

Water Quality Management Plan

For:

Majestic Chino Flight

Southeast Corner of Flight Avenue & Remington Avenue

APN NO'S. 1055-071-01, -02, 1055-061-01, -02 & 1055-051-01, -02

Prepared for:

Majestic Realty Co.

13191 Crossroads Parkway North, Sixth Floor

City of Industry, California 91746-3497

Tel. No. (562) 699-0453

Prepared by:

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Submittal Date: June, 2022

Revision Date: December, 2022

Approval Date: _____

Project Owner’s Certification

This Water Quality Management Plan (WQMP) has been prepared for Majestic Realty Co. by PBLA Engineering, Inc. The WQMP is intended to comply with the requirements of the City of Chino, Ca. and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County’s Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

“I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors.”

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	Pending
Tract/Parcel Map Number(s):		Building Permit Number(s):	Pending
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1055-071-01, -02 1055-061-01, -02 1055-051-01, -02
Owner’s Signature			
Owner Name:			
Title			
Company	MAJESTIC REALTY CO.		
Address	13191 Crossroads Parkway North, Sixth Floor, City of Industry, California 91746-3497		
Email			
Telephone #	(562) 699-0453		
Signature			Date

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	Pending
Tract/Parcel Map Number(s):		Building Permit Number(s):	Pending
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1055-071-01, -02 1055-061-01, -02 1055-051-01, -02

“The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036.”

Engineer:		PE Stamp Below
Title	Principal	
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Date	12/14/22	

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- Attachment 2 – Design Capture Volume
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- Attachment 4 – Stormwater Mapping Tool Report
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Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Majestic Chino Flight			
Project Owner Contact Name:		Matthew Vawter			
Mailing Address:	13191 Crossroads Pkwy N Industry, CA 91746	E-mail Address :	mvawter@commercelp.com	Telephone:	562-948-4395
Permit/Application Number(s):		Pending		Tract/Parcel Map Number(s):	
Additional Information/ Comments: Site Coordinates:		Latitude: 33.9740°, Longitude: -117.6155°			
Description of Project:		<p>The entire Project site has a gross area of 57.4 acres. The development consists of a proposed 925,362-sf industrial building with paved parking and landscape areas on a 46.00 net acre portion thereof, which is mostly tributary to a bio-treatment / detention basin located in the south side of the project. The remainder 10.95 net acres will not be tributary to the basin, except for limited areas as indicated on the Site Plan. The project is in the City of Chino, County of San Bernardino.</p>			

<p>Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</p>	<p>On site drainage systems consist of swales, grated inlets with filter insert and pipes that will convey the runoff to a proposed a bio-treatment / detention basin in south and downstream end of the project. The site consists of one drainage area (DA-1) that is all tributary to said basin. The bio-treatment basin wil have perforated pipes at the bottom to convey the treated water to a basin outlet pipe. The basin outlet pipe drains to an existing storm drain in Flight Avenue.</p>
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Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long-term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project			
¹ Development Category (Select all that apply):			
<input type="checkbox"/> Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input checked="" type="checkbox"/> New development involving the creation of 10,000 ft ² or more of impervious surface collectively over entire site	<input type="checkbox"/> Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	<input type="checkbox"/> Restaurants (with SIC code 5812) where the land area of development is 5,000 ft ² or more

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<input type="checkbox"/> Hillside developments of 5,000 ft ² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	<input checked="" type="checkbox"/> Developments of 2,500 ft ² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	<input checked="" type="checkbox"/> Parking lots of 5,000 ft ² or more exposed to storm water	<input type="checkbox"/> Retail gasoline outlets that are either 5,000 ft ² or more, or have a projected average daily traffic of 100 or more vehicles per day		
<input type="checkbox"/> Non-Priority / Non-Category Project <i>May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</i>					
2 Project Area (ft ²):	2,060,823-Trib to BMP 443,606 not Trib to BMP	3 Number of Dwelling Units:	n/a	4 SIC Code:	4225
5 Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					
6 Does Project include roads? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)</i>					

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
Majestic Realty Co. will be responsible to build the Site and will maintain the post-developed BMP upon completion of the Construction.

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Bacteria and viruses are a potential pollutant for Industrial/Commercial developments if the land use involves animal waste. Due to the nature of the development, there will be no animal waste associated with this land use, and the site will be treated using site and source control. Bacteria and virus can also be detected in pavement runoff; therefore, the site has incorporated treatment control throughout. All paved and hardened surfaces will flow through infiltration chamber system as part of Low Impact Design (LID).
Nutrients - Phosphorous	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Noxious Aquatic Plants	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Metals	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: <i>Select all that apply</i>			
<input type="checkbox"/> Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects <input type="checkbox"/> Vertical density [20%] <input type="checkbox"/> 7 units/ acre [5%]	<input type="checkbox"/> Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	<input type="checkbox"/> Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
<input type="checkbox"/> Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	<input type="checkbox"/> Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	<input type="checkbox"/> In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	<input type="checkbox"/> Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % <i>(Total all credit percentages up to a maximum allowable credit of 50 percent)</i>			
Description of Water Quality Credit Eligibility (if applicable)			

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.***

Form 3-1 Site Location and Hydrologic Features			
Site coordinates <i>take GPS measurement at approximate center of site</i>	Latitude 33.9740°	Longitude -117.6155°	Thomas Bros Map page
¹ San Bernardino County climatic region: <input checked="" type="checkbox"/> Valley <input type="checkbox"/> Mountain			
² Does the site have more than one drainage area (DA): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached</i>			
<pre> graph BT DMA-1[DMA-1] --> BR[Bio-Retention Basin] BR --> BOP[Basin Outlet Pipe] </pre>			
Conveyance (DMA-1)	Onsite storm drain conveys runoff to a bioretention basin		
Bio-Retention Basin	Bioretention basin with underdrains consist of 3' of engineered fill. This fill consists of 65% sand, 20% sandy loam, 15% wood based compost, 6" pea gravel.		
Basin outlet pipe	Bioretention has underdrains to convey treated water to detention basin outlet pipe.		

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft ²)	2,060,823			
2 Existing site impervious area (ft ²)	120,238			
3 Antecedent moisture condition <i>For desert areas, use</i> http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	III			
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool –</i> http://permitrack.sbcounty.gov/wap/	A			
5 Longest flowpath length (ft)	2,753			
6 Longest flowpath slope (ft/ft)	0.31			
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Industrial			
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Undeveloped poor cover			

Form 3-3 Watershed Description for Drainage Area	
<p>Receiving waters <i>Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/</i> <i>See "Drainage Facilities" link at this website</i></p>	<p>Sultana Cypress Strom Drain (SBCFCD)</p> <p style="text-align: center;">Cucamonga Creek</p> <p style="text-align: center;">Santa Ana River Reach</p>
<p>Applicable TMDLs <i>Refer to Local Implementation Plan</i></p>	<p>Santa Ana River Reach 3: Pathogens "Bacterial Indicator TMDLs for Middle Santa Ana River Watershed Waterbodies (Bill Rice) Nitrate : Santa Ana River Reach 3 Nitrate TMDL (Hope Smythe) Prado Flood Control basin Pathogens "Bacterial Indicator TMDLs for Middle Santa Ana River Watershed Waterbodies (Bill Rice) Santa Ana River Reach 2 NONE Santa Ana River Reach 1 NONE Tidal Prism, Santa Ana River NONE</p>
<p>303(d) listed impairments <i>Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water issues/programs/tmdl/index.shtml</i></p>	<p>Expected pollutants of concern include heavy metals, organic compounds, trash/debris and oil/grease. Potential pollutants of concern include bacteria virus, nutrients, pesticides, sediments, and oxygen demanding substances. There is no evidence to suggest that any other pollutants will be produced from the project site other than these</p> <p>303(d) listed impairment Santa Ana River Reach 3: Pathogens, Metals (copper & lead) Prado Flood Control Basin: Pathogens and Nutrients Santa Ana River Reach 2: Pathogens Santa Ana River Reach 1 and Tidal prism Santa Ana River: NONE</p>
<p>Environmentally Sensitive Areas (ESA) <i>Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/</i></p>	<p style="text-align: center;">NONE</p>
<p>Unlined Downstream Water Bodies <i>Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/</i></p>	<p style="text-align: center;">Santa Ana River</p>
<p>Hydrologic Conditions of Concern</p>	<p><input type="checkbox"/> Yes <i>Complete Hydrologic Conditions of Concern (HCO) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal</i></p> <p><input checked="" type="checkbox"/> No</p>
<p>Watershed-based BMP included in a RWQCB approved WAP</p>	<p><input type="checkbox"/> Yes <i>Attach verification of regional BMP evaluation criteria in WAP</i></p> <ul style="list-style-type: none"> • <i>More Effective than On-site LID</i> • <i>Remaining Capacity for Project DCV</i> • <i>Upstream of any Water of the US</i> • <i>Operational at Project Completion</i> • <i>Long-Term Maintenance Plan</i> <p><input checked="" type="checkbox"/> No</p>

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Practical education materials will be provided to property owner and warehouse Maintenance staffs covering various water quality issues that will need to be addressed on their specific site. These materials will include general practices that contribute to the protection of storm water quality and BMP's that eliminate or reduce pollution during property improvements. The developer will request these materials in writing at least 30 days prior to intended distribution and will then be responsible for publication and distribution.
N2	Activity Restrictions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Restrictions may be developed by property owner or other mechanisms. Pesticide applications will be performed by an applicator certified by the California Department of Pesticide Regulation. Vehicle washing will be prohibited.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	According to the California Stormwater Quality Associations Stormwater Best Management Practice Handbook, landscape planning is implemented to reduce groundwater and storm water contamination. This will be accomplished through an Bio-Retention basin, and landscape areas
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Responsibility for implementation, inspection and maintenance of all BMPs (structural and non-structural) shall be consistent with the BMP Inspection and Maintenance Responsibilities Matrix provided in Section V of this WQMP, with documented records of inspections and maintenance activities completed. Cleaning of all structural BMP Facilities is scheduled by Owner
N5	Title 22 CCR Compliance (How development will comply)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The proposed residential development will not generate waste subject to Title 22 CCR Compliance.
N6	Local Water Quality Ordinances	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable
N7	Spill Contingency Plan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The spill Contingency Plan shall be provided in accordance with Section 6.95 of the California Health Safety Code.

Form 4.1-1 Non-Structural Source Control BMPs				
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No underground storage tank on the site.
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous materials on the Site..

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The proposed Commercial project will not store toxic or highly toxic compressed gases
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Litter control onsite will include the use of litter controls, violation reporting and clean up during landscaping maintenance activities and as needed to ensure good housekeeping of the project's common areas
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All employees, contractors and subcontractors of the property management shall be trained on the proper use and staging of landscaping and other materials with the potential to impact runoff and proper clean-up of spills and materials.
N13	Housekeeping of Loading Docks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Trucking maintenance staffs/Operators will be instructed to keep all areas of loading docks clean and free of Trash / debris at all the time
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	As required by the TGD, at least 80% of the project's private drainage facilities shall be inspected, cleaned/maintained annually, with 100% of facilities inspected and maintained within a two-year period. Drainage facilities include catch basins (storm drain inlets), detention basins, Bio-Retention Basin, open drainage channel.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The project's private streets drive isles and parking lots shall be swept, at minimum, prior to the start of the traditional rainy season and as needed.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No other Non-Structural Measures for Public Agency Projects required.
N17	Comply with all other applicable NPDES permits	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No other applicable NPDES permits required.

Form 4.1-2 Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Storm drain stencils or signage prohibiting dumping and discharge of materials (“No Dumping – Drains to Ocean”) shall be provided adjacent to each of the project’s proposed inlets. The stencils shall be inspected and re-stenciled as needed to maintain legibility.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Project does not propose outdoor storage areas.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Where and how Trash, debris and refuse containers are stored is dictated by municipal code.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (State-wide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	In conjunction with routine landscaping maintenance activities, inspect irrigation for signs of leaks, overspray and repair or adjust accordingly. Adjust system cycle to accommodate seasonal fluctuations in water demand and temperatures. Ensure use of native or drought tolerant/non-invasive plant species to minimize water consumption
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	New landscaped areas will be constructed at a minimum of 1 inch below existing paved areas
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	In the design of maintenance bays & loading docks, containment is encouraged preventive measures including overflow containment structures & dead-end Sumps. However, in the case of loading dock from warehouse, engineered infiltration Systems may be considered
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Bays, Not applicable

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S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Vehicle Wash at the site, Not applicable
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No outdoor Processing, Not applicable

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No equipment wash areas, Not applicable
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Fueling Areas, Not applicable
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Hillside Landscaping, Not applicable
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No food Preparation, Not applicable
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Community Car Wash, Not applicable

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist
<p>Site Design Practices <i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: The Site has landscaped area, multiple planters area in additional to our infiltration/Bio-Retention Basin.</p>
<p>Maximize natural infiltration capacity: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Runoff from impervious surfaces will be conveyed to the Bioretention Basin The basin will not be lined to allow for infiltration to occur, but is not the primary BMP.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: The site currently drains Southwest. Post developed flow will also drain Southwest this is consistent with existing and Master Planned flow patterns.</p>
<p>Disconnect impervious areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: The site drains to infiltration/Bio-retention basin for infiltration.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: There are no environmentally sensitive portions onsite.</p>
<p>Re-vegetate disturbed areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Part of the disturbed areas will be revegeated,. Including planting and preservation of drought tolerant vegetation.</p>
<p>Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: No compaction will be performed within the area where the infiltration /Bio-Retention Basin are proposed.</p>
<p>Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Runoff will be intercepted by the infiltration /Bio-Retention Basin and multiple landscaped areas/planters</p>
<p>Stake off areas that will be used for landscaping to minimize compaction during construction: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: No compaction will be performed within the area where landscape areas are proposed.</p>

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P₆ method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA 1)	
1 Project area DA 1 (ft ²): 2,060,823	2 Imperviousness after applying preventative site design practices (Imp%): 78.0
3 Runoff Coefficient (Rc): <u>0.58</u> $R_c = 0.858(Imp\%)^{0.3} - 0.78(Imp\%)^{0.2} + 0.774(Imp\%) + 0.04$	
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.558 http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html	
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.8264 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>	
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>	24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 160,562 $DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C_2]$, where C ₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) <i>Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>	

Form 4.2-2 Summary of HCOC Assessment (DMA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes No

Go to: <http://permitrack.sbcounty.gov/wap/>

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below
(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 <i>Form 4.2-3 Item 12</i>	2 <i>Form 4.2-4 Item 13</i>	3 <i>Form 4.2-5 Item 10</i>
Post-developed	4 <i>Form 4.2-3 Item 13</i>	5 <i>Form 4.2-4 Item 14</i>	6 <i>Form 4.2-5 Item 14</i>
Difference	7 <i>Item 4 – Item 1</i>	8 <i>Item 2 – Item 5</i>	9 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	10 % <i>Item 7 / Item 1</i>	11 % <i>Item 8 / Item 2</i>	12 % <i>Item 9 / Item 3</i>

*The Site is with in HCOC exempt area for WQMP per the San Bernardino County WQMP Project report (WAP Report).

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft ² sum of areas of DMA should equal area of DA								
4a Curve Number (CN) use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP								
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft ² sum of areas of DMA should equal area of DA								
4b Curve Number (CN) use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP								
5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item } 5) - 10$				9 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item } 7$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item } 6) - 10$				10 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item } 8$			
11 Precipitation for 2 yr, 24 hr storm (in): Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html								
12 Pre-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 9)^2 / ((\text{Item } 11 - \text{Item } 9 + \text{Item } 7))$								
13 Post-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 10)^2 / ((\text{Item } 11 - \text{Item } 10 + \text{Item } 8))$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): $V_{HCOC} = (\text{Item } 13 * 0.95) - \text{Item } 12$								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA (For projects using the Hydrology Manual complete the form below)

Variables	Pre-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>				Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
7 Cross-sectional area of channel (ft ²)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7}/\text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min):	<i>Minimum of Item 12 pre-developed DMA</i>							
14 Post-developed time of concentration (min):	<i>Minimum of Item 12 post-developed DMA</i>							
15 Additional time of concentration needed to meet HCOC requirement (min):	$T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$							

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>			Post-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration <i>$I_{peak} = 10^{(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 / 60)}$</i>						
2 Drainage Area of each DMA (Acres) <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
3 Ratio of pervious area to total area <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) <i>$F_m = Item 3 * Item 4$</i> <i>Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
6 Peak Flow from DMA (cfs) <i>$Q_p = Item 2 * 0.9 * (Item 1 - Item 5)$</i>						
7 Time of concentration adjustment factor for other DMA to site discharge point <i>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</i>	DMA A	<i>n/a</i>		<i>n/a</i>		
	DMA B		<i>n/a</i>		<i>n/a</i>	
	DMA C		<i>n/a</i>			<i>n/a</i>
8 Pre-developed Q_p at T_c for DMA A: <i>$Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAA/2}] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAA/3}]$</i>	9 Pre-developed Q_p at T_c for DMA B: <i>$Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAB/1}] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAB/3}]$</i>			10 Pre-developed Q_p at T_c for DMA C: <i>$Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAC/1}] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAC/2}]$</i>		
10 Peak runoff from pre-developed condition confluence analysis (cfs): <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>		
14 Peak runoff from post-developed condition confluence analysis (cfs): <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): <i>$Q_{p-HCOC} = (Item 14 * 0.95) - Item 10$</i>						

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2).

Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

¹ Would infiltration BMP pose significant risk for groundwater related concerns? Yes No
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach) Due to low infiltration rate on Site.

² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes No
 (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

³ Would infiltration of runoff on a Project site violate downstream water rights? Yes No

If Yes, Provide basis: (attach)

⁴ Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes No

If Yes, Provide basis: (attach)

⁵ Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes No

If Yes, Provide basis: (attach) See attached Soils Report which includes infiltration testing results

⁶ Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes No
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

⁷ Any answer from Item 1 through Item 3 is “Yes”: Yes No
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

⁸ Any answer from Item 4 through Item 6 is “Yes”: Yes No
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.

⁹ All answers to Item 1 through Item 6 are “No”:
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 2-5; If no, proceed to Item 6</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Total impervious area draining to pervious area (ft ²)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft ³) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³):		$V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; if no, proceed to Item 14</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
7 Ponding surface area (ft ²)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft ²)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$			
13 Runoff volume retention from on-lot infiltration (ft ³):		$V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$	

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 15-20. If no, proceed to Item 21</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Rooftop area planned for ET BMP (ft ²)			
16 Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i>			
17 Daily ET demand (ft ³ /day) <i>Item 15 * (Item 16 / 12)</i>			
18 Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i>			
19 Retention Volume (ft ³) <i>V_{retention} = Item 17 * (Item 18 / 24)</i>			
20 Runoff volume retention from evapotranspiration BMPs (ft ³): <i>V_{retention} = Sum of Item 19 for all BMPs</i>			
21 Implementation of Street Trees: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 22-25. If no, proceed to Item 26</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft ²)			
24 Runoff volume retention from street trees (ft ³) <i>V_{retention} = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i>			
25 Runoff volume retention from street tree BMPs (ft ³): <i>V_{retention} = Sum of Item 24 for all BMPs</i>			
26 Implementation of residential rain barrel/cisterns: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 27-29; If no, proceed to Item 30</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft ³) <i>V_{retention} = Item 27 * 3</i>			
29 Runoff volume retention from residential rain barrels/Cisterns (ft ³): <i>V_{retention} = Sum of Item 28 for all BMPs</i>			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: <i>Sum of Items 5, 13, 20, 25 and 29</i>			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC BMP (ft ³): n/a $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$			
BMP Type <i>Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods</i>			
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>			
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>			
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>			
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity			
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Underground Retention Volume (ft ³) <i>Volume determined using manufacturer's specifications and calculations</i>			
16 Total Retention Volume from LID Infiltration BMPs: <i>(Sum of Items 14 and 15 for all infiltration BMP included in plan)</i>			
17 Fraction of DCV achieved with infiltration BMP: $\% \text{ Retention} = \text{Item 16} / \text{Form 4.2-1 Item 7}$			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.</i>			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)			
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft ³): n/a <i>V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 - Form 4.3-3 Item 16</i>			
BMP Type(s) <i>Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs</i>	DA BMP Type	DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft ³) <i>Volume of cistern</i>			
4 Landscaped area planned for use of harvested stormwater (ft ²)			
5 Average wet season daily irrigation demand (in/day) <i>Use local values, typical ~ 0.1 in/day</i>			
6 Daily water demand (ft ³ /day) <i>Item 4 * (Item 5 / 12)</i>			
7 Drawdown time (hrs) <i>Copy Item 6 from Form 4.2-1</i>			
8 Retention Volume (ft ³) <i>V_{retention} = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))</i>			
9 Total Retention Volume (ft ³) from Harvest and Use BMP <i>Sum of Item 8 for all harvest and use BMP included in plan</i>			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.</i>			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DMA 1)		
<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 160,562 <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</i></p>	<p>List pollutants of concern <i>Copy from Form 2.3-1.</i></p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input checked="" type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): 169,560 <i>Form 4.3-6 Item 15 + Form 4.3-7 Item 13</i></p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): <i>Item 1 – Item 3</i></p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % <i>Item 4 / Item 1</i></p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project’s precipitation zone (Form 3-1 Item 1)</i></p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i> 		

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>			
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>			
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>			
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>			
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Amended soil surface area (ft ²)			
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity, <i>n</i>			
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
12 Gravel porosity, <i>n</i>			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7}/2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

Form 4.3-7 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type <i>Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.</i>	DA DMA BMP Type		DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft ²) $A_{bottom} = \text{Item 2} * \text{Item 3}$				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft ²) $A_{surface} = (\text{Item 2} + (2 * \text{Item 5} * \text{Item 6})) * (\text{Item 3} + (2 * \text{Item 5} * \text{Item 6}))$				
8 Storage volume (ft ³) <i>For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i> $V = \text{Item 6} / 3 * [\text{Item 4} + \text{Item 7} + (\text{Item 4} * \text{Item 7})^{0.5}]$				
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>				
10 Outflow rate (cfs) $Q_{BMP} = (\text{Item } 8_{forebay} + \text{Item } 8_{basin}) / (\text{Item } 9 * 3600)$				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft ³) $V_{biotreated} = (\text{Item } 8_{forebay} + \text{Item } 8_{basin}) + (\text{Item } 10 * \text{Item } 11 * 3600)$				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : <i>(Sum of Item 12 for all BMP included in plan)</i>				

Form 4.3-8 Flow Based Biotreatment (DA 1)			
Biotreatment BMP Type <i>Vegetated swale, vegetated filter strip, or other comparable proprietary BMP</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5</i>			
2 Flow depth for water quality treatment (ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
3 Bed slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
4 Manning's roughness coefficient			
5 Bottom width (ft) $b_w = (\text{Form 4.3-5 Item 6} * \text{Item 4}) / (1.49 * \text{Item 2}^{1.67} * \text{Item 3}^{0.5})$			
6 Side Slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Cross sectional area (ft ²) $A = (\text{Item 5} * \text{Item 2}) + (\text{Item 6} * \text{Item 2}^2)$			
8 Water quality flow velocity (ft/sec) $V = \text{Form 4.3-5 Item 6} / \text{Item 7}$			
9 Hydraulic residence time (min) <i>Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Length of flow based BMP (ft) $L = \text{Item 8} * \text{Item 9} * 60$			
11 Water surface area at water quality flow depth (ft ²) $SA_{top} = (\text{Item 5} + (2 * \text{Item 2} * \text{Item 6})) * \text{Item 10}$			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)	
1	Total LID DCV for the Project DA-1 (ft ³): 160,562 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design hydrologic source control LID BMP (ft ³): <i>Copy Item 30 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): <i>Copy Item 16 in Form 4.3-3</i>
4	On-site retention with LID harvest and use BMP (ft ³): <i>Copy Item 9 in Form 4.3-4</i>
5	On-site biotreatment with volume based biotreatment BMP (ft ³): 169,560 <i>Copy Item 3 in Form 4.3-5</i>
6	Flow capacity provided by flow based biotreatment BMP (cfs): <i>Copy Item 6 in Form 4.3-5</i>
7	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> • Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3-5 Item 6 and Items 2, 3 and 4 are maximized</i> ▪ On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
8	<p>If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:</p> <ul style="list-style-type: none"> • Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> • An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: <input type="checkbox"/> <i>Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed</i>

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)	
<p>1 Volume reduction needed for HCOC performance criteria (ft³): <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i></p>	<p>2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): <i>Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i></p>
<p>3 Remaining volume for HCOC volume capture (ft³): <i>Item 1 – Item 2</i></p>	<p>4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): <i>Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</i></p>
<p>5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification <input type="checkbox"/> <i>Attach in-stream control BMP selection and evaluation to this WQMP</i></p>	
<p>6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP <input type="checkbox"/> <i>BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)</i> • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities <input type="checkbox"/> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	
<p>7 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs <input type="checkbox"/> <i>BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)</i> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Bio-Retention Basin	CCC During Construction Majestic Management After Construction	Maintain System per Specifications	As Needed
Education of Property Owners, Tenants and Occupants on Stormwater BMPs (N1)	CCC During Construction Majestic Management After Construction	Practical education materials will be provided to property owners covering various water quality issues that will need to be addressed on their specific site. These materials will include general good house keeping practices that contribute to the protection of storm water quality and BMP's that eliminate or reduce pollution during property improvements.	At C of O
Activity Restrictions (N2)	CCC During Construction Majestic Management After Construction	Restrictions may be developed by Owner	Ongoing by Code Enforcement
Landscape maintenance (N3)	CCC During Construction	Landscape planning is implemented to reduce groundwater and storm water contamination. This will be	Monthly

Water Quality Management Plan (WQMP)

	Majestic Management After Construction	accomplished through an infiltration basin, and landscape areas.	
BMP maintenance (N4)	CCC During Construction Majestic Management After Construction	See details hereon	Ongoing with every visit
Spill contingency plan (N7)	CCC During Construction Majestic Management After Construction	The spill contingency plan shall be provided in accordance with Section 6.95 of the California Health and Safety Code	Ongoing with every visit
Litter debris control program (N11)	CCC During Construction Majestic Management After Construction	Litter debris control program may be developed by the Owner	Ongoing with every visit
Employee training (N12)	CCC During Construction Majestic Management After Construction	Employee training may be developed by the Owner	As stated
Housekeeping of loading dock (N13)	CCC During Construction Majestic Management After Construction	Members of the warehouse/gardeners/maintenance staff will be provided instruction to clean dock area free of debris/trash all the time by the owner	Ongoing
Catch basin inspection program (N14)	CCC During Construction Majestic Management After Construction	Catch basins will be inspected a minimum of once every three months during the dry season and a minimum of once every two months during the rainy season	Inspect once a year
Vacuum Sweeping of Private Streets and	CCC During Construction Majestic Management After Construction	Vacuum of parking lot and driveways will be done by warehouse employees	Once a month minimum

Water Quality Management Plan (WQMP)

Parking lot (N15)			
Provide storm drain system stencilling and signage (N16)	CCC During Construction Majestic Management After Construction	Signs will be placed above storm drain inlets to warn the public of prohibitions against waste disposal	Once a year or according to Manufacturer Manuals
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (N3)	CCC During Construction Majestic Management After Construction	Rain sensors will be incorporated into the onsite sprinkler system so that no unnecessary watering of landscaped areas occurs after storm events.	Once a year
Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	CCC During Construction Majestic Management After Construction	New landscaped areas will be constructed at a minimum of 1 inch below existing paved areas	Once a year

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

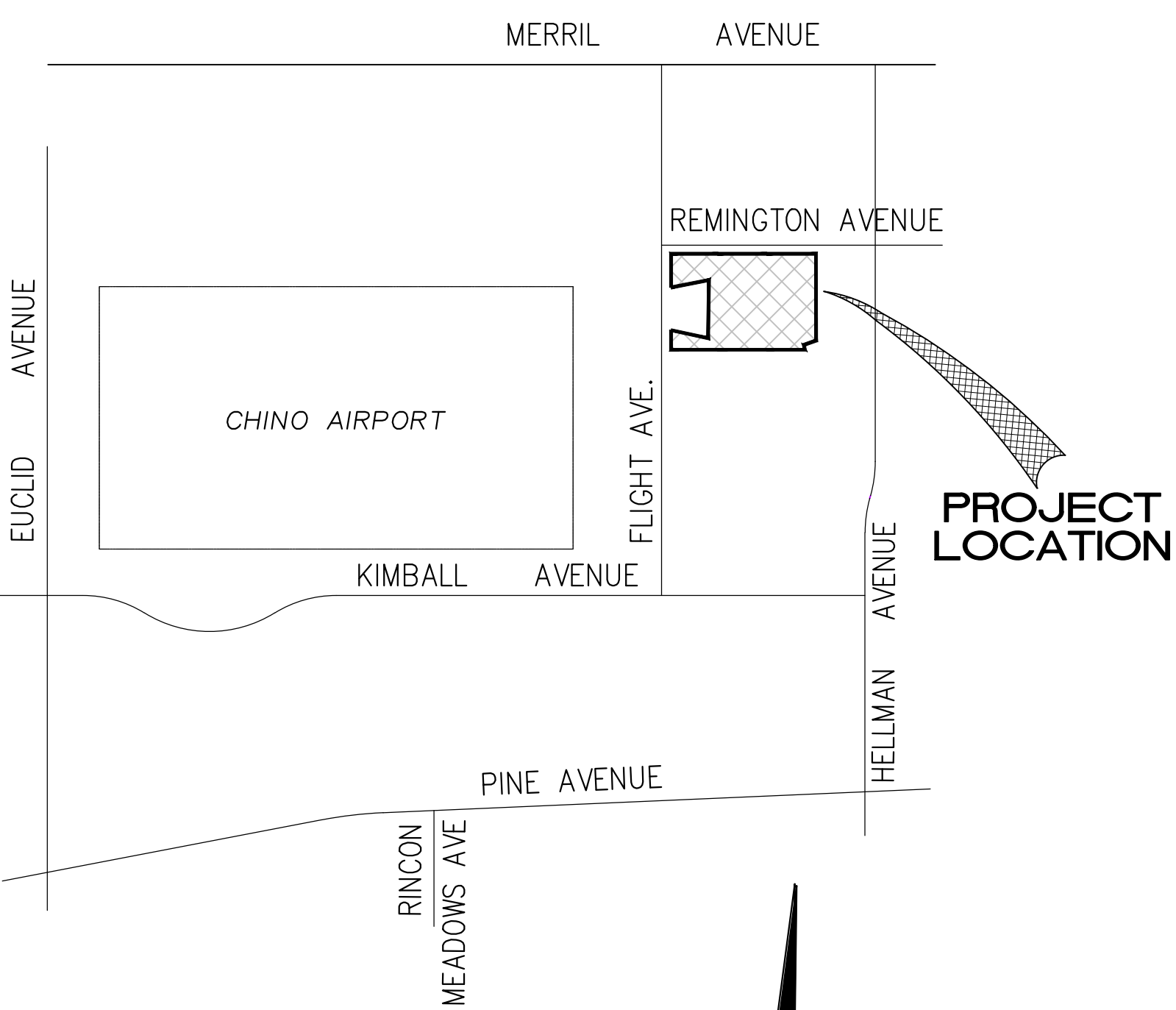
6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements

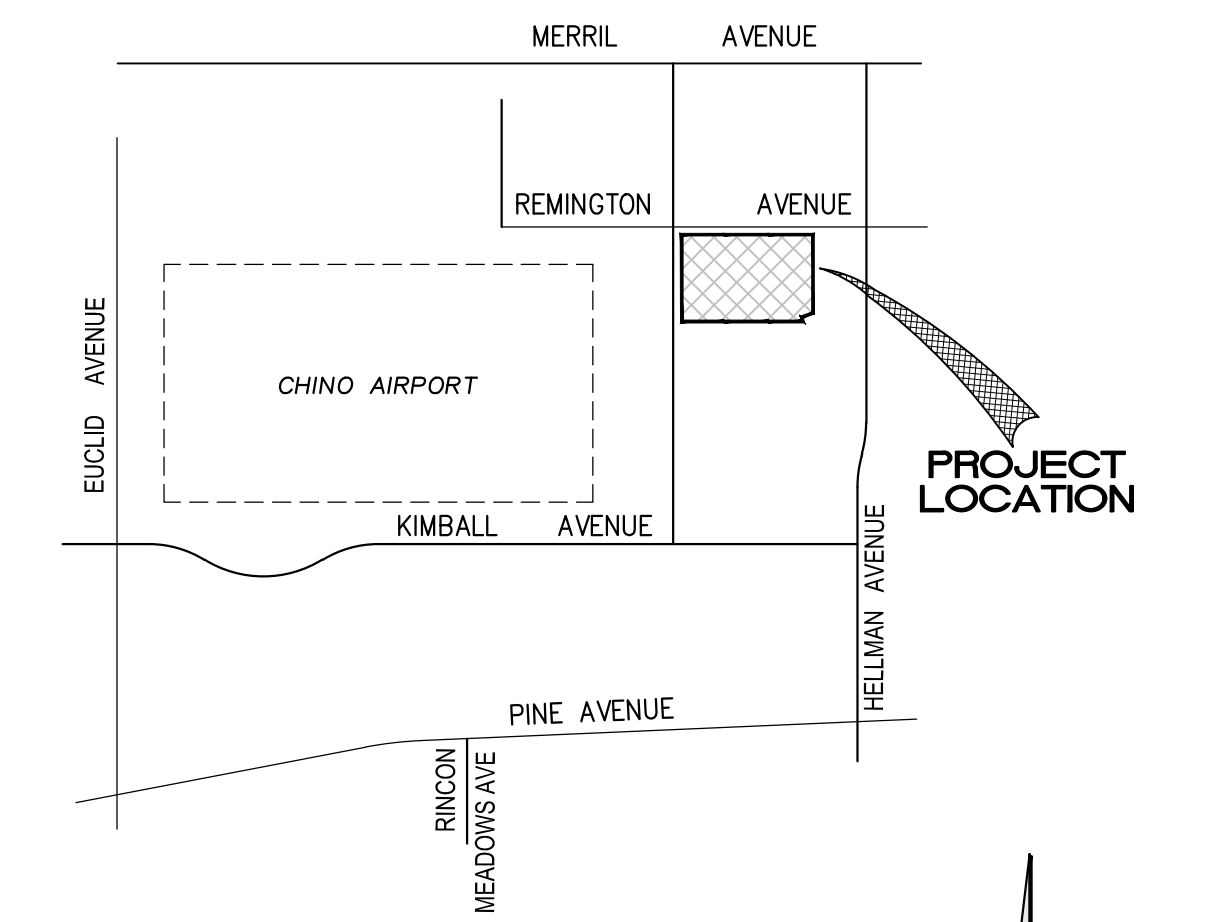
Attachment 1 - Vicinity Map and WQMP Site Plan



VICINITY MAP

NOT TO SCALE





VICINITY MAP
NOT TO SCALE

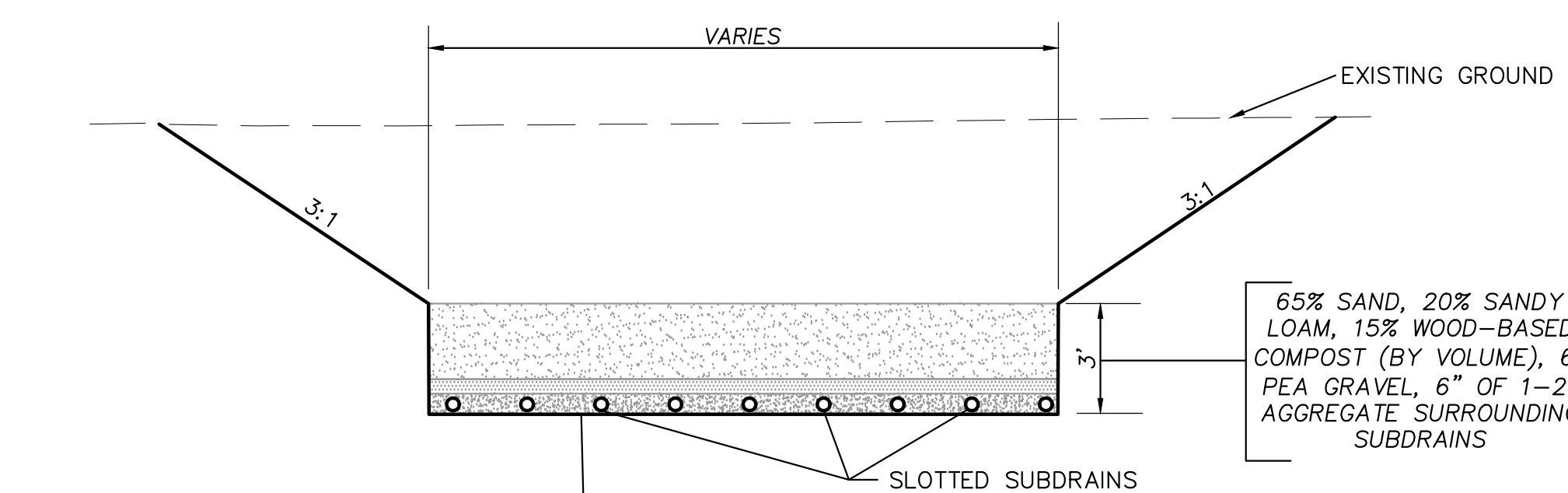
- LEGEND
- LANDSCAPE AREA EFFICIENT IRRIGATION
 - LANDSCAPE AREA RUNOFF-MINIMIZING DESIGN
 - SELF-TREATING LANDSCAPE AREAS
AREA = 443,606 S.F. - NOT TRIBUTARY TO BASIN
 - TRASH ENCLOSURE
 - DETENTION / FILTRATION BASIN
AREA=139,289 S.F.

- CATCH BASIN STENCIL TRITON INLET FILTER
- FLOW PATTERN
- ONSITE STORM DRAIN
- DMA BOUNDARY

- NON-STRUCTURAL BMPs
- HOUSEKEEPING OF LOADING DOCKS
 - PARKING LOT SWEEPING

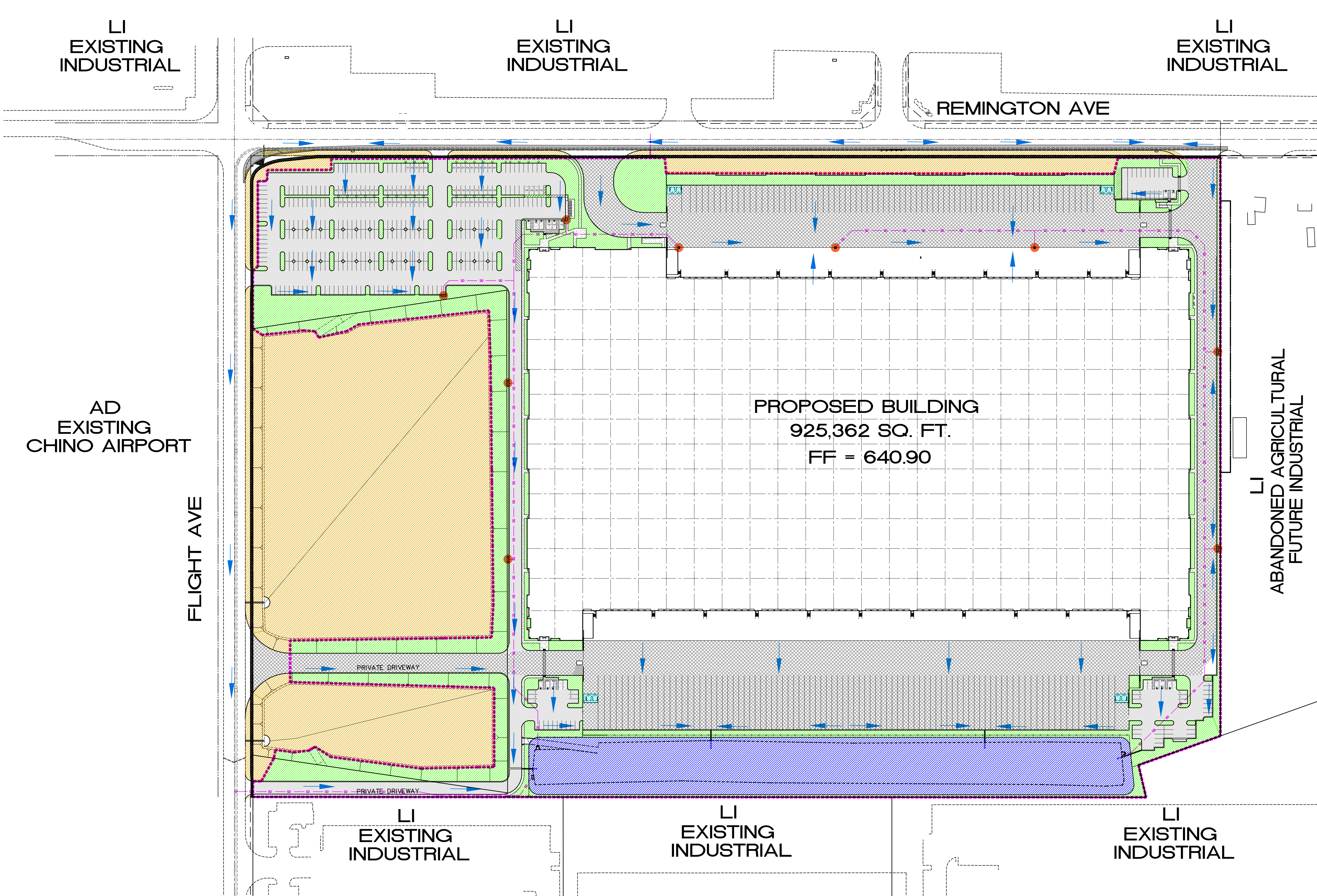
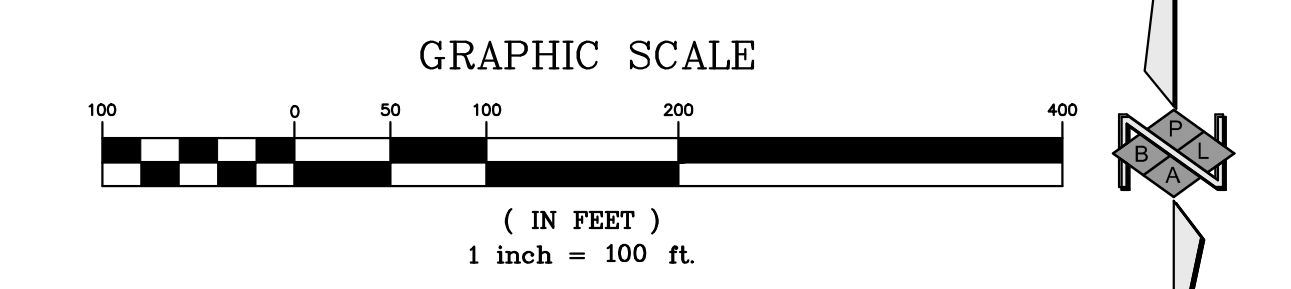
PROJECT DATA:

TOTAL SITE AREA OF PROPOSED DEVELOPMENT: 2,481,624 (56.97 AC)
 TOTAL AREA TRIBUTARY TO BASIN 2,060,781 SF (47.31 AC)
 BUILDING AREA: 925,362 SF
 PAVED AREA: 763,128 SF
 1,688,490 SF TOTAL IMPERVIOUS (38.76 AC)
 233,005 SF LANDSCAPING PROVIDED
 139,286 SF DETENTION/WMP BASIN
 372,291 SF TOTAL (8.55 AC)
 78.0% IMPERVIOUS
 DCV = 160,562 CF (3.69 AC-FT)
 CURRENT USE: VACANT
 PROPOSED USE: INDUSTRIAL / COMMERCIAL
 WATERSHED: PRADO FLOOD CONTROL BASIN
 SUB-WATERSHED: SANTA ANA RIVER REACH 3 (CHINO BASIN)



APPLY WEED BARRIER TO BASIN BOTTOM PRIOR TO SUBDRAIN AND FILTER MATERIAL PLACEMENT

BIO-RETENTION DETAIL
NOT TO SCALE



BMP LIST:

- EDUCATION OF PROPERTY OWNERS
- DETENTION/INFILTRATION BASIN PER PLAN
- CATCH BASIN STENCIL TRITON INLET FILTER
- TRAINING/EDUCATION PROGRAM
- STREET/PARKING LOT SWEEPING/VACUUMING
- CATCH BASIN INSPECTION
- LANDSCAPE PLANNING (SD-10)
- ROOF RUNOFF CONTROLS (SD-11)
- EFFICIENT IRRIGATION (SD-12)
- STORM DRAIN SIGNAGE (SD-13)
- SELF-TREATING LANDSCAPE AREA PER PLAN
- TRASH ENCLOSURE (SD-32)

BMP STATISTICS:

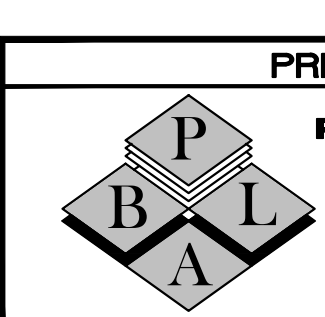
DMA#	AREA (AC)	BMP	REQUIRED VOLUME (CF)	PROVIDED VOLUME (CF)
DMA-1	47.31	BIO-RETENTION BASIN-1	160,562	169,560

DCV ACHIEVED: 105.6%

NOTES

- NO COMPACTION PERFORM WITHIN THE AREA OF THE PROPOSED INFILTRATION/BIO-RETENTION BASIN.
- STAKE OFF AREAS PROPOSED TO BE USED FOR LANDSCAPING TO MINIMIZE COMPACTION DURING CONSTRUCTION.
- CONSTRUCT ALL LANDSCAPED AREAS AT A MINIMUM OF 1 INCH BELOW EXISTING PAVED AREAS.

Dec 02 2022



PREPARED BY:
PBLA ENGINEERING, INC.
Planning • Engineering • Surveying
1809 E. DYER RD. STE 301
SANTA ANA, CA. 92705
(888) 714-9642 • (714)389-9191 FAX

REVISIONS:

NO.	DESCRIPTION

**WATER QUALITY MANAGEMENT PLAN
PRELIMINARY SITE PLAN
MAJESTIC CHINO FLIGHT
CHINO, CA**

JOB NO.
100-134
SHEET
1 of 1

Attachment 2 - Design Capture Volume

Target Captured Volume Watershed DA 1

1) Calculate the "Watershed Imperviousness Ratio", I which is equal to the percent of impervious area in the BMP Drainage Area divided by 100

$$\text{Imperviousness}(i) = \mathbf{0.78}$$

$$\text{Total Acreage}(A) = \mathbf{47.31} \quad 2,060,823 \text{ SF}$$

2) Calculate the composite Runoff Coefficient C_{bmp} for the drainage area

$$C_{\text{bmp}} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$$

$$C_{\text{bmp}} = \mathbf{0.58}$$

3) Determine which Regression Coefficient to use by region the project is located in

Valley	1.481
Mountain	1.909
Desert	1.237

Regression coefficient for this project is: 1.481

4) Determine the area averaged "6 hour Mean Storm Rainfall", P_6

$$2 \text{ yr } 1 \text{ Hr Rainfall Depth per NOAA Atlas 14} = \mathbf{0.558} \text{ inches}$$

$P_6 = 2 \text{ yr } 1 \text{ hr Rainfall} \times \text{Regression coefficient}$

$$P_6 = \mathbf{0.8264} \text{ inches}$$

5) Determine Regression Constant (a) for 48 hour drawdown

a for 24 hour = 1.582
a for 48 hour = 1.963

$$a = \mathbf{1.963}$$

6) Calculate the Maximized Detention Volume, P_0

$$P_0 = C \times a \times P_6$$

$$P_0(\text{inches}) = \mathbf{0.9349}$$

7) Calculate the Target Capture Volume, V_0 , in acre feet

$$V_0 = (P_0 \times A) / 12$$

$$V_0 = \mathbf{3.69} \text{ acre-feet}$$

$$V_0 = \mathbf{160,562} \text{ CF}$$

Attachment 3 - Bioretention Basin Calculations

Bioretention Facility - Design Procedure		BMP ID	Legend:	Required Entries
				Calculated Cells
Company Name:	PBLA Engineering		Date: 12/2/2022	
Designed by:	SDL		County/City Case No.: Chino Flight	
Design Volume				
Enter the area tributary to this feature			$A_T =$	47.3 acres
Enter V_{BMP} determined from Section 2.1 of this Handbook			$V_{BMP} =$	160,562 ft ³
Type of Bioretention Facility Design				
<input type="radio"/> Side slopes required (parallel to parking spaces or adjacent to walkways) <input checked="" type="radio"/> No side slopes required (perpendicular to parking space or Planter Boxes)				
Bioretention Facility Surface Area				
Depth of Soil Filter Media Layer			$d_S =$	3.0 ft
Top Width of Bioretention Facility, excluding curb			$w_T =$	74.0 ft
Total Effective Depth, d_E				
$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$			$d_E =$	1.80 ft
Minimum Surface Area, A_m				
$A_M (ft^2) = \frac{V_{BMP} (ft^3)}{d_E (ft)}$			$A_M =$	89,202 ft ²
Proposed Surface Area			$A =$	94,197 ft ²
Minimum Required Length of Bioretention Facility, L			$L =$	1205.4 ft
Bioretention Facility Properties				
Side Slopes in Bioretention Facility			$z =$	1 :1
Diameter of Underdrain				inches
Longitudinal Slope of Site (3% maximum)				%
6" Check Dam Spacing				feet
Describe Vegetation:				
Notes:	Treatment Capacity Provided: $(169,234/94,019) \times 94,197 = 169,560$ CF			

Attachment 4 - Stormwater Mapping Tool Report



WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Wednesday, May 25, 2022

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s): 105110115, 105110119, 105110113, 105110116, 105110147, 105110114, 105110111, 105110117, 105110154, 105110112, 105110118, 105110146

Project Site Acreage: 1.475

HCOC Exempt Area: Yes. Verify that the project is completely within the HCOC exemption area.

Closest Receiving Waters: **System Number** - 905
(Applicant to verify based on local drainage facilities and topography.) **Facility Name** - Sultana-Cypress Storm Drain
Owner - SBCFCD

Closest channel segment's susceptibility to Hydromodification: EHM

Highest downstream hydromodification susceptibility: High

Is this drainage segment subject to TMDLs? No

Are there downstream drainage segments subject to TMDLs? Yes

Is this drainage segment a 303d listed stream? No

Are there 303d listed streams downstream? Yes

Are there unlined downstream waterbodies? Yes

Project Site Onsite Soil Group(s): A

Environmentally Sensitive Areas within 200': None

Groundwater Depth (FT): -238

Parcels with potential septic tanks within 1000': No

Known Groundwater Contamination Plumes within 1000': No

Studies and Reports Related to Project Site: [City of Ontario Water Quality Report](#)
[Chino Basin Recharge Master Plan](#)
[Chino Basin Water Master 32nd Annual Report](#)
[Sphere of Influence General Plan Amendment](#)
[CSDP Project No. 1](#)
[CSDP 1 Comprehensive Storm Drain](#)
[CSDP Drainage Study Calculations](#)
[SBCounty CSDP Project No.2 Volume 1](#)
[SBCounty CSDP Project No.2 Volume 2](#)
[Volume 2 Map](#)
[SBCounty CSDP Project No.3 Volume I](#)
[SBCounty CSDP Project No.3 Volume II](#)
[West San Bernardino SD Master Plan \(Proof\)](#)
[Chino Creek Master Plan](#)
[Chino & San Antonio Creek Summary](#)
[Hydrology Zone 1, San Antonio and Chino](#)
[San Antonio and Chino Creeks Channel](#)

Attachment 5 - BMP Fact Sheets

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project’s landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

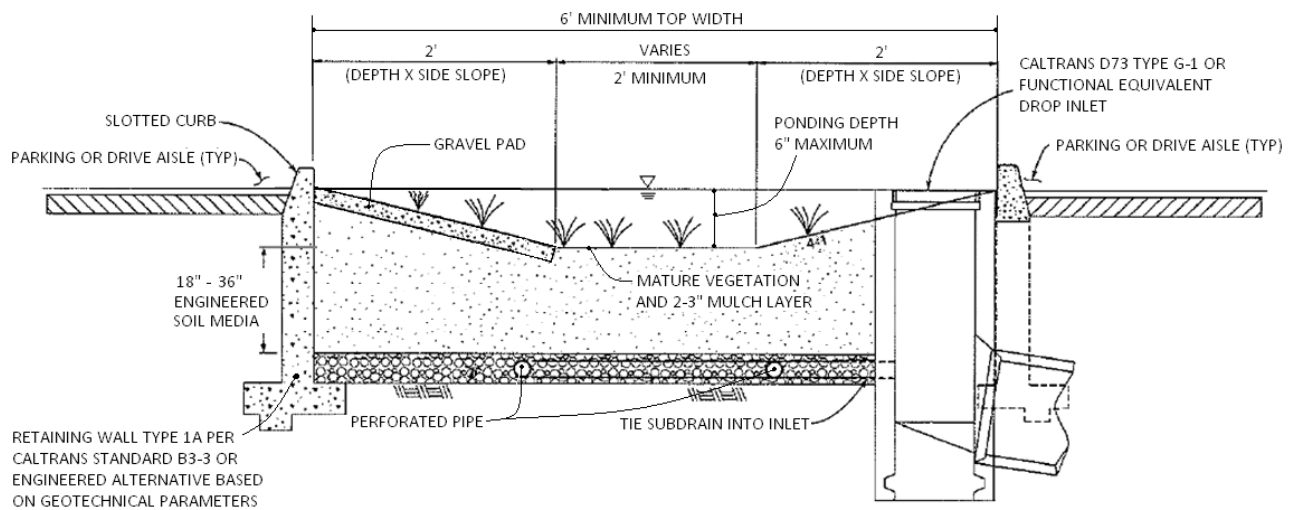
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

BIORETENTION FACILITY BMP FACT SHEET

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost¹, such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

¹ For more information on compost, visit the US Composting Council website at: <http://compostingcouncil.org/>

BIORETENTION FACILITY BMP FACT SHEET



Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

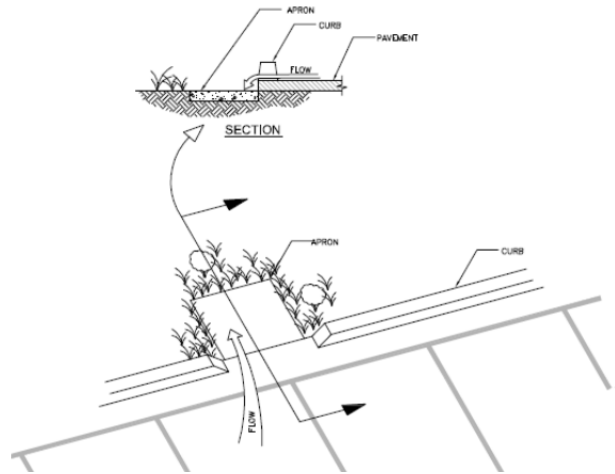


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6" Check Dam Spacing	
Slope	Spacing
1%	25'
2%	15'
3%	10'

BIORETENTION FACILITY BMP FACT SHEET

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

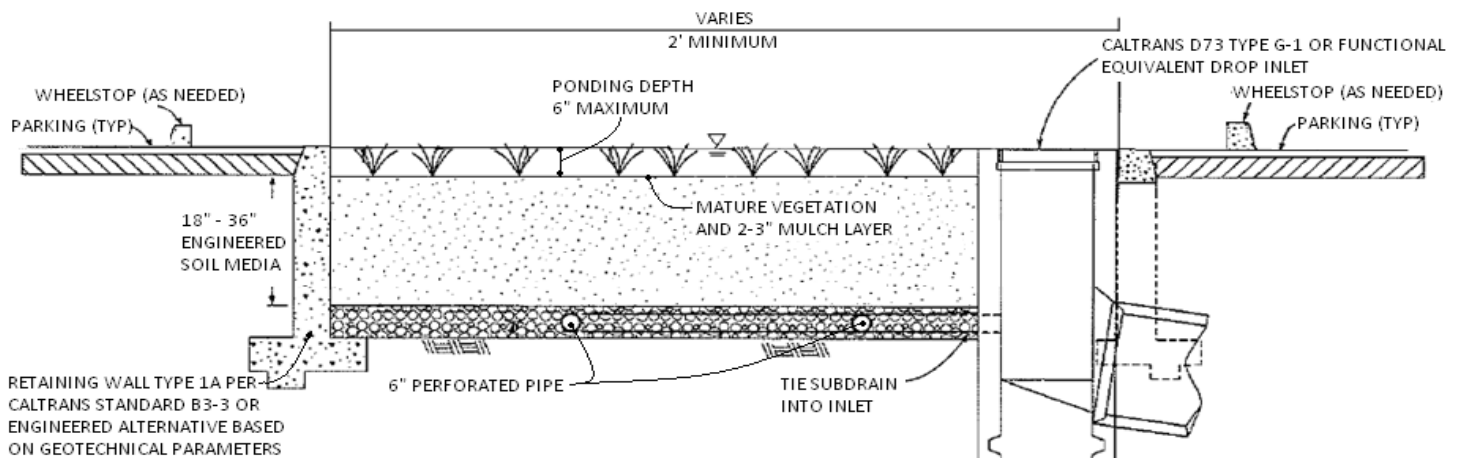
Side Slope Requirements

Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility, but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



BIORETENTION FACILITY BMP FACT SHEET

Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.



Figure 5: Planter Box

Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

BIORETENTION FACILITY BMP FACT SHEET

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.



Figure 6: Incorrect Placement of an Overflow Inlet.

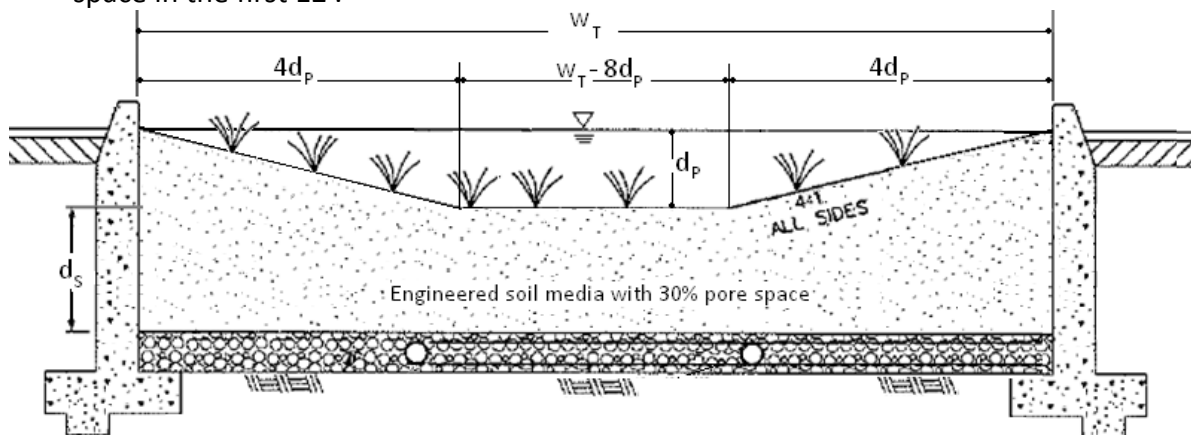
Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	<ul style="list-style-type: none">• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities.• Remove trash and debris• Replace damaged grass and/or plants• Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	<ul style="list-style-type: none">• Inspect areas for ponding
Annually	<ul style="list-style-type: none">• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

- 1) Enter the area tributary, A_T , to the Bioretention Facility.
- 2) Enter the Design Volume, V_{BMP} , determined from Section 2.1 of this Handbook.
- 3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.
- 4) Enter the depth of the engineered soil media, d_s . The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.
- 5) Enter the top width of the Bioretention Facility.
- 6) Calculate the total effective depth, d_E , within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



- a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_p is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[(w_T(\text{ft}) \times d_s(\text{ft})) + 4(d_p(\text{ft}))^2 \right] + 0.4 \times 1(\text{ft}) + d_p(\text{ft}) \left[4d_p(\text{ft}) + (w_T(\text{ft}) - 8d_p(\text{ft})) \right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5' is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_s(\text{ft}) + 0.4 \times 1(\text{ft})) - \left(\frac{0.7(\text{ft}^2)}{w_T(\text{ft})} \right) + 0.5(\text{ft})$$

- b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(\text{ft}) = d_p(\text{ft}) + [(0.3) \times d_s(\text{ft}) + (0.4) \times 1(\text{ft})]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = 0.5(\text{ft}) + [(0.3) \times d_s(\text{ft}) + (0.4) \times 1(\text{ft})]$$

- 7) Calculate the minimum surface area, A_M , required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$A_M(\text{ft}^2) = \frac{V_{\text{BMP}}(\text{ft}^3)}{d_E(\text{ft})}$$

- 8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.
- 9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.
- 10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.
- 11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.
- 12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.
- 13) Describe the vegetation used within the Bioretention Facility.

References Used to Develop this Fact Sheet

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Urbonas, Ben R. Stormwater Sand Filter Sizing and Design: A Unit Operations Approach. Denver: Urban Drainage and Flood Control District, 2002.

FLEXSTORM® CATCH-IT® REUSABLE INLET PROTECTION

SPECIFY WITH CONFIDENCE

State DOTs and Municipalities across the country now have a universal structural BMP to address the issue of storm sewer inlet protection: FLEXSTORM CATCH-IT Inlet Filters—the temporary *and* reusable solution.

The FLEXSTORM CATCH-IT system is the preferred choice for temporary inlet protection and storm water runoff control. FLEXSTORM CATCH-IT Inlet Filters will fit any drainage structure and are equipped with high-efficiency filter bags. Whether you're the specifier or the user, it's clear to see how FLEXSTORM CATCH-IT Inlet Filters outperform the competition.

APPLICATIONS:

DOT	Road Construction
Commercial	Parking Lots
Industrial	Maintenance
Residential Developments	

FEATURES:

- **Configurable:** steel frames configured and guaranteed to fit ANY storm drainage structure
- **Adjustable:** although shipped to fit your inlet, rectangular framing may be field adjusted in 1/2" increments if necessary
- **Reusable:** galvanized framing will last year after year in harsh conditions, while geotextile filter bags are easily replaced after several years of use
- **Effective:** works below grade; overflow feature allows streets to drain with full bag; third party testing results of the FX filter bag show 82% Filtration Efficiency
- **Affordable:** low per-unit cost; installs in seconds; easily maintained with Universal Removal Tool (no machinery required)



BENEFITS:

- Reduce jobsite flooding and keep projects running
- Minimize residential complaints with cleaner, dryer streets during all construction phases
- Prevent hazardous road icing conditions by eliminating ponding at curb inlets
- Significantly reduce cleanup costs
- Prevent siltation and pollution of rivers, lakes, and ponds
- Helps prevent fines; NPDES PHASE II Compliant
- Lowest cost alternative for the highest level of Inlet Protection
- Available through 5,000 ADS distributors nationwide
- Ships within 48 hours



ADS Service:
ADS representatives are committed to providing you with the answers to all your questions, including selecting the proper filter, specifications, installation and more. Also try the **ADS FLEXSTORM Online Product Configurator** at www.inletfilters.com



FLEXSTORM CATCH-IT INLET FILTERS SPECIFICATION

IDENTIFICATION

The installer shall inspect the plans and/or worksite to determine the quantity of each drainage structure casting type. The foundry casting number, exact grate size and clear opening size, or other information will be necessary to finalize the FLEXSTORM part number and dimensions. The units are shipped to the field configured precisely to fit the identified drainage structure.

MATERIAL AND PERFORMANCE

The FLEXSTORM Inlet Filter system is comprised of a corrosion resistant steel frame and a replaceable geotextile filter bag attached to the frame with a stainless steel locking band. The filter bag hangs suspended at a distance below the grate that shall allow full water flow into the drainage structure if the bag is completely filled with sediment. The standard Woven Polypropylene FX filter bags are rated for 200 gpm/sqft with a removal efficiency of 82% when filtering a USDA Sandy Loam sediment load. The Post Construction PC filter bags are rated for 137 gpm/sqft and have been 3rd party tested at 99% TSS removal to 110 micron and 97% TPH removal of used motor oil hydrocarbon mix.

INSTALLATION

Remove the grate from the casting or concrete drainage structure. Clean the ledge (lip) of the casting frame or drain- age structure to ensure it is free of stone and dirt. Drop in the FLEXSTORM Inlet Filter through the clear opening and be sure the suspension hangers rest firmly on the inside ledge (lip) of the casting. Replace the grate and confirm it is elevated no more than 1/8", which is the thickness of the steel hangers. For wall mount units, follow instructions for attaching the stainless steel mounting brackets using the provided concrete fasteners.

INSPECTION FREQUENCY

Construction site inspection should occur following each 1/2" or more rain event. Post Construction inspections should occur three times per year (every four months) in areas with mild year round rainfall and four times per year (every three months Feb-Nov) in areas with summer rains before and after the winter snowfall season. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than three times per year.

MAINTENANCE GUIDELINES

Empty the filter bag if more than half filled with sediment and debris, or as directed by the Engineer. Remove the grate, engage the lifting bars or handles with the FLEXSTORM Removal Tool, and lift from the drainage structure. Dispose of the sediment or debris as directed by the Engineer or Maintenance Contract in accordance with EPA guidelines.

As an alternative, an industrial vacuum may be used to collect the accumulated sediment. Remove any caked on silt from the sediment bag and reverse flush the bag with medium spray for optimal filtration. Replace the bag if torn or punctured to 1/2" diameter or greater on the lower half of the bag.

FILTER BAG REPLACEMENT

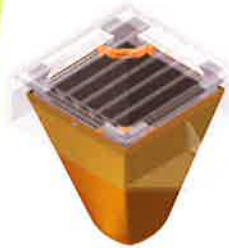
Remove the bag by loosening or cutting off the clamping band. Take the new filter bag, which is equipped with a stainless steel worm drive clamping band, and use a screw driver to tighten the bag around the frame channel. Ensure the bag is secure and that there is no slack around the perimeter of the band.

Lift Handles ease installation and maintenance



Replaceable Sediment Bag

1/8" thick steel hangers & channels; precision stampings **configured to fit each individual casting**

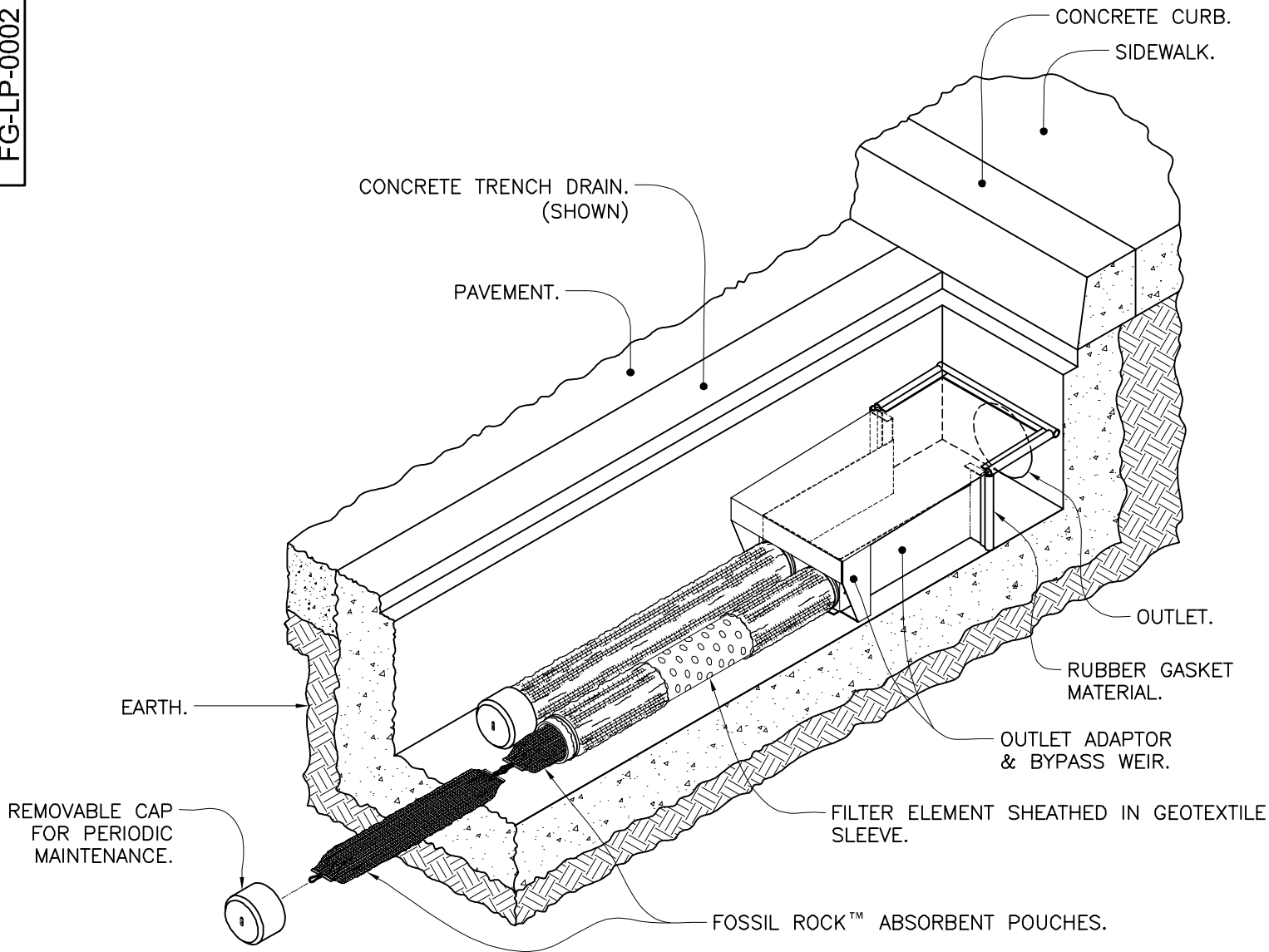


CAD drawings, work instructions and test reports on website: www.inletfilters.com



For more information on FLEXSTORM Inlet Filters and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710
Try the **ADS FLEXSTORM Online Product Configurator** at www.inletfilters.com.

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NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter outlet adapter shall be constructed from stainless steel Type 304. Alternate outlet adaptor for shallow installations shall be PVC SCH-40. See detail B, sheet 2 of 2.
3. Filter medium shall be *Fossil Rock™*, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.
5. For alternate outlet adapter configurations used for extremely shallow trench drains contact Oldcastle Stormwater Solutions for engineering assistance.
6. Filter element should be a minimum of one half the length of trench. Confirm flow rate upon order.



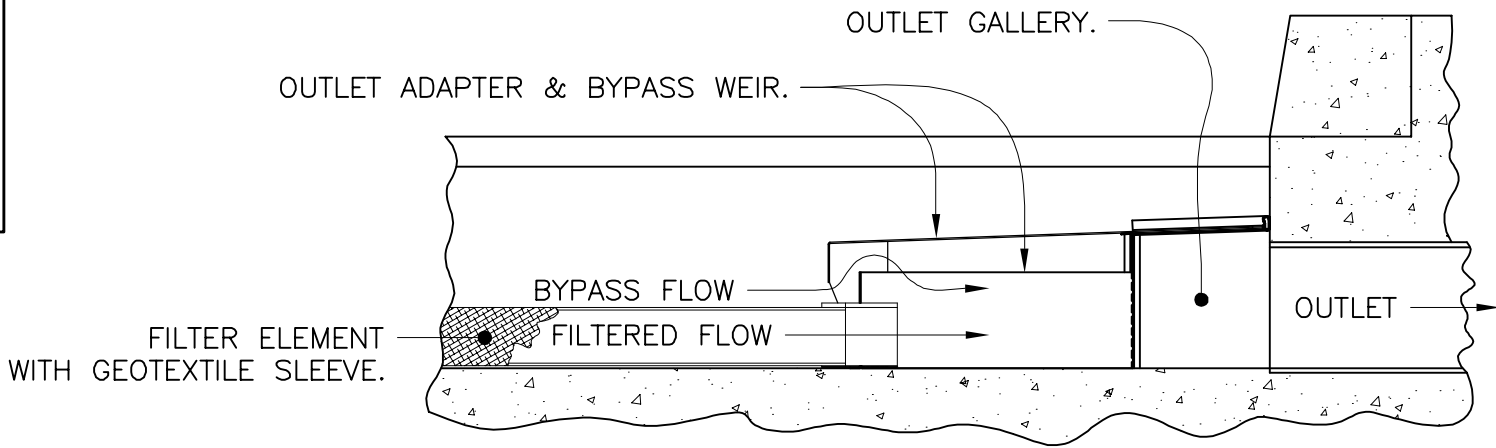
FloGard®
Catch Basin Insert Filter
Trench Drain Style



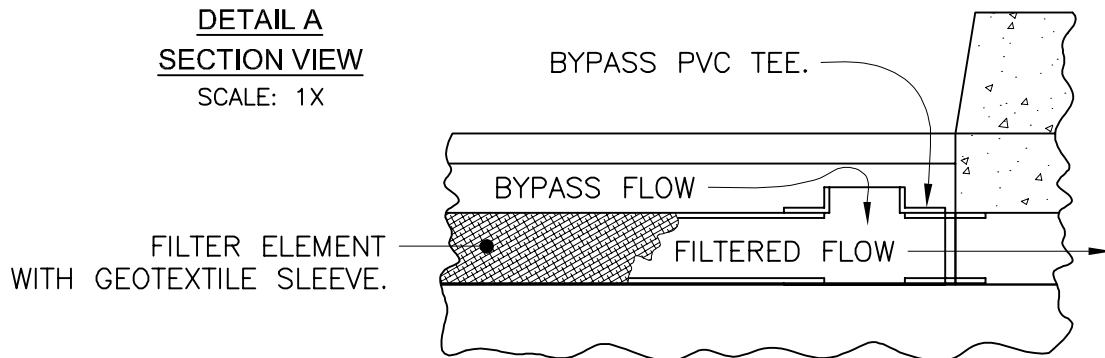
Oldcastle®
Stormwater Solutions

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DRAWING NO.	REV	ECO	DATE	SHEET
FG-LP-0002	H	ECO-0142	JPR 7/13/16	1 OF 2



DETAIL A
SECTION VIEW
SCALE: 1X



DETAIL B
SECTION VIEW
ALTERNATE ADAPTER CONFIGURATION
SCALE: 1X

SPECIFIER CHART

MODEL	FILTER TYPE	TRENCH WIDTH "ID" (CLEAR OPENING)	MINIMUM TRENCH DEPTH (FROM BOTTOM OF GRATE)	SOLIDS STORAGE CAPACITY CUBIC FEET **	FILTERED FLOW CUBIC FEET / SECOND **	TOTAL BYPASS CAPACITY CUBIC FEET / SECOND
FG-TDOF3	PIPE *	3.0	6.5	0.1	0.5	0.1
FG-TDOF4	PIPE *	4.0	6.5	0.2	0.5	0.1
FG-TDOF6	PIPE	6.0	6.5	0.4	0.5	0.2
FG-TDOF8	PIPE	8.0	6.5	0.7	0.5	0.3
FG-TDOF10	PIPE	10.0	6.5	0.9	0.5	0.5
FG-TDOF12	PIPE	12.0	6.5	0.9	1.0	0.6
FG-TDOF18	PIPE	18.0	6.5	1.3	1.5	1.1
FG-TDOF24	PIPE	24.0	6.5	1.8	2.0	1.5
FG-TDOA6	PANEL	6.0	4.5	0.4	0.2	0.2
FG-TDOA8	PANEL	8.0	4.5	0.7	0.2	0.3
FG-TDOA10	PANEL	10.0	4.5	0.8	0.3	0.5
FG-TDOA12	PANEL	12.0	4.5	1.0	0.4	0.6
FG-TDOA18	PANEL	18.0	4.5	1.4	0.8	1.1
FG-TDOA24	PANEL	24.0	4.5	1.8	1.1	1.5

* ALTERNATE ADAPTER CONFIGURATION. SEE DETAIL B.

**CAPACITY PER 5-FT. SEGMENT USED.



Inlet Filtration

FloGard®
Catch Basin Insert Filter
Trench Drain Style



Oldcastle®
Stormwater Solutions

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DRAWING NO. FG-LP-0002	REV H	ECO ECO-0142 JPR 7/13/16	DATE JPR 2/21/07	SHEET 2 OF 2
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Site Design & Landscape Planning SD-10



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.



SD-10 Site Design & Landscape Planning

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

Site Design & Landscape Planning SD-10

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.

SD-10 Site Design & Landscape Planning

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.



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



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.



- 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.



Design Objectives

- Maximize Infiltration
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- 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.



Photo Credit: Geoff Brosseau

Design Objectives

- Maximize Infiltration
 - Provide Retention
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- 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



- 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.

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Design Objectives

- Maximize Infiltration
- Provide Retention
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- Contain Pollutant
- Collect and Convey

Description

Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.

Approach

Outdoor storage areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor storage areas, infiltration is discouraged. Containment is encouraged. Preventative measures include enclosures, secondary containment structures and impervious surfaces.

Suitable Applications

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

Design Considerations

Some materials are more of a concern than others. Toxic and hazardous materials must be prevented from coming in contact with stormwater. Non-toxic or non-hazardous materials do not have to be prevented from stormwater contact. However, these materials may have toxic effects on receiving waters if allowed to be discharged with stormwater in significant quantities. Accumulated material on an impervious surface could result in significant impact on the rivers or streams that receive the runoff.

Material may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Stormwater contamination may be prevented by eliminating the possibility of stormwater contact with the material storage areas either through diversion, cover, or capture of the stormwater. Control measures may also include minimizing the storage area. Design



SD-34 Outdoor Material Storage Areas

requirements for material storage areas are governed by Building and Fire Codes, and by current City or County ordinances and zoning requirements. Control measures are site specific, and must meet local agency requirements.

Designing New Installations

Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following structural or treatment BMPS should be considered:

- Materials with the potential to contaminate stormwater should be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system, or (2) protected by secondary containment structures such as berms, dikes, or curbs.
- The storage area should be paved and sufficiently impervious to contain leaks and spills.
- The storage area should slope towards a dead-end sump to contain spills and direct runoff from downspouts/roofs should be directed away from storage areas.
- The storage area should have a roof or awning that extends beyond the storage area to minimize collection of stormwater within the secondary containment area. A manufactured storage shed may be used for small containers.

Note that the location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

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

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 permits.

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.

Outdoor Material Storage Areas SD-34

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.

Attachment 6 - NOAA Information



NOAA Atlas 14, Volume 6, Version 2
Location name: Chino, California, USA*
Latitude: 33.974°, Longitude: -117.6155°
Elevation: 641.88 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

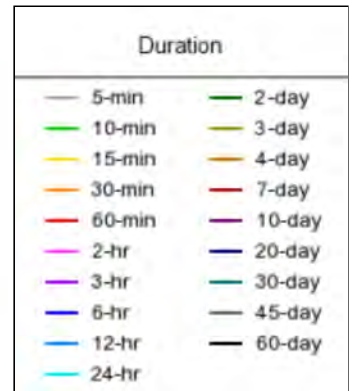
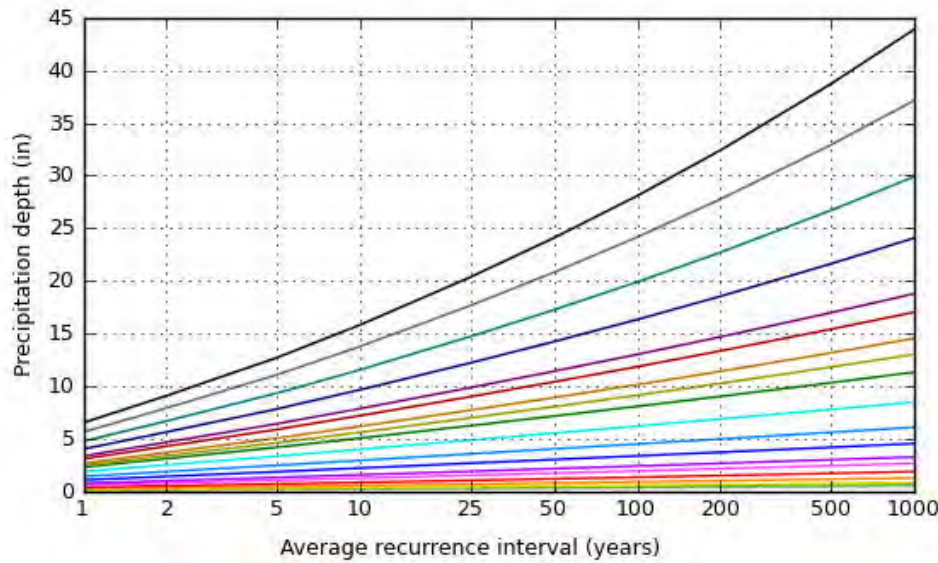
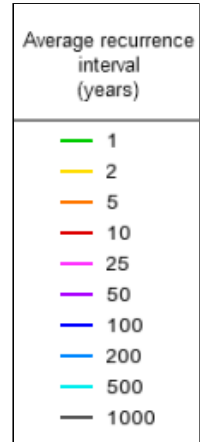
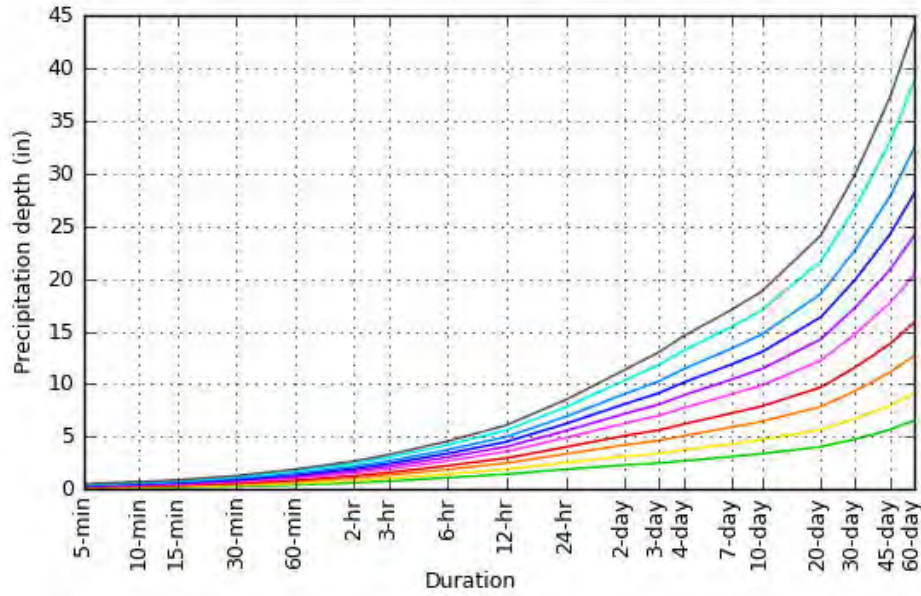
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.113 (0.094-0.136)	0.149 (0.124-0.180)	0.195 (0.163-0.237)	0.233 (0.193-0.286)	0.285 (0.227-0.362)	0.325 (0.253-0.421)	0.365 (0.277-0.486)	0.407 (0.300-0.558)	0.464 (0.328-0.665)	0.509 (0.347-0.755)
10-min	0.162 (0.135-0.196)	0.213 (0.178-0.258)	0.280 (0.233-0.340)	0.335 (0.276-0.410)	0.409 (0.325-0.518)	0.466 (0.363-0.604)	0.524 (0.398-0.697)	0.584 (0.431-0.800)	0.666 (0.470-0.952)	0.730 (0.497-1.08)
15-min	0.196 (0.163-0.237)	0.258 (0.215-0.312)	0.339 (0.282-0.411)	0.405 (0.334-0.496)	0.494 (0.394-0.627)	0.563 (0.439-0.730)	0.633 (0.481-0.843)	0.706 (0.521-0.967)	0.805 (0.568-1.15)	0.883 (0.601-1.31)
30-min	0.288 (0.241-0.348)	0.380 (0.317-0.460)	0.499 (0.415-0.606)	0.596 (0.492-0.730)	0.728 (0.580-0.923)	0.830 (0.646-1.08)	0.933 (0.709-1.24)	1.04 (0.767-1.43)	1.19 (0.837-1.70)	1.30 (0.885-1.93)
60-min	0.424 (0.354-0.512)	0.558 (0.466-0.676)	0.734 (0.610-0.891)	0.876 (0.723-1.07)	1.07 (0.852-1.36)	1.22 (0.950-1.58)	1.37 (1.04-1.83)	1.53 (1.13-2.10)	1.74 (1.23-2.50)	1.91 (1.30-2.84)
2-hr	0.630 (0.526-0.762)	0.828 (0.691-1.00)	1.08 (0.900-1.31)	1.29 (1.06-1.57)	1.56 (1.24-1.98)	1.76 (1.37-2.29)	1.97 (1.50-2.62)	2.18 (1.61-2.99)	2.47 (1.74-3.53)	2.68 (1.83-3.98)
3-hr	0.788 (0.658-0.953)	1.03 (0.863-1.25)	1.35 (1.12-1.64)	1.60 (1.32-1.96)	1.93 (1.54-2.45)	2.18 (1.70-2.83)	2.44 (1.85-3.24)	2.69 (1.98-3.69)	3.03 (2.14-4.34)	3.29 (2.24-4.88)
6-hr	1.11 (0.924-1.34)	1.45 (1.21-1.76)	1.89 (1.57-2.30)	2.24 (1.85-2.75)	2.70 (2.15-3.43)	3.05 (2.38-3.96)	3.40 (2.58-4.52)	3.75 (2.76-5.13)	4.21 (2.97-6.03)	4.57 (3.11-6.77)
12-hr	1.45 (1.21-1.75)	1.91 (1.59-2.31)	2.50 (2.08-3.04)	2.97 (2.45-3.64)	3.59 (2.86-4.56)	4.06 (3.16-5.27)	4.53 (3.44-6.02)	5.00 (3.69-6.85)	5.63 (3.97-8.05)	6.11 (4.16-9.06)
24-hr	1.91 (1.69-2.20)	2.54 (2.25-2.94)	3.36 (2.96-3.89)	4.02 (3.51-4.69)	4.89 (4.14-5.90)	5.56 (4.61-6.84)	6.22 (5.04-7.84)	6.90 (5.44-8.93)	7.80 (5.90-10.5)	8.50 (6.22-11.9)
2-day	2.32 (2.05-2.67)	3.14 (2.77-3.62)	4.21 (3.71-4.88)	5.08 (4.45-5.93)	6.27 (5.30-7.55)	7.18 (5.95-8.83)	8.10 (6.56-10.2)	9.05 (7.13-11.7)	10.3 (7.82-13.9)	11.3 (8.30-15.8)
3-day	2.49 (2.21-2.87)	3.42 (3.02-3.95)	4.64 (4.09-5.37)	5.64 (4.93-6.58)	7.01 (5.93-8.44)	8.07 (6.69-9.92)	9.15 (7.41-11.5)	10.3 (8.10-13.3)	11.8 (8.95-16.0)	13.0 (9.54-18.2)
4-day	2.70 (2.39-3.11)	3.73 (3.29-4.30)	5.08 (4.48-5.89)	6.20 (5.42-7.24)	7.74 (6.55-9.32)	8.93 (7.40-11.0)	10.2 (8.22-12.8)	11.4 (9.00-14.8)	13.2 (9.97-17.8)	14.5 (10.6-20.3)
7-day	3.11 (2.75-3.59)	4.31 (3.81-4.98)	5.90 (5.20-6.84)	7.22 (6.31-8.42)	9.02 (7.63-10.9)	10.4 (8.64-12.8)	11.9 (9.61-14.9)	13.4 (10.5-17.3)	15.4 (11.7-20.8)	17.0 (12.5-23.8)
10-day	3.38 (2.99-3.90)	4.70 (4.15-5.42)	6.45 (5.68-7.46)	7.89 (6.90-9.21)	9.88 (8.36-11.9)	11.4 (9.48-14.1)	13.0 (10.6-16.4)	14.7 (11.6-19.0)	17.0 (12.9-22.9)	18.8 (13.7-26.2)
20-day	4.04 (3.58-4.66)	5.66 (5.01-6.54)	7.85 (6.92-9.09)	9.68 (8.46-11.3)	12.2 (10.4-14.7)	14.2 (11.8-17.5)	16.3 (13.2-20.6)	18.5 (14.6-24.0)	21.6 (16.4-29.2)	24.1 (17.6-33.6)
30-day	4.77 (4.22-5.50)	6.71 (5.93-7.74)	9.35 (8.24-10.8)	11.6 (10.1-13.5)	14.7 (12.5-17.8)	17.3 (14.3-21.2)	19.9 (16.1-25.1)	22.7 (17.9-29.4)	26.7 (20.2-36.0)	29.9 (21.9-41.7)
45-day	5.66 (5.01-6.52)	7.94 (7.01-9.16)	11.1 (9.77-12.8)	13.8 (12.1-16.1)	17.7 (15.0-21.3)	20.8 (17.3-25.6)	24.2 (19.6-30.4)	27.8 (21.9-36.0)	32.9 (24.9-44.4)	37.1 (27.2-51.8)
60-day	6.54 (5.79-7.54)	9.11 (8.05-10.5)	12.7 (11.2-14.7)	15.8 (13.9-18.5)	20.4 (17.2-24.6)	24.1 (20.0-29.6)	28.1 (22.7-35.4)	32.4 (25.5-42.0)	38.7 (29.3-52.2)	43.9 (32.1-61.2)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
 Latitude: 33.9740°, Longitude: -117.6155°



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Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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[National Water Center](#)
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

Attachment 7 - Soils Report

22G145-1 PRELIMINARY EXECUTIVE SUMMARY

At the request of the client, we have provided this summary of the preliminary geotechnical design recommendations for a proposed industrial building in Chino, California. It should be understood that this summary is based on a cursory review of the boring logs, trench logs and the laboratory test data completed as of this date. Additional engineering analysis will be performed subsequent to the issuance of this preliminary summary. Therefore, the design recommendations presented in the forthcoming geotechnical report may vary somewhat from the recommendations presented below.

Preliminary Geotechnical Design Considerations

- Artificial fill soils were encountered at most of the boring and trench locations, extending from the ground surface to depths of up to 8± feet, with an average depth on the order of 5 feet.
- The near-surface alluvial soils possess variable strength, minor compressibility and collapse characteristics.
- The recommended depth of remedial grading will need to be sufficient to help reduce potential static settlements to within tolerable levels.

Preliminary Site Preparation Recommendations

- Demolition of the existing remnants of old structures, including concrete slabs, asphalt, curbs, gutters, utilities, piping and other debris will be required in order to facilitate construction of the new development.
- Site stripping should include all vegetation, organic soils, and root masses. These materials should be disposed of offsite. Site stripping should also include removal of organic topsoil. These materials should also be disposed of off-site.
- Based on our review of historic aerial photos, the site was previously developed as a dairy. It is recommended that organic materials (greater than 5 percent organics) and any old manure (if present) be removed during site stripping.
- Organic testing was performed for this investigation that indicates organic contents range from 1 to 23± percent in the upper 24 inches. Based on the test results, we anticipate that the upper 12 to 18 inches of soil will need to be removed or blended. Soils possessing minor to moderate organic contents, less than 5 percent by weight, may be blended with soils with lower organic content, provided that the final mixture contains less than 3 percent organics by weight.
- Remedial grading is recommended within the proposed building pad area to remove the undocumented fill soils in their entirety, which were observed in the borings and trenches to extend to depths of up to 8± feet. The building pad area should also be overexcavated to a depth of at least 5 feet below existing grade or 3 feet below proposed pad grade, whichever is greater. Overexcavation within the foundation areas is recommended to extend to a depth of at least 3 feet below proposed foundation bearing grade.
- After overexcavation has been completed, the subgrade soils should be evaluated by the geotechnical engineer to identify additional soils that should be overexcavated. The resulting subgrade should then be scarified to a depth of 12 inches, moisture conditioned or air dried to 0 to 4 percent above optimum, and recompact to at least 90 percent of the

ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.

- The new parking area subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Soluble Sulfates

- Results of laboratory testing indicate the on-site soils contain negligible concentrations of soluble sulfates with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary.
- Additional sulfate testing should be performed after the completion of grading in order to confirm the negligible sulfate contents.

Preliminary Foundation Design Recommendations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft² maximum allowable soil bearing pressure.
- Reinforcement consisting of four (4) No. 5 rebar, (2 top and 2 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Preliminary Building Floor Slab Design Recommendations

- Conventional Slab-on-Grade: minimum 6 inches thick, from a geotechnical standpoint.
- Minimum slab reinforcement: per structural engineer design assuming the building pad expansion potential will be classified as "Very Low".
- Modulus of Subgrade Reaction: $k = 150 \text{ psi/in.}$
- The actual thickness and reinforcement of the floor slab should be evaluated and designed by the structural engineer based on the anticipated geotechnical conditions present after grading, anticipated slab loading and intended use.

Preliminary Infiltration Rates

- Three infiltration tests were performed at the subject site.
- The soils encountered at the bottom of the test locations consist of medium dense to dense sandy silt and silty fine sand. Based on the test results and composition of the on-site soils, a preliminary infiltration rate of 1 inch per hour is recommended for the proposed infiltration system if the bottom of the system extends to a depth of 10± feet below the existing site grades.

Pavements

ASPHALT PAVEMENTS (R = 50)					
Materials	Thickness (inches)				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	4	4	5	5	7
Compacted Subgrade	12	12	12	12	12

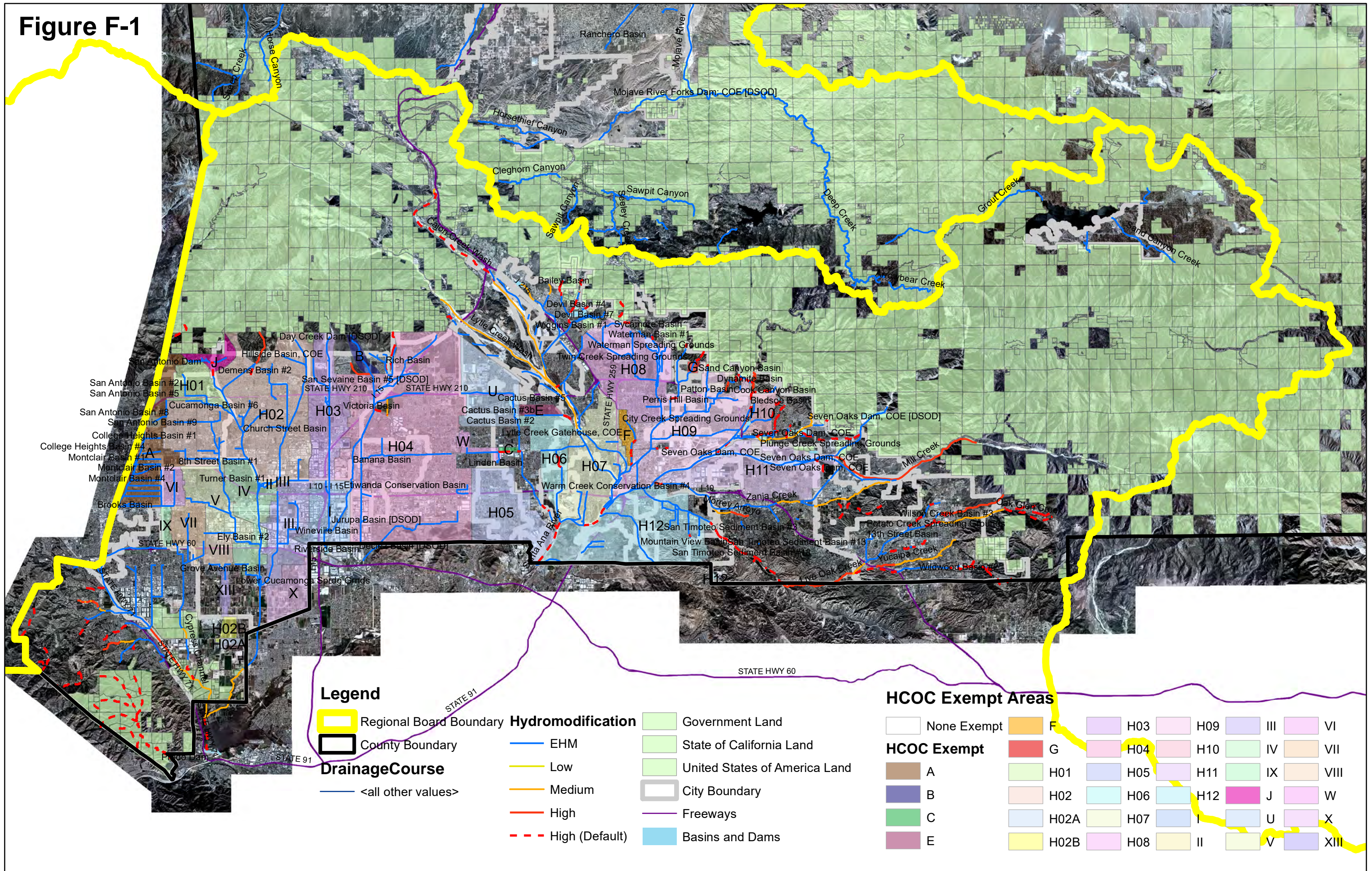
PORTLAND CEMENT CONCRETE PAVEMENTS (R = 50)				
Materials	Thickness (inches)			
	Autos and Light Truck Traffic (TI = 5.0 to 6.0)	Truck Traffic		
		(TI = 7.0)	(TI = 8.0)	(TI = 9.0)
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2019 CBC Seismic Design Parameters

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S _s	1.686
Mapped Spectral Acceleration at 1.0 sec Period	S ₁	0.602
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S _{MS}	1.686
Site Modified Spectral Acceleration at 1.0 sec Period	S _{M1}	1.023
Design Spectral Acceleration at 0.2 sec Period	S _{DS}	1.124
Design Spectral Acceleration at 1.0 sec Period	S _{D1}	0.682

Attachment 8
HCOC Exemption Map

Figure F-1



Hydromodification

A.1 Hydrologic Conditions of Concern (HCOC) Analysis

HCOC Exemption:

1. **Sump Condition:** All downstream conveyance channel to an adequate sump (for example, Prado Dam, 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 Sensitivity Maps.
2. **Pre = Post:** The runoff flow rate, volume and velocity for the post-development condition of the Priority Development Project do not exceed the pre-development (i.e, naturally occurring condition for the 2-year, 24-hour rainfall event utilizing latest San Bernardino County Hydrology Manual.
 - a. Submit a substantiated hydrologic analysis to justify your request.
3. **Diversion to Storage Area:** The drainage areas that divert to water storage areas which are considered as control/release point and utilized for water conservation.
 - a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (<http://sbcounty.permitrack.com/wap>) for reference.
4. **Less than One Acre:** The Priority Development Project disturbs less than one acre. The Co-permittee 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 project disturbs less than one acre and is not part of a common plan of development.
5. **Built Out Area:** The contributing watershed area to which the project discharges has a developed area percentage greater than 90 percent.
 - a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (<http://sbcounty.permitrack.com/wap>) for reference.

Summary of HCOC Exempted Area

	HCOC Exemption reasoning				
	1	2	3	4	5
Area					
A			X		X
B			X		
C					X
E			X		
F					X
G			X		X
H01	X		X		
H02	X		X		
H02A	X		X		
H02B			X		
H03			X		
H04	X		X		
H05	X				
H06			X		
H07	X				
H08	X		X		
H09	X				
H10	X		X		
H11	X		X		
H12	X				
J			X		
U			X		
W			X		
I			X		
II			X		
III					X
IV			X		X
V			X*		
VI					X
VII					X
VIII			X		
IX					X
X			X		
XIII			X		

*Detention/Conservation Basin

Hydromodification

A.1 Hydrologic Conditions of Concern (HCOC) Analysis

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1. **Sump Condition:** All downstream conveyance channel to an adequate sump (for example, Prado Dam, 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 Sensitivity Maps.
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Summary of HCOC Exempted Area

	HCOC Exemption reasoning				
	1	2	3	4	5
Area					
A			X		X
B			X		
C					X
E			X		
F					X
G			X		X
H01	X		X		
H02	X		X		
H02A	X		X		
H02B			X		
H03			X		
H04	X		X		
H05	X				
H06			X		
H07	X				
H08	X		X		
H09	X				
H10	X		X		
H11	X		X		
H12	X				
J			X		
U			X		
W			X		
I			X		
II			X		
III					X
IV			X		X
V			X*		
VI					X
VII					X
VIII			X		
IX					X
X			X		
XIII			X		

*Detention/Conservation Basin