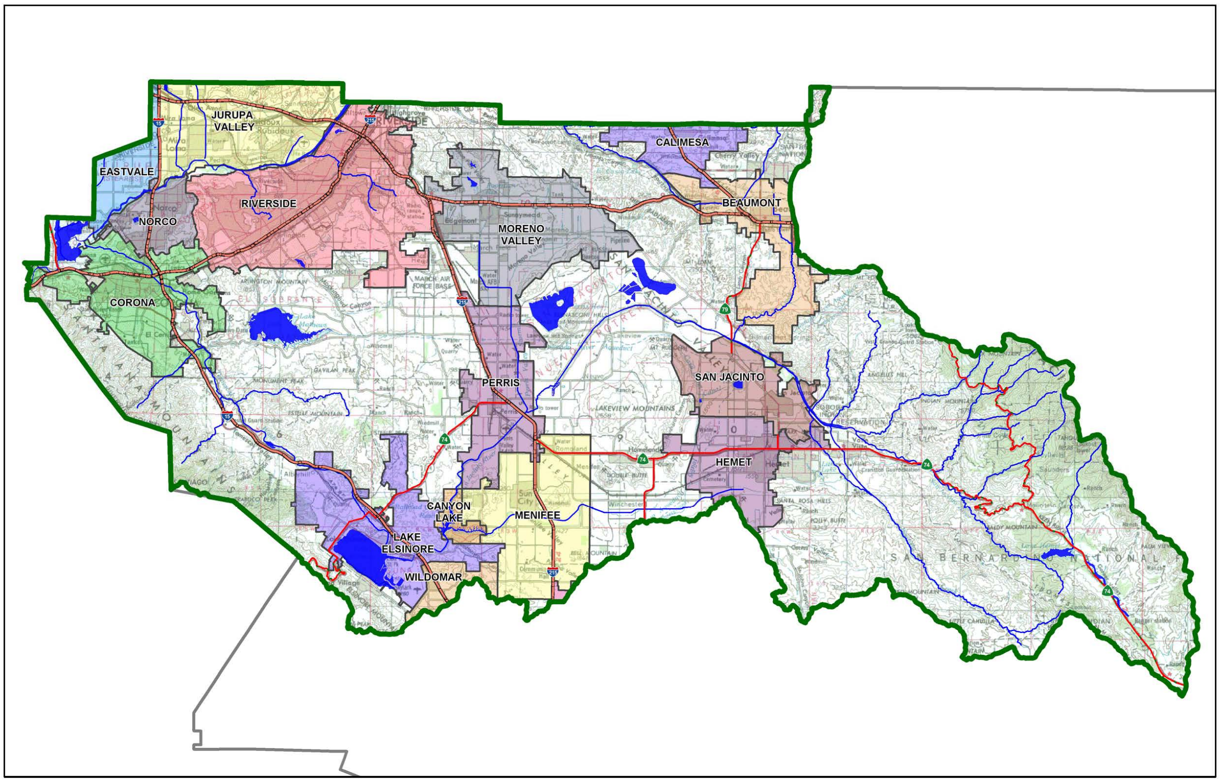
Project Specific Water Quality Management Plan

A Template for Projects located within the ***Santa Ana Watershed*** *Region of Riverside County*

Project Title: 15209 LINCOLN STREET COMMERCIAL MIXED USE

Development No: Insert text here

Design Review/Case No: 2020-092



Contact Information:

Prepared for:
Golcheh Group
1180 S. Beverly Drive #300
Los Angeles, CA 90035
Phone: (310) 923-2594
Contact: Ilan Golcheh

Prepared by:
ATC Design Group
1277 Pacific Oaks Place, Suite 102
Escondido, CA 92029
Phone: (760) 738-8800
Contact: Jim Turpin, P.E.

☒ **Preliminary**
☐ **Final**

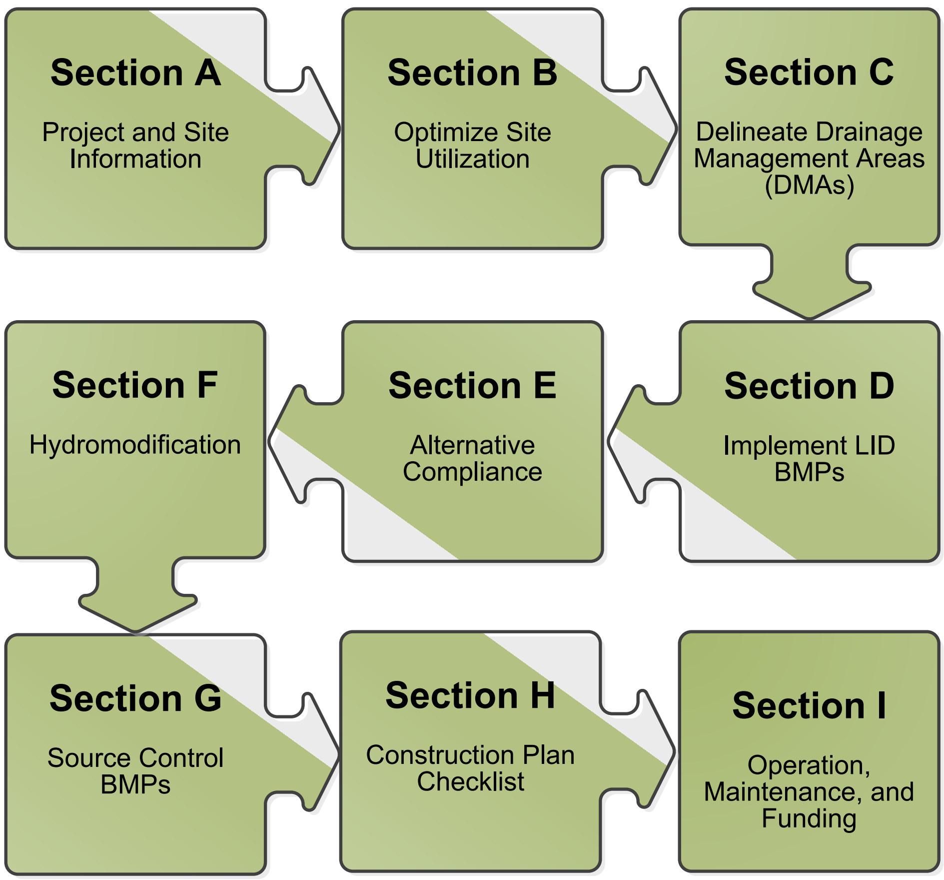
Original Date Prepared: 3/30/2020

Revision Date(s): 11/20/20

Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**
Template revised June 30, 2016

A Brief Introduction

This Project-Specific WQMP Template for the **Santa Ana Region** has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your “how-to” manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Golcheh Group by ATC Design Group for the 15209 Lincoln Street Mixed Use Commercial project.

This WQMP is intended to comply with the requirements of The City of Lake Elsinore for Ord. 1296 § 1, 2012 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under The City of Lake Elsinore Water Quality Ordinance (Municipal Code Section 14.08).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature	12/03/20 Date
Ilan Golcheh Owner's Printed Name	Manager Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

James A. Turpin Preparer's Signature	12/3/2020 Date
James A. Turpin Preparer's Printed Name	Principal Civil Engineer Preparer's Title/Position

Preparer's Licensure:

Table of Contents

List of Tables

List of Appendices

Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Mixed use Commercial
Planning Area:	Insert text here
Community Name:	Insert text here
Development Name:	15209 Lincoln Street Commercial Mixed Use
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°40'33.50"N, 117°22'30.89"W	
Project Watershed and Sub-Watershed: Santa Ana River, San Jacinto Valley, Elsinore	
Gross Acres: 6.29 Acres	
APN(s): 379-111-014	
Map Book and Page No.: Book 8, Page 377 of Maps	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Mixed Use Commercial
Proposed or Potential SIC Code(s)	4226, 5411, 5812, 7542, 7999
Area of Impervious Project Footprint (SF)	212,214
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	212,214
Does the project consist of offsite road improvements?	☒ Y ☐ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)	0 SF
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	Insert text here.
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	Insert text here.
What is the Water Quality Design Storm Depth for the project?	0.80 inches

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling
- BMP Locations (Lat/Long)

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Lake Elsinore / HU#802.31	DDT, Nutrients, Organic Enrichment/Low Dissolved Oxygen, PCBs, Toxicity	REC1, REC2, WARM, WILD, COMM, RARE	

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* City of Lake Elsinore Grading Permit	☒ Y	☐ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, **constraints** might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. **Opportunities** might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

Yes – The existing topography of the undeveloped lot sheet flows south, spilling onto Riverside Drive. Final discharge s to the City's MS4 system. The proposed design will convey roof and site improvement runoff via non-erosive storm drain improvements to WQMP Biofiltration Basins and/or underground storage facilities that include biofiltration treatment prior to discharging from the project site directly to the City's MS4.

Did you identify and protect existing vegetation? If so, how? If not, why?

No – site will be cleared and grubbed for grading activities.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

Infiltration is not allowed due to the City's Highest and Best Use Principle.

Did you identify and minimize impervious area? If so, how? If not, why?

15% minimum landscape area per Planning Conditions. Landscape was incorporated throughout the site to meet this requirement while maintaining the required parking and other site hardscape features.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Yes, all impervious surfaces will be directed to landscaped and biofiltration facilities.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1,2]	Area (Sq. Ft.)	DMA Type
Drainage Area A	*Impervious*	*37,837*	*Roof*
	Impervious	*7,261*	*PCC*
	Impervious	*43,481*	*AC*
	Pervious	*4,031*	*Landscape*
Drainage Area B	*Impervious*	*4,475*	*Roof*
	Impervious	*6,208*	*PCC*
	Impervious	*24,732*	*AC*
	Pervious	*3,821*	*Landscape*
Drainage Area C1	*Impervious*	*2,313*	*Roof*
	Impervious	*2,397*	*PCC*
	Impervious	*20,370*	*AC*
	Pervious	*4,436*	*Landscape*
Drainage Area C2	*Impervious*	*2,276*	*Roof*
	Impervious	*2,428*	*PCC*
	Impervious	*8,724*	*AC*
	Pervious	*4,967*	*Landscape*
Drainage Area D	*Impervious*	*9,245*	*Roof*
	Impervious	*7,067*	*PCC*
	Impervious	*33,400*	*AC*
	Pervious	*8,256*	*Landscape*

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*
[2]*If multi-surface provide back-up*

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA-A-ST	*17,642*	Landscape, slope < 5%	Low Flow

Table C.3 Type 'B', Self-Retaining Areas

Self-Retaining Area				Type 'C' DMAs that are draining to the Self-Retaining Area		
DMA Name/ ID	Post-project surface type	Area (square feet)	Storm Depth (inches)	DMA Name / ID	[C] from Table C.4 =	Required Retention Depth (inches)
		[A]	[B]		[C]	[D]

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Impervious fraction	Product	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
AREA A	BMP A
AREA B	BMP B
AREA C1	BMP C1
AREA C2	BMP C1
AREA D	BMP D

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☒ Y ☐ N

If yes has been checked, Infiltration BMPs shall not be used for the site; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?		
If Yes, list affected DMAs:		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: 0.991

Type of Landscaping (Conservation Design or Active Turf): Conservation Design

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 4.872

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: 1.85

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: 9.013

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
9.013	0.991

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users: 600

Project Type: Retail / Office Commercial

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 4.872

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-2 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: 167

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: 814

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
814	600

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

N/A

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand: Projected Average Daily Use (gpd)

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4: Enter Value

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: Minimum use required (gpd)

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
Minimum use required (gpd)	Projected Average Daily Use (gpd)

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment per Section 3.4.2 of the WQMP Guidance Document.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
AREA A	☐	☐	☐	☒	☐
AREA B	☐	☐	☒	☒	☐
AREA C1	☐	☐	☒	☒	☐
AREA C2	☐	☐	☒	☒	☐
AREA D	☐	☐	☒	☒	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

Infiltration BMPs are not allowed due to Highest and Best use principles. Harvest and use has been shown to be infeasible. DMA A will incorporate an underground retention system that will either gravity flow or be pumped through a biofiltration cell (or "wetland mod") connected to the City's storm drain system. The remaining DMAs will incorporate bioretention and biotreatment. Each bioretention facility will include surface ponding, "engineered" soil mix and a gravel underlayer. Each will also include a 6" perforated underdrain pipe connected to overflow risers connected to the City's storm drain system. All retention systems and areas will be lined to prevent infiltration.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First, calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second, design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA A*		
	[A]		[B]	[C]	[A] x [C]			
DMA-A-R	*37,837*	*Impervious*	*0.306*	*0.89*	*37,750*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-A-PCC	*7,261*	*Impervious*	*0.059*	*0.89*	*6,476*			
DMA-A-AC	*43,481*	*Impervious*	*0.352*	*0.89*	*38,785*			
DMA-A-LS	*4,031*	*Pervious*	*0.004*	*0.11*	*445*			
A_T =	*92,610*				Σ= 79,457	0.80	5,297	5,999

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA B*		
	[A]		[B]	[C]	[A] x [C]			
DMA-B-R	*4475*	*Impervious*	*0.102*	*0.89*	*3,992*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-B-PCC	*6208*	*Impervious*	*0.141*	*0.89*	*5,537*			
DMA-B-AC	*24732*	*Impervious*	*0.562*	*0.89*	*22,061*			
DMA-B-LS	*3821*	*Pervious*	*0.011*	*0.11*	*422*			
A_T =	*39,237*				Σ= 32,013	0.80	2,134	2,140

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA C1*		
	[A]		[B]	[C]	[A] x [C]			
DMA-C1-R	*2313*	*Impervious*	*0.070*	*0.89*	*2,063*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-C1-PCC	*2397*	*Impervious*	*0.072*	*0.89*	*2,138*			
DMA-C1-AC	*20370*	*Impervious*	*0.616*	*0.89*	*18,170*			
DMA-C1-LS	*4436*	*Pervious*	*0.017*	*0.11*	*490*			
A_T =	*29,516*				Σ= 22,861	0.80	1,524	1,768

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA C2*		
	[A]		[B]	[C]	[A] x [C]			
DMA-C2-R	*2276*	*Impervious*	*0.069*	*0.89*	*2,030*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-C2-PCC	*2428*	*Impervious*	*0.073*	*0.89*	*2,166*			
DMA-C2-AC	*8724*	*Impervious*	*0.264*	*0.89*	*7,782*			
DMA-C2-LS	*4967*	*Pervious*	*0.019*	*0.11*	*549*			
A_T =	*18,396*				Σ=12,526	0.80	835	1,001

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*DMA D*		
	[A]		[B]	[C]	[A] x [C]			
DMA-D-R	*9245*	*Impervious*	*0.142*	*0.89*	*8,247*	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-D-PCC	*7067*	*Impervious*	*0.109*	*0.89*	*6,304*			
DMA-D-AC	*33400*	*Impervious*	*0.514*	*0.89*	*29,793*			
DMA-D-LS	*8256*	*Pervious*	*0.016*	*0.11*	*912*			
A_T =	*57,968*				Σ= 45,255	0.80	3,017	3,458

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

List DMAs here.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☐ Attached Residential Development	P	N	P	P	N	P	P	P(2)
☒ Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐ Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☒ Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐ Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☒ Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☒ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☐	☐	☒	☒	☒	☐	☐	☐

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
Total Credit Percentage[1]	

[1]Cannot Exceed 50%
[2]Obtain corresponding data from Table 3-8 in the WQMP Guidance Document

E.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**		***Enter BMP Name / Identifier Here***		
	[A]		[B]	[C]	[A] x [C]				
						Design Storm Depth (in)	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
	A_T = Σ[A]				Σ= [D]	[E]	[F] = $\frac{[D]x[E]}{[G]}$	[F] X (1-[H])	[I]

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.
[2] Cross Reference Table E.1 above to populate this column.
[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration	INSERT VALUE	INSERT VALUE	INSERT VALUE
Volume (Cubic Feet)	INSERT VALUE	INSERT VALUE	INSERT VALUE

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Susceptibility Maps.

Does the project qualify for this HCOC Exemption? ☒ Y ☐ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

Lake Elsinore

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources***: Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit***: Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative***: Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Parking lots, fueling areas, trash enclosures, landscaped areas, building roofs, food service cleanup activities, carwashes	Refer to next page	Refer to next page

Non-Structural Source Control BMPs

- N1 Education for Property Owners, Operators, Tenants, Occupants, or Employees – Educational materials will be provided in the project-specific WQMP, and a list of applicable educational materials is included in Appendix 10 of this Report.
- N2 Activity Restrictions – Language will be incorporated into each lease agreement describing activity restrictions.
- N3 Landscape Management BMPs – Irrigation system and landscaping will be maintained by full time maintenance staff for each lot using BMPs described in Education Materials.
- N4 BMP Maintenance – All BMPs will be inspected and maintained by full time maintenance staff.
- N7 Spill Contingency Plan - Maintenance staff, or contractors, will be trained in fuel and oil spill cleanup that includes dry-cleanup activities only with absorption materials that will be used and discarded in a legal manner
- N11 Common Area Litter Control – Litter control will be maintained by full time maintenance staff for each lot.
- N14 Drainage Facility Inspection and Maintenance – Drainage facilities will be inspected and maintained by full time maintenance staff.
- N15 Street Sweeping Parking Lots – Parking lots and drive aisles will be regularly vacuumed by maintenance staff, or contractor on a weekly schedule.

Structural Source Control BMPs

- S1 Storm drain stenciling - Provide signage, stenciling or labeling of all catch basins, within the project area with prohibitive language (such as: “No Dumping – Flows to Creek”) and/or graphical icons to discourage illegal dumping.
- S3 Trash Storage Areas - Trash Storage Areas will be designed in accordance with City guidelines and include a solid roof cover to protect containers from rainfall.
- S4 Landscape and Irrigation System Design – Landscape and Irrigation will be designed to incorporate drought-tolerant native plants and will use drip irrigation where feasible.
- S9 Carwash and rinse water will be directed to a self-contained system for filtering and recycling
- S12 Dry sumps will be placed between each pump islands of the fueling areas to capture and contain any fuel spills or residue. The fueling area will be raised to prevent any stormwater from draining onto the fueling areas.
- S14 All food preparation/cleanup area drains shall be connected to a sanitary sewer, via an approved grease interceptor. No cleanup activities shall occur outside the building.

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
BMP A	Retention and biofiltration for Self- Storage lot	Grading & Drainage	33°40'30.17"N 117°22'31.49"W
BMP B	Bioretention for Car Wash lot	Grading & Drainage	33°40'31.36"N 117°22'30.27"W
BMP C1	Bioretention for McDonalds lot	Grading & Drainage	33°40'32.25"N 117°22'29.64"W
BMP C2	Bioretention for McDonalds lot	Grading & Drainage	33°40'32.78"N 117°22'28.99"W
BMP D	Bioretention for 7-11 lot	Grading & Drainage	33°40'33.82"N 117°22'28.02"W

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: ***Stormwater Management Facilities Operations and Maintenance Agreement and Right of Entry***

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

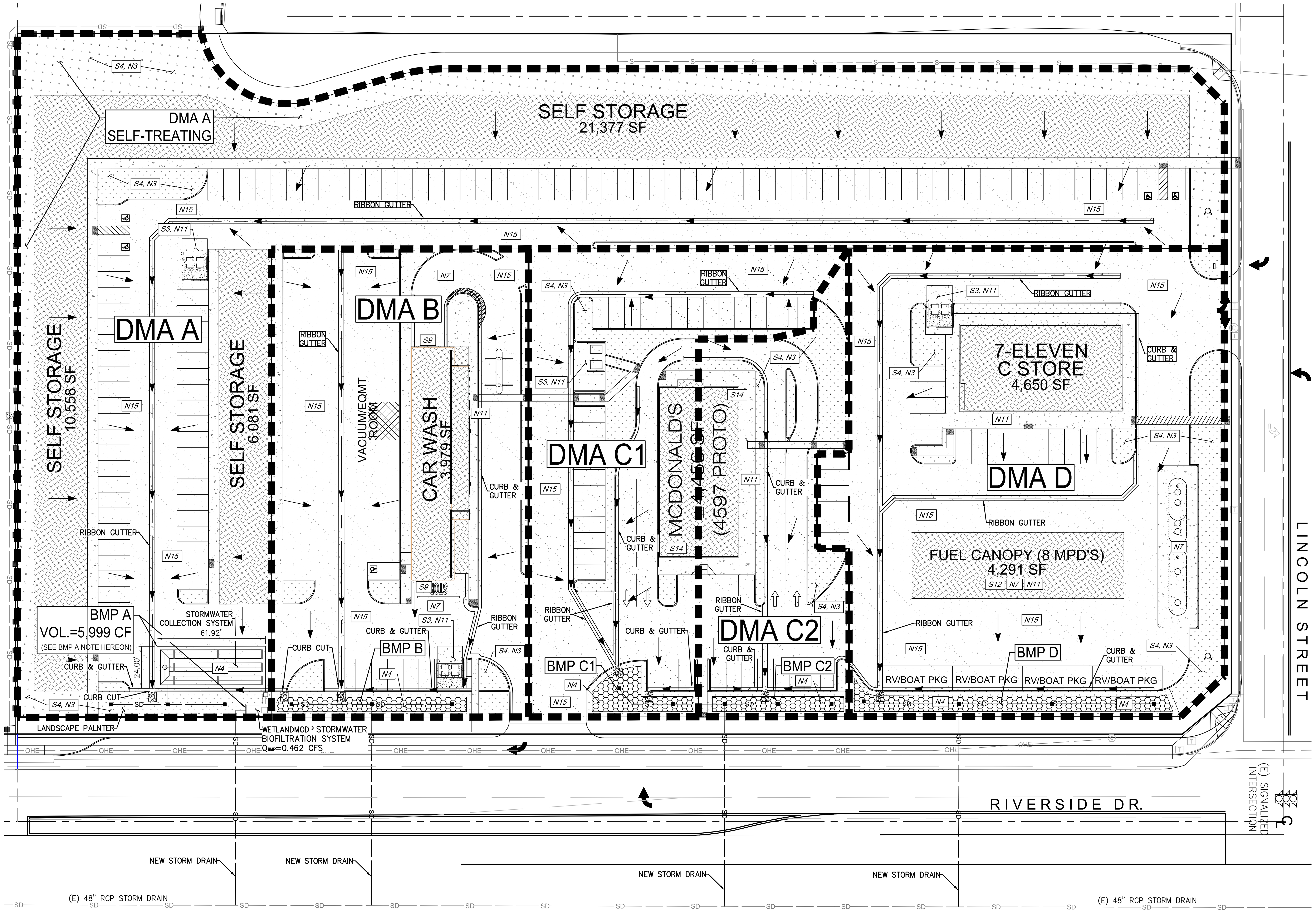
☐ Y ☒ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

Vicinity Map
Lincoln St.
Project Location
7-11 Lake Elsinnore
Riverside Dr.
Lake Elsinore
(Receiving Water)
I-15
Terra Cotta
Riverside Dr
Lincoln St
Corona Freeway
Central Ave
Collier Ave
Nichols Rd
Hwy 74
Lakeshore Dr
Lake Elsinore
5000 ft
Google Earth
© 2020 Google



LEGEND

DESCRIPTION	SYMBOL
SITE BOUNDARY	
DMA BOUNDARY	
BIORETENTION BASINS (STRUCTURAL LID BMP)	
AC PAVING	
PCC PAVING	
LANDSCAPE AREA	
ROOF	
FLOW DIRECTION	
STORM DRAIN INLET (CATCH BASIN) – S1, N14	
STORM DRAIN	SD
RIPRAP	

NON-STRUCTURAL SOURCE CONTROL BMP's

- N3 – LANDSCAPE MANAGEMENT BMPs
- N4 – BMP MAINTENANCE
- N7 – SPILL CONTINGENCY PLAN
- N11 – LITTER/DEBRIS CONTROL PROGRAM
- N14 – CATCH BASIN INSPECTION PROGRAM
- N15 – VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

STRUCTURAL SOURCE CONTROL BMP's

- S1 – PROVIDE STORM DRAIN STENCILING OR SIGNAGE
- S3 – DESIGN AND CONSTRUCT TRASH AND WASTE STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION
- S4 – USE EFFICIENT IRRIGATION SYSTEMS & LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, AND SOURCE CONTROL
- S9 – VEHICLE WASH AREAS
- S12 – FUELING AREAS
- S14 – WASH WATER CONTROL FOR FOOD PREPARATION AREAS

GENERAL INFORMATION

RECEIVING WATERS –LAKE ELSONORE

PRIORITY PROJECT POLLUTANTS OF CONCERN – PESTICIDES, TOXIC ORGANIC COMPOUNDS

HYDROLOGIC SOIL GROUP

100% OF SOIL TYPE A & B

APPROXIMATE DEPTH TO GROUNDWATER

>80 INCHES PER SOILS REPORT

INFILTRATION

INFILTRATION IS NOT ALLOWED DUE TO THE CITY OF LAKE ELSINORE HIGHEST AND BEST USE PRINCIPLES

STRUCTURAL BMPS

1) BIOFILTRATION BASIN WILL BE UTILIZED TO LIMIT POST-CONSTRUCTION PEAK RUNOFF RATES TO RATES NO GREATER THAN THOSE GENERATED BY THE PROJECT IN THE EXISTING CONDITION.

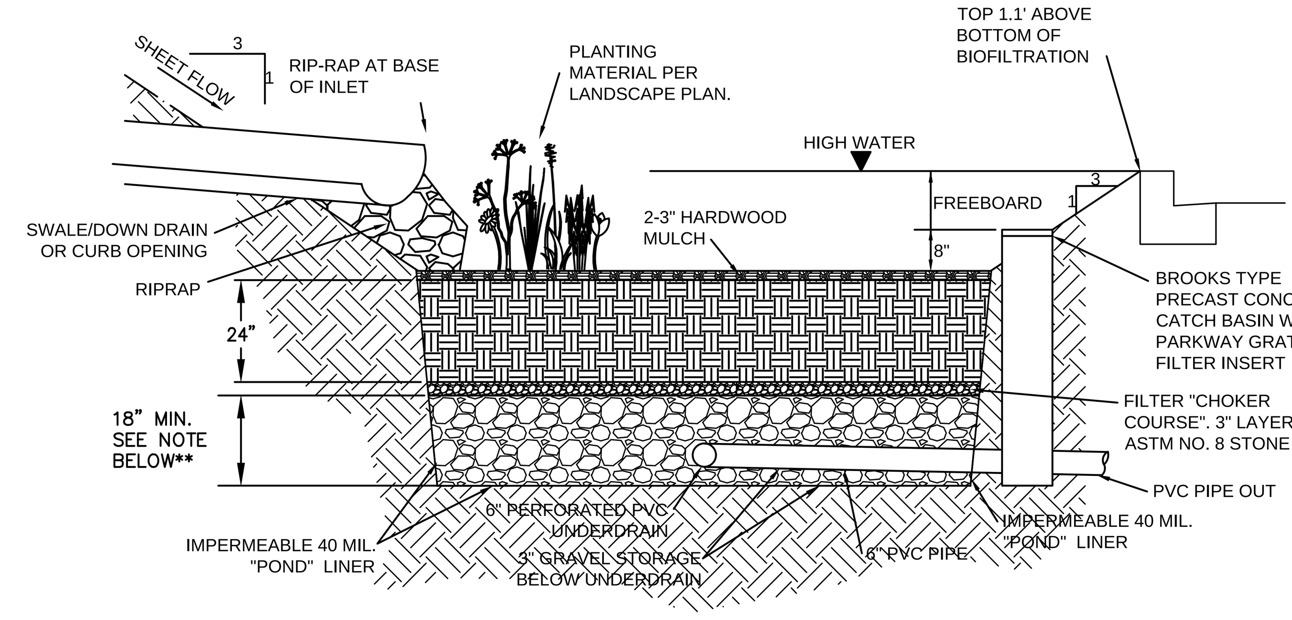
BMP A NOTE

THE STORMWATER RETENTION SYSTEM COMPRISES APPROXIMATELY 181 LF OF 60" DIA. PERFORATED CORRUGATED METAL CISTERNS (PIPES) IN A GRAVEL BACKFILLED TRENCH WITH IMPERVIOUS PLASTIC LINER.

TREATMENT WILL BE VIA A PROPRIETARY "WETLANDMOD®" STORMWATER BIOFILTRTION SYSTEM.

DRAINAGE MANAGEMENT AREA SUMMARY

ID	AREA (SF)	RUNOFF FACTOR	DCV (CF)
DMA A	110,251	0.72	5,297
DMA B	39,237	0.82	2,134
DMA C1	29,516	0.77	1,524
DMA C2	18,396	0.42	520
DMA D	57,968	0.78	3,017



*BIOFILTRATION "ENGINEERED SOIL" LAYER SHALL BE MINIMUM 18" DEEP "SANDY LOAM" SOIL MIX CONSISTING OF 3–5% ORGANIC MATTER, 8–12% FINES (SILT & CLAY), AND 85–88% WASHED SAND.

**GRAVEL LAYER – CLASS 2 CALTRANS PERMEABLE PER SPECIFICATION 68-1.025

THE EFFECTIVE AREA OF THE BASIN SHALL BE LEVEL AND SHALL BE SIZED BASED ON CITY OF SAN DIEGO STORM WATER STANDARDS MANUAL CALCULATIONS. TYPICALLY, THE SURFACE AREA OF THE BIOFILTRATION BASIN IS 4% OF THE IMPERVIOUS AREA DRAINING TO IT.

DETAIL A - BIORETENTION

NO SCALE

STRUCTURAL BMP DESIGN CRITERIA (BIORETENTION)

ITEM	SYMBOL	VOLUME (CF)	SURFACE AREA (SF)	POND DEPTH	MEDIA DEPTH	GRAVEL DEPTH
BMP B		2,140	1,651	8"	24"	24"
BMP C1		1,768	1,360	8"	24"	18"
BMP C2		1,001	1,184	8"	24"	–
BMP D		3,458	2,852	8"	24"	18"

REVISIONS

REV	REVISION	DATE

STAMP

ATC DESIGN GROUP
ARCHITECTS • ENGINEERS • SURVEYORS
1277 PACIFIC OAKS PLACE, SUITE 102, ESCONDIDO, CA 92029
PHONE: (760) 738-8800 FAX: (760) 738-8232

CLIENT:

WQMP SITE PLAN
COMMERCIAL MIXED USE CENTER
15209 LINCOLN STREET
LAKE ELSINORE, CA 92503

PROJECT NO: 20-4081
SUBMITTED DATE:
DESCRIPTION OF ISSUANCE:
PREPARED BY: JAT

SHEET DESCRIPTION:
WQMP SITE PLAN

SHEET NUMBER:
1

Appendix 2: Construction Plans

Grading and Drainage Plans

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

Not Applicable – Preliminary only

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Not Applicable

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: ATC Design Group — Date: 11/13/2020

Designed by: Jim Turpin, P.E. — Case No: 2020-092

Company Project Number/Name: 20-4081/15209 Lincoln Street Mixed Use

BMP Identification

BMP NAME / ID: BMP A

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E — D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-A-R	*37836.653*	*Roofs*	*1*	*0.89*	*33750.3*			
DMA-A-PCC	*7260.5784*	*Concrete or Asphalt*	*1*	*0.89*	*6476.4*			
DMA-A-AC	*43480.558*	*Concrete or Asphalt*	*1*	*0.89*	*38784.7*			
DMA-A-LS	*4031*	*Ornamental Landscaping*	*0.1*	*0.11*	*445.3*			
	92608.7894	***Total***			**79456.7**	**0.80**	**5297.1**	**5999**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: ATC Design Group — Date: 11/13/2020

Designed by: Jim Turpin, P.E. — Case No: 2020-092

Company Project Number/Name: 20-4081/15209 Lincoln Street Mixed Use

BMP Identification

BMP NAME / ID: BIOFILTRATION BASIN B

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-B-R	*4475.3972*	*Roofs*	*1*	*0.89*	*3992.1*			
DMA-B-PCC	*6207.5809*	*Concrete or Asphalt*	*1*	*0.89*	*5537.2*			
DMA-B-AC	*24732.3638*	*Concrete or Asphalt*	*1*	*0.89*	*22061.3*			
DMA-B-LS	*3821.204*	*Ornamental Landscaping*	*0.1*	*0.11*	*422.1*			
	39236.5459	***Total***			**32012.7**	**0.80**	**2134.2**	**2140**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: ATC Design Group | Date: 11/13/2020
Designed by: Jim Turpin, P.E. | Case No: 2020-092
Company Project Number/Name: 20-4081/15209 Lincoln Street Mixed Use

BMP Identification

BMP NAME / ID: BIOFILTRATION BASIN C1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-C1-R	*2313*	*Roofs*	*1*	*0.89*	*2063.2*			
DMA-C1-PCC	*2397*	*Concrete or Asphalt*	*1*	*0.89*	*2138.1*			
DMA-1C-AC	*20370*	*Concrete or Asphalt*	*1*	*0.89*	*18170*			
DMA-C1-LS	*4436*	*Ornamental Landscaping*	*0.1*	*0.11*	*490*			
	29516	***Total***			**22861.3**	**0.80**	**1524.1**	**1768**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries | Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: ATC Design Group
Date: 11/13/2020
Designed by: Jim Turpin, P.E.
Case No: 2020-092
Company Project Number/Name: 20-4081/15209 Lincoln Street Mixed Use

BMP Identification

BMP NAME / ID: BIOFILTRATION BASIN C2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-C-R	*2276*	*Roofs*	*1*	*0.89*	*2030.2*			
DMA-C-PCC	*2428*	*Concrete or Asphalt*	*1*	*0.89*	*2165.8*			
DMA-C-AC	*8724*	*Concrete or Asphalt*	*1*	*0.89*	*7781.8*			
DMA-C-LS	*4967*	*Ornamental Landscaping*	*0.1*	*0.11*	*548.6*			
	18395	***Total***			**12526.4**	**0.80**	***835.1***	***1001***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: ATC Design Group

Date: 11/13/2020

Designed by: Jim Turpin, P.E.

Case No: 2020-092

Company Project Number/Name: 20-4081/15209 Lincoln Street Mixed Use

BMP Identification

BMP NAME / ID: BIOFILTRATION BASIN D

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-D-R	*9245.2074*	*Roofs*	*1*	*0.89*	*8246.7*			
DMA-D-PCC	*7066.915*	*Concrete or Asphalt*	*1*	*0.89*	*6303.7*			
DMA-D-AC	*33399.859*	*Concrete or Asphalt*	*1*	*0.89*	*29792.7*			
DMA-D-LS	*8255.9255*	*Ornamental Landscaping*	*0.1*	*0.11*	*911.9*			
	57967.9069	***Total***			**45255**	**0.80**	**3017**	**3458**

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name: ATC Design Group | Date: 11/13/2020

Designed by: Jim Turpin, P.E. | Case No: 2020-092

Company Project Number/Name: 20-4081/15209 Lincoln Street Mixed Use

BMP Identification

BMP NAME / ID: BMP A

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMA-A-R	*37836.653*	*Roofs*	*1*	*0.89*	*33750.3*			
DMA-A-PCC	*7260.5784*	*Concrete or Asphalt*	*1*	*0.892*	*6476.4*			
DMA-A-AC	*43480.558*	*Concrete or Asphalt*	*1*	*0.892*	*38784.7*			
DMA-A-LS	*4031*	*Ornamental Landscaping*	*0.1*	*0.11046*	*445.3*			
	92608.7894	***Total***			**79456.7**	**0.20**	**0.4**	**0.462**

Notes:

BASIN A

Worksheet B.2-1 DCV

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.8000	inches
2	Area tributary to BMP (s)	A=	2.531	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.72	unitless
4	Trees Credit Volume	TCV=		cubic-feet
5	Rain barrels Credit Volume	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	5,297	cubic-feet

BASIN B

Worksheet B.2-1 DCV

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.8000	inches
2	Area tributary to BMP (s)	A=	0.901	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.82	unitless
4	Trees Credit Volume	TCV=		cubic-feet
5	Rain barrels Credit Volume	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	2,134	cubic-feet

BASIN C1

Worksheet B.2-1 DCV

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.8000	inches
2	Area tributary to BMP (s)	A=	0.678	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.77	unitless
4	Trees Credit Volume	TCV=		cubic-feet
5	Rain barrels Credit Volume	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1,524	cubic-feet

BASIN C2

Worksheet B.2-1 DCV

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.8000	inches
2	Area tributary to BMP (s)	A=	0.422	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.68	unitless
4	Trees Credit Volume	TCV=		cubic-feet
5	Rain barrels Credit Volume	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	835	cubic-feet

BASIN D

Worksheet B.2-1 DCV

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.8000	inches
2	Area tributary to BMP (s)	A=	1.331	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.78	unitless
4	Trees Credit Volume	TCV=		cubic-feet
5	Rain barrels Credit Volume	RCV=		cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	3,017	cubic-feet

DMA A

Effective Tributary Area = 110,251 SF
Effective Tributary Area = 2.531 Acres

DMA Name	Post Project Surface Type	Post Project Surface	DMA Area (SF)	DMA Runoff Factor	C	Imp. Fraction (I_f)
DMA-A-R	Roof	Impervious	37837	1.0	0.892	0.306
DMA-A-PCC	PCC	Impervious	7261	1.0	0.892	0.059
DMA-A-AC	AC	Impervious	43481	1.0	0.892	0.352
DMA-A-LS	Landscape	Pervious	4031	0.1	0.110	0.004
DMA-A-ST	Self-treating Landscape	Pervious	17642	-	-	-
		Check	110251		I_f =	0.7207

DMA B

Effective Tributary Area = 39,237 SF
Effective Tributary Area = 0.901 Acres

DMA Name	Post Project Surface Type	Post Project Surface	DMA Area (SF)	DMA Runoff Factor	C	Imp. Fraction (I_f)
DMA-B-R	Roof	Impervious	4475	1.0	0.892	0.102
DMA-B-PCC	PCC	Impervious	6208	1.0	0.892	0.141
DMA-B-AC	AC	Impervious	24732	1.0	0.892	0.562
DMA-B-LS	Landscape	Pervious	3821	0.1	0.110	0.011
		Check	39236.5	ΣCxAx =	I_f =	0.8159

DMA C1

Effective Tributary Area = 29516 SF
Effective Tributary Area = 0.678 Acres

DMA Name	Post Project Surface Type	Post Project Surface	DMA Area (SF)	DMA Runoff Factor	C	Imp. Fraction (I_f)
DMA-C1-R	Roof	Impervious	2313	1.0	0.892	0.070
DMA-C1-PCC	PCC	Impervious	2397	1.0	0.892	0.072
DMA-C1-AC	AC	Impervious	20370	1.0	0.892	0.616
DMA-C1-LS	Landscape	Pervious	4436	0.1	0.110	0.017
		Check	29516	ΣCxAx =	I_f =	0.7745

DMA C2

Effective Tributary Area = 18396 SF
Effective Tributary Area = 0.422 Acres

DMA Name	Post Project Surface Type	Post Project Surface	DMA Area (SF)	DMA Runoff Factor	C	Imp. Fraction (I_f)
DMA-C2-R	Roof	Impervious	2276	1.0	0.892	0.110
DMA-C2-PCC	PCC	Impervious	2428	1.0	0.892	0.118
DMA-C2-AC	AC	Impervious	8724	1.0	0.892	0.423
DMA-C2-LS	Landscape	Pervious	4967	0.1	0.110	0.030
		Check	18396	ΣCxAx =	I_f =	0.6810

DMA D

Effective Tributary Area = 57968 SF
Effective Tributary Area = 1.331 Acres

DMA Name	Post Project Surface Type	Post Project Surface	DMA Area (SF)	DMA Runoff Factor	C	Imp. Fraction (I_f)
DMA-D-R	Roof	Impervious	9245	1.0	0.892	0.142
DMA-D-PCC	PCC	Impervious	7067	1.0	0.892	0.109
DMA-D-AC	AC	Impervious	33400	1.0	0.892	0.514
DMA-D-LS	Landscape	Pervious	8256	0.1	0.110	0.016
		Check	57968	ΣCxAx =	I_f =	0.7807

DESIGN CAPTURE VOLUME (DVC)

Location: 34° 8'30.29"N Latitude
117°18'53.15"W Longitude

Given:

D_{85} = 0.800 inches

DA	SIZE (AC)	SIZE (SF)	C	DCV REQ. (CF)	TOTAL DCV PROVIDED (CF)	Check
A	2.53	110,251	0.72	5297	**2,054**	RESIZE
B	0.90	39,237	0.82	2134	**2,140**	OK
C1	0.68	29,516	0.77	1524	**1,768**	OK
C2	0.42	18,396	0.42	520	**1,001**	OK
D	1.33	57,968	0.78	3017	**3,458**	OK
			Total Site DCV =			

Where:

$DCV = D_{85} * C * A_{TRIB}/12$

BASIN WQMP VOLUME CALCULATIONS

BASIN	TYPE	PONDING DEPTH (D'_1)	SURFACE AREA (SF)	BOTTOM AREA (SF)	SOIL MEDIA (D'_2)	GRAVEL (D'_3)	DCV PROVIDED (CF)
A	Bioretention	1.00	1432	787	2	1.5	2,054
B	Bioretention	0.67	1651	915	2	2	2,140
C1	Bioretention	0.67	1360	855	2	1.5	1,768
C2	Bioretention	0.67	1184	646	2	0	1,001
D	Bioretention	0.67	2852	1630	2	1.5	3,458

System Information

CSP Information	Qty..	U of M	
Pipe Diameter	60.0	Inch	
Total Lineal Feet	181.3	Ft.	
End Area	19.6	Cu. Ft.	Pipe dia. * 3.14
Total Pipe Volume	3558.8	Cu. Ft.	Total Lineal FT * End Area
Rock Void Info			
System Width	24.0	Ft.	
System Length	61.9	Ft.	
Pipe Height	60.0	Inch	
Cover	1.0	Ft.	
Base Fill	0.5	Ft.	
Total Height	6.5	Ft.	Base + Cover + Pipe
Total Area	1486.1	Sq. Ft.	Width * Length
Total Rock Void	6100.7	Cu. Ft.	Total Area * Total Height - Total Pipe Vol.
40% Rock Void	2440.3	Cu. Ft.	Total Rock Void * 40%
Total Rock (Tons)	372.82	Tons	Total Rock Void / Cu. Yd * 1.65
Geotextile 4oz (15'x360')	0.9	Rolls	
Total System Storage	5,999.11	Cu. Ft.	Total Pipe Vol. + 40% Rock Void

9560

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

This project is exempt from hydromodification (reference HCOC Exemption 3)

All site discharge will be to an existing 48” RCP storm drain within Riverside Drive. This storm drain flows southwest to the concrete lined Leach Canyon Channel approximately 900 feet downstream. The Leach Canyon Channel discharges directly Lake Elsinore, which is an exempt “sump”

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

Non-Structural Source Control BMPs

- N1 Education for Property Owners, Operators, Tenants, Occupants, or Employees – Educational materials will be provided in the project-specific WQMP, and a list of applicable educational materials is included in Appendix 10 of this Report.
- N2 Activity Restrictions – Language will be incorporated into each lease agreement describing activity restrictions.
- N3 Landscape Management BMPs – Irrigation system and landscaping will be maintained by full time maintenance staff for each lot using BMPs described in Education Materials.
- N4 BMP Maintenance – All BMPs will be inspected and maintained by full time maintenance staff.
- N7 Spill Contingency Plan - Maintenance staff, or contractors, will be trained in fuel and oil spill cleanup that includes dry-cleanup activities only with absorption materials that will be used and discarded in a legal manner
- N11 Common Area Litter Control – Litter control will be maintained by full time maintenance staff for each lot.
- N14 Drainage Facility Inspection and Maintenance – Drainage facilities will be inspected and maintained by full time maintenance staff.
- N15 Street Sweeping Parking Lots – Parking lots and drive aisles will be regularly vacuumed by maintenance staff, or contractor on a weekly schedule.

Structural Source Control BMPs

- S1 Storm drain stenciling - Provide signage, stenciling or labeling of all catch basins, within the project area with prohibitive language (such as: "No Dumping – Flows to Creek") and/or graphical icons to discourage illegal dumping.
- S3 Trash Storage Areas - Trash Storage Areas will be designed in accordance with City guidelines and include a solid roof cover to protect containers from rainfall.
- S4 Landscape and Irrigation System Design – Landscape and Irrigation will be designed to incorporate drought-tolerant native plants and will use drip irrigation where feasible.
- S9 Carwash and rinse water will be directed to a self-contained system for filtering and recycling
- S12 Dry sumps will be placed between each pump islands of the fueling areas to capture and contain any fuel spills or residue. The fueling area will be raised to prevent any stormwater from draining onto the fueling areas.
- S14 All food preparation/cleanup area drains shall be connected to a sanitary sewer, via an approved grease interceptor. No cleanup activities shall occur outside the building.

•

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

The BMP maintenance/funding mechanism will be the responsibility of the current site owner(s) and their successors and shall be responsible for all future required operation and maintenance of the on-site water quality BMPs.

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

Riverside County Stormwater Program Members

City of Banning
(951) 922-3105

City of Beaumont
(951) 769-8520

City of Calimesa
(909) 795-9801

City of Canyon Lake
(951) 244-2955

City of Cathedral City
(760) 770-0340

City of Coachella
(760) 398-3502

City of Corona
(951) 736-2447

City of Desert Hot Springs
(760) 329-6411

City of Eastvale
(951) 361-0900

City of Hemet
(951) 765-2300

City of Indian Wells
(760) 346-2489

City of Indio
(760) 391-4000

City of Jurupa Valley
(951) 332-6464

City of Lake Elsinore
(951) 674-3124

City of La Quinta
(760) 777-7000

City of Menifee
(951) 672-6777

City of Moreno Valley
(951) 413-3000

City of Murrieta
(951) 304-2489

City of Norco
(951) 270-5607

City of Palm Desert
(760) 346-0611

City of Palm Springs
(760) 323-8299

City of Perris
(951) 943-6100

City of Rancho Mirage
(760) 324-4511

City of Riverside
(951) 826-5311

City of San Jacinto
(951) 487-7330

City of Temecula
(951) 694-6444

City of Wildomar
(951) 677-7751

Coachella Valley Water District
(760) 398-2651

County of Riverside
(951) 955-1000

Riverside County Flood Control District
(951) 955-1200

Stormwater Pollution

What you should know for...

Industrial & Commercial Facilities

Best Management Practices (BMPS) for:

- Industrial Facilities
- Commercial Facilities

<u>YOU</u> can prevent Stormwater Pollution following these practices...

Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.
- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an <u>emergency</u>, call the Fire Department's Haz Mat Team at 911.

Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at <u>www.cabmphandbooks.com</u>.

Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: <u>www.waterboards.ca.gov</u>, select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: <u>fcnpdes@rcflood.org</u>.

We ❤ our Watershed!

A clean and healthy watershed is important to all of us.

Trash, debris, chemicals and other contaminants from business activities often make their way into the Riverside County storm drain system. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife.

Did you know?

There is a difference between storm drains and sewers.

Storm drains capture rainwater and flow directly to our rivers, lakes and streams – untreated.

Sewers capture and collect water from sinks, toilets and floor drains, and then it is processed and treated before it is released into the environment.

For more information about how you can protect our watershed, please visit:

www.rcwatershed.org

Questions?

If you have questions about Best Management Practices, or if you have questions about illicit dumping and stormwater pollution visit the Pollution Prevention website: rcwatershed.org.

For more information on requirements for all retail food facilities go to Riverside County Environmental Health's website: rivcoeh.org

RIVERSIDE COUNTY
WATERSHED PROTECTION

Riverside County Watershed Protection Program is managed by Riverside County Flood Control & Water Conservation District in partnership with 27 Cities, the County of Riverside and the Coachella Valley Water District.

OUR MISSION

"To protect, preserve and enhance the quality of Riverside County watersheds by fostering a community-wide commitment to clean water."

Watershed Protection

Food Service Industry Best Practices

Restaurants
Mobile Food Trucks
Grocery Stores
Bakeries
Delicatessens

Best Kitchen Practices

Recycle Oil & Grease

- Never put oil or grease down the drain. Contain grease and oil by using covered grease storage containers or installing a grease interceptor.
- Never overfill your grease storage container or transport it without a cover.
- Grease control devices must be emptied and cleaned by permitted companies and according to manufacturer's specifications.
- Keep maintenance records on site.
- For a list of oil/grease recycling companies, contact CalRecycle www.calrecycle.ca.gov or contact your local sanitation district.

Managing Spills

- Clean food spills in loading and trash areas by using absorbent materials and sweeping then mopping.
- Discharge mop water into the sewer through a grease interceptor.
- Have spill containment and cleanup kits available.
- To report serious toxic spills, call 911.

Handling Toxic Chemicals

- Dispose of all unwanted toxics materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash!
- Use non-toxic cleaning products whenever possible.
- For information on hazardous waste transporters, call (888) 722-4234.

Dumpster Areas

- Keep dumpster lids closed and the areas around them clean.
- Do not fill with liquid waste or hose them out.
- Call your trash hauler to replace any dumpsters that are damaged or leaking.

Cleaning & Maintenance

- Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to a sanitary sewer.
- Sweep outside areas and put the debris in trash containers DO NOT hose down or sweep into the parking lot or street.
- Outside eating areas and sidewalks may not be hosed down or pressure washed UNLESS the following standards are met:
  - ✓ Use dry cleanup methods prior to any pressure washing – absorbing with kitty litter, sweeping, vacuuming, scraping off dried debris.
  - ✓ Wash waters must be captured for proper disposal: collected waters should be discharged to a sanitary drain.
  - ✓ DO NOT use any chemicals or detergents.
  - ✓ DO NOT wash or pour water in a parking lot, alley, sidewalk or street.

Mobile Food Trucks

- The potential for generating stormwater pollution as part of a mobile food business requires special attention. Cleaning activities are required to be conducted at an approved fixed location with a connection to a sanitary sewer. For more information contact Riverside County Environmental Health at (888) 722-4234.
- Do not discharge wash water into storm drains.
- Clean on a properly equipped wash pad and drain wastewater to a sanitary sewer system.

Food Waste Disposal

- Scrape food waste off of plates, pots and food prep areas and dispose of in the trash.
- Food scraps often contain grease, which can clog sewer pipes and result in costly sewer backups and overflows.
- Never put food waste down the drain.

RECYCLE USED OIL

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage — SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Fueling Areas SD-30

Photo Credit: Geoff Brosseau

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- ☑ Collect and Convey

Description

Fueling areas have the potential to contribute oil and grease, solvents, car battery acid, coolant and gasoline to the stormwater conveyance system. Spills at vehicle and equipment fueling areas can be a significant source of pollution because fuels contain toxic materials and heavy metals that are not easily removed by stormwater treatment devices.

Approach

Project plans must be developed for cleaning near fuel dispensers, emergency spill cleanup, containment, and leak prevention.

Suitable Applications

Appropriate applications include commercial, industrial, and any other areas planned to have fuel dispensing equipment, including retail gasoline outlets, automotive repair shops, and major non-retail dispensing areas.

Design Considerations

Design requirements for fueling areas are governed by Building and Fire Codes and by current local agency ordinances and zoning requirements. Design requirements described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements.

Designing New Installations

Covering

Fuel dispensing areas should provide an overhanging roof structure or canopy. The cover's minimum dimensions must be equal to or greater than the area within the grade break. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across the fueling area. The fueling area should drain to the project's treatment control BMP(s) prior to discharging to the stormwater conveyance system. Note - If fueling large equipment or vehicles that would prohibit the use of covers or roofs, the fueling island should be designed to sufficiently accommodate the larger vehicles and equipment and to prevent stormwater run-on and runoff. Grade to direct stormwater to a dead-end sump.

Surfacing

Fuel dispensing areas should be paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete should be prohibited. Use asphalt sealant to protect asphalt paved areas surrounding the fueling area. This provision may be made to sites that have pre-existing asphalt surfaces.

The concrete fuel dispensing area should be extended a minimum of 6.5 ft from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 ft, whichever is less.

Grading/Contouring

Dispensing areas should have an appropriate slope to prevent ponding, and be separated from the rest of the site by a grade break that prevents run-on of urban runoff. (Slope is required to be 2 to 4% in some jurisdictions' stormwater management and mitigation plans.)

Fueling areas should be graded to drain toward a dead-end sump. Runoff from downspouts/roofs should be directed away from fueling areas. Do not locate storm drains in the immediate vicinity of the fueling area.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

- In the case of an emergency, provide storm drain seals, such as isolation valves, drain plugs, or drain covers, to prevent spills or contaminated stormwater from entering the stormwater conveyance system.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Vehicle Washing Areas SD-33

Photo Credit: Geoff Brosseau

Design Objectives

- ☑ Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- ☑ Collect and Convey

Description

Vehicle washing, equipment washing, and steam cleaning may contribute high concentrations of metals, oil and grease, solvents, phosphates, and suspended solids to wash waters that drain to stormwater conveyance systems.

Approach

Project plans should include appropriately designed area(s) for washing-steam cleaning of vehicles and equipment. Depending on the size and other parameters of the wastewater facility, wash water may be conveyed to a sewer, an infiltration system, recycling system or other alternative. Pretreatment may be required for conveyance to a sanitary sewer.

Suitable Applications

Appropriate applications include commercial developments, restaurants, retail gasoline outlets, automotive repair shops and others.

Design Considerations

Design requirements for vehicle maintenance are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. Design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Areas for washing/steam cleaning should incorporate one of the following features:

- Be self-contained and/or covered with a roof or overhang
- Be equipped with a clarifier or other pretreatment facility
- Have a proper connection to a sanitary sewer

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Include other features which are comparable and equally effective

CAR WASH AREAS - Some jurisdictions' stormwater management plans include vehicle-cleaning area source control design requirements for community car wash racks in complexes with a large number of dwelling units. In these cases, wash water from the areas may be directed to the sanitary sewer, to an engineered infiltration system, or to an equally effective alternative. Pre-treatment may also be required.

Depending on the jurisdiction, developers may be directed to divert surface water runoff away from the exposed area around the wash pad (parking lot, storage areas), and wash pad itself to alternatives other than the sanitary sewer. Roofing may be required for exposed wash pads.

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. Jurisdictions may require some form of pretreatment, such as a trap, for these areas.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment.

Additional Information

Maintenance Considerations

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).

- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

Targeted Constituents

✓	Sediment	■
✓	Nutrients	▲
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

CASQA California Stormwater Quality Association be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft^2 of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

Pollutant	Removal Rate
Total Phosphorus	70-83%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-80%
Total Suspended Solids	90%
Organics	90%
Bacteria	90%

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at $111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of $24,000 (PGDER, 1993). And a new residential development spent a total of approximately $100,000 using bioretention cells on each lot instead of nearly $400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

References and Sources of Additional Information

Coffman, L.S., R. Goo and R. Frederick, 1999: Low impact development: an innovative alternative approach to stormwater management. Proceedings of the 26th Annual Water Resources Planning and Management Conference ASCE, June 6-9, Tempe, Arizona.

Davis, A.P., Shokouhian, M., Sharma, H. and Minami, C., "Laboratory Study of Biological Retention (Bioretention) for Urban Stormwater Management," *Water Environ. Res.*, 73(1), 5-14 (2001).

Davis, A.P., Shokouhian, M., Sharma, H., Minami, C., and Winogradoff, D. "Water Quality Improvement through Bioretention: Lead, Copper, and Zinc," *Water Environ. Res.*, accepted for publication, August 2002.

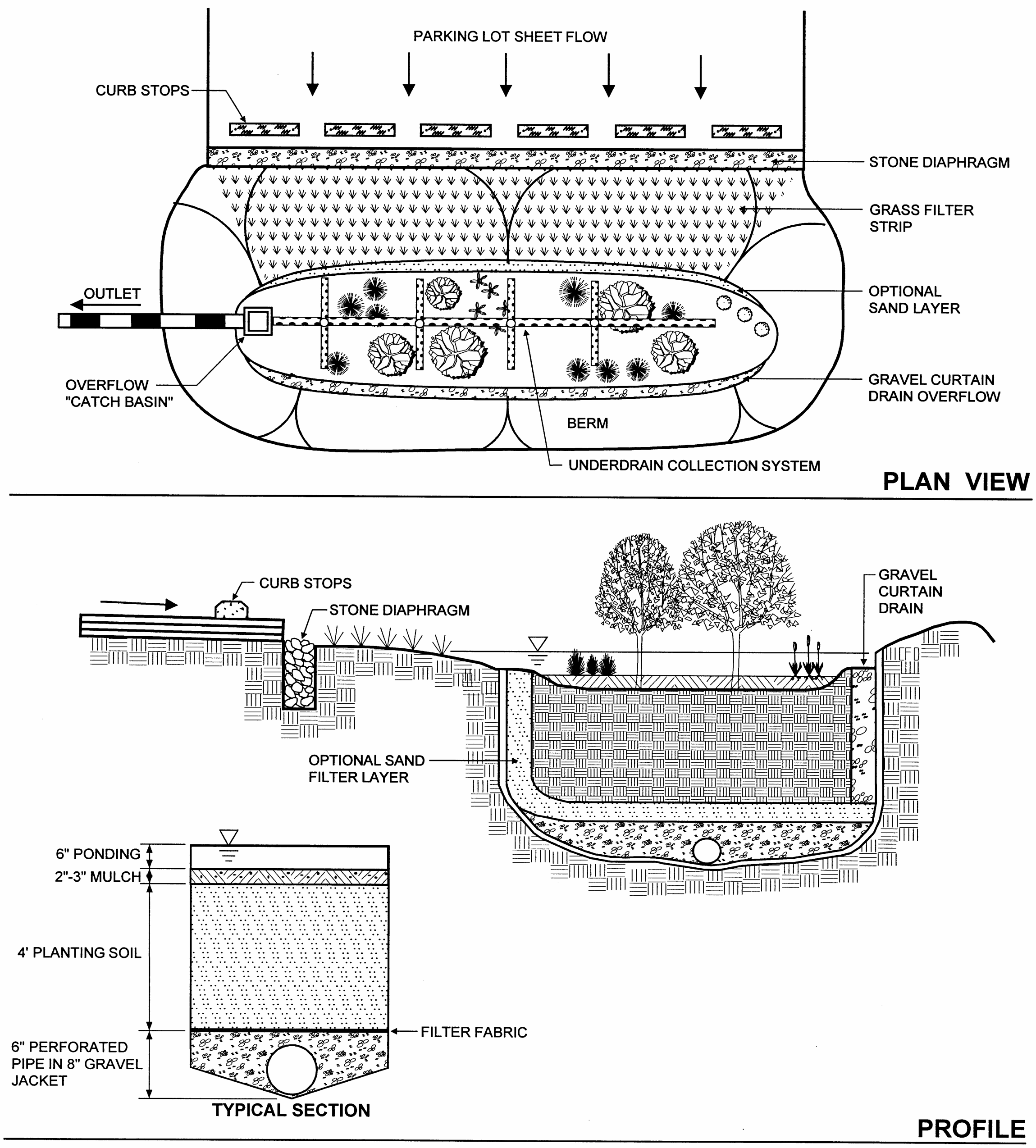
Kim, H., Seagren, E.A., and Davis, A.P., "Engineered Bioretention for Removal of Nitrate from Stormwater Runoff," *WEFTEC 2000 Conference Proceedings on CDROM Research Symposium, Nitrogen Removal*, Session 19, Anaheim CA, October 2000.

Hsieh, C.-h. and Davis, A.P. "Engineering Bioretention for Treatment of Urban Stormwater Runoff," *Watersheds 2002, Proceedings on CDROM Research Symposium*, Session 15, Ft. Lauderdale, FL, Feb. 2002.

Prince George's County Department of Environmental Resources (PGDER), 1993. Design Manual for Use of *Bioretention in Stormwater Management*. Division of Environmental Management, Watershed Protection Branch. Landover, MD.

U.S. EPA Office of Water, 1999. Stormwater Technology Fact Sheet: Bioretention. EPA 832-F-99-012.

Weinstein, N. Davis, A.P. and Veeramachaneni, R. "Low Impact Development (LID) Stormwater Management Approach for the Control of Diffuse Pollution from Urban Roadways," *5th International Conference Diffuse/Nonpoint Pollution and Watershed Management Proceedings*, C.S. Melching and Emre Alp, Eds. 2001 International Water Association



Schematic of a Bioretention Facility (MDE, 2000)

Bio Clean

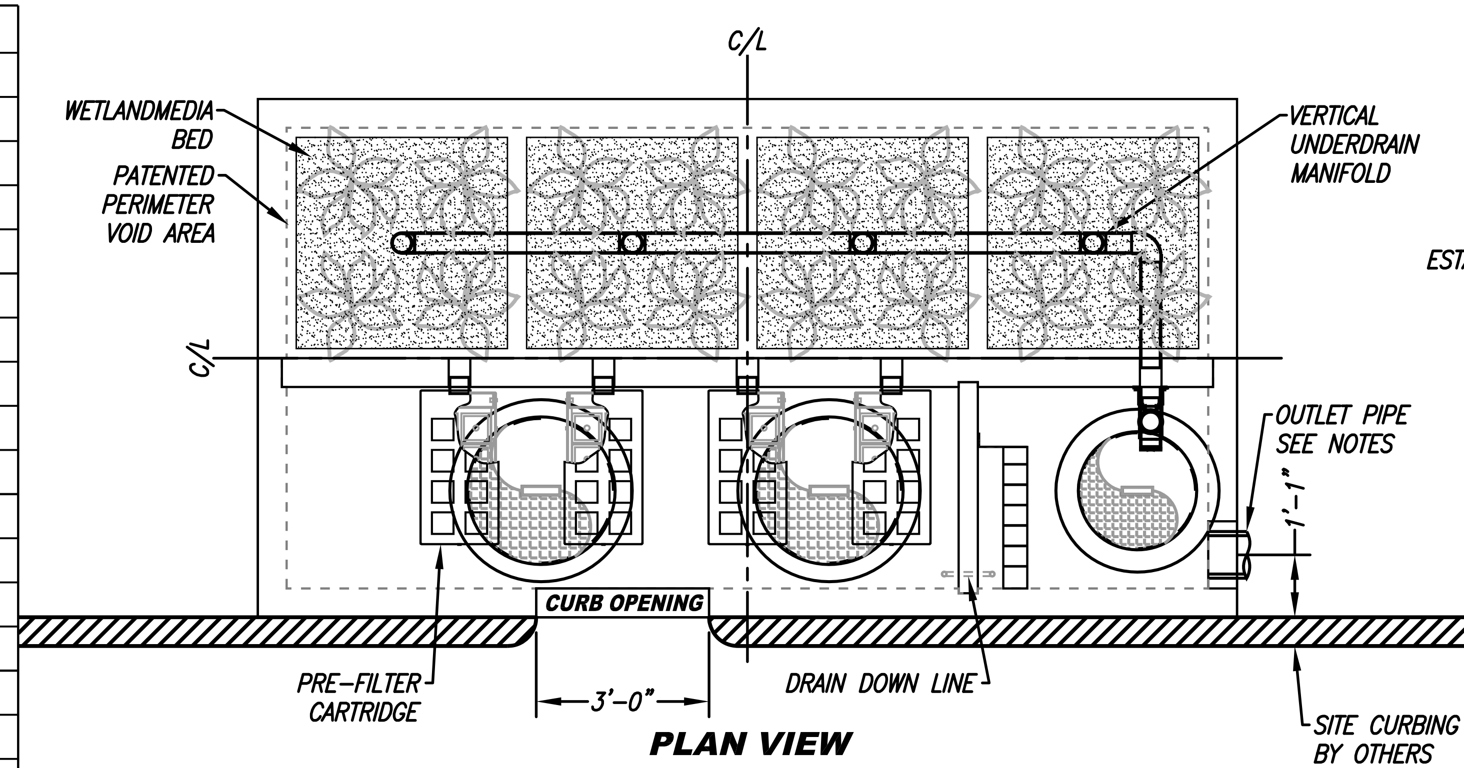
A Forterra Company

WetlandMod®

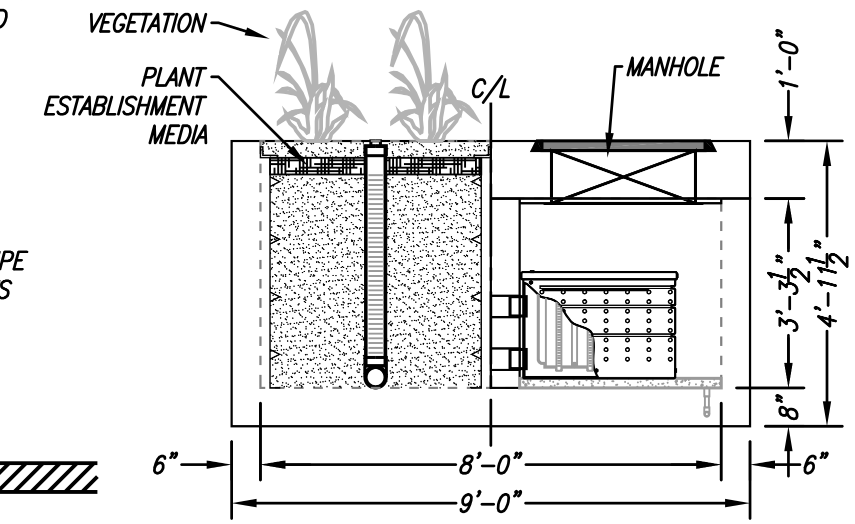
A Stormwater Biofiltration Solution

SITE SPECIFIC DATA

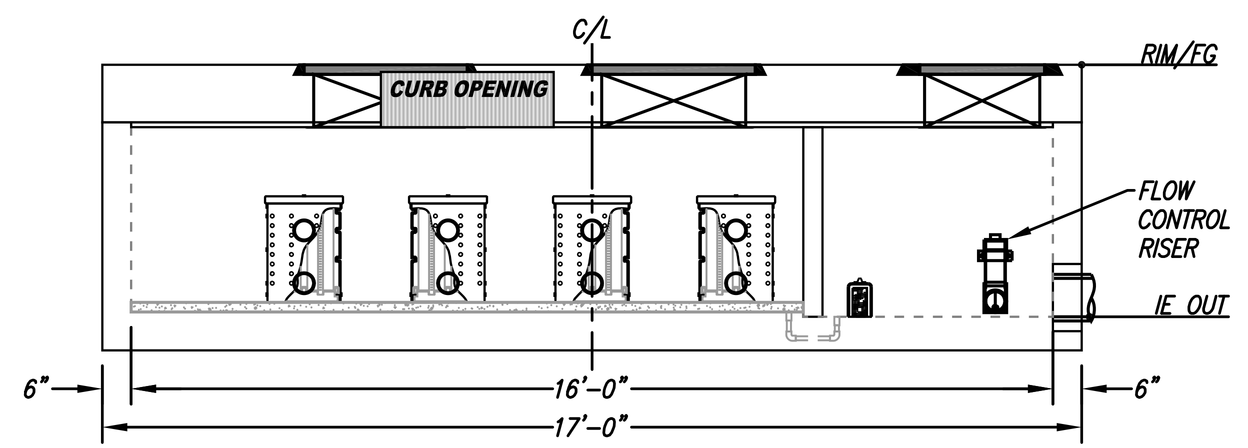
PROJECT NUMBER			
ORDER NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
TREATMENT HGL AVAILABLE (FT)			
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN	OPEN PLANTER	PEDESTRIAN
FRAME & COVER	2EA ø30"	N/A	ø24"
WETLANDMEDIA VOLUME (CY)			TBD
ORIFICE SIZE (DIA. INCHES)			TBD
NOTES: PRELIMINARY NOT FOR CONSTRUCTION.			



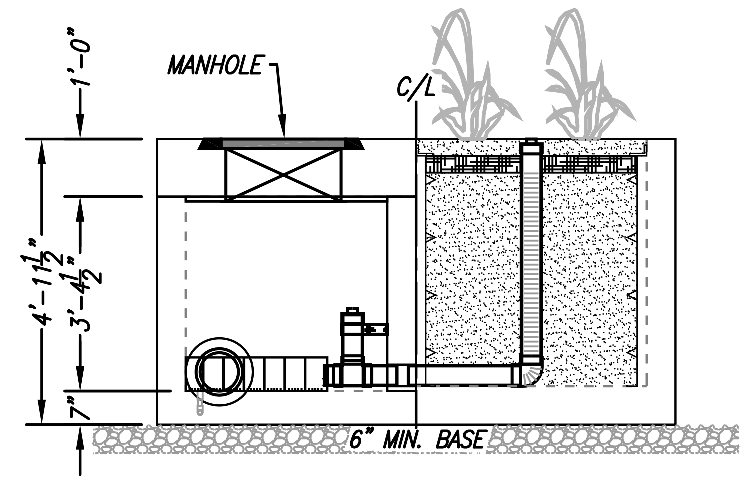
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

TREATMENT FLOW (CFS)	0.462
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

Bio Clean
A Forterra Company

MWS-L-8-16-C
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

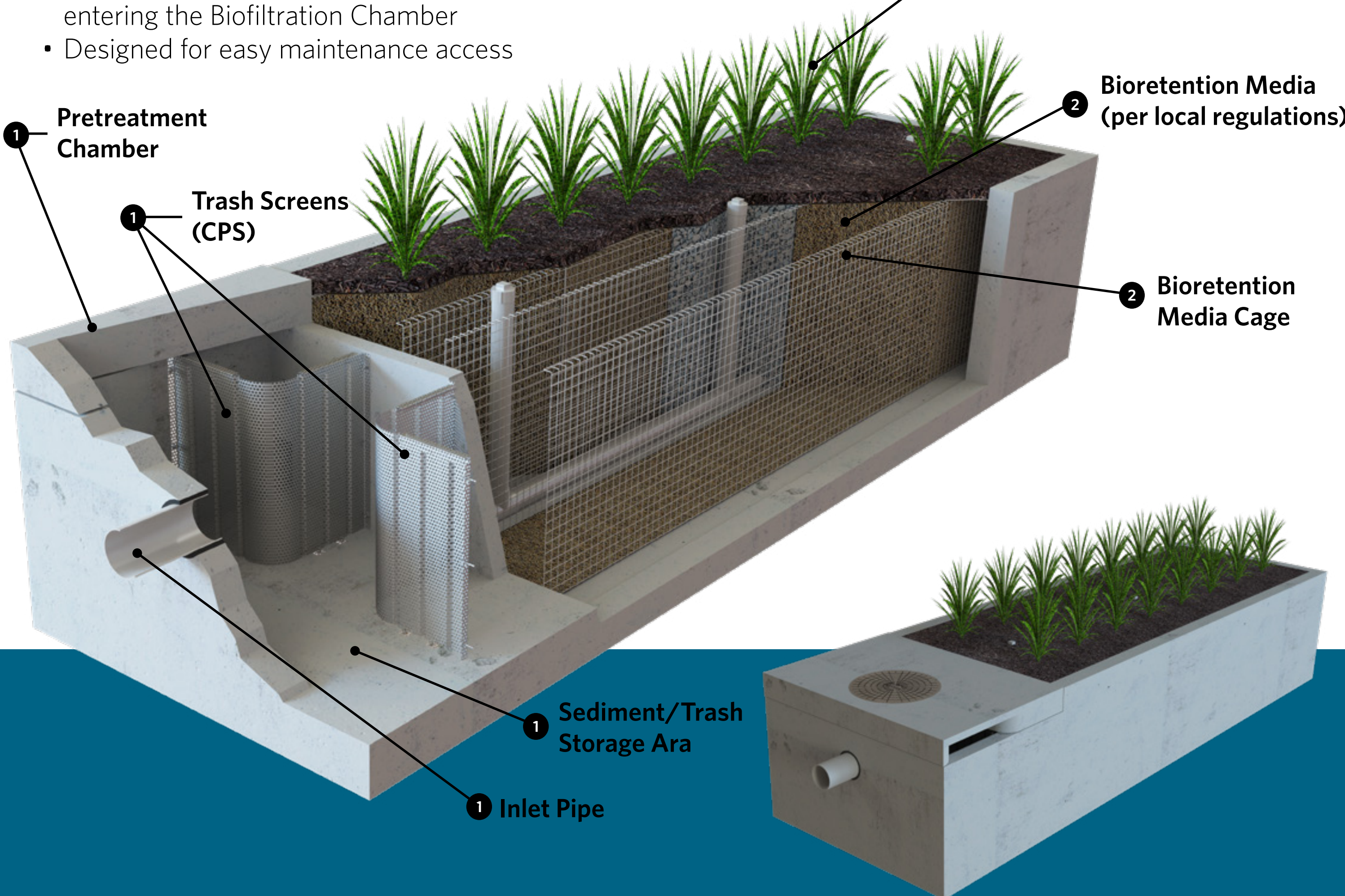
OVERVIEW

The WetlandMod® provides the ***right*** direction in stormwater bioretention/biofiltration treatment, leveraging the same horizontal flow advantages as the Modular Wetlands® System Linear to combine screening, separation, and biofiltration treatment stages.

WetlandMod is a modular compact solution, and Low Impact Development (LID) solution which is functionally equivalent to bioretention, with up to a 50% smaller footprint and the ability to reduce and control water volume in a more efficient way.

1 PRETREATMENT CHAMBER

Separation
- Trash, sediment, and debris are separated before entering the Biofiltration Chamber
- Designed for easy maintenance access



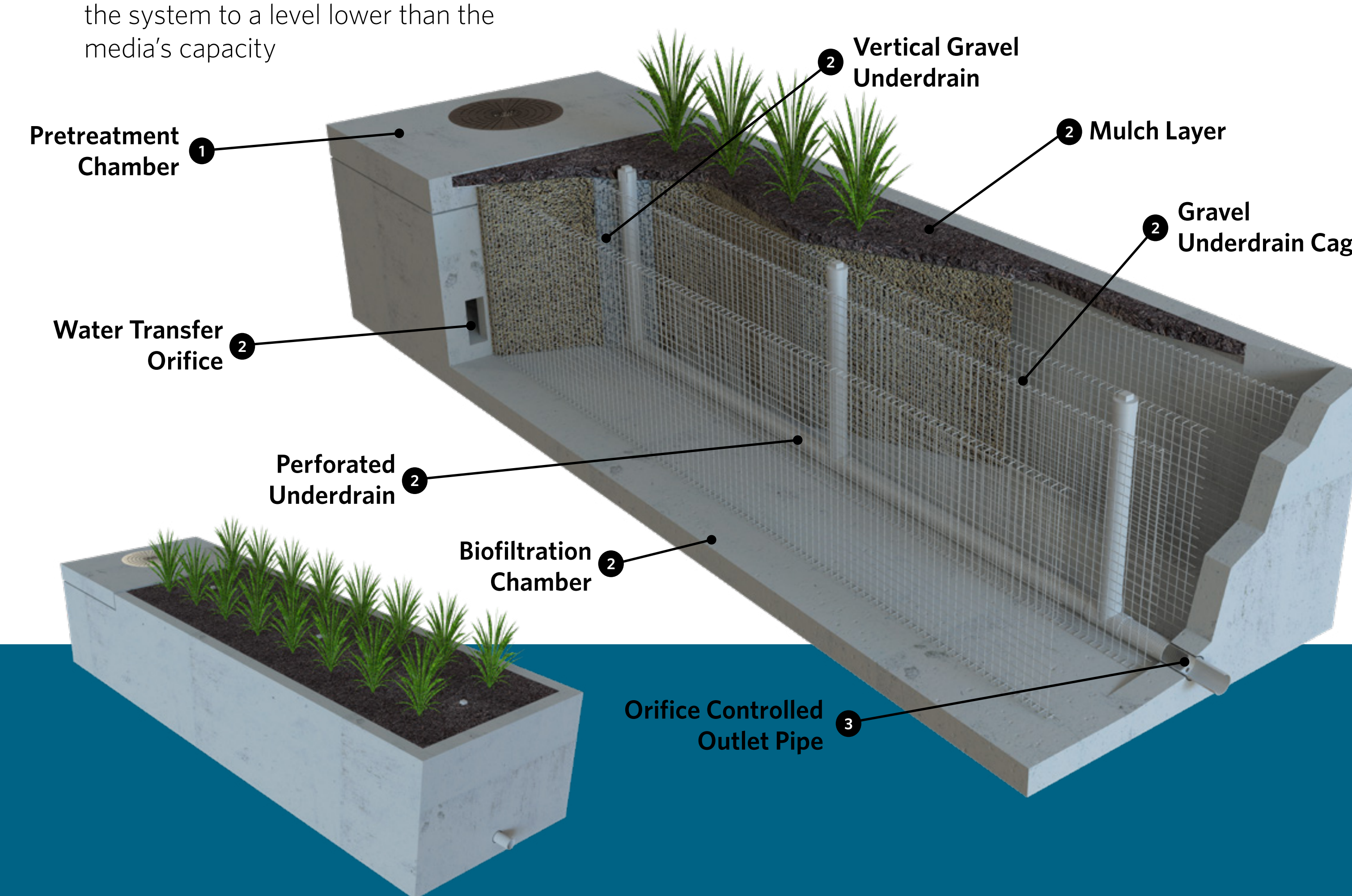
2 BIOFILTRATION CHAMBER

Horizontal Flow
- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Vertical Void Area
- Vertical ponding area between the walls and biofiltration media
- Maximizes surface area of the media for higher treatment capacity

3 DISCHARGE

Flow Control
- Orifice plate controls flow of water through the system to a level lower than the media's capacity
- Extends the life of the media and improves performance



ADVANTAGES

- REDUCES CLOGGING
- BUILT-IN PRETREATMENT
- USES AGENCY PRESCRIBED BIORETENTION SOILS
- NO DEPRESSED LANDSCAPING/ PONDING WATER
- 50% SMALLER FOOTPRINT
- LID COMPLIANT
- NO STANDING WATER / VECTOR CONTROL ISSUES

ADVANTAGES

- 5" - 12"/ HOUR INFILTRATION RATE
- LOW MAINTENANCE COSTS
- INCREASED AESTHETIC APPEAL
- NO SAFETY CONCERNS

APPROVALS

WASHINGTON ECOLOGY

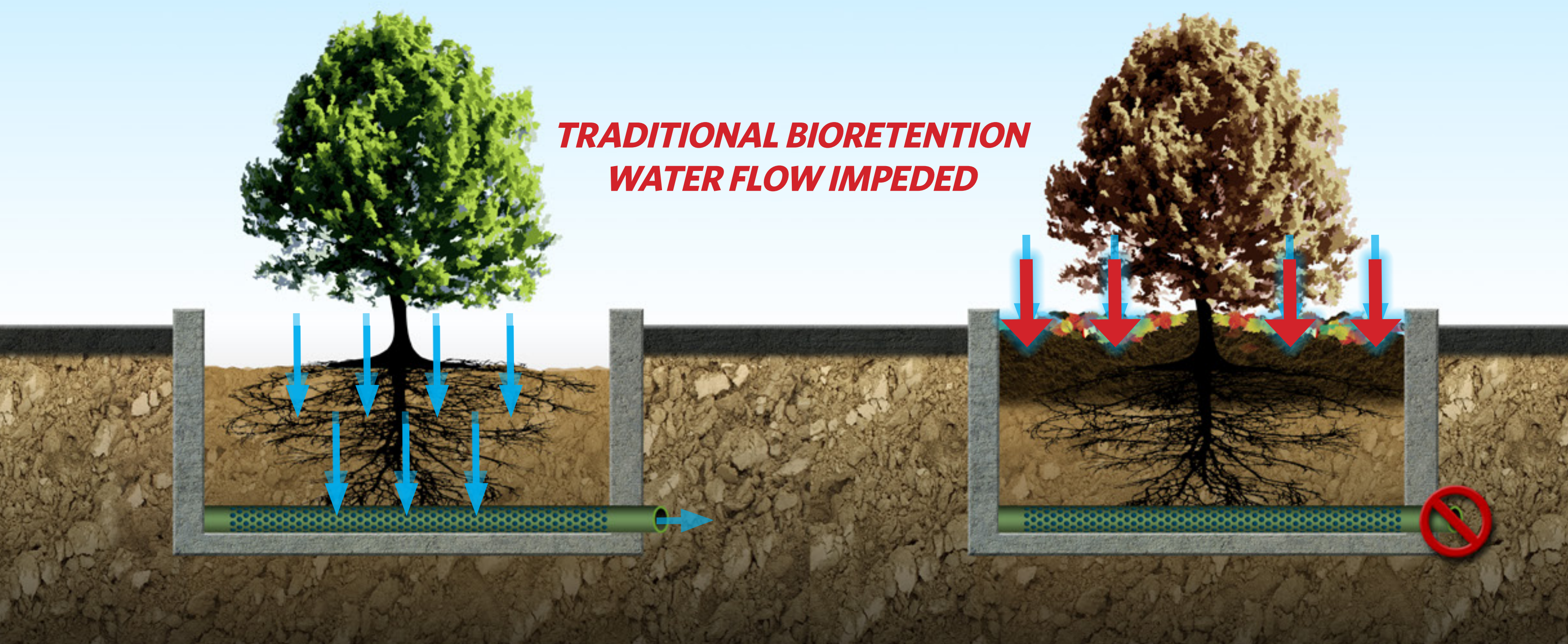
Functionally Equivalent to a Bioretention Facility for Treating Stormwater

(Bioretention examples: Planter Boxes, Rain Gardens, Biofiltration)

ALTERNATIVE DOWNWARD FLOW FLAWS

Bioretention systems have an inherent flaw — the force of gravity. As stormwater runoff carries pollutants into the system, including sediments and hydrocarbons, they are deposited on top of the bioretention media where it accumulates and quickly clogs the filter media.

It has been documented that sediment accumulation from just a few storm events can completely clog a bioretention system. This leads to drastically reduced infiltration rates, expensive maintenance burdens, and safety issues associated with standing water, depressed landscaping, and vector control.



Downward flow systems filter water in a single vertical direction, forcing polluted material to build up on the top.

As sediment rapidly builds up on the media bed, flow is impeded and the bioretention system quickly clogs or fails.

	Standard Bioretention	WetlandMod System
Total Suspended Solids (TSS) Performance Above 90%?	✓ Yes	✓ Yes
Water Volume Treated	✗ 1.074 Million Gallons	✓ 1.596 Million Gallons (33%More)
Sediment Load Treated	✗ 8,224 Pounds	✓ 11,460 Pounds (28% More)

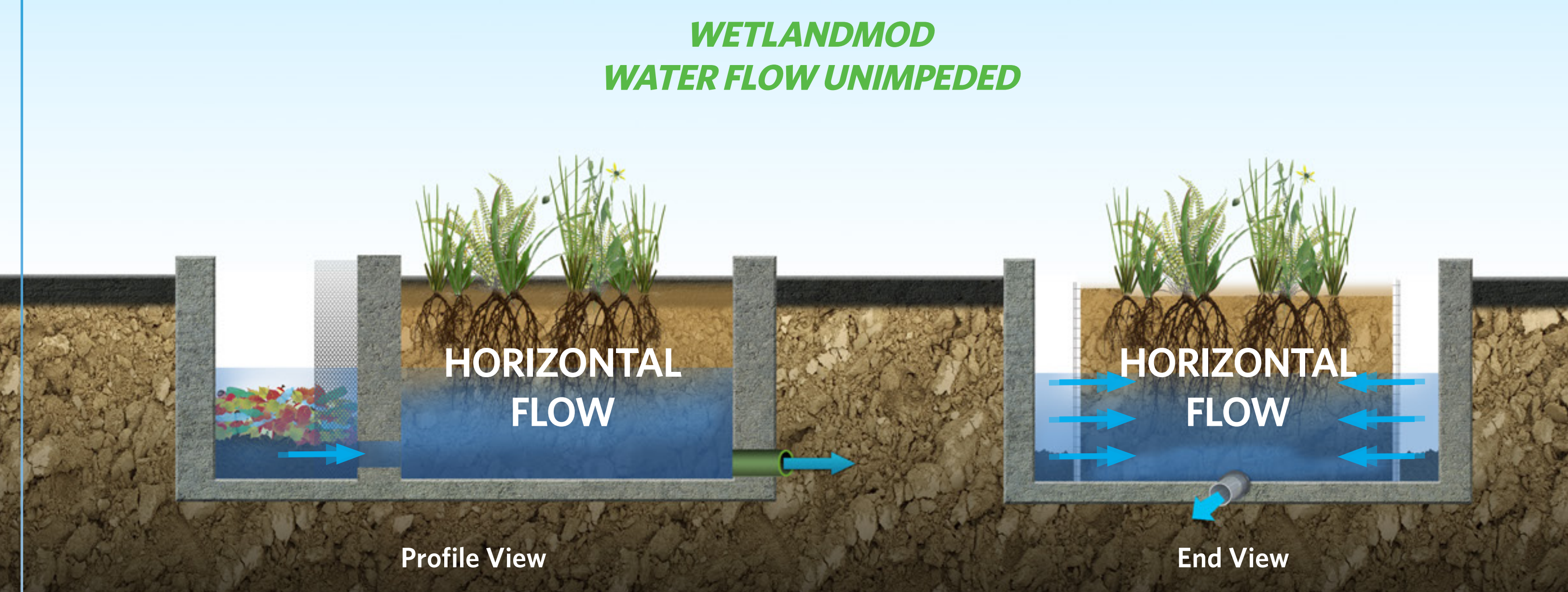
Notes
1. Numbers scaled to a 1306 sqft bioretention system which is typical sizing for a 1 acre commercial development
2. Testing stopped once infiltration rate fell below 5 in/hr at which point the system is no longer treating the design flow rate or water quality volume.
3. Based upon independent third-party comparative testing.

OPERATION

WETLANDMOD FLOW DIRECTION

Horizontal flow biofiltration systems allow sediments to accumulate adjacent to the media bed, drastically reducing clogging, and focusing maintenance attention to one area; for long-term efficiency and treatment quality.

WetlandMod's horizontal design also allows water to consistently flow subsurface, clear of obstructions in a more controlled state.



Sediment, trash and debris entering the WetlandMod accumulate adjacent to vertical media surface, reducing clogging.

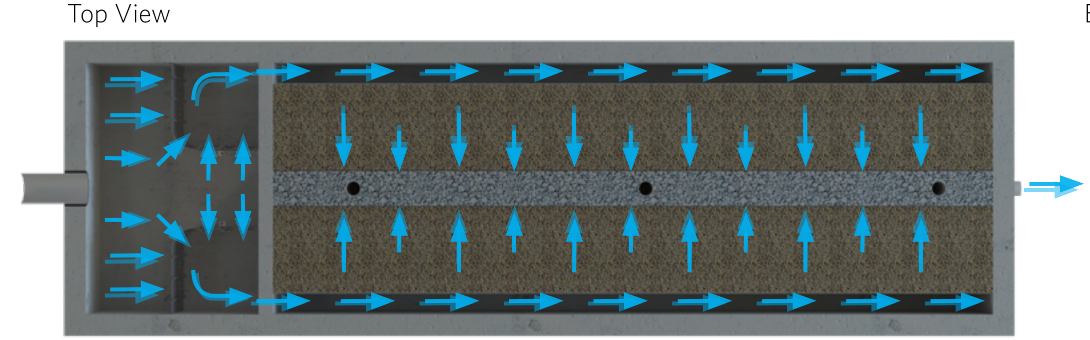
The vertical ponding area (void area) maximizes sedimentation and minimizes clogging issues associated with downward flow bioretention.

BIOFILTRATION CHAMBER

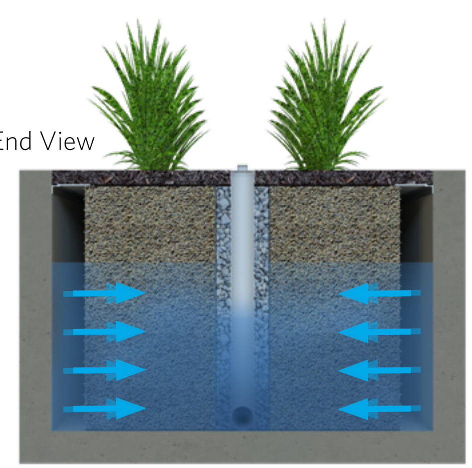
The patented void area maximizes surface area and minimizes footprint, saving space and money. The unique design accomplishes this by allowing water to penetrate the media bed, not only from the top, but from each side.

Up to 2x more surface area than traditional downward flow bioretention systems.

Top View



End View

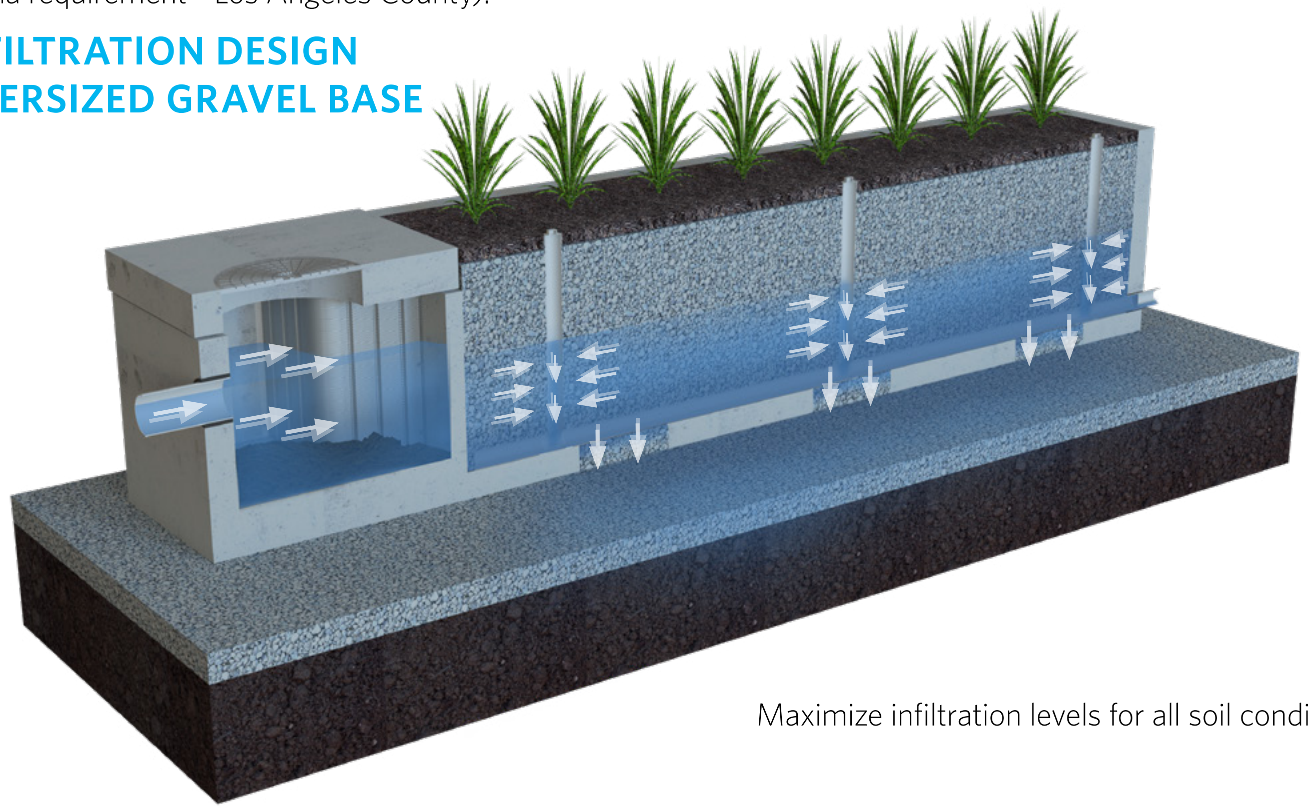


CONFIGURATIONS

The goal of the WetlandMod system is to minimize footprint and land costs associated with traditional bioretention/biofiltration systems. This is acheived by utilizing horizontal flow technology and combining it with traditional downward flow, therefore maximizing the surface area for a given footprint.

WetlandMod is constructed from modular precast concrete structures. The system can be configured as standard curb type, multiple inlet pipes, and/or grate options into the pretreatment chamber with optional internal bypass. The biofiltration chambers can be designed for various length and width combinations (shown below) to allow for easy integration with parking lot island designs. The system comes in two standard widths: 5 feet (18" minimum media requirement - San Diego County and Bay Area Region) and 6 feet (24" minimum media requirement - Los Angeles County).

INFILTRATION DESIGN OVERSIZED GRAVEL BASE

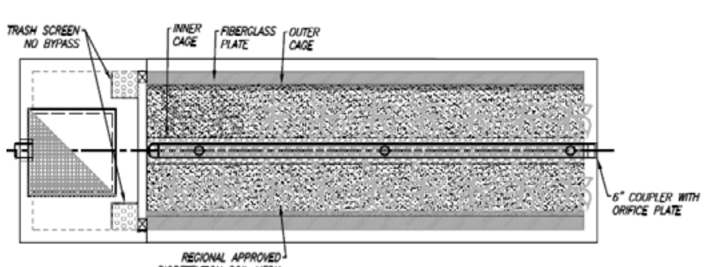


Maximize infiltration levels for all soil conditions.

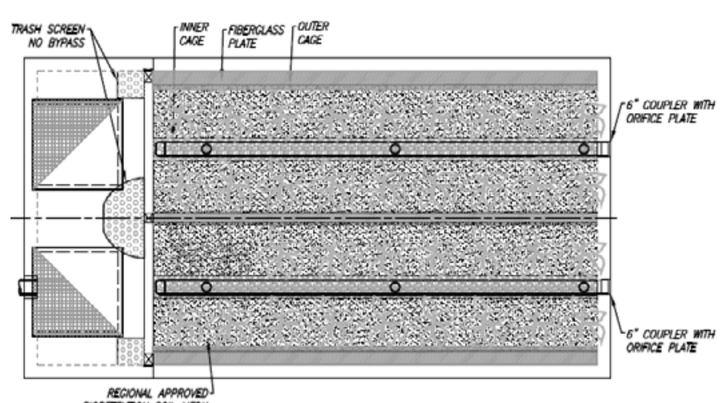
HIGHLY MODULAR

Our standard 6 foot single row and 11 foot double row models, for 24" soil media thickness, are commonly used together to meet wide design requirements and address transportation challenges.

Single Row



Double Row



INSTALLATION

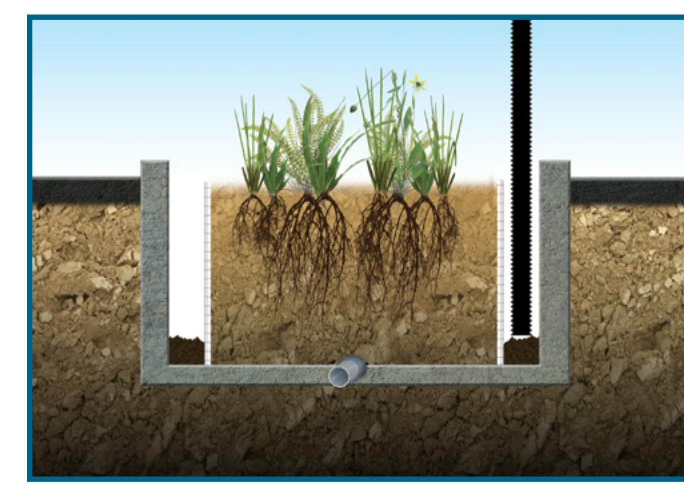
Simple vault and media installation.

All-in-one treatment train, no need for separate trash capture manhole or vault.

MAINTENANCE

A quick and easy maintenance regimen begins with a simple design, and the WetlanMod features benefits that no other bioretention system can replicate. First, the WetlandMod's pretreatment chamber can be accessed via a manhole cover or grate, providing consolidated access to most of the trash, debris, and sediment. The perimeter void areas are more easily accessible with a conventional vacuum truck, allowing plant beds to remain undisturbed.

The average maintenance time is 45 minutes using a standard vacuum truck.



The WetlandMod is designed for easy hose line access to every debris and sediment chamber.

In areas under C.3 guidance, there is no need for removal and replacement of the 6 inches or more of top soil, so there is no risk of damaging the plants and irrigation systems (if needed) that may occur during the topsoil replacement with a vertical flow planter.

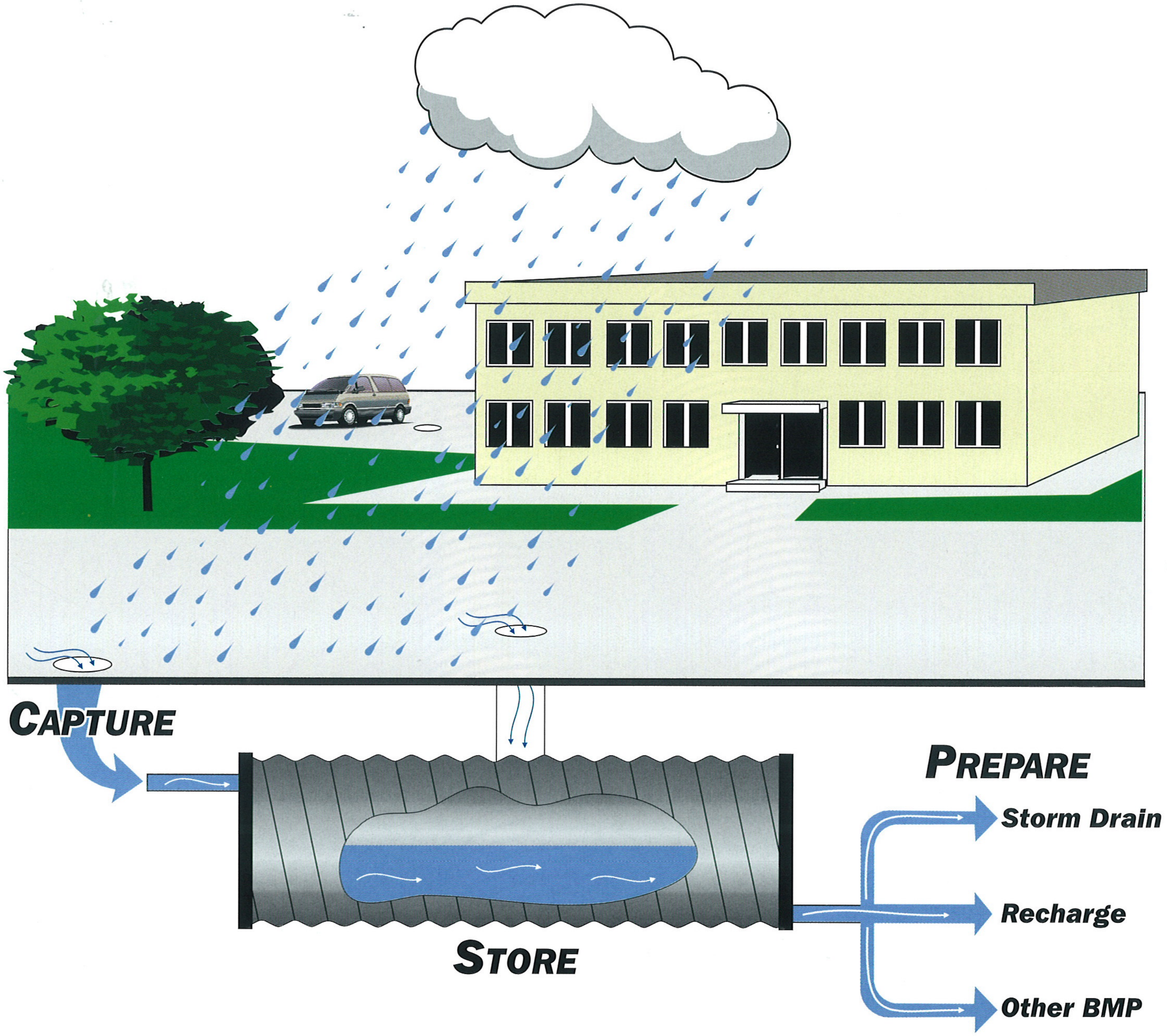
CORRUGATED STEEL PIPE PRODUCTS FOR

STORM WATER MANAGEMENT

CAPTURE · STORE · PREPARE

PACIFIC CORRUGATED PIPE CO.

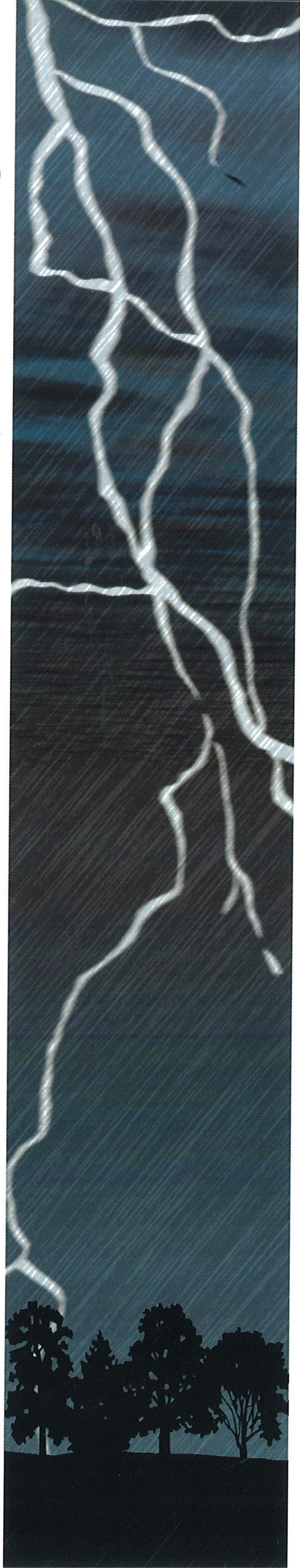
STORMWATER MANAGEMENT



CAPTURE stormwater near its inception without having to convey to a centralized detention facility.

STORE large volumes of stormwater economically underground within a small footprint conserving valuable surface space.

PREPARE stormwater for onsite infiltration, flow rate reduction control, or water quality treatment.



PACIFIC CORRUGATED PIPE CO.®

STORM WATER MANAGEMENT

As American communities continue to grow, parking lots and buildings are replacing natural open space and permeable surfaces. This transformation from permeable to impermeable surfaces increases the volume and peak flow rate of urban runoff. Increased runoff can overload existing municipal storm drains and contribute to the pollution of our national waterways.

Under the National Pollutant Discharge Elimination System (NPDES) regulations, the EPA requires government agencies to implement programs to mitigate increases in stormwater runoff and pollutant discharges from storm drains. Agencies nationwide recognize onsite detention systems as valuable tools to help meet the EPA requirements.

Detention systems can be used to store and release excess stormwater for beneficial uses, such as ground water recharge or irrigation. When required, outlet control devices can reduce the release rate into existing drainage systems or water quality treatment systems.

CORRUGATED STEEL PIPE (CSP) DETENTION SYSTEMS

Corrugated Steel Pipe (CSP) detention systems offer more design versatility, storage value, and lower installation cost than any other underground storage system or method. Large diameter CSP detention systems, with a 75-year minimum service life, provide the most cost effective stormwater storage methods available.

A simple system may consist of a single chamber with welded end caps, inlet, outlet, and a means of access to the chamber. Single detention chambers, scattered throughout the site, can sometimes utilize existing natural drainage and may eliminate the need to convey water to a large central multibarrel structure. Small diameter pipe can be used to connect multiple barrels or convey system discharges.

Most underground detention systems are designed and installed with minimal cover, typically four feet or less. Simple, more economical, 30" access risers can be substituted for larger, more expensive, storm drain sized manholes with prefabricated ladder assemblies. Special component sizes and/or configurations are available. Contact your local Pacific Corrugated Pipe Company sales representative for more information.

The storage capacity of a CSP detention system is virtually unlimited. Space permitting, any number of chambers can be added for an increased capacity.

BEST MANAGEMENT PRACTICES

In response to EPA mandates, municipalities have strengthened "zero increase" runoff and pollutant migration regulations. Most runoff control and pollutant treatment techniques available today cannot handle peak flow or volume criteria adopted by local municipalities. Pacific Corrugated Pipe CSP detention systems compliment water quality treatment systems by releasing captured runoff at a rate that maximizes treatment.

Pacific Corrugated Pipe CSP detention chambers in combination with a dry well can eliminate the need for connections to municipal storm sewers. These stand-alone combination systems may greatly reduce permit and construction costs.

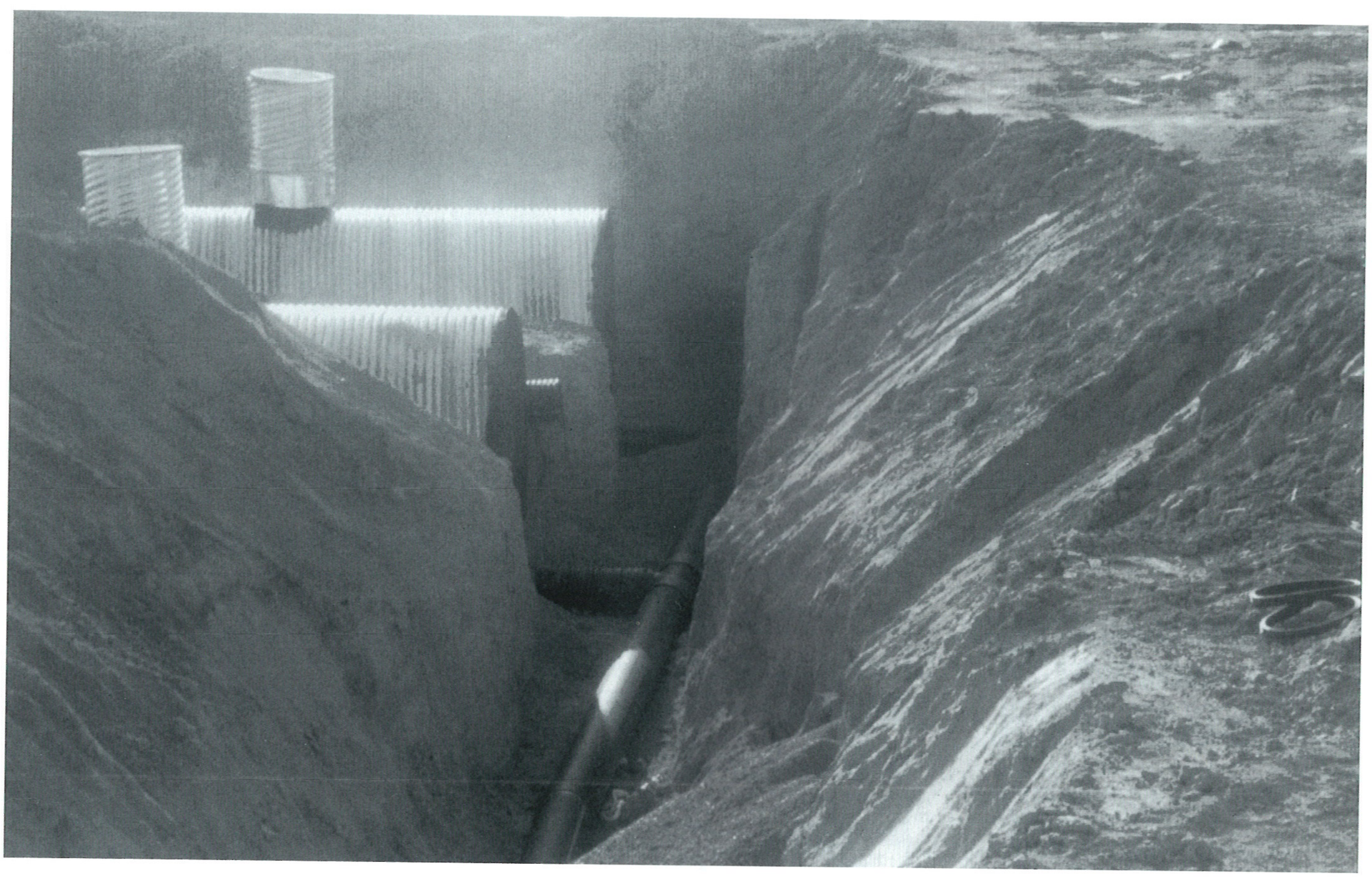
Regional flow criteria and preferred BMPS (Best Management Practices) will vary. Pacific Corrugated Pipe Company representatives will work with developers, design engineers and contractors to comply with all project requirements.

DURABILITY AND INSTALLATION

Galvanized steel can provide a 75-year service life in non-corrosive soil conditions. For longer service life or harsher environments, Aluminized Type II or specialized high performance coatings are also available.

CSP structures are designed to work in conjunction with the surrounding backfill as a soil-structure interaction system. Live loads and dead loads are carried in ring compression in the pipe wall, which in turn is supported by the surrounding backfill. Backfill may be suitable granular materials compacted to a specified AASHTO T-99 density of 90%, or flowable backfill materials that approximate the same bearing capacity.

A good system design considers not only stormwater capacity and discharge rates, but installation factors. Some of these include depth of cover, live loads, dead loads, wall thickness, backfill materials, and installation procedures. Four feet of compacted cover is required in areas where pipe is subject to construction loading.



Contact Pacific Corrugated Pipe Company for information pertaining to a specific region or jobsite design, fabrication, or installation of corrugated steel pipe products.

CSP ADVANTAGES

Corrugated Steel Pipe Detention/Retention Systems are. . .

ECONOMICAL
CSP Systems provide more storage capacity per dollar invested.

DURABLE
Can be designed for any service life requirement.

VERSATILE
Easy to design for any service life requirements.

EXPANDABLE
Just add more pipe for additional storage.

LIGHTWEIGHT
Up to 40 times lighter than concrete

Easy to install with smaller equipment.

EFFECTIVE LAND USE
Requires no valuable surface area.

LOW MAINTENANCE
Years of maintenance free operation.

ENVIRONMENTALLY SOUND
Reduce damage from excessive surface runoff.

Recharge groundwater.

Can be used to treat captured water.

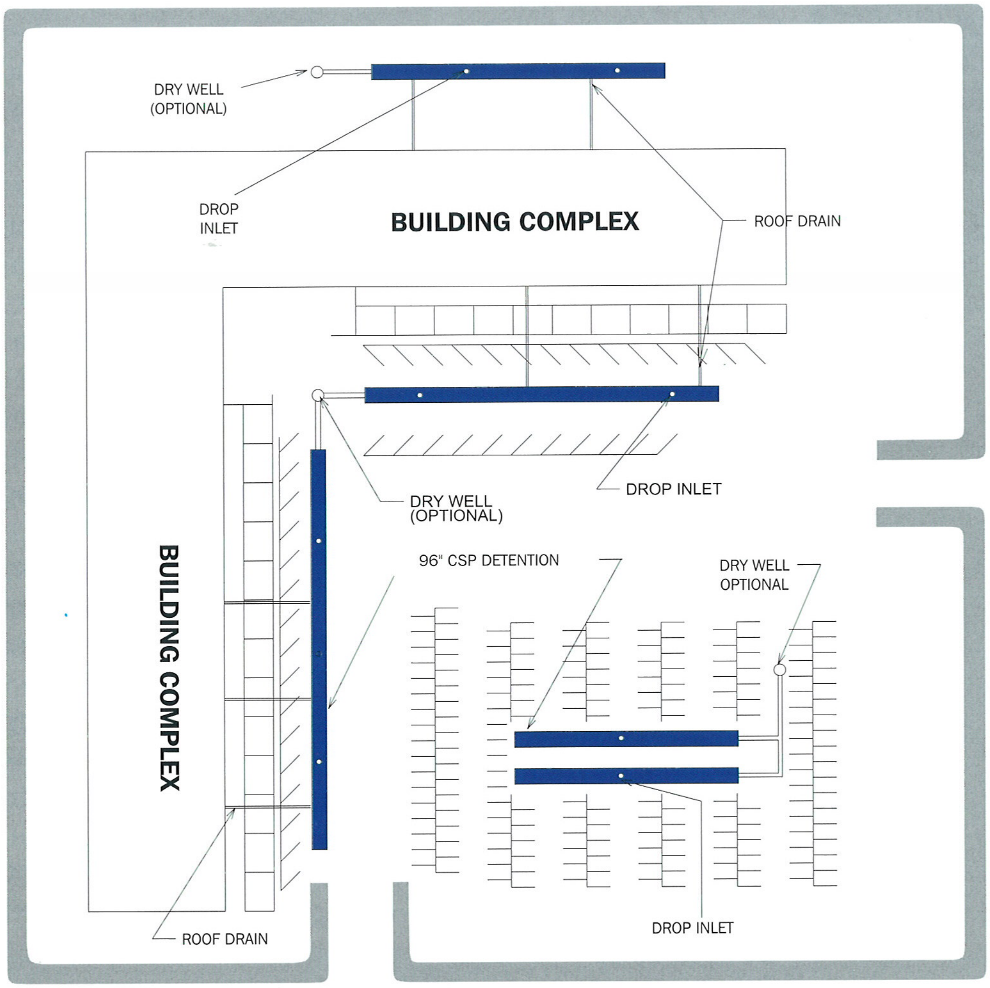
Four feet of cover is required in areas where pipe is subject to construction loading.

PACIFIC CORRUGATED PIPE CO.

DESIGN TABLE — CORRUGATED STEEL PIPE DETENTION CHAMBER

DIAMETER (INCH)	VOLUME / LF CF	VOLUME / LF GALLONS	WEIGHT (LBS/FT)	MINIMUM GAUGE	CORR (INCH)
**Larger Sizes Available					
96	50.3	376	87	16	3 X 1
90	44.2	331	82	16	3 X 1
84	38.5	288	77	16	3 X 1
78	33.2	248	71	16	3 X 1
72	28.3	212	66	16	3 X 1
66	23.8	178	60	16	3 X 1
60	19.6	147	55	16	3 X 1
**Smaller Sizes Available					

Onsite Detention



COMMITMENT TO CUSTOMER SATISFACTION

Pacific CSP representatives are committed to work closely with design engineers, developers, contractors and agencies to insure the most economical and feasible detention system is approved and designed. Construction specifications, bid estimates, calculation procedures, and structurally pre-engineered height-of-cover tables are also available.

Contact your local Pacific representative below for details and design options.

PACIFIC CORRUGATED PIPE CO.

WEB SITE: http://www.pac-corr-pipe.com EMAIL: info@pac-corr-pipe.com

13680 Slover Avenue
Fontana, CA 92337
(909) 829-4235
TOLL FREE (800) 338-5858
FAX (909) 829-8035

5999 Power Inn Road
Sacramento, CA 95824
(916) 383-4891
No. CA only (800) 852-7272
FAX (916) 383-5420

89822 Highway 99 North
Eugene, OR 97402
(541) 461-0990
TOLL FREE (800) 528-8815
FAX (541) 461-0993

28999 W. Highway 84
Casa Grande, AZ 85222
(520) 426-6000
TOLL FREE (800) 822-1770
FAX (520) 426-1209

Las Vegas, NV
(702) 363-5530

San Diego, CA
(760) 732-1444

Santa Fe, NM
(505) 474-5400

Seattle, WA
(206) 382-9889

Medford, OR
(541) 772-4123

Portland, OR
(503) 224-4817

MEMBER NCSPA
NATIONAL CORRUGATED STEEL PIPE ASSOCIATION

PCPO 2K - 10/00