retaining landscape areas, if any. ☐ Show bioretention facilities. (See instructions in Section 4 of manual.)	State that final landscape plans will accomplish all of the following. ☐ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. ☐ Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. ☐ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. ☐ Consider using pest-resistant plants, especially adjacent to hardscape. ☐ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	☐ Maintain landscaping using minimum or no pesticides. ☐ See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook ☐ Provide IPM information to new owners, lessees and operators.

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **E.** Pools, spas, ponds, decorative fountains, and other water features	☐ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.	☐ If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☐ See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook ☐ The sanitary sewer operator must be notified and a clean out identified when pools are to be drained to the sanitary sewer.
☐ **F.** Food Service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ State maintenance schedule for grease interceptor
☐ **G.** Refuse areas	☐ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☐ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☐ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☐ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☐ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **H.** Industrial Process area	☐ Show process area.	☐ If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."	☐ See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook
☐ **I.** Outdoor storage of equipment or materials (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)	☐ Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area. ☐ Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults. ☐ Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.	☐ Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains. ☐ Where appropriate, reference documentation of compliance with the requirements of programs for: • Hazardous Waste Generation • Hazardous Materials Release Response and Inventory • California Accidental Release (CalARP) • Aboveground Storage Tank • Uniform Fire Code Article 80 Section 103(b) & (c) 1991 • Underground Storage Tank	☐ See the Fact Sheets SC-31, "Outdoor Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **J.** Vehicle and Equipment Cleaning	☐ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle/ equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	☐ If a car wash area is not provided, describe measures taken to discourage on-site car washing and explain how these will be enforced.	☐ Describe operational measures to implement the following (if applicable): Wash water from vehicle and equipment washing operations shall not be discharged to the storm drain system. Car dealerships and similar may rinse cars with water only. ☐ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **K.** Vehicle and Equipment Repair and Maintenance	☐ Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater. ☐ Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas. ☐ Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	In the Stormwater Control Plan, note that all of the following restrictions apply to use the site: ☐ No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinse water from parts cleaning into storm drains. ☐ No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately. ☐ No person shall leave unattended parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment. See Fact Sheet SC-22, "Vehicle and Equipment Repair" in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **L.** Fuel Dispensing Areas	☐ Fueling areas shall have impervious floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable. ☐ Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area1.] The canopy [or cover] shall not drain onto the fueling area	☐ State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area. ☐ State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements. ☐ State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.	☐ The property owner shall dry sweep the fueling area routinely. See Fact Sheet SC-20, "Vehicle and Equipment Fueling" in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
☐ **M.** Loading Docks	☐ Show the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. ☐ Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. ☐ Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.		☐ Move loaded and unloaded items indoors as soon as possible. ☐ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook
☐ **N.** Fire Sprinkler Test Water		☐ Provide a means to drain fire sprinkler test water to the sanitary sewer	☐ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.casqa.org/resources/municipal-bmp-handbook

IF THESE SOURCES WILL BE ON THE PROJECT SITE…	**… THEN YOUR STORMWATER CONTROL PLAN (SCP) SHOULD INCLUDE THESE SOURCE CONTROL BMPS**		
1 **Potential Sources of Runoff Pollutants**	2 **Structural Source Controls – Show on SCP Drawings**	3 **Structural Source Control – List in SCP Table and Narrative**	4 **Operational Source Control BMPs – Include in SCP Table and Narrative**
O. Miscellaneous Drain or Wash Water or Other Sources ☐ Boiler drain lines ☐ Condensate drain lines ☐ Rooftop equipment ☐ Drainage sumps ☐ Roofing, gutters, and trim ☐ Other sources	☐ Show drain lines and drainage sumps	☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☐ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☐ Include controls for other sources as specified by local reviewer.	If architectural copper is used, implement the following BMPs for management of rinse water during installation: ☐ If possible, purchase copper materials that have been pre-patinated at the factory. ☐ If patination is done on-site, prevent rinse water from entering storm drains by discharging to landscaping or by collecting in a tank and hauling off-site. ☐ Consider coating the copper materials with an impervious coating that prevents further corrosion and runoff. Implement the following BMPs during routine maintenance: ☐ Prevent rinse water from entering storm drains by discharging to landscaping or by collecting in a tank and hauling off-site.
☐ **P.** Plazas, sidewalks, and parking lots.	☐ Show extent of pervious paving materials		☐ Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. ☐ Collect debris from pressure washing to prevent entry into the storm drain system. ☐ Collect wash water containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Applicable CASQA BMP Fact Sheets are available as a separate document, check with the County or City Department with project location jurisdiction for availability.

BMP Fact Sheets referenced above are also available for download from the CASQA website at:

https://www.casqa.org/resources/bmp-handbooks/municipal-bmp-handbook

APPENDIX 8

Mounding Analysis Procedures

Ground Water Mounding Analysis: Narrative How-To

Pertinent Variables	
Variable	*Unit*
m: aquifer thickness	Feet
w: width of flow path	Feet
L: length of the side of the drain field that is **perpendicular** to the flow	Feet
ΔH: change in height of groundwater	Feet
Q: design flow rate per unit time	Gallons/day (design storm event)
A: area of flow path (cross-sectional) (m*w)	Square feet
K: hydraulic conductivity (average)	Feet/day

1. Calculate K, the hydraulic conductivity
2. Calculate Q based drainage area and design storm event
3. Set Q/A as less than K (determined in step #2).

4a. Determine the A range that keeps (Q/A) < K. A **must** be large enough that (Q/A) < K. A is a cross-sectional area, found by multiplying the thickness of the aquifer (m) and the width of the window of flow (w).

4b. If (Q/A) > K and A cannot be increased or if the soil is determined to be silt or clay, groundwater mounding— in which the hydraulic head immediately below the drainage field rises to within 5 feet of the bottom of the drain field then infiltration trenches cannot be used.

5a. Use the equation ΔH= ([Q x L] / [A x K]) to determine by how much the groundwater will mound. ()

5b. Ensure that ΔH does not put the groundwater mounding level within 5 feet or less of the bottom of the drain field.

Helpful note	
Aquifer thickness: (Distance to impermeable boundary below aquifer) - (distance to groundwater when groundwater is at its highest level)	Example: Distance to impermeable boundary below aquifer is found to be 29 feet. When groundwater is at its highest, it is found 4 feet below ground. Therefore, 29-4=25, so the aquifer is 25 feet thick.

Example (from "Model Decentralized Wastewater Practitioner Curriculum", Aziz Amoozegar, PhD, North Carolina State University)

Ground Water Mounding: The lateral movement of water in the saturated zone must be determined to assess the level of rise of water table (i.e., ground water mounding) under the drain field of the system. Based on the depth to water table (3 ft) and the impermeable boundary below the aquifer (25 ft), the thickness of aquifer is assumed to be 22 ft. Using an average saturated hydraulic conductivity of 18 ft/d and a drainage ditch located at 300 ft from the edge of drain field, the groundwater mound under the drain field (approximately 60 ft by 105 ft) was calculated by the Hantush model presented by Molden et al. (1984). The model predicted a maximum ground water mounding of approximately 0.47 ft, which puts the top of the water table at 2.53 ft below the land surface.

Another way to determine ground water mounding is to assume that all the applied wastewater must move toward the drainage ditch located at approximately 300 ft from the drain field edge. Similar

to the above analysis, we assume the length of the drain field (105 ft) is parallel to the drainage ditch, the thickness of aquifer at the edge of the field is 22 ft , and the average K_{sat} for the saturated zone is 18 ft/d. The length of flow (i.e., the width of the drain field) for calculating hydraulic gradient is 60 ft, and the cross sectional of the flow is 2,310 ft^2 Using Eq. [2], the rise in water table for a total flow volume of 425 ft^3/day is then:

$$\Delta H = ([425 \times 60]/(2{,}310 \times 18) = \mathbf{0.61\ ft}$$

APPENDIX 9

Definitions

Hydromodification - Modification of hydrologic pathways (precipitation, surface runoff, infiltration, groundwater flow, return flow, surface-water storage, groundwater storage, evaporation and transpiration) that results in negative impacts to watershed health and functions.

Illicit Discharge - Any discharge to a municipal separate storm sewer (storm drain) system (MS4) that is prohibited under local, state, or federal statutes, ordinances, codes, or regulations. The term illicit discharge includes all non-storm water discharges not composed entirely of storm water and discharges that are identified under the Discharge Prohibitions section of this General Permit. The term illicit discharge does not include discharges that are regulated by an NPDES permit (other than the NPDES permit for discharges from the MS4).

Impervious Surface - A surface covering or pavement of a developed parcel of land that prevents the land's natural ability to absorb and infiltrate rainfall/storm water. Impervious surfaces include, but are not limited to; roof tops, walkways, patios, driveways, parking lots, storage areas, impervious concrete and asphalt, and any other continuous watertight pavement or covering. Landscaped soil and pervious pavement, including pavers with pervious openings and seams, underlain with pervious soil or pervious storage material, such as a gravel layer sufficient to hold the specified volume of rainfall runoff are not impervious surfaces.

Linear Underground/Overhead Projects (LUPs) - Include, but are not limited to, any conveyance, pipe, or pipeline for the transportation of any gaseous, liquid (including water and wastewater for domestic municipal services), liquescent, or slurry substance; any cable line or wire for the transmission of electrical energy; any cable line or wire for communications (e.g., telephone, telegraph, radio, or television messages); and associated ancillary facilities. Construction activities associated with LUPs include, but are not limited to, (a) those activities necessary for the installation of underground and overhead linear facilities (e.g., conduits, substructures, pipelines, towers, poles, cables, wires, connectors, switching, regulating and transforming equipment, and associated ancillary facilities); and include, but are not limited to, (b) underground utility mark-out, potholing, concrete and asphalt cutting and removal, trenching, excavation, boring and drilling, access road and pole/tower pad and cable/wire pull station, substation construction, substructure installation, construction of tower footings and/or foundations, pole and tower installations, pipeline installations, welding, concrete and/ or pavement repair or replacement, and stockpile/borrow locations.

Low Impact Development – A sustainable practice that benefits water supply and contributes to water quality protection. Unlike traditional storm water management, which collects and conveys storm water runoff through storm drains, pipes, or other conveyances to a centralized storm water facility, Low Impact Development (LID) takes a different approach by using site design and storm water management to maintain the site's pre-development runoff rates and volumes. The goal of LID is to mimic a site's predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to the source of rainfall. LID has been a proven approach in other parts of the country and is seen in California as an alternative to conventional storm water management.

Municipal Separate Storm Sewer System (MS4) - The regulatory definition of an MS4 (40 CFR 122.26(b)(8)) is "a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created to or pursuant to state law) including special districts under state law such as a sewer district, flood control district or 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 Clean Water Act that discharges into waters of the United States. (ii) Designed or used for collecting or conveying storm water;
(iii) Which is not a combined sewer; and (iv) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."

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

New Development - New Development means land disturbing activities; structural development, including construction or installation of a building or structure, creation of impervious surfaces; and land subdivision on an area that has not been previously developed.

Pervious Pavement - Pavement that stores and infiltrates rainfall at a rate that exceeds conventional pavement.

Pollutant - Dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.)), heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.

Receiving Water – Surface water that receives regulated and unregulated discharges from activities on land

Redevelopment - Land-disturbing activity that results in the creation, addition, or replacement of exterior impervious surface area on a site on which some past development has occurred. Redevelopment does not include trenching, excavation and resurfacing associated with LUPs; pavement grinding and resurfacing of existing roadways; construction of new sidewalks, pedestrian ramps, or bike lanes on existing roadways; or routine replacement of damaged pavement such as pothole repair or replacement of short, non-contiguous sections of roadway.

Regulated Project – Refers to projects subject to the new and redevelopment standards in Section E.11; all projects (excluding single family homes) that create and/or replace 5,000 sq. ft. or more of impervious surface

Single-family Home Project - 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.

Source Control - Land use or site planning practices, or structural or nonstructural measures, that aim to prevent runoff pollution by reducing the potential for contact with rainfall runoff at the source of pollution. Source control BMPs minimize the contact between pollutants and urban runoff.

Storm Drain System - The basic infrastructure in a municipal separate storm sewer system that collects and conveys storm water runoff to a treatment facility or receiving water body.

Storm Water – Storm water is generated when precipitation from rain and snowmelt events flows over land or impervious surfaces and does not percolate into the ground. As storm water flows over the land or impervious surfaces, it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the storm water is discharged untreated.

APPENDIX 10

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