
APPENDIX G

PRELIMINARY WATER QUALITY MANAGEMENT PLAN

City of Hesperia

Preliminary Project Specific Water Quality Management Plan

For:

APN: 3064-591-12,13 & 631-01

Prepared for:

Cargo Solutions Express 14581 v

14587 Valley Blvd

Rancho Cucamonga, CA 92335

909-350-1644 ex 330

Prepared by:

Allard Engineering

16866 Seville Avenue

Fontana, CA 92335

909-356-1815

Preparation Date: **9-30-2023**

Revision No. and Date: #1: 8-8-2022, #2: 9-20-2022, #3: **9-30-2023**, #4 **9-3-2024**

Final Approval Date: _____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Bobby Kang, CEO-Cargo Solutions Express by Allard Engineering. The WQMP is intended to comply with the requirements of the City of Hesperia and the Phase II Small MS4 General Permit for the Mojave River Watershed. 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 the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town 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):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 3064-591-12,13 & 631-01
Owner's Signature			
Owner Name: Bobby Kang			
Title	CEO		
Company	Cargo Solutions Express		
Address	14587 Valley Blvd, CA 92335		
Email	bobby@cargosolutionexpress.com		
Telephone #	(909) 350-1644 ex 330		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 3064-591-12,13 & 631-01

"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 the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: BOBBY ALLARD		PE Stamp Below 
Title	VICE PRESIDENT	
Company	Allard Engineering	
Address	16866 Seville Avenue, Fontana, CA 92335	
Email	rallard@allardeng.com	
Telephone #	909-356-1815	
Signature	<i>Robert K. Allard</i>	
Date	9-3-2024	

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Section I – Introduction

This WQMP has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB).

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name Cargo Solution Express		APN: 3064-591-12,13 & 631-01			
Project Owner Contact Name:		Bobby Kang			
Mailing Address:	14581 Valley Blvd. Fontana, CA 92335	E-mail Address:	bobby@cargosolutionexpress.com	Telephone:	909-350-1644
Permit/Application Number(s):		Tract/Parcel Map Number(s):		APN: 3064-591-12,13 & 631-01	
Additional Information/ Comments: Site Coordinates		Latitude: 34.4148, Longitude: -117.3925			
Description of Project:		The project site is a 20.33 acre of proposed development of Commercial Facility located in the City of Hesperia, County of San Bernardino, State of California. Consist of Warehouse & Truck/Trailer parking. The proposed site development is for combined 2 Parcels which consist of a single drainage area DA-1 with two Drainage Management Areas DMA-1,2. In DMA-1 (10.5 acres), the on site drainage systems consist of swales, grated inlets with filter insert and pipes will convey the flows to the proposed infiltration/retention basin-1 with two-stage pits system (Maxwell plus Drywell System) at the northeast corner in the drainage management area DMA-1. The proposed infiltration/retention basin-1 with two-stage pits system is sized to qualify for both required WQMP volume (30,956 CF) as well as the required detention volume (55,572 CF) from the drainage management area DMA-1. In DMA-2 (9.83 acres), the on site drainage systems consist of swales, grated inlets with filter insert and pipes will convey the flows to the proposed infiltration/retention basin-2 with two-stage pits system (Maxwell plus Drywell System) at the northwest corner in the drainage management area DMA-2. The proposed infiltration/retention basin-2 with two-stage pits system is sized to qualify for both required WQMP volume (28,981 CF) as well as the required detention volume (52,035 CF) from the drainage management area DMA-1. Detention volume has been calculated based upon the City of Hesperia "13.5-cf per 100-sf of impervious area" rule. Required combined detention volume (107,606 CF) exceeds the combined water quality volume (59,937 CF) from DMA-1 & DMA-2. The infiltration/retention basin-1 with two-stage pits system will drain out at the northeast corner of DMA-1 to Poplar Street via undersidewalk parkway drain when reaches capacity. The infiltration/retention basin-2 with two-stage pits system will drain out at the northeast corner of DMA-2 to Poplar Street via undersidewalk parkway drain when reaches capacity.			

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	
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Section 2 Project Description

2.1 Project Information

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project

¹ Regulated Development Project Category (Select all that apply):

- | | | | |
|--|--|---|--|
| ☒ #1 New development involving the creation of 5,000 ft ² or more of impervious surface collectively over entire site | ☐ #2 Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site | ☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface | ☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface |
|--|--|---|--|

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.

² Project Area (ft ²):	855,648	³ Number of Dwelling Units:		⁴ SIC Code:	4225
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⁵ Is Project going to be phased? Yes ☒ No ☐ If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.

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:

Cargo Solutions Express. will be responsible to build the site and will maintain the post-developed BMPs upon completion of construction.

Address:

Cargo Solutions Express

14587 Valley Blvd, Fontana, CA 92335

-

Phone Number: 909-350-1644

2.3 Potential Stormwater Pollutants

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Bacteria and viruses are a potential pollutant for Commercial developments if the land use involves animal waste. Due to the nature of the development, there will be minimal animal waste associated with this land use, and the site will be treated using site and source and treatment control BMPs. 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 basins as part of Low Impact Design (LID).
Nutrients - Phosphorous	E ☒	N ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☒	N ☐	
Sediment	E ☒	N ☐	
Metals	E ☐	N ☒	Not identified in TGD Table 3.3 with detached SFR lots.
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs 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 Drainage Management Areas (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. A map presenting the DMAs must be included as an appendix to the WQMP document.*

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude 34.4525	Longitude -117.3925	Thomas Bros Map page
¹ San Bernardino County climatic region: ☒ Desert			
² Does the site have more than one drainage area (DA): Yes ☐ No ☒ <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 DMA1_1[DMA 1] --> IB1[Infiltration Basin-1 With Two Stage Pit System] IB1 --> O1[Outlet 1] DMA1_2[DMA 1] --> IB2[Infiltration Basin-2 With Two Stage Pit System] IB2 --> O2[Outlet 2] O1 --> PS[Poplar Street] O2 --> PS </pre>			
Conveyance			
DMA1 to Outlet 1 DMA2 to Outlet 2	The project site is a 20.33 acre of proposed development of Commercial Facility located in the City of Hesperia, County of San Bernardino, State of California. Consist of Warehouse & Truck/Trailer parking. The proposed site development is for combined 2 Parcels which consist of a single drainage area DA-1 with two Drainage Managemen Areas DMA-1,2. In DMA-1 (10.5 acres), the on site drainage systems consist of swales, grated inlets with filter insert and pipes will convey the flows to the proposed infiltration/retention basin-1 with two-stage pits system (Maxwell plus Drywell System) at the northeast corner in the drainage management area DMA-1. The		

	proposed infiltration/retention basin-1 with two-stage pits system is sized to qualify for both required WQMP volume (30,956 CF) as well as the required detention volume (55,572 CF) from the drainage management area DMA-1. In DMA-2 (9.83 acres), the on site drainage systems consist of swales, grated inlets with filter insert and pipes will convey the flows to the proposed infiltration/retention basin-2 with two-stage pits system (Maxwell plus Drywell System) at the northwest corner in the drainage management area DMA-2. The proposed infiltration/retention basin-2 with two-stage pits system is sized to qualify for both required WQMP volume (28,981 CF) as well as the required detention volume (52,035 CF) from the drainage management area DMA-1. Detention volume has been calculated based upon the City of Hesperia "13.5-cf per 100-sf of impervious area" rule. Required combined detention volume (107,606 CF) exceeds the combined water quality volume (59,937 CF) from DMA-1 & DMA-2. The infiltration/retention basin-1 with two-stage pits system will drain out at the northeast corner of DMA-1 to Poplar Street via undersidewalk parkway drain when reaches capacity. The infiltration/retention basin-2 with two-stage pits system will drain out at the northeast corner of DMA-2 to Poplar Street via undersidewalk parkway drain when reaches capacity.
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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)	885,648			
2 Existing site impervious area (ft ²)	0			
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	III			
4 Hydrologic soil group <i>Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf</i>	A			
5 Longest flowpath length (ft)	2230			
6 Longest flowpath slope (ft/ft)	1.21%			
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Natural Cover Open Brush			
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>	Poor			

KANG, HESPERIA

Write a description for your map.



Form 3-3 Watershed Description for Drainage Area	
Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Drainage Course along Poplar Street Oro Grande Wash Mojave River
Applicable TMDLs http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	None
303(d) listed impairments http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River: Mojave Forks Reservoir Outlet to Upper Narrows: -Fluoride Upper Narrows to Lower Narrows: -Fluoride -Sulfates -Total Dissolved Solids
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP	Desert Tortoise Habitat Cat 3
Hydromodification Assessment	☐ Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal ☒ No



WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Friday, May 13, 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): 306462101, 306458104, 306458103, 306458102, 306458105

Project Site Acreage: 58.597

HCOG Exempt Area: No

Closest Receiving Waters:

(Applicant to verify based on local drainage facilities and topography.)

System Number -

Facility Name - Oro Grande Wash

Owner - SBCFCD

Closest channel segment's susceptibility to Hydromodification: EHM

Highest downstream hydromodification susceptibility: NULL

Is this drainage segment subject to TMDLs? No

Are there downstream drainage segments subject to TMDLs? No

Is this drainage segment a 303d listed stream? No

Are there 303d listed streams downstream? No

Are there unlined downstream waterbodies? No

Project Site Onsite Soil Group(s): B

Environmentally Sensitive Areas within 200': DESERT TORTOISE HABITAT CAT 3

Groundwater Depth (FT): No data available

Parcels with potential septic tanks within 1000': No

Known Groundwater Contamination Plumes within 1000': No

Studies and Reports Related to Project Site:

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

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.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

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	☒	☐	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	☒	☐	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	☒	☐	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 infiltration basins, and landscape areas.
N4	BMP Maintenance	☒	☐	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 future Owner.

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Form 4.1-1 Non-Structural Source Control BMPs				
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	The proposed commercial development will not generate waste subject to Title 22 CCR Compliance.
N6	Local Water Quality Ordinances	☐	☒	Not applicable
N7	Spill Contingency Plan	☒	☐	Soil Contingency Plan shall be provided in accordance with Section 6.95 of the California Health Safety Code.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tank on the site.
N9	Hazardous Materials Disclosure Compliance	☐	☒	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	☐	☒	The proposed Commercial project will not store toxic or highly toxic compressed gases.
N11	Litter/Debris Control Program	☒	☐	Litter control onsite will include the use of litter patrols, 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	☒	☐	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.

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N13	Housekeeping of Loading Docks	☒	☐	Trucking maintenance staffs/Operators will be instructed to keep all areas of loading docks clean and free of Trash / debris at all time.
N14	Drop Inlets Inspection Program	☒	☐	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, retention basins, open drainage channel.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The project's private streets drives parking lot 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	☐	☒	No other non-structural measures required.
N17	Comply with all other applicable NPDES permits	☐	☒	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)	☒	☐	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)	☐	☒	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)	☐	☒	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 (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	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	☒	☐	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)	☐	☒	Implemented the following design principles to the project: avoid disturbance of existing westerly channel, constructing retention basins.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	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)	☐	☒	No Bays, Not applicable

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S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Vehicle Wash at the site, Not applicable
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor Processing, Not applicable
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas, Not applicable
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☒	☐	Will comply with the City requirements. Water from fueling area will be directed to drain into the site sewer system.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No Hillside Landscaping, Not applicable
S14	Wash water control for food preparation areas	☐	☒	No food Preparation, Not applicable
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No Community Car Wash, Not applicable

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

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.

Proposed site design practices and their implementation at this site is provided in Form 4.1-3 (Site Design Practices Check List). Proposed Site Design BMPs is provided in Form 4.3-2 (Site Design BMPs). Please refer to Form 4.1-3 and Form 4.3-2 for site design practices and site design BMPs.

Form 4.1-3 Site Design Practices Checklist

Site Design Practices

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

Minimize impervious areas: Yes ☒ No ☐

Explanation: The site has landscaped area along the site perimeter, large number of planter areas in addition to an infiltration/retention basin with two stage pits system.

Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐

Explanation: Runoff from impervious surfaces will be conveyed through landscaped areas along site perimeter and the planters so that infiltration is maximized. Runoff will also be intercepted by an infiltration/retention basin-1,2 with two stage pits system.

Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐

Explanation: The site currently drains Northeast. Post developed flow will also drain Northeast this is consistent with existing and Master Planned flow patterns.

Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☒ No ☐

Explanation: Part of the impervious areas including rerouting rooftop drainage pipes will be drained into landscaped areas where available & conveyed to infiltration/retention basin-1,2 with two stage pits system.

Use of Porous Pavement.: Yes ☐ No ☒

Explanation: Due to the low infiltration capability of the underlying soil and site constraint, the site is proposed to drain to the infiltration/retention basin-1,2 with two stage pits system for infiltration.

Protect existing vegetation and sensitive areas: Yes ☐ No ☒

Explanation: There are no environmentally sensitive portions onsite and existing vegetation will be kept as much as possible.

Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐

Explanation: Part of the disturbed areas will be revegetated with drought tolerant vegetation.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐

Explanation: No compaction will be performed within the area of landscaping/planters and the proposed infiltration/retention basin-1,2 with two stage pits system.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒

Explanation: Part of the Runoff will be rerouted into the landscape area and will be conveyed & intercepted by the infiltration/retention-1,2 basin with two stage pits system for infiltration.

Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☒ No ☐

Explanation: No compaction will be performed within the area where landscape areas are proposed.

Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒

Explanation: Instead, the site is utilizing the proposed infiltration/retention basin-1,2 with two stage pits system for water collection and infiltration.

Stream Setbacks. Includes a specified distance from an adjacent stream: : Yes ☐ No ☒

Explanation: There are no adjacent streams to the site.

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evapotranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA-1)		
¹ Project area DMA 1 (ft ²): 457,380	² Imperviousness after applying preventative site design practices (Imp%): 90%	³ Runoff Coefficient (Rc): 0.73 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
⁴ Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.458 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
⁵ Compute P_6 , Mean 6-hr Precipitation (inches): 0.5665 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)		
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 ☐ 48-hrs ☒
⁷ Compute design capture volume, DCV (ft ³): 30,956 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, 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>		

Target Captured Volume/Retention Volume Calculation Watershed DMA 1 (West Lot)

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

Imperviousness(i)= **0.9**

Total Acreage(A) = **10.50** 457,380

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

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

C_{bmp} = 0.73

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: 1.237

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

2 yr 1 Hr Rainfall Depth per NOAA Atlas 14= **0.458** inches

P_6 = 2 yr 1 hr Rainfall x Regression coefficient

P_6 = 0.5665 inches

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

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

a = 1.963

6) Calculate the Maximized Detention Volume, P_0

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

$$P_0(\text{inches}) = 0.8122$$

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

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

V_0 = **0.71 acre-feet**
 V_0 = **30,956 CF**

8) Detention Volume Calculation:

Use City rule of "13.5-cf of retention per 100-sf of impervious area"

Detention Volume: **55,572 CF** $\{[(20.33 \times 43560) \times 0.9] \times 13.5\} / 100$

Form 4.2-1 Continues: LID BMP Performance Criteria for Design Capture Volume (DMA-2)		
¹ Project area DMA (ft ²): 428,268	² Imperviousness after applying preventative site design practices (Imp%): 90%	³ Runoff Coefficient (Rc): 0.73 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
⁴ Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr}-1\text{hr}}$ (in): 0.458 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
⁵ Compute P_6 , Mean 6-hr Precipitation (inches): 0.5665 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)		
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 ☐ 48-hrs ☒
⁷ Compute design capture volume, DCV (ft ³): 28,981 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Combined Design Capture Volume from DA-1 (DMA-1 & DMA-2): 59,937 CF

Target Captured Volume/Retention Volume Calculation Watershed DMA 2 (East Lot)

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

Imperviousness(i)= **0.9**

Total Acreage(A) = **9.83** 428,268

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

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

C_{bmp} = 0.73

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: 1.237

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

2 yr 1 Hr Rainfall Depth per NOAA Atlas 14= **0.458** inches

P_6 = 2 yr 1 hr Rainfall x Regression coefficient

P_6 = 0.5665 inches

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

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

a = 1.963

6) Calculate the Maximized Detention Volume, P_0

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

P_0 (inches) = 0.8122

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

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

V_0 = **0.67 acre-feet**
 V_0 = **28,981 CF**

Required Detention
Volume Calculation

8) Detention Volume Calculation:

Use City rule of "13.5-cf of retention per 100-sf of impervious area"

Detention Volume: **52,035 CF** $[(20.33 \times 43560) \times 0.9] \times 13.5 / 100$



NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4148°, Longitude: -117.3924°
Elevation: 3620.3 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	0.087 (0.072-0.106)	0.124 (0.102-0.151)	0.172 (0.142-0.211)	0.212 (0.173-0.262)	0.267 (0.211-0.341)	0.310 (0.240-0.404)	0.354 (0.267-0.473)	0.400 (0.294-0.550)	0.464 (0.327-0.665)	0.514 (0.350-0.762)
10-min	0.125 (0.103-0.152)	0.177 (0.147-0.217)	0.247 (0.203-0.302)	0.304 (0.248-0.375)	0.383 (0.303-0.489)	0.444 (0.344-0.579)	0.507 (0.383-0.678)	0.573 (0.421-0.788)	0.664 (0.468-0.953)	0.736 (0.501-1.09)
15-min	0.151 (0.125-0.184)	0.214 (0.177-0.262)	0.298 (0.246-0.366)	0.367 (0.300-0.454)	0.463 (0.366-0.591)	0.537 (0.416-0.700)	0.613 (0.463-0.820)	0.693 (0.509-0.953)	0.804 (0.566-1.15)	0.890 (0.606-1.32)
30-min	0.228 (0.189-0.278)	0.324 (0.268-0.396)	0.451 (0.371-0.552)	0.555 (0.454-0.686)	0.699 (0.553-0.893)	0.811 (0.628-1.06)	0.927 (0.700-1.24)	1.05 (0.769-1.44)	1.21 (0.855-1.74)	1.35 (0.915-2.00)
60-min	0.323 (0.267-0.394)	0.458 (0.379-0.560)	0.637 (0.525-0.781)	0.785 (0.642-0.970)	0.989 (0.782-1.26)	1.15 (0.888-1.50)	1.31 (0.990-1.75)	1.48 (1.09-2.04)	1.72 (1.21-2.46)	1.90 (1.30-2.82)
2-hr	0.473 (0.391-0.577)	0.641 (0.530-0.784)	0.869 (0.716-1.07)	1.06 (0.867-1.31)	1.33 (1.05-1.70)	1.54 (1.19-2.01)	1.76 (1.33-2.36)	2.00 (1.47-2.75)	2.33 (1.64-3.34)	2.59 (1.76-3.85)
3-hr	0.596 (0.494-0.728)	0.797 (0.659-0.974)	1.07 (0.882-1.31)	1.30 (1.06-1.61)	1.63 (1.29-2.08)	1.89 (1.46-2.46)	2.16 (1.63-2.89)	2.46 (1.81-3.38)	2.87 (2.02-4.12)	3.21 (2.19-4.77)
6-hr	0.849 (0.702-1.04)	1.12 (0.929-1.37)	1.50 (1.24-1.84)	1.82 (1.49-2.25)	2.28 (1.81-2.92)	2.66 (2.06-3.47)	3.05 (2.31-4.08)	3.48 (2.56-4.79)	4.10 (2.89-5.87)	4.60 (3.13-6.83)
12-hr	1.11 (0.918-1.35)	1.51 (1.24-1.84)	2.05 (1.69-2.51)	2.51 (2.05-3.10)	3.17 (2.51-4.06)	3.71 (2.87-4.84)	4.28 (3.23-5.72)	4.90 (3.60-6.73)	5.78 (4.07-8.29)	6.51 (4.43-9.66)
24-hr	1.50 (1.33-1.73)	2.11 (1.87-2.43)	2.93 (2.59-3.39)	3.63 (3.18-4.24)	4.64 (3.93-5.58)	5.45 (4.52-6.70)	6.31 (5.11-7.94)	7.23 (5.70-9.37)	8.56 (6.47-11.6)	9.65 (7.05-13.5)
2-day	1.73 (1.54-2.00)	2.43 (2.15-2.80)	3.40 (3.00-3.93)	4.23 (3.70-4.93)	5.43 (4.60-6.54)	6.41 (5.32-7.88)	7.46 (6.04-9.40)	8.61 (6.78-11.1)	10.3 (7.76-13.9)	11.6 (8.50-16.3)
3-day	1.86 (1.65-2.14)	2.61 (2.31-3.00)	3.65 (3.22-4.21)	4.55 (3.98-5.30)	5.86 (4.96-7.05)	6.94 (5.76-8.53)	8.10 (6.56-10.2)	9.37 (7.38-12.1)	11.2 (8.49-15.2)	12.8 (9.33-17.8)
4-day	2.00 (1.78-2.31)	2.81 (2.49-3.24)	3.93 (3.47-4.54)	4.91 (4.30-5.72)	6.33 (5.36-7.62)	7.50 (6.22-9.22)	8.76 (7.10-11.0)	10.1 (7.99-13.1)	12.2 (9.20-16.4)	13.9 (10.1-19.4)
7-day	2.25 (1.99-2.59)	3.13 (2.77-3.61)	4.36 (3.85-5.04)	5.42 (4.75-6.32)	6.97 (5.90-8.39)	8.24 (6.84-10.1)	9.62 (7.79-12.1)	11.1 (8.76-14.4)	13.3 (10.1-18.0)	15.1 (11.1-21.2)
10-day	2.40 (2.13-2.77)	3.34 (2.95-3.85)	4.63 (4.09-5.35)	5.75 (5.04-6.70)	7.37 (6.25-8.88)	8.71 (7.23-10.7)	10.1 (8.22-12.8)	11.7 (9.24-15.2)	14.0 (10.6-18.9)	15.9 (11.6-22.2)
20-day	2.89 (2.56-3.32)	3.99 (3.53-4.60)	5.52 (4.87-6.38)	6.84 (5.99-7.97)	8.74 (7.41-10.5)	10.3 (8.56-12.7)	12.0 (9.72-15.1)	13.8 (10.9-17.9)	16.5 (12.5-22.3)	18.8 (13.7-26.3)
30-day	3.40 (3.02-3.92)	4.68 (4.14-5.40)	6.45 (5.69-7.45)	7.96 (6.98-9.28)	10.2 (8.61-12.2)	12.0 (9.93-14.7)	13.9 (11.3-17.5)	16.1 (12.7-20.8)	19.2 (14.5-25.9)	21.8 (15.9-30.5)
45-day	4.06 (3.60-4.67)	5.51 (4.88-6.35)	7.51 (6.63-8.68)	9.24 (8.09-10.8)	11.7 (9.95-14.1)	13.8 (11.4-17.0)	16.0 (13.0-20.2)	18.5 (14.6-23.9)	22.1 (16.7-29.8)	25.1 (18.4-35.1)
60-day	4.63 (4.11-5.33)	6.19 (5.48-7.14)	8.34 (7.37-9.64)	10.2 (8.93-11.9)	12.9 (10.9-15.5)	15.1 (12.5-18.6)	17.5 (14.2-22.0)	20.2 (15.9-26.1)	24.1 (18.2-32.6)	27.5 (20.1-38.4)

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

ACTUAL IMPERVIOUS COVER		
Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
→ Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

**ACTUAL IMPERVIOUS COVER
FOR
DEVELOPED AREAS**

Form 4.2-2 Summary of Hydromodification Assessment

Is the change in post- and pre- condition flows captured on-site? : Yes ☒ No ☐

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr 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- Addendum 1*)

If "No," then proceed to Section 4.3 BMP Selection and Sizing

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>

HCOC Mitigation:

In developed condition the site will drain to the proposed Infiltration/Retention Basin 1-4 for mitigation of WQMP volume and the Detention Volume per the City requirement.

The "13.5-cf of retention per 100-sf of impervious area" rule was used to quantify and mitigate onsite retention volume to comply with the City mitigation requirement.

When the Infiltration/Retention Basin-1,2 with two stage pits system reaches their capacity, they will drain to the Poplar Street via under sidewalk parkway drains to the existing drainage course located at the northeast corner of the site. Water will ultimately drain to Oro Grande Wash via the existing drainage courses.

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretenention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small 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 Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

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)

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 ten 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)

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, Selection and Evaluation of Biotreatment 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, Site Design 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, Site Design BMPs.

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures 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 Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs 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 BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design 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 ☒ No ☐ If yes, complete Items 2-5; If no, proceed to Item 6	DA 1 DMA 1 BMP Type	DA 1 DMA 2 BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft ²)	182,952	171,190	
3 Ratio of pervious area receiving runoff to impervious area	0.11	0.09	
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	838 CF	642 CF	
5 Sum of retention volume achieved from impervious area dispersion (ft ³): 1,480 $V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☐ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
7 Ponding surface area (ft ²)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft ²)			
10 Average depth of amended soil/gravel (ft) (min. 1 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 BMPs (DA 1)

Form 4.3-2 cont. Site Design BMPs (DA 1)

14 Implementation of Street Trees: Yes ☐ No ☐ <i>If yes, complete Items 14-18. If no, proceed to Item 19</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft ²)			
17 Runoff volume retention from street trees (ft ³) <i>$V_{\text{retention}} = \text{Item 15} * \text{Item 16} * (0.05/12)$ assume runoff retention of 0.05 inches</i>			
18 Runoff volume retention from street tree BMPs (ft ³): <i>$V_{\text{retention}} = \text{Sum of Item 17 for all BMPs}$</i>			
19 Total Retention Volume from Site Design BMPs: 1,480 <i>Sum of Items 5, 13 and 18</i>			

4.3.3 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 C 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 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 4.3-2 Infiltration LID BMP - including underground BMPs (DA-1: DMA-1, DMA-2)			
1 Remaining LID DCV not met by site design BMP (ft³): 59,937 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 19}$			
BMP Type 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	DMA 1 BMP Type Inf. Basin 1	DMA 2 BMP Type : Inf. Basin-2	DA DMA BMP Type (Use additional forms for more BMPs)
2 Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods	6.45	6.45	
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	2.25	2.25	
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	2.85	2.85	
5 Pondered water drawdown time (hr) Copy Item 6 in Form 4.2-1	48	48	
6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details	11.4	11.4	
7 Pondering Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	4.0	4.0	
8 Infiltrating surface area, SA_{BMP} (ft²) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	56,794	59,140	
9 Amended soil depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details	0	0	
10 Amended soil porosity	0	0	
11 Gravel depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details	-	-	
12 Gravel porosity	-	-	
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3 hrs	3 hrs	
14 Above Ground Retention Volume (ft³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	56,794	59,140	
15 Underground Retention Volume (ft³) Volume determined using manufacturer's specifications and calculations	1,037	1,037	
16 Total Retention Volume from LID Infiltration BMPs: 118,008 (Sum of Items 14 and 15 for all infiltration BMP included in plan)			
17 Fraction of DCV achieved with infiltration BMP: 197% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ 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.

RET/INF BASIN-1 (WEST LOT)

Surface Area	8461 SF	Inf. Surface area at halfway water depth
Rock Depth	0 FT	
Surface Depth	6 FT	Ponding Water Depth
<i>Infiltration</i>	0.7125 FT	[(2.85/12)*3] Design Inf Rate: 2.85 "/hr per Inf. Testing Report 3-hr Inf. Credit while basin filling
Volume Provided	56794 CF	
<i>Volume Needed</i>	55,572 CF	Detention Vol. Required per City Standard From DMA-1
Difference	1,222 CF	

Total Retention/Infiltration Vol. Provided in Basin-1: 56,794 CF
--

Infiltration Drawdown Time Calculation: Inf. Basin-1 (In DMA-1)

Infiltration Surface Area Provided:	8,461 SF	
Infiltration Rate per WebSoil Report	6.45 in/hr	(Average Inf. Rate per Inf Testing Report)
	0.54 ft/hr	
Factor of Safety	2.25	
Design Infiltration Rate	0.239 ft/hr	
Volume needed to be Infiltrated	56,794 cu.ft	(Provided Volume)(Reqd. Vol. 55,572 CF)
Infiltration Volume per hour	2021.24 cu.ft/hr	(8,461 sft * 0.239 ft/hr)
Infiltration Draw Down Time	28.10 Hours	(56,794 cu.ft / 2021.24 cu.ft/hr)
	28 hr	< 48 hr draw down time. OK

RET/INF BASIN-2 (EAST LOT)

Surface Area	14925 SF	Inf. Surface area at halfway water depth
Rock Depth	0 FT	
Surface Depth	3.25 FT	Ponding Water Depth
<i>Infiltration</i>	0.7125 FT	[(2.85/12)*3] Design Inf Rate: 2.85 "/hr per Inf. Testing Report 3-hr Inf. Credit while basin filling
Volume Provided	59140 CF	
<i>Volume Needed</i>	52,035 CF	Detention Vol. Required per City Standard From DMA-2
Difference	7,105 CF	

Total Retention/Infiltration Vol. Provided in Basin-1: 59,140CF

Infiltration Drawdown Time Calculation: Inf. Basin-2 (In DMA-2)

Infiltration Surface Area Provided:	14,925 SF	
Infiltration Rate per WebSoil Report	6.45 in/hr	(Average Inf. Rate per Inf Testing Report)
	0.54 ft/hr	
Factor of Safety	2.25	
Design Infiltration Rate	0.239 ft/hr	
Volume needed to be Infiltrated	59,140 cu.ft	(Provided Volume)(Reqd. Vol. 52,035 CF)
Infiltration Volume per hour	3565.42 cu.ft/hr	(14,925 sft * 0.239 ft/hr)
Infiltration Draw Down Time	16.59 Hours	(59,140 cu.ft / 3,665.42 cu.ft/hr)
	17 hr	< 48 hr draw down time. OK

Two Stage Pit Retention Capacity Calculation in DMA-1 & DMA-2

Drywell Infiltration and Retention Volume Capacity Calc:

*Design Inf. Rate (Assumed Deep Inf)	1.13 IN/HR	0.000026 FT/SEC	
Drawdown Time	48 HR	*Infiltration rate provided by	
Min Depth to Infiltration	9 FT	the Maxwell Plus drywell	
Proposed Drywell Depth	40 FT	system per their designed and	
Drywell Diameter-	5 FT	installed system within 1-mile	
Drywell Rock Shaft Diameter	5 FT	of the proposed project.	
Bottom Surface Area	19.63 SF		
Side Surface per foot of depth	15.71 SF		
Total Side Surface Area:	487 SF		
Primary Chamber Storage Depth	23 FT		
Secondary Chamber Depth	23 FT		
Porosity of Gravel	0.40		
Total Inf. Surface Area:		507 SF	
Combine Design Rate with Inf. Area (Dispersal Flow Rate for Drywell) (0.00004*276)		0.0133 CF/SEC	
Pit Dispersal/Inf. Vol. with 48 HR DrawDown Time:		2,290 CF	(Inf/Dispersal Vol. provided by Drywell System)
Drywell System WQ Mitigation Volume: (Drywell in 48 hour)		2,290 CF	(Inf/Dispersal Vol. provided by Combined System)
Storage Vol. provided in Drywell System with Primary Depth of 13-ft and two Secondary pit Depth of 13-ft: [(23'+23') x 19.63+ ((40-23)*19.63*0.4)]		1,037 CF	(Retention Volume provided by Drywell System)

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, S _A = Σp			
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	2	0.50
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, S _B = Σp			
Combined Safety Factor, S _{TOT} = S _A x S _B				2.25	
Measured Infiltration Rate, inch/hr, K _M (corrected for test-specific bias)				6.45	
Design Infiltration Rate, in/hr, K _{DESIGN} = S _{TOT} / K _M				2.85	
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					
Average Inf. Rate : 6.45 in/hr Avg. Inf. Rate from two tested pit in the WQMP BMP basin. Soil Infiltration Testing Report, dated October 28, 2022 Design Inf Rate: 6.45/2.25 = 2.85"/hr					

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

6.2 INFILTRATION TEST RESULTS

Based on the soils infiltration testing completed at the test locations and at the test depth as described, the observed soils' percolation rates are 5.71 inches/hour and 7.20 inches/hour for test locations P-1 and P-2, respectively.

Calculations to convert the percolation test rate to infiltration test rates in accordance with Section 2.3 of the County Handbook are presented in Table I and II below. For design, it is suggested that an appropriate Factor of Safety as selected by the design engineer should be considered to the observed field percolation rate described.

6.3 SUMMARY & CONVERSION CALCULATIONS

For WQMP-BMP design, based on the soils infiltration testing completed and, on the calculations as described, the following infiltration rates may be considered. Actual field test data are attached.

TABLE I
Observed Infiltration Rate for Design

Test Location (9-23-22)	Test Depth Below Grade, feet	Porchet Method Observed Rate, inch/hour
P-1	4	5.71
P-2	4	7.20

TABLE II
Conversion Table (Porchet Method)

Test No.	Depth Test Hole, inches	Time Interval, minutes	Initial Depth, inches	Final Depth, inches	Initial Water Height, inches	Final Water Height, inches	Change in Height/ Time	Average Head Height/Time
	D _t	Δ _T	D _o	D _f	H _o =D _t -D _o	H _f =D _t -D _f	ΔH= H _f -H _o	H _{avg} = (H _o +H _f)/2
P-1	48	10	24	34	24	14	10	19
P-2	48	10	24	36	24	12	12	18

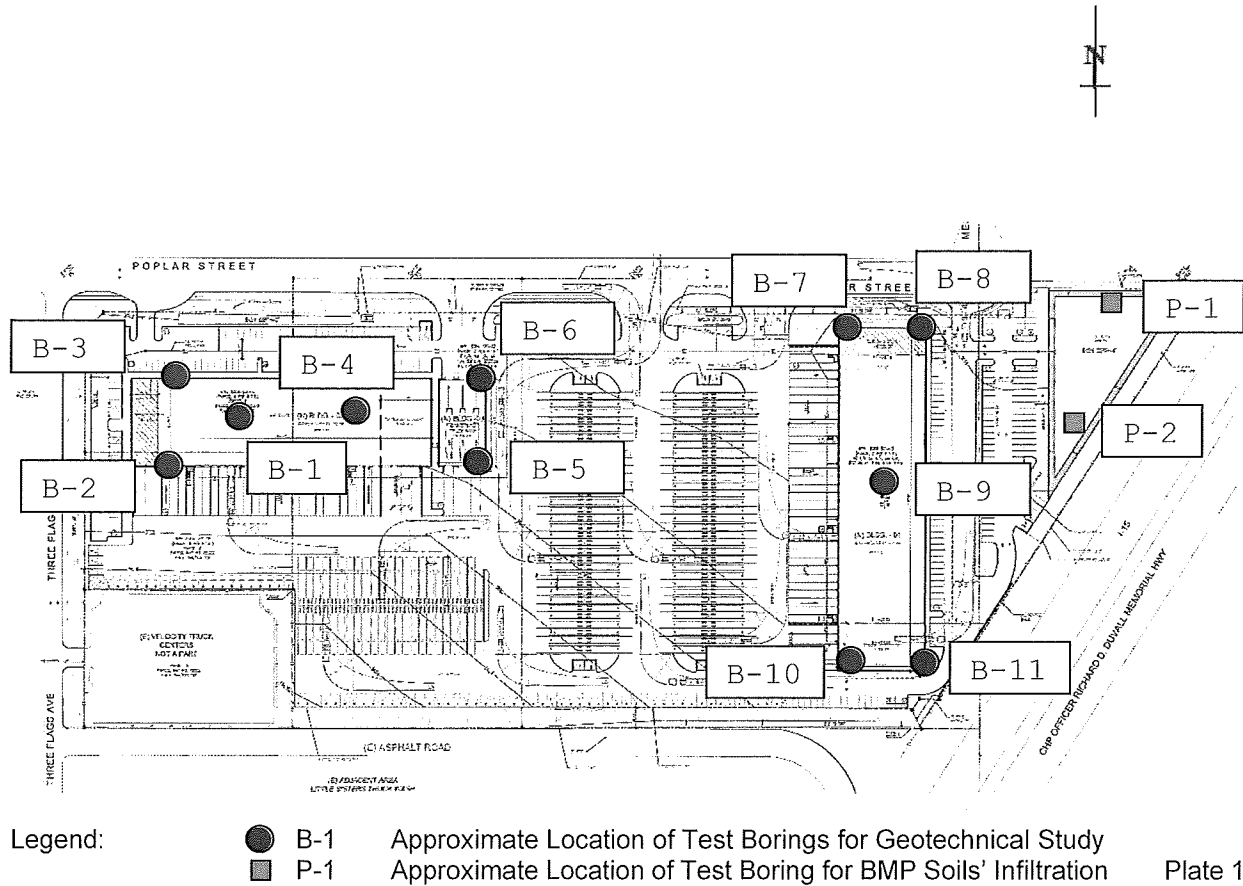
Test No.	Infiltration Rate (It)=ΔH60r/Δt(r+2Havg)		
	A	B	C
	ΔH60r	Δt(r+2Havg)	A/B=inch/hour
P-1	2400	420	5.71
P-2	2880	400	7.20

Use of a safety factor of approximately 1.5 may be considered to account for long-term saturation, inconsistencies in subsoil conditions and potential for silting of percolating soils.

Avg. Inf Rate: 6.45"/hr

The infiltration rate described is based on the in-situ testing completed at the locations as suggested by the project civil engineer. In the event that the final chamber location and depth vary considerably from those described herein, supplemental soils infiltration testing may be warranted.

PLOT PLAN AND TEST LOCATIONS
 Planned Cargo Solutions Express Warehouses and Truck Wash
 SEC Three Flags Avenue & Poplar Street
 Hesperia, California
 APN: 3064-591-12, 13, 17, and 18
 NTS



4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, 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 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1: DMA1 & DMA-2)	
1	Total LID DCV for the Project DA-1 (ft ³): 59,937 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design BMP (ft ³): 1,480 <i>Copy Item 18 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 118,008 CF <i>Copy Item 16 in Form 4.3-2</i>
4	On-site biotreatment with volume based biotreatment BMP (ft ³): 0 <i>Copy Item 3 in Form 4.3-4</i>
5	Flow capacity provided by flow based biotreatment BMP (cfs): <i>Copy Item 6 in Form 4.3-4</i>
6	LID BMP performance criteria are achieved if answer to any of the following is "Yes": - Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐ <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 ☐ No ☐ <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; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
7	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: - Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐ <i>Checked yes if Form 4.3-4 Item 7 is checked yes, Form 4.3-4 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> - Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated: 1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐ 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐ 3) Equal or greater protection against shock loadings and spills; ☐ 4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs 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 a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater Department

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration/Retention basin-1,2 w/two stage pits system	Cargo Solution Express	Remove accumulated trash and debris in the basin at the start and end of the wet season. Inspect for standing water at the end of the wet season. Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin. Inspect two-stage pits system for any accumulated sediments, debris. If erosion is occurring within the basin, re-vegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.	2 times a year at the beginning and end of the rainy season (October to March)
Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Cargo Solution Express	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	Ongoing

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

		during property improvements.	
Landscape maintenance	Cargo Solution Express	Landscape planning is implemented to reduce groundwater and storm water contamination. This will be accomplished through an infiltration basin, and landscape areas.	
BMP maintenance	Cargo Solution Express	See BMP fact sheets and Table 5-1 details hereon	Ongoing with every visit
Employee training	Cargo Solution Express	Employee training may be developed by the owner	As stated
Litter debris control program	Cargo Solution Express	Litter debris control program may be developed by City of Hesperia	Ongoing with every visit
Drop Inlets inspection program	Cargo Solution Express	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.	Place at grate installation and inspect once a year
Provide storm drain system stencilling and signage	Cargo Solution Express	Signs will be placed above storm drain inlets to warn the public of prohibitions against waste disposal	Inspect once a year
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Cargo Solution Express	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 or according to Manufacturer Manuals
Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or	Cargo Solution Express	New landscaped areas will be constructed at a minimum of 1 inch below existing paved areas	Inspect once a year

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

pavement			
Street Sweeping	Cargo Solution Express	Street weeping and Vaccuming	Bi Monthly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan (WQMP BMP Exhibit)

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

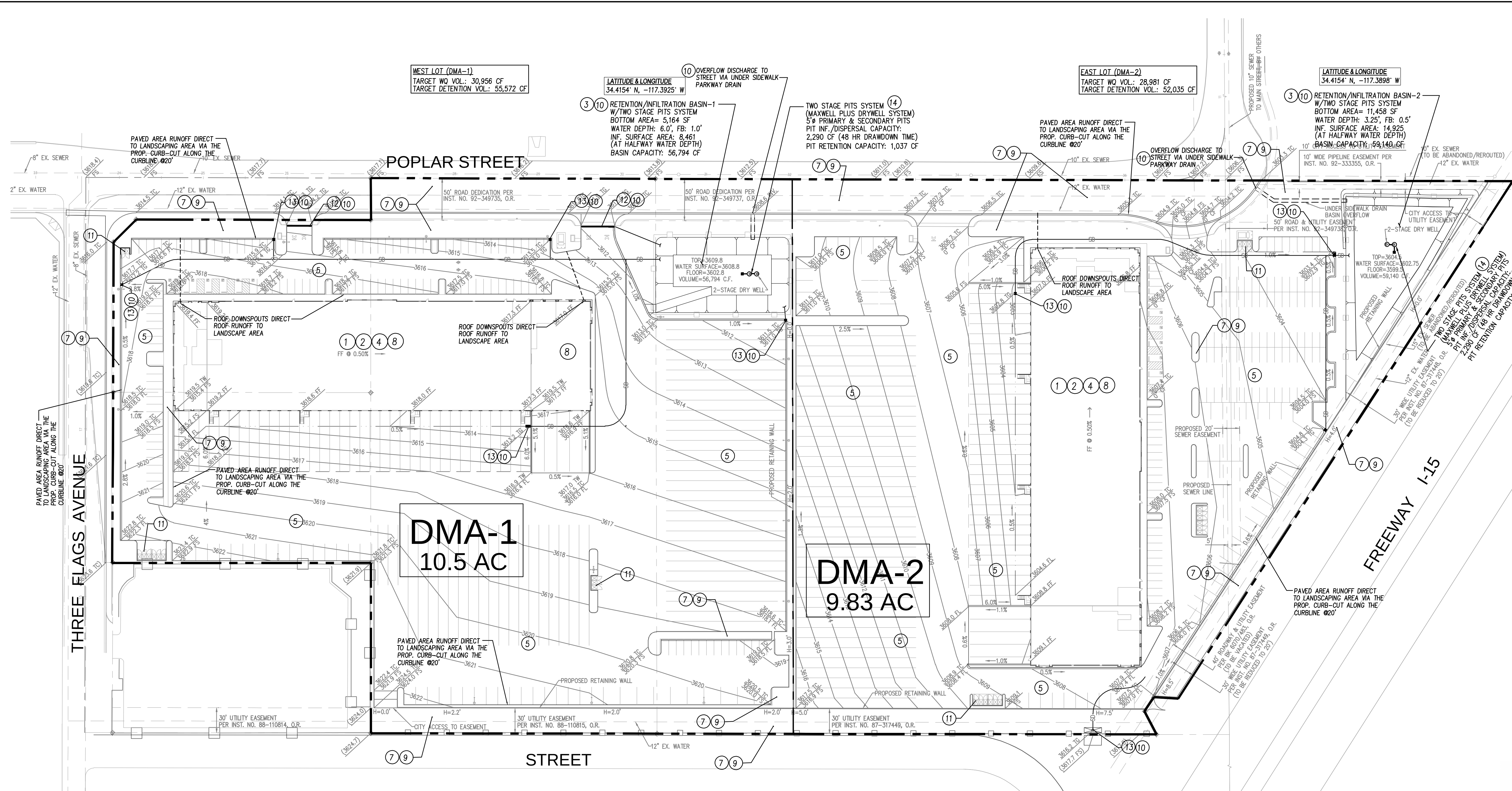
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

Appendix: 6.1

**Site Plan:
WQMP BMP Exhibit**



LATITUDE & LONGITUDE
34.472153" N, -117.172113" W

- BMP LIST:**
- 1 EDUCATION OF PROPERTY OWNERS (N1)
 - 2 ACTIVITY RESTRICTIONS (N2)
 - 3 INFILTRATION/RETENTION BASIN-1 WITH TWO STAGE PITS SYSTEM PER PLAN
 - 4 TRAINING/EDUCATION PROGRAM (N12)
 - 5 PARKING LOT SWEEPING/VACUUMING (N15)
 - 6 COMMON AREA CATCH BASIN INSPECTION (N14)
 - 7 LANDSCAPE PLANNING (N3)
 - 8 ROOF RUNOFF CONTROLS (SD-11)
 - 9 EFFICIENT IRRIGATION (S-4)
 - 10 STORM DRAIN SIGNAGE (S-1)
 - 11 TRASH STORAGE AREAS (N11)
 - 12 TRENCH DRAIN FILTER INSERT-FLO-GARD INSERT FILTER
 - 13 GRATE INLET FILTER INSERT- ADS FLEXSTORM PURE INLET FILTER OR APPROVED EQUAL (N14)
 - 14 TWO-STAGE DRYWELL SYSTEM (MAXWELL PLUS DRYWELL SYSTEM)

- LEGEND:**
- DMA-1:** DRAINAGE MANAGEMENT AREA
- DRAINAGE MANAGEMENT AREA BOUNDARY
 - CATCH BASIN, DROP INLET WITH FLOGARD INSERT FILTER
 - PROPOSED ONSITE STORM DRAIN
 - DRAINAGE FLOW DIRECTION
 - N1 NON-STRUCTURAL SOURCE CONTROL BMP IDENTIFIER
 - S1 STRUCTURAL SOURCE CONTROL BMP IDENTIFIER
 - SD-1 CASQA BMP IDENTIFIER

BMP STATISTICS:

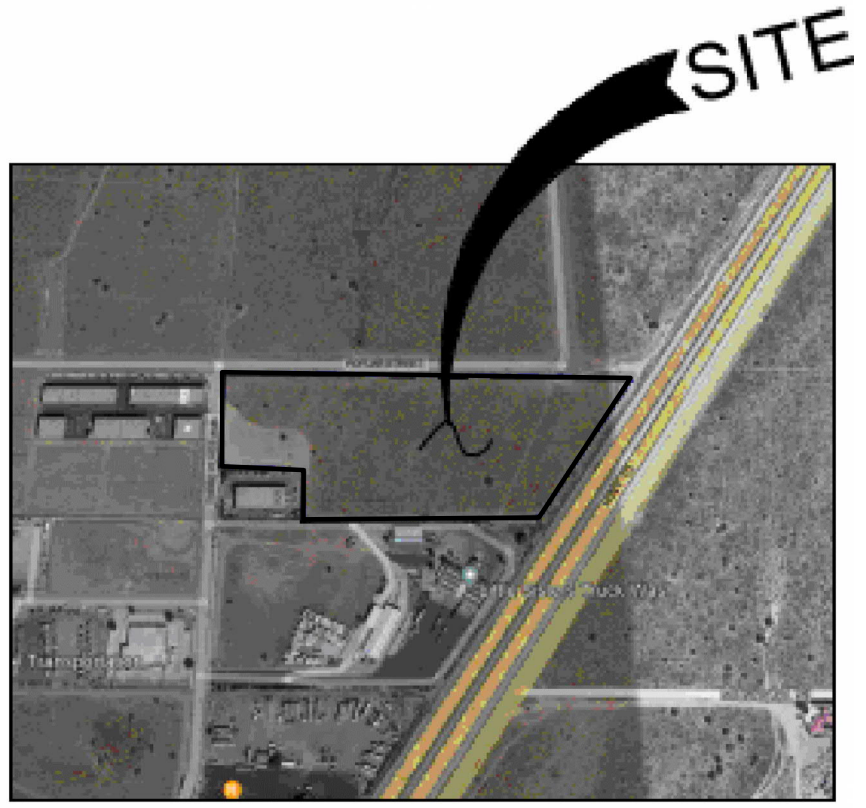
DMA#s	AREA (AC)	BMP	BMP CAPACITY (CF)	REQUIRED VOLUME (CF)	PROVIDED VOLUME (CF)
DMA-1	10.5	INF/RET BASIN-1 WITH TWO STAGE PITS SYSTEM	57,831	30,956	*57,831
DMA-1	9.83	INF/RET BASIN-2 WITH TWO STAGE PITS SYSTEM	60,177	28,981	*60,177

DA-1: 20.33 AC 118,008 CF 59,937 CF *118,008 CF
*INCLUDED TWO-STAGE PIT RET. CAPACITY

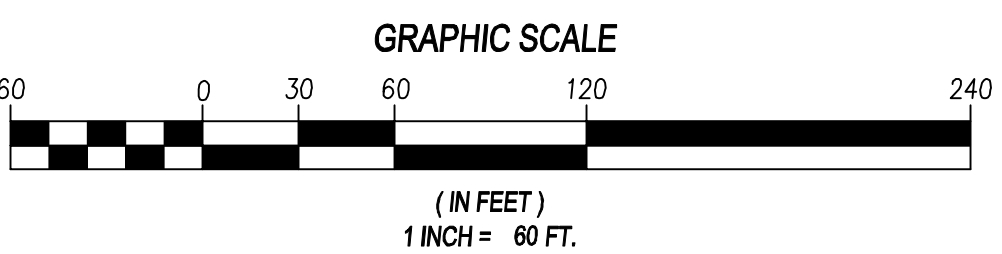
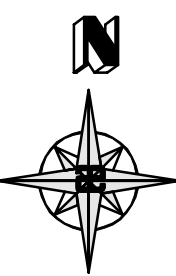
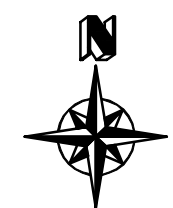
WATER VOLUME PROVIDED BY BASIN-1,2
W/ TWO STAGE PITS SYSTEM= 118,008 CF
REQUIRED DETENTION VOLUME= 107,606 CF FROM THE
ENTIRE SITE (DA-1)

SITE STATISTICS:

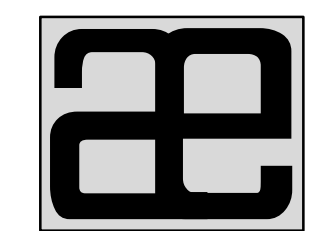
GROSS AREA:20.33 AC (DA-1: DMA1 & DMA2)
DISTURBED AREA: 100%
PROPOSED IMPERVIOUS AREA: 90% (DMA-1, DMA-2)



VICINITY MAP
NTS



SITE LATITUDE & LONGITUDE
34.4148" N, -117.3925" W



Prepared By:
ALLARD ENGINEERING
Civil Engineering - Land Surveying - Land Planning
16866 Seville Avenue
Fontana, California 92335
(909) 356-1815 Fax (909) 356-1795

Prepared For:
CARGO SOLUTIONS EXPRESS
14587 VALLEY BLVD.
FONTANA, CA 92335
PHONE: (909) 350-1644 ex 330

CITY OF HESPERIA, CALIFORNIA
WQMP EXHIBIT
APN: 3064-591-12, 13
& 3064-631-01

Appendix: 6.2

Electronic Data Submittal

Appendix: 6.3

O&M Plans and Maintenance Agreements for BMP

RECORDING REQUESTED BY

City of Hesperia: Engineering Division

AND WHEN RECORDED MAIL DOCUMENT TO:

NAME

City Clerk: c/o _____

STREET
ADDRESS

9700 7th Avenue

CITY, STATE &
ZIP CODE

Hesperia, CA 92345

SPACE ABOVE FOR RECORDER'S USE ONLY

**COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND
STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE**

Title of Document

Document exempt from recording fees pursuant to Cal. Gov. Code 6103 & 27383

**THIS AREA FOR
RECORDER'S
USE ONLY**

THIS COVER SHEET ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

OWNER NAME: CARGO SOLUTIONS EXPRESS

PROPERTY ADDRESS:

APN: 3064-591-12, 13 & 3064-631-01

THIS AGREEMENT is made and entered into in

CITY OF HESPERIA, COUNTY OF SAN BERNARDINO, California, this _____ day of

_____, by and between

Doug Cox, hereinafter

referred to as Owner, and the CITY OF HESPERIA, a political subdivision of the State of California, hereinafter referred to as "the City";

WHEREAS, the Owner owns real property ("Property") in the State of California, County of San Bernardino, located at [STREET ADDRESS] within the City of Hesperia, more commonly referred to as San Bernardino County Tax Assessor Parcel No. [APN Number] specifically described in Exhibit "A" and depicted in Exhibit "B", each of which is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of initial approval of the development project known as

3064-591-12, 13 & 3064-631-01 within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, dated _____, on file with the City and incorporated herein by this reference, hereinafter referred to as "WQMP", to minimize pollutants in stormwater and urban runoff and to minimize other adverse impacts of stormwater and urban runoff; and

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City; and

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner shall comply with the WQMP.
2. All maintenance or replacement of any BMPs specified within the approved WQMP is the sole responsibility of the Owner in accordance with the terms of this Agreement.
3. Owner hereby provides the City's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the City, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the Clean Water Act, the California Water Code, and/or the City's NPDES Permit Implementation regulations. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the City may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay City for all costs incurred by City in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of City invoice.
4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination, testing construction or reconstruction.
5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the City, the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorney's fees and interest thereon at the maximum rate authorized by the City Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay City within thirty (30) calendar days of City invoice.
6. The City may require the owner to post security in form and for a time period satisfactory to the City to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety (ies) to perform the obligations of this Agreement.

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

7. The City agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the City in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a City invoice and prior to the City's issuance of such certificate. Where the City cannot issue an estoppel certificate, Owner shall pay the City within thirty (30) calendar days of receipt of a City invoice.
8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the City and the Owner.
9. City and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.
10. In addition to any remedy available to City under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the City if said cure reasonably requires more than the subject time, the City may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the City may recover any damages to which the City may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.
11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.
12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the City harmless and pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.
13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.
14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the City) and hold harmless the City and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the City on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the City's "active" as well as "passive" negligence but does not apply to the City's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the City under this Agreement.

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Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

IF TO CITY:

City of Hesperia _____
9700 Seventh Avenue _____
Hesperia, CA 92345 _____

IF TO OWNER:

CARGO SOLUTIONS EXPRESS _____
14587 VALLEY BLVD _____
FONTANA, CA 92335 _____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Signature: _____
Name: _____
Title: _____
Date: _____

FOR: Maintenance Agreement, dated _____, for the project known as

APN: 3064-591-12, 13
& 3064-631-01

As described in the WQMP dated _____.

OWNER:

Signature: _____
Name: _____
Title: _____
Date: _____

NOTARIES ON FOLLOWING PAGE(S)

A notary acknowledgement for each signature is required for recordation.

ACCEPTED BY:

Director of Development Services or designee

Date: _____

Attachment: Notary Acknowledgement

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

ATTACHMENT 1

(Notary Acknowledgement)

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

ATTACHMENT 1, Page 2

(Notary Acknowledgement)

Covenant and Agreement Regarding Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance

EXHIBIT A

(Legal Description)

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

PARCEL A: (APN: 3064-591-17)

PARCEL 1 OF PARCEL MAP NO. 15322, IN THE CITY OF HESPERIA, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 188 OF PARCEL MAPS, PAGE(S) 100 AND 101 RECORDS OF SAID COUNTY.

PARCEL B: (APN: 3064-591-18)

PARCEL 2 OF PARCEL MAP NO. 15322, IN THE CITY OF HESPERIA, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 188 OF PARCEL MAPS, PAGE(S) 100 AND 101 RECORDS OF SAID COUNTY.

PARCEL C: (APN: 3064-591-12)

THE EAST 1/2 OF THE NORTHWEST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 4 NORTH, RANGE 5 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT OF SAID LAND.

TOGETHER WITH THAT PORTION AS VACATED BY THE CITY OF HESPERIA AND DESCRIBED IN THAT CERTAIN "RESOLUTION NO. 2007-037" RECORDED JUNE 04, 2007, AS INSTRUMENT NO. 2007-0333115, OF OFFICIAL RECORDS.

EXCEPT THEREFROM THOSE PORTIONS THEREOF CONVEYED TO THE STATE OF CALIFORNIA BY DEEDS RECORDED JULY 14, 1954 IN BOOK 3420, PAGE 390, OFFICIAL RECORDS AND RECORDED FEBRUARY 8, 1963 IN BOOK 5848, PAGE 800, OFFICIAL RECORDS.

PARCEL D: (APN: 3064-591-13)

THE NORTHEAST QUARTER OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 4 NORTH, RANGE 5 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT OF SAID LAND.

TOGETHER WITH THAT PORTION AS VACATED BY THE CITY OF HESPERIA AND DESCRIBED IN THAT CERTAIN "RESOLUTION NO. 2007-037" RECORDED JUNE 04, 2007, AS INSTRUMENT NO. 2007-0333115, OF OFFICIAL RECORDS.

EXCEPT THEREFROM THOSE PORTIONS THEREOF CONVEYED TO THE STATE OF CALIFORNIA BY DEEDS RECORDED JULY 14, 1954 IN BOOK 3420, PAGE 390, OFFICIAL RECORDS AND RECORDED FEBRUARY 8, 1963 IN BOOK 5848, PAGE 800, OFFICIAL RECORDS.

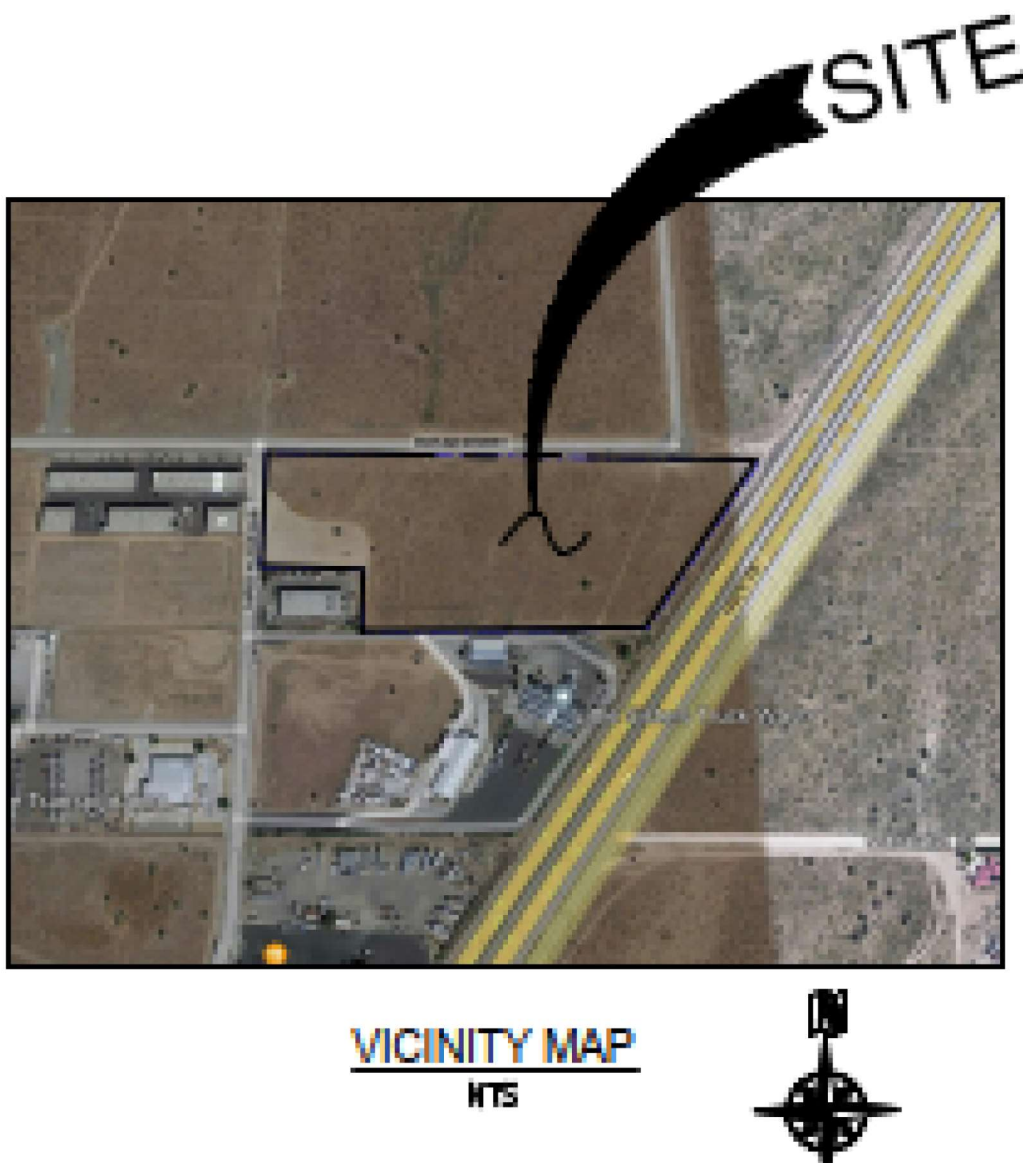
PARCEL E: (APN: 3064-631-01)

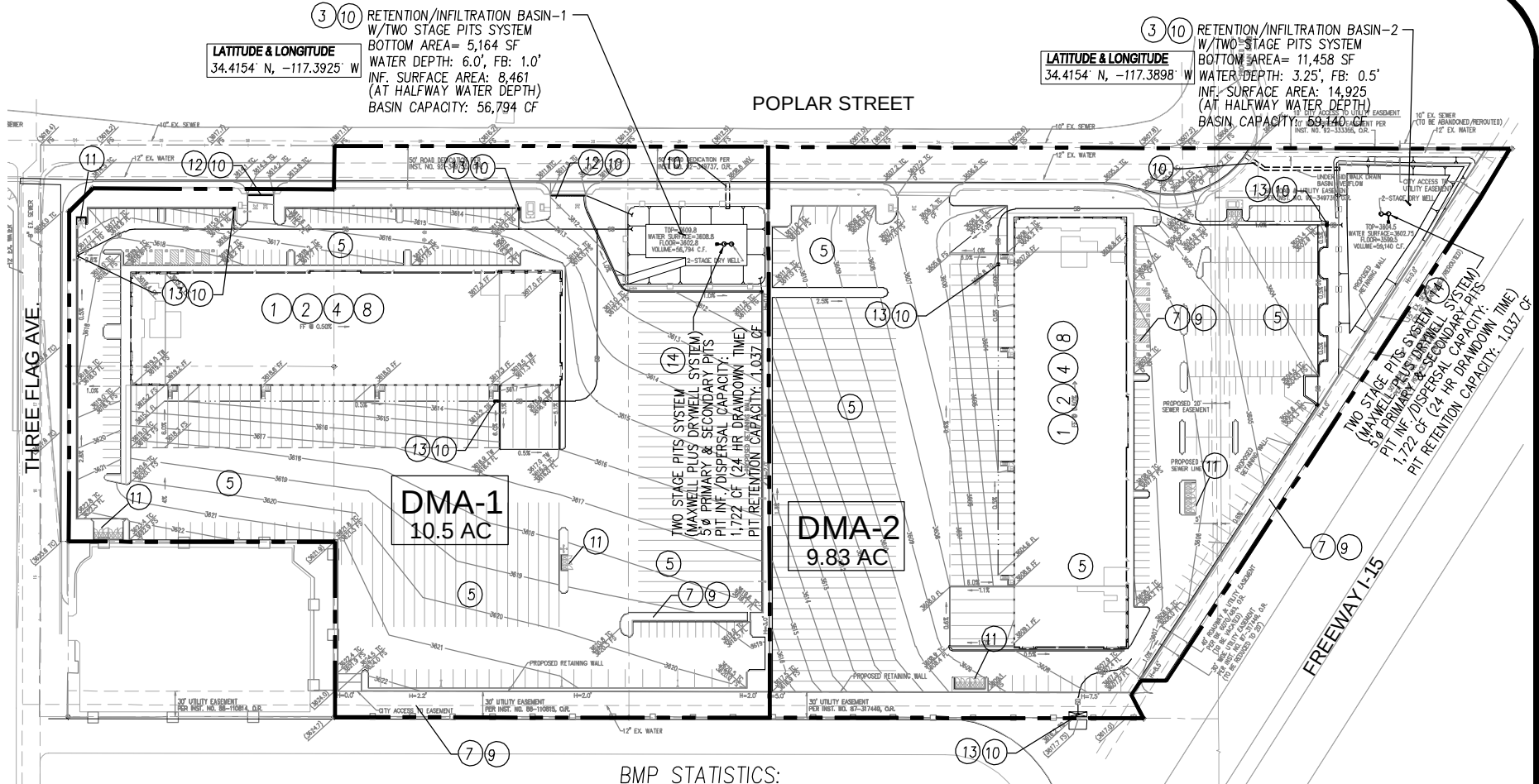
THAT PORTION OF THE WEST 1/2 OF THE SOUTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 22, TOWNSHIP 4 NORTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT OF SAID LAND ON FILE IN THE DISTRICT LAND OFFICE, DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWESTERLY CORNER OF SAID SOUTHWEST 1/4; THENCE SOUTHERLY ALONG THE WESTERLY LINE OF SAID SOUTHWEST 1/4 TO A LINE PARALLEL WITH AND DISTANT 14.00 FEET NORTHWESTERLY, MEASURED AT RIGHT ANGLES, FROM THE NORTHEASTERLY PROLONGATION OF THE NORTHWESTERLY LINE OF THAT CERTAIN PARCEL OF LAND CONVEYED TO THE STATE OF CALIFORNIA BY DEED FROM SIMON FRIEDMAN AND WIFE, RECORDED JANUARY 28, 1949, IN BOOK 2353, PAGE 423, OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY; THENCE NORTHEASTERLY ALONG SAID PARALLEL LINE TO THE NORTHERLY LINE OF SAID SOUTHWEST 1/4; THENCE WESTERLY ALONG SAID NORTHERLY LINE TO THE POINT OF BEGINNING.

EXHIBIT B

(Map/illustration)





BMP LIST:

- (1) EDUCATION OF PROPERTY OWNERS (N1)
- (2) ACTIVITY RESTRICTIONS (N2)
- (3) INFILTRATION/RETENTION BASIN-1
WITH TWO STAGE PITS SYSTEM PER PLAN
- (4) TRAINING/EDUCATION PROGRAM (N12)
- (5) PARKING LOT SWEEPING/VACUUMING (N15)
- (6) COMMON AREA CATCH BASIN INSPECTION (N14)
- (7) LANDSCAPE PLANNING (N3)
- (8) ROOF RUNOFF CONTROLS (SD-11)
- (9) EFFICIENT IRRIGAION (S-4)
- (10) STORM DRAIN SIGNAGE (S-1)
- (11) TRASH STORAGE AREAS (N11)
- (12) TRENCH DRAIN FILTER INSERT
-FLO-GARD INSERT FILTER
- (13) GRATE INLET FILTER INSERT- ADS FLEXSTORM
PURE INLET FILTER OR APPROVED EQUAL (N14)
- (14) TWO-STAGE DRYWELL SYSTEM (MAXWELL PLUS
DRYWELL SYSTEM)

BMP STATISTICS:

DMA#s	AREA (AC)	BMP	BMP CAPACITY (CF)	REQUIRED VOLUME (CF)	PROVIDED VOLUME (CF)
DMA-1	10.5	INF/RET BASIN-1 WITH TWO STAGE PITS SYSTEM	57,831	30,956	*57,831
DMA-1	9.83	INF/RET BASIN-2 WITH TWO STAGE PITS SYSTEM	60,177	28,981	*60,177

DA-1: 20.33 AC

118,008 CF

59,937 CF

*118,008 CF

*INCLUDED TWO-STAGE PIT RET. CAPACITY



SCALE: 1" = 200'



Prepared By:
ALLARD ENGINEERING
Civil Engineering - Land Surveying - Land Planning
16866 Seville Avenue
Fontana, California 92335
PHONE (909) 356-1815 Fax (909) 356-1795

Prepared For:
CARGO SOLUTIONS EXPRESS
14587 VALLEY BLVD.
FONTANA, CA 92335
PHONE: (909) 350-1644 ex 330

CITY OF HISPERIA, CALIFORNIA
WQMP EXHIBIT
APN 3064-591-12, 13 & 3064-631-01

Appendix: 6.4

BMP Educational Materials

POLLUTION STORMWATER PREVENTION

PAINTING

Paints, solvents, adhesives and other toxic chemicals used in painting often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect our health.



Water-Based Paints

Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or "cleans with water."



Paint Removal

Sweep up paint stripping residue, chips and dust instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



Painting Cleanup

Never clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which can be reused by putting it in a jar to settle out the paint particles and then pouring off the clear liquid for future use. Wrap dried paint residue in newspaper and dispose of it in the trash.

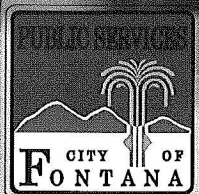
Exterior Paint Removal

When stripping or cleaning building exteriors with high-pressure water, block nearby storm drains and divert washwater onto a designated dirt area. Ask your local wastewater treatment authority if you can collect building cleaning water and discharge it to the sewer.



Recycling Paint

Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

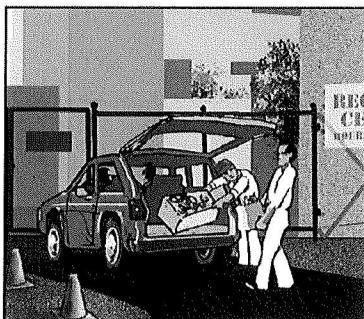
www.1800cleanup.org



POLLUTION STORMWATER Prevention

HOME & GARDEN

Yard waste and household toxics like paints and pesticides often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.



Recycle Household Hazardous Waste

Household products like paint, pesticides, solvents and cleaners are too dangerous to dump and too toxic to trash. Take them to be recycled at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



Disposing of Yard Waste

Recycle leaves, grass clippings and other yard waste, instead of blowing, sweeping or hosing into the street. Try grasscycling, leaving grass clippings on your lawn instead of using a grass catcher. The clippings act as a natural fertilizer, and because grass is mostly water, it also irrigates your lawn, conserving water.



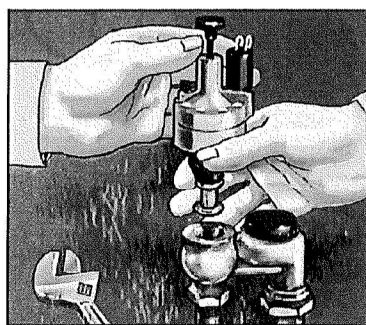
Use Fertilizers & Pesticides Safely

Fertilizers and pesticides are often carried into the storm drain system by sprinkler runoff. Try using organic or non-toxic alternatives. If you use chemical fertilizers or pesticides, avoid applying near curbs and driveways and never apply before a rain.



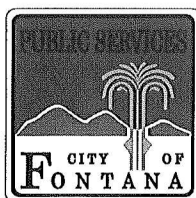
Planting in the Yard

Produce less yard waste and save water by planting low maintenance, drought-tolerant trees and shrubs. Using drip irrigation, soaker hoses or micro-spray systems for flower beds and vegetation can also help reduce your water bill and prevent runoff.



Use Water Wisely

Cut your water costs and prevent runoff by controlling the amount of water and direction of sprinklers. The average lawn needs about an inch of water a week, including rainfall, or 10 to 20 minutes of watering. A half-inch per week is enough for fall and spring. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org



Fertilizer Tips to Prevent Pollution

Water that runs off your lawn and garden can carry excess fertilizer into the San Bernardino County storm drain system, and it does not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health:



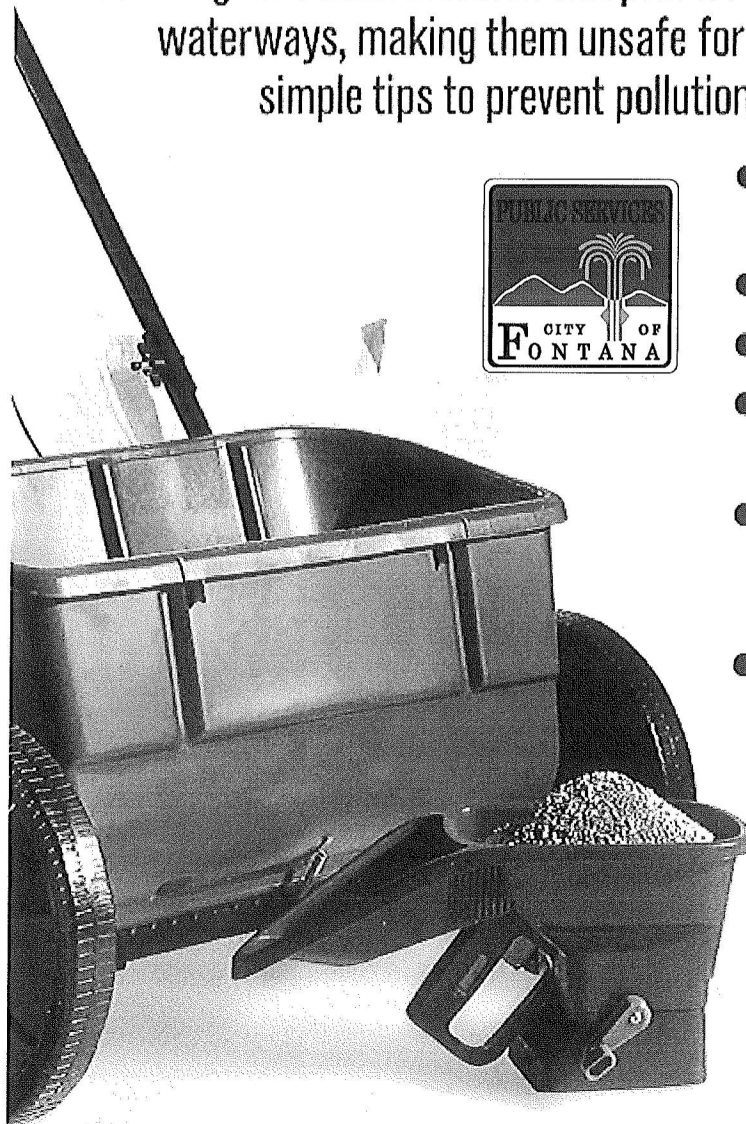
- Read the product label and follow the directions carefully, using only as directed.
- Avoid applying near driveways or gutters.
- Never apply fertilizer before a rain.
- Store fertilizers and chemicals in a covered area and in sealed, waterproof containers.
- Take unwanted lawn or garden chemicals to a household hazardous waste collection facility. Call (800) 253-2687.
- Use non-toxic products for your garden and lawn whenever possible.

To report illegal dumping or for more information on Stormwater pollution prevention, call:



1 (800) CLEANUP

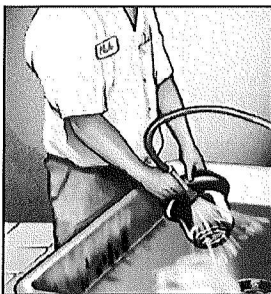
www.1800cleanup.org



POLLUTION ^{STORMWATER} Prevention

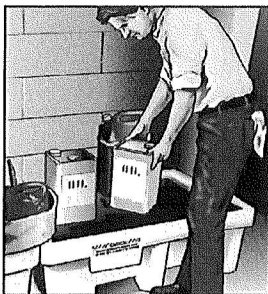
AUTO MAINTENANCE

Oil, grease, anti-freeze and other toxic automotive fluids often make their way into the San Bernardino County storm drain system, and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



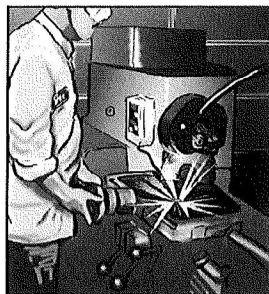
Cleaning Auto Parts

Scrape parts with a wire brush or use a bake oven rather than liquid cleaners. Arrange drip pans, drying racks and drain boards so that fluids are directed back into the parts washer or the fluid holding tank. Do not wash parts or equipment in a shop sink, parking lot, driveway or street.



Storing Hazardous Waste

Keep your liquid waste segregated. Many fluids can be recycled via hazardous waste disposal companies if they are not mixed. Store all materials under cover with spill containment or inside to prevent contamination of rainwater runoff.



Metal Grinding and Polishing

Keep a bin under your lathe or grinder to capture metal filings. Send uncontaminated filings to a scrap metal recycler for reclamation. Store metal filings in a covered container or indoors.



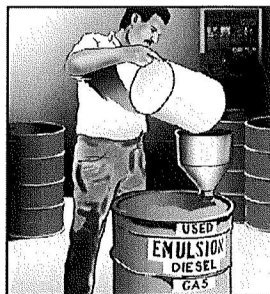
Preventing Leaks and Spills

Place drip pans underneath to capture fluids. Use absorbent cleaning agents instead of water to clean work areas.



Cleaning Spills

Use dry methods for spill cleanup (sweeping, absorbent materials). Follow your hazardous materials response plan, as filed with your local fire department or other hazardous materials authority. Be sure that all employees are aware of the plan and are capable of implementing each phase. To report serious toxic spills, call 911.



Proper Disposal of Hazardous Waste

Recycle used motor oil and oil filters, anti-freeze and other hazardous automotive fluids, batteries, tires and metal filings collected from grinding or polishing auto parts. Contact a licensed hazardous waste hauler. For more recycling information, call (909) 386-8401.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

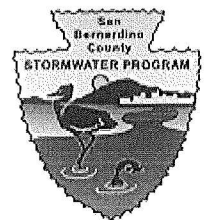
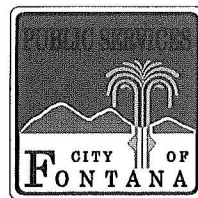
www.1800cleanup.org



Pick up after your pooch to curb pollution.

Maybe you weren't aware, but dog waste left on the ground gets into storm drains, polluting rivers, lakes and beaches.

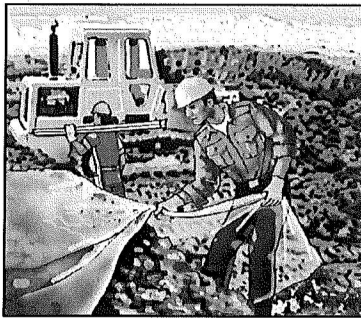
The bacteria and risk of disease threatens the health of our kids and communities. Wherever you live in San Bernardino County, this pollution is a problem. The answer? Pick up after your dog, to help prevent pollution and protect our health. It's in your hands.



POLLUTION STORMWATER Prevention

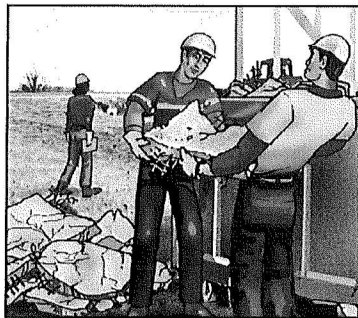
FRESH CONCRETE & MORTAR APPLICATION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



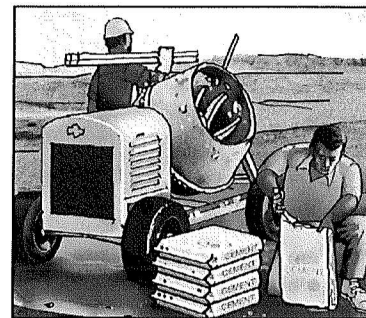
Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Secure open bags of cement and cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



Ordering Materials & Recycling Waste

Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. When breaking up paving, recycle the pieces at a crushing company. You can also recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. Call (909) 386-8401 for recycling and disposal information.

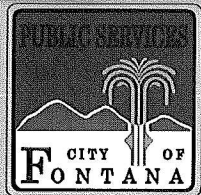
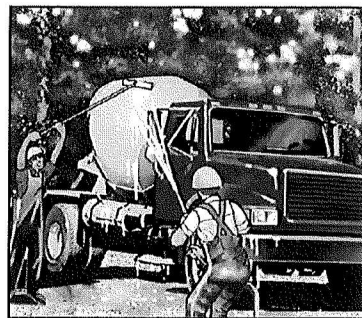


During Construction

Schedule excavation and grading during dry weather. Prevent mortar and cement from entering the street and storm drains by placing erosion controls. Setup small mixers on tarps or drop cloths, for easy cleanup of debris. Never bury waste material. Recycle or dispose of it as hazardous waste.

Cleaning Up

Wash concrete dust onto designated dirt areas, not down driveways or into the street or storm drains. Wash out concrete mixers and equipment in specified washout areas, where water can flow into a containment pond. Cement washwater can be recycled by pumping it back into cement mixers for reuse. Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org



STORMWATER Pollution Prevention

HOME REPAIR & REMODELING

Paints, solvents, adhesives and other toxic substances used in home repair and remodeling often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.



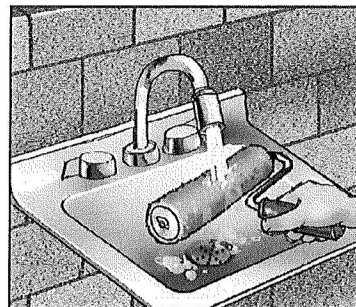
Construction Projects

Keep construction debris away from the street, gutter and storm drains. Schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of soil, sand or gravel, protected from rain, wind and runoff. Prevent erosion by planting fast-growing annual and perennial grass, which can shield and bind soil.



Landscaping & Gardening

Avoid applying fertilizers or pesticide near curbs and driveways, and store covered, protected from rain, wind and runoff. Try using organic or non-toxic alternatives. Reduce runoff and lower your water bill by using drip irrigation, soaker hoses or micro-spray systems. Recycle leaves instead of blowing, sweeping or raking them into the street, gutter or storm drain.



Painting Cleanup

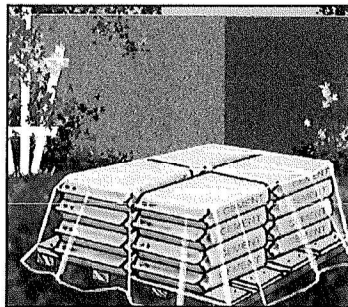
Avoid cleaning brushes or rinsing paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which you can filter and reuse. Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.

Recycle Household Hazardous Waste

Household cleaners, paint and other home improvement products like wallpaper and tile adhesives are too toxic to trash. Recycle them instead, at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.

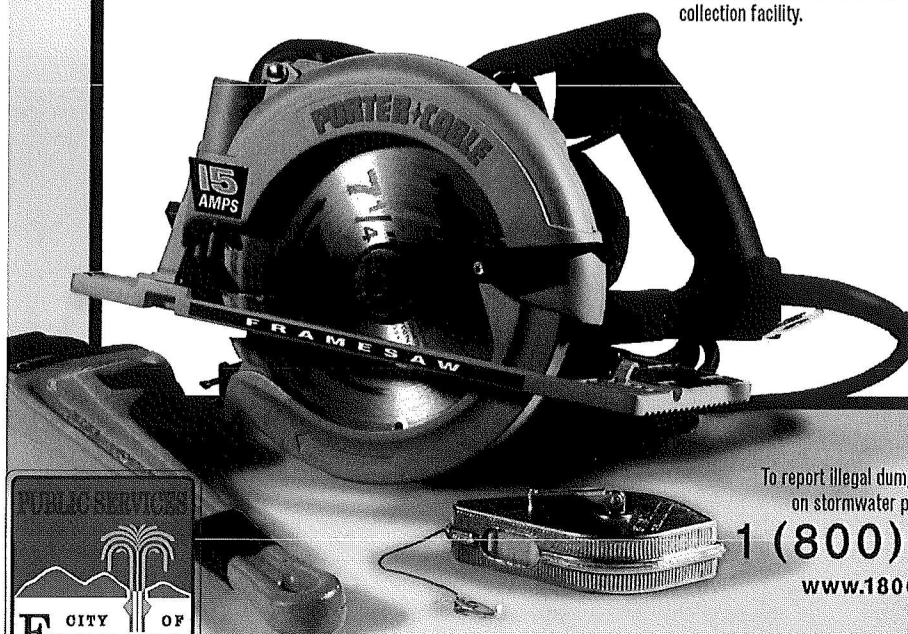
Paint Removal

Paint stripping residue, chips and dust from marine paints and paints containing lead or tributyl tin are hazardous wastes. Sweep them up instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility.



Concrete and Masonry

Store bags of cement and plaster away from gutters and storm drains, and cover them to protect against rain, wind and runoff. Sweep or scoop up cement washout or concrete dust instead of hosing into driveways, streets, gutters or storm drains.



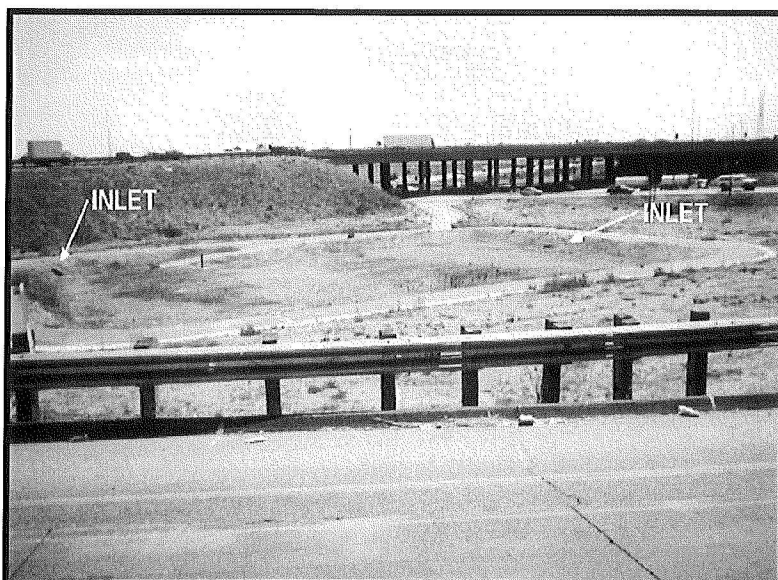
To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org



BMP Fact Sheets



Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

☒	Sediment	■
☒	Nutrients	■
☒	Trash	■
☒	Metals	■
☒	Bacteria	■
☒	Oil and Grease	■
☒	Organics	■

Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabilized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide ("low pressure") tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.
- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.
- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.
- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.
- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.
- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.
- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

- (1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.
- (2) Provide pretreatment if sediment loading is a maintenance concern for the basin.
- (3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.
- (4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m²)

WQV = water quality volume (m³)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

- (5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.
- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.
- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.
- Remove accumulated trash and debris in the basin at the start and end of the wet season.
- Inspect for standing water at the end of the wet season.
- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.
- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.
- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about \$2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about \$18/ft³ for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

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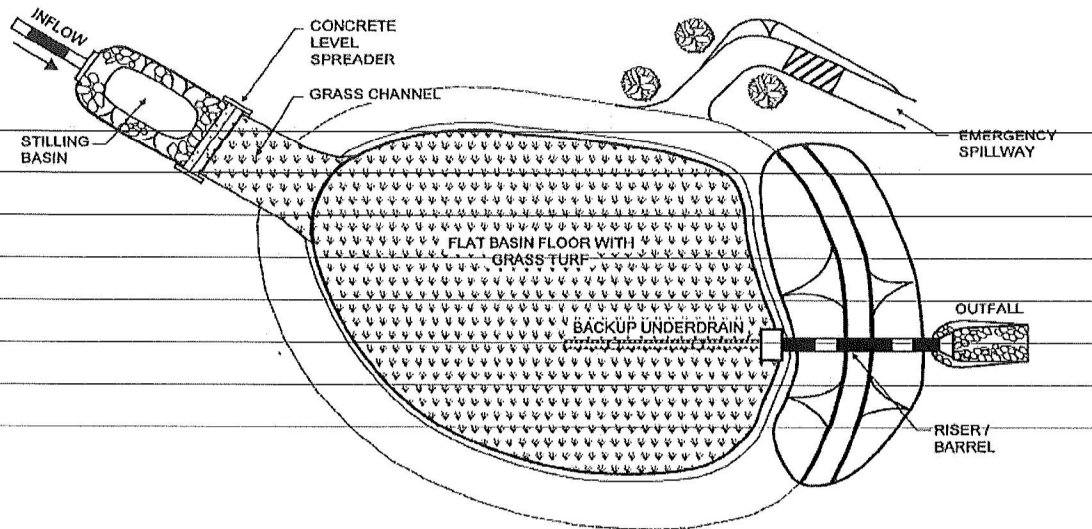
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Information Resources

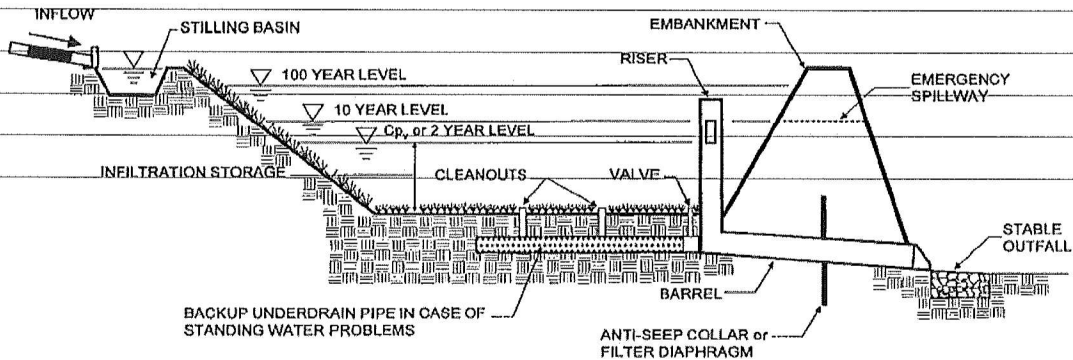
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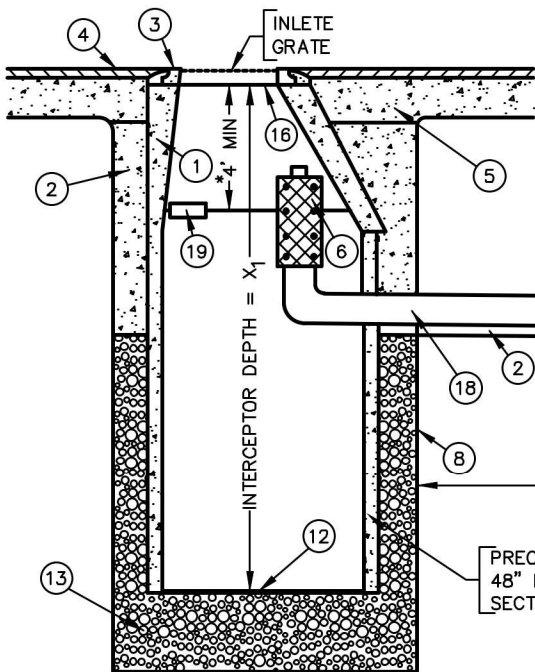


PLAN VIEW



PROFILE

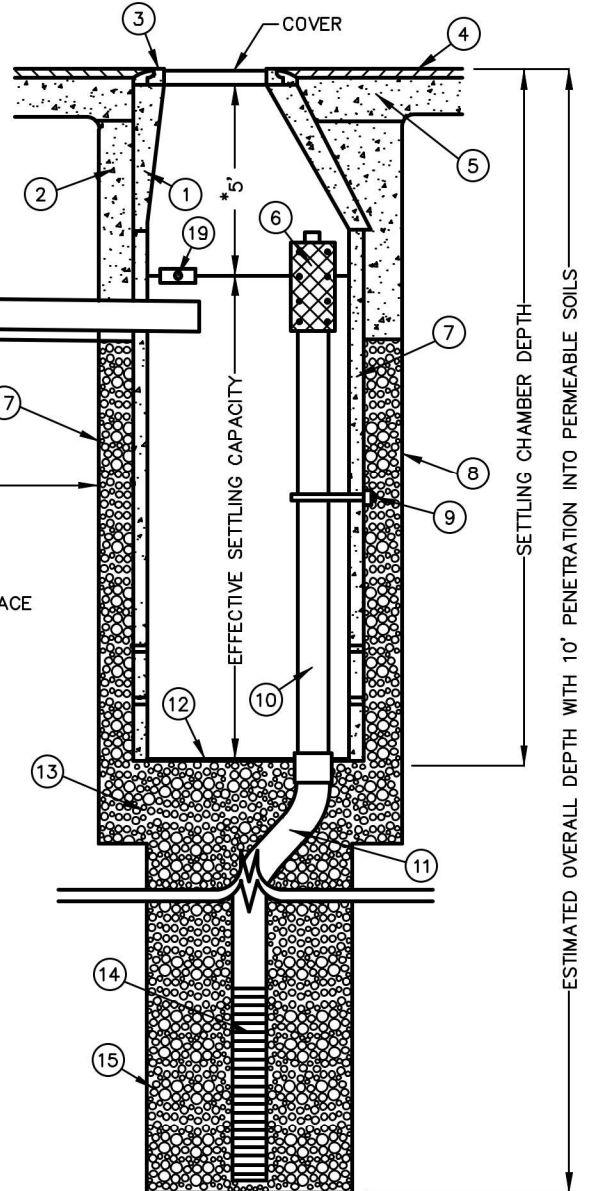
DRAINAGE SYSTEM DETAIL AND SPECIFICATION



PRECAST LINER 2500 PSI CONCRETE
48" ID. 54" OD. CENTER IN HOLE
SECTIONS TO MAXIMIZE BEARING SURFACE

NOTES:

- (1) MANHOLE CONE MODIFIED FLAT BOTTOM.
- (2) STABILIZED BACKFILL 1 SACK CONCRETE SLURRY IN PAVED AREAS.
- (3) BOLTED RING & GRATE/COVER CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS. SECURED TO CONE WITH MORTAR. RIM ELEVATION $\pm 0.02'$ OF PLANS.
- (4) GRADED BASIN OR PAVING.
- (5) COMPACTED BASE MATERIAL.
- (6) 6" PVC PIPE x 4' LONG, WITH 2" PERFORATIONS WRAPPED WITH 1/8" GALVANIZED MESH.
- (7) PRECAST LINER 2500 PSI CONCRETE 48" ID. 54" OD. CENTER IN HOLE SECTIONS TO MAXIMIZE BEARING SURFACE 2" CENTER PREFORMED HOLES AT THE BOTTOM 3' OF SHAFT (3 ROWS @ 8 NOS. PER ROW, MIDDLE ROW TO BE STAGGERED).
- (8) MIN. 6" ϕ DRILLED SHAFT.
- (9) SUPPORT BRACKET FORMED 12 GA. STEEL. FUSION BONDED EPOXY COATED.
- (10) 6" OVERFLOW PIPE SCH 40 PVC. MATED TO DRAINAGE BELOW BASE SEAL.
- (11) DRAINAGE PIPE ADS HIGHWAY GRADE WITH MDI-A COUPLER. (OR APPROVED EQUAL) SUSPEND PIPE DURING BACKFILL OPERATIONS TO PREVENT BUCKLING OR BREAKAGE. MINIMUM PIPE SIZE TO BE 8" DIAMETER
- (12) BASE SEAL - GEOTEXTILE, POLY LINER OR CONCRETE SLURRY.
- (13) ROCK CLEAN AND WASHED, SIZED BETWEEN 3/4" AND 1-1/2" TO BEST COMPLEMENT SOIL CONDITIONS.
- (14) 6-INCH CORRUGATED PERFORATED POLYETHYLENE (ADS OR APPROVED EQUAL).
- (15) MIN. 4' ϕ SHAFT DRILLED TO MAINTAIN PERMEABILITY OF DRAINAGE SOILS.
- (16) FABRIC SEAL UV RESISTANT GEOTEXTILE TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION



- (17) 2-STAGE PIT IS TO BE USED FOR COMMERCIAL DEVELOPMENT ONLY.
- (18) CONNECTOR PIPE 6" ϕ SCH 40 PVC
- (19) ABSORBENT HYDROPHOBIC PETRO CHEMICAL SPONGE MIN. 100 OZ. CAPACITY.

* FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE INTERCEPTOR/ SETTLING CHAMBER DEPTH AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.

X_1 = 10' MAXIMUM

NOTE:

A SOILS INVESTIGATION SHALL BE PERFORMED BY A REGISTERED SOILS ENGINEER TO ENSURE THAT THE SEEPAGE PIT WILL HAVE ADEQUATE PERCOLATION.

DRAWN BY: M.W.M.

APPROVED BY:

DATE: 8/20/13

CITY OF HESPERIA

2 STAGE
SEEPAGE PITS



REV. DATE

STD. DRWG. NO.

SP-1

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Injection Wells & Galleries

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Drainage Rehabilitation
Drywell Abandonments
OSHA HAZMAT-Certified

Drainage Renovation

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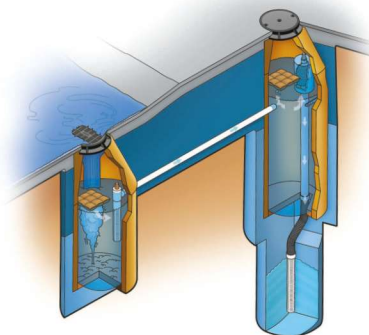
An evolution of McGuckin Drilling

MaxWell® Plus

DRAINAGE SYSTEM
Product Information and Design Features



The **MaxWell® Plus**, as manufactured and installed exclusively by Torrent Resources Incorporated, is the industry standard for draining large paved surfaces, nuisance water and other demanding applications. This patented system incorporates state-of-the-art pre-treatment technology.



THE ULTIMATE IN DESIGN

Since 1974, nearly 65,000 MaxWell® Systems have proven their value as a cost-effective solution in a wide variety of drainage applications. They are accepted by state and municipal agencies and are a standard detail in numerous drainage manuals. Many municipalities have recognized the inherent benefits of the MaxWell Plus and now require it for drainage of all paved surfaces.

SUPERIOR PRE-TREATMENT

Industry research, together with Torrent Resources' own experience, have shown that initial storm drainage flows have the greatest impact on system performance. This "first flush" occurs during the first few minutes of runoff, and carries the majority of sediment and debris. Larger paved surfaces or connecting pipes from catch basins, underground storage, etc. can also generate high peak flows which may strain system function. In addition, nuisance water flows require controlled processing separate from normal storm runoff demands.

In the **MaxWell® Plus**, preliminary treatment is provided through collection and separation in deep large-volume settling chambers. The standard MaxWell Plus System has over 2,500 gallons of capacity to contain sediment and debris carried by incoming water. Floating trash, paper, pavement oil, etc. are effectively stopped by the **PureFlo®** Debris Shields in each chamber. These shielding devices are equipped with an effective screen to filter suspended material and are vented to prevent siphoning of floating surface debris as the system drains.

EFFECTIVE PROCESSING

Incoming water from the surface grated inlets or connecting pipes is received in the Primary Settling Chamber where silt and other heavy particles settle to the bottom. A PureFlo Debris Shield ensures containment by trapping floating debris and pavement oil. The pre-treated flow is then regulated to a design rate of up to 0.25cfs and directed to a Secondary Settling Chamber. The settling and containment process is repeated, thereby effectively achieving controlled, uniform treatment. The system is drained as water rises under the PureFlo Debris Shield and spills into the top of the overflow pipe. The drainage assembly returns the cleaned water into the surrounding soil through the **FloFast®** Drainage Screen.

ABSORBENT TECHNOLOGY

Both MaxWell Plus settling chambers are equipped with absorbent sponges to provide prompt removal of pavement oils. These floating pillow-like devices are 100% water repellent and literally wick petrochemical compounds from the water. Each sponge has a capacity of up to 128 ounces to accommodate effective, long-term treatment. The absorbent is completely inert and will safely remove runoff constituents down to rainbow sheens that are typically no more than one molecule thick.

SECURITY FEATURES

MaxWell Plus Systems include bolted, theft-deterrent, cast iron gratings and covers as standard security features. Special inset castings which are resistant to loosening from accidental impact are available for use in landscaped applications. Machined mating surfaces and "Storm Water Only" wording are standard.

THE MAXWELL FIVE-YEAR WARRANTY

Innovative engineering, quality materials and exacting construction are standard with every MaxWell System designed, manufactured and installed by Torrent Resources Incorporated. The MaxWell Drainage Systems Warranty is the best in the industry and guarantees against failures due to workmanship or materials for a period of five years from date of completion.

Manufactured and Installed Exclusively by Torrent Resources Incorporated
Please see reverse side for additional information
U.S. Patent No. 4,923,330

MAXWELL® PLUS DRAINAGE SYSTEM DETAIL AND SPECIFICATIONS

CALCULATING MAXWELL PLUS REQUIREMENTS:

The type of property, soil permeability, rainfall intensity and local drainage ordinances determine the number and design of MaxWell Systems. For general applications draining retained stormwater, use one standard **MaxWell® Plus** per the instructions below for up to 5 acres of landscaped contributory area, and up to 2 acres of paved surface. To drain nuisance water flows in storm runoff systems, add a remote inlet to the system. For smaller drainage needs, refer to our **MaxWell® IV**. For industrial drainage, our **Encibro® System** may be recommended. For additional considerations, please refer to **"Design Suggestions For Retention And Drainage Systems"** or consult our Design Staff.

COMPLETING THE MAXWELL PLUS DRAWING

To apply the MaxWell Plus drawing to your specific project, simply fill in the blue boxes per the following instructions. For assistance, please consult our Design Staff.

PRIMARY SETTLING CHAMBER DEPTH

The overall depth of the Primary Settling Chamber is determined by the amount of surface area being drained. Use a standard depth of **15 feet** for the initial acre of contributory drainage area, **plus 2 feet** for each additional acre, up to the design limits of the property type noted in "Calculating MaxWell Plus Requirements" noted above. Other conditions that would require increased chamber depths are property usage, maintenance scheduling, and severe or unusual service conditions. Connecting pipe depth may dictate deeper chambers so as to maintain the effectiveness of the settling process. Maximum chamber depth is 25 feet. A pump and lift station is recommended for systems with deeper requirements.

ESTIMATED TOTAL DEPTH

The Estimated Total Depth is the approximate total system depth required to achieve 10 continuous feet of penetration into permeable soils, based upon known soil information. Torrent utilizes specialized **"crowd"** equipped rigs to get through the difficult cemented soil and to reach clean drainage soils at depths up to **180 feet**. An extensive drilling log database is available to use as a reference.

SETTLING CHAMBER DEPTH

On MaxWell Plus Systems of over 30 feet overall depth and up to 0.25cfs design rate, the standard Settling Chamber Depth is **18 feet**. Maximum chamber depth is 25 feet.

OVERFLOW HEIGHT

The Overflow Height and Secondary Settling Chamber Depth determine the effectiveness of the settling process. The higher the overflow pipe, the deeper the chamber, the greater the settling capacity. An overflow height of **13 feet** is used with the standard settling chamber depth of **18 feet**.

DRAINAGE PIPE

This dimension also applies to the **PureFlo®** Debris Shields, the **FloFast®** Drainage Screen, and fittings. The size is based upon system design rates, multiple primary settling chambers, soil conditions, and need for adequate venting. Choices are 6", 8", or 12" diameter. Refer to our company's **"Design Suggestions for Retention and Drainage Systems"** for recommendations on which size best matches your application.

BOLTED RING & GRATE / COVER

Standard models are quality cast iron and available to fit 24" Ø or 30" Ø manhole openings. All units are bolted in two locations with wording "Storm Water Only" in raised letters. For other surface treatments, please refer to "Design Suggestions for Retention and Drainage Systems."

INLET PIPE INVERT

Pipes up to 12" in diameter from catch basins, underground storage, etc. may be connected into the primary settling chamber. Larger pipe diameters dictate the use of manhole material for the primary setting chamber with 48" grates on the cone. Inverts deeper than 5 feet will require additional depth in both system settling chambers to maintain respective effective settling capacities.

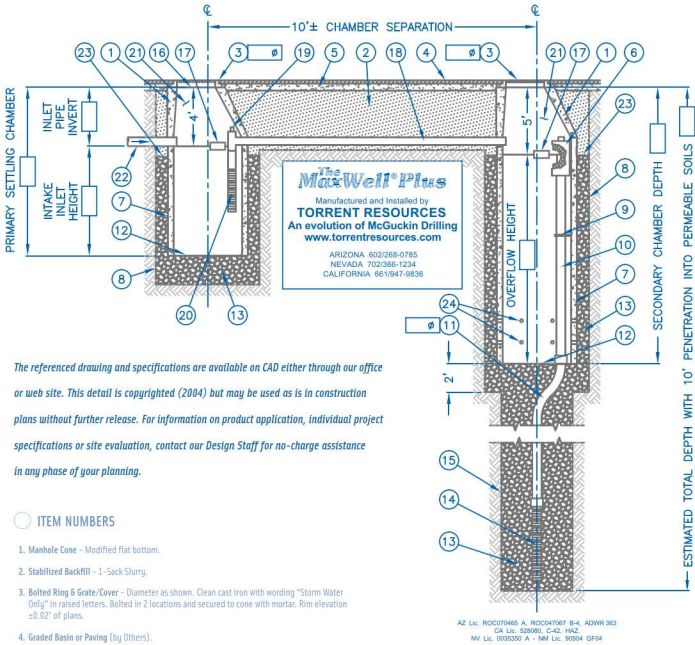
INTAKE INLET HEIGHT

The Intake Inlet Height determines the effectiveness of the settling process in the Primary Settling Chamber. A minimum inlet height of **11 feet** is used with the standard primary settling chamber depth of 15 feet. Greater inlet heights would be required with increased system demands as noted in Primary Settling Chamber Depth. Freeboard Depth Varies with inlet pipe elevation. Increase primary/secondary settling chamber depths as needed to maintain all inlet pipe elevations above connector pipe overflow.

CHAMBER SEPARATION

The standard separation between chambers is **10 feet** from center to center. Soil conditions and deeper inverts may dictate required variations in chamber separation.

The MaxWell® Plus Drainage System Detail And Specifications

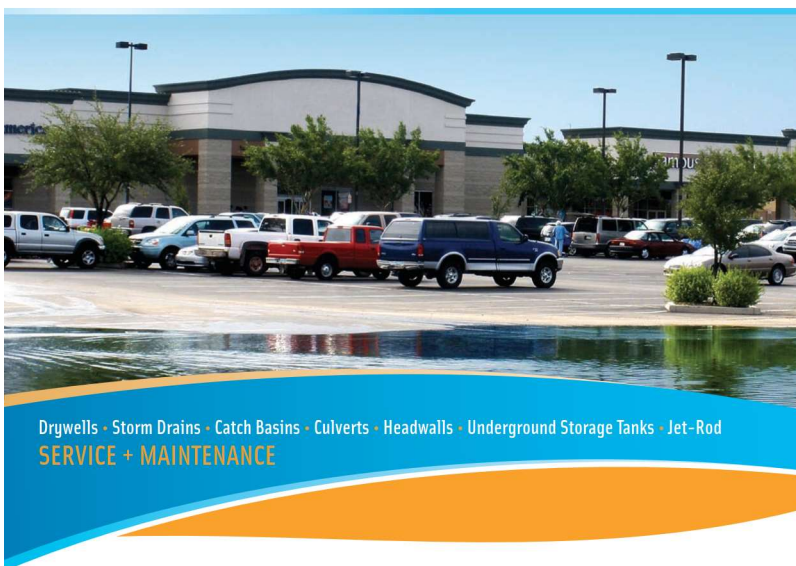


The referenced drawing and specifications are available on CAD either through our office or web site. This detail is copyrighted (2004) but may be used as is in construction plans without further release. For information on product application, individual project specifications or site evaluation, contact our Design Staff for no-charge assistance in any phase of your planning.

ITEM NUMBERS

1. Manhole Case - Modified flat bottom.
2. Stabilized Backfill - 1-Sack Slurry.
3. Bolted Ring & Grate / Cover - Diameter as shown. Clean cast iron with wording "Storm Water Only" in raised letters. Bolted in 2 locations and secured to cone with mortar. Rim elevation $\pm 0.02'$ of plans.
4. Graded Basin or Paving (by Others).
5. Compacted Base Material (by Others).
6. PureFlo® Debris Shield - Rolled 16 Ga. steel X 24" length with vented anti-siphon and internal .295" Max. SWD flattened expanded steel screen X 12" length. Fusion bonded epoxy coated.
7. Pre-cast Liner - 4000 PSI concrete 48" ID, X 54" OD. Center in hole and align sections to maximize bearing surface.
8. Min. 6" Ø Drilled Shaft.
9. Support Bracket - Formed 12 Ga. steel. Fusion bonded epoxy coated.
10. Overflow Pipe - Sch. 40 PVC mated to drainage pipe at base seal.
11. Drainage Pipe - ADS highway grade with TRI-A coupler. Suspend pipe during backfill operations to prevent buckling or breakage. Diameter as noted.
12. Base Seal - Geotextile or concrete slurry.
13. Rack - Washed, sized between 3/8" and 1-1/2" to best complement soil conditions.
14. FloFast® Drainage Screen - Sch. 40 PVC Ø 120" slotted well screen with 32 slots per row/ft. Diameter varies 120" overall length with TRI-B coupler.
15. Min. 4" Ø Shaft - Drilled to maintain permeability of drainage soils.
16. Fabric Seal - U.V. Resistant Geotextile - To be removed by customer at project completion.
17. Absorbent - Hydrophobic Petrochemical Sponge. Min 128 oz. capacity.
18. Connector Pipe - 4" Ø Sch. 40 PVC.
19. Anti-Siphon Vent with flow regulator.
20. Intake Screen - Sch. 40 PVC Ø 120" modified slotted well screen with 32 slots per row/ft. 48" overall length with TRI-C end cap.
21. Freeboard Depth Varies with inlet pipe elevation. Increase primary/secondary settling chamber depths as needed to maintain all inlet pipe elevations above connector pipe overflow.
22. Optional Inlet Pipe (by Others).
23. Moisture Membrane - 6 mil. Plastic. Place securely against eccentric cone and hole sidewall. Used in lieu of slurry in landscaped areas.
24. Eight - (8) perforations per foot, 2 row minimum.

NOT THE NEW WATER FEATURE YOU
HAD IN MIND FOR YOUR PROPERTY?



Drywells • Storm Drains • Catch Basins • Culverts • Headwalls • Underground Storage Tanks • Jet-Rod
SERVICE + MAINTENANCE

TORRENT RESOURCES STORMWATER SOLUTIONS

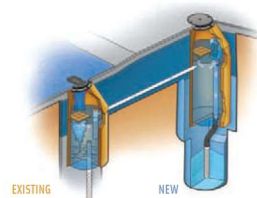
The Need for Maintenance

Like any other part of your infrastructure, drywells and other storm drain components need periodic maintenance to function at optimum levels. Over time, silt, sediment and debris build up in the system and reduce the drainage capability. This leads to water standing for periods of time longer than the state requirement. It also inconveniences customers at retail locations and residential areas. With Arizona leading the nation in cases of West Nile Virus and other diseases carried by mosquitoes, standing water is a particular concern. A lack of maintenance can eventually lead to costly repair to the system as well as the basins and parking lots in which they inhabit.

The Cleaning Process

The process starts with a thorough inspection of the drywells and other storm drain components. If the systems need to be serviced, it is imperative they are cleaned by someone familiar with the interworking of a drywell and compliant with the strict regulations of the ADEQ. The highly qualified Torrent Resources team offers:

• Certified Confined Space Entry • Disposal at an Approved Facility • Top of Line Equipment • Licensed, Bonded and Insured



Drywell Restoration

If your property has a non-functioning drywell, Torrent Resources has a solution. By adding a new drywell to your existing system, we effectively convert the single chamber drywell into a new state-of-the-art MaxWell® Plus system (shown in the illustration to the left).

The existing structure remains to receive water and trap additional debris while directing the treated flow to the new drywell. This retrofit makes the entire system far superior to the original design.

Industry Leader

As the Valley's #1 drywell contractor with over 65,000 systems installed, Torrent Resources has defined drywell design, installation, service and maintenance. Our drainage systems are specified by most Civil Engineers and Municipalities in the Southwest. With the largest, state-of-the-art equipment in the market, experienced construction crews and professional field supervisors, we are your experts when it comes to drainage solutions.

SERVICE AND MAINTENANCE IS **ONE** EASY CALL OR CLICK AWAY



Torrent Resources Incorporated

1509 E. Elwood Street Phoenix, Arizona 85040

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SCHEDULE YOUR **FREE** INITIAL DRAINAGE SITE REVIEW TODAY.



Description

Retention/irrigation refers to the capture of stormwater runoff in a holding pond and subsequent use of the captured volume for irrigation of landscape of natural pervious areas. This technology is very effective as a stormwater quality practice in that, for the captured water quality volume, it provides virtually no discharge to receiving waters and high stormwater constituent removal efficiencies. This technology mimics natural undeveloped watershed conditions wherein the vast majority of the rainfall volume during smaller rainfall events is infiltrated through the soil profile. Their main advantage over other infiltration technologies is the use of an irrigation system to spread the runoff over a larger area for infiltration. This allows them to be used in areas with low permeability soils.

Capture of stormwater can be accomplished in almost any kind of runoff storage facility, ranging from dry, concrete-lined ponds to those with vegetated basins and permanent pools. The pump and wet well should be automated with a rainfall sensor to provide irrigation only during periods when required infiltration rates can be realized. Generally, a spray irrigation system is required to provide an adequate flow rate for distributing the water quality volume (LCRA, 1998). Collection of roof runoff for subsequent use (rainwater harvesting) also qualifies as a retention/irrigation practice.

This technology is still in its infancy and there are no published reports on its effectiveness, cost, or operational requirements. The guidelines presented below should be considered tentative until additional data are available.

California Experience

This BMP has never been implemented in California, only in the Austin, Texas area. The use there is limited to watersheds where no increase in pollutant load is allowed because of the sensitive nature of the watersheds.

Advantages

- Pollutant removal effectiveness is high, accomplished primarily by: (1) sedimentation in the primary storage facility; (2) physical filtration of particulates through the soil profile; (3) dissolved constituents uptake in the vegetative root zone by the soil-resident microbial community.

Design Considerations

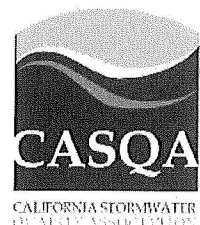
- Soil for Infiltration
- Area Required
- Slope
- Environmental Side-effects

Targeted Constituents

☒	Sediment	■
☒	Nutrients	■
☒	Trash	■
☒	Metals	■
☒	Bacteria	■
☒	Oil and Grease	■
☒	Organics	■

Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



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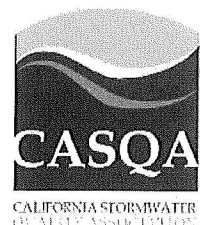
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☒	Nutrients	■
☒	Trash	■
☒	Metals	■
☒	Bacteria	■
☒	Oil and Grease	■
☒	Organics	■

Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



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 1/4 to 1/2 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

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- Provide Retention
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- ☒ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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



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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

Supplemental Information

Examples

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

Other Resources

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

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

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