MOJAVE RIVER WATERSHED

Conceptual Water Quality Management Plan

For:

HESPERIA SPEC INDUSTRIAL

WHERE APPLICABLE, INSERT GRADING PERMIT NO., BUILDING PERMIT NO., TRACT NUMBER, LAND DEVELOPMENT FILE NO., CUP, SUP AND/OR APN (SPECIFY LOT NUMBERS IF SITE IS A PORTION OF A TRACT)

Prepared for:

Rachamin 5, LLC

6001 E Slauson Ave

Commerce, CA 90040

(213) 769-4222

Prepared by:

4150 Concours, Suite 100

Ontario, CA 91764

(909) 989-9789

Job Number: 2019-164

Submittal Date: 07-13-20212

Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for **Rachamin 5, LLC** by **Westland Group, Inc**. 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):	Parcel Map No.	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			

Owner's Signature		
Owner Name: Brandon Gallup		
Title	Project Manager	
Company	Rachamin 5, LLC	
Address	6001 E Slauson Ave., Commerce, CA 90040	
Email		
Telephone #	(213) 769-4222	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	Parcel Map No. 18615	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			

"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: Glenn Chung		PE Stamp Below
Title	Executive Vice President/Principal	
Company	Westland Group, Inc.	
Address	4150 Concours, Suite 100, Ontario, CA 91764	
Email	gchung@westlandgroup.net	
Telephone #	(909) 989-9789	
Signature		
Date		

Table of Contents

Forms

Section I – Introduction

This WQMP template 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). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: http://cms.sbcounty.gov/dpw/Land/NPDES.aspx to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Hesperia Spec Industrial Center				
Project Owner Contact Name:	Mr. Ramin Namvar				
Mailing Address:	6001 E Slauson Ave	E-mail Address:		Telephone:	(213) 769-4222
Permit/Application Number(s):		Tract/Parcel Map Number(s):	Parcel Map No.		
Additional Information/ Comments:					
Description of Project:	The proposed site is an industrial development located near the northwest corner of Palmeto Way and Amargosa Rd in Hesperia, California. There are no erosive site conditions with a relatively flat topography. The project is currently vacant and undeveloped with the topography displays a drainage pattern via surface flow to the northeast. As runoff is draining northeast via surface flow, it will then flow into the roadside drainage swale and flow north along Amargosa Road. The flows would then eventually lead into the Oro Grande Wash. The proposed site will be considered an industrial development. The flows shall be collected through the nearest catch basin which is conveyed to infiltration/retention basins via a storm drain system. The storm drain system was designed to efficiently direct flow into infiltration/detention basins, as well as a single underground infiltration basin. The proposed project will convey flows into the underground infiltration system and when filled, flows will be conveyed into the infiltration/retention basin. The project proposes to construct a building that will be used for industrial and commercial purposes. The site will have dedicated parking areas and truck docking areas. In addition, for water quality the project proposes to have its own storm drain system that will use the combination of underground and above ground infiltration to treat the stormwater runoff. Part of the project will include offsite improvements that include constructing the parkway along the frontage of the project on Avenal Street.				

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	Not Applicable

Section 2 Project Description

2.1 Project Information

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

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

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 (ft2):	1,376,060	**3** Number of Dwelling Units:		**4** SIC Code:	1541

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:

Maintenance of the WQMP facilities will be the sole responsibility of the property owner:

Rachamin 5, LLC
6001 E Slauson Ave
Commerce, CA 90040
Contact: Mr. Ramin Namvar
Phone: (213) 769-4222

The owner may choose to contract the appropriate employers for the maintenance of stormwater to whom will provide the proper equipment if the current owners to not have the proper equipment and/or knowledge to do so.

Any future property owner(s) whom will succeed Rachamin 5 as the entity responsible for long term maintenance.

No infrastructure will be transferred to a public agency after completion. Refer to Section 5 of this WQMP report for detailed maintenance activities.

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Wild Bird and Pet Waste, Garbage
Nutrients - Phosphorous	E ☒	N ☐	Fertilizers, Food Waste, & Garbage
Nutrients - Nitrogen	E ☒	N ☐	Fertilizer & Waste
Noxious Aquatic Plants	E ☐	N ☒	The proposed development does not include any areas where water will be standing long enough to allow the growth of aquatic plants.
Sediment	E ☒	N ☐	Driveways, Rooftops, Sidewalks, Paved areas & landscape
Metals	E ☒	N ☐	Cars, Trucks & Parking Areas
Oil and Grease	E ☒	N ☐	Leaking Vehicles & Parking Areas
Trash/Debris	E ☒	N ☐	Poorly managed Trash Container & Parking area
Pesticides / Herbicides	E ☒	N ☐	Landscape Area
Organic Compounds	E ☒	N ☐	Cars & Trucks
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	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.***

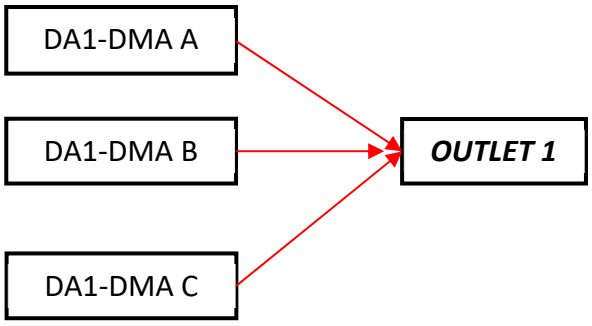
Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34°26'11.5"N	Longitude 117°22'36.6"W	Thomas Bros Map page

1 San Bernardino County climatic region: ☒ Desert

2 Does the site have more than one drainage area (DA): Yes☐ No☒ *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*

c



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
	Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property
	*Runoff sheet flows into the nearest catch basin which is then routed into a combination of an "**Underground CMP Infiltration System**" and "**Retention Basin-1**".*
	*Runoff sheet flows into the nearest catch basin which is then routed into a combination of an "**Retention Basin-2**" and the remaining flow is then directed into "**Retention Basin-4**".*
	*Runoff sheet flows into the nearest catch basin which is then routed into a combination of an "**Retention Basin-3**" and the remaining flow is then directed into "**Retention Basin-4**".*

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A			
1 DMA drainage area (ft^2)	1,376,060			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC II			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	B			
5 Longest flowpath length (ft)	2,695			
6 Longest flowpath slope (ft/ft)	0.014			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Chaparral			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	Poor			

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	Mojave River (Mojave Forks Reservoir outlet to Upper Narrows) Oro Grande Owner: SBCFCD
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Boron, Chloride, Dissolved oxygen saturation, Nitrate, Nitrite, Dissolved Oxygen, Total Kjeldahl Nitrogen, Total Dissolved Solids, Water Temperature, Sulfates, Specific Conductance, Phosphorus, Phosphate, pH,
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Fluoride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	Not Applicable
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

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	☒	☐	The current owner/developer and future owners and their POA shall be familiar with the contents of this WQMP and County & City ordinances and brochures and furnish copies of these documents to all future property owners.
N2	Activity Restrictions	☒	☐	Property owners and their tenants or occupants shall not be allowed to discharge chemicals, chemical residues, wastewater or other prohibited discharges listed in the City stormwater Ordinance, to the outside, paved areas of the site; or store chemicals or other pollutant sources in a non-spill contained or covered facilities as stipulated in the CC&Rs.
N3	Landscape Management BMPs	☒	☐	The POA and their landscape maintenance contractor shall inspect the irrigation system plant health and erosion problems after each landscape procedure and shall report all repairs and problems to the POA. All routine landscaping maintenance.
N4	BMP Maintenance	☒	☐	The POA shall inspect for standing water in the water retention/infiltration basins, 48 hours after storm events. BMP maintenance shall be performed per the schedule in Form 5-1, as needed to restore free drainage.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	The POA will file appropriate hazardous material disclosures, if any storage is conducted, and must comply with all Title 22 CCR, Chapter 29 regulations.
N6	Local Water Quality Ordinances	☐	☒	The POA shall ensure that all maintenance activities at the site comply with the City of Ontario's Stormwater Ordinance, through the implementation of BMPs.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials on site for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, ect.
N8	Underground Storage Tank Compliance	☐	☒	There are no underground storage tanks at this site.
N9	Hazardous Materials Disclosure Compliance	☐	☒	The current owner and the future POA shall prohibit the storage of hazardous materials.

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 current owners or the future POA shall require all fire code requirements to be implemented at this project site.
N11	Litter/Debris Control Program	☒	☐	The property owners, POA and their contractor shall pick up litter and sweep and clean the existing trash enclosure weekly. The trash enclosure is designed to divert all flows around the dumpsters and shall be roofed. The HOA shall contract with a refuse company to have the dumpsters emptied on a weekly basis, at a minimum.
N12	Employee Training	☒	☐	The POA shall require all maintenance contractors to train their employees in stormwater BMP implementation.
N13	Housekeeping of Loading Docks	☒	☐	Dock areas shall be swept regularly with litter control and cleanup procedures eliminating the use of water.
N14	Catch Basin Inspection Program	☒	☐	The on-site catch basins shall be inspected monthly during the rainy season (October-May) and before and after each storm to ensure proper operation. The HOA shall contract with a qualified landscape contractor to inspect and clean out accumulation of trash, litter and sediment and check for evidence of illegal dumping of waste materials into on-site drains.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The paved areas and common open areas of the project site shall be swept and cleaned weekly by the POA's contractor
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	This development is not part of a Public Agency Project.
N17	Comply with all other applicable NPDES permits	☒	☐	The developer of this site shall comply with all BMP implementation requirements of the City of Ontario for Stormwater discharges during construction of this project and shall file for a permit coverage under the Statewide General Construction Stormwater Permit, prior to beginning construction/grading activities at this site. Following occupancy, owners, tenants, and POA shall comply with SB County MS4 Permit requirements, enforced by the City of Ontario.

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)	☒	☐	A painted message "No Dumping-Drains to River" shall be placed on each catch basin by developer. The message shall be inspected annually & repainted as necessary by the POA.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Stormwater flows are diverted away from the trash enclosure. All dumpsters shall have working lids which shall be kept closed, at all times. Trash enclosure shall comply with CASQA SD-32 and shall have doors and a solid roof.
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)	☒	☐	The irrigation system will include devices to prevent low head drainage, overspray and run off through the use of pressure regulating devices, check valves, rain shutoff valves, flow sensors, pressure drop sensors, proper spacing, low precipitation emission devices and ET or weather-based controllers. Landscape and irrigation shall be consistent with the State Model Water Efficient landscape Ordinance and the City of Ontario landscape Development Standards. Plants installed will be arranged according to similar hydrozones and meet the required water budget for the site. Shade trees shall be used to intercept rainwater and reduce heat gain on paving.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	All landscaped areas shall comply with depressed grading requirements by finish grading to a minimum of 1" below pavement grades or top-of-curb.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☐	All slopes shall be hard lined, rip-rapped or vegetated to provide erosion protection and prevent sediment transport
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Unloading of truck trailers at docks will occur under cover of the building. It is not feasible to cover the entire loading area as it would be cost prohibitive. Project will incorporate dock high rollup doors and sweeping activities at the outside of the building.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Maintenance bays are not proposed as a part of this development, and no maintenance activities will be allowed on site.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Vehicle wash areas are not provided as part of this development.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Outdoor processing is not associated with the proposed development.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Outdoor equipment is not associated with the proposed development.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	Fueling areas are not included as part of this development.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☒	☐	No hillsides will require re-vegetation as part of the proposed development.
S14	Wash water control for food preparation areas	☐	☒	The proposed development does not include food preparation areas.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	The proposed development does not include community car wash areas

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.

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: Impervious areas will be minimized to the maximum extent practicable. The proposed development requires large areas for loading docks and building foot prints.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: All pervious areas will be below adjacent impervious areas to maximize natural infiltration, and the project site utilizes subsurface infiltration basins.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Post-development has different travel distance, surface roughness and time concentration from the existing condition.
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: Most areas are run through landscape areas prior to entering the storm drain system. Roof area will be conveyed through adjacent landscaping, where feasible.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Any areas that are disturbed will be stabilized prior to project completion.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: Native vegetation has been mostly removed by agricultural activities, and the existing undeveloped area will not be preserved.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: Any areas that are disturbed will be stabilized prior to project completion.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Landscaping areas will be staked off after rough grading has been completed to prevent excessive compaction, the areas in which the subsurface basins are to be constructed will minimize compaction.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: The project does not incorporate naturalized/ rock-lined drainage swales in place of underground piping.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscaping areas will be staked off after rough grading has been completed to prevent excessive compaction.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: The project does not incorporate rain barrels and cisterns.
Stream Setbacks. Includes a specified distance from an adjacent steam: Yes ☐ No ☒ Explanation: There are no adjacent to the property.

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -
http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants -
http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

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, evaportranspire, 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

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA1 DMA A)		
1 Project area DA1 DMA A (ft^2): 273,992	**2** Imperviousness after applying preventative site design practices (Imp%): 81	**3** Runoff Coefficient (Rc): 0.61 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.43 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.54 *P_6 = 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 *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.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 14,742 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA1 DMA B)		
1 Project area DA1 DMA B (ft^2): 831,125	**2** Imperviousness after applying preventative site design practices (Imp%): 90	**3** Runoff Coefficient (Rc): 0.73 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.43 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.54 *P_6 = 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 *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.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 52,842 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA1 DMA C)		
1 Project area DA1 DMA C (ft^2): 270,943	**2** Imperviousness after applying preventative site design practices (Imp%): 48	**3** Runoff Coefficient (Rc): 0.33 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.43 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.54 *P_6 = 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 *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.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 7,720 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) 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:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

> Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

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

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

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

If the combination of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;

2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and

3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

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. 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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=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) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

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

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

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).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

.

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

1 Remaining LID DCV not met by site design BMP (ft^3): 75,304 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

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*	DA 1 BMP Type Infiltration/Retention Basin		
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*	TBD		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	5		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.5		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	50,203		
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*	4		
10 Amended soil porosity	0.35		
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*	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	295,000(Basin 1)		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	305,000		

16 Total Retention Volume from LID Infiltration BMPs: 600,000 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 797% *Retention% = Item 16 / 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.

4.3.4 Biotreatment BMP

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

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.* Pathogen, Phosphorous, Nitrogen, Sediment, Metals, Oil Grease, Trash/Debris, Pesticides/ Herbicides, Organic Compounds	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): 0 *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

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)

1 Total LID DCV for the Project DA-1 (ft^3): 75,304 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 600,000 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-4*

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 ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- 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 ☒
  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
- 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 ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

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: ☐
  Checked yes if Form 4.3-4 Item 7is 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)%*

- 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. ☐

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

4.4 Alternative Compliance Plan (if applicable)

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

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following 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.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

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
Underground Infiltration System	Property Owner	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris, and sediment as determined by inspections. Cleaning is recommended during dry weather. See manufacturer recommendations for additional maintenance activities.	Monthly and within 48 hours following a significant storm event to verify there is no standing water in the chambers.
Onsite storm drain catch basins and piping	Property Owner	Onsite catch basins shall be inspected quarterly for debris buildup and evidence of illegal dumping and shall be cleaned whenever debris/sediment accumulates. Removal can be accomplished by vac-truck or other equally effective method.	Quarterly
Hydrodynamic Separator	Property Owner	Visual inspection and debris removed quarterly per manufactures recommendations	Quarterly
Above ground infiltration/ detention Basins	Property Owner	Inspections and maintenance by owners contracted maintenance staff to ensure that water infiltrates into the subsurface completely in 48 hours or less. Visual inspection, landscape maintenance, debris removal and erosion damage repair.	Monthly and within 48 hours following a significant storm event to verify there is no standing water in the chambers.
Landscape Maintenance	Property Owner	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains.	Weekly
Litter Control	Property Owner	Maintain roofed waste collection areas and vacuum-sweep drive aisles and parking areas to remove potential stormwater contamination before anticipated storm events.	Weekly/Monthly

Anti-Dumping Stenciling & Signage	Property Owner	Visual inspection and replacement of damaged or illegible stenciling and signage over on-site catch basins	Annually
Irrigation System	Property Owner	Check and repair the irrigation system. Verify there are no leaks or runoff from landscaped areas. Adjust irrigation heads and system run times as necessary to percent overwater of vegetation, overspray or run-off from landscape areas and to ensure the health and aesthetic quality of the landscape.	Weekly
Loading Docks	Property Owner	Sweep and clear debris from dock areas to remove potential stormwater contaminates prior to anticipated storms.	Weekly
Catch Basin Filter Inserts	Property Owner	Visual inspect filter for debris buildup. Removal can be accomplished by vac-truck or other equally effective method. See manufacturer recommendations for additional maintenance activities.	Quarterly and within 48 hours following a significant storm event to verify there is no standing water in the chambers

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

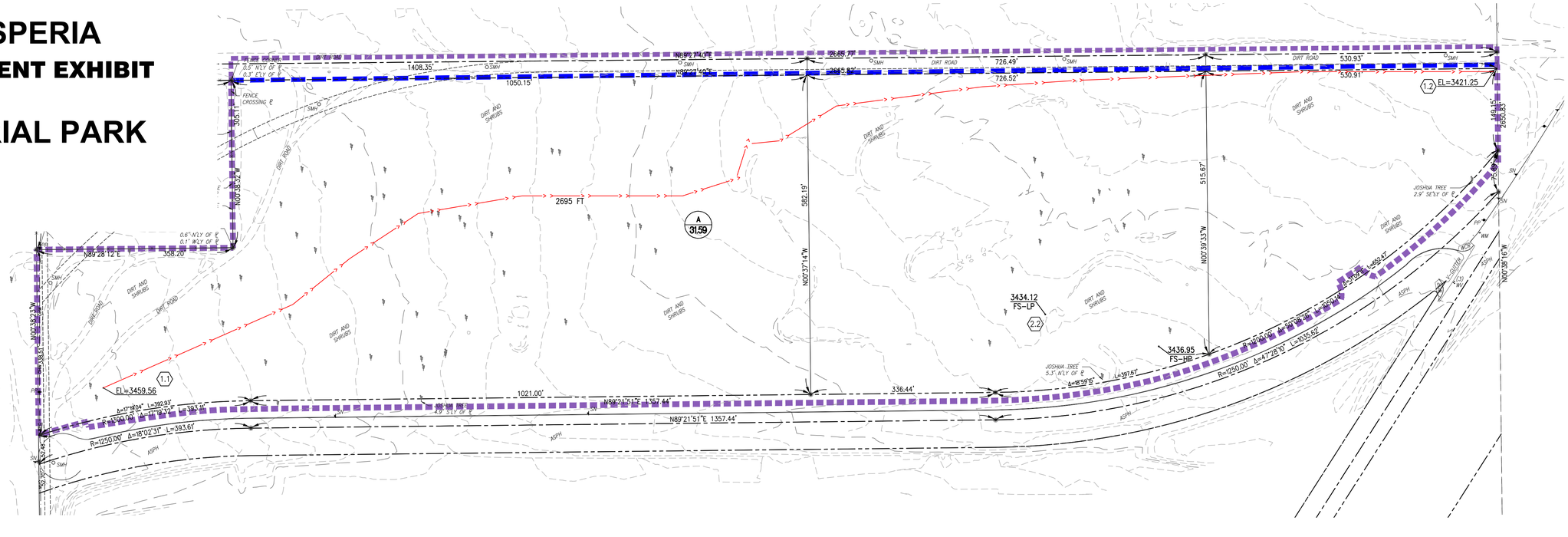
6.3 Post Construction

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

6.4 Other Supporting Documentation

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

CITY OF HESPERIA
PRE DEVELOPMENT EXHIBIT
FOR
SPEC INDUSTRIAL PARK



HYDROLOGY INFORMATION

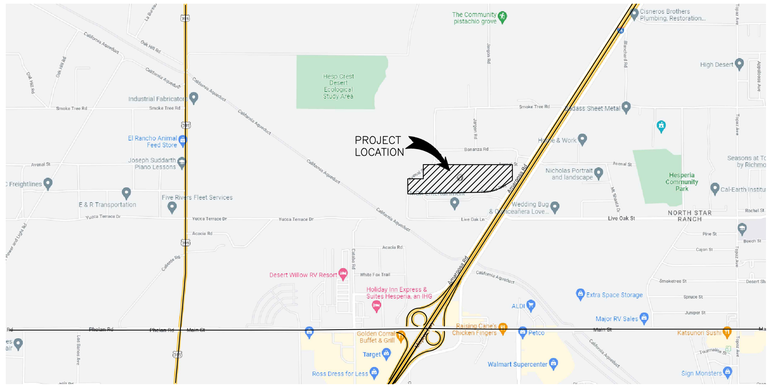
SITE AREA:	31± ACRES	
SOIL GROUP:	B	(PER USDA WEB SOIL SURVEY)
IMPERVIOUS:	80%	(PER CALCULATIONS)
ISOHYETALS:	0.433" 1.25"	(2-YEAR 1 HOUR) (100-YEAR 1 HOUR)
CN NUMBER:	78	(SOIL GROUP B)
FREQUENCY:	100 YEAR 2/10 YEAR	(FOR STORM DRAIN DESIGN) (FOR WATER QUALITY)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL	

LEGEND:

- DRAINAGE AREA/SITE BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- STORM WATER FLOW PATH
- PROPOSED STORM DRAIN PIPE
- PROPOSED FLOW DIRECTION ARROW
- DRAINAGE AREA DESIGNATION (X / XXX) AREA(AC)
- NODE (US/DS) (X.X)
- STREAM # (3)
- PROPOSED UNDERGROUND INFILTRATION/DETENTION
- PROPOSED BUILDING
- PROPOSED LANDSCAPING

DRAINAGE NOTES:

1. PROPOSED STORM DRAIN INLET
2. PROPOSED STORM DRAIN
3. PROPOSED INFILTRATION/DETENTION BASIN
4. PROPOSED UNDERGROUND INFILTRATION CMP



VICINITY MAP
N.T.S

PREPARED BY:
WestLAND Group, Inc. Land Surveyors • Civil Engineers • GIS
4150 CONCOURS, ONTARIO, CA 91764
PHONE: (909) 989-9789 FAX: (909) 989-9660
JOB NO: 2019-185

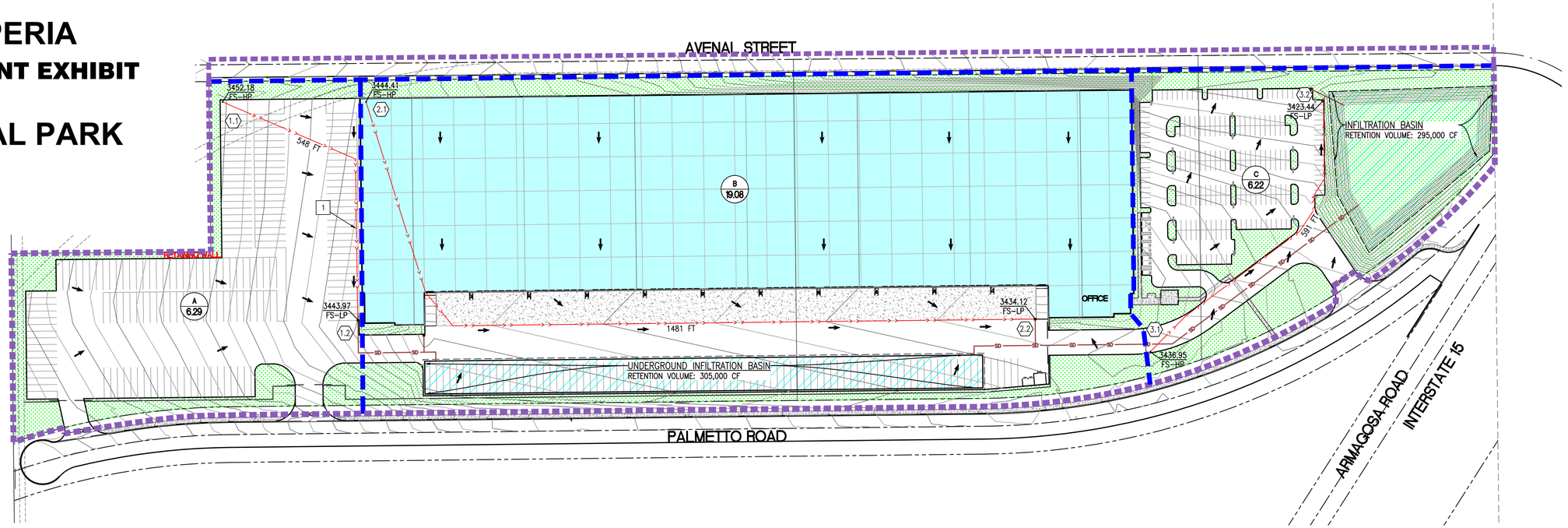
HCCII INDUSTRIAL PARK
WQMP PRE EXHIBIT

CITY OF HESPERIA

DATE: DEC 2021
SHEET 1 OF 1

Drawing Name: P:\Year_2021\2021-196 Hesperia Industrial - RDA - Chris Sovage\06 Engineering\Reports\Hydrology\3_Exhibits\2021-196_Hydro_Exhibit_Pre.dwg
Last Opened: Jul 10, 2022 - 7:48pm by: lucas.glauser

CITY OF HESPERIA
POST DEVELOPMENT EXHIBIT
FOR
SPEC INDUSTRIAL PARK



HYDROLOGY INFORMATION

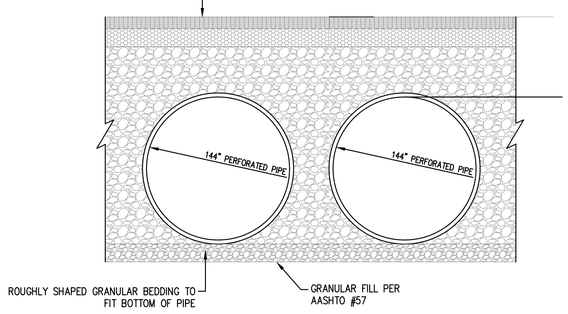
SITE AREA:	31± ACRES	
SOIL GROUP:	B	(PER USDA WEB SOIL SURVEY)
IMPERVIOUS:	80%	(PER CALCULATIONS)
ISOHYETALS:	0.433" 1.25"	(2-YEAR 1 HOUR) (100-YEAR 1 HOUR)
CN NUMBER:	78	(SOIL GROUP B)
FREQUENCY:	100 YEAR 2/10 YEAR	(FOR STORM DRAIN DESIGN) (FOR WATER QUALITY)
METHOD:	SAN BERNARDINO COUNTY HYDROLOGY MANUAL	

LEGEND:

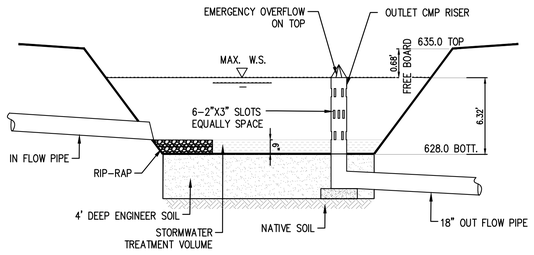
- DRAINAGE AREA/SITE BOUNDARY
- DRAINAGE SUB-AREA BOUNDARY
- STORM WATER FLOW PATH
- PROPOSED STORM DRAIN PIPE
- PROPOSED FLOW DIRECTION ARROW
- DRAINAGE AREA DESIGNATION (X / XXX) AREA(AC)
- NODE (US/DS) (X.X)
- STREAM # (3)
- PROPOSED UNDERGROUND INFILTRATION/DETENTION
- PROPOSED BUILDING
- PROPOSED LANDSCAPING

DRAINAGE NOTES:

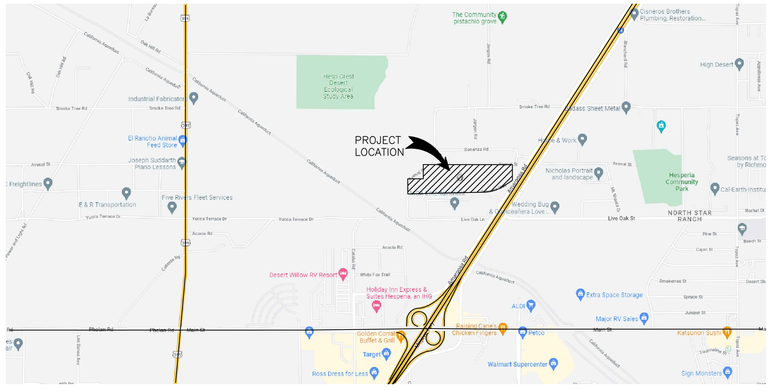
1. PROPOSED STORM DRAIN INLET
2. PROPOSED STORM DRAIN
3. PROPOSED INFILTRATION/DETENTION BASIN
4. PROPOSED UNDERGROUND INFILTRATION CMP



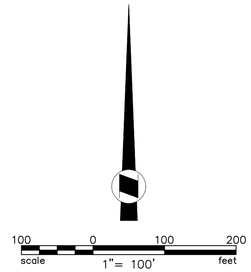
TYPICAL CMP UNDERGROUND INFILTRATION DETAIL
N.T.S



INFILTRATION/DETENTION BASIN-3 DETAIL
N.T.S



VICINITY MAP
N.T.S



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PHONE: (909) 989-9789 FAX: (909) 989-9660
JOB NO: 2019-185

HCCII INDUSTRIAL PARK HYDROLOGY EXHIBIT

CITY OF HESPERIA

DATE: DEC 2021
SHEET 1 OF 1

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005
Version 7.1

Rational Hydrology Study Date: 07/15/22

2021-196 Hesperia Spec Industrial
Rational Method
25-year

Program License Serial Number 6277

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.942 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        1.100 to Point/Station
1.200
      **** INITIAL AREA EVALUATION ****
      ____________________________________________________________________
____
      Soil classification AP and SCS  values input by user
      USER INPUT of soil data for subarea
      SCS curve number for soil(AMC 2)  = 56.00
      Pervious ratio(Ap) = 0.1900     Max loss rate(Fm)=
0.139(In/Hr)
      Initial subarea data:
      Initial area flow distance =   548.000(Ft.)
      Top (of initial area) elevation =    52.200(Ft.)
      Bottom (of initial area) elevation =    44.000(Ft.)
      Difference in elevation =     8.200(Ft.)
      Slope =    0.01496  s(%)=       1.50
      TC = k(0.321)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =    9.279 min.
      Rainfall intensity =      3.479(In/Hr) for a    25.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.864
      Subarea runoff =     18.908(CFS)
      Total initial stream area =        6.290(Ac.)
      Pervious area fraction = 0.190
      Initial area Fm value =    0.139(In/Hr)
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        1.200 to Point/Station
2.200
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
____
      Upstream point/station elevation =    44.000(Ft.)
      Downstream point/station elevation =    34.000(Ft.)
      Pipe length  =  1386.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    18.908(CFS)
      Nearest computed pipe diameter  =     24.00(In.)
      Calculated individual pipe flow  =    18.908(CFS)
      Normal flow depth in pipe =   19.31(In.)
      Flow top width inside pipe =   19.03(In.)
      Critical Depth =   18.77(In.)
      Pipe flow velocity =      6.97(Ft/s)
      Travel time through pipe =    3.31 min.
      Time of concentration (TC) =    12.59 min.
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        2.100 to Point/Station
2.200
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
____
      Soil classification AP and SCS  values input by user
      USER INPUT of soil data for subarea
      SCS curve number for soil(AMC 2)  = 56.00
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=
0.073(In/Hr)
      Time of concentration =    12.59 min.
      Rainfall intensity =      2.810(In/Hr) for a    25.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.871
      Subarea runoff =     43.201(CFS) for   19.080(Ac.)
      Total runoff =     62.109(CFS)
      Effective area this stream =       25.37(Ac.)
      Total Study Area (Main Stream No. 1) =       25.37(Ac.)
      Area averaged Fm value =    0.090(In/Hr)
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        2.200 to Point/Station
3.200
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
____
      Upstream point/station elevation =    34.100(Ft.)
      Downstream point/station elevation =    23.400(Ft.)
      Pipe length  =   675.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    62.109(CFS)
      Nearest computed pipe diameter  =     33.00(In.)
      Calculated individual pipe flow  =    62.109(CFS)
      Normal flow depth in pipe =   25.27(In.)
      Flow top width inside pipe =   27.96(In.)
      Critical Depth =   30.18(In.)
      Pipe flow velocity =     12.74(Ft/s)
      Travel time through pipe =    0.88 min.
      Time of concentration (TC) =    13.47 min.
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        3.100 to Point/Station
3.200
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
____
      Soil classification AP and SCS  values input by user
      USER INPUT of soil data for subarea
      SCS curve number for soil(AMC 2)  = 56.00
      Pervious ratio(Ap) = 0.5200     Max loss rate(Fm)=
0.382(In/Hr)
      Time of concentration =    13.47 min.
      Rainfall intensity =      2.680(In/Hr) for a    25.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.851
      Subarea runoff =      9.891(CFS) for    6.220(Ac.)
      Total runoff =     72.000(CFS)
      Effective area this stream =       31.59(Ac.)
      Total Study Area (Main Stream No. 1) =       31.59(Ac.)
      Area averaged Fm value =    0.147(In/Hr)
      End of computations, Total Study Area =           31.59 (Ac.)
      The following figures may
      be used for a unit hydrograph study of the same area.
      Note: These figures do not consider reduced effective area
      effects caused by confluences in the rational equation.

      Area averaged pervious area fraction(Ap) = 0.201
      Area averaged SCS curve number =  56.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005
Version 7.1

Rational Hydrology Study Date: 07/15/22

2021-196 Hesperia Spec Industrial
Rational Method
100-year

Program License Serial Number 6277

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        1.100 to Point/Station
1.200
      **** INITIAL AREA EVALUATION ****
      ____________________________________________________________________
____
      Soil classification AP and SCS  values input by user
      USER INPUT of soil data for subarea
      SCS curve number for soil(AMC 2)  = 56.00
      Adjusted SCS curve number for AMC 3 = 75.80
      Pervious ratio(Ap) = 0.1900     Max loss rate(Fm)=
0.084(In/Hr)
      Initial subarea data:
      Initial area flow distance =   548.000(Ft.)
      Top (of initial area) elevation =    52.200(Ft.)
      Bottom (of initial area) elevation =    44.000(Ft.)
      Difference in elevation =     8.200(Ft.)
      Slope =    0.01496  s(%)=       1.50
      TC = k(0.321)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =    9.279 min.
      Rainfall intensity =      4.617(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
      Subarea runoff =     25.664(CFS)
      Total initial stream area =        6.290(Ac.)
      Pervious area fraction = 0.190
      Initial area Fm value =    0.084(In/Hr)
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        1.200 to Point/Station
2.200
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
____
      Upstream point/station elevation =    44.000(Ft.)
      Downstream point/station elevation =    34.000(Ft.)
      Pipe length  =  1386.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    25.664(CFS)
      Nearest computed pipe diameter  =     27.00(In.)
      Calculated individual pipe flow  =    25.664(CFS)
      Normal flow depth in pipe =   21.56(In.)
      Flow top width inside pipe =   21.66(In.)
      Critical Depth =   21.24(In.)
      Pipe flow velocity =      7.54(Ft/s)
      Travel time through pipe =    3.06 min.
      Time of concentration (TC) =    12.34 min.
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        2.100 to Point/Station
2.200
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
____
      Soil classification AP and SCS  values input by user
      USER INPUT of soil data for subarea
      SCS curve number for soil(AMC 2)  = 56.00
      Adjusted SCS curve number for AMC 3 = 75.80
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=
0.044(In/Hr)
      Time of concentration =    12.34 min.
      Rainfall intensity =      3.781(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.887
      Subarea runoff =     59.445(CFS) for   19.080(Ac.)
      Total runoff =     85.109(CFS)
      Effective area this stream =       25.37(Ac.)
      Total Study Area (Main Stream No. 1) =       25.37(Ac.)
      Area averaged Fm value =    0.054(In/Hr)
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        2.200 to Point/Station
3.200
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
____
      Upstream point/station elevation =    34.100(Ft.)
      Downstream point/station elevation =    23.400(Ft.)
      Pipe length  =   675.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    85.109(CFS)
      Nearest computed pipe diameter  =     39.00(In.)
      Calculated individual pipe flow  =    85.109(CFS)
      Normal flow depth in pipe =   26.86(In.)
      Flow top width inside pipe =   36.12(In.)
      Critical Depth =   34.49(In.)
      Pipe flow velocity =     13.98(Ft/s)
      Travel time through pipe =    0.80 min.
      Time of concentration (TC) =    13.15 min.
```

```
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++
      Process from Point/Station        3.100 to Point/Station
3.200
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
____
      Soil classification AP and SCS  values input by user
      USER INPUT of soil data for subarea
      SCS curve number for soil(AMC 2)  = 56.00
      Adjusted SCS curve number for AMC 3 = 75.80
      Pervious ratio(Ap) = 0.5200     Max loss rate(Fm)=
0.229(In/Hr)
      Time of concentration =    13.15 min.
      Rainfall intensity =      3.618(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.878
      Subarea runoff =     15.238(CFS) for    6.220(Ac.)
      Total runoff =    100.347(CFS)
      Effective area this stream =       31.59(Ac.)
      Total Study Area (Main Stream No. 1) =       31.59(Ac.)
      Area averaged Fm value =    0.088(In/Hr)
      End of computations, Total Study Area =           31.59 (Ac.)
      The following figures may
      be used for a unit hydrograph study of the same area.
      Note: These figures do not consider reduced effective area
      effects caused by confluences in the rational equation.

      Area averaged pervious area fraction(Ap) = 0.201
      Area averaged SCS curve number =  56.0
```

U n i t H y d r o g r a p h A n a l y s i s

Study date 07/15/22

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6277

2021-196 Hesperia Spec Industrial
Unit Hydrograph
100-year

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
0.01	1	0.75
Rainfall data for year 2		
0.01	6	1.01
Rainfall data for year 2		
0.01	24	1.89

```
--
      Rainfall data for year 100
                0.01            1           1.25
      ------------------------------------------------------------------
--
      Rainfall data for year 100
                0.01            6           2.81
      ------------------------------------------------------------------
--
      Rainfall data for year 100
                0.01           24           5.90
      ------------------------------------------------------------------
--
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++

      ******** Area-averaged max loss rate, Fm ********


      SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap
Fm
      No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)
(In/Hr)
       56.0      75.8         31.59      1.000     0.440    0.200
0.088

      Area-averaged adjusted loss rate Fm (In/Hr) =  0.088

      ********* Area-Averaged low loss rate fraction, Yb **********

      Area       Area          SCS CN    SCS CN      S     Pervious
       (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
           6.32   0.200         56.0      75.8       3.19     0.555
          25.27   0.800         98.0      98.0       0.20     0.960

      Area-averaged catchment yield fraction, Y =  0.879
      Area-averaged low loss fraction, Yb =  0.121
      User entry of time of concentration  =   0.227 (hours)
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++
      Watershed area =      31.59(Ac.)
      Catchment Lag time =   0.182 hours
      Unit interval =   5.000 minutes
      Unit interval percentage of lag time = 45.8884
      Hydrograph baseflow =     0.00(CFS)
      Average maximum watershed loss rate(Fm) =  0.088(In/Hr)
      Average low loss rate fraction (Yb) = 0.121 (decimal)
      MOUNTAIN S-Graph Selected
      Computed peak 5-minute rainfall =  0.593(In)
      Computed peak 30-minute rainfall =  1.015(In)
      Specified peak 1-hour rainfall =  1.250(In)
      Computed peak 3-hour rainfall =  2.054(In)
      Specified peak 6-hour rainfall =  2.810(In)
      Specified peak 24-hour rainfall =  5.900(In)
```

```
      Rainfall depth area reduction factors:
      Using a total area of      31.59(Ac.) (Ref: fig. E-4)

      5-minute factor = 0.999     Adjusted rainfall =  0.592(In)
      30-minute factor = 0.999    Adjusted rainfall =  1.014(In)
      1-hour factor = 0.999       Adjusted rainfall =  1.248(In)
      3-hour factor = 1.000       Adjusted rainfall =  2.054(In)
      6-hour factor = 1.000       Adjusted rainfall =  2.810(In)
      24-hour factor = 1.000      Adjusted rainfall =  5.900(In)
      ----------------------------------------------------------------
---

                     U n i t  H y d r o g r a p h
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++
      Interval          'S' Graph          Unit Hydrograph
      Number            Mean values             ((CFS))
      ----------------------------------------------------------------
---
                (K =       382.04 (CFS))

        1                 6.828                  26.086
        2                34.241                 104.729
        3                53.812                  74.769
        4                63.412                  36.675
        5                69.929                  24.899
        6                74.936                  19.129
        7                78.803                  14.773
        8                81.823                  11.537
        9                84.264                   9.327
       10                86.308                   7.807
       11                88.171                   7.119
       12                89.787                   6.173
       13                91.208                   5.430
       14                92.506                   4.960
       15                93.668                   4.438
       16                94.719                   4.017
       17                95.623                   3.454
       18                96.455                   3.176
       19                97.281                   3.156
       20                98.107                   3.156
       21                98.933                   3.156
       22               100.000                   1.578
      ----------------------------------------------------------------
---
      ----------------------------------------------------------------
--
      ----------------------------------------------------------------
--
      Total soil rain loss =      0.64(In)
      Total effective rainfall =      5.26(In)
      Peak flow rate in flood hydrograph =     81.24(CFS)
      ----------------------------------------------------------------
---
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++
```

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	22.5	45.0	67.5	90.0
0+ 5	0.0017	0.25	Q				
0+10	0.0104	1.26	Q				
0+15	0.0241	1.98	Q				
0+20	0.0402	2.34	VQ				
0+25	0.0581	2.59	VQ				
0+30	0.0772	2.78	VQ				
0+35	0.0974	2.93	VQ				
0+40	0.1184	3.05	VQ				
0+45	0.1400	3.14	VQ				
0+50	0.1622	3.23	VQ				
0+55	0.1850	3.30	VQ				
1+ 0	0.2082	3.37	VQ				
1+ 5	0.2319	3.43	VQ				
1+10	0.2559	3.49	VQ				
1+15	0.2803	3.54	VQ				
1+20	0.3050	3.59	VQ				
1+25	0.3300	3.63	VQ				
1+30	0.3553	3.67	|Q				
1+35	0.3809	3.71	|Q				
1+40	0.4067	3.75	|Q				
1+45	0.4328	3.79	|Q				
1+50	0.4591	3.82	|Q				

1+55	0.4855	3.83	|Q	|	|	|
2+ 0	0.5119	3.84	|Q	|	|	|
2+ 5	0.5384	3.85	|Q	|	|	|
2+10	0.5650	3.86	|Q	|	|	|
2+15	0.5917	3.87	|Q	|	|	|
2+20	0.6184	3.88	|Q	|	|	|
2+25	0.6452	3.89	|Q	|	|	|
2+30	0.6721	3.90	|Q	|	|	|
2+35	0.6990	3.91	|QV	|	|	|
2+40	0.7260	3.92	|QV	|	|	|
2+45	0.7531	3.93	|QV	|	|	|
2+50	0.7803	3.95	|QV	|	|	|
2+55	0.8076	3.96	|QV	|	|	|
3+ 0	0.8349	3.97	|QV	|	|	|
3+ 5	0.8623	3.98	|QV	|	|	|
3+10	0.8898	3.99	|QV	|	|	|
3+15	0.9174	4.00	|QV	|	|	|
3+20	0.9450	4.02	|QV	|	|	|
3+25	0.9728	4.03	|QV	|	|	|
3+30	1.0006	4.04	|QV	|	|	|
3+35	1.0285	4.05	|QV	|	|	|
3+40	1.0565	4.06	|Q V	|	|	|
3+45	1.0845	4.08	|Q V	|	|	|
3+50	1.1127	4.09	|Q V	|	|	|
3+55	1.1410	4.10	|Q V	|	|	|
4+ 0	1.1693	4.11	|Q V	|	|	|
4+ 5	1.1977	4.13	|Q V	|	|	|
4+10	1.2262	4.14	|Q V	|	|	|

4+15	1.2548	4.15	|Q V	|	|	|
4+20	1.2835	4.17	|Q V	|	|	|
4+25	1.3123	4.18	|Q V	|	|	|
4+30	1.3412	4.19	|Q V	|	|	|
4+35	1.3702	4.21	|Q V	|	|	|
4+40	1.3993	4.22	|Q V	|	|	|
4+45	1.4284	4.24	|Q V	|	|	|
4+50	1.4577	4.25	|Q V	|	|	|
4+55	1.4871	4.26	|Q V	|	|	|
5+ 0	1.5165	4.28	|Q V	|	|	|
5+ 5	1.5461	4.29	|Q V	|	|	|
5+10	1.5758	4.31	|Q V	|	|	|
5+15	1.6055	4.32	|Q V	|	|	|
5+20	1.6354	4.34	|Q V	|	|	|
5+25	1.6654	4.35	|Q V	|	|	|
5+30	1.6955	4.37	|Q V	|	|	|
5+35	1.7257	4.38	|Q V	|	|	|
5+40	1.7560	4.40	|Q V	|	|	|
5+45	1.7864	4.42	|Q V	|	|	|
5+50	1.8169	4.43	|Q V	|	|	|
5+55	1.8475	4.45	|Q V	|	|	|
6+ 0	1.8783	4.47	|Q V	|	|	|
6+ 5	1.9092	4.48	|Q V	|	|	|
6+10	1.9401	4.50	|Q V	|	|	|
6+15	1.9712	4.52	| Q V	|	|	|
6+20	2.0025	4.53	| Q V	|	|	|
6+25	2.0338	4.55	| Q V	|	|	|
6+30	2.0653	4.57	| Q V	|	|	|

6+35	2.0969	4.59	Q	V		
6+40	2.1286	4.60	Q	V		
6+45	2.1604	4.62	Q	V		
6+50	2.1924	4.64	Q	V		
6+55	2.2245	4.66	Q	V		
7+ 0	2.2567	4.68	Q	V		
7+ 5	2.2891	4.70	Q	V		
7+10	2.3216	4.72	Q	V		
7+15	2.3542	4.74	Q	V		
7+20	2.3870	4.76	Q	V		
7+25	2.4199	4.78	Q	V		
7+30	2.4530	4.80	Q	V		
7+35	2.4862	4.82	Q	V		
7+40	2.5195	4.84	Q	V		
7+45	2.5530	4.86	Q	V		
7+50	2.5867	4.89	Q	V		
7+55	2.6205	4.91	Q	V		
8+ 0	2.6544	4.93	Q	V		
8+ 5	2.6886	4.95	Q	V		
8+10	2.7228	4.98	Q	V		
8+15	2.7573	5.00	Q	V		
8+20	2.7919	5.03	Q	V		
8+25	2.8267	5.05	Q	V		
8+30	2.8616	5.07	Q	V		
8+35	2.8967	5.10	Q	V		
8+40	2.9320	5.12	Q	V		
8+45	2.9675	5.15	Q	V		
8+50	3.0032	5.18	Q	V		

8+55	3.0390	5.20	Q	V		
9+ 0	3.0750	5.23	Q	V		
9+ 5	3.1112	5.26	Q	V		
9+10	3.1476	5.29	Q	V		
9+15	3.1842	5.31	Q	V		
9+20	3.2211	5.34	Q	V		
9+25	3.2581	5.37	Q	V		
9+30	3.2953	5.40	Q	V		
9+35	3.3327	5.43	Q	V		
9+40	3.3704	5.47	Q	V		
9+45	3.4082	5.50	Q	V		
9+50	3.4463	5.53	Q	V		
9+55	3.4846	5.56	Q	V		
10+ 0	3.5232	5.60	Q	V		
10+ 5	3.5619	5.63	Q	V		
10+10	3.6010	5.67	Q	V		
10+15	3.6402	5.70	Q	V		
10+20	3.6797	5.74	Q	V		
10+25	3.7195	5.77	Q	V		
10+30	3.7595	5.81	Q	V		
10+35	3.7998	5.85	Q	V		
10+40	3.8404	5.89	Q	V		
10+45	3.8813	5.93	Q	V		
10+50	3.9224	5.97	Q	V		
10+55	3.9638	6.01	Q	V		
11+ 0	4.0055	6.06	Q	V		
11+ 5	4.0476	6.10	Q	V		
11+10	4.0899	6.15	Q	V		

11+15	4.1326	6.19	Q	V		
11+20	4.1755	6.24	Q	V		
11+25	4.2188	6.29	Q	V		
11+30	4.2625	6.34	Q	V		
11+35	4.3065	6.39	Q	V		
11+40	4.3509	6.44	Q	V		
11+45	4.3956	6.49	Q	V		
11+50	4.4407	6.55	Q	V		
11+55	4.4862	6.61	Q	V		
12+ 0	4.5321	6.67	Q	V		
12+ 5	4.5779	6.65	Q	V		
12+10	4.6221	6.42	Q	V		
12+15	4.6653	6.27	Q	V		
12+20	4.7082	6.23	Q	V		
12+25	4.7510	6.22	Q	V		
12+30	4.7940	6.24	Q	V		
12+35	4.8372	6.27	Q	V		
12+40	4.8806	6.31	Q	V		
12+45	4.9244	6.36	Q	V		
12+50	4.9686	6.42	Q	V		
12+55	5.0133	6.48	Q	V		
13+ 0	5.0584	6.55	Q	V		
13+ 5	5.1040	6.62	Q	V		
13+10	5.1501	6.70	Q	V		
13+15	5.1969	6.78	Q	V		
13+20	5.2442	6.88	Q	V		
13+25	5.2922	6.97	Q	V		
13+30	5.3409	7.07	Q	V		

13+35	5.3903	7.18	Q	V		
13+40	5.4406	7.29	Q	V		
13+45	5.4916	7.41	Q	V		
13+50	5.5435	7.54	Q	V		
13+55	5.5963	7.67	Q	V		
14+ 0	5.6502	7.83	Q	V		
14+ 5	5.7052	7.98	Q	V		
14+10	5.7613	8.16	Q	V		
14+15	5.8187	8.33	Q	V		
14+20	5.8774	8.53	Q	V		
14+25	5.9375	8.72	Q	V		
14+30	5.9991	8.94	Q	V		
14+35	6.0623	9.17	Q	V		
14+40	6.1272	9.43	Q	V		
14+45	6.1939	9.69	Q	V		
14+50	6.2627	9.99	Q	V		
14+55	6.3336	10.30	Q	V		
15+ 0	6.4071	10.66	Q	V		
15+ 5	6.4831	11.04	Q	V		
15+10	6.5623	11.49	Q	V		
15+15	6.6447	11.97	Q	V		
15+20	6.7311	12.54	Q	V		
15+25	6.8192	12.79	Q	V		
15+30	6.9024	12.08	Q	V		
15+35	6.9840	11.84	Q	V		
15+40	7.0691	12.36	Q	V		
15+45	7.1603	13.25	Q	V		
15+50	7.2622	14.79	Q	V		

```
   15+55       7.3815      17.32 |      Q  |         |V        |
|
   16+ 0       7.5389      22.85 |         Q         |V        |
|
   16+ 5       7.8297      42.23 |         |       Q | V       |
|
   16+10       8.3892      81.24 |         |         |   V     |     Q
|
   16+15       8.8238      63.10 |         |         |    V  Q |
|
   16+20       9.1005      40.18 |         |      Q  |     V   |
|
   16+25       9.3166      31.37 |         |  Q      |      V  |
|
   16+30       9.5058      27.48 |         | Q       |      V  |
|
   16+35       9.6734      24.33 |         Q         |       V |
|
   16+40       9.8218      21.55 |        Q|         |       V |
|
   16+45       9.9556      19.43 |       Q |         |       V |
|
   16+50      10.0782      17.80 |      Q  |         |        V|
|
   16+55      10.1930      16.67 |      Q  |         |        V|
|
   17+ 0      10.2997      15.49 |     Q   |         |        V|
|
   17+ 5      10.3993      14.47 |     Q   |         |         V
|
   17+10      10.4934      13.65 |     Q   |         |         V
|
   17+15      10.5821      12.88 |    Q    |         |         V
|
   17+20      10.6661      12.20 |    Q    |         |         |V
|
   17+25      10.7452      11.49 |    Q    |         |         |V
|
   17+30      10.8208      10.97 |   Q     |         |         |V
|
   17+35      10.8937      10.59 |   Q     |         |         |V
|
   17+40      10.9639      10.19 |   Q     |         |         |V
|
   17+45      11.0306       9.69 |   Q     |         |         | V
|
   17+50      11.0887       8.43 |  Q      |         |         | V
|
   17+55      11.1388       7.28 |  Q      |         |         | V
|
   18+ 0      11.1869       7.00 |  Q      |         |         | V
|
   18+ 5      11.2342       6.85 |  Q      |         |         | V
|
   18+10      11.2820       6.95 |  Q      |         |         | V
|
```

18+15	11.3300	6.96	Q			V	
18+20	11.3774	6.89	Q			V	
18+25	11.4242	6.80	Q			V	
18+30	11.4704	6.70	Q			V	
18+35	11.5158	6.60	Q			V	
18+40	11.5606	6.50	Q			V	
18+45	11.6048	6.41	Q			V	
18+50	11.6483	6.32	Q			V	
18+55	11.6912	6.23	Q			V	
19+ 0	11.7335	6.15	Q			V	
19+ 5	11.7753	6.06	Q			V	
19+10	11.8165	5.99	Q			V	
19+15	11.8572	5.91	Q			V	
19+20	11.8974	5.84	Q			V	
19+25	11.9372	5.77	Q			V	
19+30	11.9764	5.70	Q			V	
19+35	12.0153	5.64	Q			V	
19+40	12.0537	5.58	Q			V	
19+45	12.0917	5.52	Q			V	
19+50	12.1293	5.46	Q			V	
19+55	12.1665	5.40	Q			V	
20+ 0	12.2032	5.34	Q			V	
20+ 5	12.2396	5.28	Q			V	
20+10	12.2756	5.22	Q			V	
20+15	12.3112	5.17	Q			V	
20+20	12.3464	5.12	Q			V	
20+25	12.3813	5.07	Q			V	
20+30	12.4158	5.02	Q			V	

20+35	12.4500	4.97	Q				V
20+40	12.4839	4.92	Q				V
20+45	12.5175	4.88	Q				V
20+50	12.5508	4.83	Q				V
20+55	12.5838	4.79	Q				V
21+ 0	12.6165	4.75	Q				V
21+ 5	12.6490	4.71	Q				V
21+10	12.6812	4.67	Q				V
21+15	12.7131	4.63	Q				V
21+20	12.7447	4.60	Q				V
21+25	12.7761	4.56	Q				V
21+30	12.8073	4.52	Q				V
21+35	12.8382	4.49	Q				V
21+40	12.8689	4.46	Q				V
21+45	12.8994	4.42	Q				V
21+50	12.9296	4.39	Q				V
21+55	12.9596	4.36	Q				V
22+ 0	12.9894	4.33	Q				V
22+ 5	13.0191	4.30	Q				V
22+10	13.0485	4.27	Q				V
22+15	13.0777	4.24	Q				V
22+20	13.1067	4.21	Q				V
22+25	13.1355	4.19	Q				V
22+30	13.1642	4.16	Q				V
22+35	13.1926	4.13	Q				V
22+40	13.2209	4.11	Q				V
22+45	13.2490	4.08	Q				V
22+50	13.2770	4.06	Q				V

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   22+55      13.3047      4.03  |Q        |         |         |        V
|
   23+ 0      13.3323      4.01  |Q        |         |         |        V
|
   23+ 5      13.3598      3.98  |Q        |         |         |        V
|
   23+10      13.3871      3.96  |Q        |         |         |        V
|
   23+15      13.4142      3.94  |Q        |         |         |        V
|
   23+20      13.4412      3.92  |Q        |         |         |
V|
   23+25      13.4680      3.89  |Q        |         |         |
V|
   23+30      13.4947      3.87  |Q        |         |         |
V|
   23+35      13.5212      3.85  |Q        |         |         |
V|
   23+40      13.5476      3.83  |Q        |         |         |
V|
   23+45      13.5738      3.81  |Q        |         |         |
V|
   23+50      13.5999      3.79  |Q        |         |         |
V|
   23+55      13.6259      3.77  |Q        |         |         |
V|
   24+ 0      13.6518      3.75  |Q        |         |         |
V|
   24+ 5      13.6757      3.48  |Q        |         |         |
V|
   24+10      13.6926      2.46  |Q        |         |         |
V|
   24+15      13.7045      1.72  Q         |         |         |
V|
   24+20      13.7139      1.36  Q         |         |         |
V|
   24+25      13.7216      1.12  Q         |         |         |
V|
   24+30      13.7280      0.93  Q         |         |         |
V|
   24+35      13.7333      0.78  Q         |         |         |
V|
   24+40      13.7379      0.66  Q         |         |         |
V|
   24+45      13.7418      0.57  Q         |         |         |
V|
   24+50      13.7452      0.49  Q         |         |         |
V|
   24+55      13.7481      0.42  Q         |         |         |
V|
   25+ 0      13.7506      0.36  Q         |         |         |
V|
   25+ 5      13.7527      0.31  Q         |         |         |
V|
   25+10      13.7545      0.26  Q         |         |         |
V|
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   25+15      13.7559      0.21  Q          |          |          |
V|
   25+20      13.7571      0.17  Q          |          |          |
V|
   25+25      13.7581      0.14  Q          |          |          |
V|
   25+30      13.7588      0.11  Q          |          |          |
V|
   25+35      13.7594      0.08  Q          |          |          |
V|
   25+40      13.7597      0.05  Q          |          |          |
V|
   25+45      13.7598      0.02  Q          |          |          |
V
------------------------------------------------------------------------
```

3.1 INFILTRATION BASIN

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evapotranspiration (when vegetated), Evaporation, and Sedimentation
Maximum Treatment Area	50 acres
Other Names	Bioinfiltration Basin

Description

An Infiltration Basin is a flat earthen basin designed to capture the design capture volume, V_{BMP}. The stormwater infiltrates through the bottom of the basin into the underlying soil over a 72 hour drawdown period. Flows exceeding V_{BMP} must discharge to a downstream conveyance system. Trash and sediment accumulate within the forebay as stormwater passes into the basin. Infiltration basins are highly effective in removing all targeted pollutants from stormwater runoff.

Figure 1 – Infiltration Basin

See Appendix A, and Appendix C, Section 1 of *Basin Guidelines*, for additional requirements.

Siting Considerations

The use of infiltration basins may be restricted by concerns over ground water contamination, soil permeability, and clogging at the site. See the applicable WQMP for any specific feasibility considerations for using infiltration BMPs. Where this BMP is being used, the soil beneath the basin must be thoroughly evaluated in a geotechnical report since the underlying soils are critical to the basin's long term performance. To protect the basin from erosion, the sides and bottom of the basin must be vegetated, preferably with native or low water use plant species.

In addition, these basins may not be appropriate for the following site conditions:

- Industrial sites or locations where spills of toxic materials may occur
- Sites with very low soil infiltration rates
- Sites with high groundwater tables or excessively high soil infiltration rates, where pollutants can affect ground water quality
- Sites with unstabilized soil or construction activity upstream
- On steeply sloping terrain
- Infiltration basins located in a fill condition should refer to Appendix A of this Handbook for details on special requirements/restrictions

Setbacks

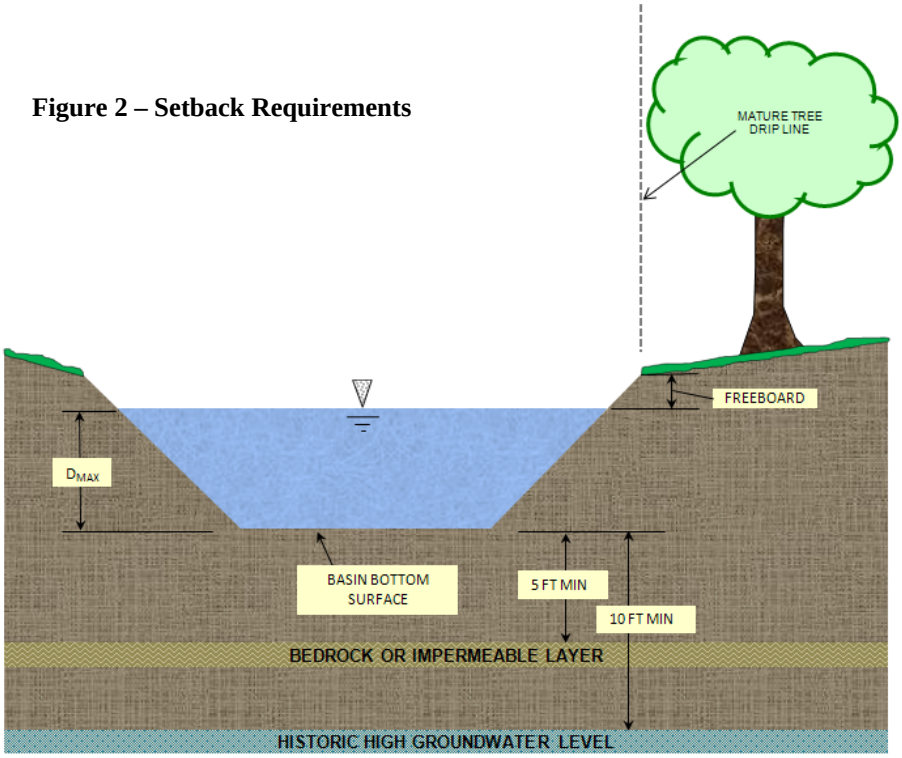
Always consult your geotechnical engineer for site specific recommendations regarding setbacks for infiltration trenches. Recommended setbacks are needed to protect buildings, existing trees, walls, onsite or nearby wells, streams, and tanks. Setbacks should be considered early in the design process since they can affect where infiltration facilities may be placed and how deep they are allowed to be. For instance, depth setbacks can dictate fairly shallow facilities that will have a larger footprint and, in some cases, may make an infiltration basin infeasible. In that instance, another BMP must be selected.

Infiltration basins typically must be set back:

- 10 feet from the historic high groundwater (measured vertically from the bottom of the basin, as shown in Figure 2)
- 5 feet from bedrock or impermeable surface layer (measured vertically from the bottom of the basin, as shown in Figure 2)
- From all existing mature tree drip lines as indicated in Figure 2 (to protect their root structure)
- 100 feet horizontally from wells, tanks or springs

Setbacks to walls and foundations must be included as part of the Geotechnical Report. All other setbacks shall be in accordance with applicable standards of the District's *Basin Guidelines* (Appendix C).

Figure 2 – Setback Requirements



Forebay

A concrete forebay shall be provided to reduce sediment clogging and to reduce erosion. The forebay shall have a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall / berm. Full height notch-type weir(s), offset from the line of flow from the basin inlet to prevent short circuiting, shall be used to outlet the forebay. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

Overflow

Flows exceeding V_{BMP} must discharge to an acceptable downstream conveyance system. Where an adequate outlet is present, an overflow structure may be used. Where an embankment is present, an emergency spillway may be used instead. Overflows must be placed just above the design water surface for V_{BMP} and be near the outlet of the system. The overflow structure shall be similar to the District's Standard Drawing CB 110. Additional details may be found in the District's *Basin Guidelines* (Appendix C).

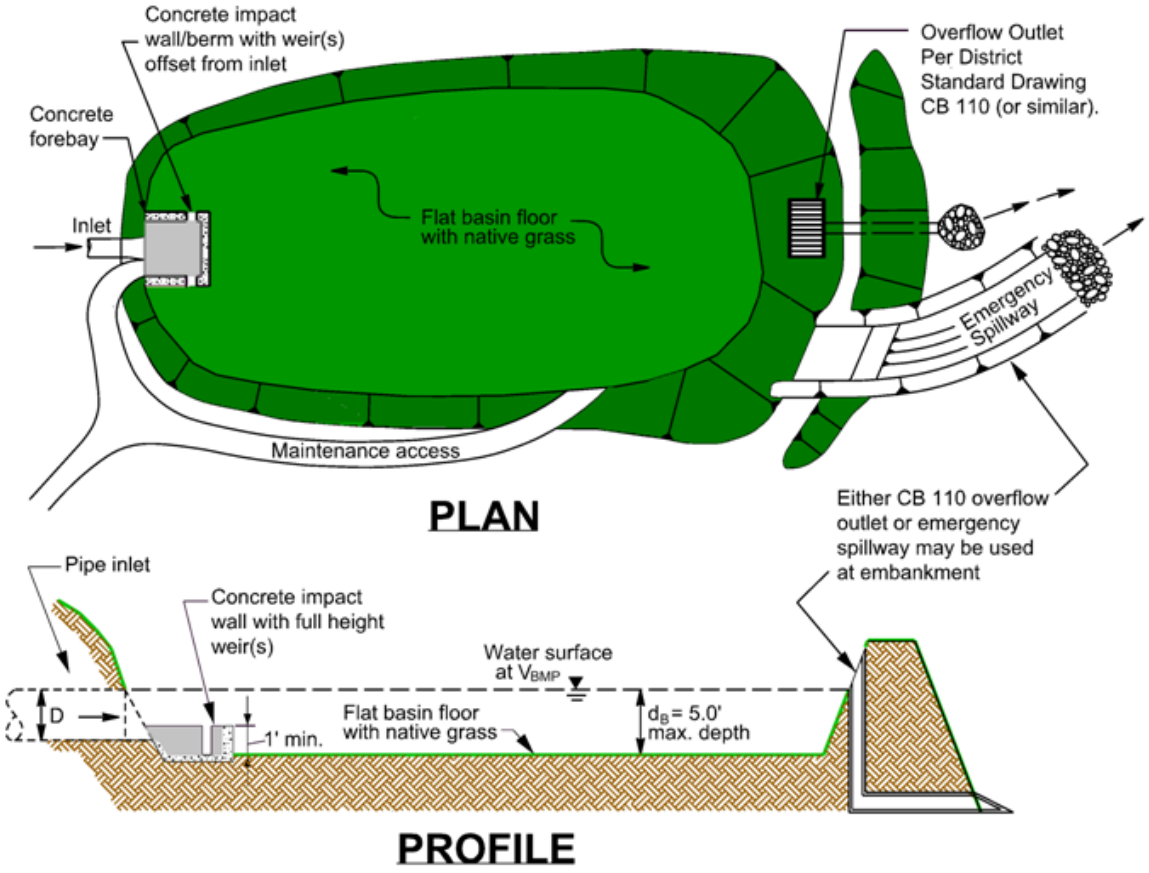


Figure 3 – Infiltration Basin

Landscaping Requirements

Basin vegetation provides erosion protection, improves sediment removal and assists in allowing infiltration to occur. The basin surface and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with County of Riverside Ordinance 859 and the District's *Basin Guidelines* (Appendix C), or other guidelines issued by the Engineering Authority.

Maintenance

Normal maintenance of an infiltration basin includes the maintenance of landscaping, debris and trash removal from the surface of the basin, and tending to problems associated with standing water (vectors, odors, etc.). Significant ponding, especially more than 72 hours after an event, may indicate that the basin surface is no longer providing sufficient infiltration and requires aeration. See the District's *Basin Guidelines* (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.).

Table 1 - Inspection and Maintenance

Schedule	Inspection and Maintenance Activity
Ongoing including just before annual storm seasons and following rainfall events.	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strenuously avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used, o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rain season. • Remove debris and litter from the entire basin to minimize clogging and improve aesthetics. • Check for obvious problems and repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. There should be no long-term ponding water. • Check for erosion and sediment laden areas in the basin. Repair as needed. Clean forebay if needed. • Revegetate side slopes where needed.
Annually. If possible, schedule these inspections within 72 hours after a significant rainfall.	• Inspection of hydraulic and structural facilities. Examine the inlet for blockage, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Check basin depth for sediment build up and reduced total capacity. Scrape bottom as needed and remove sediment. Restore to original cross-section and infiltration rate. Replant basin vegetation. • Verify the basin bottom is allowing acceptable infiltration. Use a disc or other method to aerate basin bottom only if there is actual significant loss of infiltrative capacity, rather than on a routine basis[1]. • No water should be present 72 hours after an event. No long term standing water should be present at all. No algae formation should be visible. Correct problem as needed.

1. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**

Table 2 - Design and Sizing Criteria for Infiltration Basins

Design Parameter	Infiltration Basin
Design Volume	V_{BMP}
Forebay Volume	0.5% V_{BMP}
Drawdown time (maximum)	72 hours
Maximum tributary area	50 acres [2]
Minimum infiltration rate	Must be sufficient to drain the basin within the required Drawdown time over the life of the BMP. The WQMP may include specific requirements for minimum tested infiltration rates.
Maximum Depth	5 feet
Spillway erosion control	Energy dissipators to reduce velocities[1]
Basin Slope	0%
Freeboard (minimum)	1 foot [1]
Historic High Groundwater Setback (max)	10 feet
Bedrock/impermeable layer setback (max)	5 feet
Tree setbacks	Mature tree drip line must not overhang the basin
Set back from wells, tanks or springs	100 feet
Set back from foundations	As recommended in Geotechnical Report

1. **Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures**
2. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the District's Basin Guidelines (Appendix C). In addition, information herein may be superseded by other guidelines issued by the co-permittee.

INFILTRATION BASIN SIZING PROCEDURE

1. Find the Design Volume, V_{BMP}.
   a) Enter the Tributary Area, $A_{T.}$
   b) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.
2. Determine the Maximum Depth.
   a) Enter the infiltration rate. The infiltration rate shall be established as described in Appendix A: "Infiltration Testing".
   b) Enter the design Factor of Safety from Table 1 in Appendix A: "Infiltration Testing".
   c) The spreadsheet will determine D_1, the maximum allowable depth of the basin based on the infiltration rate along with the maximum drawdown time (72 hours) and the Factor of Safety.

$$D_1 = [(t) \times (I)] / 12s$$

Where I = site infiltration rate (in/hr)
s = safety factor
t = drawdown time (maximum 72 hours)

d) Enter the depth of freeboard.

e) Enter the depth to the historic high groundwater level measured from the top of the basin.

f) Enter the depth to the top of bedrock or other impermeable layer measured from the finished grade.

g) The spreadsheet will determine D_2, the total basin depth (including freeboard, if used) of the basin, based on restrictions to the depth by groundwater and an impermeable layer.

D_2 = Depth to groundwater – (10 + freeboard) (ft);

or

D_2 = Depth to impermeable layer – (5 + freeboard) (ft)

Whichever is least.

h) The spreadsheet will determine the maximum allowable effective depth of basin, D_{MAX}, based on the smallest value between D_1 and D_2. D_{MAX} is the maximum depth of water only and does not include freeboard. D_{MAX} shall not exceed 5 feet.

3. Basin Geometry

a) Enter the basin side slopes, z (no steeper than 4:1).

b) Enter the proposed basin depth, d_B excluding freeboard.

c) The spreadsheet will determine the minimum required surface area of the basin:

$$A_s = V_{BMP} / d_B$$

Where A_s = minimum area required (ft^2)
V_{BMP} = volume of the infiltration basin (ft^3)
d_B= proposed depth not to exceed maximum allowable depth, D_{MAX} (ft)

d) Enter the proposed bottom surface area. This area shall not be less than the minimum required surface area.

4. Forebay

A concrete forebay with a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall shall be provided. Full-height rectangular weir(s) shall be used to outlet the forebay. The weir(s) must be offset from the line of flow from the basin inlet. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

a) The spreadsheet will determine the minimum required forebay volume based on 0.5% V_{BMP}.

b) Enter the proposed depth of the forebay berm/splashwall (1foot minimum).

c) The spreadsheet will determine the minimum required forebay surface area.

d) Enter the width of rectangular weir to be used (minimum 1.5 inches). Weir width should be established based on a 5 minute drawdown time.

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4371°, Longitude: -117.3766°
Elevation: 3440.77 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	**0.083** (0.068-0.101)	**0.118** (0.098-0.145)	**0.166** (0.136-0.203)	**0.204** (0.167-0.252)	**0.257** (0.203-0.329)	**0.299** (0.231-0.390)	**0.341** (0.257-0.456)	**0.385** (0.283-0.529)	**0.445** (0.314-0.638)	**0.493** (0.335-0.731)
10-min	**0.118** (0.098-0.145)	**0.170** (0.140-0.207)	**0.237** (0.196-0.291)	**0.293** (0.239-0.362)	**0.369** (0.292-0.471)	**0.428** (0.331-0.558)	**0.488** (0.369-0.653)	**0.552** (0.405-0.759)	**0.638** (0.449-0.915)	**0.706** (0.481-1.05)
15-min	**0.143** (0.119-0.175)	**0.205** (0.170-0.251)	**0.287** (0.236-0.352)	**0.354** (0.289-0.437)	**0.446** (0.353-0.570)	**0.517** (0.400-0.675)	**0.591** (0.446-0.790)	**0.667** (0.490-0.917)	**0.772** (0.544-1.11)	**0.854** (0.581-1.27)
30-min	**0.217** (0.180-0.265)	**0.311** (0.257-0.380)	**0.435** (0.359-0.533)	**0.537** (0.439-0.664)	**0.677** (0.535-0.865)	**0.785** (0.608-1.02)	**0.896** (0.677-1.20)	**1.01** (0.743-1.39)	**1.17** (0.824-1.68)	**1.30** (0.881-1.92)
60-min	**0.302** (0.250-0.369)	**0.433** (0.358-0.530)	**0.606** (0.499-0.743)	**0.747** (0.611-0.924)	**0.942** (0.744-1.20)	**1.09** (0.846-1.43)	**1.25** (0.942-1.67)	**1.41** (1.03-1.94)	**1.63** (1.15-2.34)	**1.80** (1.23-2.68)
2-hr	**0.434** (0.359-0.530)	**0.590** (0.488-0.722)	**0.802** (0.661-0.983)	**0.979** (0.800-1.21)	**1.23** (0.971-1.57)	**1.43** (1.11-1.86)	**1.64** (1.24-2.19)	**1.86** (1.36-2.55)	**2.17** (1.53-3.11)	**2.42** (1.64-3.58)
3-hr	**0.548** (0.453-0.669)	**0.733** (0.605-0.895)	**0.985** (0.812-1.21)	**1.20** (0.981-1.48)	**1.51** (1.19-1.92)	**1.75** (1.36-2.29)	**2.01** (1.52-2.69)	**2.29** (1.68-3.15)	**2.69** (1.89-3.85)	**3.01** (2.05-4.47)
6-hr	**0.766** (0.634-0.935)	**1.01** (0.838-1.24)	**1.36** (1.12-1.67)	**1.66** (1.35-2.05)	**2.09** (1.65-2.66)	**2.44** (1.89-3.18)	**2.81** (2.12-3.76)	**3.22** (2.37-4.43)	**3.81** (2.69-5.46)	**4.30** (2.93-6.38)
12-hr	**0.980** (0.811-1.20)	**1.34** (1.11-1.64)	**1.84** (1.51-2.25)	**2.27** (1.85-2.80)	**2.88** (2.28-3.69)	**3.39** (2.63-4.43)	**3.93** (2.97-5.26)	**4.53** (3.32-6.23)	**5.38** (3.79-7.72)	**6.09** (4.15-9.04)
24-hr	**1.34** (1.19-1.54)	**1.89** (1.68-2.18)	**2.66** (2.35-3.08)	**3.33** (2.91-3.88)	**4.28** (3.63-5.16)	**5.06** (4.20-6.22)	**5.90** (4.78-7.43)	**6.80** (5.36-8.81)	**8.11** (6.13-11.0)	**9.20** (6.72-12.8)
2-day	**1.50** (1.33-1.72)	**2.11** (1.87-2.44)	**2.98** (2.63-3.44)	**3.72** (3.26-4.34)	**4.81** (4.08-5.80)	**5.71** (4.74-7.03)	**6.69** (5.42-8.42)	**7.75** (6.10-10.0)	**9.30** (7.03-12.6)	**10.6** (7.74-14.8)
3-day	**1.60** (1.42-1.84)	**2.25** (1.99-2.60)	**3.17** (2.80-3.66)	**3.96** (3.47-4.62)	**5.13** (4.35-6.18)	**6.10** (5.06-7.50)	**7.15** (5.79-9.01)	**8.31** (6.54-10.8)	**10.00** (7.56-13.5)	**11.4** (8.34-15.9)
4-day	**1.73** (1.53-1.99)	**2.42** (2.15-2.79)	**3.40** (3.00-3.93)	**4.26** (3.73-4.96)	**5.51** (4.67-6.63)	**6.55** (5.43-8.05)	**7.67** (6.22-9.67)	**8.91** (7.02-11.5)	**10.7** (8.11-14.5)	**12.3** (8.96-17.1)
7-day	**1.92** (1.70-2.21)	**2.66** (2.36-3.07)	**3.71** (3.28-4.29)	**4.62** (4.05-5.38)	**5.95** (5.04-7.16)	**7.05** (5.85-8.66)	**8.24** (6.67-10.4)	**9.54** (7.52-12.4)	**11.4** (8.65-15.4)	**13.0** (9.53-18.2)
10-day	**2.05** (1.82-2.36)	**2.84** (2.52-3.27)	**3.94** (3.48-4.55)	**4.89** (4.28-5.70)	**6.27** (5.31-7.55)	**7.41** (6.15-9.11)	**8.64** (7.00-10.9)	**9.99** (7.87-12.9)	**12.0** (9.04-16.1)	**13.6** (9.93-19.0)
20-day	**2.49** (2.21-2.87)	**3.42** (3.03-3.94)	**4.71** (4.16-5.44)	**5.82** (5.10-6.78)	**7.43** (6.30-8.95)	**8.76** (7.27-10.8)	**10.2** (8.25-12.8)	**11.7** (9.25-15.2)	**14.0** (10.6-18.9)	**15.9** (11.6-22.2)
30-day	**2.94** (2.60-3.38)	**4.00** (3.54-4.61)	**5.48** (4.84-6.33)	**6.75** (5.91-7.87)	**8.59** (7.28-10.3)	**10.1** (8.39-12.4)	**11.7** (9.50-14.8)	**13.5** (10.6-17.5)	**16.1** (12.2-21.7)	**18.3** (13.4-25.5)
45-day	**3.48** (3.08-4.00)	**4.68** (4.14-5.39)	**6.34** (5.60-7.33)	**7.78** (6.81-9.06)	**9.85** (8.35-11.9)	**11.5** (9.59-14.2)	**13.4** (10.8-16.9)	**15.4** (12.1-20.0)	**18.3** (13.9-24.8)	**20.8** (15.2-29.1)
60-day	**3.95** (3.50-4.55)	**5.24** (4.64-6.03)	**7.01** (6.19-8.11)	**8.55** (7.48-9.96)	**10.8** (9.12-13.0)	**12.6** (10.4-15.5)	**14.6** (11.8-18.3)	**16.7** (13.2-21.7)	**19.9** (15.1-26.9)	**22.6** (16.5-31.6)

[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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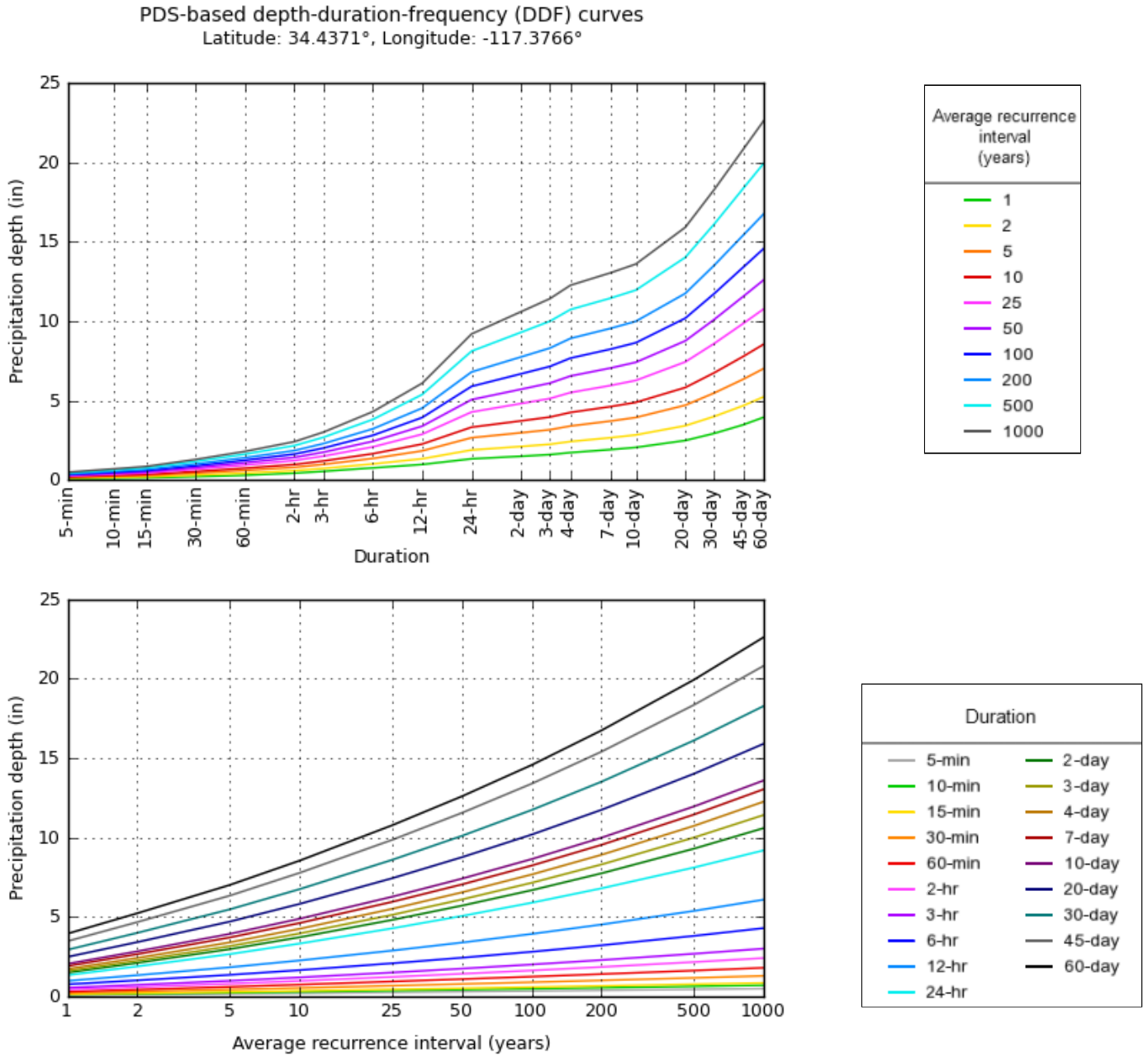
PF graphical



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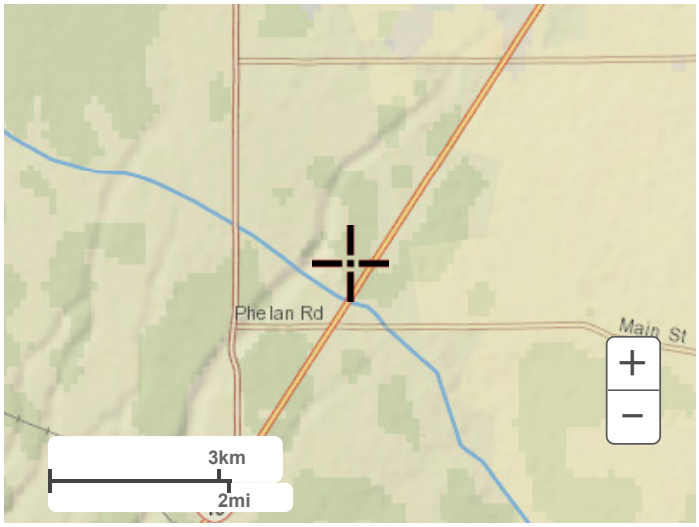
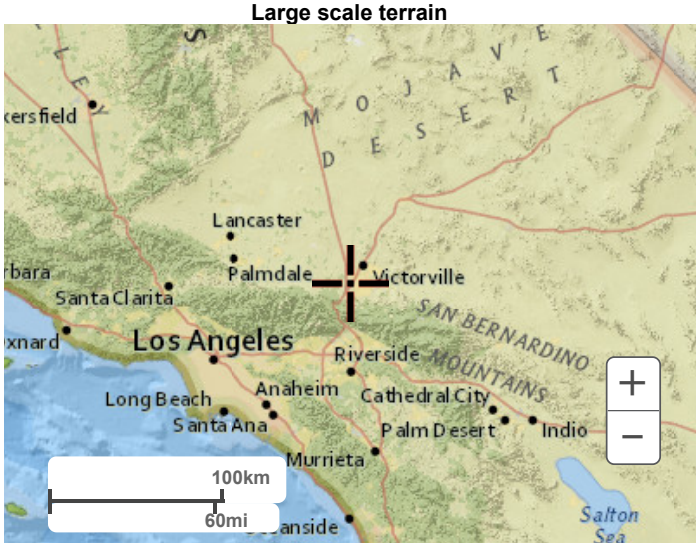
Maps & aerials

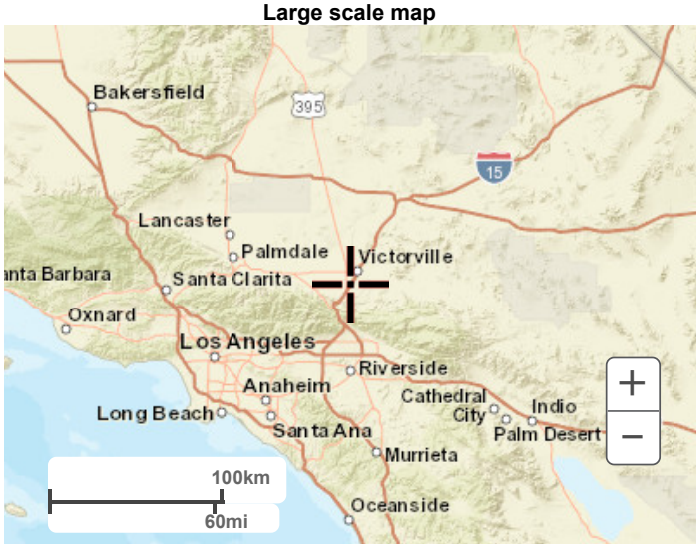
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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