Green Infrastructure Design Guide – Overview

- Connie Goldade
  Community Design + Architecture

- New model guidance document and standards for local agency use in meeting Green Infrastructure Plan provision

c d + a
COMMUNITY DESIGN + ARCHITECTURE

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MRP Provisions

- C.3.i(2)(e): General guidelines for overall streetscape and project design and construction so that projects have a unified, complete design that implements the range of functions associated with the projects.
- C.3.i(2)(f): Standard specifications and, as appropriate, typical design details and related information necessary for the Permittee to incorporate green infrastructure into projects in its jurisdiction.

Existing Documents

- *Sustainable Green Streets and Parking Lots Design Guidebook*, January 2009
- *C.3 Stormwater Technical Guidance*, Version 5, June 2016

- Streets and Parking Lots Guidebook
  - 10 years old
  - Some key details not provided
- Terminology differences
- Some differences in guidance
- Additional technical guidance needed for:
  - non-regulated projects
  - "under-sized" GI treatment measures / elements
- O&M not comprehensive
- Layout & graphic design not consistent

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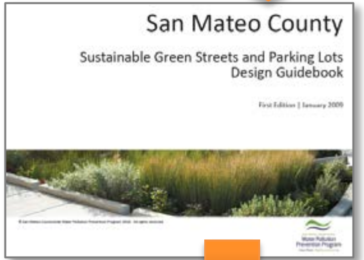
Guidelines, Standard Specifications and Typical Design Details

Core element of MRP 2.0 requirements for the 2019 Annual Report



- Reorganize and develop new guidance:
  - Build from *San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook*
    - CD+A and URD experience through developing other GI guidance and projects
  - Reference Best Practice and other Model Documents
  - Coordinate with BASMAA Development Committee and GI Design Charrette

- Best Practices
- New Custom Guidance
- Local Experience

Guidelines, Standard Specifications and Typical Design Details

- Developed with input and feedback from GI Committee
- Emphasis on landscape-based measures
  - See *C.3 Regulated Projects Guide* for elements such as mechanical treatment measures
- Focus on universal aspects and implementation of GI – no distinction between bioretention and infiltration

Green Infrastructure Design Guide Chapters

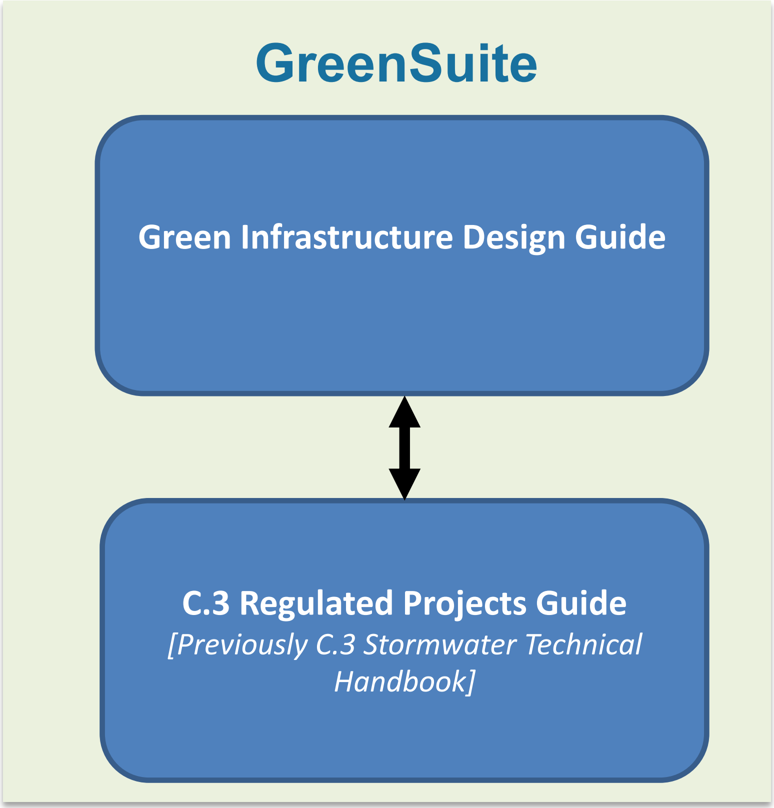
Chapters	Content
1. Introduction	• Overview • Stormwater Basics, Regulations & Policies, Function
2. GI Measures and Opportunities	• 13 GI types • When to use, benefits, constraints, considerations
3. Introduction to the Design Strategies and Guidelines	• Design strategies and guidelines • Design examples • Design elements and process • Complete streets primer and integration into Sustainable Streets
4. Key Design and Construction Considerations	• Focused considerations for design and construction in specific conditions and applications
5. Key Implementation Strategies	• Costs • Policy and incentives • Education/outreach
6. Operations and Maintenance	• Potential GI Funding Source Analysis • O&M Recommendations

Green Infrastructure Design Guide Appendices

Appendix	Content
1. Glossary	• Definitions of key technical terms and phrases
2. Reference Documents	• Alphabetical listing of references compiled from Design Guide Chapters
3. Sustainable Streets Typical Design Details	• How to use typical design details, customization • SFPUC and select new/modified SFPUC/Other details
4. Sustainable Streets Specifications	• Pervious Pavements – Concrete, Asphalt, Pavers • Bioretention Soil • Composted Mulch
5. Sample Maintenance Plan Forms	• Landscape Stormwater Facility Maintenance Checklist • Pervious Pavement Maintenance Checklist
6. Potential GI Funding Source Analysis & Rec's	• Final GI Funding Report
7. Guidance for Sizing GI Facilities in Streets	• BASMAA's regional approach for sizing for constrained non-regulated street projects • 2 companion documents

Ch 1 Introduction

- **Background "Primer" for those less knowledgeable about GI**
- **1.0 Introduction**
- **Overview**
- **How to Use**
  - Guide for GI design, implementation, and O&M
  - Not for construction activities
  - How to use the GreenSuite and Design Guide
- **Principles of GI Stormwater Design**
  - Stormwater management goals
  - Benefits of GI



Ch 1 Introduction

- **1.1 Sustainable Stormwater Design Basics**
  - Regional Projects, Green Streets, Parcel types
  - Case studies
- **1.2 Existing Regulatory Framework & Related Policies and Programs**
  - MRP; C.3 and GI Plans
  - Reasonable Assurance Analysis
  - SMCWPPP
- **1.3 Local GI Policies and Programs**
  - Countywide Stormwater Resource Plan
  - Planning and related Documents
- **1.4 GI Design Functions, Design Considerations, and Strategies**
  - GI Functions
  - San Mateo County considerations

Ch 2 GI Measures & Opportunities

- **2.1 Introduction**
  - Toolbox of GI measures
  - Opportunities
  - GI Measure Applicability
    - locations
    - Type
    - Function

Table 2.1 Green Infrastructure Measure Applicability

Green Infrastructure Measures	Guidance Location	Suitable Green Infrastructure Location				C.3 Regulated Project Type		Primary and Secondary Functions[9]				
		Site	Parking Lot	Building	Street	Stand-alone Treatment	Element of Treatment Train	Infiltration[1]	Bio-Retention	Pollutant Removal	Interception	Detention
Treatment Measures												
Stormwater Planter[2]	2.1	●	●		●	●		■/□	■	■	□[3]	■/□
Stormwater Curb Extension	2.2		●		●	●		■/□	■	■	□[3]	■/□
Rain Garden	2.3	●	●		●	●		■/□	■	■	□[3]	■/□
Tree Well	2.4	●	●		●	●		■/□	■	■	■	■/□
Infiltration Systems	2.5	●	●		●	●	●[6]	■/□	□	■		■/□
Pervious Pavement	2.6	●	●		●	●	●			■		■/□
Green Roof	2.7	●		●		●[4]			■	■	■	
Rainwater Harvesting[5]	2.8	●	●	●		●						■
Alternative Treatment Measures[7]												
Vegetated Swale	2.9	●	●		●		●	■/□		□	■/□	
Green Gutter	2.10	●	●		●			■/□	□	□		
Stormwater Tree	2.11	●	●		●			■/□	□		■	
Site Design Measures												
Interceptor Tree	2.12	●	●	●	●					□	■	
Green Wall[8]	2.13			●					□	□	■	

Endnotes

1. Where site-specific percolation tests confirm that an infiltration rate of 0.5/hour is realistic, see **C.3 Regulated Projects Guide** for further discussion.
2. Alternative Term: "Bioretention Swale" – linear bioretention areas, not the same as "Vegetated Swale".
3. Primary Function if trees are included in design.
4. If built to specifications approved by Regional Water Board.
5. Includes cisterns, rain barrels, and other measures and strategies for maximizing use of rain water for non-potable uses such as toilet flushing or landscape irrigation.
6. Some types of infiltration systems require pre-treatment.
7. Alternative Treatment Measures have limited, or currently, no credit towards C.3 regulated project treatment requirements.
8. Not identified as a site design measure in the MRP.
9. See page 1-30 for definitions of these functions.

Legend

- ● Applicable Green Infrastructure Measure
- ■ Primary Function
- □ Secondary Function
- ■/□ Primary or Secondary Function Depending on Site Conditions and Design

Ch 2 GI Measures & Opportunities

- **GI Measures**
  - Definition and description
  - Why use and constraints
  - Opportunities for Buildings, Sites, and Streets
  - Special design considerations

Chapter 2 - Green Infrastructure Measures and Opportunities 2-1

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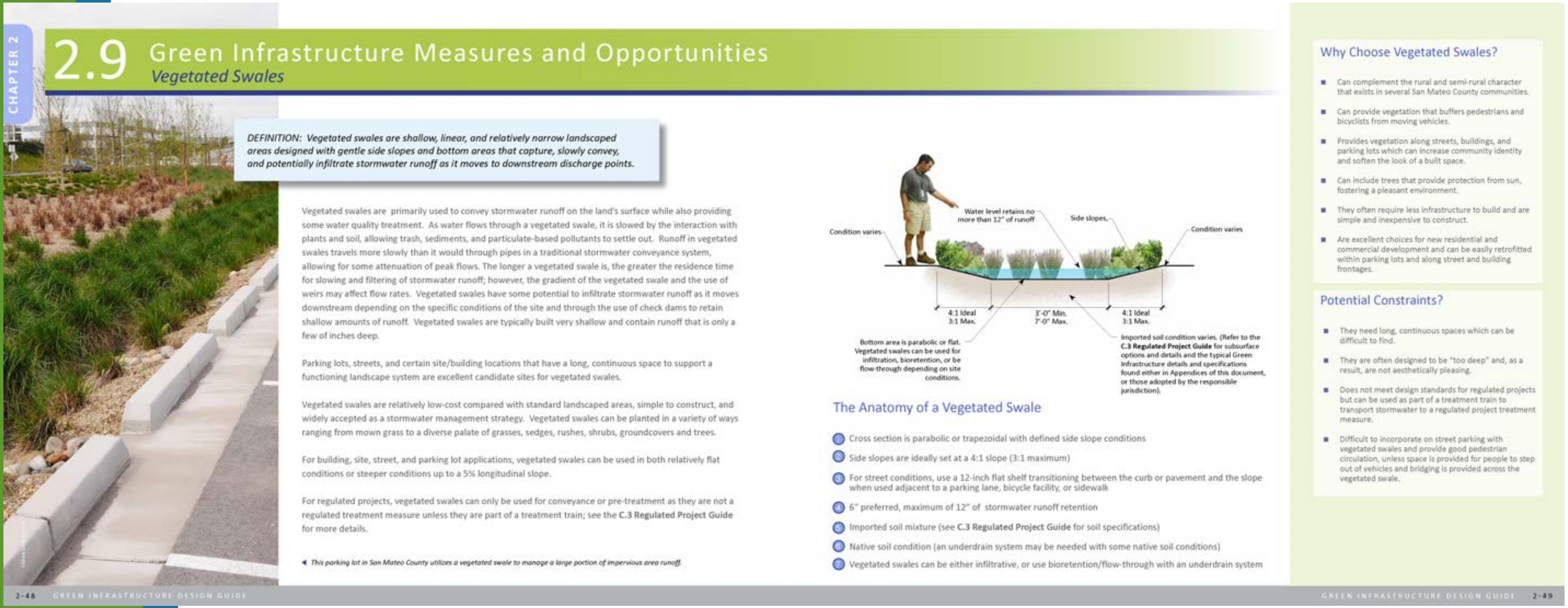
Ch 2 GI Measures & Opportunities



CHAPTER 2

2.9 Green Infrastructure Measures and Opportunities

Vegetated Swales

DEFINITION: Vegetated swales are shallow, linear, and relatively narrow landscaped areas designed with gentle side slopes and bottom areas that capture, slowly convey, and potentially infiltrate stormwater runoff as it moves to downstream discharge points.

Vegetated swales are primarily used to convey stormwater runoff on the land's surface while also providing some water quality treatment. As water flows through a vegetated swale, it is slowed by the interaction with plants and soil, allowing trash, sediments, and particulate-based pollutants to settle out. Runoff in vegetated swales travels more slowly than it would through pipes in a traditional stormwater conveyance system, allowing for some attenuation of peak flows. The longer a vegetated swale is, the greater the residence time for slowing and filtering of stormwater runoff; however, the gradient of the vegetated swale and the use of weirs may affect flow rates. Vegetated swales have some potential to infiltrate stormwater runoff as it moves downstream depending on the specific conditions of the site and through the use of check dams to retain shallow amounts of runoff. Vegetated swales are typically built very shallow and contain runoff that is only a few of inches deep.

Parking lots, streets, and certain site/building locations that have a long, continuous space to support a functioning landscape system are excellent candidate sites for vegetated swales.

Vegetated swales are relatively low-cost compared with standard landscaped areas, simple to construct, and widely accepted as a stormwater management strategy. Vegetated swales can be planted in a variety of ways ranging from mown grass to a diverse palate of grasses, sedges, rushes, shrubs, groundcovers and trees.

For building, site, street, and parking lot applications, vegetated swales can be used in both relatively flat conditions or steeper conditions up to a 5% longitudinal slope.

For regulated projects, vegetated swales can only be used for conveyance or pre-treatment as they are not a regulated treatment measure unless they are part of a treatment train; see the **C.3 Regulated Project Guide** for more details.

◄ *This parking lot in San Mateo County utilizes a vegetated swale to manage a large portion of impervious area runoff.*

The Anatomy of a Vegetated Swale

1. Cross section is parabolic or trapezoidal with defined side slope conditions
2. Side slopes are ideally set at a 4:1 slope (3:1 maximum)
3. For street conditions, use a 12-inch flat shelf transitioning between the curb or pavement and the slope when used adjacent to a parking lane, bicycle facility, or sidewalk
4. 6" preferred, maximum of 12" of stormwater runoff retention
5. Imported soil mixture (see **C.3 Regulated Project Guide** for soil specifications)
6. Native soil condition (an underdrain system may be needed with some native soil conditions)
7. Vegetated swales can be either infiltrative, or use bioretention/flow-through with an underdrain system

Why Choose Vegetated Swales?

- Can complement the rural and semi-rural character that exists in several San Mateo County communities.
- Can provide vegetation that buffers pedestrians and bicyclists from moving vehicles.
- Provides vegetation along streets, buildings, and parking lots which can increase community identity and soften the look of a built space.
- Can include trees that provide protection from sun, fostering a pleasant environment.
- They often require less infrastructure to build and are simple and inexpensive to construct.
- Are excellent choices for new residential and commercial development and can be easily retrofitted within parking lots and along street and building frontages.

Potential Constraints?

- They need long, continuous spaces which can be difficult to find.
- They are often designed to be "too deep" and, as a result, are not aesthetically pleasing.
- Does not meet design standards for regulated projects but can be used as part of a treatment train to transport stormwater to a regulated project treatment measure.
- Difficult to incorporate on street parking with vegetated swales and provide good pedestrian circulation, unless space is provided for people to step out of vehicles and bridging is provided across the vegetated swale.

Ch 2 GI Measures & Opportunities

CHAPTER 2

2.3 Green Infrastructure Measures and Opportunities
Rain Gardens

▲ *This rain garden at the Serramonte Library front entrance accepts runoff from a large parking lot.*

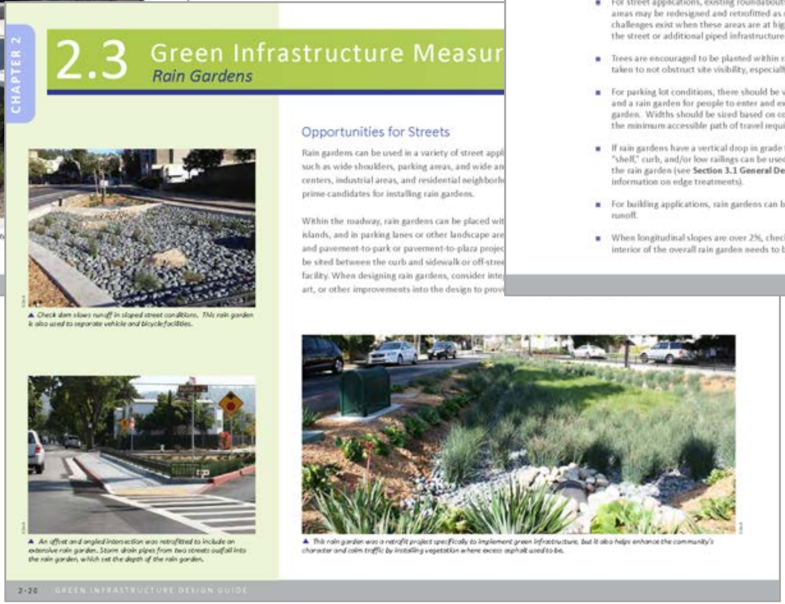
▲ *The Brisbane City Hall Rain Garden replaced what was once an under-utilized asphalt space.*

Opportunities for Buildings and Sites

Rain gardens can be retrofitted in a variety of building site applications. Large areas of unused or inefficiently used spaces are prevalent throughout mixed-use, commercial, industrial areas, and residential neighborhoods. These leftover landscape and asphalt spaces are prime candidates for building rain gardens that can accept building runoff. In some cases, rain gardens can be sited to accept runoff from both buildings and parking lots.

▲ *A rain garden capturing surface and roof runoff at Laurel Elementary in San Mateo County*

2-18 GREEN INFRASTRUCTURE DESIGN GUIDE



CHAPTER 2

2.3 Green Infrastructure Measur
Rain Gardens

▲ *Check dam slows runoff in sloped street conditions. This rain garden is also used to separate vehicle and bicycle facilities.*

▲ *An offset and angled intersection was retrofitted to include an extensive rain garden. Storm drain pipes from two streets outfall into the rain garden, which set the depth of the rain garden.*

Opportunities for Streets

Rain gardens can be used in a variety of street appl
such as wide shoulders, parking areas, and wide an
centers, industrial areas, and residential neighborh
prime candidates for installing rain gardens.

Within the roadway, rain gardens can be placed wit
islands, and in parking lanes or other landscape are
and pavement-to-park or pavement-to-plaza projec
be sited between the curb and sidewalk or off-stre
facility. When designing rain gardens, consider inte
art, or other improvements into the design to prov

▲ *This rain garden was a retrofit project specifically to implement green infrastructure, but it also helps enhance the community's character and calm traffic by installing vegetation where excess asphalt used to be.*

2-20 GREEN INFRASTRUCTURE DESIGN GUIDE

Special Considerations for Rain Garden Design

- Pedestrian access across rain gardens may be needed to allow convenient and direct access between two destinations, such as between an on-street parking stall and a building entry. This can be achieved with breaks between rain gardens or using pedestrian bridges constructed of decking, grates, or other acceptable and accessible materials.
- Where space permits, consider rain garden edges having a short flat bench along a pedestrian or bicycle facility and a low gradient slope leading to the bottom of the rain garden. This edge condition, rather than curbed side walk, can save construction materials costs as well as present a more garden appearance.
- The top surface of the rain garden should be kept as high as possible; however, the bottom elevation may need to be designed to accept stormwater runoff from existing storm drain pipe outlet elevations.
- For street applications, existing roundabouts, medians, traffic islands, and remnant landscape areas may be redesigned and retrofitted as rain gardens to manage stormwater, however, challenges exist when these areas are at high points of the roadway. Significant regrading of the street or additional piped infrastructure may be needed to route runoff to these spaces.
- Trees are encouraged to be planted within rain garden spaces, however, care needs to be taken to not obstruct site visibility, especially for drivers.
- For parking lot conditions, there should be wide enough space between a parking stall edge and a rain garden for people to enter and exit their vehicles without having to enter the rain garden. Widths should be sized based on context and level of pedestrian use, and at least, the minimum accessible path of travel requirements.
- If rain gardens have a vertical drop in grade to manage stormwater volumes, a flat landscaped "shelf," curb, and/or low railings can be used to prevent pedestrians or vehicles from entering the rain garden (see **Section 3.1 General Design Strategies and Guidelines** for additional information on edge treatments).
- For building applications, rain gardens can be either elevated or in-ground to receive rooftop runoff.
- When longitudinal slopes are over 2%, check dams will be needed. For slopes over 5%, the interior of the overall rain garden needs to be terraced.

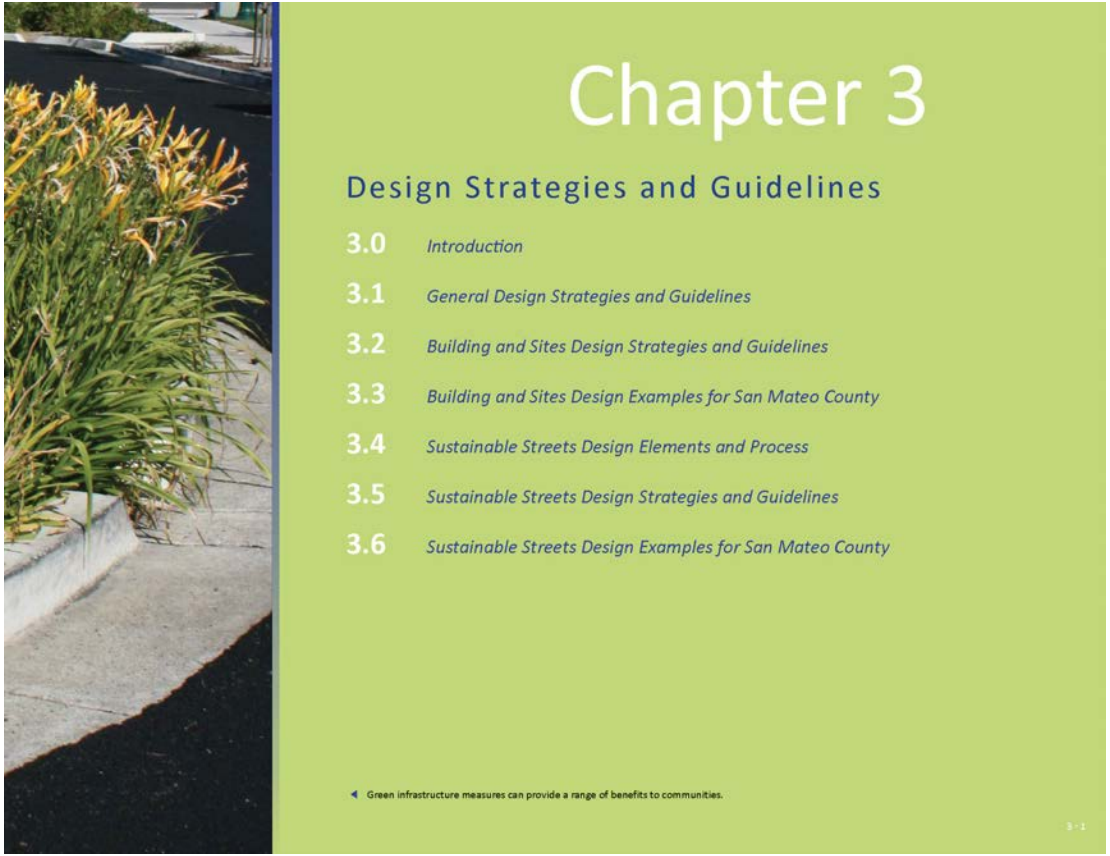
▲ *A rain garden in Village Homes accepts street and site runoff.*

▲ *This rain garden at the UC Davis campus captures roof runoff and features drought-tolerant plantings.*

▲ *A large rain garden within a regional park in Los Angeles features a boardwalk and integrated seating.*

GREEN INFRASTRUCTURE DESIGN GUIDE 2-21

GI Design Guide



Chapter 3

Design Strategies and Guidelines

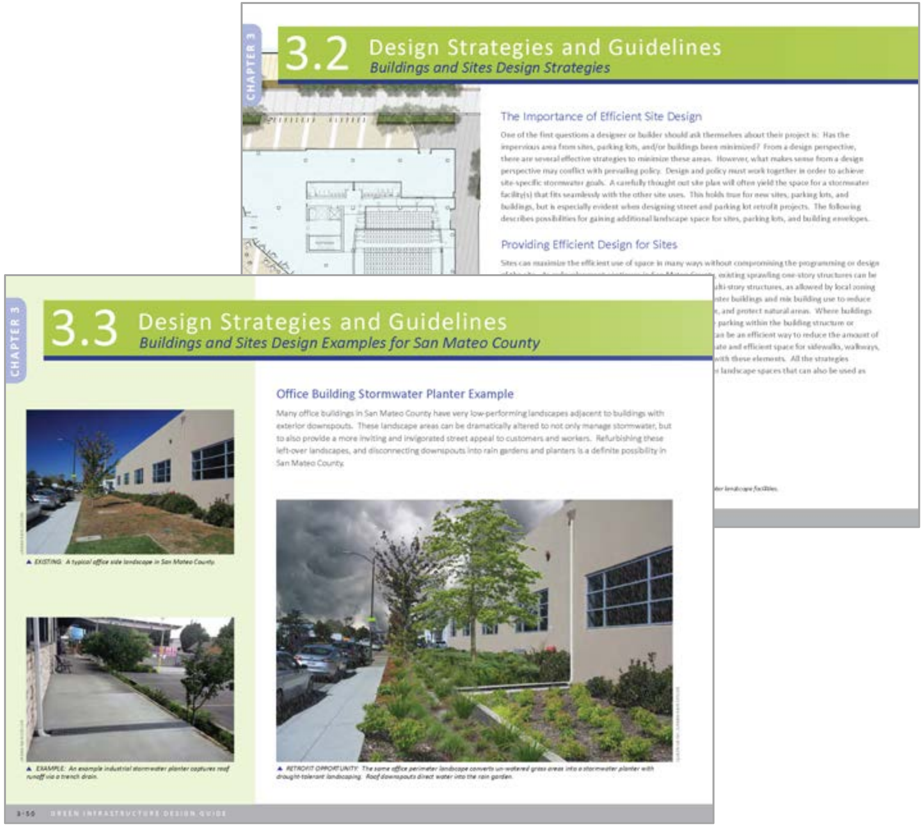
◄ Green infrastructure measures can provide a range of benefits to communities.

Ch 3 Intro to Design Strategies and Guidelines

- **3.1 General Design Strategies & Guidelines**
  - For All Locations and For Sustainable Streets
    - Applicable to most GI measures and locations
    - Builds on Ch 2 and Ch 4 design considerations

Ch 3 Intro to Design Strategies and Guidelines

- **3.2 Building & Sites Design Strategies and Guidelines**
  - Focused building & sites design strategies and guidance
- **3.3 Building & Sites Design Examples for San Mateo County**
  - How can implement GI and what can look like
  - Different contexts and types

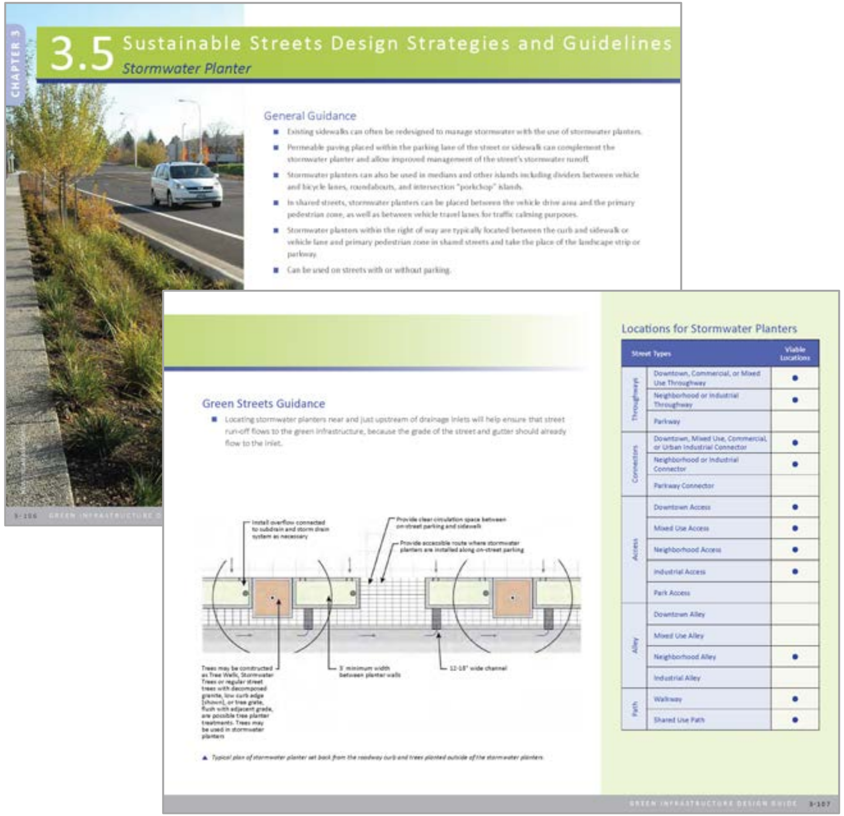


Ch 3 Intro to Design Strategies and Guidelines

- **3.4 Sustainable Streets Design Elements & Process**
  - What is a Sustainable Green and Complete Street?
    - Definition
    - Summarizes Complete Street types
    - How to select complementary GI and Complete Street techniques
    - GI measure applicability by street type
    - GI measure applicability by context type
    - GI locations within streets
    - Implementation approach and phases

Ch 3 Intro to Design Strategies and Guidelines

- **3.5 Sustainable Streets Design Strategies and Guidelines**
  - Focused for GI within street environment
  - More detailed guidance building upon Ch 2 and 4, and Section 3.1
  - Organized by:
    - GI measure
    - General, Green Street, Complete Street



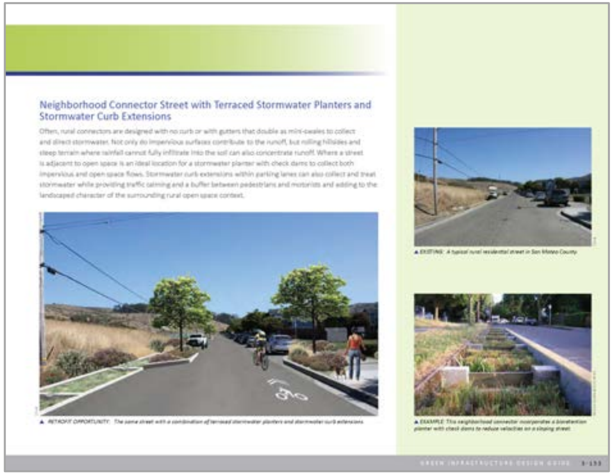
Ch 3 Intro to Design Strategies and Guidelines

- **3.6 Sustainable Streets Design Examples for San Mateo County**
  - How can implement GI and what could can like
  - Different contexts & street types

3.6 Sustainable Streets Design Examples

Neighborhood Connector Street with Rain Garden Intersections

Street intersections that are wide due to angled intersecting streets present opportunities to use rain gardens either within the center of the intersection as an island or roundabout, or to the side to expand a corner area for stormwater management and increasing public space and character. Street grades need to be considered to allow runoff to flow into the rain garden either from adjacent catch basins or sheet flow. Placing rain gardens within the roadway can aid in calming traffic and making a more comfortable and safer place for people to walk, bicycle, and drive. Where connectors and other streets are multi-lane or have a wide lane width, consider the ability to perform a lane reduction or add bicycle facilities. The illustration below shows rain gardens used to define vehicle circulation and calm traffic, and the addition of bicycle lanes. Corner curb extensions are placed at adjoining corners to increase pedestrian safety and comfort and shorten crossing distances.



Neighborhood Connector Street with Terraced Stormwater Planters and Stormwater Curb Extensions

Often, rural connectors are designed with no curb or with gutters that double as mini-swales to collect and direct stormwater. Not only do impervious surfaces contribute to the runoff, but rolling hillsides and steep terrain where rainfall cannot fully infiltrate into the soil can also concentrate runoff. Where a street is adjacent to open space is an ideal location for a stormwater planter with check dams to collect both impervious and open space flows. Stormwater curb extensions within parking lanes can also collect and treat stormwater while providing traffic calming and a buffer between pedestrians and motorists and adding to the landscaped character of the surrounding rural open space context.

In addition, existing landscape areas are redesigned to become stormwater planters. Pervious pavement can be used across the entire alleyway for added stormwater management and treatment. Different pavement colors and materials can be used to define the vehicle travel way, parking spaces, and pedestrian areas.

Ch 4 Intro to Design Strategies and Guidelines

Chapter 4 - Key Design and Construction Considerations 4-1

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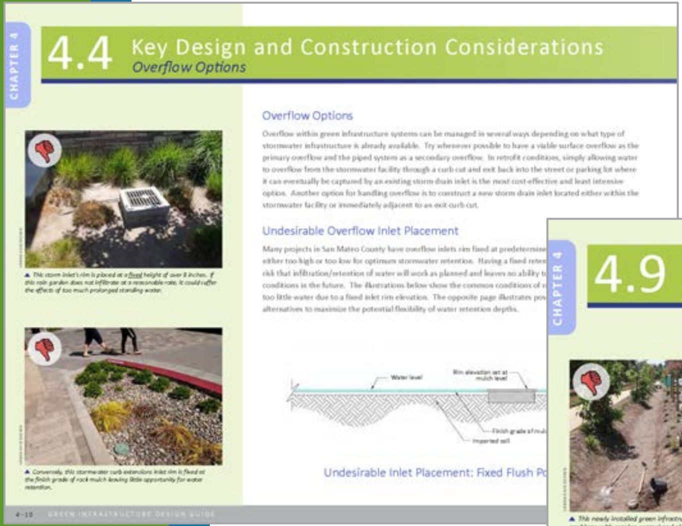
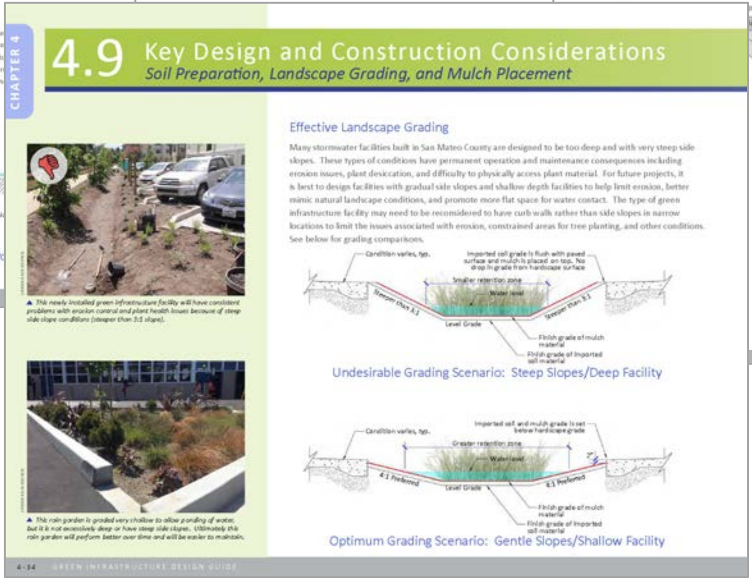
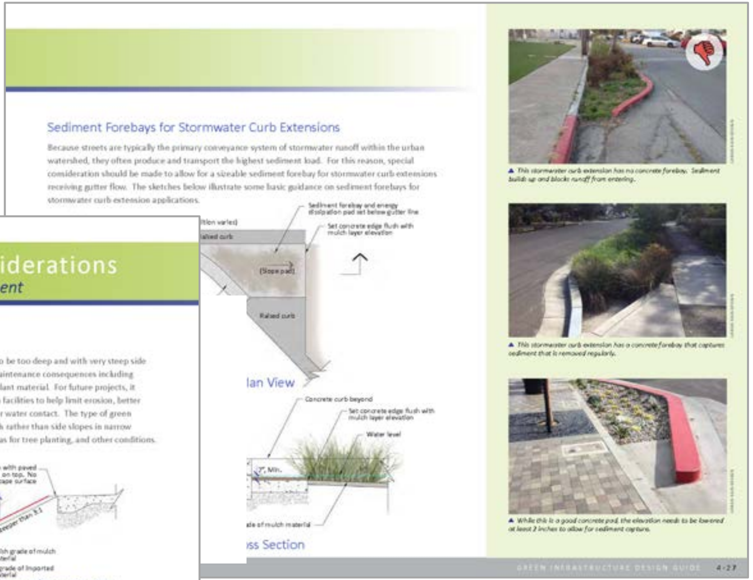
Ch 4 Intro to Design Strategies and Guidelines







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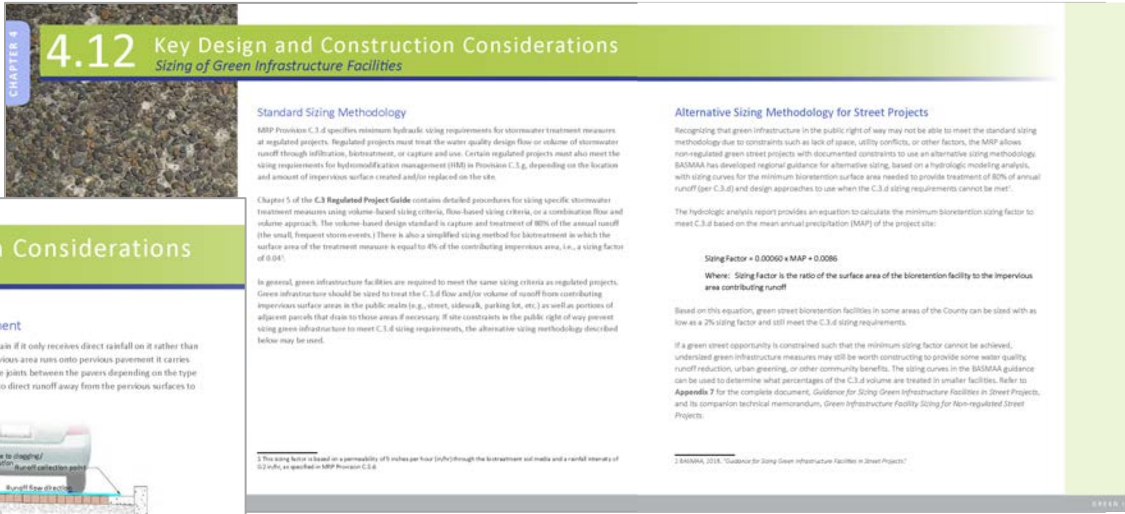
Ch 4 Intro to Design Strategies and Guidelines



CHAPTER 4

4.12 Key Design and Construction Considerations

Sizing of Green Infrastructure Facilities

Standard Sizing Methodology

MRP Provision C.3.d specifies minimum hydraulic sizing requirements for stormwater treatment measures at regulated projects. Regulated projects must treat the water quality design flow or volume of stormwater runoff through infiltration, biotreatment, or capture and use. Certain regulated projects must also meet the sizing requirements for hydromodification management (HM) in Provision C.3.g, depending on the location and amount of impervious surface created and/or replaced on the site.

Chapter 5 of the **C.3 Regulated Project Guide** contains detailed procedures for sizing specific stormwater treatment measures using volume-based sizing criteria, flow-based sizing criteria, or a combination flow and volume approach. The volume-based design standard is capture and treatment of 80% of the annual runoff (the small, frequent storm events.) There is also a simplified sizing method for biotreatment in which the surface area of the treatment measure is equal to 4% of the contributing impervious area, i.e., a sizing factor of 0.04[1].

In general, green infrastructure facilities are required to meet the same sizing criteria as regulated projects. Green infrastructure should be sized to treat the C.3.d flow and/or volume of runoff from contributing impervious surface areas in the public realm (e.g., street, sidewalk, parking lot, etc.) as well as portions of adjacent parcels that drain to those areas if necessary. If site constraints in the public right of way prevent sizing green infrastructure to meet C.3.d sizing requirements, the alternative sizing methodology described below may be used.

Alternative Sizing Methodology for Street Projects

Recognizing that green infrastructure in the public right of way may not be able to meet the standard sizing methodology due to constraints such as lack of space, utility conflicts, or other factors, the MRP allows non-regulated green street projects with documented constraints to use an alternative sizing methodology. BASMAA has developed regional guidance for alternative sizing, based on a hydrologic modeling analysis, with sizing curves for the minimum bioretention surface area needed to provide treatment of 80% of annual runoff (per C.3.d) and design approaches to use when the C.3.d sizing requirements cannot be met[1].

The hydrologic analysis report provides an equation to calculate the minimum bioretention sizing factor to meet C.3.d based on the mean annual precipitation (MAP) of the project site:

Sizing Factor = 0.00060 x MAP + 0.0086

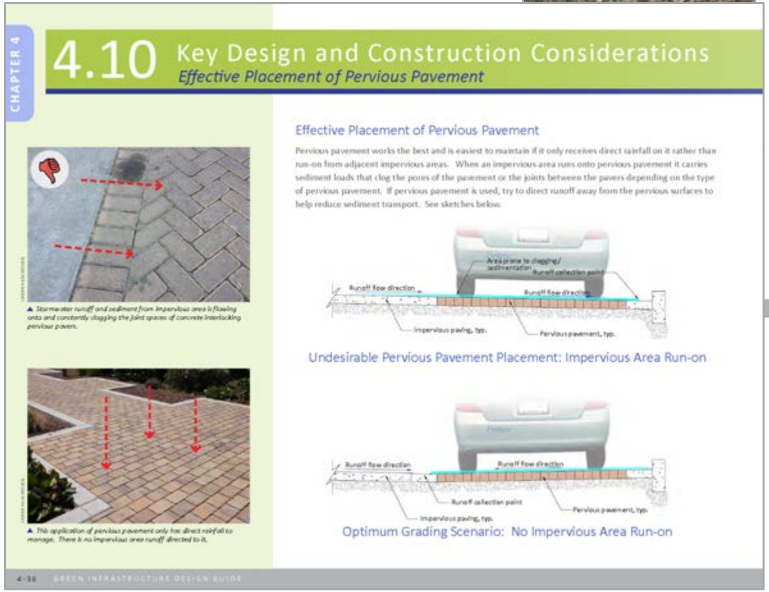
Where: Sizing Factor is the ratio of the surface area of the bioretention facility to the impervious area contributing runoff

Based on this equation, green street bioretention facilities in some areas of the County can be sized with as low as a 2% sizing factor and still meet the C.3.d sizing requirements.

If a green street opportunity is constrained such that the minimum sizing factor cannot be achieved, undersized green infrastructure measures may still be worth constructing to provide some water quality, runoff reduction, urban greening, or other community benefits. The sizing curves in the BASMAA guidance can be used to determine what percentages of the C.3.d volume are treated in smaller facilities. Refer to **Appendix 7** for the complete document, *Guidance for Sizing Green Infrastructure Facilities in Street Projects*, and its companion technical memorandum, *Green Infrastructure Facility Sizing for Non-regulated Street Projects*.

1 This sizing factor is based on a permeability of 5 inches per hour (in/hr) through the biotreatment soil media and a rainfall intensity of 0.2 in/hr, as specified in MRP Provision C.3.d.

1 BASMAA, 2018. "Guidance for Sizing Green Infrastructure Facilities in Street Projects."



CHAPTER 4

4.10 Key Design and Construction Considerations

Effective Placement of Pervious Pavement

▲ *Stormwater runoff and sediment from impervious area is flowing onto and constantly clogging the joint spaces of concrete interlocking pervious pavers.*

▲ *This application of pervious pavement only has direct rainfall to manage. There is no impervious area runoff directed to it.*

Effective Placement of Pervious Pavement

Pervious pavement works the best and is easiest to maintain if it only receives direct rainfall on it rather than run-on from adjacent impervious areas. When an impervious area runs onto pervious pavement it carries sediment loads that clog the pores of the pavement or the joints between the pavers depending on the type of pervious pavement. If pervious pavement is used, try to direct runoff away from the pervious surfaces to help reduce sediment transport. See sketches below.

Undesirable Pervious Pavement Placement: Impervious Area Run-on

Optimum Grading Scenario: No Impervious Area Run-on

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Ch 5 Key Implementation Strategies

- **5.1 Funding GI and Reducing Project Costs**
  - Strategies for Funding GI
  - How to reduce Project Costs

- **5.2 Changing Municipal Policy and Code**
  - Demonstration Projects
  - Staff Collaboration
  - Flexible Design Guidance

Ch 5 Key Implementation Strategies

- **5.3 Creating Incentives**
  - Reward-based
  - Mandate-based
  - Community-based
- **5.4 Public Education, Outreach, and Demonstration Projects**
  - How to
  - Types

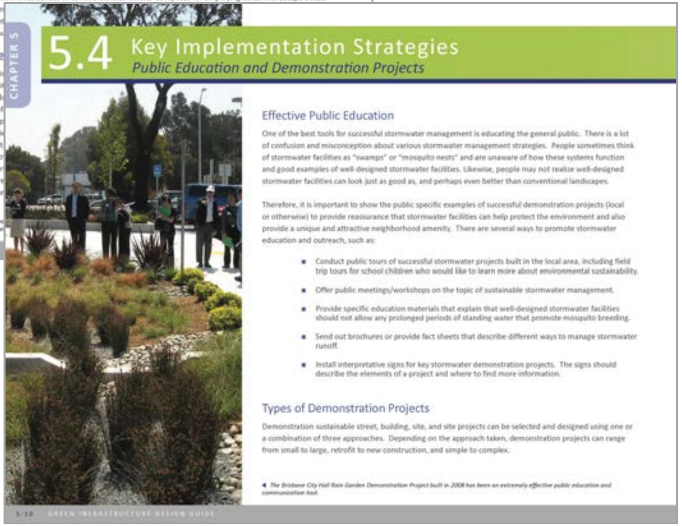

CHAPTER 5

5.3 Key Implementation Strategies
Creating Incentives

There are several options for creating incentives for municipalities and property owners to retrofit streets, buildings, and sites. As described below, these incentives can be classified into three different categories: reward-based incentives, mandate-based incentives, and community-based incentives. Especially where jurisdictions lack direct control over site improvements, incentives can become a very effective tool.

Reward-based Incentives

Reward-based incentives compensate a developer or property owner for incorporating green infrastructure elements into their project. This type of incentive may include utility fee discounts, tax benefits, project grant funding, or even expedited review and permitting of development proposals. Reward-based incentives are particularly applicable to private development associated with parking lot projects. However, when private development occurs in conjunction with public streets, reward-based incentives can also apply. An example of a reward-based incentive is the City of Portland's Clean River Rewards Discount Program that allows up to a 35% reduction in residential or commercial stormwater utility fees for employing certain landscape-based


CHAPTER 5

5.4 Key Implementation Strategies
Public Education and Demonstration Projects

Effective Public Education

One of the best tools for successful stormwater management is educating the general public. There is a lot of confusion and misconception about various stormwater management strategies. People sometimes think of stormwater facilities as "swamps" or "mosquito nests" and are unaware of how these systems function and good examples of well-designed stormwater facilities. Likewise, people may not realize well-designed stormwater facilities can look just as good as, and perhaps even better than conventional landscapes.

Therefore, it is important to show the public specific examples of successful demonstration projects (local or otherwise) to provide reassurance that stormwater facilities can help protect the environment and also provide a unique and attractive neighborhood amenity. There are several ways to promote stormwater education and outreach, such as:

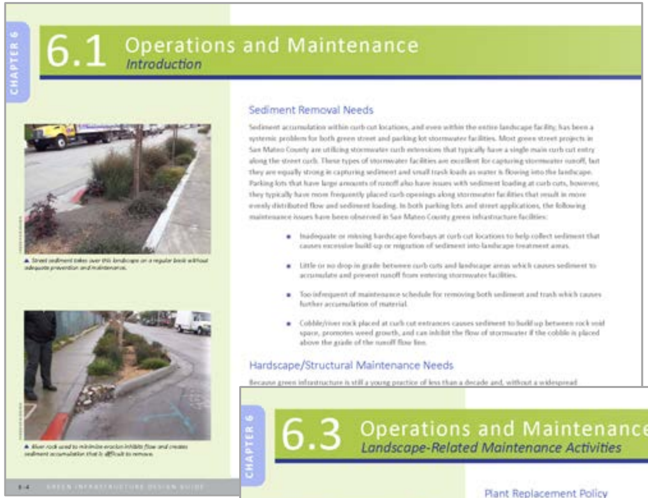
- Conduct public tours of successful stormwater projects built in the local area, including field trip tours for school children who would like to learn more about environmental sustainability.
- Offer public meetings/workshops on the topic of sustainable stormwater management.
- Provide specific education materials that explain that well-designed stormwater facilities should not allow any prolonged periods of standing water that promote mosquito breeding.
- Send out brochures or provide fact sheets that describe different ways to manage stormwater runoff.
- Install interpretative signs for key stormwater demonstration projects. The signs should describe the elements of a project and where to find more information.

Types of Demonstration Projects

Demonstration sustainable street, building, site, and site projects can be selected and designed using one or a combination of three approaches. Depending on the approach taken, demonstration projects can range from small to large, retrofit to new construction, and simple to complex.

Ch 6 Operations & Maintenance

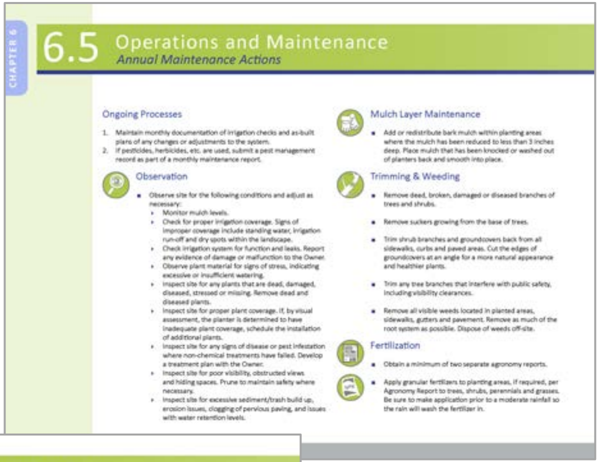
- **6.1 Introduction**
  - Purpose
  - Difference from C.3 Regulated Projects Guide
  - Common types of GI O&M issues
  - How to conduct site maintenance
  - Types of maintenance programs
- **6.2 Hardscape and Functional Maintenance Activities**
  - Focused on issues found with hardscape and functional elements of GI facilities
- **6.3 Landscape-related Maintenance Activities**
  - Focused on landscape-related issues and activities found with GI facilities


CHAPTER 6
6.1 Operations and Maintenance
Introduction
Sediment Removal Needs
Hardscape/Structural Maintenance Needs


CHAPTER 6
6.3 Operations and Maintenance
Landscape-Related Maintenance Activities
Plant Replacement Policy
Plant Replacement Guidelines

Ch 6 Operations & Maintenance

- **6.4 Maintenance Quality Observation Levels**
  - What to look for to determine level of maintenance activity
- **6.5 Annual Maintenance Actions**
  - GI maintenance activity plan
- **6.6 Annual Landscape & Hardscape Maintenance Schedule**
  - Monthly checklist for GI maintenance activities


CHAPTER 6
6.5 Operations and Maintenance
Annual Maintenance Actions
Ongoing Processes
Observation
Mulch Layer Maintenance
Trimming & Weeding
Fertilization


CHAPTER 6
6.4 Operations and Maintenance
Maintenance Quality Observation Levels

OVERALL TREE HEALTH		
Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine

VISUAL SAFETY & PUBLIC SAFETY		
Good, Continue Maintenance Routine	Mediocre, Modify Maintenance Routine	Poor, Overhaul Maintenance Routine

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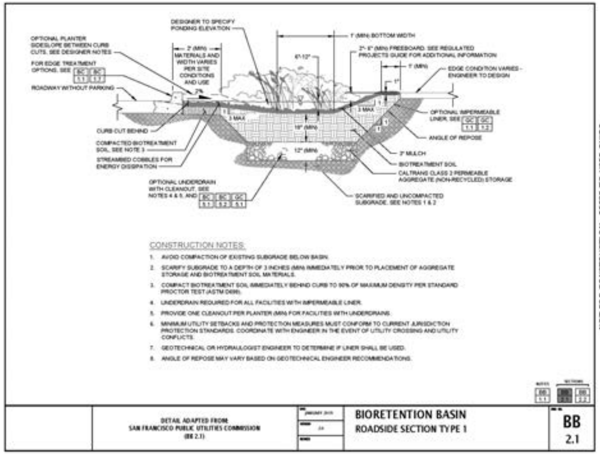
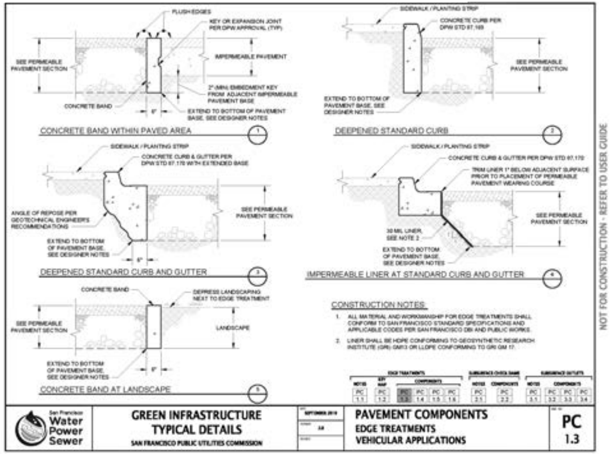
Appendices

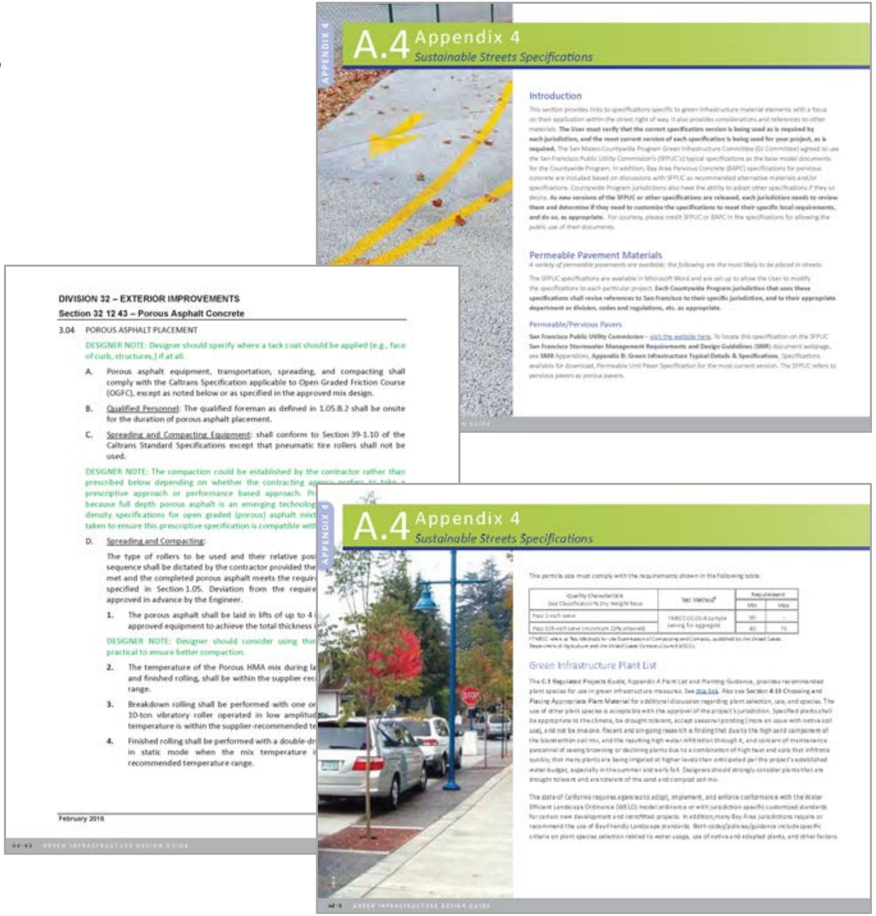
- **1 Glossary**
  - Terms in Design Guide
- **2 Reference Documents**
  - Documents cited or referenced
- **3 Sustainable Streets Typical Design Details**
  - How to use
    - Customize for site specific conditions
    - Verify most current version is used
    - Verify if jurisdiction where project is has different details
  - Base details: SFPUC GI Typical Details
  - SMCWPPP modified/new typical details
  - References to other agency typical details





Appendices

- **4 Sustainable Streets Specifications**
  - How to use
    - Customize for site specific conditions
    - Verify most current version is used
    - Verify if jurisdiction where project is has different specifications
  - For permeable pavements, biotreatment soil, and composted mulch
  - Plant palette and MWELO
  - Design and functional considerations
  - Base specs: SFPUC or Bay Area Pervious Concrete


A.4 Appendix 4
Sustainable Streets Specifications

Introduction

Permeable Pavement Materials

DIVISION 32 – EXTERIOR IMPROVEMENTS
Section 32 12 43 – Porous Asphalt Concrete

3.04 POROUS ASPHALT PLACEMENT

February 2016

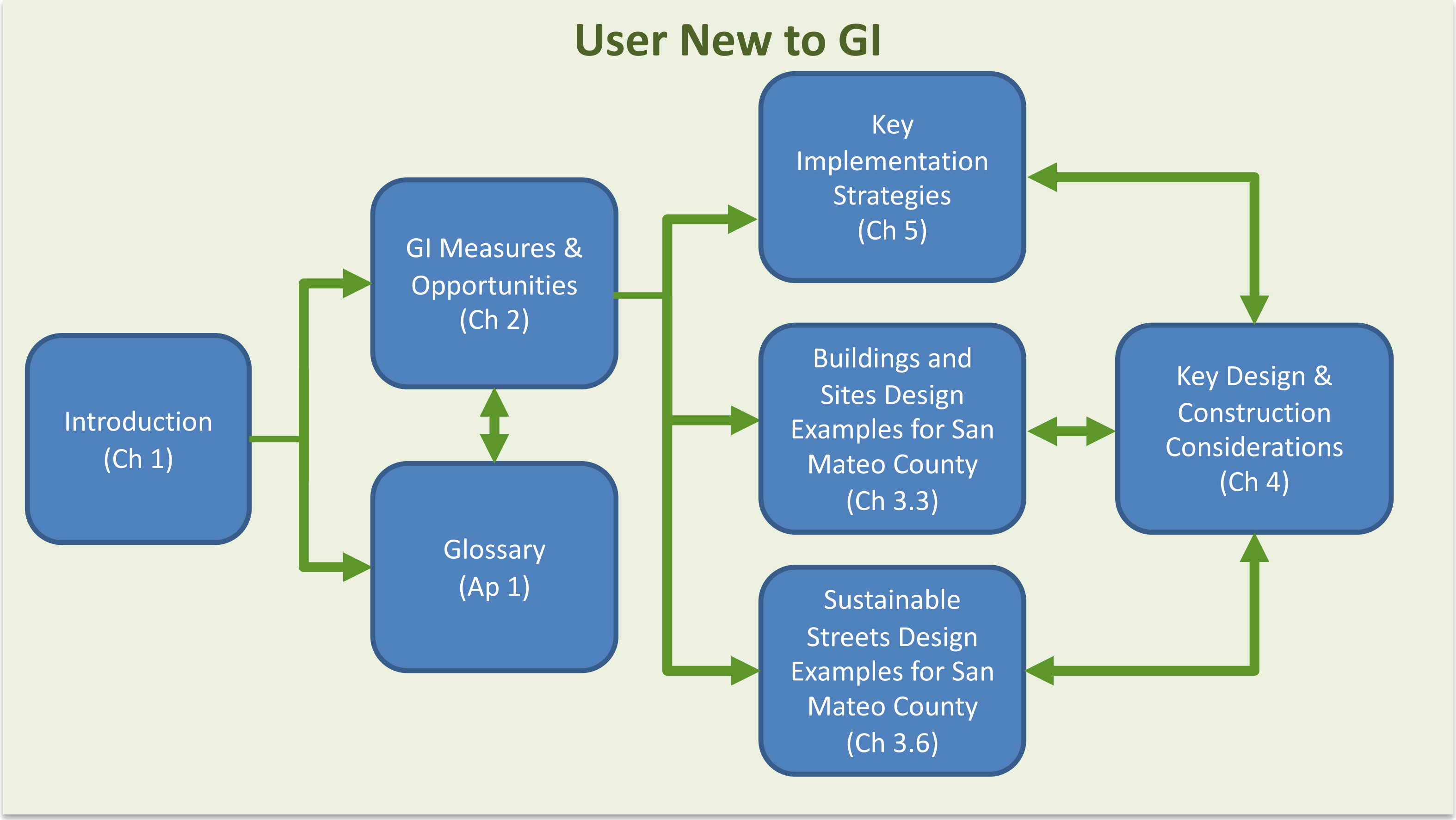
A.4 Appendix 4
Sustainable Streets Specifications

Green Infrastructure Plant List

Appendices

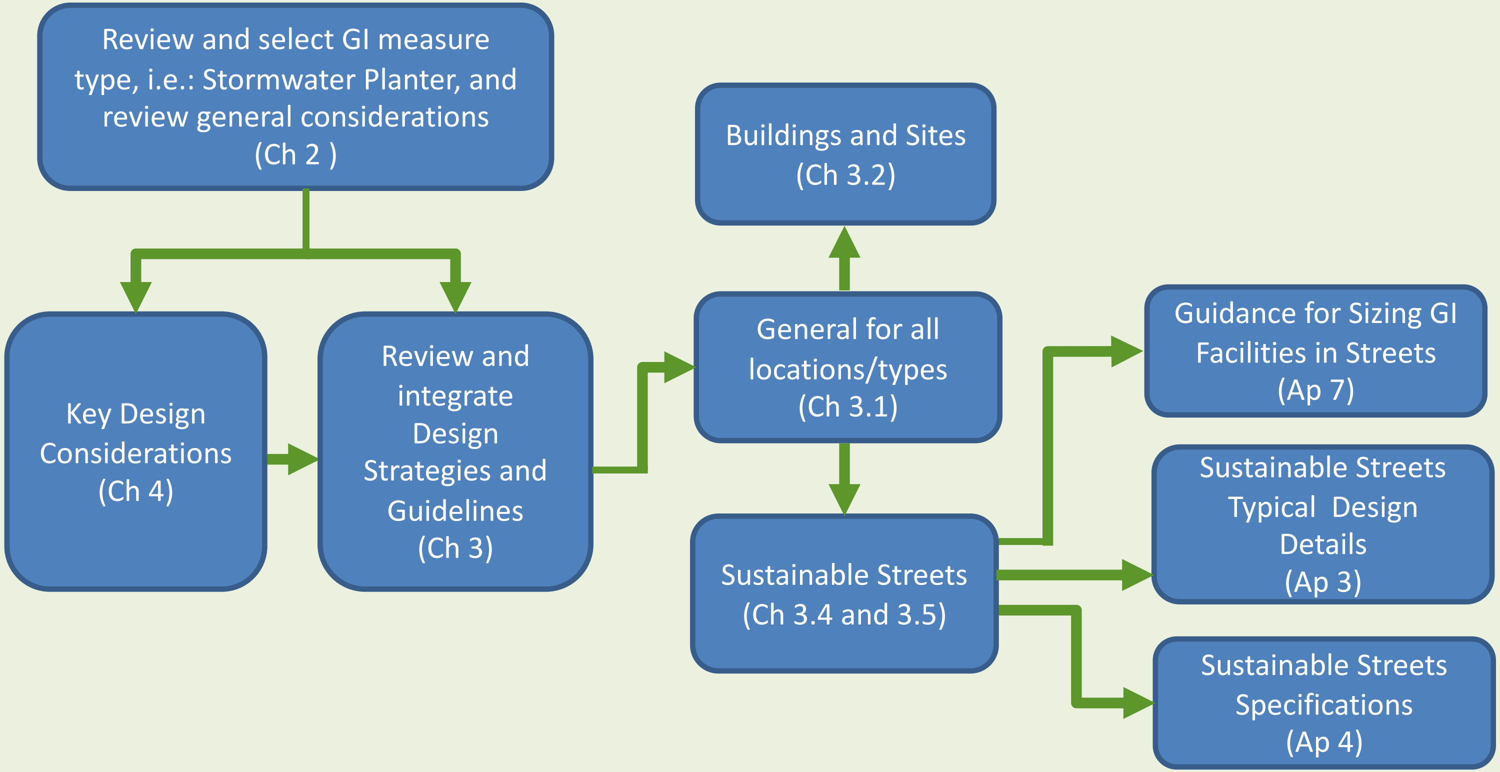
- **5 Sample Maintenance Plan Forms**
  - Maintenance checklists for:
    - Landscaped Stormwater Facility
    - Pervious pavement
- **6 Potential GI Funding Source Analysis & Recommendations**
  - SMCWPPP GI Funding Nexus Evaluation
- **7 Guidance for Sizing GI Facilities in Streets**
  - BASMAA's regional approach for sizing for constrained non-regulated street projects

How to Use the GI Design Guide



How to Use the GI Design Guide

User Experienced with GI and Ready to Design



GI Design Guide Next Steps

- Consider and Respond to GI Committee comments
  - Reorganize Chapters 2 and 3 content and matrices to group:
    - All tree type measures (tree well, stormwater tree, and interceptor tree)
    - All building type measures (green roof, green wall, and water harvesting)
  - Update photos, graphics and typical GI construction details
  - Clarify, add or expand content:
    - GI Measures, e.g., vegetated swale, rain garden, interceptor tree
    - Water reuse of water capture projects
    - Design considerations, e.g.: curb cuts, inlet/outlet cobbles
    - Etc.

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GI Design Guide Next Steps

- Address any inconsistencies with newly updated C.3 Regulated Projects Guide

- Consider and respond to comments received as jurisdictions and consultants use the Design Guide

GI Design Guide Next Steps

- Develop web-based document
  - Allow for more interactive and easier to use digital document
  - Final format TBD (whether fully web-based or a more interactive PDF on web)
  - Allow user to jump between certain sections and to other elements

Green Infrastructure Design Guide

- Questions?


Green Infrastructure
Design Guide

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