APPENDICES

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APPENDIX A

STORM WATER LID

DETERMINATION WORKSHEET

2017 Storm Water LID Determination Worksheet

PURPOSE AND APPLICABILITY: This determination worksheet is intended to satisfy the specific requirements of "ORDER NO. R1-2015-0030, NPDES NO. CA0025054 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM THE MUNICIPAL SEPARATE STORM SEWER SYSTEMS." Additional design requirements imposed by Governing Agencies, such as local grading ordinances, CAL Green, CEQA, 401 permitting, and hydraulic design for flood control still apply as appropriate. Additionally, coverage under another regulation may trigger the requirement to design in accordance with the Storm Water LID Technical Design Manual.

Part 1: Project Information

Project Name	Applicant (owner or developer) Name
Project Site Address	Applicant Mailing Address
Project City/State/Zip	Applicant City/State/Zip
Permit Number(s) - (if applicable)	Applicant Phone/Email/Fax
Designer Name	Designer Mailing Address
Designer City/State/Zip	Designer Phone/Email

Type of Application/Project:

☐ Subdivison ☐ Grading Permit ☐ Building Permit ☐ Hillside Development

☐ DesignReview ☐ Use Permit ☐ Encroachment ☐ Time Extensions ☐ Other :_____

PART 2: Project Exemptions

1. Is this a project that creates or replaces *less than* 10,000 square feet of impervious surface[1], including all project phases and off-site improvements?

   ☐ Yes ☐ No

1 Impervious surface replacement, such as the reconstruction of parking lots or excavation to roadway subgrades, is not a routine maintenance activity. Reconstruction is defined as work that replaces surfaces down to the subgrade. Overlays, resurfacing, trenching and patching are defined as maintenance activities per section VI.D.2.b.

2. Is this project a routine maintenance activity[2] that is being conducted to maintain original line and grade, hydraulic capacity, and original purpose of facility such as resurfacing existing roads and parking lots?

☐ Yes ☐ No

3. Is this project a stand alone pedestrian pathway, trail or off-street bike lane?

☐ Yes ☐ No

4. **Did you answer "YES" to any of the questions in Part 2?**

☐ **YES:** This project will *not* need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 Permit. **Please complete the "Exemption Signature Section" on Page 4.**

☐ **NO:** Please complete the remainder of this worksheet.

Part 3: Project Triggers

Projects that Trigger Requirements:
Please answer the following questions to determine whether this project requires permanent Storm Water BMP's and the submittal of a SW LIDs as required by the NPDES MS4 Permit order No. R1-2015-0030.

1. Does this project create or replace a combined total of 10,000 square feet or more of impervious surface[1] including all project phases and off-site improvements?

☐ Yes ☐ No

2. Does this project create or replace a combined total or 10,000 square feet or more of impervious streets, roads, highways, or freeway construction or reconstruction[3]? ☐ Yes ☐ No

3. Does this project create or replace a combined total of 1.0 acre or more of impervious surface[1] including all project phases and off-site improvements? ☐ Yes ☐ No

4. **Did you answer "YES" to any of the above questions in Part 3?**

☐ **YES:** This project will need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 Permit. **Please complete remainder of worksheet and sign the "Acknowledgement Signature Section" on Page 4.**

☐ **NO:** This project will *not* need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 permit. **Please complete the "Exemption Signature Section" on Page 4.**

---

1 Imprevious surface replacement, such as the reconstruction of parking lots or excavation to roadway subgrades, is not a routine maintence activity. Reconstruction is defined as work that replaces surfaces down to the subgrade. Overlays, resurfacint, trenching and patching are defined as maintenance activities per section VI.D.2.b.

2 "Rountine Maintenance Activity" includes activities such as overlays and/or resurfacing of existing roads or parking lots as well as trenching and patching activities and reroofing activities per section VI.D.2.b.

3 "Reconstruction" is defined as work that extends into the subgrade of a pavement per section VI.D.2.b.

Part 4: Project Description

1. Total Project area: ☐ square feet ☐ acres

2. Existing land use(s): (check all that apply)

☐ Commercial ☐ Industrial ☐ Residential ☐ Public ☐ Other

Description of buildings, significant site features (creeks, wetlands, heritage trees), etc.:

3. Existing impervious surface area: ☐ square feet ☐ acres

4. Proposed Land Use(s): (check all that apply)

☐ Commercial ☐ Industrial ☐ Residential ☐ Public ☐ Other

Description of buildings, significant site features (creeks, wetlands, heritage trees), etc.:

5. Existing impervious surface area: ☐ square feet ☐ acres

Acknowledgment Signature Section:

As the property owner or developer, I understand that this project is required to implement permanent Storm Water Best Management Practices and provide a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) Permit Order No. R1-2015-0030. *Any unknown responses must be resolved to determine if the project is subject to these requirements.

_____ _____

Applicant Signature Date

Exemption Signature Section:

As the property owner or developer, I understand that this project as currently designed does not require permanent Storm Water BMP's nor the submittal of a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) Permit*. I understand that redesign may require submittal of a new Determination Worksheet and may require permanent Storm Water BMP's.

_____ _____

Applicant Signature Date

* **This determination worksheet is intended to satisfy the specific requirements of "ORDER NO. R1-2015-0030, NPDES NO. CA0025054 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM THE MUNICIPAL SEPARATE STORM SEWER SYSTEMS." Additional design requirements imposed by Governing Agencies, such as local grading ordinances, CAL Green, CEQA, 401 permitting, and hydraulic design for flood control still apply as appropriate. Additionally, coverage under another regulation may trigger the requirement to design in accordance with the Storm Water LID Technical Design Manual.**

_____

Implementation Requirements: *All calculations shall be completed using the "Storm Water Calculator" available at: www.srcity.org/stormwaterLID*

Hydromodification Control/100% Volume Capture: Capture (infiltration and/or reuse) of 100% of the volume of runoff generated by a 1.0" 24-hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual method. This is a retention requirement.

***Treatment Requirement*:** Treatment of 100% of the flow calculated using the modified Rational Method and a known intensity of 0.20 inches per hour.

Delta Volume Capture Requirement: Capture (infiltration and/or reuse) of the increase in volume of storm water due to development generated by a 1.0" 24-hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual method. This is a retention requirement.

APPENDIX B

BMP SELECTION TABLE

BMP Selection Table

	Best Management Practice (BMP)	Detail Sheet	Detail Title	Can be used with...	High Ground Water	Contamination	Slope Constraints	Achieves...	Treatment	Volume Capture	Pollution Prevention Credit	BMP in priority selected?	Yes	No	Explanation of selection	Other notes:
Universal LID Features- to be considered on all projects.	Living Roof	N/A	N/A		x	x	x		x	x						
	Rainwater Harvesting	N/A	N/A		x	x	x			x						
	Interceptor Trees	N/A	N/A		x	x	x				x					
	Vegetated Buffer Strip	UN-01	Vegetated Buffer Strip								x					
	Bovine Terrace	UN-02	Bovine Terrace		x						x					
	Impervious Area Disconnection	N/A	N/A		x	x	x				x					

BMP Selection Table

	Best Management Practice (BMP)	Detail Sheet	Detail Title	Can be used with...	High Ground Water	Contamination	Slope Constraints	Achieves...	Treatment	Volume Capture	Pollution Prevention Credit	BMP in this priority selected?	Yes	No	Explanation of selection	Other notes:
Priority 1 and 1A BMPs- to be installed with no underdrains or liners. Must drain all stading water within 72 hours.	Rain Garden	P1-01	Rain Garden						x	x						
	Roadside Bioretention	P1-02	Roadside Bioretention - no C & G						x	x						
	Vegetated Swale-with Bioretention	P1-06	Swale with Bioretention						x	x						
	Constructed Wetlands	N/A	N/A						x	x						
	Infiltration Trench	P1-07	Infiltration Trench						x	x						

BMP Selection Table

	Best Management Practice (BMP)	Detail Sheet	Detail Title	Can be used with...	High Ground Water	Contamination	Slope Constraints	Achieves...	Treatment	Volume Capture	Pollution Prevention Credit	BMP in this priority selected?	Yes	No	Explanation of selection	Other notes:
Priority 2 BMPs- with subsurface drains installed above the capture volume.	Rain Garden	P2-01	Rain Garden						x	x						
	Roadside Bioretention	~~P2-02~~	Roadside Bioretinton - Flush Design Roadside						x	x						
		~~P2-03~~	Roadside Bioretenion-Contiguous SW						x	x						
		P2-04	Roadside Bioretenion-Curb Opening						x	x						
		P2-05	Roadside Bioretenion-No C & G						x	x						
	Pervious Pavement	P2-06	Vegetated Buffer Strip						x	x						
	Constructed Wetlands	N/A	N/A						x	x						

BMP Selection Table

	Best Management Practice (BMP)	Detail Sheet	Detail Title	Can be used with...	High Ground Water	Contamination	Slope Constraints	Achieves...	Treatment	Volume Capture	Pollution Prevention Credit	BMP in this priority selected?	Yes	No	Explanation of selection	Other notes:
Priority 3 BMPs- installed with subdrains and/or impermeable liner. Does not achieve volume capture and must be used as part of a treatment train.	Rain Garden	P3-01	Rain Garden		x	x	x		x							
	Bioretention	~~P3-02~~	Roadside Bioretinton - Flush Design Roadside		~~x~~	~~x~~	~~x~~		~~x~~							
		~~P3-03~~	Roadside ~~Bioretenion-~~ Contiguous SW		~~x~~	~~x~~	~~x~~		~~x~~							
		P3-04	Roadside Bioretenion- Curb Opening		x	x	x		x							
		P3-05	Roadside Bioretenion- No C & G		x	x	x		x	x						
	Flow Through Planters															
	Pervious Pavement	P1-04	Vegetated Buffer Strip		x	x	x		x	x						
	Vegetated Swale	P3-07	Vegetated Swale		x	x	x		x	x						

BMP Selection Table

	Best Management Practice (BMP)	Can be used with...	High Ground Water	Contamination	Slope Constraints	Achieves...	Treatment	Volume Capture	Pollution Prevention Credit	BMP in this priority selected?	Yes	No	Explanation of selection	Other notes:
Priority 4 BMPs- does not achieve volume capture and must be used as part of a treatment train.	Tree Filter Unit		x	x	x		x							
	Modular Bioretention		x	x	x		x							
Priority 5 BMPs- does not achieve volume capture and must be used as part of a treatment train.	Chambered Separator Units		x	x	x		x							
	Centrifugal Separator Units		x	x	x		x							
	Trash Excluders		x	x	x		x							
	Filter Inserts		x	x	x		x							
Priority 6 BMPs-	Offset Program						N/A	N/A	N/A					
Other	Detention		x											

APPENDIX C

STORM WATER CALCULATOR

STORM WATER CALCULATOR*

***For example only, go to www.srcity.org/stormwaterlid for the latest version of the calculator**

Project:	Enter Project Name
Address/Location:	Enter Address
Designer:	Design Engineer
Date:	Date
Inlet Number/Tributary Area/BMP:	Enter ID information

NOTE: In order for this calculator to function properly **macros must be enabled**.

Physical Tributary Area that drains to Inlet/BMP = **10,000** ft²

This portion of the Storm water Calculator is designed to account for pollution prevention measures implemented on site. Additional information and description of these measures can be found in the Fact Sheets in Appendix F and in Chapter 4 of the narrative.

Disconnected Roof Drains [1]

Input:

Select disconnection condition: **Runoff is directed across landscape; Width of area: 5' to 9'**
Condition Factor = **0.25**

Method 1: **Based on the total rooftop drainage area** - to be used if rooftop information is known.

Input:

Enter amount of rooftop area that drain to disconnected downspouts = **0** ft²
Rooftop Area Factor = **0.00** Rooftop Area Factor= (Total Rooftop Disconnected Area/Tributary Area)

Solution:

Area reduction = (Physical Tributary Area x Conditional Factor x Rooftop Area Factor)

(10,000 x 0.25 x 0.00) = **0** ft² **Rooftop Drainage Area Reduction**

Method 2: **Based on density (units per acre)** - to be used if rooftop information is unknown.

Input:

Enter percent of rooftop area to be disconnected from downspouts: **0** %

Select Density: **3-4** Units per Acre
Density Reduction Factor= **0.2**

Solution:

Area reduction = (Physical Tributary Area x Conditional Factor x Percent Disconnected x Density Factor)

(10,000 x 0.25 x 0.00 x 0.19) = **0** ft² **Density Reduction**

NOTE:
Either Method 1 (rooftop area) or Method 2 (density) can be used. Providing input for both methods will cause an error. If rooftop area information is available, Method 1 should be used.

[1] *See "Impervious Area Disconnection" Fact Sheet in Appendix E for further details.*

[2] See "Interceptor Trees" Fact Sheet in Appendix E for further details and see "Plant and Tree List" in Appendix G for approved trees.

[3] See "Vegetated Buffer Strip" and "Bovine Terrace" Fact Sheets in Appendix E for further details.

[4] *Total area reductions due to pollution Prevention Measures cannot exceed 50% of the physical Tributary Area.*

[5] *Per the "Urban Hydrology For Small Watersheds" TR-55 manual.*

[6] *Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.*

[7] *From Sonoma County Water Agency Flood Control Design Criteria.*

[8] *Hydrologic soil type based of infiltration rate of native soil as defined by "Urban Hydrology For Small Watersheds" TR-55 Manual.*

[9] *Composite CN calculated per "Worksheet 2 Part 1 of the Urban Hydrology For Small Watersheds" TR-55 manual.*

[10] *From "Using Site Design to Meet Development Standards For Storm water Quality" by the Bay Area Storm water Management Agencies Association (BASMAA).*

Paved Area Disconnection [1]

Paved Area Type (select from drop down list): Not Directly-connected Paved Area
Multiplier = 1

Enter area of alternatively designed paved area: 0 ft^2

Area Reduction = 0 ft^2

INSTRUCTIONS:
Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.

Interceptor Trees [2]

Number of new ***Evergreen Trees*** that qualify as interceptor trees= 0 **New Evergreen Trees**

Area Reduction due to new Evergreen Trees= 0 ft^2 (200 ft^2/tree)

Number of new ***Deciduous Trees*** that qualify as interceptor trees= 0 **New Deciduous Trees**

Area Reduction due to new Deciduous Trees= 0 ft^2 (100 ft^2/tree)

Enter square footage of qualifying **existing tree canopy** = 0 **Existing Tree Canopy**

Allowed reduction credit for existing tree canopy= 0 ft^2 Allowed credit for existing tree canopy = 50 % of actual canopy square footage

Area Reduction = 0 ft^2 = Sum of areas managed by evergreen + deciduous + existing canopy

NOTE:
Total Interceptor Area Reduction is limited to 50% of the physical tributary area.

INSTRUCTIONS:
Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.

Buffer Strips & Bovine Terraces [3]

Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft^2

Buffer Factor = 0.7

Solution:

Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =

Area Reduction = 0 ft^2

INSTRUCTIONS:
Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.

City of Santa Rosa

APPENDIX C
STORM WATER CALCULATOR

Enter Project Name
Enter Address
Design Engineer
Enter ID information

Revised Tributary Area due to Pollution Prevention Measures

Physical Tributary Area =	10,000	ft^2
Tributary Area Reduction due to Pollution Prevention Measures [4] =	0	ft^2
Reduced Tributary Area to be used for Calculations =	10,000	ft^2

This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.

Design Goal: 100% Volume Capture

Capture (infiltration and/or reuse) of 100% of the volume of runoff generated by the 85th percentile 24 hour storm event.

Formulas:

$$S = \frac{1000}{CN} - 10$$

Where:
S= Potential maximum retention after runoff (in) [5]
CN= Curve Number [5]

$$Q = \frac{[(P*K)-(0.2*S)]^2}{[(P*K)+(0.8*S)]} \times \frac{1ft}{12"}$$

Where:
Q= Runoff depth (ft) [6]
P= Precipitation (in) = **0.92**
K= Seasonal Precipitation Factor [7]

0.92 inches in the Santa Rosa area, based on local historical data.

$$V = (Q)(A_r)$$

Where:
V= Volume of Storm Water to be Retained (ft^3)
A_r= Reduced Tributary Area including credit for Pollution Prevention Measures (ft^2)

Input: (Pick data from drop down lists or enter calculated values)

A_r =	10,000	ft^2
K [7] =	1.00	

Drop down Lists

Select post development hydrologic soil type within tributary area [8] =	C: 0.05 - 0.15 in/hr infiltration (transmission) rate
Select post development ground cover description [5] =	Residential - 1/8 acre or less (town houses)
CN_{POST} =	90
OR: Composite post development CN [9] =	

NOTE:
Entering a calculated composite CN will override selections made from the pull down menu above. Calculation worksheet should be used for all composite calculations and included with submittal.

Solution:

Volume of storm water - Post Development

S_{POST}= 1.11 in

$$S_{POST} = \frac{1000}{90} - 10$$

Where:
S_{POST}= Post development potential maximum retention after runoff (in).

Q_{POST}= 0 ft

$$Q_{POST} = \frac{[(0.92 * 1.00)-(0.2 * 1.11)]^2}{[(0.92 * 1.00)+(0.8 * 1.11)]} \times \frac{1ft}{12in}$$

Q_{POST}= *Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.*

V_{GOAL}= 225 ft^3

$$V_{GOAL} = (0.02246)(10,000)$$

V_{GOAL}= Post Development Volume of Storm Water to be Retained (ft^3)

INSTRUCTIONS:
This Design Goal of 100% Capture is the ideal condition and if achieved satisfies all requirements so that no additional treatment is required and pages 4 and 5 of this calculator do not need to be completed.

NOTE:
If the Design Goal of 100% Capture is not achieved, 100% Treatment AND Volume Capture must be achieved and both pages 4 and 5 of this calculator need to be completed.

Release 7 Rev. 0
8/16/2012

Requirement 1: 100% Treatment

Treatment of 100% of the flow generated by 85th percentile 24 hour mean annual rain event (0.2 in/hr).

Formula:

$Q_{TREATMENT}$= (0.2 in/hr)(A)(C_{POST})(K) cfs

Where:

$Q_{TREATMENT}$= Design flow rate required to be treated (cfs)
C_{POST} = Rational method runoff coefficient for the developed condition [10]
A_r = Reduced Tributary Area including credit for Pollution Prevention Measures (ft^2)
K = Seasonal Precipitation Factor [7]

Input:

A_r =	10,000	ft^2 =	0	Acres
C_{POST} [10] =	0.0			
K [7] =	1.0			

Solution:

$Q_{TREATMENT}$= 0 cfs

$Q_{TREATMENT}$= (0.2)(0.23)(0.00)(1.00)

INSTRUCTIONS:

If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, this page of the calculator, AND Requirement 2- Volume Capture, page 5 of the calculator, **must** be achieved.

Requirement 2: Delta Volume Capture

No increase in volume of runoff leaving the site due to development for the 85th percentile 24 hour storm event.

Formulas:

$S = \frac{1000}{CN} - 10$

Where:
S= Potential maximum retention after runoff (in)[5]
CN= Curve Number [5]

$Q = \frac{[(P*K)-(0.2*S)]^2}{[(P*K)+(0.8*S)]} \times \frac{1ft}{12in}$

Where:
Q= Runoff depth (ft) [6]
P= Precipitation (in) = 0.92 *0.92 inches in the Santa Rosa area, based on local historical data.*
K= Seasonal Precipitation Factor [7]

$V = (Q)(A_r)$

Where:
V= Volume of Storm Water to be Retained (ft^3)
A_r= Reduced Tributary Area including credit for Pollution Prevention Measures (ft^2)

Input: (Pick data from drop down lists or enter calculated values)

A_r =	10,000	ft^2
K [7] =	1.0	

Drop down Lists

Select hydrologic soil type within tributary area [8] =	C: 0.05 - 0.15 in/hr infiltration (transmission) rate
Select predevelopment ground cover description [5] =	Residential - 1 acre lots
Select post development ground cover description [5] =	Residential - 1/8 acre or less (town houses)
CN_{PRE} =	79
CN_{POST} =	90
OR Composite Predevelopment CN [9] =	
Composite Post development CN [9] =	

Solution:

Pre Development Storm Water Runoff Volume

S_{PRE}= 3 in

$S_{PRE} = \frac{1000}{79} - 10$

Where:
S_{PRE}= Pre development potential maximum retention after runoff (in).

Q_{PRE}= 0 ft

$Q_{PRE} = \frac{[(0.92*1.00)-(0.2*2.66)]^2}{[(0.92*1.00)+(0.8*2.66)]} \times \frac{1ft}{12in}$

Q_{PRE}= *Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.*

V_{PRE}= 41 ft^3

$V_{PRE} = (0.00412)(10,000)$

V_{PRE}= Pre Development Volume of Storm Water Generated (ft^3)

Post Development Storm Water Runoff Volume

S_{POST}= 1 in

$S_{POST} = \frac{1000}{90} - 10$

Where:
S_{POST}= Post development potential maximum retention after runoff (in).

Q_{POST}= 0 ft

$Q_{POST} = \frac{[(0.92*1.00)-(0.2*1.11)]^2}{[(0.92*1.00)+(0.8*1.11)]} \times \frac{1ft}{12in}$

Q_{POST}= *Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.*

V_{POST}= 225 ft^3

$V_{POST} = (0.02246)(10,000)$

V_{POST}= Post Development Volume of Storm Water Generated (ft^3)

Solution: Volume Capture Requirement

Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).

Delta Volume Capture= $(V_{POST}-V_{PRE})$

Delta Volume Capture= (224.60) - (41.20)

V_{DELTA}= 183 ft^3

Where:
Delta Volume Capture= The increase in volume of storm water generated by the 85th percentile 24 hour storm event due to development that must be retained onsite (may be infiltrated or reused).

INSTRUCTIONS:

If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, **must** be achieved.

NOTE:

If the amount of volume generated after development is less than or equal to that generated before development, Requirement 2-Volume Capture is not required.

($C_{POST} \leq C_{PRE}$ or $CN_{POST} \leq CN_{PRE}$)

LID BMP Sizing Tool: 100% Volume Capture Goal; V_{GOAL}

NOTE:
LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.

Formulas:

$V_{LID\ GOAL}=((V_{GOAL}))/(P)$ = 864 ft^3

$A_{LID\ GOAL}=(W)(L)$ = 800 ft^2

Where:
$V_{LID\ GOAL}$ = Required volume of soil in LID BMP.
$A_{LID\ GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pipe if present).

V_{GOAL} = 225 ft^3

$$\text{Percent of Goal Achieved} = \frac{(D)(A_{LID\ GOAL})}{V_{LID\ GOAL}} \times 100$$

Where:
P= Porosity (enter as a decimal)
D= Depth below perforated pipe if present (in decimal feet)
W= Width (in decimal feet)
L= Length (in decimal feet)

Input:

P =	0.3		as a decimal
D =	3.5	ft	Below perforated pipe if present
W =	8.0	ft	
L =	100.0	ft	

Solution:

Percent of Goal Achieved = 324 % = [(3.5 x 800) / 864] x 100

INSTRUCTIONS:
The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the design goal of 100% volume capture of the post development condition. Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.

LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA}

NOTE:
LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.

Formulas:

$V_{LID\ DELTA}=((V_{DELTA}))/(P)$ = 705 ft^3

$A_{LID\ DELTA}=(W)(L)$ = 0 ft^2

Where:
$V_{LID\ DELTA}$ = Required volume of soil in LID BMP
$A_{LID\ DELTA}$ = Footprint of LID BMP area for a given depth (below perforated pipe if present).

V_{DELTA} = 183 ft^3

$$\text{Percent of Requirement Achieved} = \frac{(D)(A_{LID\ DELTA})}{V_{LID\ DELTA}} \times 100$$

Where:
P= Porosity (enter as a decimal)
D= Depth below perforated pipe if present (in decimal feet)
W= Width (in decimal feet)
L= Length (in decimal feet)

Input:

P =	0.3		as a decimal
D =	0.0	ft	Below perforated pipe if present
W =	0.0	ft	
L =	0.0	ft	

Solution:

Percent of Requirement Achieved = 0 % = [(0.0 x 0) / 705] x 100

INSTRUCTIONS:
The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the design requirement of the delta volume capture. Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches 100%.

APPENDIX D

LID SUBMITTAL COVERSHEET

Preliminary SUSMP Submittal Guide

Project Information:

Applicant Name (owner or developer)	
Mailing Address	
City/State/Zip	
Phone/Email/Fax	

Project Name	
Site Address	
City/State/Zip	
Permit # (s)	

Engineer Name	
Mailing Address	
City/State/Zip	
Phone/Email/Fax	

Type of Application/Project:

☐ Subdivision ☐ Grading Permit ☐ Building Permit ☐ Design Review ☐ Use Permit ☐ Other _____

What your Preliminary Plan must include:

Narrative:

Project Description

- ☐ Description of proposed project type, location, and any specific uses or features.
- ☐ Description of any sensitive features (creeks, wetlands, trees, etc) and weather they are going to be preserved, removed or altered.
- ☐ Description of the existing site.
- ☐ Description of how this project triggers these requirements (impervious area, CALGreen, 401 Permit, etc).

Pollution Prevention and Credits

- ☐ Description of all proposed pollution prevention measures (street sweeping, covered trash enclosures, indoor uses, etc).
- ☐ Description of all credits utilized (Interceptor Trees, Impervious Area Disconnection, and/or Alternative Driveway Design).
- ☐ Summary of tributary area reduction due to credits.

Type of BMPs proposed

- ☐ Description of the types of BMPs selected including priority group that each is in.
- ☐ Description of level of treatment and volume capture achieved (if 100% Capture is achieved treatment is not required).

Maintenance

- ☐ Description of maintenance for each type of BMP.
- ☐ Description of funding mechanism.
- ☐ Designation of Responsible Party.

EXHIBITS AND ATTACHMENTS

Completed BMP Selection Table

- ☐ Completed BMP Selection Table for each tributary area including explanation for each Priority not used.

Proposed SUSMP Exhibit

- ☐ Exhibit should include: street names, property lines, storm drainage system, waterways, title block, scale, and north arrow.
- ☐ Tributary areas shown for all inlets (including offsite drainage areas).
- ☐ C value for each tributary area.
- ☐ Soil Type of existing site.
- ☐ New or replaced impervious area.
- ☐ All inlets shown (including identifier).
- ☐ All interceptor trees shown.
- ☐ All proposed BMPs shown.

Existing Condition Exhibit

- ➢ *Not necessary if no impervious area existed on the undeveloped site or if the Design Goal of 100% Volume Capture is achieved.*

☐ Exhibit should include: street names, property lines, proposed storm drainage system, waterways, title block, scale, and north arrow.

☐ Soil Type of existing site.

☐ Proposed tributary areas shown for all proposed inlets (including offsite drainage areas).Existing impervious areas.

☐ Existing impervious area.

BMP Details:

☐ Preliminary detail for each type of BMP selected- provide a preliminary 8.5”x11” detail for each BMP type or include on submitted drawings. These can be taken straight from the Fact Sheets if no significant changes are proposed.

ON PLANS

☐ Show all applicable elements of the selected BMPs on the appropriate sheets.

CALCULATIONS

☐ Preliminary calculations; both volume and treatment, using the “storm water calculator” for each inlet.

APPENDIX E

BMP FACT SHEETS, DETAILS AND INSPECTION CHECKLISTS

FACT SHEET- LIVING ROOF

Living Roof

Also know as: Green Roof, Roof Garden, and Vegetated Roof







DESCRIPTION

Living roofs are roofs that are entirely or partially covered with vegetation and soils. Living roofs function as a soil and plant-based filtration feature that removes pollutants through a variety of natural physical, biological, and chemical treatment processes. Areas treated with a living roof are exempt from the Volume Capture requirement.

ADVANTAGES

- Living roofs are excluded from Volume Capture calculations.
- Provides water quality treatment.
- Used in urban areas where space is limited.
- Used on sloped sites.
- Provides habitat for birds and attracts pollinators like butterflies and bees.
- Reduces building heating and cooling costs.
- Provides noise reduction.
- Reduces heat island effect.

FACT SHEET- LIVING ROOF

LIMITATIONS

- Need to be integrated into the overall building and structural design.
- Overflow requirements need to be considered in design.
- Building orientation and shading needs to be considered in design.
- Plants must be selected for shallow soil layer and fast draining soils.
- Can only be installed on relatively flat roofs.

KEY DESIGN FEATURES

- All vegetated roofs are assembled in layers. The top layer includes the engineered soils and the plants. The soil is a lightweight mix that includes some organic material. Under the soil is a drainage layer that includes filter fabric to keep the soil in place and a core material that stores water and allows it to drain off the roof surface. Next is the root barrier, which prevents the roots from puncturing the waterproof membrane that lies below it, and finally there is the roof structure.
- Include plants suited to the unique shallow soil conditions and design to achieve ___% cover.
- Design for high flow as well as the water quality design storm.
- Underdrain or drainage system required.
- Designed to prevent standing water. All surface water must drain within 72 hours to prevent mosquito breeding.
- Select non-floatable surface mulching material to prevent clogging of downstream inlets.
- Building must be designed for the added weight of the living roof and all retained storm water.
- Seismic analysis may be necessary due to increased weight.
- Irrigation may be necessary for plant establishment and extended dry periods.

SIZING DESIGN- GOAL AND REQUIREMENTS

- **Water Quality Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a known intensity of 0.20 inches per hour.
- Living roofs are excluded from Volume Capture calculations.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID

FACT SHEET- LIVING ROOF

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include; recommended maintenance practices, identify the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary, and provide site specific inspection checklist.

At a minimum inspection and maintenance shall include the following:

- Drainage features should be inspected and cleaned as necessary to remove any obstructions.
- Irrigation, if present, should be routinely inspected to ensure plant establishment and survival.
- Plants should be pruned, weeds pulled, and dead plants replaced as needed.
- Eroded areas should be repaired as needed

FACT SHEET- RAINWATER HARVESTING

RAINWATER HARVESTING

Also know as: Rain Barrel, Cistern, and Rainwater Collection



DESCRIPTION

Rainwater harvesting is the practice of collecting and using rainwater from impervious surfaces such as roofs and patios. Rain barrels, or cisterns, are containers or tanks, designed to capture rainwater runoff from roofs later used for irrigation. Rain barrels are inexpensive, easy to install and maintain, and well suited for small-scale residential sites. Cisterns are larger than rain barrels and can be installed above or below ground depending upon design requirements and site conditions.

ADVANTAGES

- Can provide volume capture.
- Can be used as part of a treatment train with other BMPs.
- Low maintenance requirements (for above ground installations).
- Good for sites where infiltration is limited.
- Provides another source for irrigation water.
- Prioritized as a “Universal LID feature.”

LIMITATIONS

- Limited storage capacity.
- Does not provide water quality treatment.
- May require infrastructure (pumps or valves) to use stored water.
- Inadequate maintenance can result in mosquito breeding and/or algae production.
- May require building permits. Contact the governing agency for requirements.

FACT SHEET- RAINWATER HARVESTING

KEY DESIGN FEATURES



- Roof surfaces shall not include copper or materials treated with fungicides or herbicides.
- Gutters must be fully screened and installed at continuous grade.
- Storage containers, tank liners, and tank coatings must be listed as food grade, or be approved for potable water storage.
- Containers must be opaque, water tight, vented, completely covered and screened.
- Screen all openings.
- For above-ground systems, spigot and/or hose bib for drawing water must be at least 2 inches from the bottom and must be labeled “NONPOTABLE”.
- Overflow device must be equal in size to the total of all inlets and must lead to an approved discharge location with approved air gap.
- First flush diverter must be automatic self-draining with a clean out.
- Safety labels (non-potable, vector hazard, drowning hazard icons).
- Outdoor spigots must have an atmospheric vacuum breaker attached.
- Prior to installation, roofs must be cleaned, and downspouts disconnected from the storm drain system.
- All municipal water service lines to facilities with rainwater harvesting systems require the installation of an approved backflow prevention device. This condition may be met if the backflow prevention was installed as part of the fire sprinkler system.
- Not permitted within the front yard setback.
- Tanks up to 8 feet in height are permitted within the rear and side yard setbacks.
- Tanks in excess of 8 feet in height, shall be subject to the same setbacks as a detached residential accessory structure.
- Both rain barrels and above-ground cisterns must be sited in a stable, flat area. Rain barrels and cisterns may not block the path of travel for fire safety access.
- Overflow locations, which can include rain gardens, additional rain barrels or cisterns, or a discharge point to the storm drain system, must be designed to both direct outflow away from building foundations and prevent nuisance flows to adjacent properties.
- Overflow may not discharge water across a public right-of-way.
- Tanks should be placed in a cool or shaded area to avoid algal growth.
- Regular use of the water stored in systems between rain events is critical to ensure that storage is available for the next storm event.

FACT SHEET- RAINWATER HARVESTING

SIZING DESIGN GOALS AND REQUIREMENTS

- The **design goal** for rain water harvesting is to capture 100% of the runoff volume generated by the 85th percentile 24 hour storm event. 100% volume capture has been established as the ideal condition. If achieved, all requirements are satisfied and no additional treatment is required. This is a retention requirement.
- If the *design goal* is not achievable, then the rain water harvesting *sizing requirement* is:
- **Volume Capture** of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist. At a minimum maintenance shall include the following:

- Inspect twice annually to confirm that all the parts are operable and not leaking.
- Debris and clear all screens to prevent mosquitoes and other vectors from breeding.
- Clean tanks annually with a non-toxic cleaner, such as vinegar and dispose of wash water in a sink, bathtub or sewer cleanout.
- Test all backflow prevention assemblies annually by the system owner using an approved certified tester.
- Regular use of the water stored in systems between rain events is critical to ensure that storage is available for the next storm event.
- Clear roof gutter screens.

RAINWATER HARVESTING- INSPECTION CHECKLIST

Rainwater Harvesting
Inspection and Maintenance Checklist
(aka: Rain Barrel, Cistern, Rainwater Collection)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water after 3 days of dry weather around the storage tank(s) area?		• Regrade over flow drainage area. • Reposition splash block /dissipater. • Check for leaks from storage tank(s).	
	RS	Is there excessive splashing/spray from the overflow outlet?		• Reposition splash block or dissipater to reduce or eliminate splash/spray.	
	RS	Are the house/building gutters overflowing during a rain event?		• Check gutter down spout and gutter for obstructions. • Check storage tank(s) inlet screens for blockage. • Check storage tank(s) outlet(s) for blockage.	
	RS	Are the storage tank(s) over flowing?		• Check storage tank(s) outlet(s) for blockage.	

RAINWATER HARVESTING- INSPECTION CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there evidence of under cutting or washouts around storage tank(s)?		• Reposition splash block(s) or dissipater(s). • Fill in eroded areas and regrade. • Repair any leaks or overflows from storage tank(s).	
	PRS RS ARS	Is there accumulation of sediment, debris in the storage tank(s)?		• Remove sediment and check inlet and gutter screens. • Verify that the lid of the storage tank is secure.	
	RS ARS	Is there under cutting or washouts around the outlet splash block(s)?		• Reposition splash block(s) or dissipater(s). • Fill in eroded areas and regrade.	

RAINWATER HARVESTING- INSPECTION CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging the outlet areas?		• Trim and/or remove the excess vegetation around the outlet flow areas.	
	PRS RS ARS	Is the mulch/gravel spread evenly throughout the storage tank(s) area?		• Redistribute and add additional mulch/gravel if needed. • Regrade storage area.	
	PRS RS ARS	Are there dead or dry plants/weeds?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a trip or access hazard.	

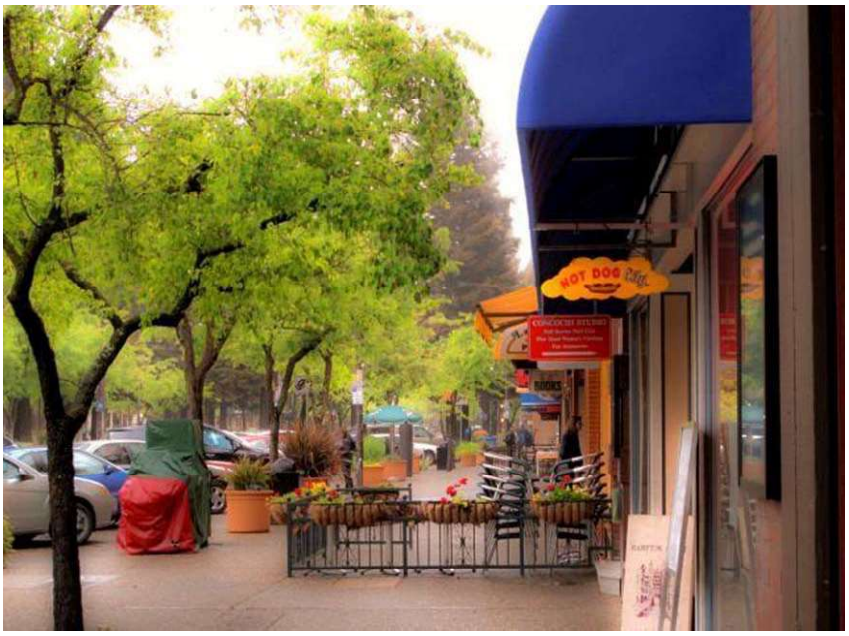
RAINWATER HARVESTING- INSPECTION CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the area?		• Remove all trash/debris.	
	PRS RS ARS	Is the surrounding area marked with Graffiti?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Are the vector control/prevention devices in place and functional?		• Replace or repair all damage components. • Contact vector control if problem persist.	
	PRS RS ARS	Is the irrigation system functional?		• Repaired any broken components.	
	PRS RS ARS	Is the Backflow operation/maintenance log current? (if installed)		• Test all backflow prevention assemblies annually by the system owner using an approved certified tester.	
	PRS RS ARS	Is there algae or other growth in the storage containers?		• Clean tank(s) with non-toxic cleaner.	

FACT SHEET- INTERCEPTOR TREES

INTERCEPTOR TREES

Also known as: Tree Credits





DESCRIPTION

Interceptor trees are new trees, or existing trees that are located within 25' of impervious areas. Trees intercept rain water on their leaves and branches, allowing rain water to evaporate or run down the branches and trunk of the tree where it readily infiltrates into the soil. Tree roots also increase infiltration. Trees also provide shade over impervious surfaces which reduce peak flow in streams and provide shade which reduces the "heat island" effects of urban areas.



Interceptor tree credits are calculated into the site design by reducing the amount of tributary area that must be used to calculate treatment and volume capture. New deciduous trees provide a credit of 100 ft², new evergreen trees provide 200 ft², and existing trees provide one half of the existing canopy. Only tree that overhang impervious areas or are within 25' of impervious areas can qualify as interceptor trees. The total area reduction credit due to the use of interceptor trees cannot exceed one half of the total physical tributary area. All interceptor tree credit calculations should be completed with the Credit Calculator in Appendix C.

FACT SHEET- INTERCEPTOR TREES

For example, if a project has 10,000 ft^2 of impervious area and plants 3 new deciduous interceptor trees and 2 evergreen interceptor trees, the area entered into the Storm Water Calculator to determine treatment and volume capture would be 10,000 ft^2 -(3*100 ft^2)-(2*200 ft^2) = 9,300 ft^2. If the project also kept an existing tree with a 100 ft^2 canopy, the tributary area could be reduced by an additional 50 ft^2.

ADVANTAGES

- Reduces the amount of pollutants entering the storm drain system.
- Can reduce size of downstream storm water quality treatment measure(s) by reducing the volume required to be treated.
- Provides shade to cool pavement and reduces surface runoff temperatures.
- Aids in removal of air pollutants and noise reduction.
- Trees required by the permitting agency may be counted as interceptor trees.
- Establishes habitat for birds and other pollinators like butterflies and bees.

KEY DESIGN FEATURES

- Appropriate new trees must be selected from the approved tree list. See Appendix G.
- Existing trees must be adequately protected during construction.
- Only tree that overhang impervious areas or are within 25’ of impervious areas can qualify as interceptor trees.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary, and provide site specific inspection checklist.

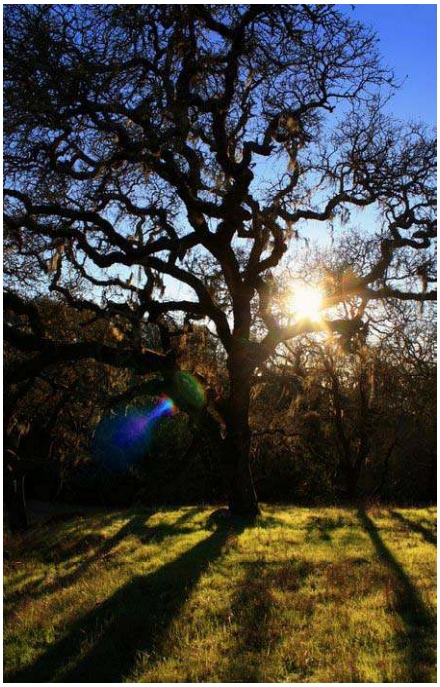
At a minimum inspection and maintenance shall include the following:

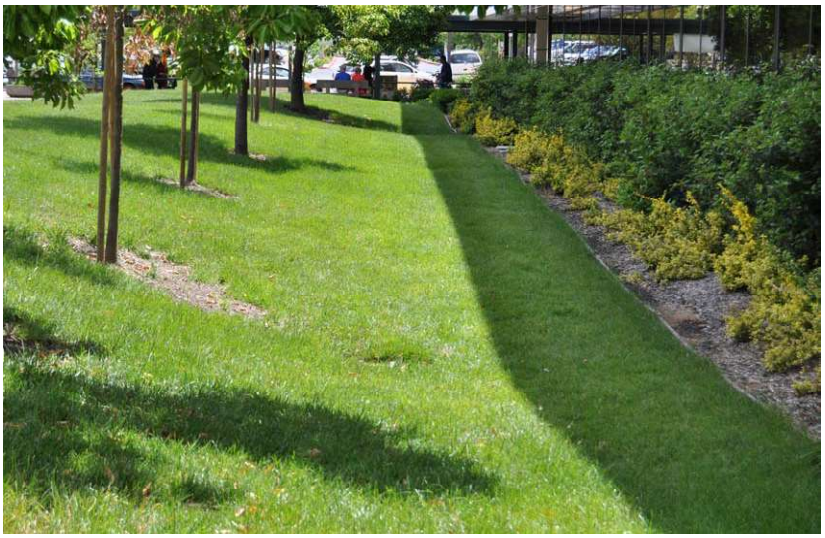
- Annual inspection prior to the rainy season.
- Annual proper watering and application of mulch.
- Routine pruning and weeding as needed.
- Replacement of trees as needed.

FACT SHEET- VEGETATED BUFFER STRIP

VEGETATED BUFFER STRIP

Also know as: Filter Strip, Grassed Filter





DESCRIPTION

Vegetated buffer strips are sloping planted areas designed to allow storm water to naturally infiltrate sheet flow from adjacent impervious surfaces. Buffer strips slope away from the impervious surface and are most often vegetated with low lying ground cover. Buffer strips function by slowing storm water runoff and allowing sediment and other pollutants to settle and infiltrate. Vegetated buffer strips are well-suited to addressing runoff from roads and highways, roof downspouts, and parking lots.

ADVANTAGES

- Provides a tributary area reduction. Calculations to be completed using the Pollution Prevention Credit Calculator in Appendix C.
- Enhances water quality of downstream water bodies through natural processes.
- Aesthetically pleasing.
- Can establish habitat for birds and other pollinators like butterflies and bees.
- Require minimal maintenance (typically erosion prevention, mowing, and/or pruning).

FACT SHEET- VEGETATED BUFFER STRIP

LIMITATIONS

- Requires sufficient area.
- Ultimate storm water collection needs to be considered in design.
- May not be appropriate for industrial sites or locations where chemical spills may occur.
- A thick vegetative cover is needed for these practices to function properly.
- Prohibited in areas of known contamination. If soil and/or groundwater contamination is present on the site or within a 100' radius of the proposed location, the North Coast Regional Water Quality Control Board review and approval is required.
- Not appropriate for sites with a high risk of landslides or other geotechnical concerns. Slope stability shall be determined by a licensed Geotechnical Engineer.

KEY DESIGN FEATURES

- Slopes should not exceed 15%.
- Slope shall be at least 2%.
- Minimum length (in direction of flow) shall be 15 feet.
- Strip shall be sized as long as the site will reasonably allow.
- Vegetation whose growing season corresponds to the wet season is preferred (see Appendix A for list of locally suitable plant species).
- Strip shall be free of gullies or rills.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include; recommended maintenance practices, parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary, and provide site specific inspection checklist.

At a minimum inspection and maintenance shall include the following:

- Mow as needed and irrigate during dry weather to the extent necessary to keep vegetation alive. Remove obstructions and trash from vegetated buffer strip.
- Pesticides and fertilizers shall not be used in the vegetated buffer strip.
- Where mowing is required, grass height shall be maintained between 3" and 6".

Vegetated buffer strips shall be inspected and maintained twice a year to review:

- Condition of vegetation.
- Obstructions and trash.
- Ponded flow is drained within 72 hours after a rainfall event.
- If ponding is observed, grading will be required to restore positive drainage.

VEGETATED BUFFER STRIP- CHECKLIST

Vegetated Buffer Strip
Inspection and Maintenance Checklist
(aka: Filter Strip, Grassed Filter)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water after 3 days of dry weather?		• Remove any obstruction in the buffer strip and/or regrade to restore positive drainage. • Clean and/or remove any obstructions in and around the storm drain inlet.	
	PRS RS ARS	Is there poor drainage during a high intensity storm event?		• Clean and/or remove any obstructions in and around the storm drain inlet.	
	RS	Is the flow into the buffer strip even and uniform?		• Remove any obstruction preventing a uniform flow into the buffer strip.	

VEGETATED BUFFER STRIP- CHECKLIST

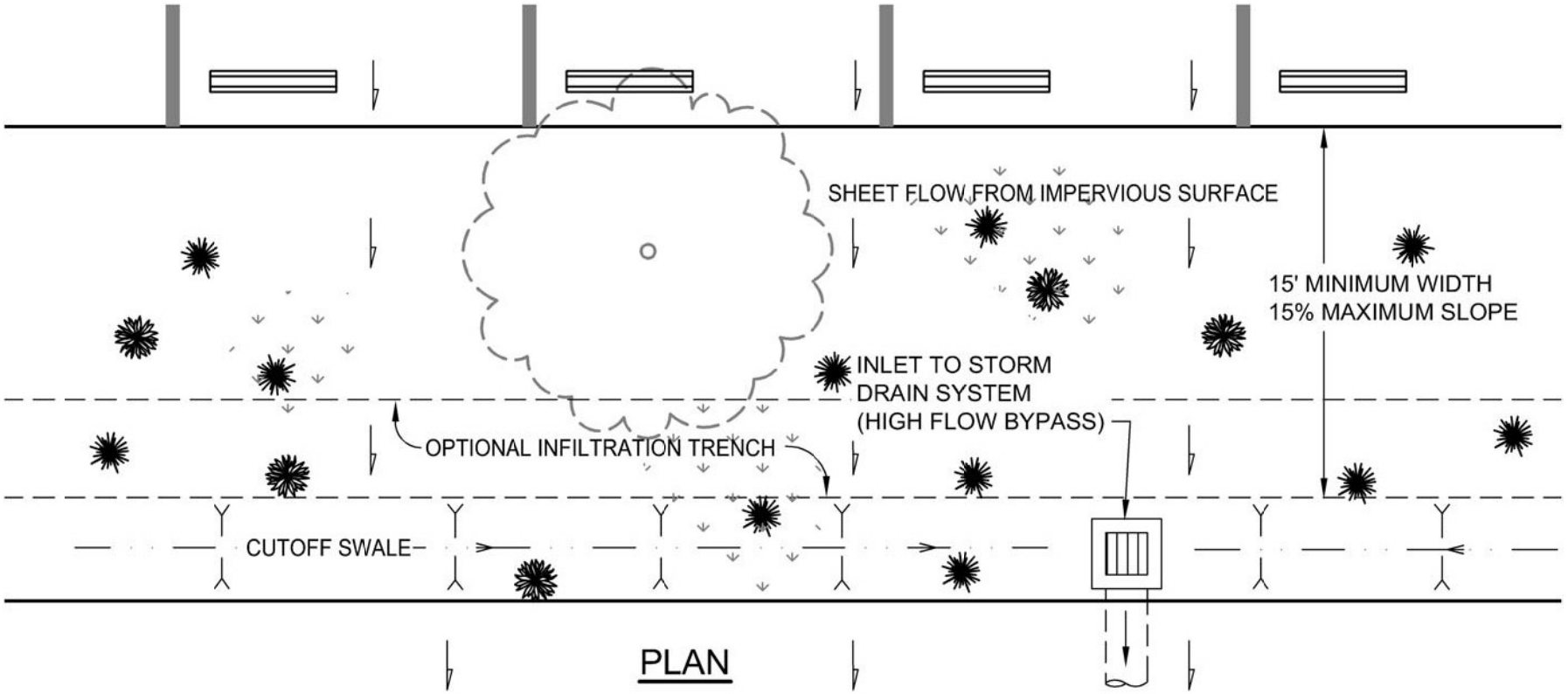
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there evidence of under cutting or washouts along the impervious surfaces of the buffer strip?		• Fill in eroded areas and regrade.	
	RS ARS	Is there channelization (gully) forming along the length of the buffer strip area?		• Fill in eroded areas and regrade.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the buffer strip?		• Remove sediment and check the grading. Add replacement soil and or mulch.	
	PRS RS ARS	Is the mulch unevenly distributed in the buffer strip area?		• Redistribute and add additional mulch if needed. • Regrade buffer strip area.	
	PRS RS ARS	Are there voids and/or holes around the storm drain inlet?		• Inspect the storm drain inlet for damage. Replace or repair as necessary. • Fill in eroded areas and regrade.	
	PRS RS ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		• Repair and fill in damaged areas. • Rodent control activities must be in accordance with applicable laws and do not affect any protected species.	

VEGETATED BUFFER STRIP- CHECKLIST

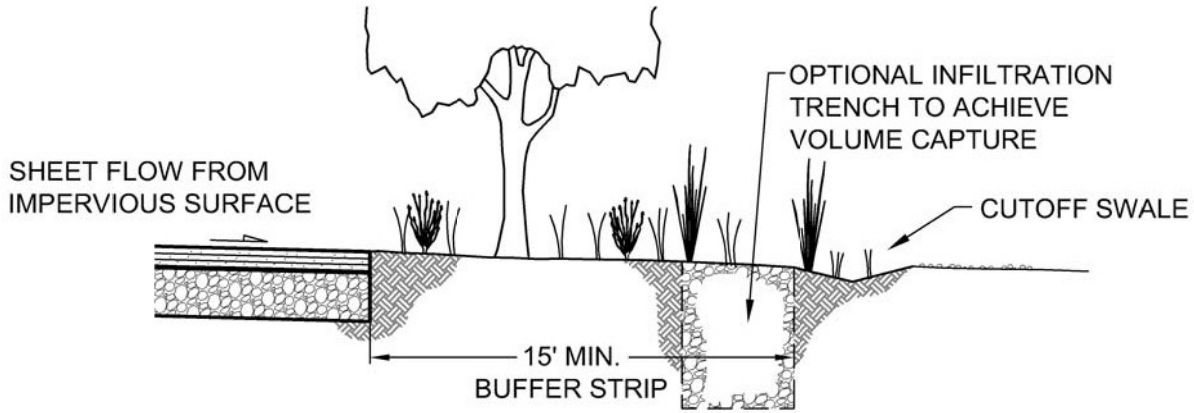
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging or redirecting the inlet/outlet flow areas?		• Trim and/or remove the excess vegetation.	
	PRS RS ARS	Is the mulch distributed evenly throughout the buffer strip?		• Redistribute and add additional mulch if needed. • Regrade buffer strip area.	
	PRS RS ARS	Are there dead or dry plants/weeds? Is the vegetation over grown?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a visual barrier, trip, and or obstruction hazards. • Mow grass as needed.	

VEGETATED BUFFER STRIP- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the buffer strip area?		• Remove all trash and debris.	
	PRS RS ARS	Is Graffiti present?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition and/or adjust to eliminate over spray and/or over watering.	
	PRS RS ARS	Are the aesthetic features firmly secured in place?		• Repair and/or replace loose or damaged features.	
	PRS RS ARS	Check for damaged sidewalk, curb, gutter, and catch basin. This includes uplift and settling.		• Remove and replace damaged areas.	



PLAN



TYPICAL SECTION

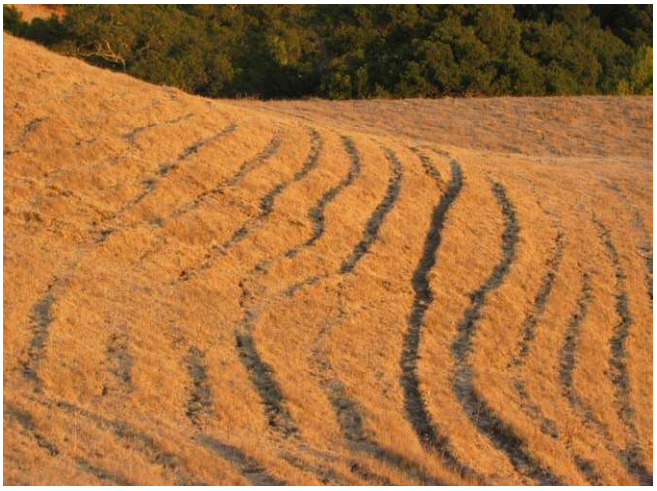
Not to Scale

RUNOFF REDUCTION MEASURE VEGETATED BUFFER STRIP		
SCALE: *NONE*	DATE: *03/28/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 1	RRM–02

FACT SHEET- BOVINE TERRACE

BOVINE TERRACE

Also know as: Terracing, Cow Terraces, and Infiltration Terraces.





DESCRIPTION

Bovine terraces are a low tech option for slowing runoff on slopes and maximizing infiltration potential. Cows (bovine) walk on contour when they graze on hillsides and create ruts, or terraces, where they walk. Intentionally replicating this natural occurrence slows runoff, increases infiltration and prevents erosion.

ADVANTAGES

- Provides a tributary area reduction. Calculations to be completed using the Storm Water Calculator in Appendix C.
- Can be used on sloped sites.
- Increases infiltration potential.
- Increases time of concentration.
- Decreases erosion.
- Enhances water quality of downstream water bodies through natural processes.
- Aesthetically pleasing.
- Can establish habitat for birds and other pollinators like butterflies and bees.
- Require minimal maintenance.

LIMITATIONS

- Requires sufficient area.
- Ultimate storm water collection needs to be considered in design.

- Prohibited in areas of known contamination. If soil and/or groundwater contamination is present on the site or within a 100' radius of the proposed location, the North Coast Regional Water Quality Control Board review and approval is required.
- Not appropriate for sites with a high risk of landslides or other geotechnical concerns. Slope stability shall be determined by a licensed Geotechnical Engineer.

KEY DESIGN FEATURES

- Fill portion of terrace not to exceed 8" high.
- Vertical portion of cut not to exceed 2' high.
- Horizontal portion of cut must be at least as wide as vertical portion of cut is high.
- For slopes between 4:1 and 2:1 spacing of terraces shall not exceed 15'.
- Not to be used on slopes exceeding 2:1.
- Terraces must be installed on contour.
- Termination of terraces needs to be designed to avoid concentrating flow at edges.
- Top portion of each terrace must be adequately constructed to prevent wash out.
- Vegetate sufficiently to support slope stability.
- Install overflow collection system to accept flow that exceeds design capacity of the terraces.
- Infiltration rate and flow rate must be considered in the design.
- Terraces must be designed to eliminate standing water within 72 hours to prevent mosquito breeding.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, designation of parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

At a minimum inspection and maintenance shall include the following:

- Inspect prior to the start and end of the rainy season to repair washouts or remove excess sediment accumulation.
- Pesticides and fertilizers should be avoided in terraced areas.



BOVINE TERRACE- CHECKLIST

Bovine Terrace
Inspection and Maintenance Checklist
(aka: Terracing, Cow Terrance, Infiltration Terrace)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water after 3 days of dry weather?		• Fill in and regrade terrace section.	

BOVINE TERRACE- CHECKLIST

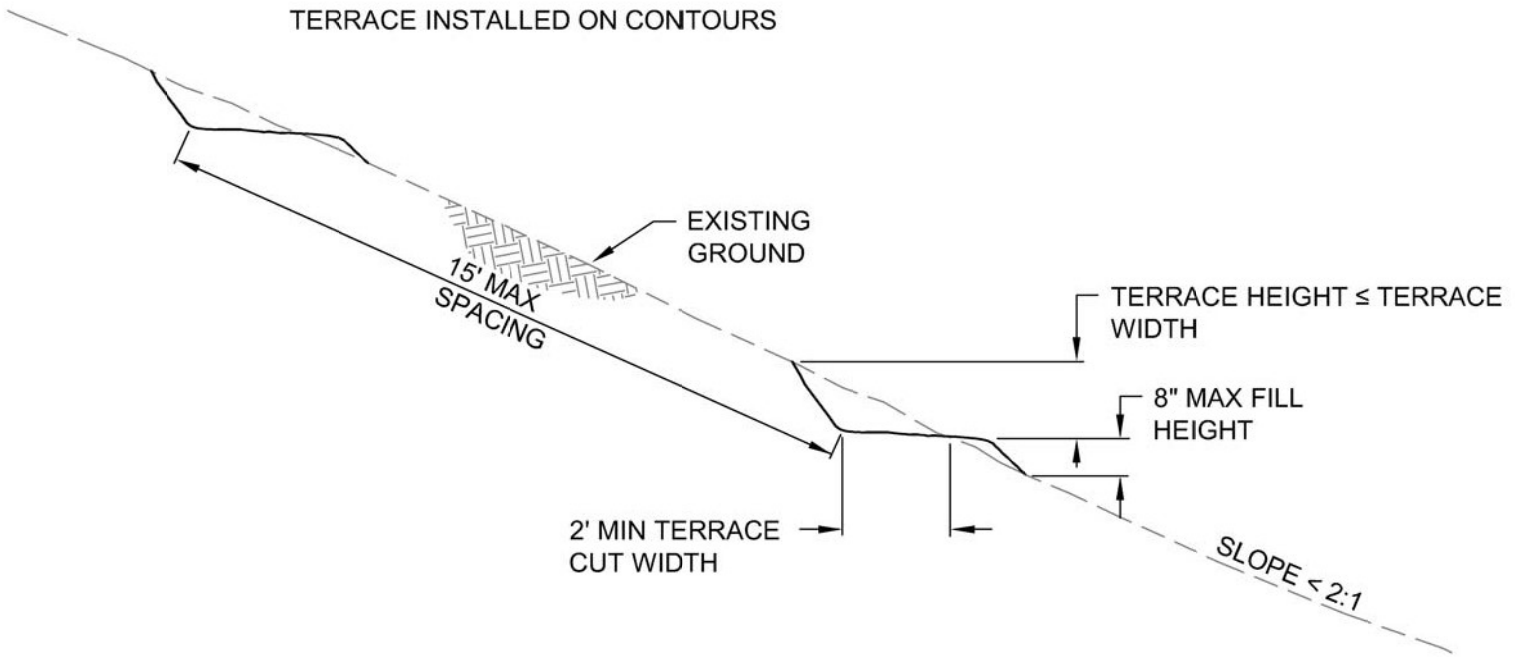
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	PRS, RS, ARS	Is there evidence of washouts and/or deep channeling along the terrace?		• Fill in eroded areas and regrade. • Repair and/or add flow dissipaters along the terrace. • Terrace width may need adjusting for additional capacity.	
	RS, ARS	Is there channelization (gully) forming up/down slope of the terrace section?		• Fill in eroded areas, regrade, and replant slopes.	
	RS, ARS	Is there accumulation of excess sediment?		• Remove sediment and regrade section.	
	PRS, RS, ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		• Repair and fill in damaged areas. Regrade if needed. • Rodent/animal control activities must be in accordance with applicable laws and do not affect any protected species.	

BOVINE TERRACE- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS, RS,ARS	Is the vegetation concentrating the flow to a portion of the terrace?		• Trim and/or remove the excess vegetation to establish a uniform flow.	
	PRS, RS, ARS	Is there excess vegetation in the terrace area?		• Remove the excess vegetation. • Regrade if needed.	
	ARS, PRS	Are there dead or dry plants/weeds?		• Remove or trim any vegetation that is causing a visual barrier hazard. • Remove any nuance, dangerous plant species. • Remove, trim, mow all vegetation that may present an unusually high fire hazard.	

BOVINE TERRACE- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS, RS, ARS	Is trash/debris present?		• Remove all trash and debris.	
	PRS, RS, ARS	Is the surrounding area marked with graffiti?		• Remove all graffiti from the area.	
	PRS, RS, ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS, RS, ARS	Are there mosquitoes present?		• Contact vector control.	
	PRS, RS, ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition to eliminate over spray and/or over watering.	
	PRS, RS, ARS	Are the aesthetic features in good condition and firmly secured?		• Repair and/or replace loose or damaged features.	
	PRS, RS, ARS	Are the signage, fencing in place and in good condition?		• Replace/repair signage and fencing. • Add additional barriers signage to block access to hazardous areas.	



Not to Scale

RUNOFF REDUCTION MEASURE
BOVINE TERRACE

SCALE: *NONE*		DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 1		RRM–01

FACT SHEET- IMPERVIOUS AREA DISCONNECTION

IMPERVIOUS AREA DISCONNECTION

Including: splash blocks, rain chains, bubble up emitters, and pavement disconnection.



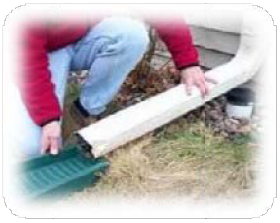






OVERVIEW

Impervious area disconnection allows storm water from impervious areas, such as rooftops and pavement, to be directed to pervious natural or landscaped areas and infiltrate into the soil. Impervious surfaces that drain directly to catch basins or storm drains are a directly connected impervious area. These areas prevent storm water infiltration into the soil or filtering through vegetation and soil. Impervious areas also increase the speed and amount of runoff from a site, which may contribute to peak flows and scour in downstream creeks and waterways. This BMP addresses these issues by disconnecting direct discharges by using: splash blocks, bubble-up emitter, and paved area disconnection.



SPLASH BLOCK DESCRIPTION

Splash blocks are a low tech option to hard piped downspout systems. Existing downspouts can be retrofitted using splash blocks.

ADVANTAGES

- Can be used as part of a treatment train with volume capture BMPs.
- Can reduce the size of downstream water quality treatment and volume capture BMPs by increasing the potential for infiltration.



- Can be used as a retrofit BMP.
- Can be used to direct storm water to other BMPs

LIMITATIONS

- Adjacent buildings and overflow requirements need to be considered in design.
- May not be appropriate on all sites due to space constraints.

KEY DESIGN FEATURES

- Sites should be evaluated to ensure that splash blocks won't have negative impacts.
- Rain water must be directed away from foundations and footings.
- Downspouts should not be directed to paved areas or across sidewalks.
- Landscaped areas receiving roof water should be adequately sized to prevent runoff or erosion.

BUBBLE-UP EMITTER DESCRIPTION

Bubble-up emitters work very much like splash blocks, but allow for storm water to be released further from the building and even in landscape areas that are not directly adjacent to the building.

ADVANTAGES



- Can be used as part of a treatment train with volume capture BMPs.
- Can reduce the size of downstream water quality treatment and volume capture BMPs by increasing the potential for infiltration.
- Can be used as a retrofit BMP.
- Can be used to direct storm water to other BMPs

LIMITATIONS

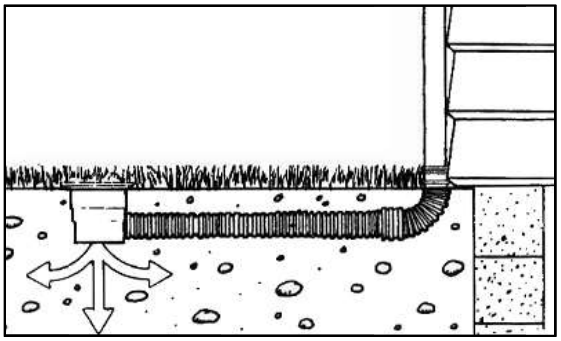
- Adjacent buildings and overflow requirements need to be considered in design.
- May not be appropriate on all sites due to space constraints.

KEY DESIGN FEATURES

- Rain water must be directed away from foundations and footings.
- Downspouts should not be directed to paved areas or across sidewalks.
- 4" diameter SDR-35 pipe required as a minimum.

FACT SHEET- IMPERVIOUS AREA DISCONNECTION

- Distance and location of emitter relative to the building must be approved by a Licensed Geotechnical Engineer.
- Landscaped areas receiving roof water should be adequately sized to prevent runoff or erosion.
- Landscaped areas receiving roof water need to be designed to ensure proper drainage and to prevent ponding water.
- May be installed with a bottomless emitter to allow for infiltration. Bottom of emitter should be placed over drain rock to prevent sedimentation of pipe.
- Emitter should be equipped with "pop up" cover to prevent mosquito breeding.



PAVED AREA DISCONNECTION DESCRIPTION

Paved areas that can be graded so that they drain onto pervious area, such as landscape or natural area can increase the opportunity for infiltration and minimize the size of downstream treatment.

ADVANTAGES

- Can be used as part of a treatment train with other BMPs.
- Can reduce the size of downstream treatment and volume capture BMPs by increasing the potential for infiltration.



LIMITATIONS

- Areas receiving flow need to be adequately sized and stabilized.
- May be limited by site slopes.
- Overflow drainage must be provided.
- May not be appropriate on all sites.

KEY DESIGN FEATURES

- Rain water must be directed away from foundations and footings.
- Landscaped areas receiving storm water should be adequately sized to prevent runoff or erosion.
- Landscaped areas receiving roof water need to be designed to ensure proper drainage and to prevent ponding water.

IMPERVIOUS AREA DISCONNECTION- CHECKLIST

Impervious Area Disconnection

Inspection and Maintenance Checklist

(aka: splash blocks, rain chains, bubble up emitters and pavement disconnection)

Date of Inspection: _____

Inspector(s): _____

BMP ID #:_____

Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be usde in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water after 3 days of dry weather?		• Regrade drainage area. • Reposition splash block. • Clean inlets/outlets of obstructions.	
	RS	Is there excessive splashing/spray?		• Reposition splash block or dissipater to reduce or eliminate splash/spray.	
	RS	Are the house/building gutters overflowing during a rain event?		• Flush bubble up pipe to remove any obstructions. • Check gutter down spout and gutter for obstructions. Clean if necessary.	

IMPERVIOUS AREA DISCONNECTION- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there evidence of under cutting or washouts around splash block/dissipater?		• Reposition the inlet splash block or dissipater. • Fill in eroded areas and regrade.	
	RS ARS	Is there channelization (gully) forming around the bubble ups?		• Fill in eroded areas and regrade.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the inlets/outlets areas?		• Remove sediment and check the grading.	
	RS ARS	Are there voids or holes along the path of the bubble up pipe or excess sediment in and around the bubble up outlet?		• Flush and inspect pipe for damage. • Replace damage pipe, fill in voids, and regrade.	

IMPERVIOUS AREA DISCONNECTION- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging the Inlet/outlet areas?		• Trim and/or remove the excess vegetation around the inlet/outlet areas.	
	PRS RS ARS	Is the mulch spread evenly throughout the vegetation area?		• Redistribute and add additional mulch if needed. • Regrade vegetation area.	
	PRS RS ARS	Are there dead or dry plants/weeds?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a visual barrier hazard.	

IMPERVIOUS AREA DISCONNECTION- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the area?		• Remove all trash and debris.	
	PRS RS ARS	Is the surrounding area marked with graffiti?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetic features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Check for broken or damage drain inlets/outlets, splash blocks, bubble ups, and grates.		• Replace or repair all damaged features.	
	PRS RS ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition to eliminate over spray and/or over watering.	
	PRS RS ARS	Are the aesthetic features firmly secured in placed?		• Repair and/or replace loose or damaged features.	

FACT SHEET- RAIN GARDEN

RAIN GARDEN

Also know as: Bioretention cell, infiltration planter







DESCRIPTION

Rain Gardens function as a soil and plant-based filtration and infiltration feature that remove pollutants through a variety of natural physical, biological, and chemical treatment processes. Rain gardens are usually installed in yards or common open areas to treat storm water from rooftops and parking lots.

ADVANTAGES

- Provides both water quality treatment and volume capture.
- Provides storm water treatment that enhances water quality of downstream water bodies through natural processes.
- Vegetation provides shade and wind breaks, absorbs noise, reduces heat island effects and adds to an area's landscape features.
- Establishes habitat for birds and attracts pollinators like butterflies and bees.

LIMITATIONS

- Most effective if installed flat to promote infiltration.
- Prohibited in areas of known soil and/or groundwater contamination. If soil and/or groundwater contamination is present on the site or within a 100’ radius of the proposed location, the North Coast Regional Board review and approval is required.

- Should not be used in areas of high ground water. A minimum of 2' of clearance needs to be provided between the bottom of the BMP and the seasonal high ground water level. If ground water is less than 2' from the bottom, additional design elements may be necessary (impermeable liner, subdrains, etc).
- Do not use in areas of slope instability where infiltrated storm water may cause failure. Slope stability shall be determined by a licensed Geotechnical Engineer.
- Do not use in locations that can negatively impact building foundation or footings. Location shall be approved by a licensed Geotechnical Engineer.

KEY DESIGN FEATURES

- Native soil shall remain uncompacted to preserve infiltration capacity. Fence off during construction.
- Bottom of rain garden should be unlined to allow infiltration into native soil.
- If present, structural soil shall be installed as described in Reference Document E.
- For rain garden that adjoin pavement or utility trenches, moisture barrier shall be installed to protect road sub-base and any trenches.
- Use plants from the approved plant and tree list included in Appendix M.
- Devise vegetation that is both wet and dry tolerant is required.
- Design to achieve 51% cover.
- Install a designated high flow bypass inlet for storms larger than the design storm. See "Sizing Design" below.
- If required, perforated pipe shall be a minimum of SDR 35 plastic and installed in straight runs.
- Volume below the perforated pipe must be sufficient to hold and infiltrate the design volume.
- Surface ponding depth shall range between 6" and 12".
- Must be designed to prevent extended standing water. All surface water must drain within 72 hours to prevent mosquito breeding.
- Select non-floatable surface mulching material to prevent clogging of downstream inlets.
- Direct downspouts into rain gardens and incorporate splash blocks and/or other dissipation methods to prevent erosion.

SIZING DESIGN- GOAL AND REQUIREMENTS

- The **design goal** for all rain gardens is to capture (infiltration and/or reuse) 100% of the volume of runoff generated by the 85th percentile 24 hour storm event. This is a retention requirement. If 100% volume capture is achieved than no additional treatment is required.
- If the *design goal* is not achievable, then the bioretention area *sizing requirement* is:

  - **Water Quality Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a known intensity of 0.92 inches per hour, **and**
  - **Volume Capture** (infiltration and/or reuse) of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event. This is a retention requirement.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID.

Inspection and Maintenance Requirements

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

At a minimum inspection and maintenance shall include the following:

- Inspect twice annually and prior to rain events for blocked or clogged inlets, eroded areas, sedimentation and trash or debris accumulation.
- Obstructions and trash shall be removed and properly disposed of.
- Inspect twice during the rainy season for ponded water.
- If ponded water is observed, the first few inches of topsoil should be removed and replaced. If ponded water is still present, further grading and replacement may be necessary to prevent mosquito breeding.
- Pesticides and fertilizers shall not be used in the rain garden area. Non floatable mulch should be instead.
- Plants should be pruned, weeds pulled and dead plants replaced as needed.
- Observe level and condition of mulch. Add to, re-grade or replace as needed (non-floatable mulch required).
- Confirm slash blocks, or other dissipation method, exist to direct downspouts into rain garden. Readjust location if needed. Replace if necessary.

RAIN GARDEN - CHECKLIST

Rain Garden
Inspection and Maintenance Checklist
(aka: Bioretention Cell, Infiltration Planter)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water in the Rain Garden area after 3 days of dry weather?		• Check perforated pipe outlet for obstruction or damage. * • Flush perforated pipe to remove obstructions/sediment. * • Remove and replace the first few inches of topsoil. • Remove soil and inspect perforated pipe. Repair or replace perforated pipe, replace with new soil and regrade.	
	RS	Is there poor drainage during a high intensity storm event?		• Clean the high flow bypass inlet and pipe.	
	RS	Is the flow into the Rain Garden even and uniform?		• Remove any obstruction preventing a uniform flow into the swale. • Regrade up slope if necessary. • Reposition splash block/dissipater.	

* If perforated pipe is present.

RAIN GARDEN - CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there under cutting or washouts around the splash blocks or dissipaters?		• Fill in eroded areas and regrade. • Reposition splash block/dissipater.	
	RS ARS	Is there channelization (gully) forming along the length of the Rain Garden area?		• Fill in eroded areas and regrade.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the Rain Garden?		• Remove sediment and check the grading. Add replacement soil and/or mulch.	
	PRS RS ARS	Is the mulch unevenly distributed in the Rain Garden area?		• Redistribute and add additional mulch if needed. • Regrade planter area.	
	PRS RS ARS	Are there voids or deep holes present? Is there sediment present in the catch basin and in the overflow pipe?		• Check perforated pipe outlet for damage. *	
	PRS RS ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		• Repair and fill in damage areas. • Rodent control activities must be in accordance with applicable laws and do not affect any protected species.	

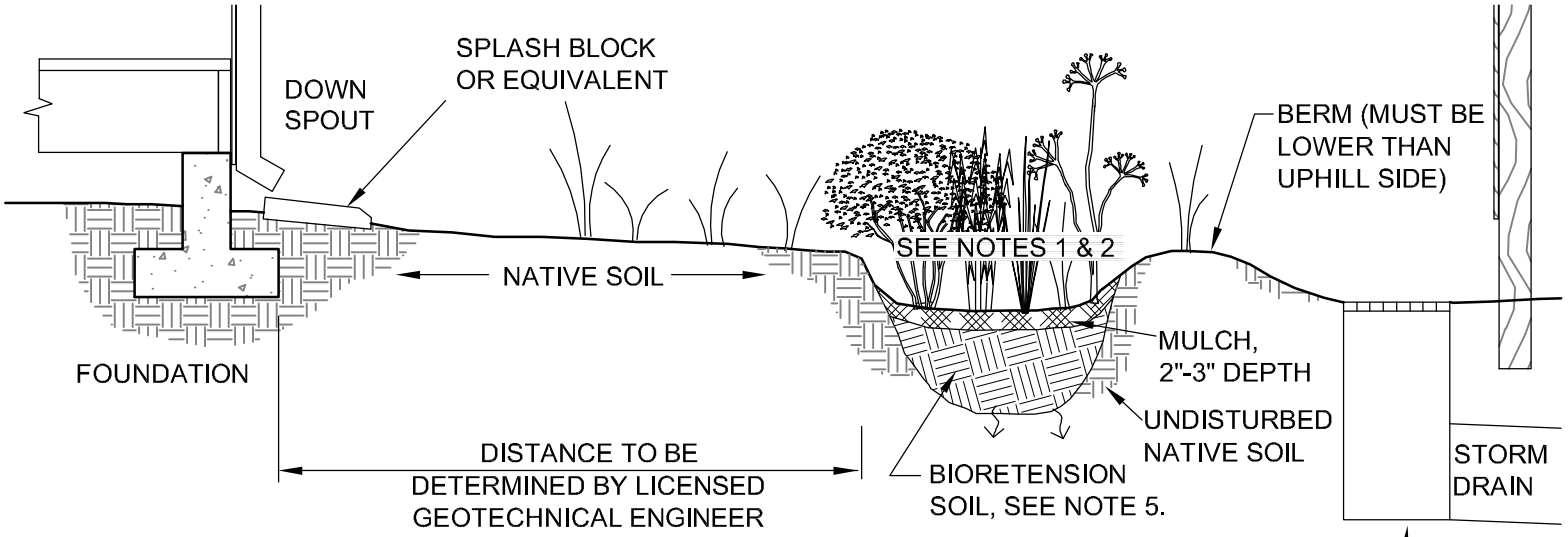
* If perforated pipe is present.

RAIN GARDEN - CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging or diverting the input flow areas?		• Trim and /or remove the excess vegetation.	
	PRS RS ARS	Is the mulch evenly distributed throughout the area?		• Redistribute and add additional mulch if needed. • Regrade planter area.	
	PRS RS ARS	Are there dead or dry plants/weeds? Is the vegetation over grown?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a visual barrier, trip, and/or obstruction hazard.	

RAIN GARDEN - CHECKLIST

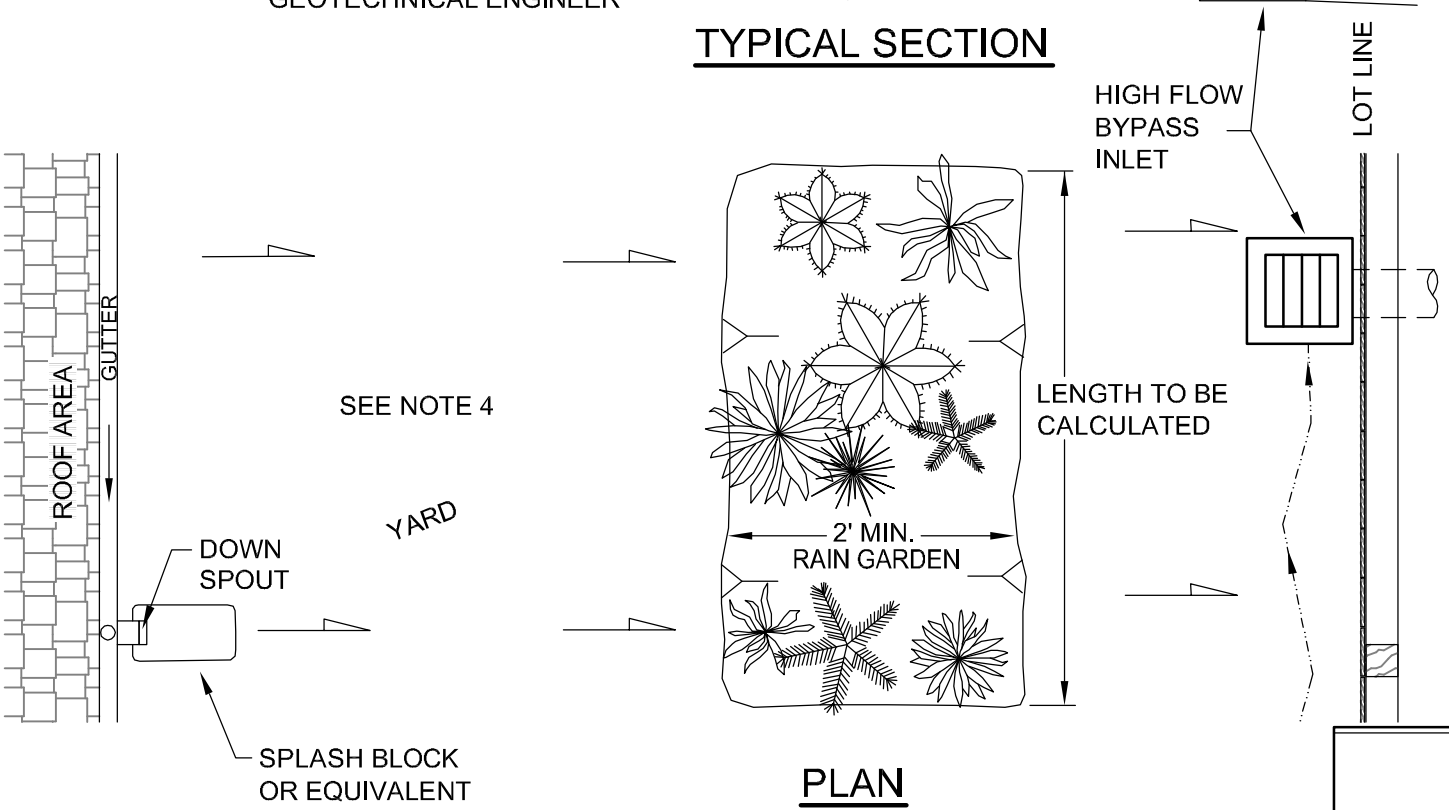
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the Rain Garden area?		• Remove all trash and debris.	
	PRS RS ARS	Is Graffiti present?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetic features?		• Replace and/or reposition aesthetic features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition and/or adjust to eliminate over spray and/or over watering.	
	PRS RS ARS	Are the aesthetic features firmly secured in place?		• Repair and/or replace loose or damaged features.	



NOTES:

1. DENSE, WET AND DRY-TOLERANT VEGETATION.
2. PONDING DEPTH 6" MAX.
3. PONDED WATER MUST DRAIN WITHIN 72 HOURS TO PREVENT MOSQUITO BREEDING.
4. MAXIMUM CONTRIBUTING AREA OF 1 ACRE.
5. BIORETENTION SOIL DEPTH 12" MIN. DEPTH TO BE CALCULATED.

TYPICAL SECTION

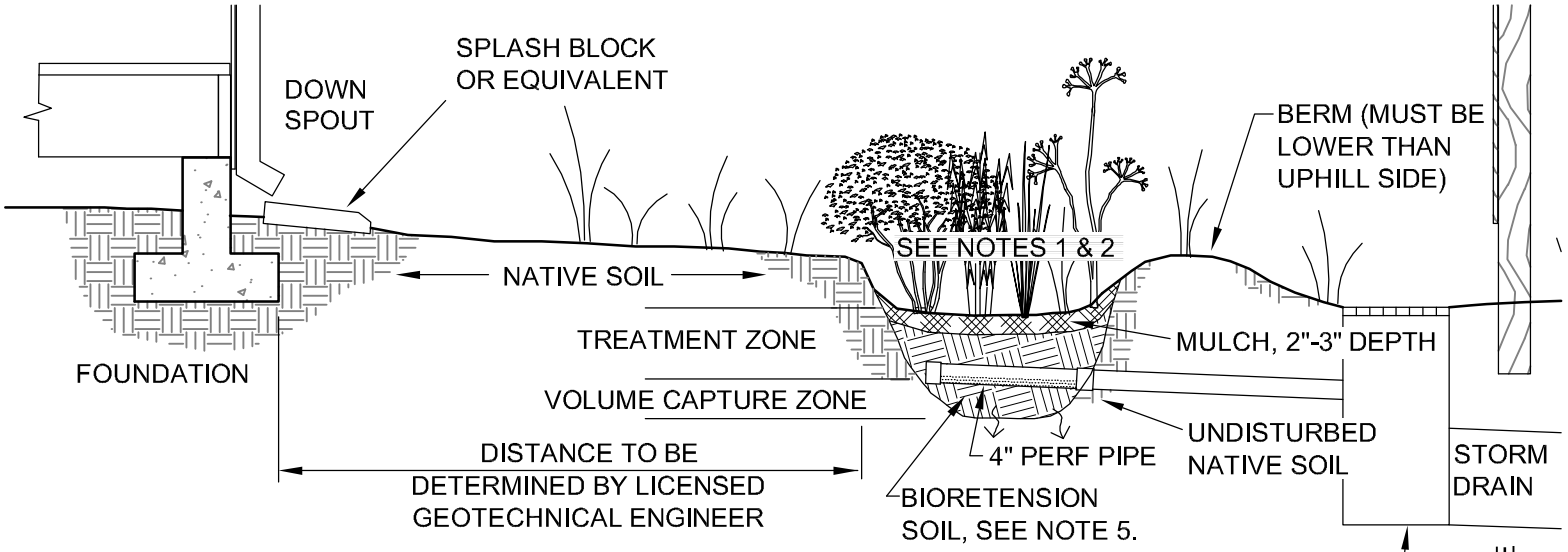


PLAN

Not to Scale

PRIORITY 1 RAIN GARDEN

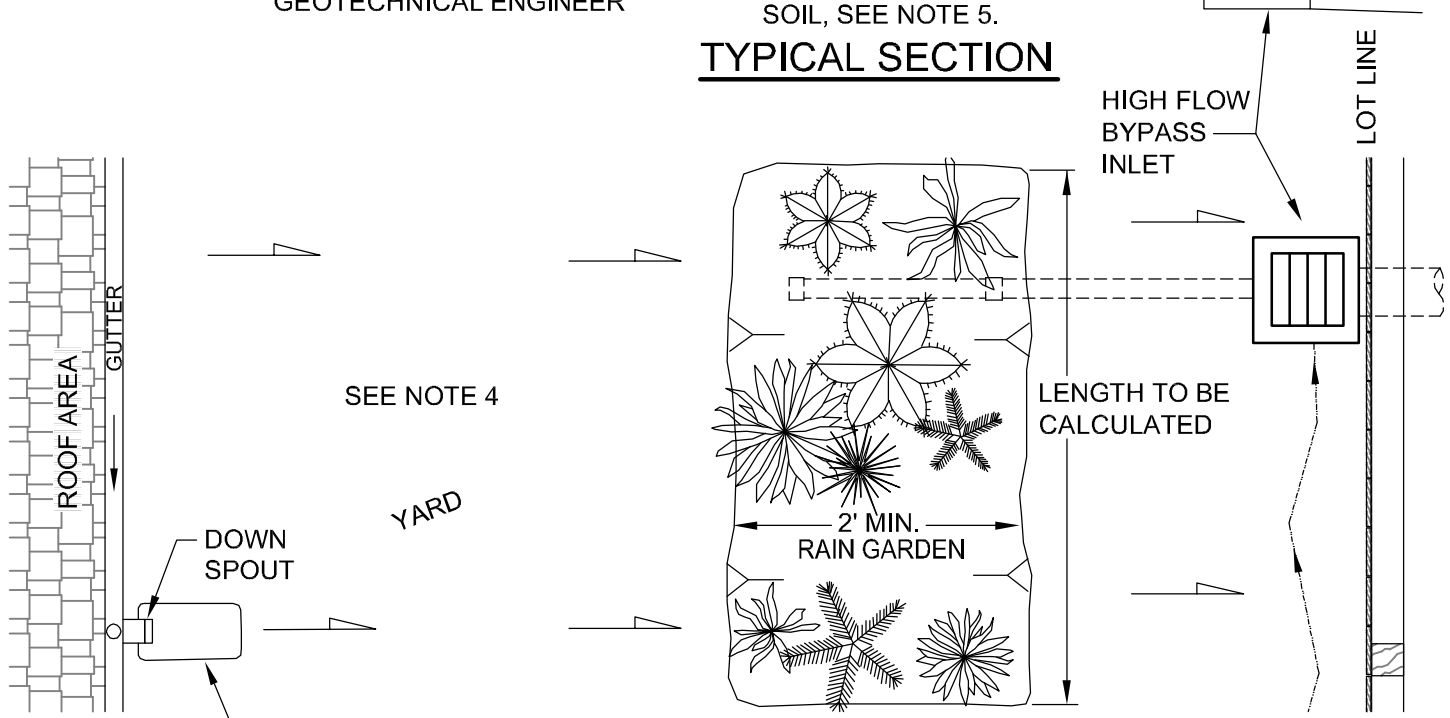
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DWN. *DIT* CHK. *HH*	SHEET 1 of 1	P1–01



TYPICAL SECTION

NOTES:

1. DENSE, WET AND DRY-TOLERANT VEGETATION.
2. PONDING DEPTH 6" MAX.
3. PONDED WATER MUST DRAIN WITHIN 72 HOURS TO PREVENT MOSQUITO BREEDING.
4. MAXIMUM CONTRIBUTING AREA OF 1 ACRE.
5. BIORETENTION SOIL DEPTH 12" MIN. DEPTH TO BE CALCULATED.



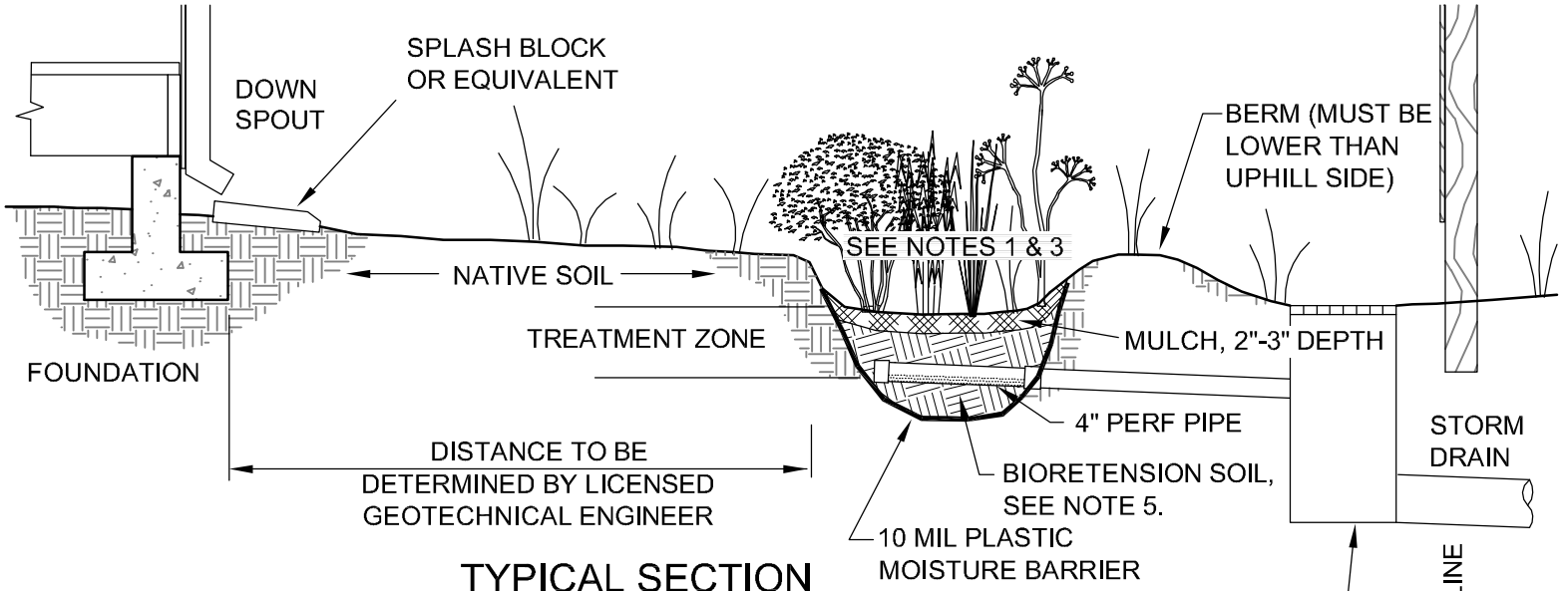
PLAN

P1-01 WITH A PERFORATED UNDER DRAIN

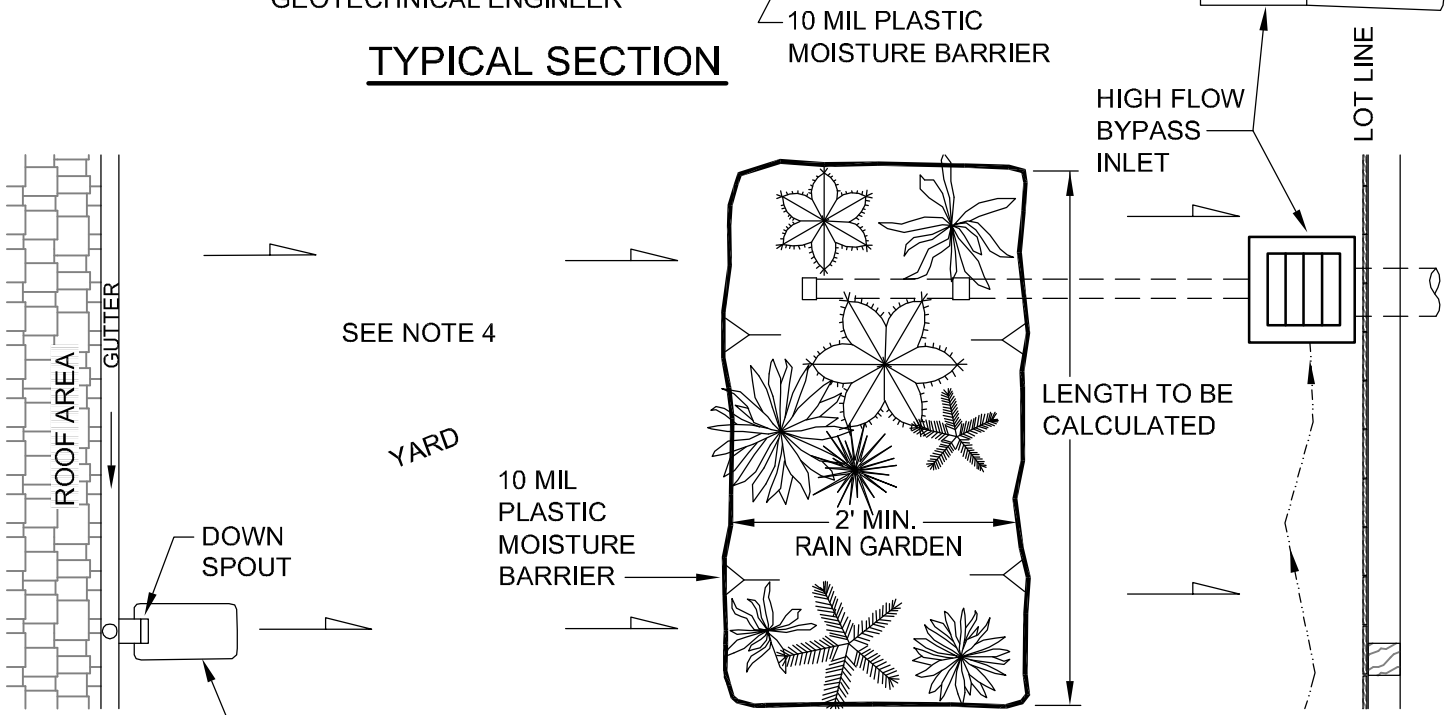
PRIORITY 2 RAIN GARDEN

SCALE: *NONE*	DATE: *05/10/11*	
DWN. *DIT* CHK. *HH*	SHEET 1 of 1	P2–01

Not to Scale



TYPICAL SECTION



PLAN

NOTES:

1. DENSE, WET AND DRY-TOLERANT VEGETATION.
2. PONDING DEPTH 6" - 12"
3. PONDED WATER MUST DRAIN WITHIN 72 HOURS TO PREVENT MOSQUITO BREEDING.
4. MAXIMUM CONTRIBUTING AREA OF 1 ACRE.
5. BIORETENTION SOIL DEPTH 12" MIN. DEPTH TO BE CALCULATED.

P2-01 WITH A MOISTURE BARRIER, NO INFILTRATION.

Not to Scale

PRIORITY 3 RAIN GARDEN

SCALE: *NONE*	DATE: *05/10/11*	
DWN. *DIT* CHK. *HH*	SHEET 1 of 1	P3–01

FACT SHEET- BIORETENTION

BIORETENTION

Also know as: Street rain garden, roadside bioretention, and bioretention cell







DESCRIPTION

The bioretention area best management practice (BMP) functions as a soil and plant-based filtration and infiltration feature that removes pollutants through a variety of natural physical, biological, and chemical treatment processes.

ADVANTAGES

- Achieves both water quality and volume capture objectives.
- Bioretention areas provide storm water treatment that enhances the quality of downstream water bodies by using natural processes.
- The vegetation provides shade and wind breaks, absorbs noise, reduces heat island effects and improves an area's landscape.
- Bioretention provides habitat for birds and attracts other pollinators like butterflies and bees.
- Does not interrupt utility installation.
- Does not interfere with tree planting.

FACT SHEET- BIORETENTION

LIMITATIONS

- Bioretention is not recommended for areas where street slopes exceed 10%.
- Should not be used in areas of known contamination. If soil and/or groundwater contamination is present on the site or within a 100' radius of the proposed BMP location, the North Coast Regional Water Quality Control Board will need to be contacted and the site reviewed.
- Should not be used in areas of high groundwater. In general a minimum of 2' of clearance should be provided between the bottom of the bioretention cell and seasonal high groundwater.
- Should not be used in areas of slope instability where infiltrated storm water may cause failure. Slope stability should be determined by a licensed geotechnical engineer.
- Do not use in locations that can negatively impact building foundation or footings. Location shall be approved by a licensed Geotechnical Engineer.

KEY DESIGN FEATURES

ALL BIORETENTION

- Structural soil should be used within the bioretention area requiring load bearing capacity (adjacent to roadways and/or buildings.)
- Structural soil shall be installed as described in Reference Document E.
- Some BMPs may not require the use of structural soil and a more organic type planting soil and/or treatment media may be used in its place. It may be possible in some cases to use native soil or to amend the native soil so that it is suitable. Use of non-structural soil will depend on evaluation of the criteria in "Chapter 4-Site Assessment" as well as consideration of structural needs and may require evaluation by a licensed Geotechnical Engineer.
- Native soil should remain uncompacted to preserve infiltration capacity. Fence off the area during construction to protect it from compaction.
- Bottom of bioretention should be unlined to allow infiltration into native soil.
- Moisture barrier must be installed to protect road sub-base and any trenches adjacent to the bioretention area.
- If used, pervious concrete shall be designed and installed as described in Appendix G.
- ~~If used, porous gutter must be protected during construction to prevent sediment loading.~~
- ~~If the porous gutter design option is used additional trash and sediment capture BMPs may be required~~
- A curb opening type design may be used in place of a porous gutter if appropriate for the project.
- Bioretention areas shall be planted with plants from the approved plant and tree list included in Appendix F and shall be planted to achieve 51% cover.

- All bioretention areas shall be designed with a designated high flow bypass inlet for storms larger than the design storm.
- 6" perforated pipe to be installed at a depth of 6" below road structural section.
- Perforated pipe shall be installed in straight runs.
- The volume below the perforated pipe must be sufficient to hold and infiltrate the design volume.

SIZING DESIGN- GOAL AND REQUIREMENTS

- The **design goal** for all bioretention areas is to capture (infiltration and/or reuse) 100% of the volume of runoff generated by the 85th percentile 24 hour storm event. This is a retention requirement. If 100% volume capture is achieved than no additional treatment is required.
- If the design goal is not achievable, then the bioretention area *sizing requirement* is:
    - **Water Quality Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a known intensity of 0.20 inches per hour, **and**
    - **Volume Capture** (infiltration and/or reuse) of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event. This is a retention requirement.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

At a minimum maintenance shall include the following:

- Dry street sweeping upon completion of construction
- Dry street sweeping annually, and
    - When water is observed flowing in the gutter during a low intensity storm.
    - Algae is observed in the gutter.
    - Sediment/debris covers 1/3 of the gutter width or more.
- Inspect twice annually for sedimentation and trash accumulation in the gutter. Obstructions and trash shall be removed and properly disposed of.
- Inspect twice during the rainy season for ponded water.
- Pesticides and fertilizers shall not be used in the bioretention area.
- Plants should be pruned, weeds pulled and dead plants replaced as needed.

PLANTER STRIP BIORETENTION- CHECKLIST

Planter Strip Bioretention
Inspection and Maintenance Checklist
(aka: Street Rain Garden, Roadside Bioretention, Bioretention Cell)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water in the Bioretention area after 3 days of dry weather?		• Check perforated pipe outlet for obstruction or damage. * • Flush perforated pipe to remove obstructions/sediment. * • Remove and replace the first few inches of topsoil. • Remove soil and inspect perforated pipe. Repair or replace perforated pipe, replace with new soil and regrade.	
		Is water not draining into catch basin from the overflow pipe during a high intensity storm? *			
	PRS RS ARS	Is there sediment visible in the gutter?		• In dry weather, use a mechanical sweeper or a Vactor truck to clean gutter pan.	
	RS	Is there water flowing in the pervious concrete gutter section during a low intensity storm? *		• In wet weather, use a Vactor truck to clean gutter pan.	

* If perforated pipe is present.

PLANTER STRIP BIORETENTION- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there under cutting or washouts along the sidewalks and/or curbs abutting the planter strip?		• Fill in eroded areas and regrade.	
	RS ARS	Is there channelization (gully) forming along the length of the planter area?		• Fill in eroded areas and regrade.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the planter?		• Remove sediment and check the grading. Add replacement soil and/or mulch.	
	PRS RS ARS	Is the mulch unevenly distributed in the planter area?		• Redistribute and add additional mulch if needed. • Regrade planter area.	
	PRS RS ARS	Are there voids or deep holes present? Is there sediment present in the catch basin and in the overflow pipe?		• Check the perforated pipe for damage.*	
	PRS RS ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		• Repair and fill in damage areas. • Rodent control activities must be in accordance with applicable laws and do not affect any protected species.	

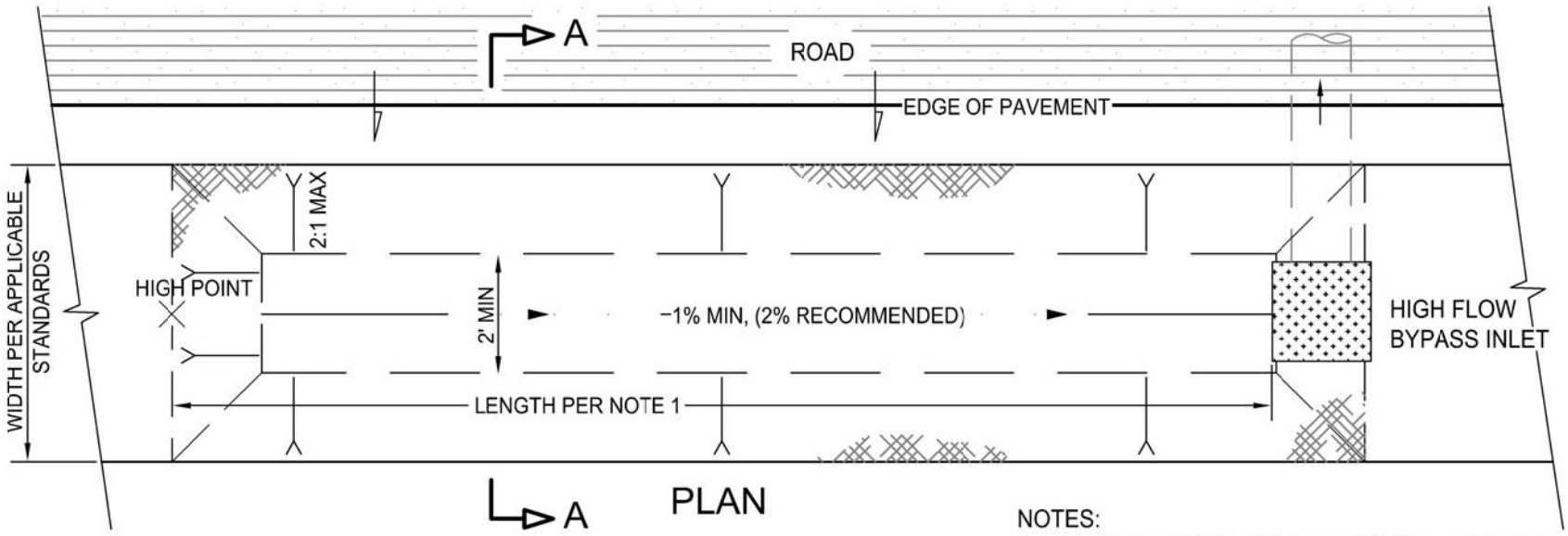
* If perforated pipe is present.

PLANTER STRIP BIORETENTION- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging the inlet flow areas?		• Trim and/or remove the excess vegetation.	
	PRS RS ARS	Is the mulch distributed evenly throughout the planter area?		• Redistribute and add additional mulch if needed. • Regrade planter area.	
	PRS RS ARS	Are there dead or dry plants/weeds? Is the vegetation over grown?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a visual barrier, trip, and or obstruction hazard.	

PLANTER STRIP BIORETENTION- CHECKLIST

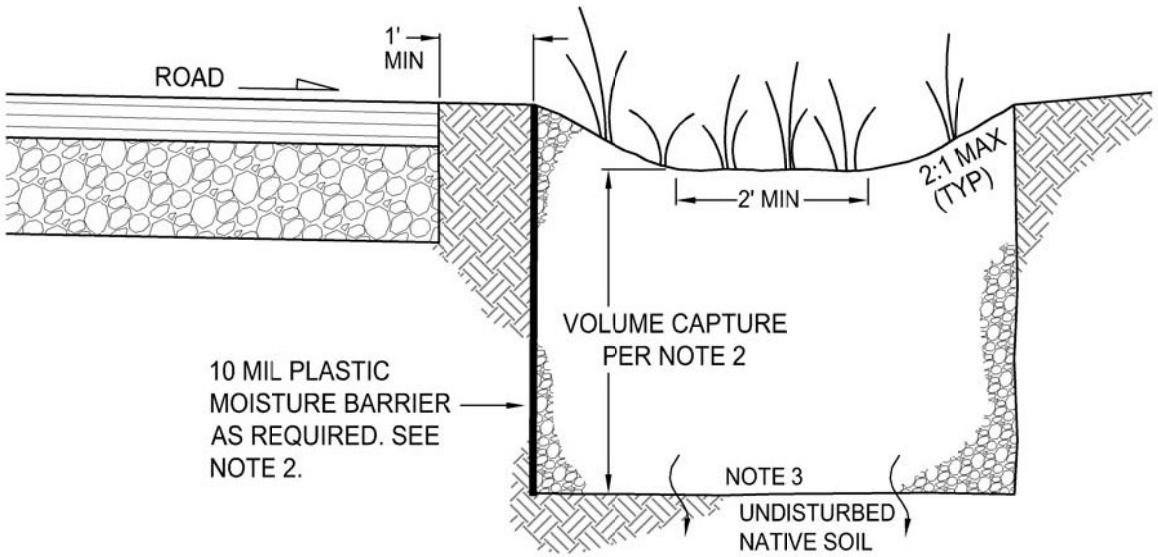
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the planter area?		• Remove all trash and debris.	
	PRS RS ARS	Is graffiti present?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition and/or adjust to eliminate over spray and/or over watering.	
	PRS RS ARS	Are the aesthetic features firmly secured in placed?		• Repair and/or replace loose or damage features.	
	PRS RS ARS	Check for damage sidewalk, curb, gutter, and catch basin including uplift and settling.		• Remove and replace damaged areas.	



PLAN

NOTES:

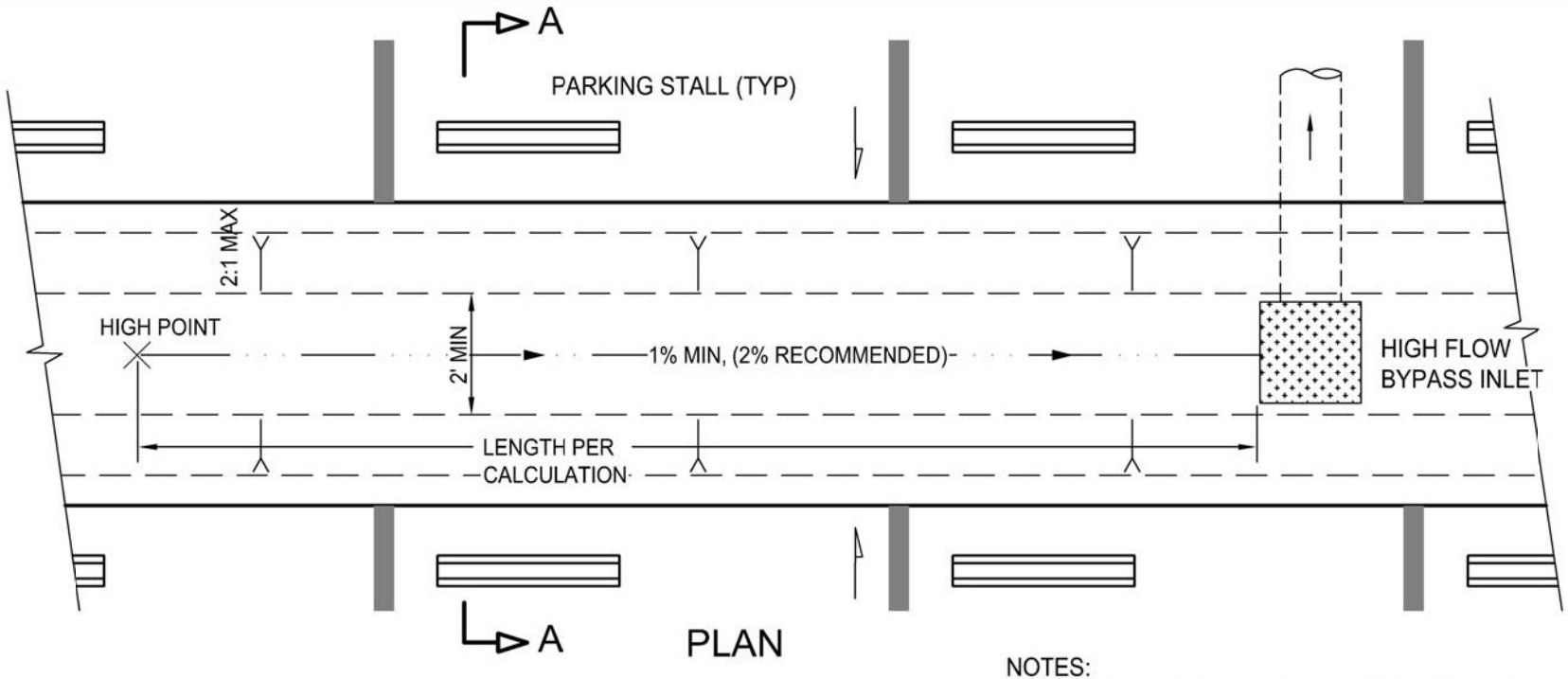
1. IF SWALE PROVIDES TREATMENT, LENGTH SHALL BE DESIGNED TO PROVIDE 12 MINUTES OF CONTACT TIME IF FLOW ENTERS UNIFORMLY ALONG LENGTH. LENGTH SHALL PROVIDE 5 MINUTES OF CONTACT TIME IF 90% OR MORE OF THE FLOW ENTERS AT THE UPSTREAM END.
2. SOIL TO BE SPECIFIED BY DESIGN ENGINEER TO MEET VOLUME CAPTURE AND GOVERNING AGENCY REQUIREMENTS. IF NON-STRUCTURAL SOIL IS SELECTED A CUTOFF WALL IS REQUIRED IN PLACE OF A MOISTURE BARRIER.
3. SWALE MUST CONVEY HIGH FLOWS PER GOVERNING AGENCY DESIGN STANDARDS.



SECTION A-A

Not to Scale

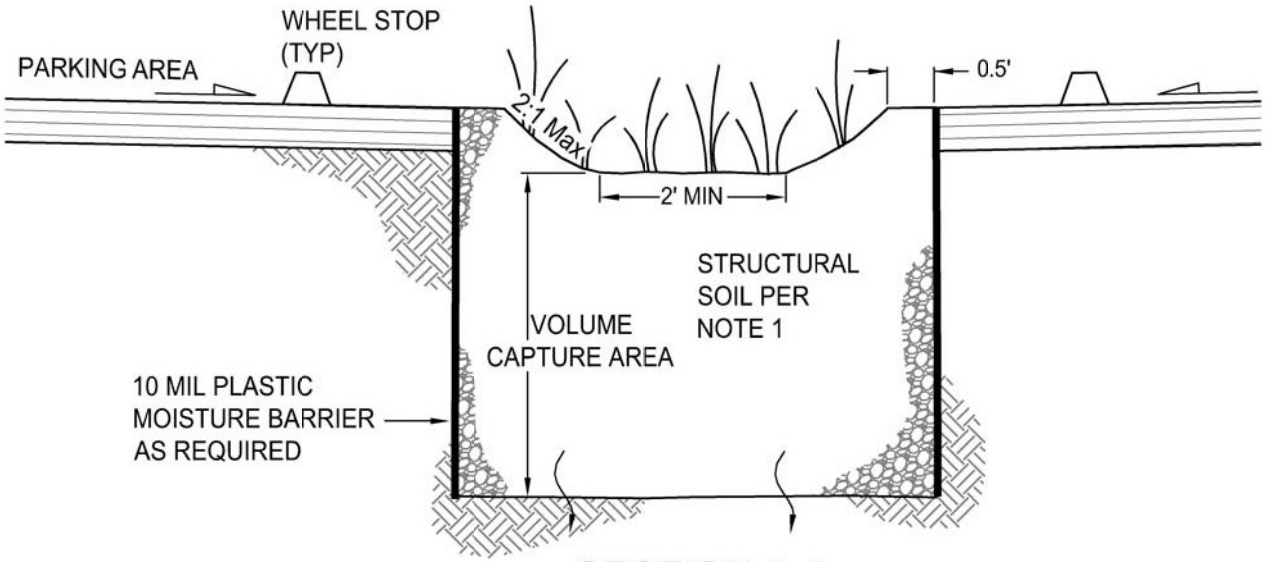
PRIORITY 1 ROADSIDE BIORETENTION - NO CURB AND GUTTER		
SCALE: *NONE*	DATE: *03/29/17*	
DWN. *DIT* CHK. *HM*		P1–02



PLAN

NOTES:

1. STRUCTURAL SOIL UNLESS OTHERWISE APPROVED BY GEOTECHNICAL ENGINEER AND ACCEPTED BY GOVERNING AGENCY.
2. SWALE MUST CONVEY FLOOD DESIGN FLOWS PER GOVERNING AGENCY DESIGN STANDARDS.
3. PARKING ISLAND WIDTH PER APPLICABLE GOVERNING AGENCY STANDARDS.

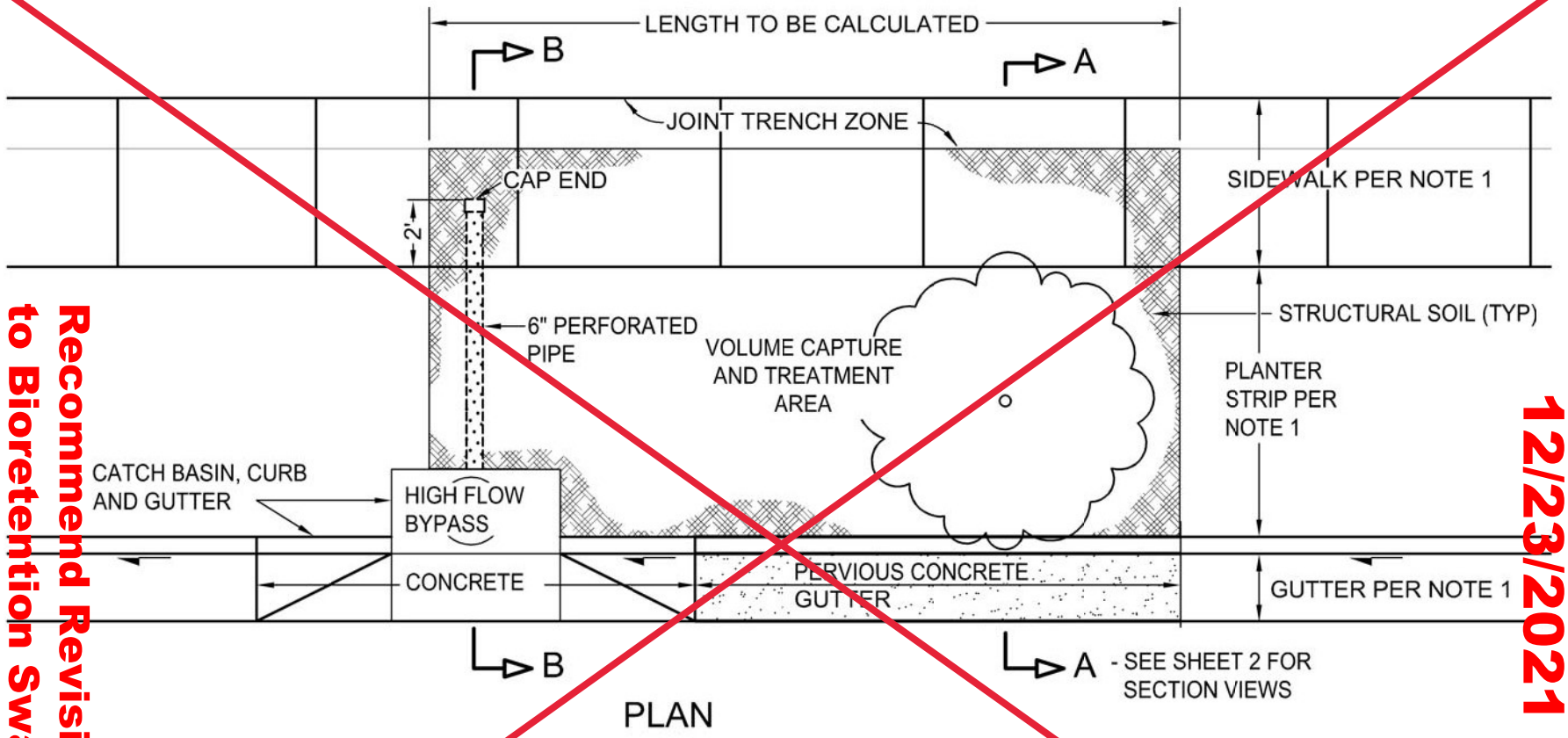


SECTION A-A

Not to Scale

PRIORITY 1
SWALE WITH BIORETENTION

SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 1	P1–06



PLAN

NOTES:

1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).

Not to Scale

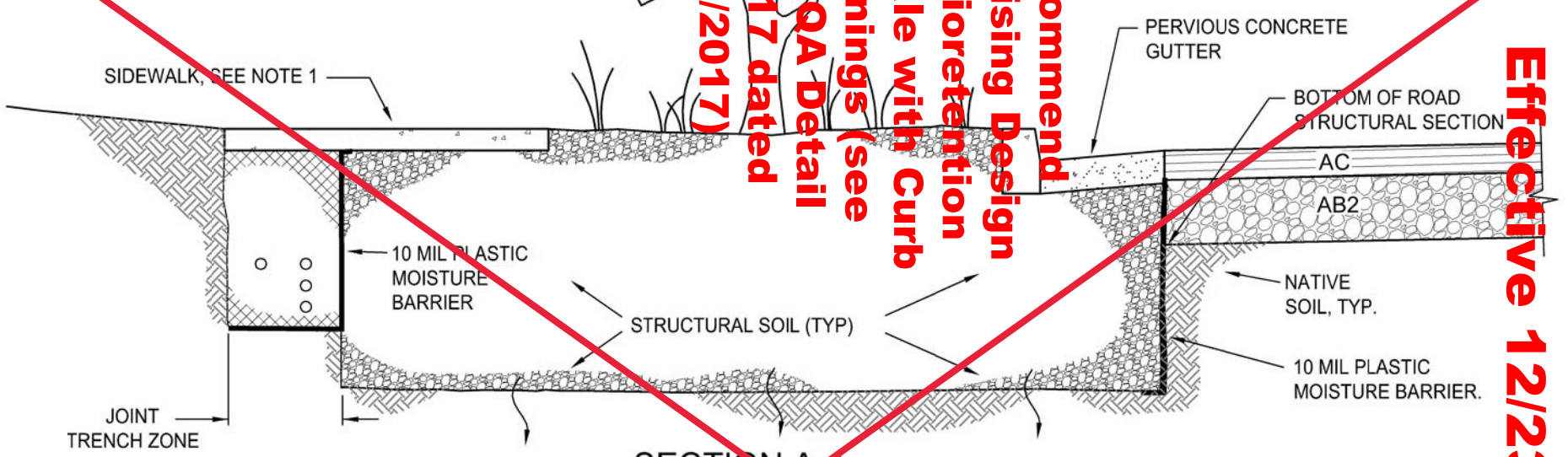
PRIORITY 2 ROADSIDE BIORETENTION - FLUSH DESIGN		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 2	P2–02

Not Permitted Effective 12/23/2021

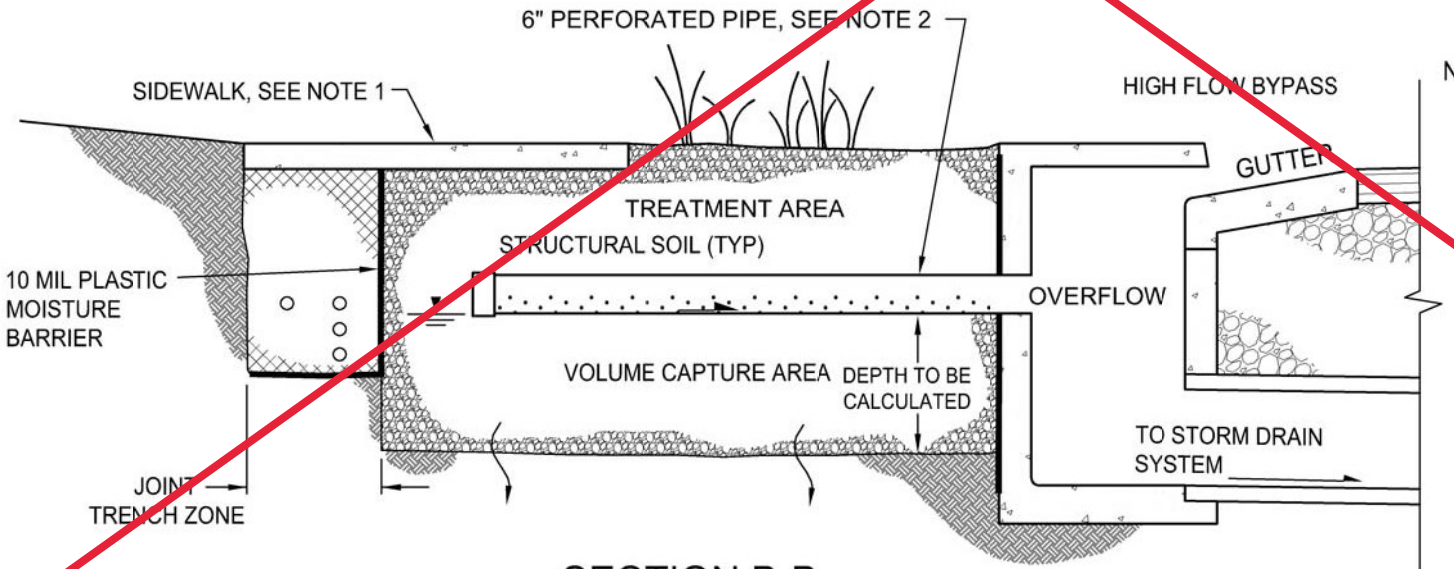
Recommend Revising Design to Bioretention Swale with Curb Openings (see CASQA Detail SW-17 dated 8/31/2017)

Recommend Revising Design to Bioretention Swale with Curb Openings (see CASQA Detail SW-17 dated 8/31/2017)

Not Permitted Effective 12/23/2021



SECTION A-A



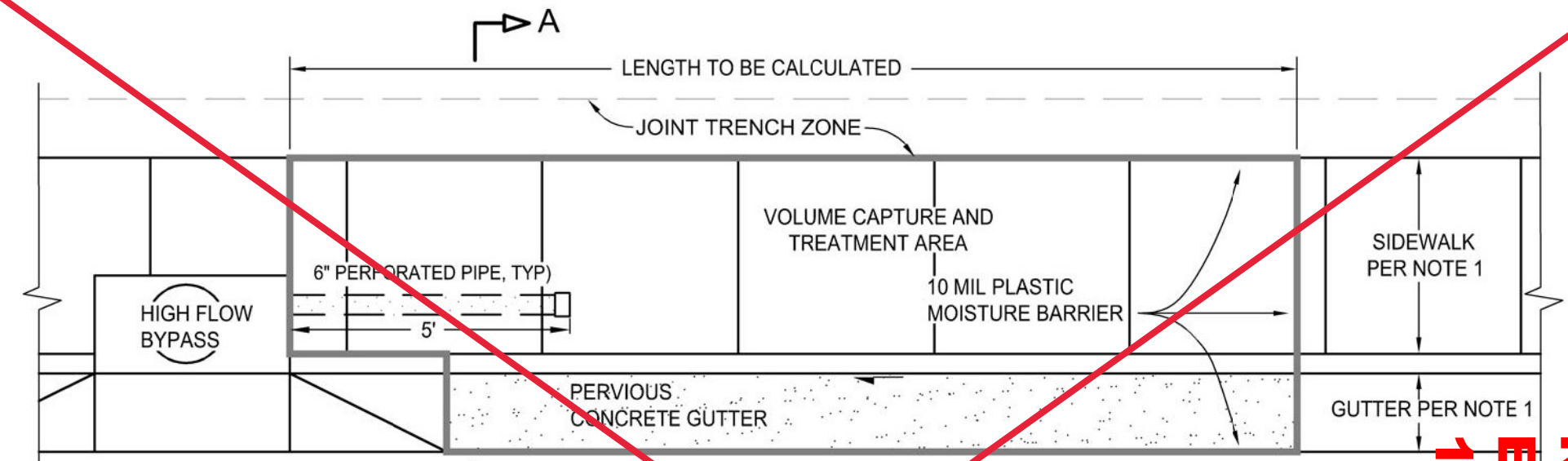
SECTION B-B

NOTES:

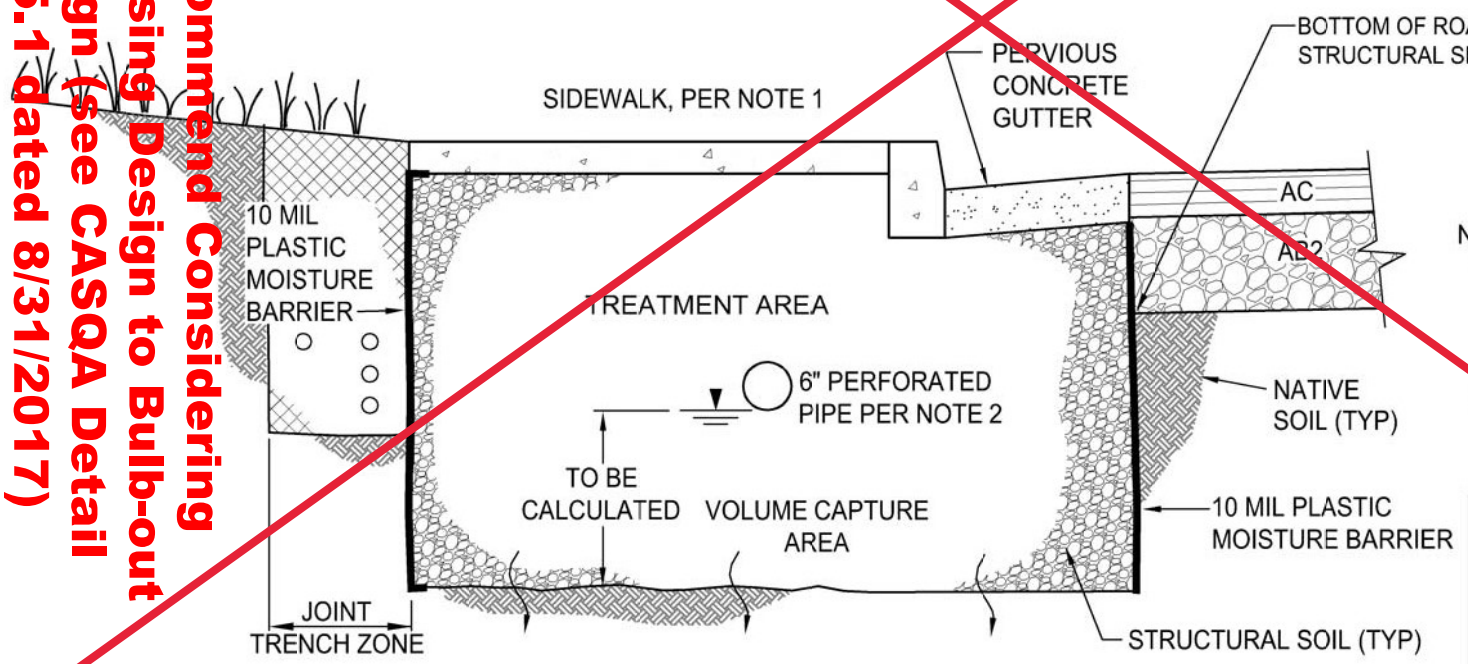
1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. TOP OF 6" PERFORATED PIPE TO BE SET 6" BELOW BOTTOM OF ROAD STRUCTURAL SECTION, MIN.

Not to Scale

PRIORITY 2 ROADSIDE BIORETENTION - FLUSH DESIGN		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 2 of 2	P2–02



PLAN



SECTION A-A

NOTE:
1. SIDEWALK AND CURB AND GUTTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. TOP OF 6" PERFORATED PIPE TO BE SET 6" BELOW BOTTOM OF ROAD STRUCTURAL SECTION, MIN.

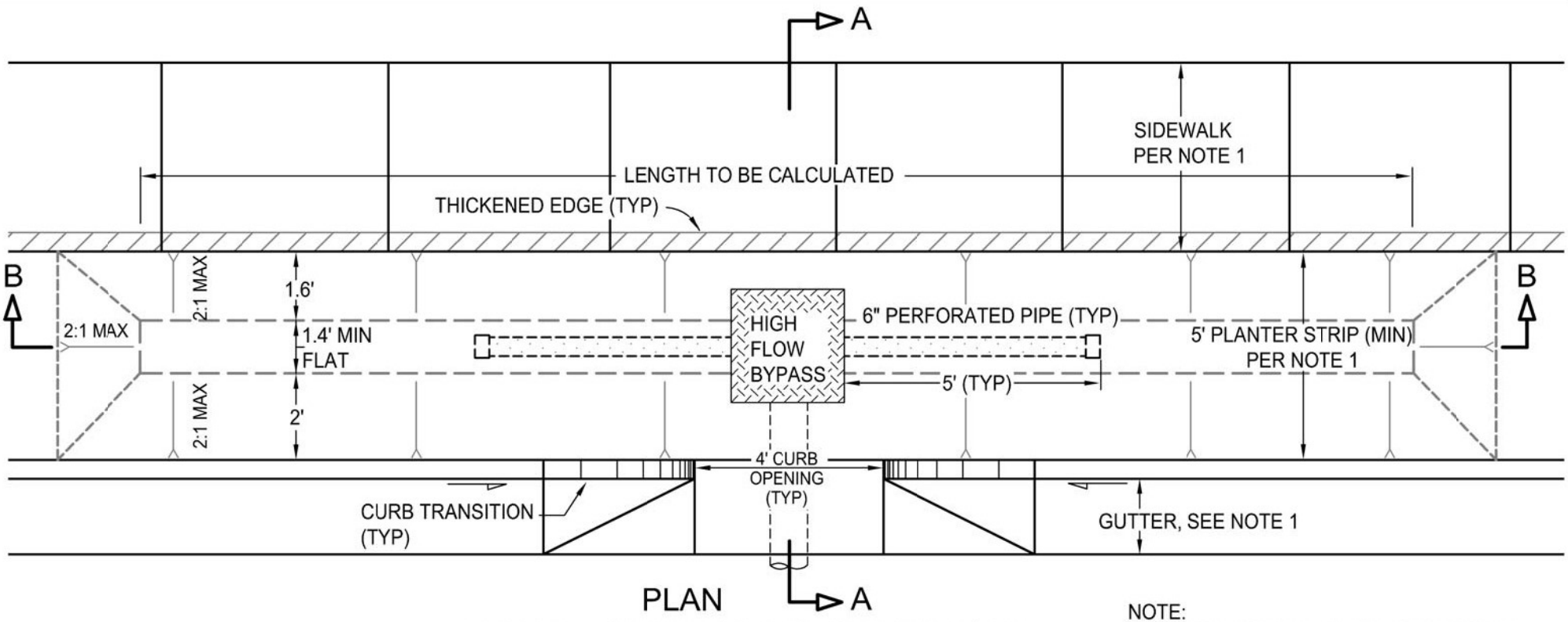
PRIORITY 2
ROADSIDE BIORETENTION
- CONTIGUOUS SIDEWALK

SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 1	P2–03

Not to Scale

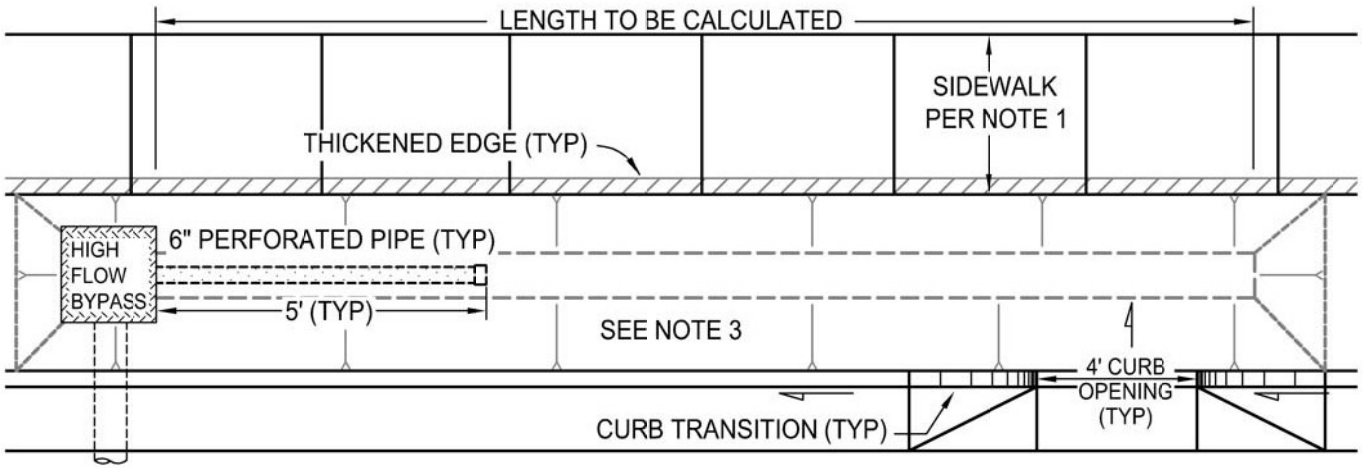
Not Permitted
Effective
12/23/2021

Recommend Considering
Revising Design to Bulb-out
Design (see CASQA Detail
SW-5.1 dated 8/31/2017)



PLAN

TYPE A - CURB OPENING AT LOW POINT



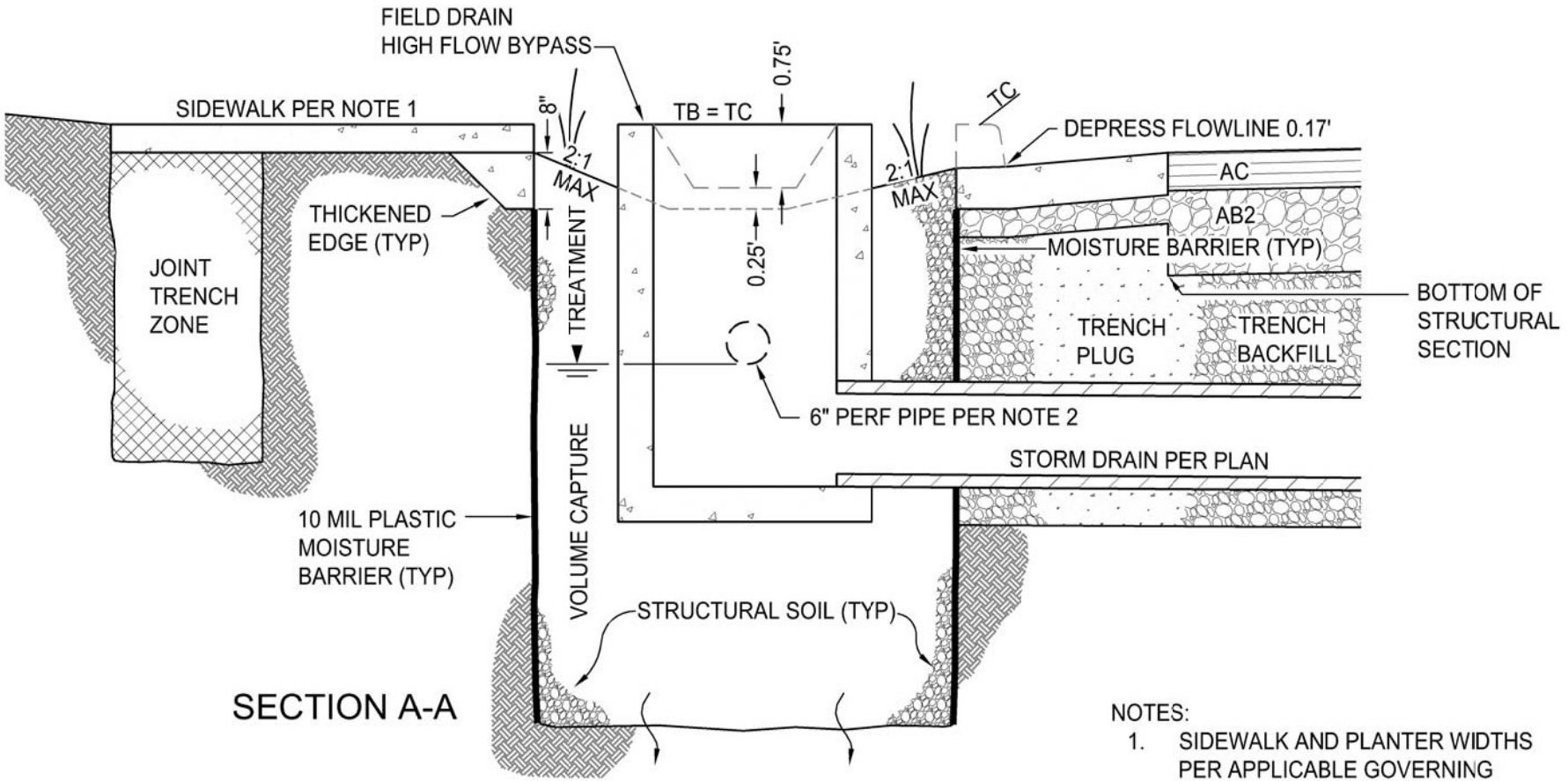
TYPE B -CURB OPENING ALONG A SLOPE

NOTE:

1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE MUNICIPAL STANDARDS (TYP).
2. TOP OF 6" PERFORATED PIPE TO BE SET 6" BELOW ROAD STRUCTURAL SECTION, MIN.
3. TYPE A MINIMUM DIMENSIONS AND GRADES APPLY TO TYPE B.

Not to Scale

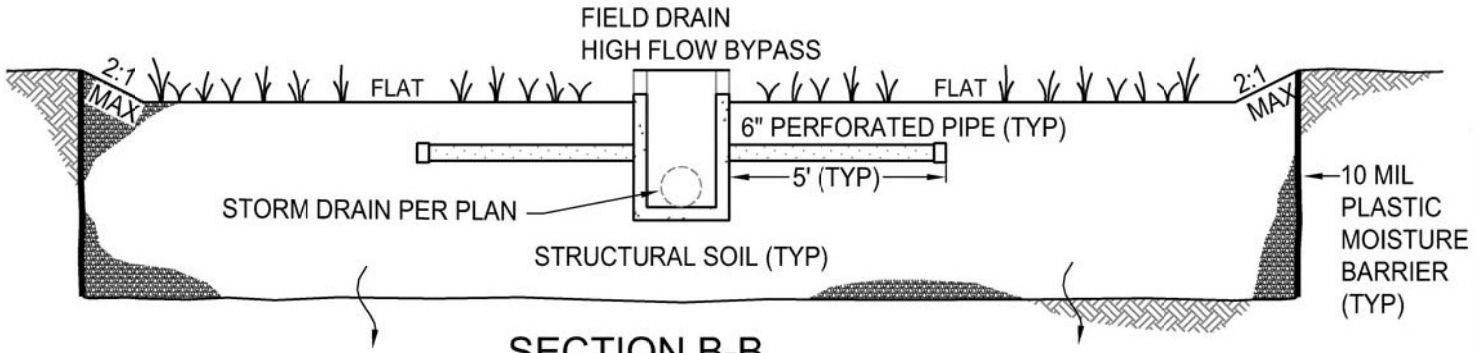
PRIORITY 2 ROADSIDE BIORETENTION - CURB OPENING		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 2	P2–04



SECTION A-A

NOTES:

1. SIDEWALK AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. TOP OF 6" PERFORATED PIPE TO BE SET 6" BELOW BOTTOM OF ROAD STRUCTURAL SECTION.

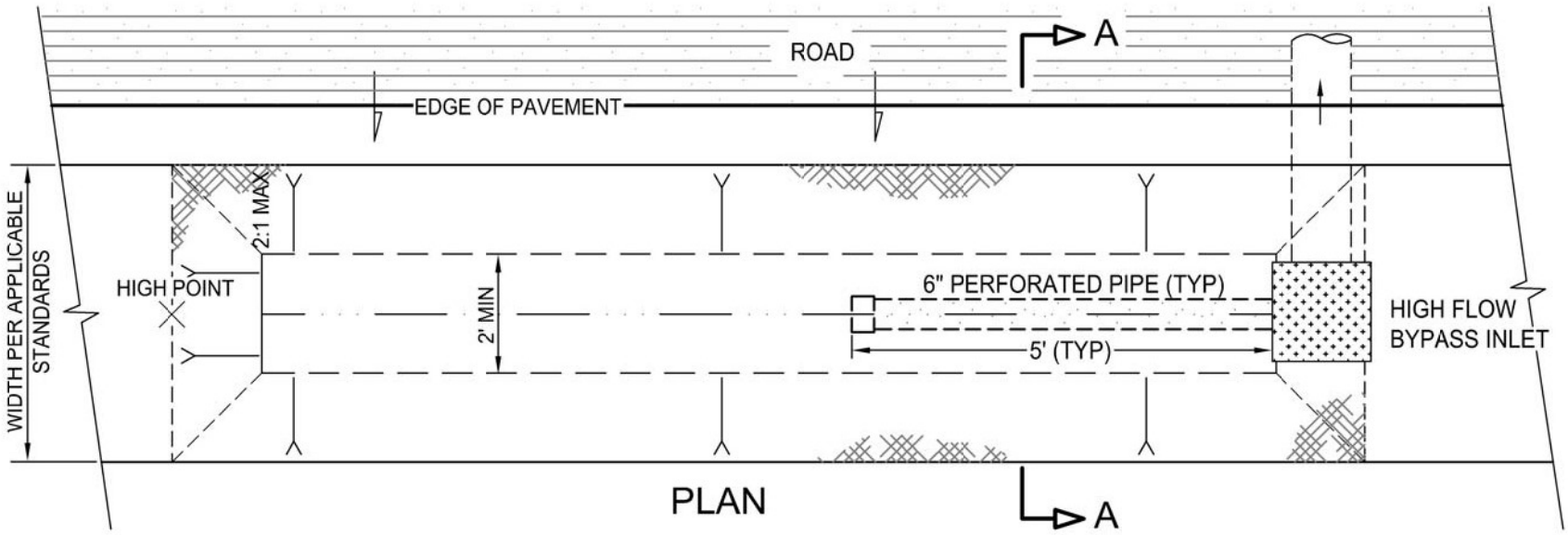


SECTION B-B

Not to Scale

PRIORITY 2
ROADSIDE BIORETENTION
- CURB OPENING
SECTION A-A & B-B

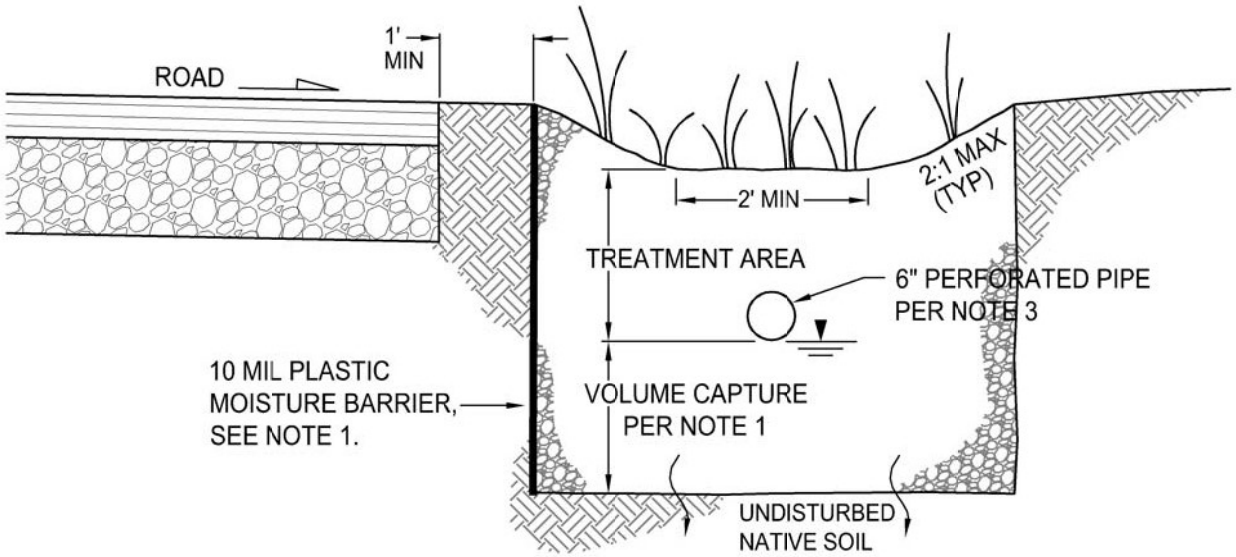
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 2 of 2	P2–04



PLAN

NOTES:

1. SOIL TO BE SPECIFIED BY DESIGN ENGINEER TO PROVIDE VOLUME CAPTURE AND MEET GOVERNING AGENCY REQUIREMENTS. IF NON STRUCTURAL SOIL IS SELECTED A CUTOFF WALL IS REQUIRED IN PLACE OF A MOISTURE BARRIER.
2. SWALE MUST CONVEY DESIGN FLOWS PER GOVERNING AGENCY DESIGN STANDARDS.
3. TOP OF 6" PERFORATED PIPE TO BE SET 6" BELOW BOTTOM OF ROAD STRUCTURAL SECTION.

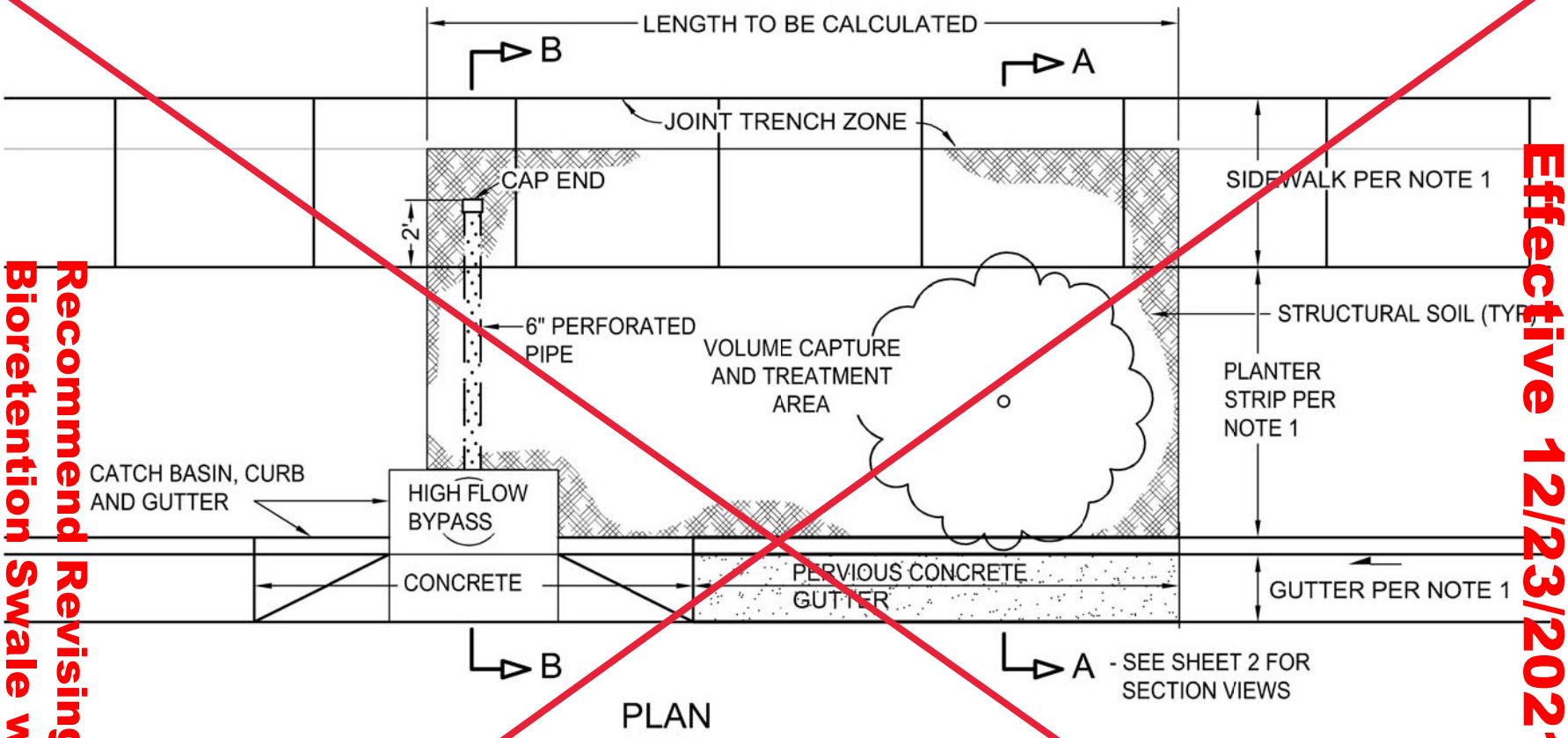


SECTION A-A

SIMILAR TO P1-02 WITH A PERFORATED DRAIN PIPE

PRIORITY 2 ROADSIDE BIORETENTION - NO CURB AND GUTTER		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*		P2–05

Not to Scale



PLAN

SIMILAR TO P2-02 WITH A MOISTURE BARRIER LINER, NO INFILTRATION.

NOTES:

1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).

Not to Scale

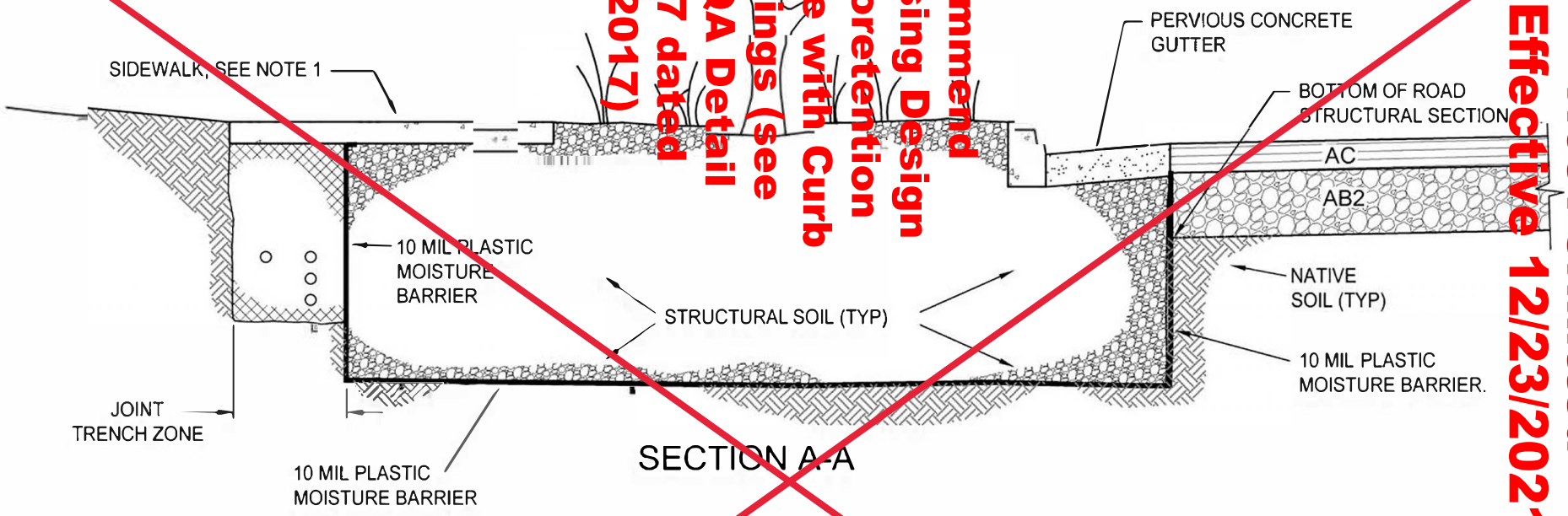
PRIORITY 3 ROADSIDE BIORETENTION - FLUSH DESIGN		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 2	P3–02

Not Permitted
Effective 12/23/2021

Recommend Revising Design to Bioretention Swale with Curb Openings (see CASQA Detail SW-17 dated 8/31/2017)

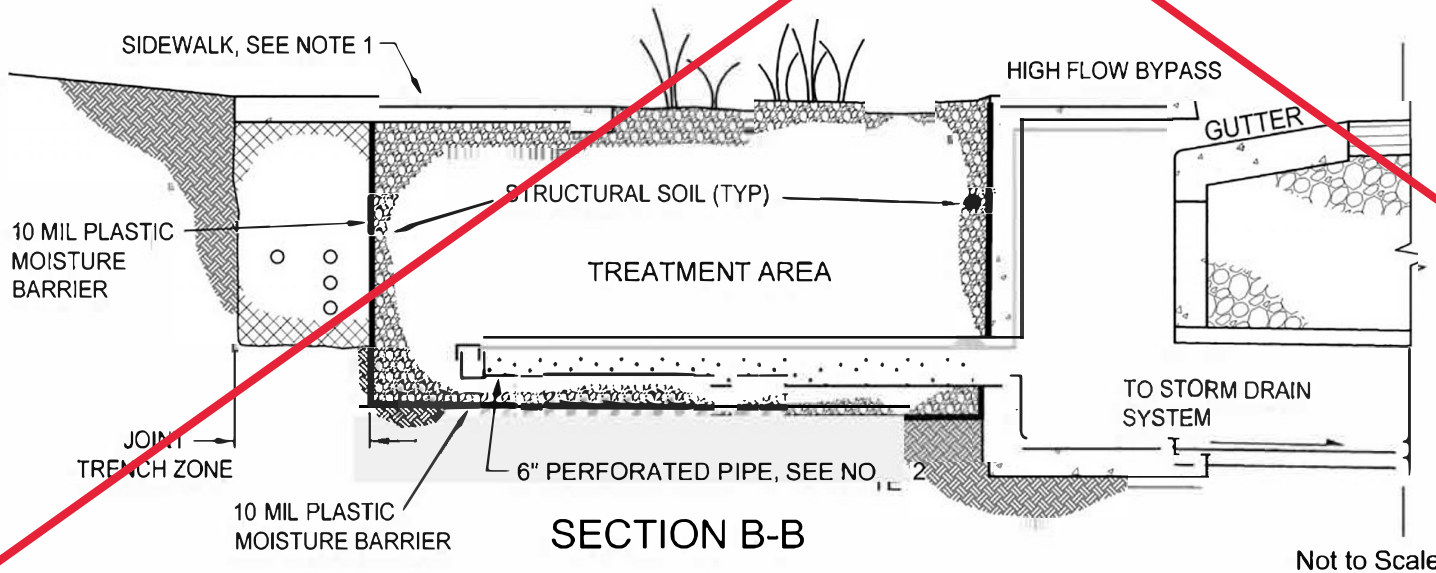
Not Permitted
Effective 12/23/2021

Recommend Revising Design to Bioretention Swale with Curb Openings (see CASQA Detail SW-17 dated 8/31/2017)



SECTION A-A

NOTES:
1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. 6" PERFORATED PIPE TO BE SET IN BOTTOM OF TREATMENT AREA.



SECTION B-B

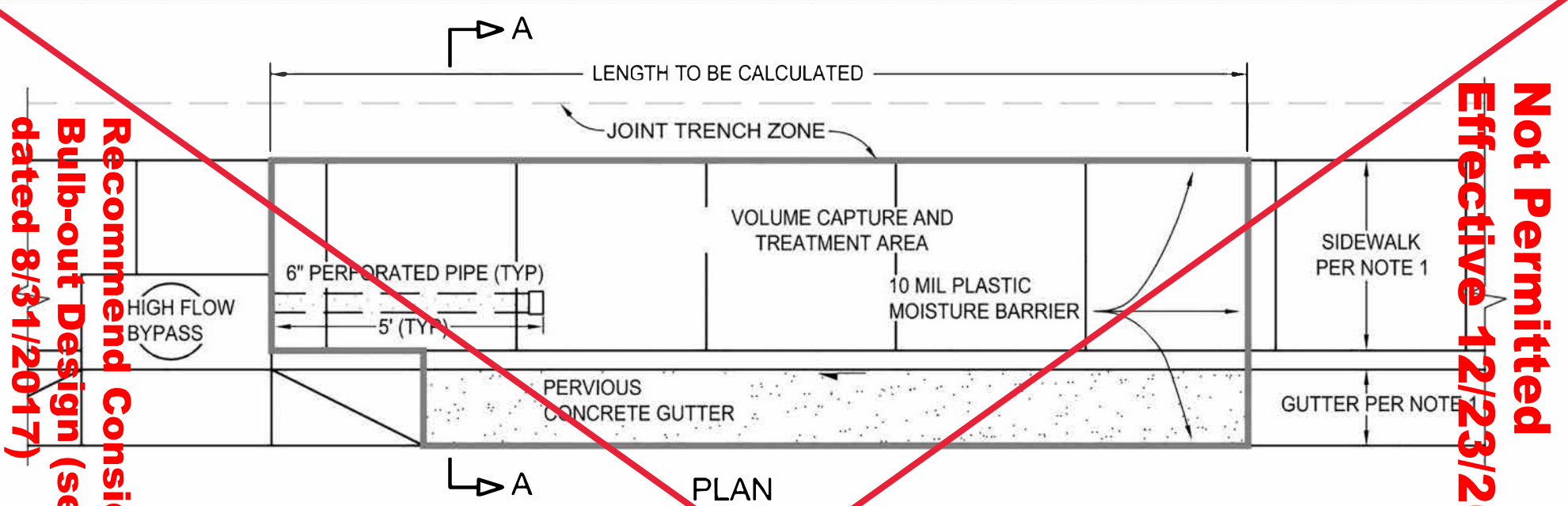
SIMILAR TO P2-02 WITH A MOISTURE BARRIER LINER, NO INFILTRATION.

Not to Scale

PRIORITY 3
ROADSIDE BIORETENTION
FLUSH DESIGN

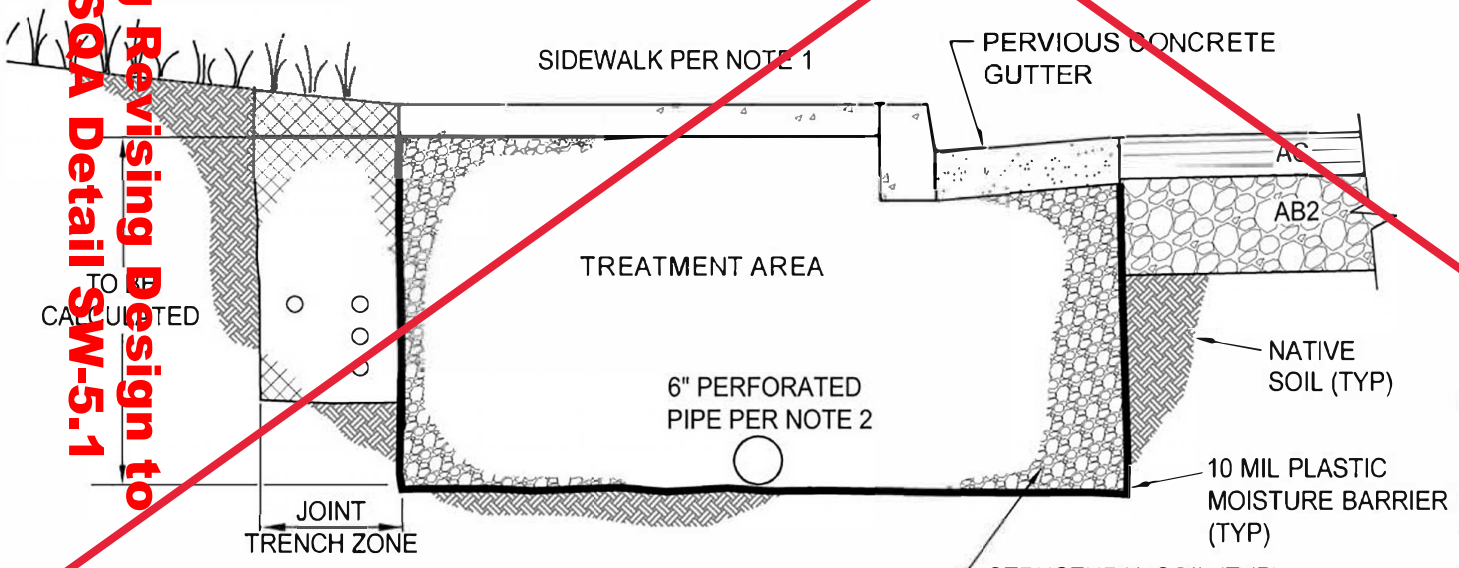
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 2 of 2	P3–02

Not Permitted
Effective 12/23/2021
Recommend Considering Revising Design to
Bulb-out Design (see CASQA Detail SW-5.1
dated 8/31/2017)



PLAN

NOTE:
1. SIDEWALK AND CURB AND GUTTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. 6" PERFORATED PIPE TO BE SET IN BOTTOM OF TREATMENT AREA.

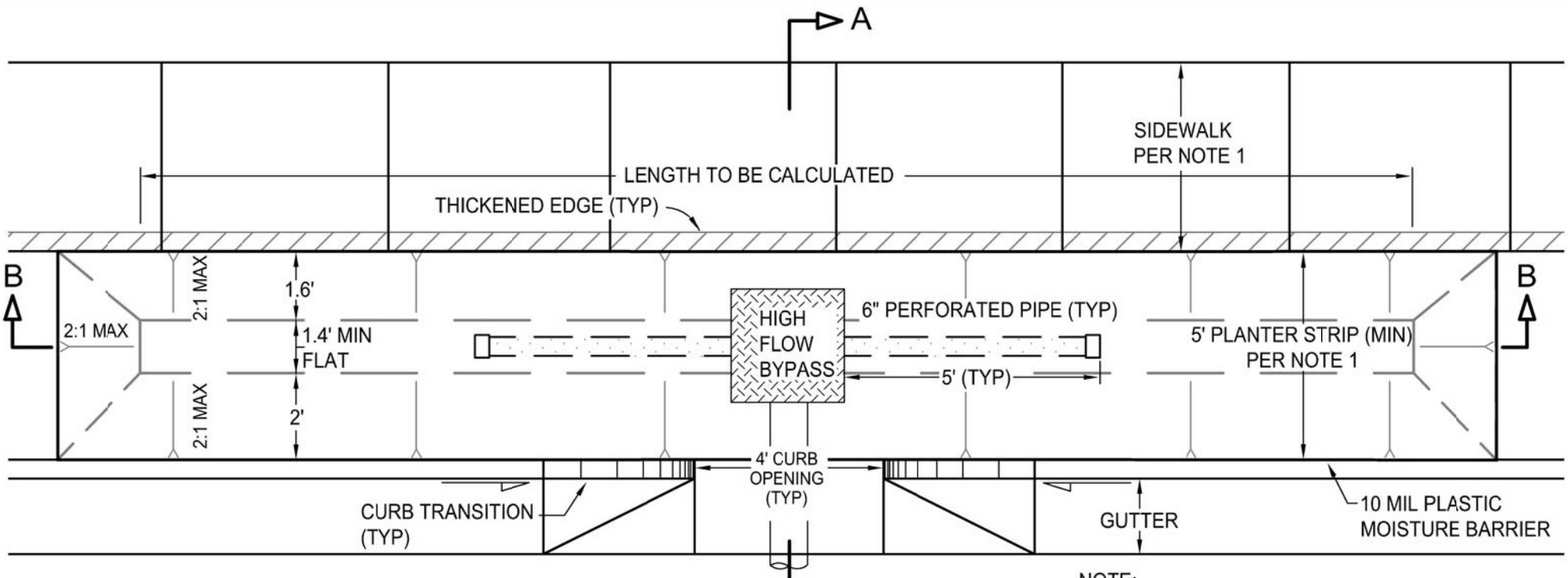


SECTION A-A

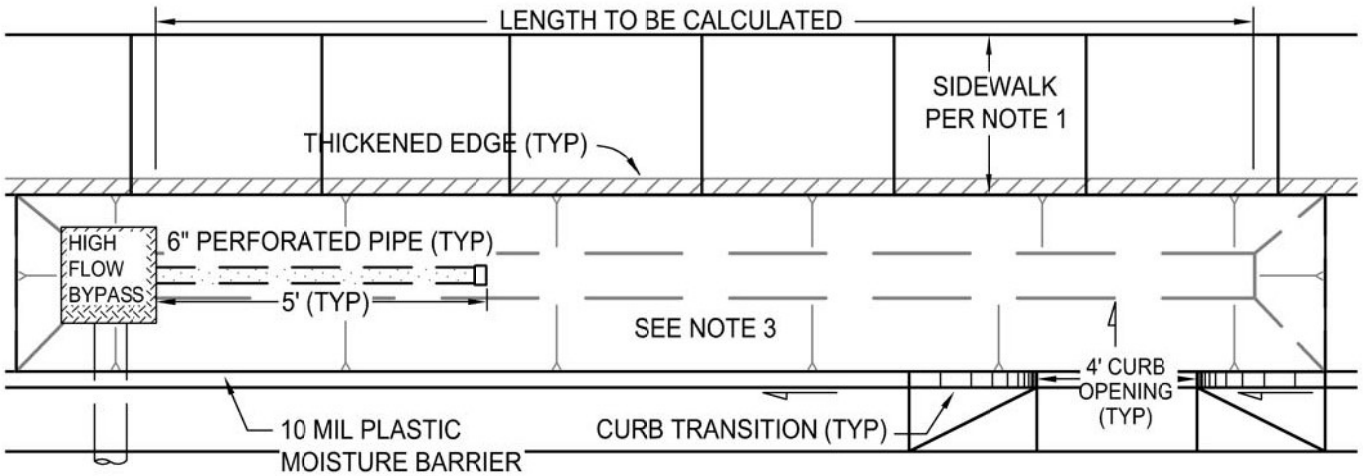
SIMILAR TO P2-03 WITH A MOISTURE BARRIER LINER, NO INFILTRATION.

Not to Scale

PRIORITY 3 ROADSIDE BIORETENTION - CONTIGUOUS SIDEWALK		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 1	P3-03



TYPE A - CURB OPENING AT LOW POINT



TYPE B -CURB OPENING ALONG A SLOPE

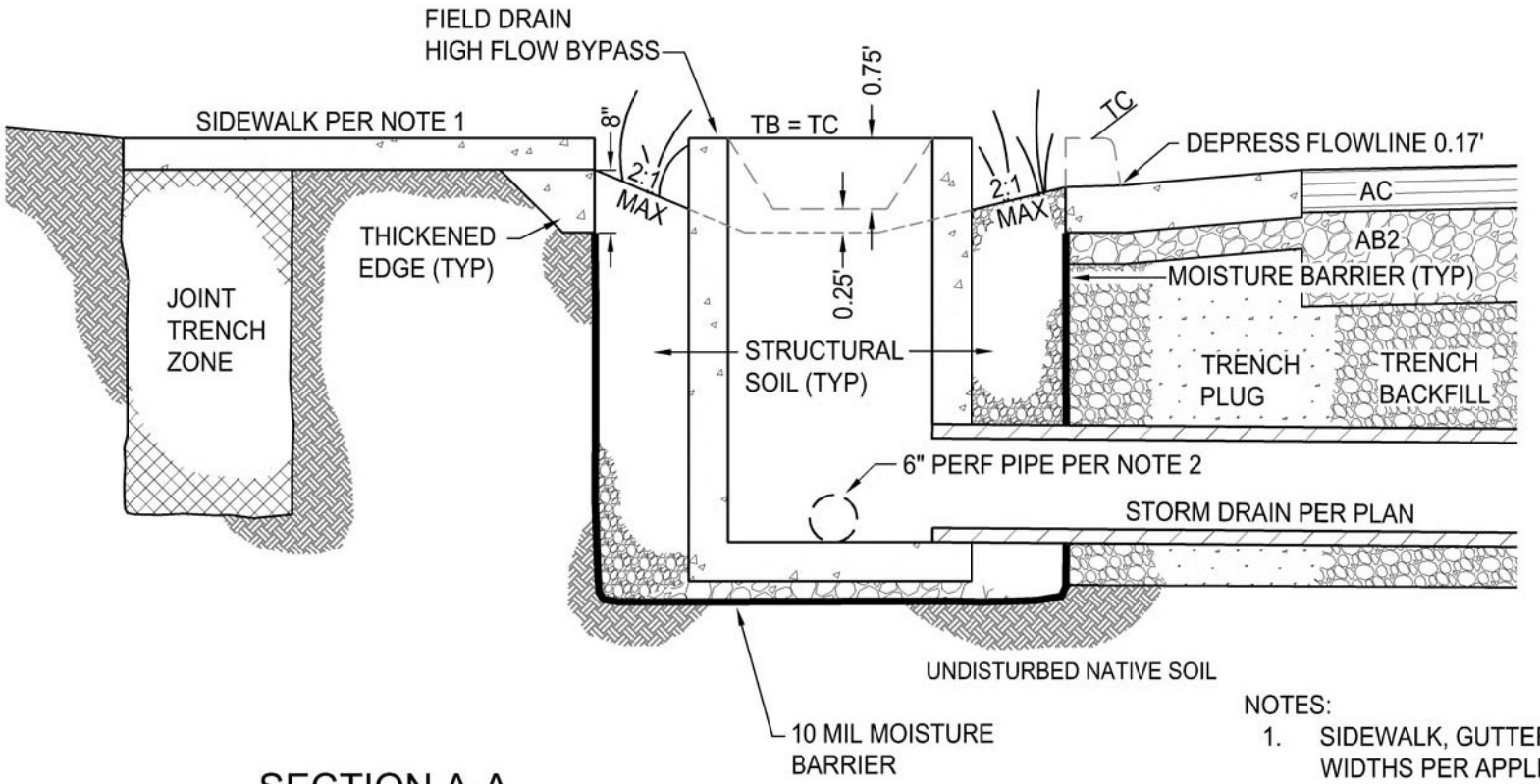
NOTE:

1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. 6" PERFORATED PIPE TO BE SET IN BOTTOM OF TREATMENT AREA.
3. TYPE A MINIMUM DIMENSIONS AND GRADES APPLY TO TYPE B.

SIMILAR TO P2-04 WITH A MOISTURE BARRIER LINER, NO INFILTRATION.

Not to Scale

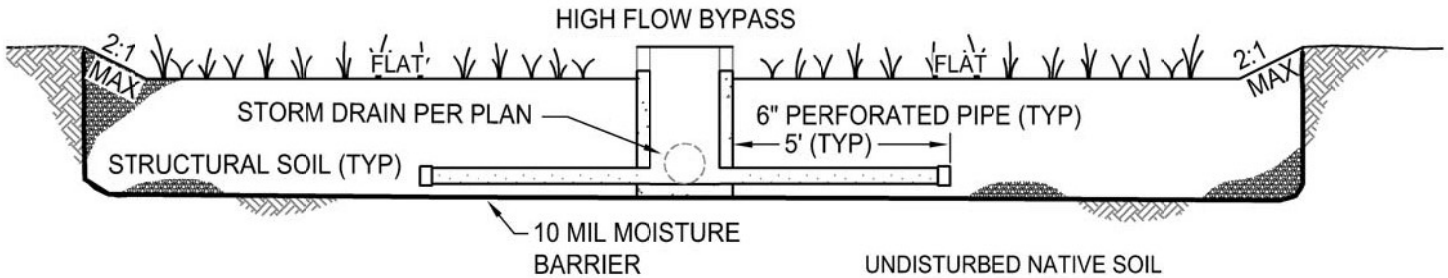
PRIORITY 3 ROADSIDE BIORETENTION - CURB OPENING		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 1 of 2	P3–04



SECTION A-A

NOTES:

1. SIDEWALK, GUTTER AND PLANTER WIDTHS PER APPLICABLE GOVERNING AGENCY STANDARDS (TYP).
2. 6" PERFORATED PIPE TO BE SET IN BOTTOM OF TREATMENT AREA.



SECTION B-B

SIMILAR TO P2-04 WITH A MOISTURE BARRIER LINER, NO INFILTRATION.

Not to Scale

PRIORITY 3 ROADSIDE BIORETENTION - CURB OPENING SECTION A-A & B-B		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*	SHEET 2 of 2	P3–04

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FACT SHEET- CONSTRUCTED WETLANDS

CONSTRUCTED WETLAND

Also know as: Artificial Wetlands



DESCRIPTION

Constructed wetlands are designed to mimic natural wetlands with varied depth pools and wetland plants. Constructed wetlands remove pollutants through a variety of natural physical, biological, and chemical treatment processes. They retain storm water and allow it to infiltrate and evapotranspirate while allowing pollutants to settle out and provide habitat.

ADVANTAGES

- Provides both water quality treatment and volume capture.
- Provides storm water treatment that enhances water quality of downstream water bodies through natural processes.
- Aesthetically pleasing.
- Can provide recreation and educational information to the public.
- Vegetation provides shade and wind breaks, absorbs noise, reduces heat island effects and adds to an area's landscape features.
- Establishes habitat for birds, amphibians, dragonflies, and pollinators like butterflies and bees.



FACT SHEET- CONSTRUCTED WETLANDS

LIMITATIONS

- Requires sufficient area.
- Prohibited in areas of known contamination. If soil and/or groundwater contamination is present on the site or within a 100’ radius of the proposed location, the Regional Board review and approval is required.
- Do not use in areas of slope instability where infiltrated storm water may cause failure. Slope stability shall be determined by a licensed Geotechnical Engineer.

KEY DESIGN FEATURES

- Compartmentalization and variation in pool size and depth recommended.
- 20’ maximum distance across wetland if only accessible from all weather access road on one side.
- Perimeter all weather access road required if wetland is greater than 20’ wide. Roads should be located as close to the shoreline as possible.
- 40’ maximum distance across wetland.
- Design for water depth over 1’. Preferably 3’-4’ with plant free areas over 5’ in depth.
- 50% or less overall vegetative cover.
- 25% of vegetation should be maintained as isolated islands away from the ponds perimeter.
- Raised planting beds to limit and narrow vegetated zones.
- 1%-5% slope recommended along bottom of wetland for dewatering, maintenance, and mosquito control.
- 2.5:1 to 4:1 bank slope recommended to limit vegetation growth and ensure access.
- 4:1 max bank slope to allow access for mowing and sampling.
- Peripheral vegetation zones should be less than 3’ wide or minimum required for wildlife.
- Design to maximize spread and movement of water in wetland.
- Design to allow for complete dewatering of wetland for maintenance and mosquito control.
- Include an access ramp to basin floor for maintenance equipment.
- Concrete liners in shallow areas to discourage vegetation where not necessary.
- Design and necessary approvals to drain wetland completely when needed (Salinas – Outlet structure should be designed to drain the WQv (Water Quality Volume) within a minimum of 48 hours.

FACT SHEET- CONSTRUCTED WETLANDS

SIZING DESIGN- GOAL AND REQUIREMENTS

- The **design goal** for all constructed wetlands is to capture (infiltration and/or reuse) 100% of the runoff volume generated by the 85th percentile 24 hour storm event. 100% volume capture has been established as the ideal condition. If achieved, all requirements are satisfied and no additional treatment is required. This is a retention requirement.

- If the *design goal* is not achievable, then the constructed wetland sizing requirement is:
    - **Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a know intensity of 0.20 inches per hour, **and**
    - **Volume Capture** (infiltration and/or reuse) of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event. This is a retention requirement.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID.

INSPECTION AND MAINTENANCE REQUIREMENTS

- A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary, and provide site specific inspection checklist. Remember; designing for maintenance and to restrict emergent vegetation minimizes maintenance requirements.

At a minimum inspection and maintenance shall include the following:

- If vegetation removal is performed, biomass must be removed
- Ability to dewater sections or the entire wetland for mosquito control or maintenance. Valves, weirs, etc.
- Vegetation control – removal, thinning, or mowing

CONSTRUCTED WETLANDS- CHECKLIST

Constructed Wetlands
Inspection and Maintenance Checklist
(aka: Artificial Wetlands)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	PRS RS ARS	Is there a high drawdown of water level over a short period?		• Check outlet control values and height of outlet/over flow channel. Repair and/or replace components as necessary. • Review operational manual.	
	PRS RS ARS	Check the operation of the drainage system (Valves, Weirs, pipes etc.)		• Cycle the drainage system to verify operation.	
	RS	Is water overflowing the sides of the pond during major storm events?		• Check outlet area for obstruction or damage. • Check High Flow Bypass inlet pipe/ overflow channel for obstruction or damage.	

CONSTRUCTED WETLANDS- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there evidence of under cutting or washouts around the inlet/outlet of the pond?		• Re-position the inlet splash rocks and/or dissipater(s). • Fill in eroded areas and re-grade.	
	RS ARS	Is there channelization (gully) forming along the banks of the pond?		• Fill in eroded areas, re-grade banks, and replant area. • Remove excess sediment from the pond.	
	PRS RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the pond?		• Remove sediment from the pond and re-grade the pond's bottom if needed.	
	PRS RS ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		• Repair and fill in damaged areas. Re-grade if needed. • Rodent/animal control activities must be in accordance with applicable laws and do not affect any protected species.	

CONSTRUCTED WETLANDS- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging the Inlet/outlet areas?		• Trim and/or remove the excess vegetation around the inlet/outlet areas.	
	PRS RS ARS	Is there excess vegetation in the pond?		• Remove the excess vegetation and biomass. • Re-grade pond bottom if need.	
	PRS RS ARS	Are there dead or dry plants/weeds on the banks of the pond?		• Remove dead and/or dry vegetation. • Remove or trim any vegetation that is causing a visual barrier hazard. • Remove any nuance, dangerous plant species. • Remove, trim, mow all vegetation that may present a fire hazard.	

CONSTRUCTED WETLANDS- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there trash/debris in and around the pond?		• Remove all trash and debris.	
	PRS RS ARS	Is the surrounding area marked with graffiti?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Are there mosquitoes present?		• Contact vector control.	
	PRS RS ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition to eliminate over spray and/or over watering.	
	PRS RS ARS	Are the aesthetic features in good condition and firmly secured?		• Repair and/or replace loose or damage features.	
	PRS RS ARS	Are the signage, fencing in place and in good condition?		• Replace/repair signage and fencing. • Add additional barriers signage to block access to hazardous areas.	

FACT SHEET- INFILTRATION TRENCH

INFILTRATION TRENCH

Also know as: Infiltration Gallery, Soakage Trench







DESCRIPTION

Infiltration Trenches are typically long narrow trenches that are filled with gravel that receive storm water and allow it to infiltrate into the soil. Infiltration trenches can be used to intercept storm water from landscape or open space before it crosses onto paved area or can be used as part of a treatment train with other BMP (such as Vegetated Buffer Strips or Vegetated Swales) to achieve the Volume Capture requirement.

ADVANTAGES

- Provides volume capture.
- Can be used as part of a treatment train with treatment BMPs.
- Can be used on sloped sites.
- Simple to install.

LIMITATIONS

- Does not achieve treatment.

- Impacts to adjacent buildings and overflow requirements need to be considered in design.
- Requires adequate space.

KEY DESIGN FEATURES

- Install a designated high flow bypass inlet or route.
- Design to prevent standing water. All surface water must drain within 72 hours to prevent mosquito breeding.

SIZING DESIGN- GOAL AND REQUIREMENTS

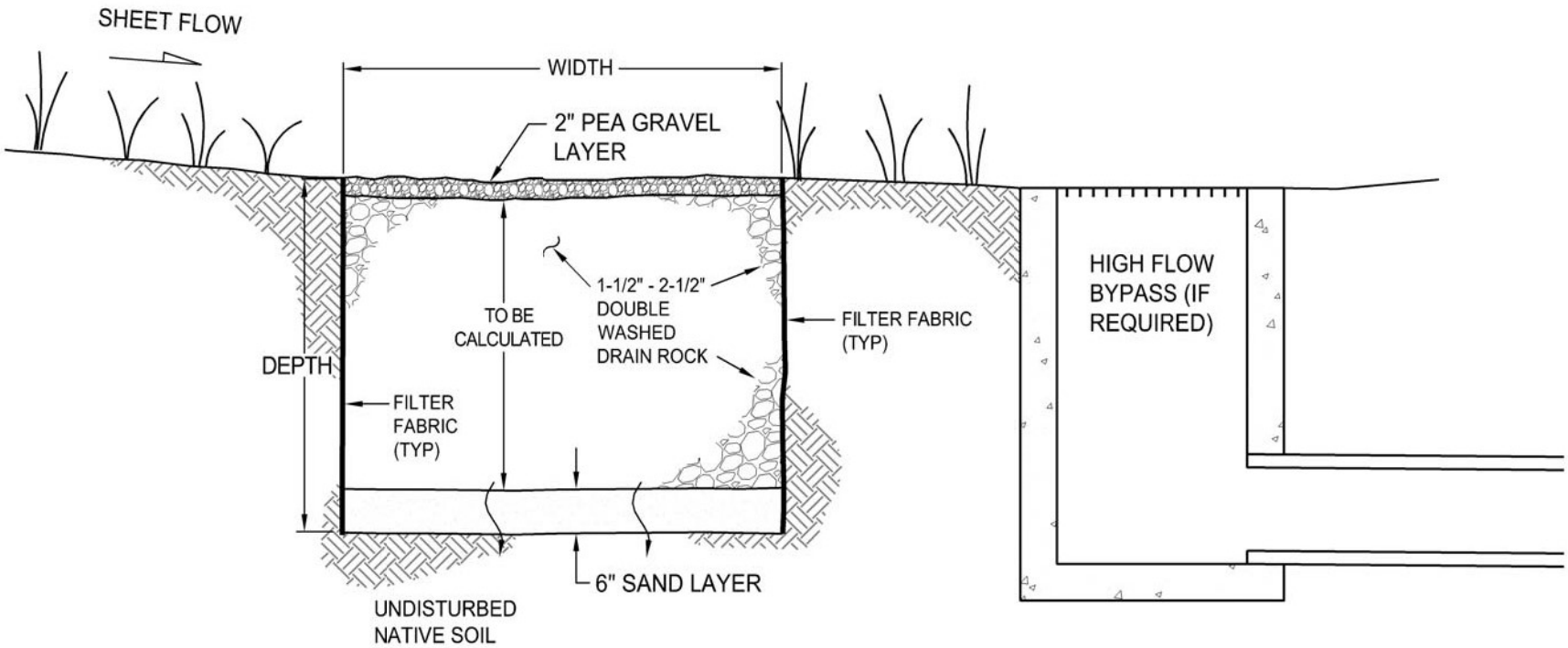
- The **design goal** is to capture of 100% of the runoff volume generated by the 85th percentile 24 hour storm event. 100% volume capture has been established as the ideal condition. If achieved, all requirements are satisfied and no additional treatment is required. This is a retention requirement.
- If the *design goal* is not achievable, then the rain water harvesting *sizing requirement* is:
  - **Volume Capture** of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual.
- All calculations shall be completed using the “Storm Water Calculator” available at www.srcity.org/stormwaterLID

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, identify the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

At a minimum inspection and maintenance shall include the following:

- Inspect twice annually for ponded water. If ponded water is observed, the top layer of pea gravel will need to be replaced.
- If ponded water remains, further grading and replacement may be necessary to prevent mosquito breeding.
- The high flow inlet should be inspected and cleaned as necessary to remove any obstructions.
- Pesticides and fertilizers shall not be used in vegetated areas draining to the infiltration trench.
- Remove any accumulated sediment and/or trash.



NOTES:

1. DEPTH SHALL NOT EXCEED WIDTH OR LENGTH.
2. TO BE USED AS PART OF A TREATMENT TRAIN.
3. ALL SURFACE WATER MUST DRAIN WITHIN 72 HOURS.

Not to Scale

PRIORITY 3 INFILTRATION TRENCH		
SCALE: *NONE*	DATE: *04/06/17*	
DWN. *DIT* CHK. *HM*		P1–07

FACT SHEET- POROUS PAVEMENT

POROUS PAVEMENT

Also know as: Unit Pavers, Porous Concrete, and Pervious Pavement







DESCRIPTION

Porous Pavement is a system comprised of load-bearing, durable surface together with an underlying layered structure that temporarily stores water prior to infiltration or drainage to a controlled outlet. The surface can be porous such that water infiltrates across the entire surface of the material (e.g., crushed aggregate, porous concrete and porous asphalt), or it can be constructed of impermeable blocks separated by spaces and joints, through which the water can drain. This latter system is termed 'permeable' paving. Pervious paving is used for light vehicle loading in parking areas. For a surface to be considered porous it must allow water to infiltrate in to the soil below. Perforated pipe may be installed high in the section and the volume below the perforated pipe may be counted toward volume capture if no impermeable liner is installed. Sections with perforated pipe or liners at the bottom provide treatment only.

ADVANTAGES

- Significant flow attenuation and improvement in water quality.
- Can remove both the soluble and fine particulate pollutants.
- Roof runoff can be piped into the subsurface storage area directly, which would increase the level of flow attenuation.
- Within lined systems, there is the opportunity for stored runoff to be piped out for reuse.
- Pervious pavements have a high level of applicability because they are unobtrusive.

FACT SHEET- POROUS PAVEMENT

LIMITATIONS

- Can become clogged if improperly installed or maintained. However, this problem is minimized by the ease with which small areas of paving can be cleaned or replaced when blocked or damaged.
- Use should be limited to car parking areas and other lightly trafficked or nontrafficked areas. Pervious surfaces are currently not considered suitable for roadways within the public right-of-way.
- Prohibited in areas of known contamination. If soil and/or groundwater contamination is present on the site or within a 100' radius of the proposed location, the North Coast Regional Board review and approval is required.
- Do not use in areas of slope instability where infiltrated storm water may cause failure. Slope stability shall be determined by a licensed Geotechnical Engineer.
- Do not use in locations that can negatively impact building foundation or footings. Location shall be approved by a licensed Geotechnical Engineer.



KEY DESIGN FEATURES

- The subgrade should be able to sustain traffic loading without excessive deformation.
- The granular capping and sub-base layers should give sufficient load-bearing to provide an adequate construction platform and base for the overlying pavement layers.
- Prevent cracking or excessive rutting from the wear of traffic. The horizontal tensile stress at the base of these layers.
- Pervious pavements require a single size grading to create voids for infiltration. The choice of materials is therefore a compromise between stiffness, permeability and storage capacity.
- Because the sub-base and capping will be in contact with water for extended periods, the strength and durability of the aggregate particles when saturated and subjected to wetting and drying should be assessed.
- A uniformly graded single size material cannot be compacted and is liable to move when construction traffic passes over it. This effect can be reduced by the use of angular crushed rock material with a high surface friction.
- Pervious concrete shall be designed and installed as described in Appendix G.

SIZING DESIGN- GOAL AND REQUIREMENTS

- The **design goal** is to capture (infiltration and/or reuse) 100% of the volume of runoff generated by the 85th percentile 24 hour storm event. This is a retention requirement. If 100% volume capture is achieved than no additional treatment is required.

- If the *design goal* is not achievable, then the *sizing requirement* is:
    - **Water Quality Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a known intensity of 0.92 inches per hour, **and**
    - **Volume Capture** (infiltration and/or reuse) of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event. This is a retention requirement.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

At a minimum inspection and maintenance shall include the following:

- Keep landscaped areas well maintained
- Prevent soil from washing onto pavement

Pervious Pavement shall be inspected and maintained 2-3 times per year:

a) Vacuum clean surface using commercial sweeping machines at the following times:

- End of winter (April)
- Mid-summer (July / August)
- After autumn leaf-fall (November)
- Inspect outlets annually

b) As needed maintenance:

- If routine cleaning does not restore infiltration rates, then reconstruction of part of the pervious surface may be required.
- The surface area affected by hydraulic failure should be lifted for inspection of the internal materials to identify the location and extent of the blockage.
- Surface materials should be lifted and replaced after brush cleaning. Geotextiles may need complete replacement.
- Sub-surface layers may need cleaning and replacing.
- Due to the accumulation of pollutants, removed silts may need to be disposed of as controlled waste.

POROUS PAVEMENT- CHECKLIST

Porous Pavement
Inspection and Maintenance Checklist
(aka: Unit Pavers, Porous Concrete)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____
Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)
This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water?		• Check perforated pipe outlet for obstruction or damage. * • Flush perforated pipe to remove obstructions/sediment. * • Repair or replace perforated pipe, replace with new soil and regrade. • Subsurface layers may need cleaning and/or replacing. • In dry weather, use a mechanical sweeper or a vactor truck to vacuum clean surface area. • In wet weather, use a vactor truck to vacuum clean surface area.	
		Is there visible water flowing over the surface of the pervious concrete/pavers during a low intensity storm?			
	PRS RS ARS	Is there sediment visible on the surface of the pervious concrete/pavers?		• In dry weather, use a mechanical sweeper or a vactor truck to vacuum clean surface area.	

* If perforated pipe is present.

POROUS PAVEMENT- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there under cutting or washouts along the sidewalks and/or curbs abutting a planter strip?		• Fill in eroded areas and regrade.	
	PRS RS ARS	Are there cracks, uplifts, slumps, missing pavers, and/or pot holes present? Is there sediment present in the catch basin and in the overflow pipe?		• Check perforated pipe outlet for damage. * • Repair or replace perforated pipe, replace with new soil and regrade.* • Subsurface layers may need cleaning and/or replacing. • Replace or repair damaged areas.	

* If perforated pipe is present.

POROUS PAVEMENT- CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging the inlet flow areas?		• Trim and/or remove the excess vegetation.	
	PRS RS ARS	Is there vegetation growing in the cracks, stress lines, and/or abutment areas?		• Remove vegetation. • In dry weather, use a mechanical sweeper or a vactor truck to vacuum clean surface area. • In wet weather, use a vactor truck to vacuum clean surface area.	
	PRS RS ARS	Is algae present?		• In dry weather, use a mechanical sweeper or a vactor truck to vacuum clean surface area. • In wet weather, use a vactor truck to vacuum clean surface area.	

POROUS PAVEMENT- CHECKLIST

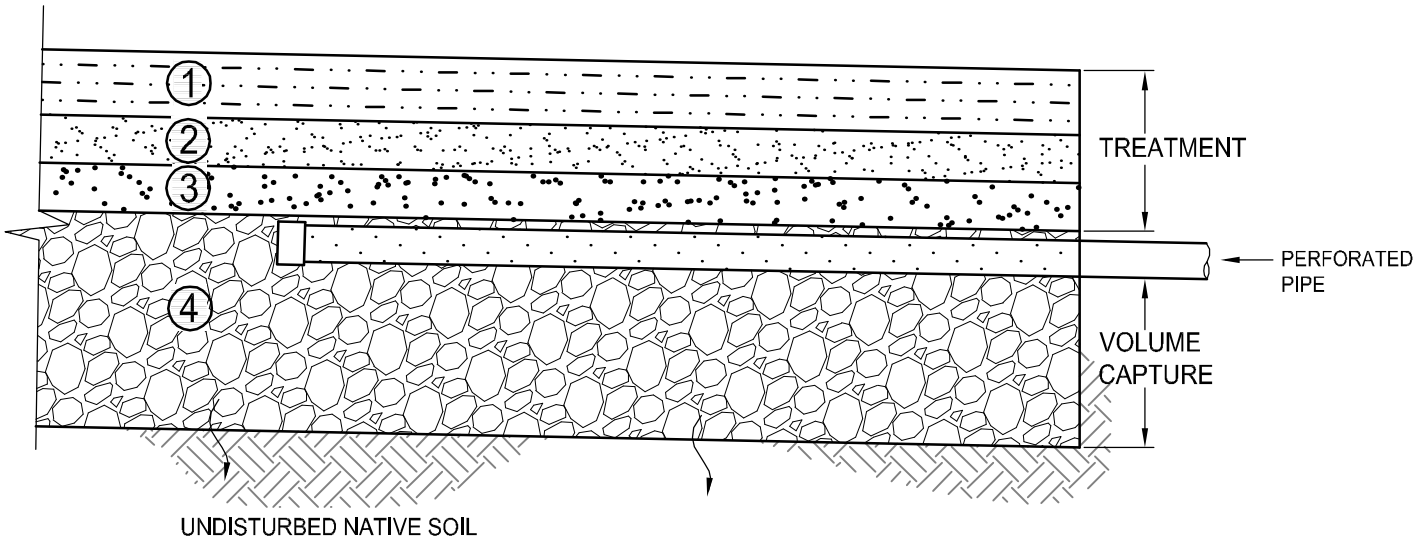
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash area?		• Remove all trash and debris.	
	PRS RS ARS	Is there gum or other material stuck to the pervious surface?		• In dry weather, use a mechanical sweeper or a vactor truck to vacuum clean surface area. • In wet weather, use a vactor truck to vacuum clean surface area.	
	PRS RS ARS	Is graffiti present?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Are the aesthetic features firmly secured in placed?		• Repair and/or replace loose or damaged features.	
	PRS RS ARS	Check for damage sidewalk, curb, gutter, and catch basin including uplift and settling.		• Remove and replace damaged areas.	

① PERMEABLE PAVEMENT OR SURFACE PER GOVERNING AGENCY STANDARDS

② SAND LAYER (FINE SAND)

③ TRANSITION LAYER (COARSE SAND) AS NEEDED FOR CONVEYANCE AND TREATMENT

④ STRUCTURAL SOIL OR DRAIN ROCK



Not to Scale

PRIORITY 2 PERMEABLE PAVEMENT		
SCALE: *NONE*	DATE: *05/10/11*	
DWN. *DIT* CHK. *HH*		P2–06

FACT SHEET- VEGETATED SWALE

VEGETATED SWALE

Also know as: Bioretention Swale, Treatment Swale, and Grassy Swale







DESCRIPTION

The swale best management practice (BMP) functions as a soil and plant-based filtration and infiltration feature that removes pollutants through a variety of natural physical, biological, and chemical treatment processes. Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of storm water runoff. Vegetated swales can serve as part of a storm water drainage system and can replace curbs, gutters and storm sewer systems.

ADVANTAGES

- Can achieve both water quality and volume capture objectives.

FACT SHEET- VEGETATED SWALE

- Vegetated swales provide storm water treatment that enhances the quality of downstream water bodies by using natural processes.
- The vegetation reduces heat island effects and improves an area's landscape.
- Vegetated swales can be designed to convey high flow as well as water quality flow.

LIMITATIONS

- Can be difficult to avoid channelization, which may cause erosion and limit infiltration potential.
- May not be appropriate for industrial sites or locations where spills may occur.
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- Not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- Swales are more susceptible to failure if not properly maintained than other treatment BMPs.
- Should not be used in areas of know contamination. If soil and/or groundwater contamination is present on the site or within a 100’ radius of the proposed BMP location, the North Coast Regional Water Quality Control Board will need to be contacted and the site reviewed.
- Should not be used in areas of slope instability where infiltrated storm water may cause failure. Slope stability should be determined by a licensed geotechnical engineer.
- Do not use in locations that can negatively impact building foundation or footings. Location shall be approved by a licensed Geotechnical Engineer.

KEY DESIGN FEATURES

- The longest flow path for the swale shall have a minimum retention time of 12 minutes for conditions when the treatment flows enter the Vegetated Swale uniformly along the swale length. The longest flow path for the swale shall have a minimum retention time of 5 minutes if 90 percent or more of the treatment flow enters the swale at the upstream end.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, whichever is less, at the design treatment rate.
- Longitudinal slopes between 1% and 2.5% are recommended.
- Maximum allowable slope is 8% slope. In steep areas, check dams up to 24-inches high and at least 25 feet apart are allowed.
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.

FACT SHEET- VEGETATED SWALE



- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- Vegetated swales shall have a maximum treatment width of 10 feet. The vegetated swale bed shall be at least 2-feet wide and no more than 7-feet wide. Parallel swales may be used if calculations show greater width is needed.
- The bed of the swale flow area shall slope at about 2% from toe of side slope to center of swale. Side slopes shall be no greater than a 2 to 1 slope.
- If vegetation is not established by October 1st, a 1-year biodegradable loose weave geofabric shall be placed on swale surface. If vegetation is not established by October 15th of the year, sod shall be placed over loose soils.
- Vegetated swale shall be sized using the spreadsheet provided by the local agency.
- The swale shall convey the 10-year storm event with flows contained within the swale. Adjacent to streets, the 100-year storm event shall be conveyed with flows below the top of curb elevation. (Include flow in the gutter in the calculation.)
- If the 10 or 100-year storm event flow velocity is greater than 4 feet per second, a permanent geofabric liner shall be used that is rated for the calculated flow velocity.
- If used, the perforated pipe trench shall be backfilled with ¾" crushed rock with a 2-inch bed underneath and 6-inch cover.

SIZING DESIGN- GOAL AND REQUIREMENTS

- The **design goal** for vegetated swale is to capture (infiltration and/or reuse) 100% of the volume of runoff generated by the 85th percentile 24 hour storm event. This is a retention requirement. If 100% volume capture is achieved than no additional treatment is required.
- If the *design goal* is not achievable, then the vegetated swale *sizing requirement* is:
    - **Water Quality Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a known intensity of 0.20 inches per hour, **and**
    - **Volume Capture** (infiltration and/or reuse) of the increase in volume of storm water due to development generated by the 85th percentile 24 hour storm event. This is a retention requirement.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID

FACT SHEET- VEGETATED SWALE

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, state the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

At a minimum maintenance shall include the following:

- Mow and irrigate during dry weather to the extent necessary to keep vegetation alive. Where 6-inch high grasses are used, the grass height shall be at least 3 inches after mowing. Where mowed grasses are shown, the grass height shall be mowed when the height exceeds 3 inches.
- Remove obstructions and trash from vegetated swale.
- Pesticides and fertilizers shall not be used in the swale.

Vegetated Swales shall be inspected and maintained monthly during the rainy season to review:

- Obstructions and trash.
- Ponded flow is drained within 72 hours after a rainfall event.
- Condition of grasses.
- If ponding is observed, grading will be required to restore positive drainage.

VEGETATED SWALE - CHECKLIST

Vegetated Swale
Inspection and Maintenance Checklist
(aka: Bioretention Swale, Treatment Swale, Grassy Swale)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____

Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water after 3 days of dry weather?		• Remove any obstruction in the swale and/or regrade to restore positive drainage.	
	RS	Is there poor drainage during a high intensity storm event?		• Clean the High Flow Bypass Inlet. • Check pipe for damage and/or blockage. Repair if required.	
	RS	Is the flow into the vegetative swale even and uniform?		• Remove any obstruction preventing a uniform flow into the swale.	

VEGETATED SWALE - CHECKLIST

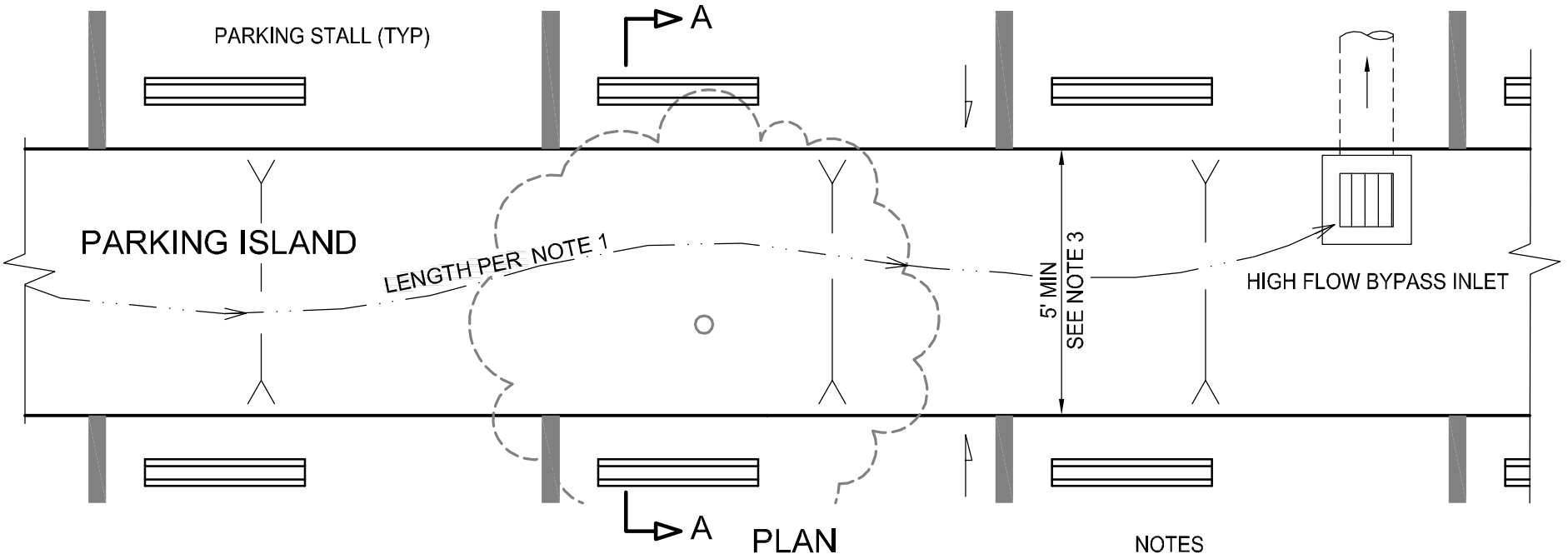
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there under cutting or washouts along the impervious surfaces abutting the Vegetative Swale?		• Fill in eroded areas and regrade.	
	RS ARS	Is there channelization (gully) forming along the length of the swale area?		• Fill in eroded areas and regrade.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the swale?		• Remove sediment and check the grading. Add replacement soil and/or mulch.	
	PRS RS ARS	Is the mulch unevenly distributed in the Vegetative Swale area?		• Redistribute and add additional mulch if needed. • Regrade area.	
	PRS RS ARS	Are there voids and/or holes around the High Flow Bypass Inlet?		• Inspect the High Flow Bypass pipe and Inlet box for damage. Replace or repair as necessary.	
	PRS RS ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		• Repair and fill in damaged areas. • Rodent control activities must be in accordance with applicable laws and do not affect any protected species.	

VEGETATED SWALE - CHECKLIST

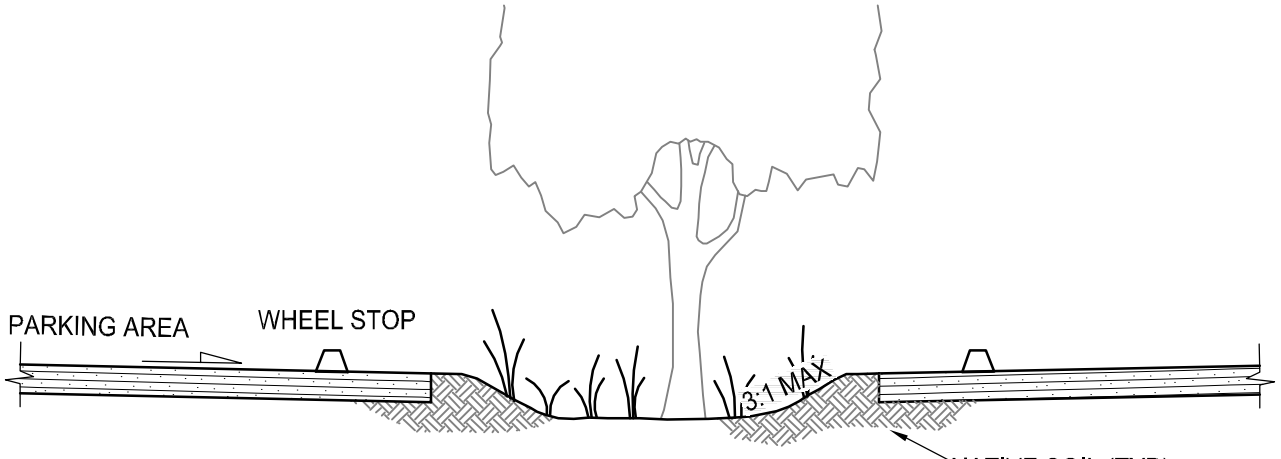
Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging or redirecting the inlet/outlet flow areas?		• Trim and/or remove the excess vegetation.	
	PRS RS ARS	Is the mulch distributed evenly throughout the swale area?		• Redistribute and add additional mulch if needed. • Regrade planter area.	
	PRS RS ARS	Are there dead or dry plants/weeds? Is the vegetation over grown?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a visual barrier, trip, and or obstruction hazards. • Mow grass as needed.	

VEGETATED SWALE - CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the planter/swale area?		• Remove all trash and debris.	
	PRS RS ARS	Is Graffiti present?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition and/or adjust to eliminate over spray and/or over watering.	
	PRS RS ARS	Are the aesthetic features firmly secured in placed?		• Repair and/or replace loose or damaged features.	
	PRS RS ARS	Check for damaged sidewalk, curb, gutter, and catch basin. This includes uplift and settling.		• Remove and replace damaged areas.	



PLAN



SECTION A-A

NOTES

1. SWALE LENGTH TO BE DESIGNED TO PROVIDE 12 MINUTES OF CONTACT TIME WHEN FLOW ENTERS UNIFORMLY ALONG LENGTH.
   OR
   PROVIDE 5 MINUTES OF CONTACT TIME IF 90% OR MORE OF THE FLOW ENTERS AT THE UPSTREAM END.
2. SWALE MUST CONVEY DESIGN FLOWS PER MUNICIPAL DESIGN STANDARDS.
3. PARKING ISLAND WIDTH PER APPLICABLE MUNICIPAL STANDARDS.

N.T.S.

Not to Scale

PRIORITY 3
VEGETATED SWALE

SCALE: *NONE*	DATE: *05/10/11*	
DWN. *DIT* CHK. *HH*	SHEET 1 of 1	P3–07

FACT SHEET- FLOW THROUGH PLANTER

FLOW THROUGH PLANTER

Also know as: Above Ground Bioretention, Filter Planter, and Water Quality Planter







DESCRIPTION

Flow Through Planters function as a soil and plant-based filtration feature that removes pollutants through a variety of natural physical, biological, and chemical treatment processes. Flow Through Planters are usually installed next to buildings or common open areas to treat storm water from rooftops.

ADVANTAGES

- Provides water quality treatment.
- Can be used as part of a treatment train with volume capture BMPs.
- Used in urban areas where space is limited.
- Used on sloped sites.
- Provides habitat for birds and attracts pollinators like butterflies and bees.

FACT SHEET- FLOW THROUGH PLANTER

LIMITATIONS

- Do not achieve volume capture/infiltration requirements.
- Impacts to adjacent buildings and overflow requirements need to be considered in design.
- Plant selection needs to consider effects of fast draining soils.

KEY DESIGN FEATURES

- Bottom shall be impervious to protect adjacent structures and slope stability, unless otherwise approved by a licensed Geotechnical Engineer. If designed to allow infiltration, the underlying soil will need to be tested to determine the infiltration rate and should not be compacted.
- Include plants suited to the unique conditions in the planter and design to achieve 51% cover.
- Install a designated high flow bypass inlet or route.
- Underdrain required.
- Designed to prevent standing water. All surface water must drain within 72 hours to prevent mosquito breeding.
- Select non-floatable surface mulching material to prevent clogging of downstream inlets.
- Downspouts to incorporate splash blocks and/or other dissipation methods to prevent erosion.

SIZING DESIGN- GOAL AND REQUIREMENTS
(Applies to all tributary areas with impervious surfaces)

- **Water Quality Treatment** of 100% of the flow generated by the 85th percentile 24 hour storm event, as calculated using the Rational Method and a known intensity of 0.20 inches per hour.
- All calculations shall be completed using the "Storm Water Calculator" available at www.srcity.org/stormwaterLID.

INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include recommended maintenance practices, identify the parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.
At a minimum inspection and maintenance shall include the following:

- Inspect twice annually for ponded water. If ponded water is observed, the perforated pipe shall be cleaned.

FACT SHEET- FLOW THROUGH PLANTER

- If ponded water remains, further grading and replacement may be necessary to prevent mosquito breeding.
- The high flow inlet should be inspected and cleaned as necessary to remove any obstructions.
- Pesticides and fertilizers shall not be used in the rain garden area.
- Plants should be pruned, weeds pulled and dead plants replaced as needed.
- Check downspout splash blocks for proper location and fill/regard any washouts.
- Evaluate mulching around plants. Add/replace as needed.

FLOW THROUGH PLANTER - CHECKLIST

Flow Through Planter
Inspection and Maintenance Checklist
(aka: Above Ground Bioretention, Filter Planter, Water Quality Planter)

Date of Inspection: _____
Inspector(s): _____
BMP ID #: _____
Property Owner: _____

Location Description: _____
Type of Inspection: ☐ Pre-rainy Season (PRS) ☐ Rainy Season (RS) ☐ After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Drainage	RS	Is there standing or pooling of water after 3 days of dry weather?		• Check perforated pipe outlet for obstruction or damage. • Flush perforated pipe to remove obstructions. • Remove and replace the first few inches of topsoil. • Remove all the soil and inspect perforated pipe. Repair or replace perforated pipe, replace with new soil and re-grade.	
	RS	Is there overflow due to excessive splashing/spray?		• Reposition splash block or dissipater to reduce or eliminate splash/spray overflow.	
	RS	Is water overflowing the sides of the planter unit during major storm events?		• Check outlet area for obstruction or damage. • Check High Flow Bypass inlet pipe for obstruction or damage.	

FLOW THROUGH PLANTER - CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Erosion	RS ARS	Is there under cutting or washouts around the inlet splash block(s)?		• Re-position the inlet splash block(s) or dissipater(s). • Fill in eroded areas and re-grade.	
	RS ARS	Is there channelization (gully) forming along the length of the planter area?		• Re-position the inlet splash block or dissipater. Re-grade planter area.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the planter?		• Remove sediment and check the grading. Add replacement soil and or mulch.	
	PRS RS ARS	Is the mulch unevenly distributed in the planter area?		• Re-distribute and add additional mulch if needed. • Re-grade planter area.	

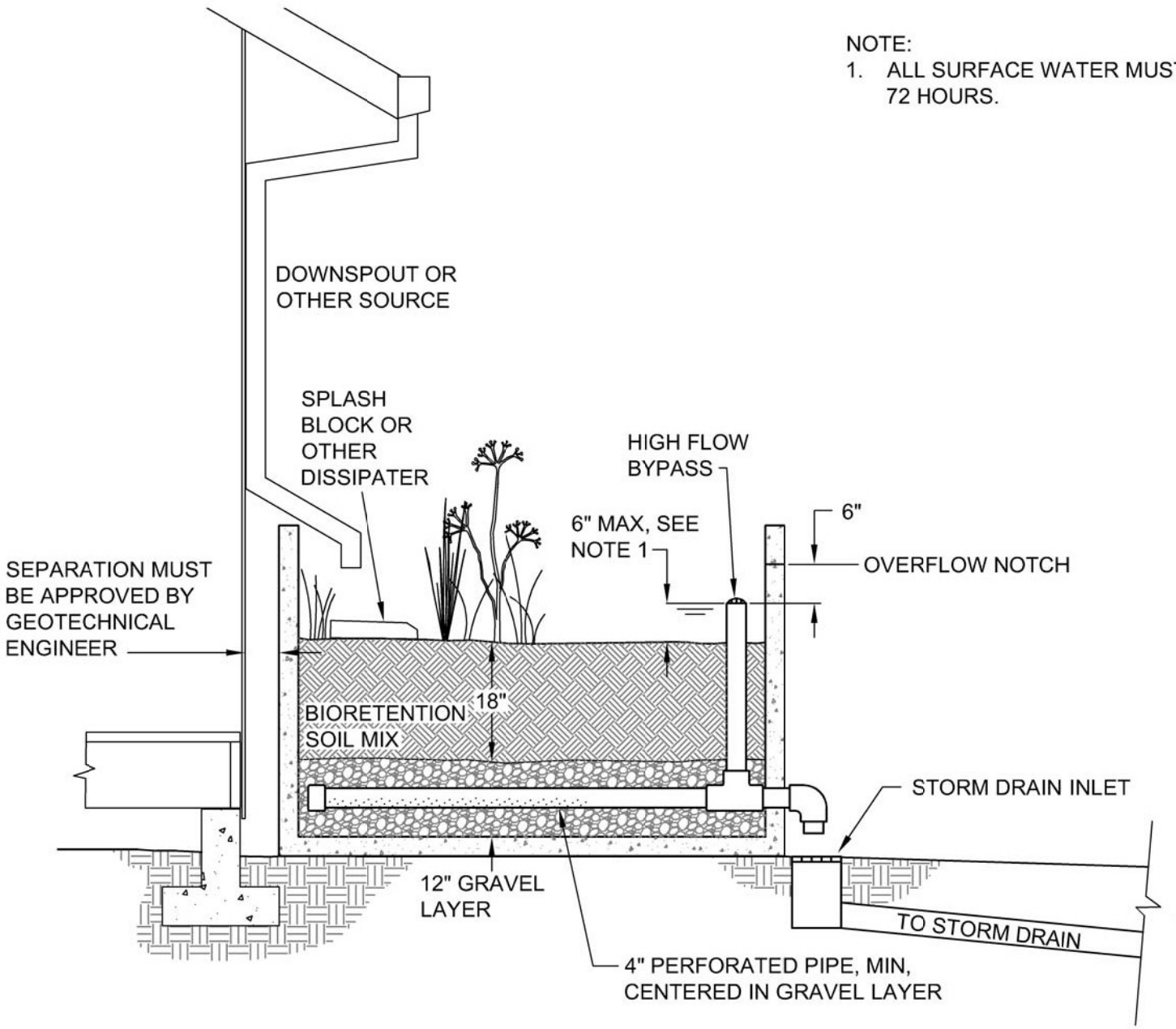
FLOW THROUGH PLANTER - CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
Vegetation	PRS RS ARS	Is the vegetation clogging the Inlet/outlet areas?		• Trim and/or remove the excess vegetation around the inlet/outlet areas.	
	PRS RS ARS	Is the mulch spread evenly throughout the planter area?		• Re-distribute and add additional mulch if needed. • Re-grade planter area.	
	PRS ARS	Are there dead or dry plants/weeds?		• Remove dead and/or dry vegetation. Replace as needed. • Remove or trim any vegetation that is causing a visual barrier hazard.	

FLOW THROUGH PLANTER - CHECKLIST

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
BMP General	PRS RS ARS	Is there debris/trash in the planter area?		• Remove all trash and debris.	
	PRS RS ARS	Is the planter and/or surrounding area marked with graffiti?		• Remove all graffiti from the area.	
	PRS RS ARS	Are there missing or disturbed aesthetics features?		• Replace and/or reposition aesthetics features to original placement. • Placement should not disrupt flow characteristics/design.	
	PRS RS ARS	Check for broken or damaged drain inlets/outlets, splash blocks, and grates.		• Replace or repair all damage features.	
	PRS RS ARS S	Is the vegetation irrigation functional?		• Repaired broken missing spray/drip emitters. • Reposition to eliminate over spray and/or over watering.	
	PRS RS ARS	Are there cracks, holes, and/or damage sides, top of the planter unit?		• Repair or replace unit. Repairs must be watertight.	
	PRS RS ARS	Are the aesthetic features firmly secured in placed?		• Repair and/or replace loose or damage features.	

NOTE:
1. ALL SURFACE WATER MUST DRAIN WITHIN 72 HOURS.



PRIORITY 3
FLOW THROUGH PLANTER

SCALE: *NONE*		DATE: *04/06/17*	
Not to Scale	DWN. *DIT* CHK. *HM*	SHEET 1 of 1	P3–05

FACT SHEET- PROPRIETARY UNITS

PROPRIETARY UNITS

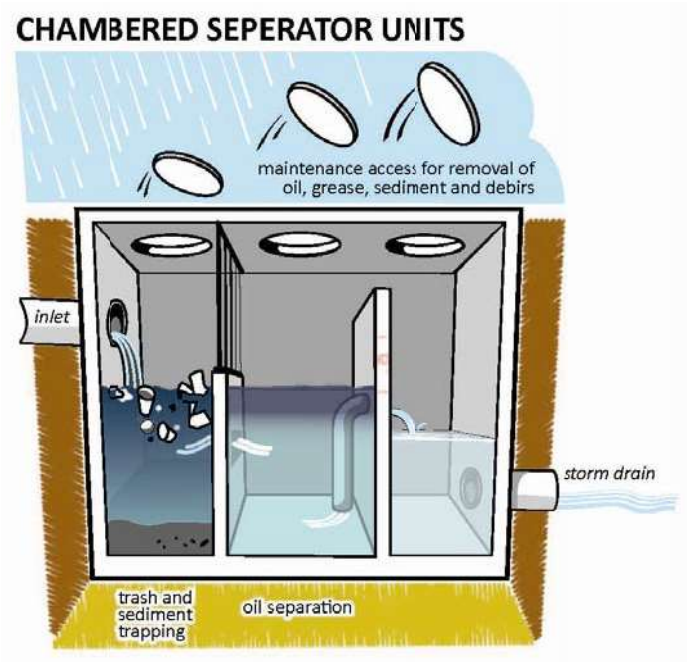
Also know as: Structural Units, Physical Separators, Prefabricated Units, and Manufactured Units.





GENERAL DESCRIPTION

Proprietary units, or manufactured units, very in design and use to serve a wide variety of storm water quality needs. They are generally constructed offsite and are installed as a unit. Some are designed to target a particular pollutant, such as hydrocarbons, while others remove multiple pollutants. Proprietary units can be very useful when a particular pollutant needs to be removed as part of pretreatment or where space is limited as part of a treatment train. Proprietary typically provide treatment, but not volume capture.



GENERAL INSPECTION AND MAINTENANCE REQUIREMENTS

A maintenance plan shall be provided with the Final SUSMP. The maintenance plan shall include the manufacturers recommended maintenance practices, designation of parties responsible for maintenance and upkeep, specify the funding source for ongoing maintenance with provisions for full replacement when necessary and provide site specific inspection checklist.

FACT SHEET- PROPRIETARY UNITS

CHAMBERED SEPERATOR UNITS

Use the properties of different pollutants to remove each in a separate chamber. As such, these units tend to be larger. They can either be inline with the storm drain system, or offline. An access point must be provided to each chamber for maintenance purposes. These units must be maintained with a vacuum truck.



TRASH EXCLUDERS

Use screens or other physical filtration to prevent trash from entering the storm drain system. The collected trash can either be stored in a portion of the inlet or in the curb. High flow bypass must be provided to prevent clogging and backup. These units must be maintained with a vacuum truck.



FILTER INSERTS

Use bags and/or fabric or other physical filtration to filter out trash, sediment, and/or hydrocarbons. Some filter inserts are designed to remove particular pollutants. High flow bypass must be provided to prevent backup.

FACT SHEET- PROPRIETARY UNITS



CENTRIFUGAL SEPERATOR UNITS

Use curved baffles to direct storm water so that centrifugal force drops sediment and debris out and usually use screens to collect floatable material. These units can be either inline with the storm drain system or offline. These units must be maintained with a vacuum truck.



TREE FILTER UNITS

Are combination units that use both structural and biological elements to clean storm water. They generally consist of a concrete vault filled with a special soil mix that a tree or shrub is planted in. Storm water is directed into the unit, filtered through the soil, and collected in a perforated pipe and conveyed to the storm drain system. High flow bypass must be provided for high intensity rain events.

APPENDIX F

PLANT AND TREE LISTS

Botanical Name	Common Name	Low Zone (Riparian)	Mid Zone (Meadowland)	High Zone (Upland)	Vegetated Swales	Bioretention	Extended Detention Basin	Vegetated Buffer	Constructed Wetland	Tolerates Saturation	Drought Tolerant	WUCOLS (IV)	Likely WUCOLS if not rated	Other Notes
Grasses and Grass-like Plants														
Agrostis exarata	spike bentgrass		X	X	Yes		Yes	Yes				NR	M	
Alopecurus aequalis	short awn foxtail	X	X		Yes		Yes					NR	M	`
Alopecurus saccatus	Pacific foxtail	X	X		Yes		Yes					NR	M	
Bromus carinatus	California brome		X	X	Yes	Yes		Yes				NR	L	
Carex barbarae	Santa Barbara sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes	Yes	M		Not for full sun
Carex brevicaulis	short stem sedge		X	X	Yes	Yes	Yes	Yes			Yes	M		Short turf-like growth habit
Carex densa	dense sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex deweyanna	Dewey sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex divulsa	Berkeley sedge	X	X		Yes	Yes	Yes	Yes		Yes	Yes	M		Not a native. Mistakenly sold as the native C. tumulicola
Carex obnupta	slough sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex pansa	California meadow sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes	Yes	M		
Carex rupestris	curly sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex stipata	sawbeak sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex subfusca	rusty sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex testacea	New Zealand orange sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Carex tumulicola	foothill sedge	X	X	X	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L		
Carex vesicaria	inflated sedge	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Danthonia californica	California oatgrass		X	X	Yes		Yes		Yes			M		
Deschampsia danthonoides	annual hairgrass		X	X	Yes	Yes	Yes	Yes	Yes	Yes		NR	L	Can tolerate saturation if top soil layer drains
Deschampsia cespitosa	tufted hairgrass		X	X	Yes	Yes	Yes	Yes		Yes		L		Can tolerate saturation if top soil layer drains
Distichlis spicata	salt grass	X	X		Yes		Yes	Yes	Yes			L		
Eleocharis acicularis	needle spike rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		H		
Eleocharis macrostachya	creeping spike rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		H		
Eleocharis ovata	ovate spike rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		H		
Eleocharis palustris	creeping spike rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		H		
Elymus glaucus	blue wild rye		X	X	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L		
Elymus triticoides	creeping wild rye		X	X	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L		Synonym: *Leymus triticoides*
Festuca californica	California fescue			X	Yes	Yes	Yes	Yes			Yes	L		Can tolerate saturation if top soil layer drains
Festuca idahoensis	blue bunchgrass			X	Yes	Yes	Yes	Yes		Yes	Yes	VL		Can tolerate saturation if top soil layer drains
Festuca rubra	red fescue			X	Yes	Yes	Yes	Yes		Yes	Yes	L		Can be mowed as turf alternative. Can tolerate saturation if top soil layer drains
Glyceria occidentalis	western mannagrass	X	X		Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	H	
Hordeum brachyantherum	meadow barley		X	X	Yes	Yes	Yes	Yes	Yes			NR	L	Can tolerate saturation if top soil layer drains
Juncus balticus	Baltic rush	X	X		Yes	Yes	Yes	Yes	Yes			NR	M	
Juncus bufonis	toad rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		NR	M	
Juncus effusus	Pacific rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		M		
Juncus ensofolius	dagger leaf rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		NR	M	
Juncus patens	blue rush	X	X	X	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L		May not need summer irrigation after establishment
Juncus tenuis	slender rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes	Yes	NR	M	
Juncus xiphiodes	iris-leaved rush	X	X		Yes	Yes	Yes	Yes	Yes	Yes		NR	M	
Melica californica	California melic			X	Yes	Yes	Yes	Yes		Yes	Yes	NR	L	Low or very low water use in other regions
Melica imperfecta	small flowered melic			X	Yes	Yes	Yes	Yes		Yes	Yes	VL		Can tolerate saturation if top soil layer drains
Muhlenbergia rigens	deergrass			X	Yes	Yes	Yes	Yes			Yes	L		
Phalaris californica	California canary grass	X	X	X	Yes	Yes	Yes	Yes	Yes	Yes		M		
Pleuropogon californicus	semaphore grass	X	X		Yes				Yes			NR	H	
Schoenoplectus americanus	three square	X					Yes		Yes	Yes		NR	H	
Schoenoplectus californicus	California bulrush	X					Yes		Yes	Yes		NR	H	
Stipa lepida	foothill needlegrass			X	Yes		Yes	Yes			Yes	VL		Synonym: *Nassella lepida*
Stipa pulchra	purple needlegrass			X	Yes		Yes	Yes			Yes	VL		Synonym: *Nassella pulchra*
Typha angustifolia	narrowleaf cattail	X					Yes		Yes	Yes		NR	H	
Typha latifolia	cattail	X					Yes		Yes	Yes		NR	H	

Botanical Name	Common Name	Low Zone (Riparian)	Mid Zone (Meadowland)	High Zone (Upland)	Vegetated Swales	Bioretention	Extended Detention Basin	Vegetated Buffer	Constructed Wetland	Tolerates Saturation	Drought Tolerant	WUCOLS	Likely WUCOLS if not rated	Other Notes
Herbaceous Plants														
Achilea millefolium	CA Native cultivars			X	Yes	Yes				Yes	L			
Achilea millefolium	non-native cultivars			X	Yes	Yes					M			
Aster sp.	aster		X	X	Yes	Yes		Yes			M			
Athyrium filix-femina	lady fern		X	X	Yes	Yes		Yes			M			For use in shade only
Blechnum spicant	deer fern		X	X	Yes	Yes	Yes	Yes			L			For use in shade only
Camassia leichtilinii	camas lily	X	X		Yes	Yes	Yes				NR	M		
Camassia quamash	common camas	X	X		Yes	Yes	Yes				M			
Epilobium canum	California fuschia			X	Yes	Yes		Yes*			Yes	L		
Eriogonum fasciculatum	flattop buckwheat			X	Yes	Yes					Yes	L		
Eschscholzia californica	California poppy			X	Yes	Yes					Yes	VL		
Fragaria chiloensis	beach strawberry			X	Yes	Yes		Yes		Yes	Yes	M		
Iris douglasiana	Douglas iris		X	X	Yes	Yes		Yes		Yes	Yes	L		
Lupinus bicolor	miniature lupine			X	Yes	Yes		Yes		Yes	Yes	NR	L	Tolerates saturation in winter only
Lupinus polyphyllus	large leaf lupine		X	X	Yes	Yes		Yes		Yes		H		similar to Russell hybrids
Mimulus guttatus	seep monkey flower	X	X		Yes		Yes		Yes	Yes		H		
Polypodium californicum	California polypody		X	X	Yes	Yes		Yes			Yes	VL		
Polypodium glycrrhiza	licorice fern		X	X	Yes	Yes		Yes			Yes	NR	L	
Polystichum californicum	California sword fern	X	X	X	Yes	Yes	Yes	Yes	Yes	Yes	Yes	M		
Polystichum munitum	western sword fern	X	X	X	Yes	Yes	Yes	Yes	Yes	Yes		M		
Pteridium aquilinum	bracken fern		X	X	Yes	Yes	Yes	Yes				NR	M	
Sisyrinchium bellum	blue-eyed grass			X	Yes	Yes		Yes		Yes	Yes	VL		
Sisyrinchium californicum	yellow-eyed grass		X	X	Yes	Yes		Yes		Yes		M		
Veronica liwanensis	speedwell			X	Yes	Yes		Yes				M		

Botanical Name	Common Name	Low Zone (Riparian)	Mid Zone (Meadowland)	High Zone (Upland)	Vegetated Swales	Bioretention	Extended Detention Basin	Vegetated Buffer	Constructed Wetland	Tolerates Saturation	Drought Tolerant	WUCOLS	Likely WUCOLS if not rated	Other Notes
Shrubs														
Acmispon glaber	deerweed			X	Yes	Yes		Yes			Yes	VL		Formerly known as *Lotus scoparius*
Amelanchier alnifolia	western serviceberry											M		
Arctostaphylos manzanita	common manzanita			X		Yes		Yes			Yes	VL		Hybrids are considered low water-use
Arctostaphylos uva-ursi	manzanita 'Emerald Carpet'			X		Yes					Yes	L		
Baccharis pillularis	coyote brush		X	X	Yes	Yes		Yes			Yes	L		
Baccharis salicifolia	mulefat		X	X	Yes	Yes	Yes	Yes	Yes	Yes	Yes	L		
Berberis aquifolium	Oregon grape		X	X	Yes	Yes		Yes				M		Variety repens is considered low water-use
Berberis pinnata	California barberry			X	Yes	Yes		Yes			Yes	L		Formerly known as *Mahonia pinnata*
Calycanthus occidentalis	Western spicebush		X	X	Yes	Yes		Yes		Yes	Yes	L		
Ceanothus sp	California lilac			X	Yes			Yes			Yes	L		Most species and cultivars ore considered low water-use
Cercis occidentalis	redbud			X	Yes			Yes			Yes	VL		
Cornus sp	dogwood		X	X	Yes	Yes	Yes	Yes		Yes	Yes	M		
Cornus sericea	dogwood		X	X	Yes	Yes	Yes	Yes		Yes		H		
Cornus stolonifera	redtwig dogwood		X		Yes	Yes	Yes	Yes		Yes		H		
Frangula californica	coffee berry			X	Yes			Yes			Yes	L		Also known as Rhamnus californica
Hebe 'Autumn Glory'	hebe		X	X	Yes	Yes		Yes				M		
Heteromeles arbutifolia	toyon		X	X	Yes	Yes		Yes		Yes	Yes	L		
Holodiscus discolor	ocean spray			X	Yes	Yes		Yes			Yes	L		
Lonicera involucrata	twinberry			X	Yes	Yes					Yes	L		similar to L. hispidula
Mimulus aurantiacus	sticky monkey flower		X	X	Yes	Yes	Yes	Yes		Yes		VL		
Mimulus cardinalis	scarlet monkey flower		X	X	Yes	Yes	Yes	Yes		Yes	Yes	L		
Morella californica	wax myrtle			X	Yes	Yes		Yes			Yes	M		Formerly known as *Myrica californica*
Oemleria cerasiformis	Indian plum		X	X	Yes	Yes		Yes				M		
Philadelphus lewisii	mock orange		X	X	Yes	Yes		Yes				M		
Philadelphus mexicanus	evergreen mock orange		X	X	Yes	Yes		Yes				L		
Physocarpus capitatus	Pacific ninebark		X	X	Yes	Yes		Yes			Yes	NR	L	
Ribes aureum	golden currant		X	X	Yes			Yes			Yes	L		
Ribes sanguineum	red flowering currant		X	X	Tes			Yes			Yes	L		
Rosa californica	California wild rose		X	X	Yes	Yes		Yes			Yes	L		
Rosa nutkana	Nootka rose		X	X	Yes	Yes		Yes			Yes	L		
Rosemarinus officinalis	rosemary			X	Yes			Yes*			Yes	L		
Rubus ursinus	California blackberry		X	X	Yes			Yes			Yes	L		
Salvia clevelandii	Cleveland sage			X	Yes			Yes*			Yes	L		
Sambucus cerulea	blue elderberry		X	X	Yes	Yes	Yes	Yes		Yes	Yes	L		
Sambucus mexicana	western elderberry		X	X	Yes	Yes	Yes	Yes		Yes	Yes	L		
Sambucus racemosa	red elderberry		X	X	Yes	Yes	Yes	Yes		Yes	Yes	L		
Spirea douglasii	Douglas spirea				Yes	Yes		Yes			Yes	M		
Symphoricarpos albus	snowberry		X	X	Yes	Yes	Yes	Yes		Yes	Yes	M		For use in shade only
Viburnum edule	highbush cranberry	X	X	X	Yes	Yes	Yes	Yes		Yes	Yes	NR	L	

Botanical Name	Common Name	Low Zone (Riparian)	Mid Zone (Meadowland)	High Zone (Upland)	Vegetated Swales	Bioretention	Extended Detention Basin	Vegetated Buffer	Constructed Wetland	Tolerates Saturation	Drought Tolerant	Street Tree	WUCOLS	Other Notes
Trees														
Acer buergerianum	Trident maple			X	Yes			Yes				Yes	M	2-3' planter
Acer campestre	Hedge maple			X	Yes			Yes				Yes	M	2-3' planter
Acer circinatum	vine maple	X	X	X	Yes	Yes		Yes		Yes		No	M	
Acer davidii	David's maple		X	X	Yes	Yes		Yes		Yes		Yes	M	2-3' planter
Acer fremanii	Freeman's maple			X	Yes	Yes		Yes			Yes	Yes	M	5-6' planter
Acer ginnala	Amur maple			X	Yes	Yes		Yes				Yes	M	2-3' planter
Acer macrophylum	Big leaf maple			X	Yes	Yes		Yes		Yes		No	M	
Acer pseudoplatanus	Sycamore maple			X	Yes	Yes		Yes				Yes	M	5-6' planter
Acer rubrum	Red maple			X	Yes	Yes		Yes				Yes	M	3-4' planter
Acer negundo 'Flamingo'	flamingo box eder			X	Yes	Yes		Yes				Yes	M	2-3' planter
Aesculus californica	California buckeye		X	X	Yes	Yes	Yes	Yes		Yes	Yes	Yes	VL	8' planter
Aesculus carnea	Red horsechestnut			X	Yes	Yes		Yes				Yes	M	4-5' planter
Alnus cordata	Italian alder		X	X	Yes	Yes		Yes				Yes	M	?
Carpinus betulus	various cultivars		X	X	Yes	Yes		Yes				Yes	M	3-4' planter
Cercis canadensis	eastern redbud		X	X	Yes	Yes		Yes				Yes	M	2-3' planter
Cercis canadensis 'texensis'	Texas redbud		X	X	Yes	Yes		Yes			Yes	Yes	M	2-3' planter
Cercis occidentalis	western redbud		X	X	Yes	Yes		Yes			Yes	Yes	VL	2-3' planter
Crataegus phaenopyrum	Washington thorn			X	Yes	Yes		Yes				Yes	M	possibly invasive
Fraxinus latifolia	Oregon ash	X	X		Yes	Yes	Yes	Yes	Yes	Yes		Yes	M	
Magnolia grandiflora	Little gem' or 'St. Mary'			X	Yes	Yes		Yes				Yes	M	3-4' planter
Magnolia grandiflora	Samuel Somner' or 'Russet'			X	Yes	Yes		Yes				Yes	M	6-8' planter
Metasequoia glyptostroboides	Dawn redwood		X	X	Yes	Yes		Yes				Yes	H	8' planter only
Populus fremontii	Fremont's cottonwood	X	X	X	Yes	Yes		Yes				Yes?	M	8' planter only
Pyrus calleryana	Flowering pear			X	Yes	Yes		Yes				Yes	M	need to specify varieties
Quercus agrifolia	Coast live oak		X	X	Yes	Yes		Yes				Yes	VL	8' planter only
Quercus garyana	Oregon white oak		X	X				Yes		Yes	Yes	No	L	
Quercus lobata	Valley oak		X	X	Yes	Yes		Yes		Yes	Yes	Yes	L	8' planter only
Quercus suber	Cork oak			X	Yes	Yes		Yes		Yes	Yes	Yes	L	6-8' planter
Salix laevigata	Red willow	X	X	X	Yes	Yes		Yes		Yes	Yes	No	H	
Salix lasiolepis	Arroyo willow	X	X	X	Yes	Yes		Yes		Yes	Yes	No	H	
Salix lucida ssp. Lasiandra	Shining willow	X	X	X	Yes	Yes		Yes		Yes	Yes	No	H	
Washingtonia robusta	Mexican fan palm		X	X	Yes	Yes		Yes			Yes	Yes	L	5-6' planter, possibly other species should be explored