

Planning, Design, and Construction of Low Impact Development Features and Facilities

Provision C.3 Stormwater Compliance for Land Development Projects

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April 24, 2018



Basics of C.3 and Low Impact Development

A quick review of objectives and methods

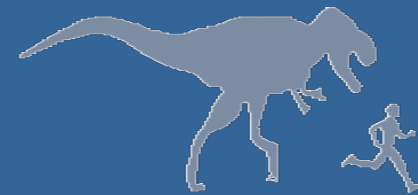
C.3 and LID Basics

- Mandate
- Objectives
- Methods
- Compliance Process
- Tools and Assistance

Mandate

- 1987 Amendments to the Clean Water Act
- Permits issued by California Water Boards
- C.3 added to Contra Costa's permit 2003, 2006
- Municipal Regional Permit 2009, 2011, 2015
- Municipalities are required to use their land use authority to require controls on runoff from new developments
- Low Impact Development (LID) is required

Two Objectives



Compliance

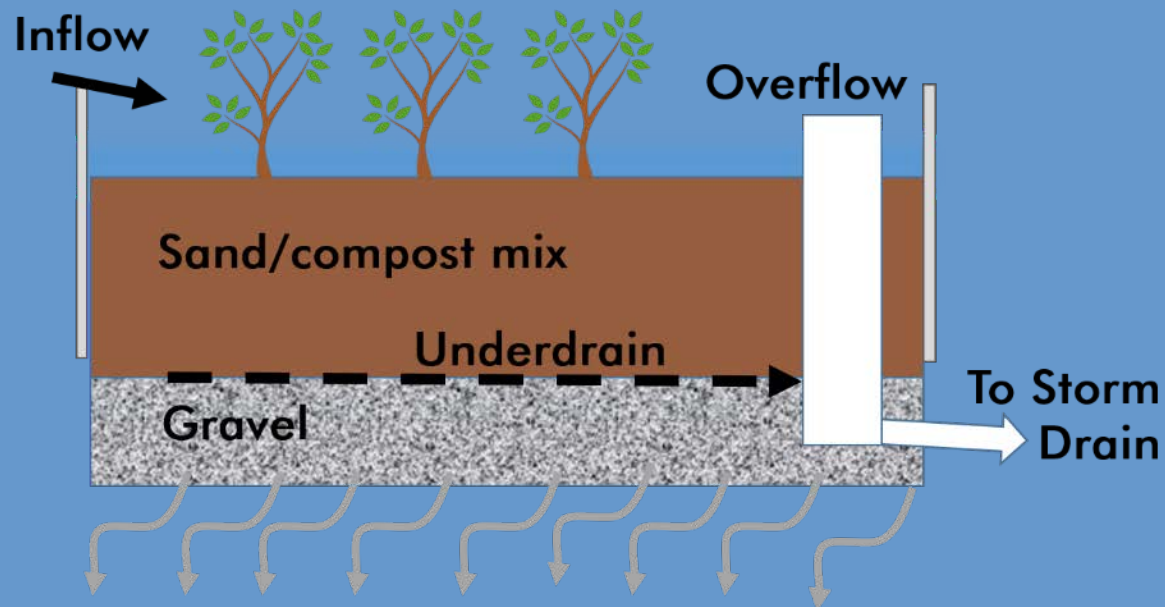
- Mandate
- Client support
- Acceptance of costs
- Structure
- Schedule
- Accountability

Project Quality

- Enthusiasm
- Interest
- Energy
- Synergies
- Opportunities
- Elegance

Low Impact Development

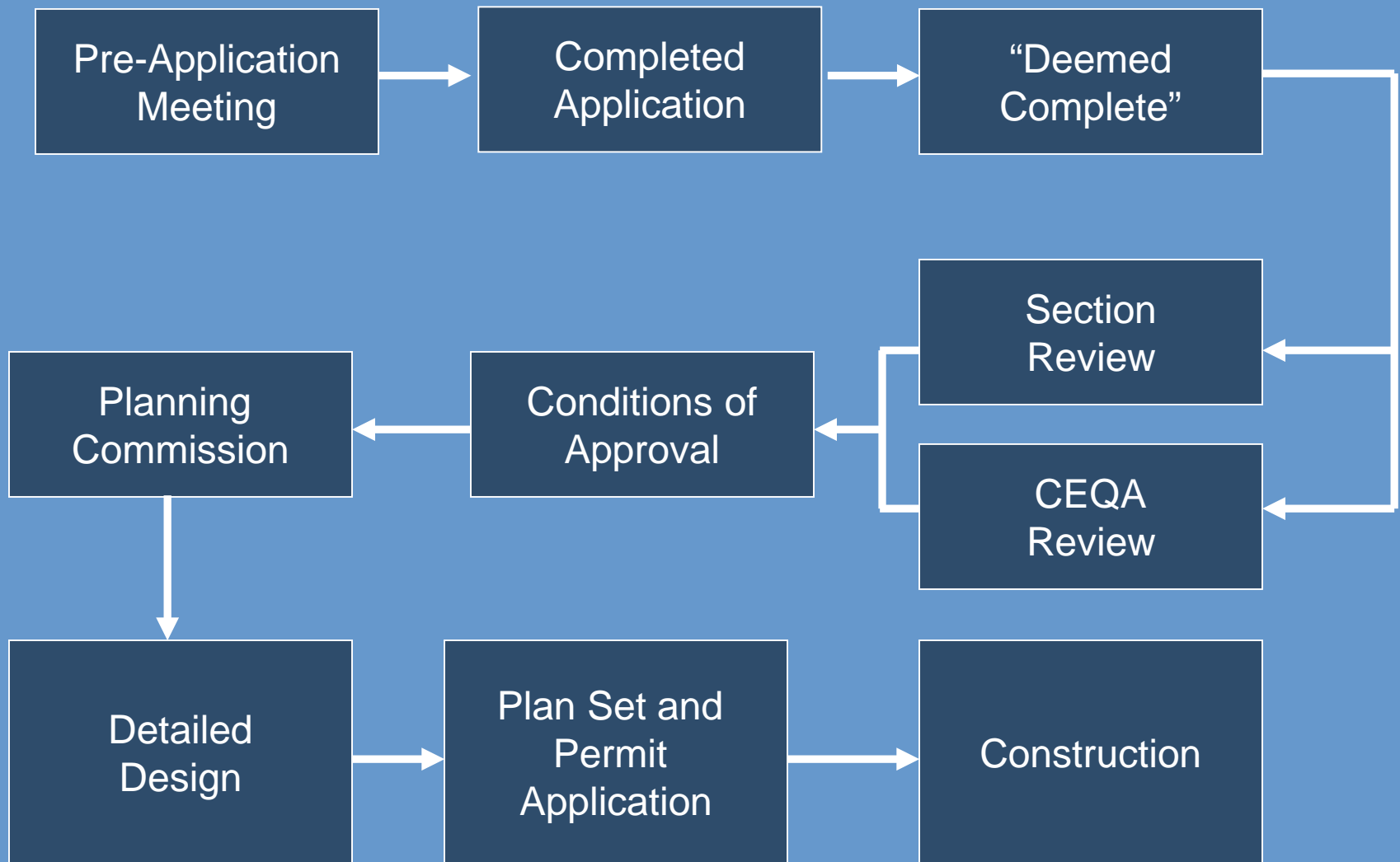
- Minimize imperviousness
 - Minimize roofs and paving
 - Substitute pervious paving where possible
- Disperse runoff to landscaping
- Direct runoff to bioretention facilities



Why Bioretention?

- Filtration and pollutant sequestration
- Biological processing and renewal
- No mosquito problems
- Mimic natural hydrology
- Attractive landscape amenity
- Potential use as park or playground
- Low maintenance
- Easy to inspect

Development Review Process



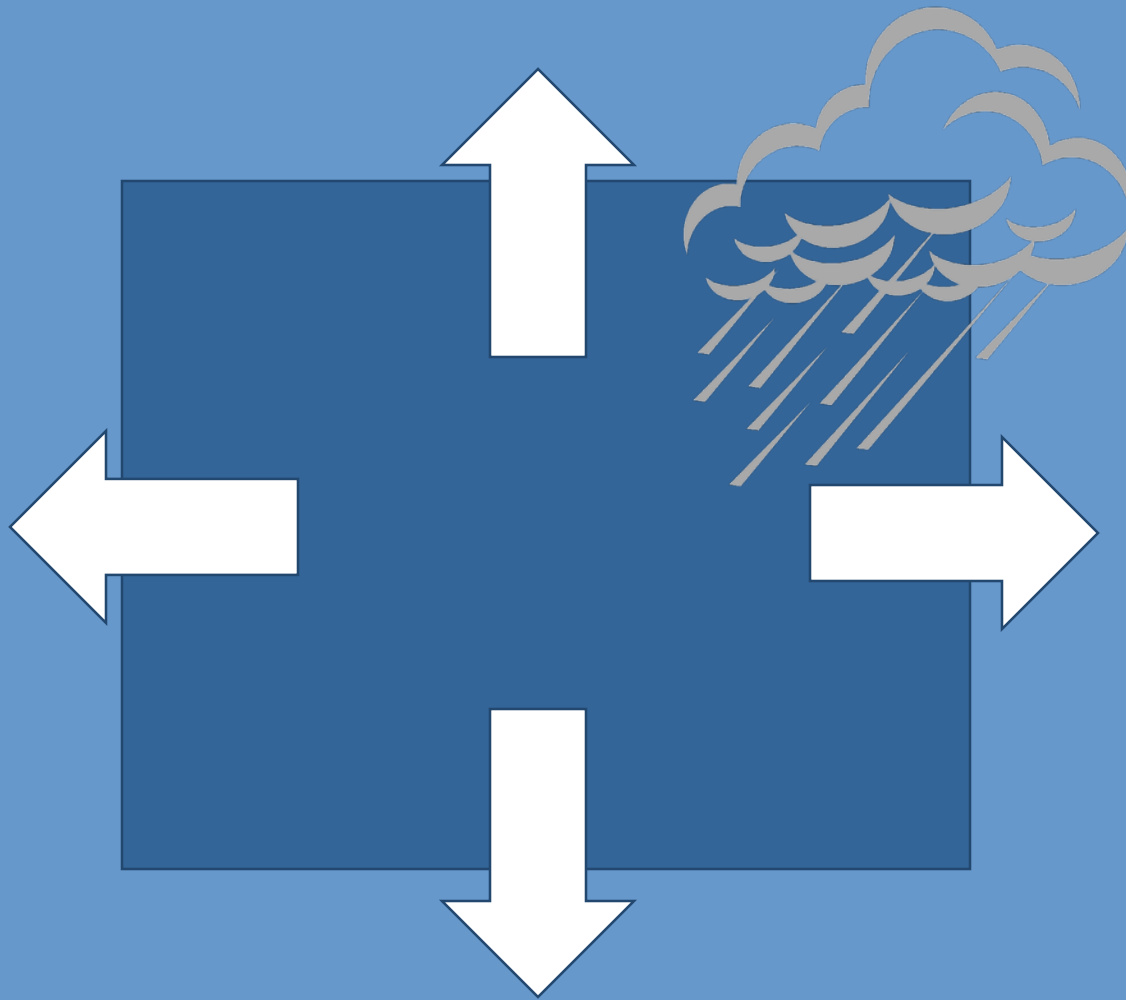
LID Drainage Design

1. Delineate entire site into Drainage Management Areas (DMAs).
2. Categorize and tabulate DMAs. Minimize impervious area and disperse runoff.
3. Select and lay out LID facilities.
4. Use the sizing calculator to evaluate sizing of bioretention facility footprints.
5. Iterate until all facilities meet or exceed the minimum required area.

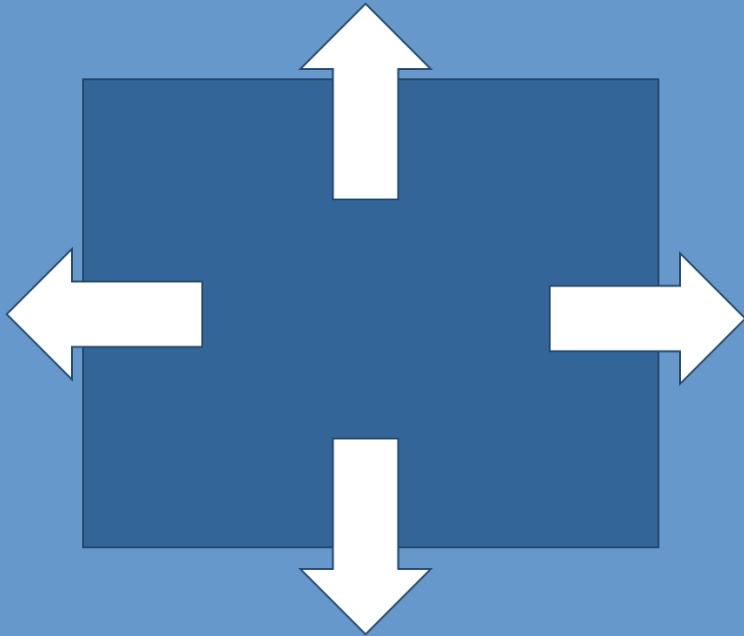
Documenting LID Site Design

Paved or
Roofed Area

LID Site Design Principles

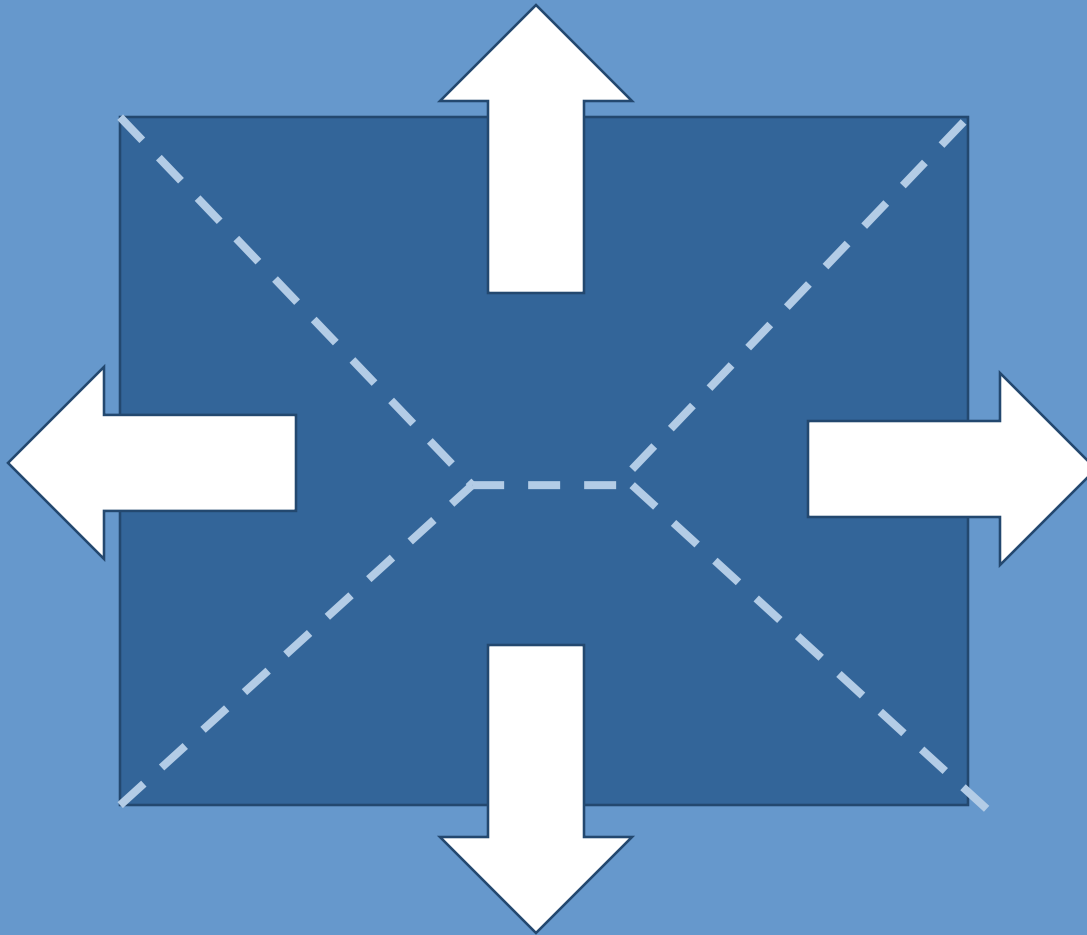


LID Site Design Principles

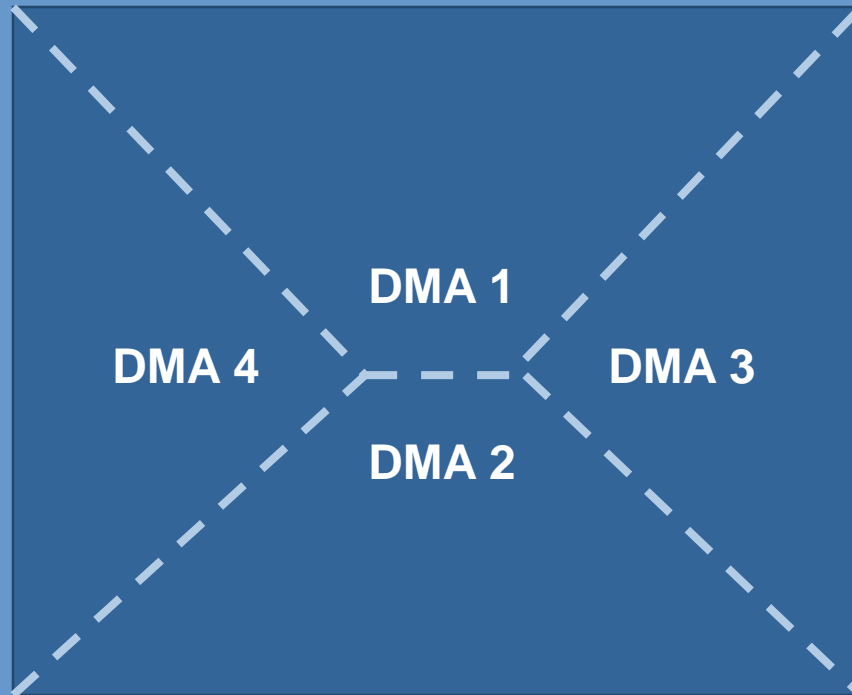


- Mimic natural hydrology
- Disperse runoff
- Keep drainage areas small
- Don't concentrate runoff
- Don't allow run-on from landscaped or natural areas

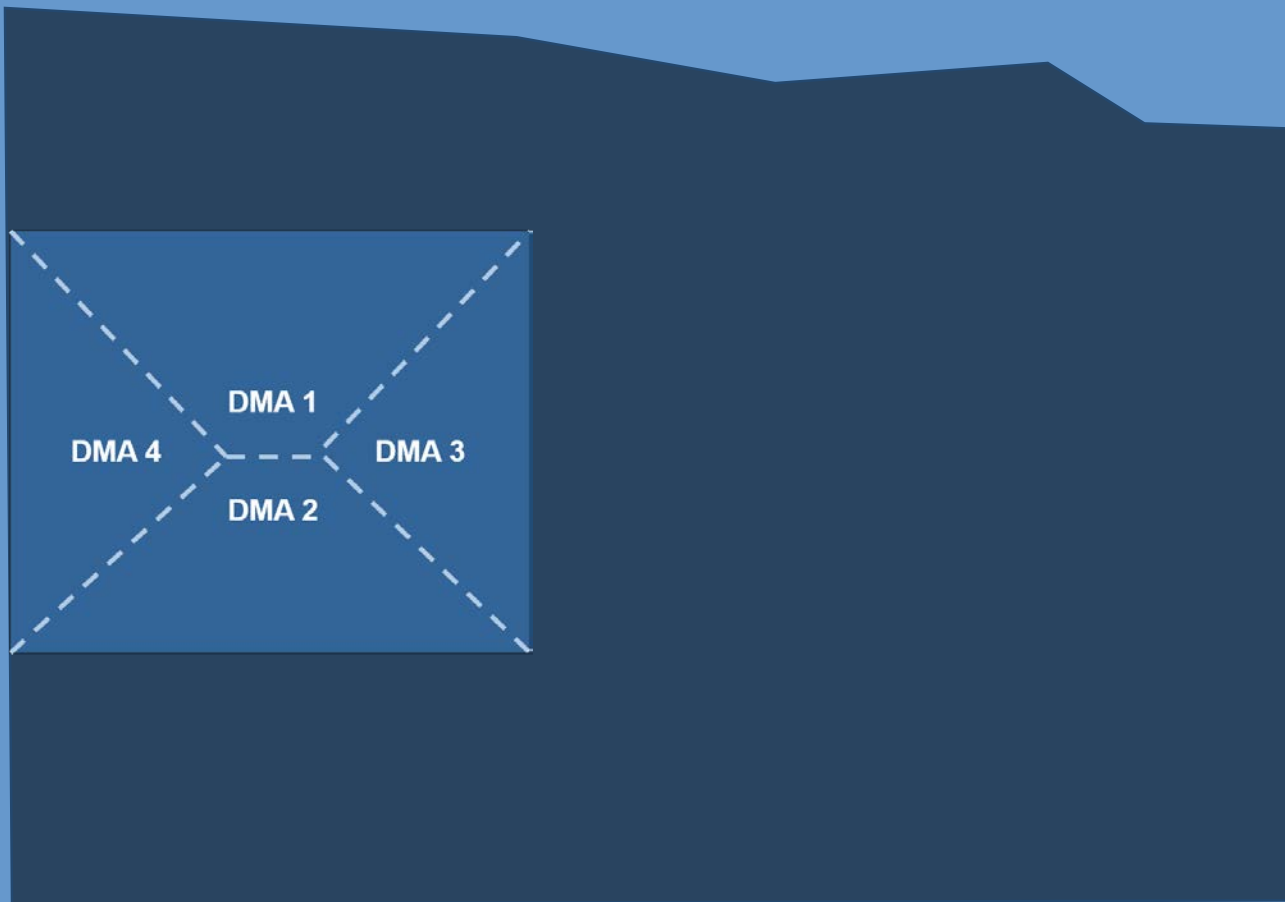
Drainage Management Areas



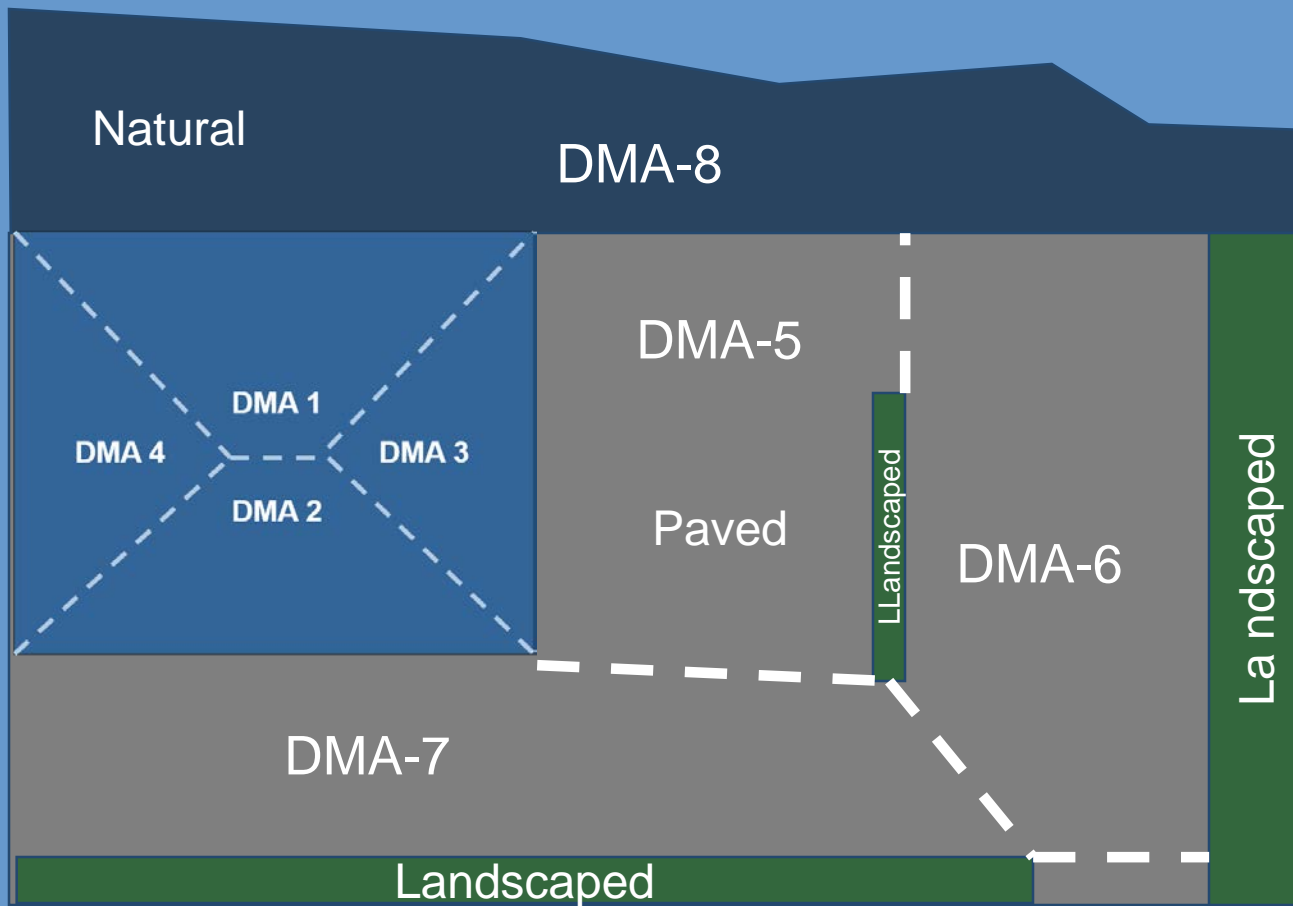
Drainage Management Areas



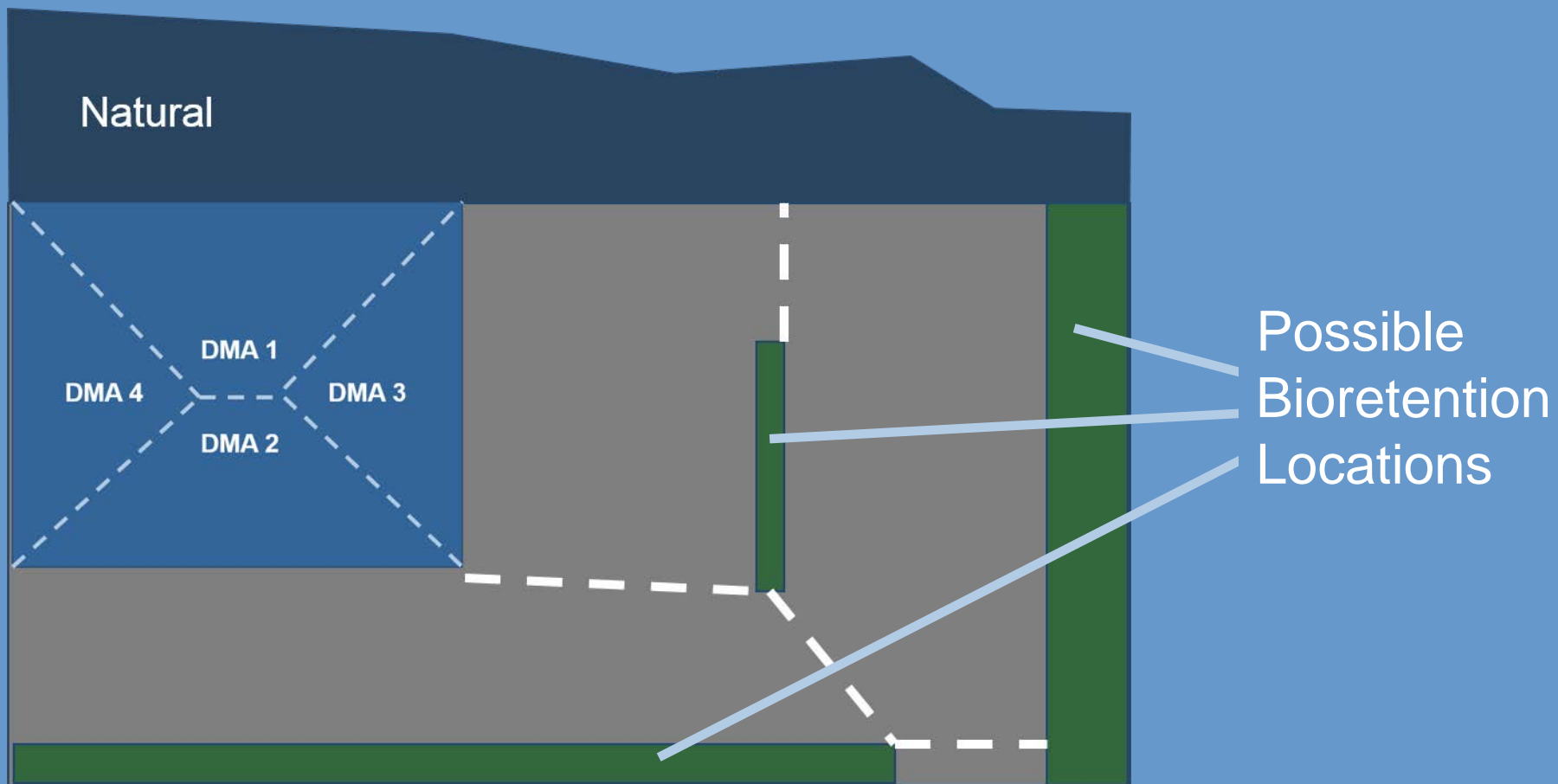
Drainage Management Areas



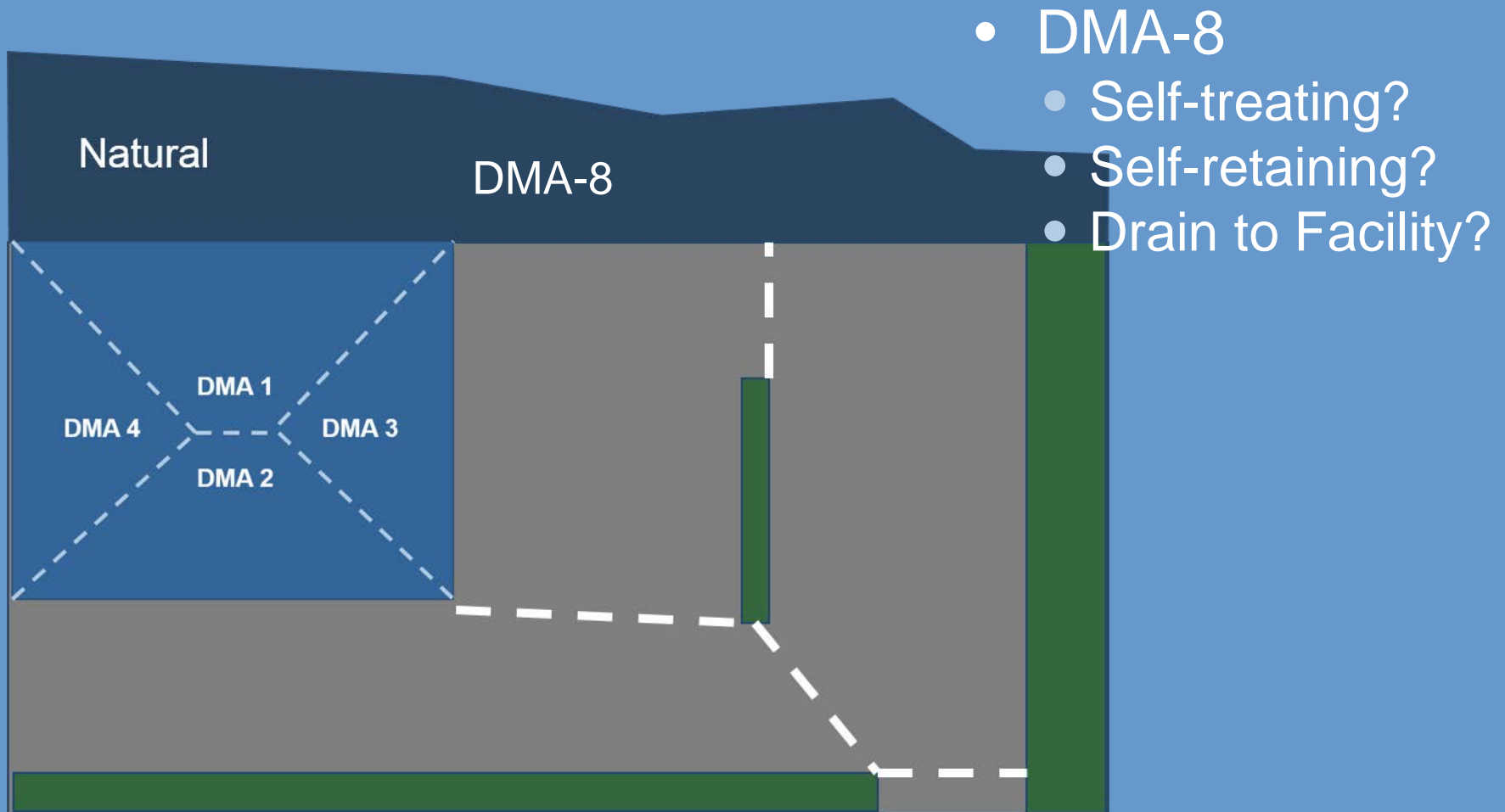
Drainage Management Areas



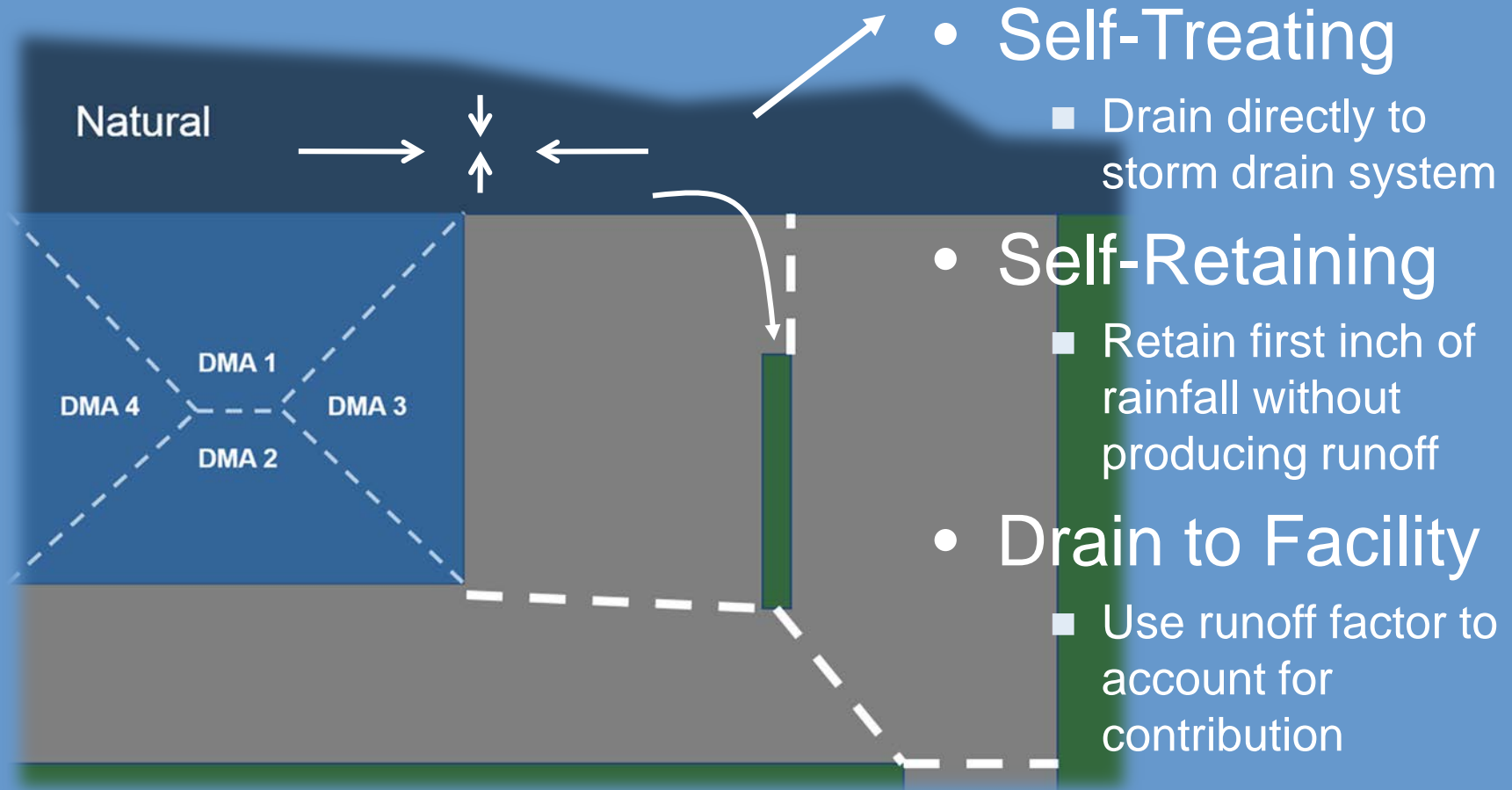
Drainage Management Areas



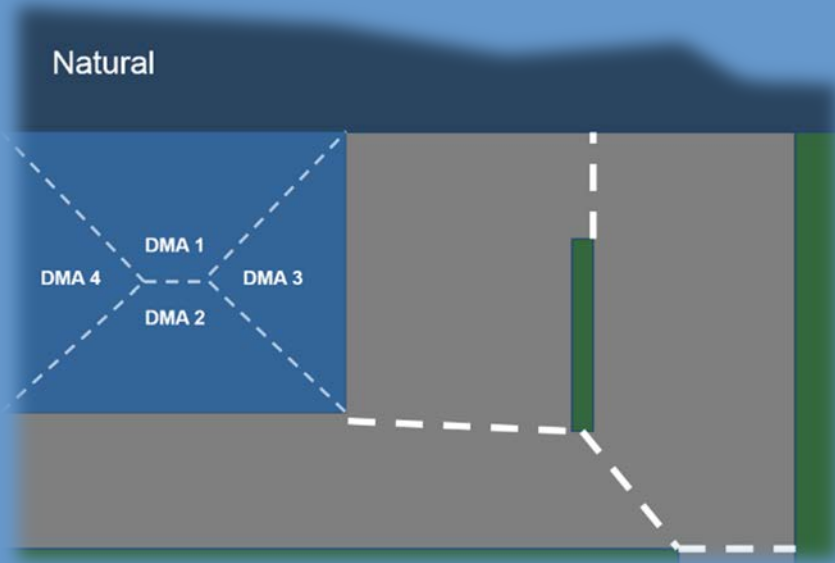
Options – Pervious DMAs



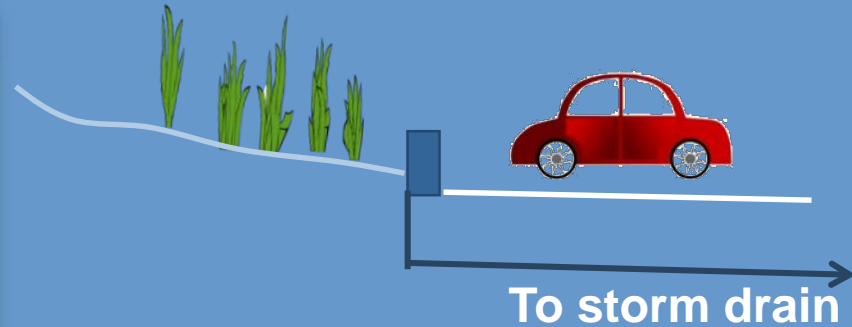
DMA 8



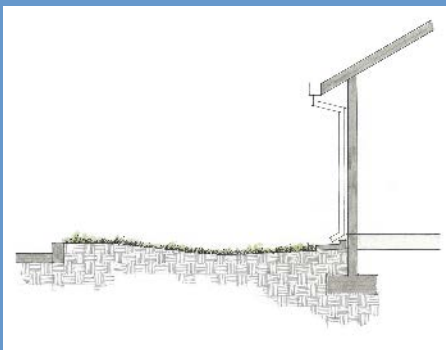
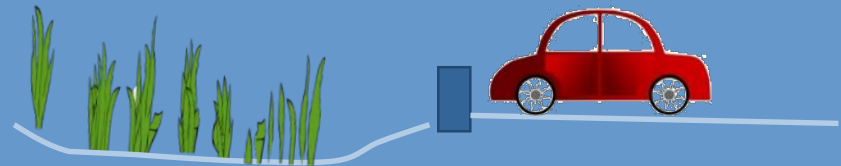
Self treating and self-retaining



Use a curb to avoid run-on from self-treating areas

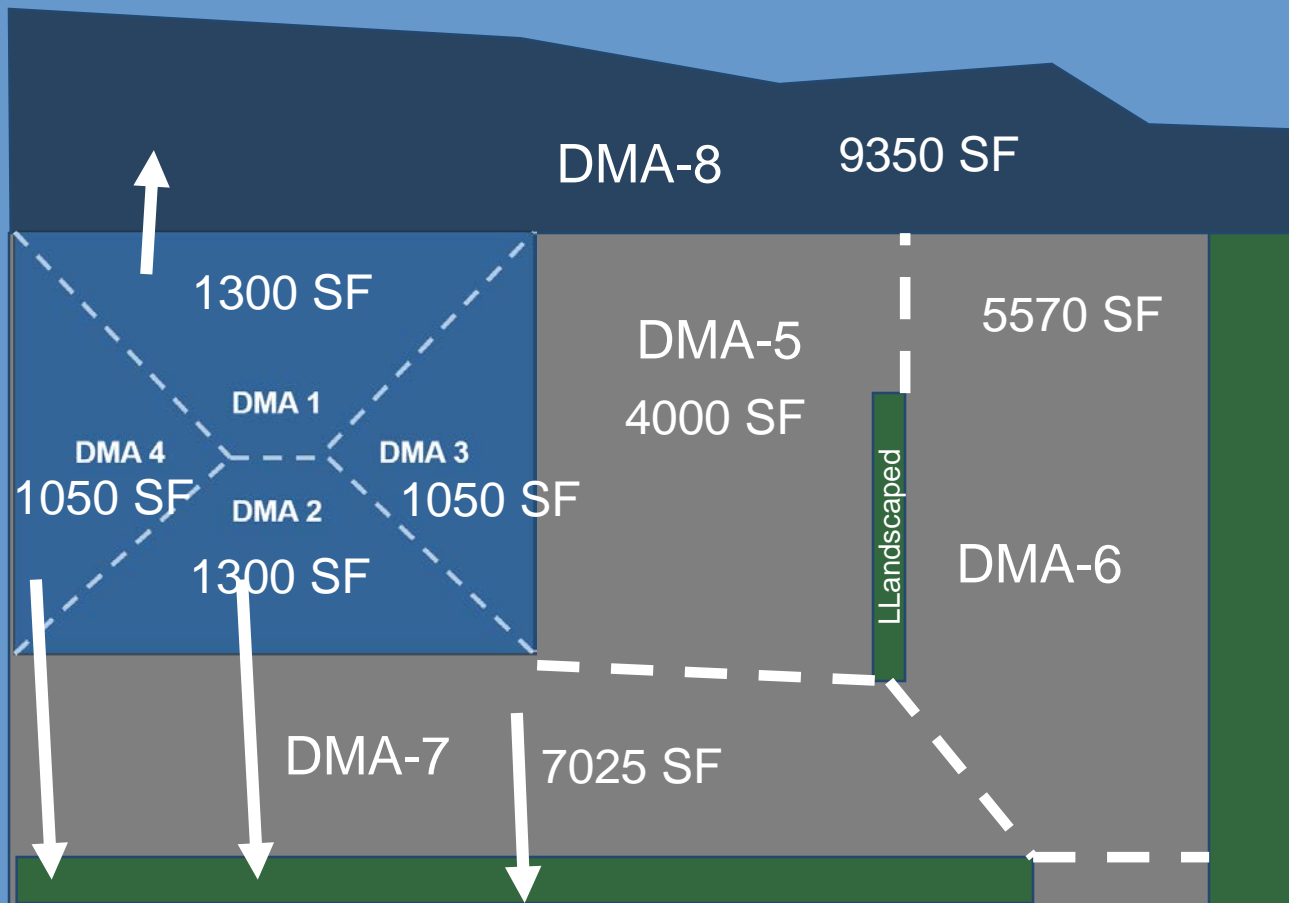


Grade self-retaining areas to drain inward. Set any area drains to pond 3"-4"



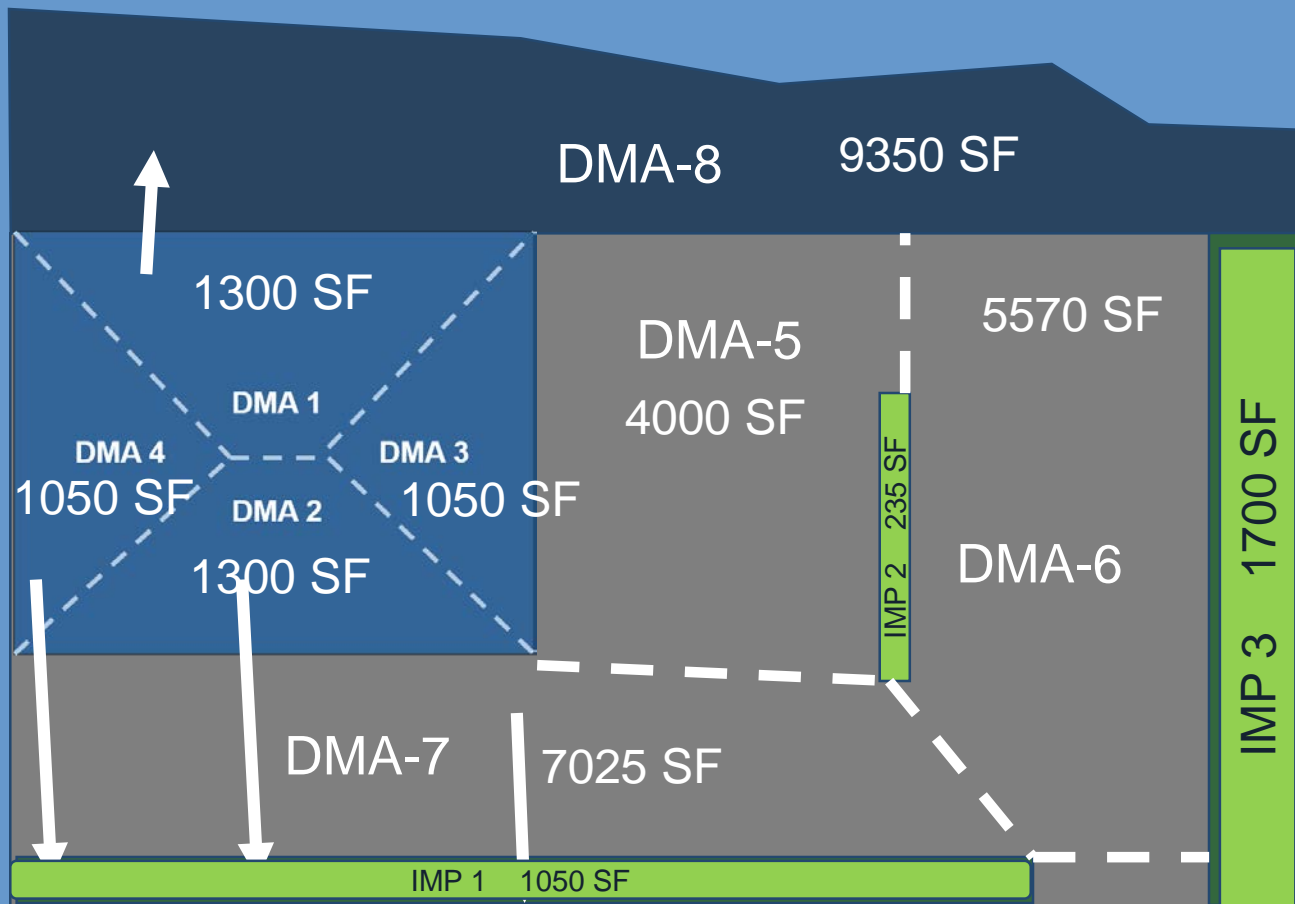
Consider that adjacent roofs or paved areas could drain to self-retaining areas

2. Tabulate DMAs



| DMA | SF |
|--------------|--------------|
| 1 | 1300 |
| 2 | 1050 |
| 3 | 1300 |
| 4 | 1050 |
| 5 | 4000 |
| 6 | 5570 |
| 7 | 7025 |
| 8 | 9350 |
| Total | 30645 |

3. Select and Lay Out Facilities



4. Use the Sizing Calculator

Integrated Management Practice Calculator [123_Main_St_Anytown.xml]

File Tools Help

Project Information

All of the project information is required. Please fill in all of the information before editing the DMAs and IMPs.

Project Name: Example for a Commercial Project

Location: 123 Main Street, Anytown

APN: 00-123-4567

Total Area: 27810 sq ft Mean Annual Precip: 20 in

Design Goal

Treatment Plus Flow Control

Treatment Only

Drainage Management Areas (DMAs) Integrated Management Practices (IMPs) Calculation Warnings(0) Summary Report

IMP1 IMP2 **IMP3**

NRCS Soil Group: D

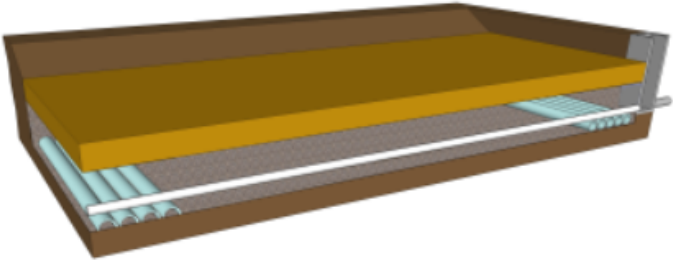
IMP Type: Bioretention Facility

| Parameter | Minimum | Proposed |
|--------------|---------|----------|
| Area (sq ft) | 442 | 465 |

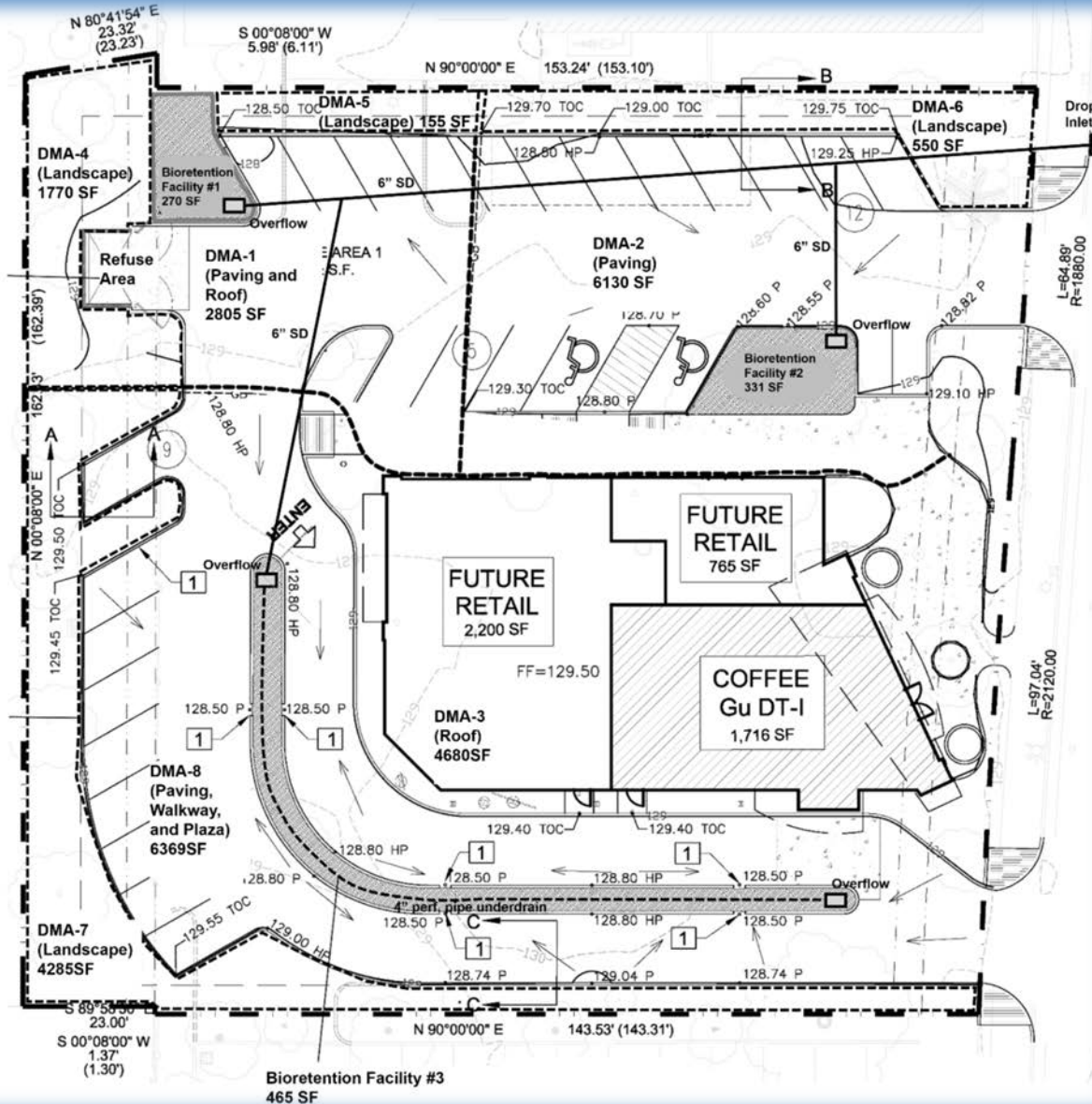
Connected

DMA3 DMA8

Connect IMP Disconnect Selected IMP



Example Commercial Site



Example Commercial Site

Project Name: Example for a Commercial Project

Project Type: Treatment Only

APN: 00-123-4567

Drainage Area: 27,810

Mean Annual Precipitation: 20.0

II. Self-Retaining Areas

| Self-Retaining DMA | |
|--------------------|--------------|
| DMA Name | Area (sq ft) |
| DMA4 | 1,770 |
| DMA5 | 155 |
| DMA6 | 550 |
| DMA7 | 4,285 |

IV. Areas Draining to IMPs

IMP Name: IMP1

IMP Type: Bioretention Facility

Soil Group: IMP1

| DMA Name | Area (sq ft) | Post Project Surface Type | DMA Runoff Factor | DMA Area x Runoff Factor | IMP Sizing | | | |
|----------|--------------|---------------------------|-------------------|--------------------------|-------------------|------------------------|------------------------|-------------------------|
| DMA1 | 2,805 | Concrete or Asphalt | 1.00 | 2,805 | IMP Sizing Factor | Rain Adjustment Factor | Minimum Area or Volume | Proposed Area or Volume |
| Total | | | | 2,805 | | | | |
| Area | | | | | 0.040 | 1.000 | 112 | 270 |

IMP Name: IMP2

IMP Type: Bioretention Facility

Soil Group: IMP2

| DMA Name | Area (sq ft) | Post Project Surface Type | DMA Runoff Factor | DMA Area x Runoff Factor | IMP Sizing | | | |
|----------|--------------|---------------------------|-------------------|--------------------------|-------------------|-----------------|-----------------|------------------|
| DMA2 | 6,130 | Concrete or Asphalt | 1.00 | 6,130 | IMP Sizing Factor | Rain Adjustment | Minimum Area or | Proposed Area or |
| | | | | | | | | |

Tools and Assistance

- *Stormwater C.3 Guidebook*
- IMP Sizing Calculator
- Templates
 - Stormwater Control Plan for a Small Project
 - Stormwater Control Plan for a Regulated Project
- Examples
 - Commercial Project
 - Residential Subdivision

Recent and Forthcoming Changes in C.3 Compliance

MRP 2.0 Changes to Provision C.3

- Grandfathering
- Pervious Pavements
 - Design specifications
 - Inspect installations $\geq 3,000$ SF (contiguous)
- Special Projects/Non-LID Treatment
 - Changes to density criteria (definitions)
 - Must show infeasibility of using LID

MRP 2.0 Changes to Provision C.3

- Hydromodification Management
 - Made requirements regionally consistent
 - Contra Costa municipalities submitted in September 2017:
 - Applicability map
 - Updated facility sizing criteria
 - Water Board staff agreed Contra Costa municipalities will continue current practices pending their response to submittals

Stormwater C.3 Guidebook, 7th Ed.

- Refinements and clarifications
- Reorganization of information
- Significant changes:
 - are summarized in a June 21, 2017 memo (available on CCCWP website)
 - Will be discussed today

Stormwater C.3 Guidebook, 8th Ed.

- Updated HM criteria and maps
- Updated IMP Sizing Calculator
- Compliance for higher-density development, which may include
 - New sizing criteria for treatment only
 - Further guidance on off-site compliance
- Ongoing improvements and clarifications

Green Infrastructure Planning

Provision C.3.j.

What is Green Infrastructure?

- Retrofit existing street drainage with Low Impact Development drainage design
- Also encompasses LID for development and redevelopment



Green Infrastructure Benefits

- Stops spills, dumping, and “urban slobber”
- Sustainable, low maintenance treatment
- Synergies
 - Multi-modal transport, “complete streets”
 - Urban greening and air quality
 - Heat island mitigation
 - Active and passive recreation
 - Urban creek restoration and habitat creation

Provision C.3.j. Requirements

- 1. Green Infrastructure Plans**
- 2. Include Green Infrastructure
in Public Infrastructure Projects**

Green Infrastructure Plans

- A Plan for each municipal Permittee
- Frameworks/Work Plans were adopted by June 2017
- Plans are due September 30, 2019

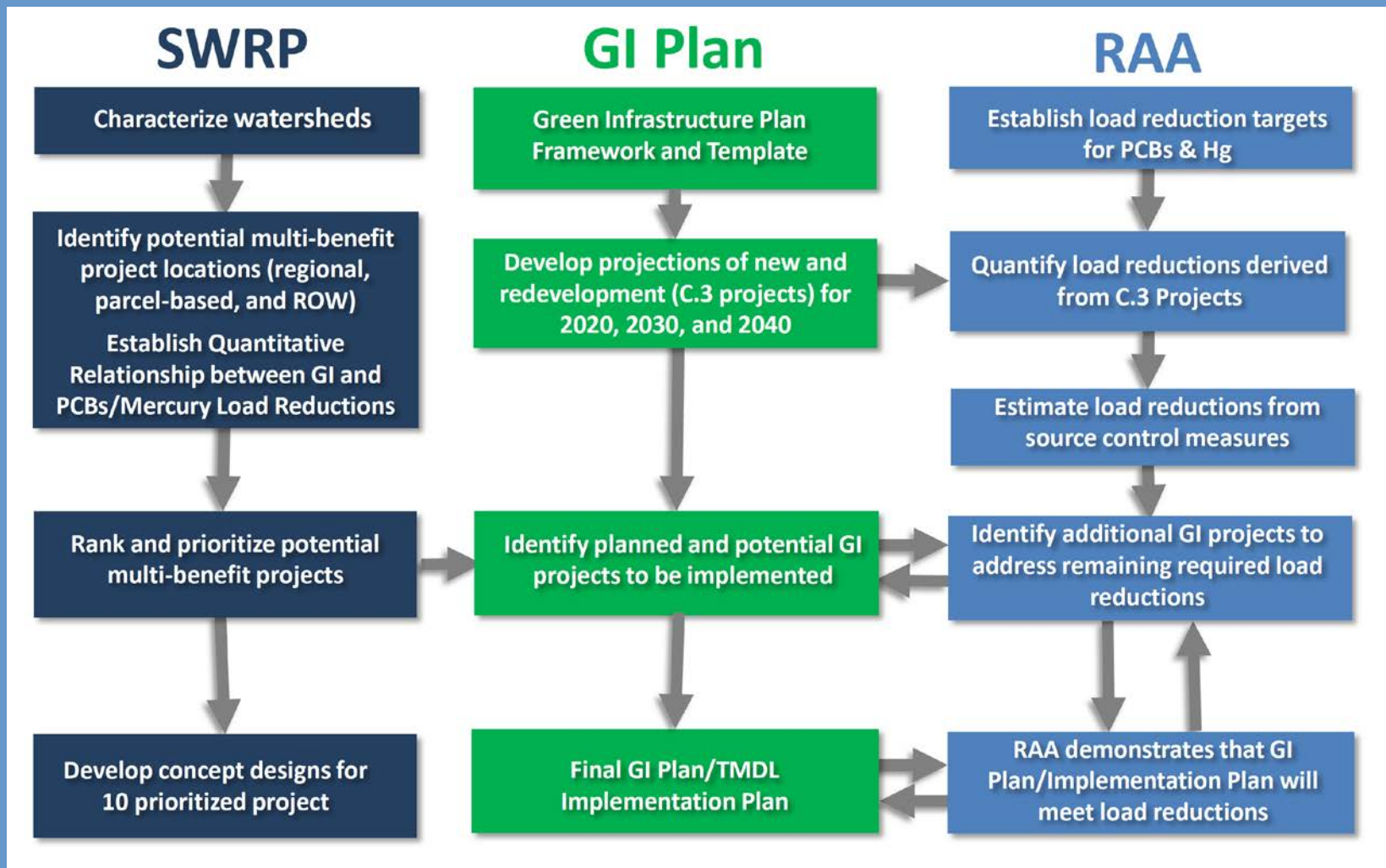
GI Plan Elements

- Projections/Targets for impervious surface converted to GI:
 - Development/Redevelopment
 - Public Infrastructure (retrofits)
- Associated reductions in PCBs & Mercury
- Target dates: 2020, 2030, and 2040
- Project lists and maps
- Tracking of completed projects

Ancillary GI Plan Elements

- Updates to Related Planning Documents
- Design Guidelines – Streetscapes
- Standard Specifications and Details
- Guidance for Sizing GI Facilities
- Funding Strategies
- Policies and Ordinances
- Outreach and Education

Related Countywide Planning



Provision C.3.j. Requirements

1. Green Infrastructure Plans
- 2. Include Green Infrastructure
in Public Infrastructure Projects**

Infrastructure Projects (C.3.j.ii.)

- Ongoing: Screen capital improvement projects for potential to include Green Infrastructure
- Report capital projects reviewed and GI projects planned/constructed
- Regional guidance for reviewing and reporting was distributed in May 2016 (and on website)

GI and Load Reductions

Yield Classification

- Old Industrial
- Old Urban
- New Urban
- Open Space
- Other



Legend

| | |
|---|--|
| City Limits | Yield |
| County Boundary | Old Industrial |
| | Old Urban |
| | New Urban |
| | Open Space |
| | Other |

Legend

| | |
|---|--|
| City Limits | Yield Classification |
| County Boundary | Old Industrial |
| | Old Urban |
| | New Urban |
| | Open Space |
| | Other |



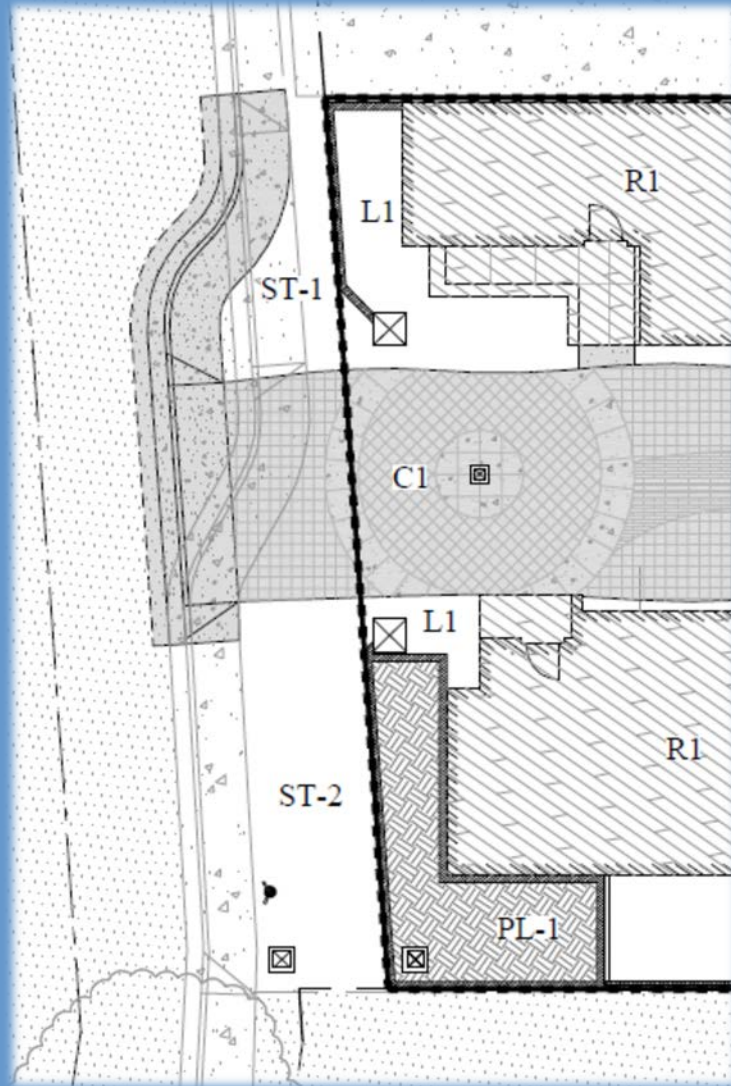
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|---|------------------------------|
| Watershed/Management Areas and Control Measures City of Richmond Contra Costa Clean Water Program | |
| | Figure 18-1 |
| Oakland | April 2018 |

GI Engineering Considerations

- Flat areas near catch basins
- Opportunities to expand tributary area



Green Infrastructure in Frontage



LID Topics

Implementing Low Impact Development
Drainage Design in
Land Development Projects

Topic List (see agenda)

1. Applicability Thresholds – Regulated vs. “Small” Projects
2. Self-Treating, Self-Retaining, and Draining to Self-Retaining
3. LID Grading and Drainage Design
4. Options for Alternative Compliance/Offsets
5. What to Include in Construction Documents
6. Hydromodification Management: IMP Sizing Calculator
7. Special Projects/High Density/
Treatment Credits for Non-LID
8. Operation and Maintenance of Bioretention Facilities

1. Applicability and Thresholds

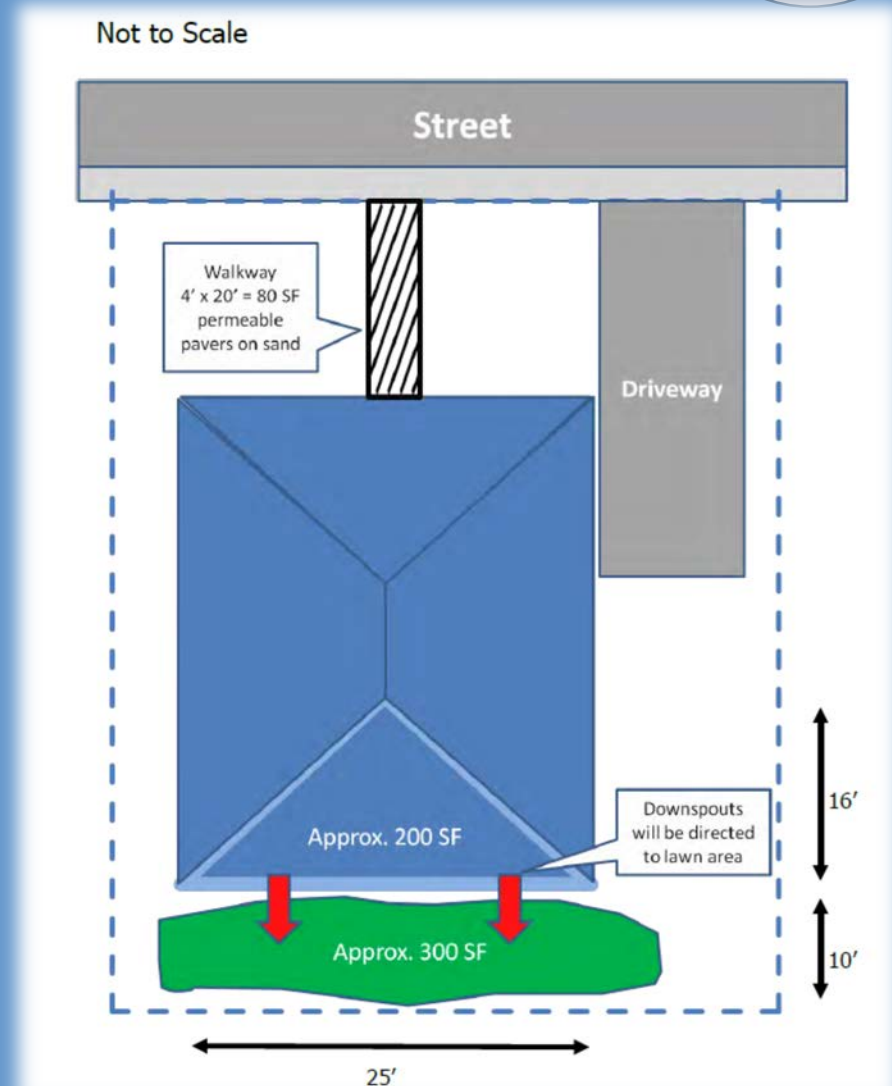
| Threshold* | Requirement |
|--|---|
| All projects | “As encouraged or directed by local staff” |
| 2,500-10,000 SF | Stormwater Control Plan for a Small Project |
| Single-family home with SF > 10,000 | Stormwater Control Plan for a Small Project |
| Auto service, gas station, restaurant, uncovered parking lot SF > 5,000 | Stormwater Control Plan for a Regulated Project |
| All projects with SF > 10,000 | Stormwater Control Plan for a Regulated Project |
| All projects with SF > 1 acre | Stormwater Control Plan for a Regulated Project Include Hydromodification Management |

*Impervious surface created or replaced

“Small” Projects

C

- Provision C.3.i.
- Address **some amount** of impervious surface
- Use one or more design measures
 - Downspout directed to landscaping ✓
 - Pervious walkway ✓
- Use the template and follow the directions
- Don't overdesign



2. Self-Treating and Self-Retaining

- Essential to LID design
- Track and quantify runoff reduction
- Steps:
 - Delineate Drainage Management Areas
 - Classify DMAs
 1. Self-treating areas
 2. Self-retaining areas
 3. Areas draining to self-retaining areas
 4. Areas that drain to IMPs

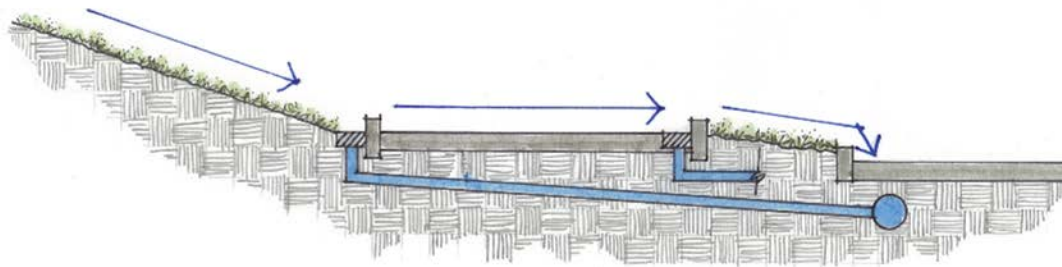
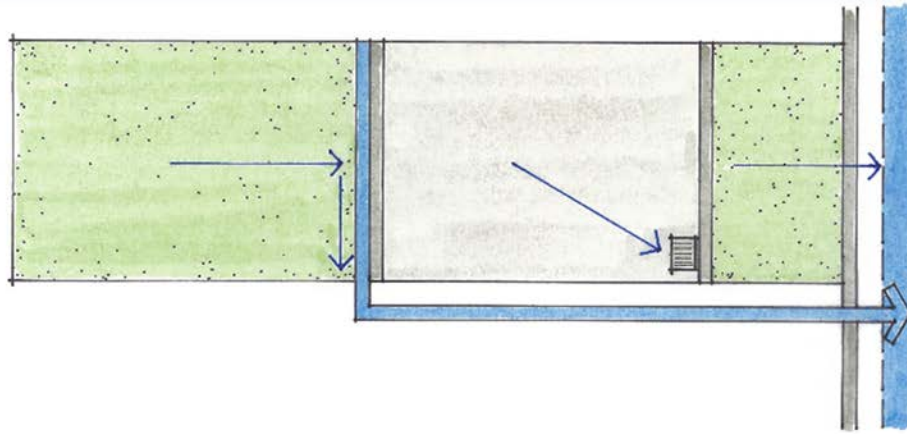


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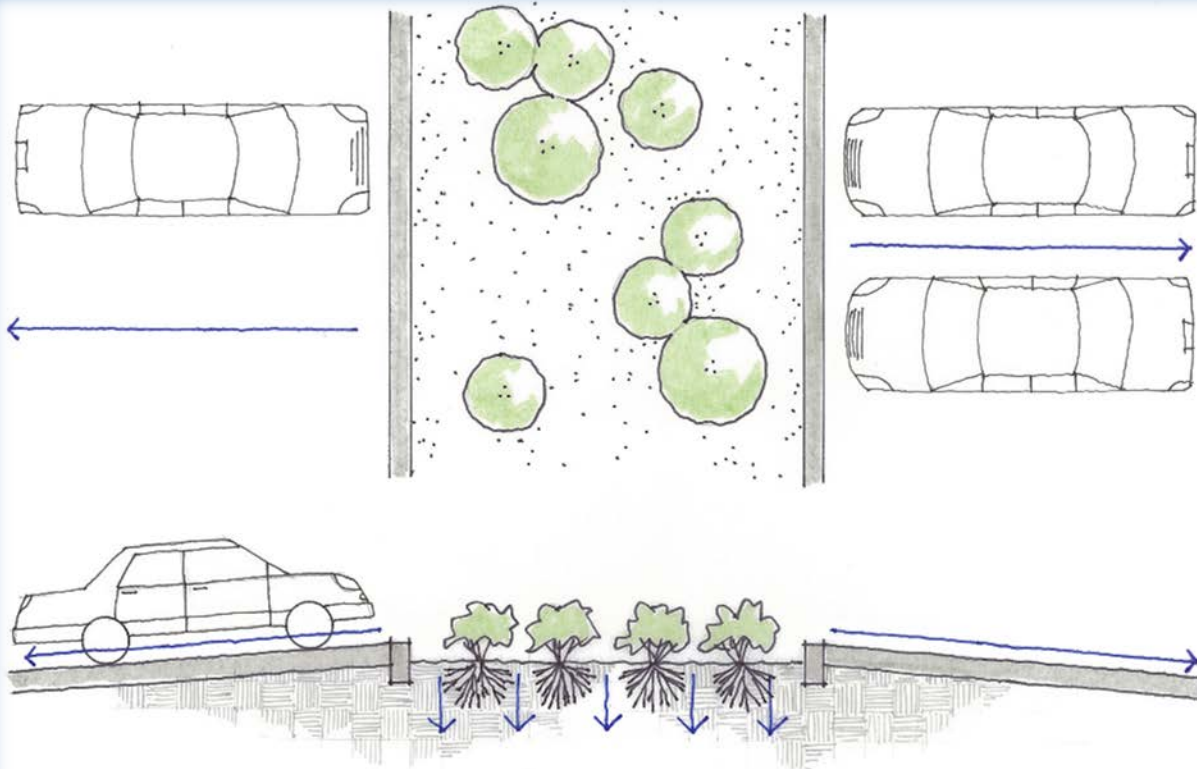
Self-treating Areas

31

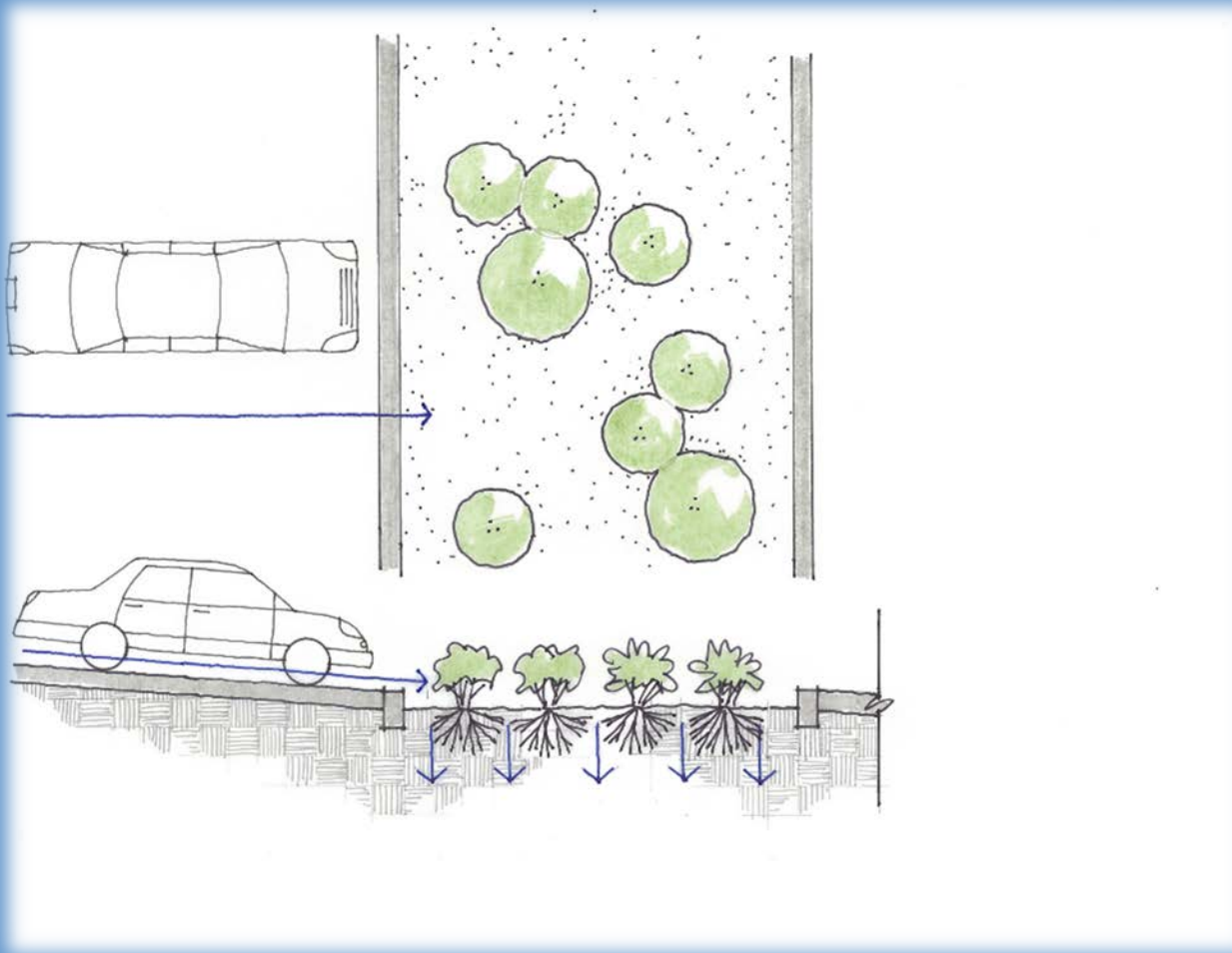


Self-retaining Areas

32



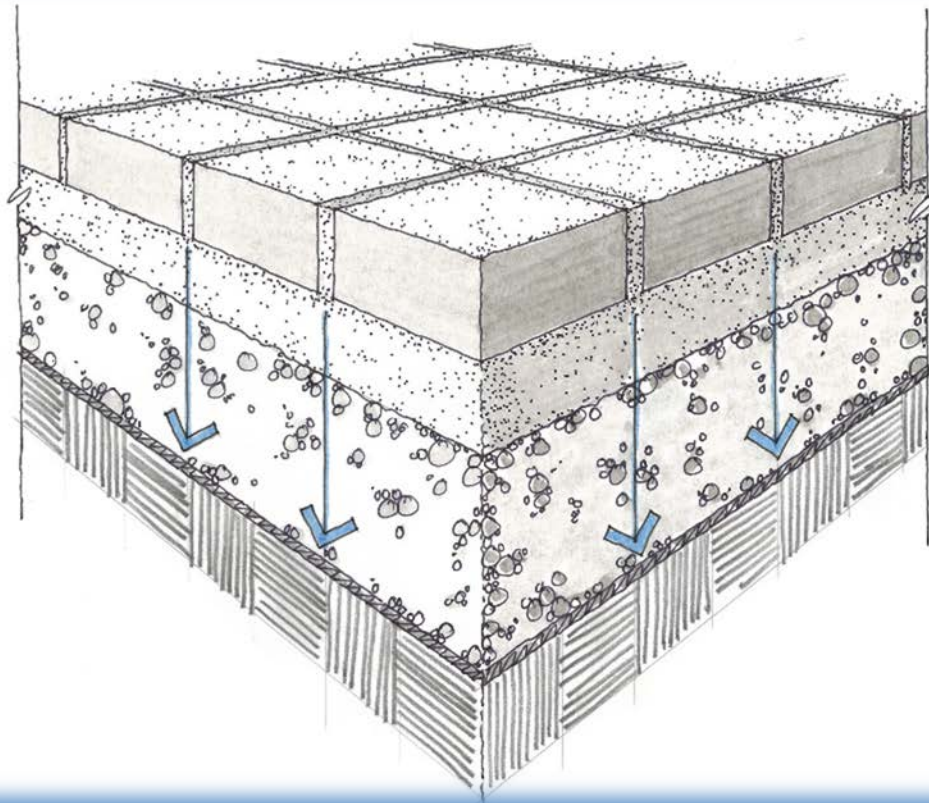
Areas draining to self-retaining



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Pervious Pavements

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3. Placing bioretention on the site

- High-visibility, well-trafficked places
- Common, accessible area
- Drain only impervious roofs and pavement
- Use surface drainage; keep runs short
- Make top of soil elevation high as possible
- Make facilities flat and level
- Follow the design criteria

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66

67

Make This Happen

- Bioretention facilities are level so they “fill up like a bathtub.”



Don't create pits



Don't create pits



Problems with pits



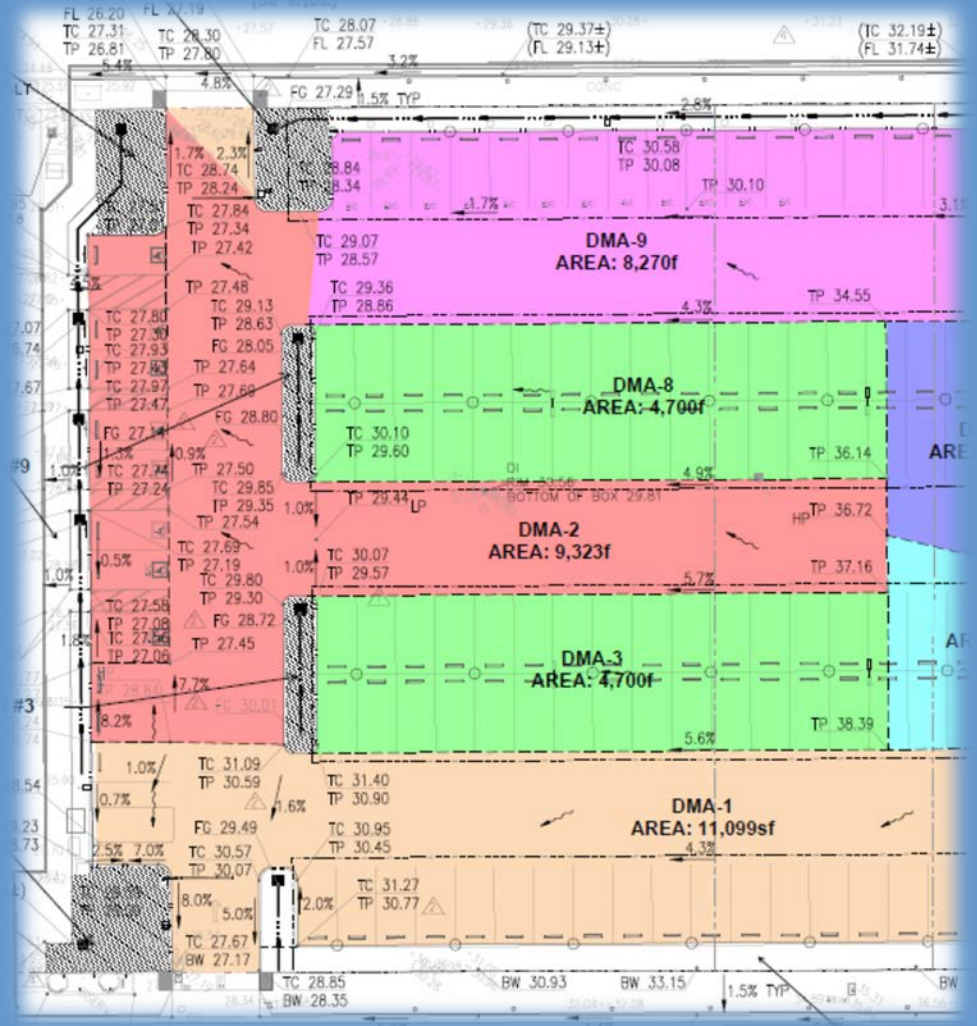
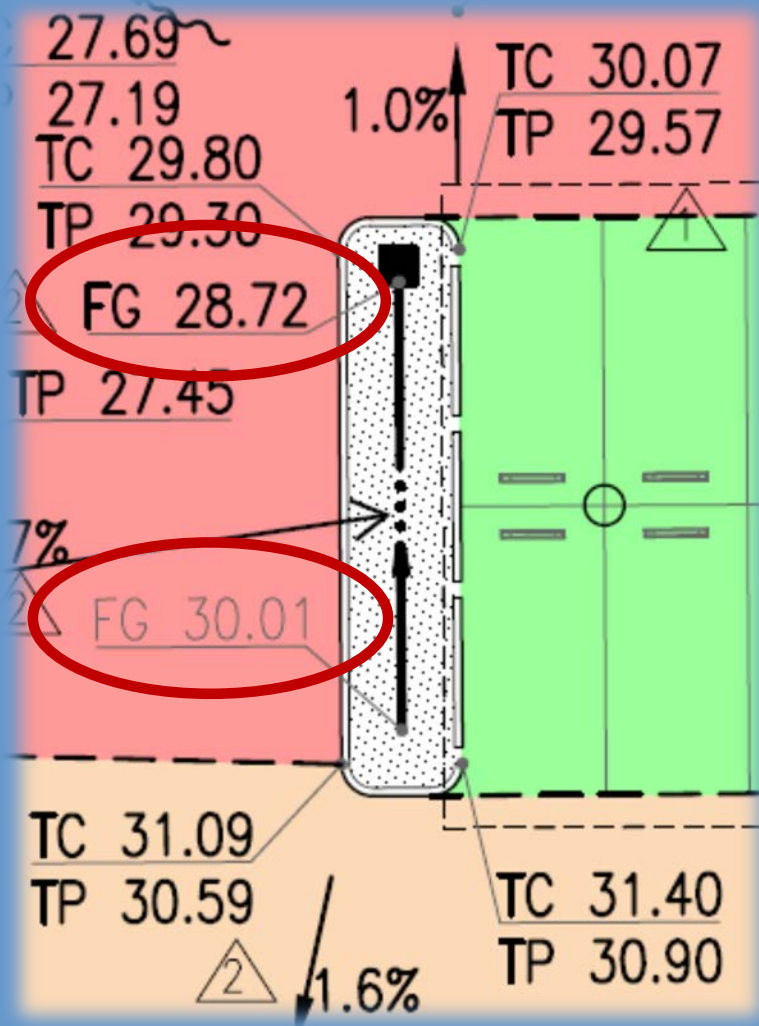
Flat, Flat, Flat



Flat, Flat, Flat



Parking Lot



Soil specification

B-2

- Reference Guidebook Appendix B
- Note submittal requirements
- Current issue: Insufficient coarse fraction in compost



4. Offsets/Alternative Compliance

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- Two cases:
 - Part of the project:
 - Driveway or other steep portion at perimeter of site can't be configured to drain to bioretention
 - Most or all of the project:
 - Applicant feels on-site bioretention cannot be made compatible with the project
 - Non-LID treatment not an option

5. Construction Documents

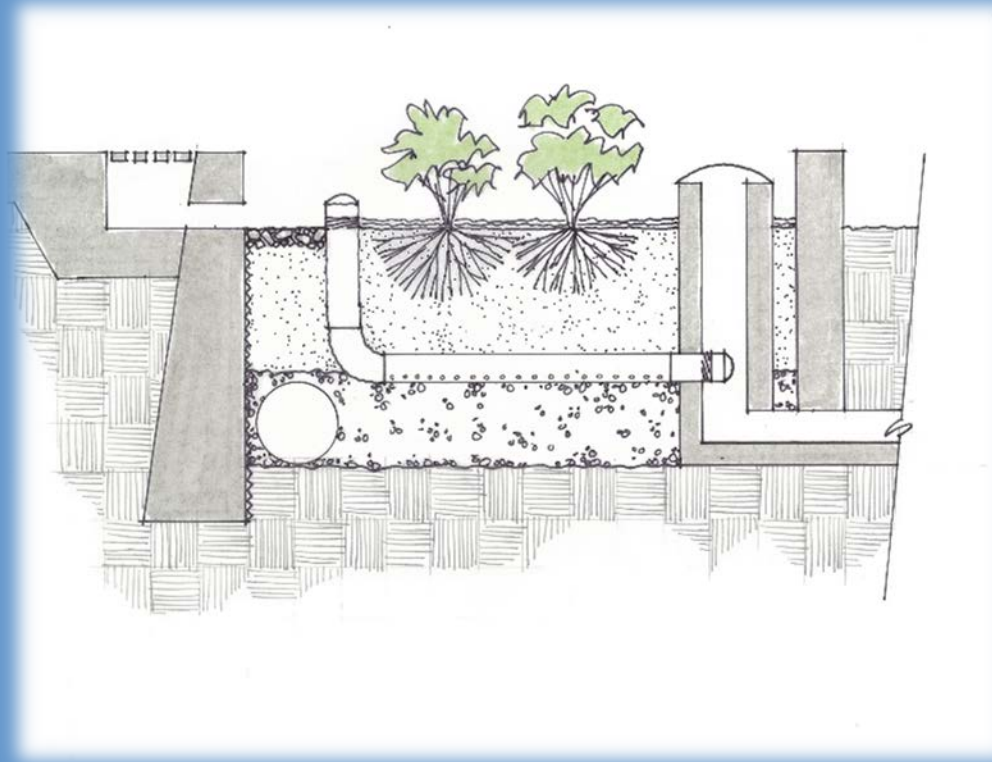
48

- Show DMAs and facilities
 - On the Grading and Drainage Plan, or
 - a separate Stormwater Control Plan
- Consider screening the G&D plan, possibly combined with the roof plan, as background for showing DMAs
- Show key elevations
- Coordinate with utility and landscaping plans
 - Soil specifications in planting plan

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Bioretention Design Criteria

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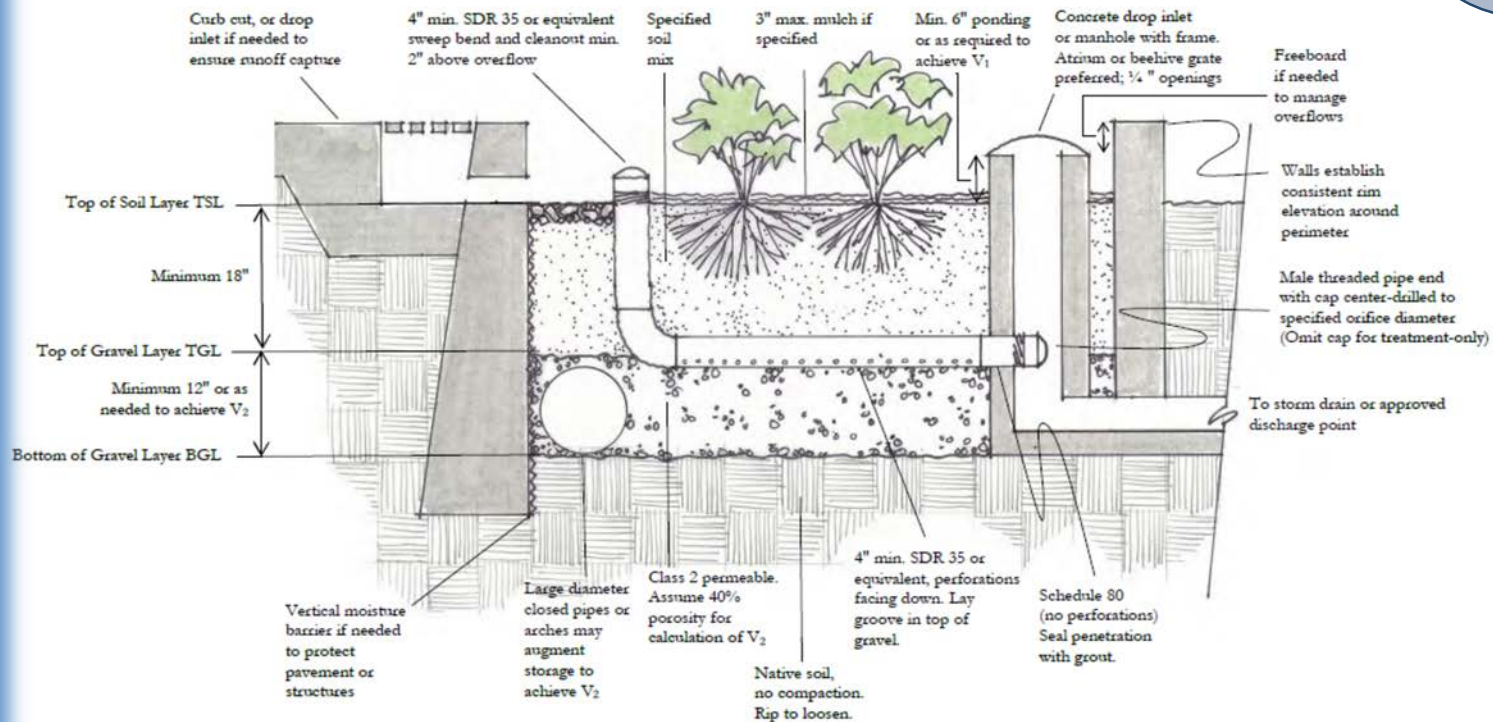


Bioretention Design Criteria

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Bioretention Facility

Cross-section
Not to Scale



Notes:

- No liner, no filter fabric, no landscape cloth.
- Maintain BGL, TGL, TSL throughout facility area at elevations to be specified on drawing.
- Class 2 perm layer may extend below and underneath drop inlet.
- Elevation of perforated pipe underdrain is atop gravel layer.
- See Appendix B for soil mix specification, planting and irrigation guidance.
- See Chapter 3 for factors and equations used to calculate V_1 , V_2 , and orifice diameter.

6. HM & the IMP Sizing Calculator

Integrated Management Practice Calculator [WhisperingPinesLane.xml]

File Tools Help

Project Information

All of the project information is required. Please fill in all of the information before editing the DMAs and IMPs.

Project Name: Example Small Residential Subdivision

Location: Whispering Pines Lane, Anytown, USA

APN: []

Total Area: 130680 sq ft Mean Annual Precip: 13 in

Design Goal

- Treatment Plus Flow Control
- Treatment Only

Drainage Management Areas (DMAs) | Integrated Management Practices (IMPs) | Calculation Warnings(0) | Summary Report

| 1-RF | 1-RR | 1-DW | 1-FY-1 | 1-FY-2 | 1-RY | 9-RY | 2-RF | 2-RR | 2-DW | 2-FY-1 | 2-FY-2 | 2-RY | 3-RF | 3-RR |
|------|------|------|--------|--------|------|------|------|------|------|--------|--------|------|------|------|
| | | | | | | | | | | | | | | |

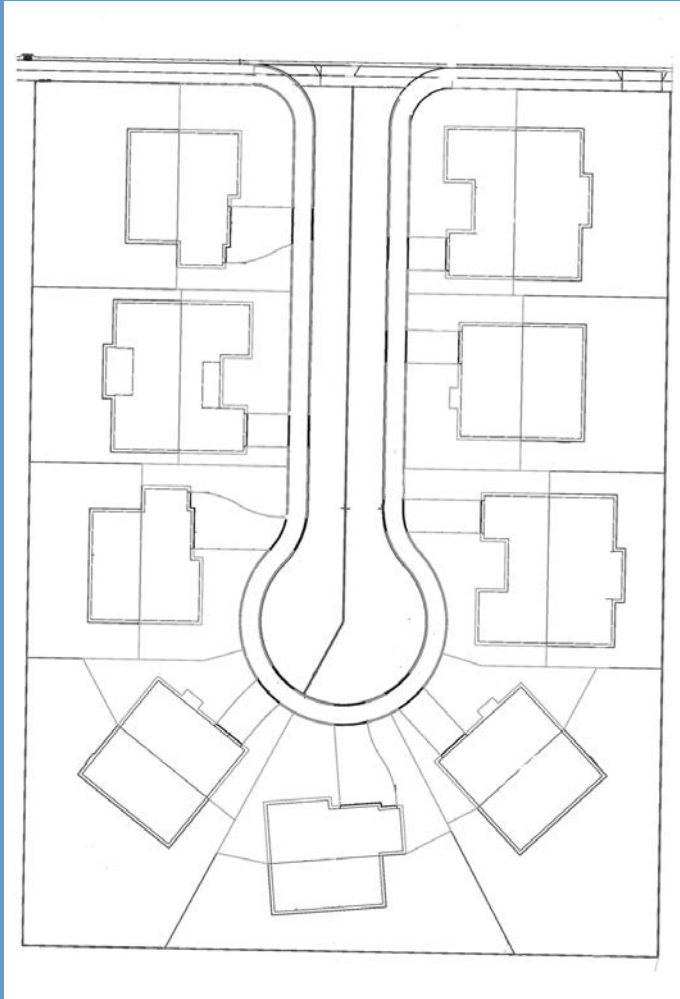
DMA Type: Drains to IMP IMP: Bioretention-1

NOTE: The DMA can only be assigned to IMPs with the same s...

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E-8

Residential Subdivision Example



- LID Design
- 45 DMAs
- 27 Self-retaining areas
- 2 Bioretention facilities
 - Sizing factor = .66
- Drain rear roofs to backyards
- No storm drains

Notes and Takeaways

- Calculator looks up sizing factors
- Sizing factors are calculated using iterative continuous simulation of 30+ years of hourly rainfall on a 1-acre impervious area
- Runoff factor for landscape, “D” soils = 0.7

7. Special Projects

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- Meet the density criteria
- Demonstration of LID infeasibility
 - Onsite
 - Offsite

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For areas not covered by buildings

- Inadequate SF to accommodate bioretention
- Slopes too steep to terrace
- Environmental constraints
- High groundwater (< 2 feet BGS)
- Subsurface utilities
- Cap over polluted soil
- Lack of head or routing path to or from facility

Non-LID Facilities

E-7

- Criteria for non-LID Facilities
- Example calculations



8. Operation and Maintenance

- New in 2018
 - Template for a Stormwater Facilities O&M Plan
 - Example O&M Plan for a Commercial Project
 - Example O&M Plan for a Residential Subdivision
 - Fact Sheet for Bioretention Facilities
- Also available on the website:
 - O&M Legal Agreement Forms

Key O&M Requirements

B-4

- Composted mulch
- No fertilizer
 - See instructions for using compost tea
- Weed manually
 - Listed “natural” herbicides for invasions
- No synthetic pesticides
 - Beneficial nematodes or listed natural pesticides

Typical maintenance plan

- Inspect weekly for trash and remove
- Weed monthly
- Check drainage and inspect facilities before the rainy season
- Inspect after each significant rainfall
- Annual vegetation cut-back and maintenance

Workshop Summary

Please complete and hand in the request for feedback on the back of your agenda