Appendix E

Water Quality Management Plan for APN 0407-251-12

Sake Engineers Inc

February 28, 2024

Water Quality Management Plan

For:

APN 0407-251-12-0000

APN 0407-251-12-0000

Prepared for:

Mazi Hossein Trust

8440 Svl Box

Victorville, Ca 92395

(760) 954-1551 Ph.

Prepared by:

Sake Engineers Inc.

400 S. Ramona Ave. Ste. 202

Corona, Ca 92879

(951) 279-4041 Ph.

Submittal Date: 2-28-2024

Revision Date: Insert Current Revision Date

Approval Date:_____

Project Owner's Certification

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

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

Project Data

Permit/Application Number(s):	Grading Permit Number(s):
Tract/Parcel Map Number(s):	Building Permit Number(s):

CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract): APN 0407-251-12-0000

Owner's Signature

Owner Name: Hossein Mazi

Title	Owner
Company	Mazi Hossein Trust
Address	8440 Svl Box Victorville, Ca 92395
Email	hossein_mazi@yahoo.com
Telephone #	760-954-1551
Signature	Date 2-28-2024

Preparer's Certification

Project Data

Permit/Application Number(s):	Grading Permit Number(s):
Tract/Parcel Map Number(s):	Building Permit Number(s):
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):	APN 0407-251-12-0000

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

PE Stamp Below

Engineer: Sam Akbarpour

Title	Civil Engineer
Company	Sake Engineers Inc.
Address	400 S. Ramona Ave. Ste. 202 Corona, Ca 92879
Email	Sam@Sakeengineers.com
Telephone #	(951) 279-4041 Ph.
Signature	
Date	2-28-2024

Table of Contents

Forms

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	APN 0407-251-12-0000				
Project Owner Contact Name:	Hossein Mazi				
Mailing Address:	8440 Svl Box Victorville, Ca 92395	E-mail Address:	hossein_mazi@yahoo.com	Telephone:	760-954-1551
Permit/Application Number(s):		Tract/Parcel Map Number(s):			
Additional Information/ Comments:	N/A				
Description of Project:	Construction of 9 two story townhomes located at the ____ Smoke Tree Street in the City of Hesperia, San Bernardino County, California. Vicinity map attached. The Zone= HDR, Land-use= High Density Residential. The existing site is vacant. Existing drainage flows northeast. Homeowner's association will be formed in the future. The site has one DA which consist is a total of 174,242 SF and 33,060 SF of pervious area and 141,182 SF of impervious area. The proposed DA will drain to Storm tech system (MC-3500), see site plan for location and size.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	N/A				

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	Parking lots of 5,000 ft^2 or more exposed to storm water	Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day

Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2): 174,242 **3** Number of Dwelling Units: 9 **4** SIC Code: 6513

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.*

6 Does Project include roads? Yes No *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

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:
HOA will be responsible for maintenance of storm tech system, see site plan for locations. No infrastructure will transfer to public agencies after project completion.

2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Caused by the transport of animal or human fecal wastes from the watershed.
Nutrients - Phosphorous	E ☒	N ☐	Caused by fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Caused by fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Caused by fertilizers and eroded soils.
Sediment	E ☒	N ☐	Caused by eroded land surface.
Metals	E ☐	N ☒	N/A
Oil and Grease	E ☒	N ☐	Caused by petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Caused by trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste products on the landscape.
Pesticides / Herbicides	E ☒	N ☐	Caused by organic compounds used to destroy and/or prevent insects, rodents, fungi, weeds, and other undesirable pests.
Organic Compounds	E ☒	N ☐	Caused by rinsing off objects, toxic levels of solvents and cleaning compounds can be discharged to storm drains. Dirt, grease, and grime retained in the cleaning fluid or rinse water may also adsorb levels of organic compounds that are harmful or hazardous to aquatic life.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: *Select all that apply*

☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]

2 Total Credit % 0 *(Total all credit percentages up to a maximum allowable credit of 50 percent)*

Description of Water Quality Credit Eligibility (if applicable)	N/A

Section 3 Site and Watershed Description

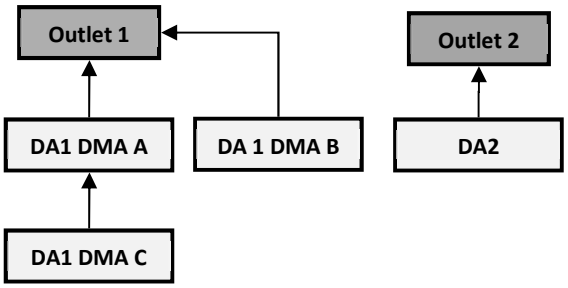
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.428330	Longitude -117.323256	Thomas Bros Map page Page 346, Grid B6

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

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*



Example only – modify for project specific WQMP using additional form

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA A to Outlet 1	
DA1 DMA B to Outlet 1	
DA2 to Outlet 2	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	174,242			
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*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	560			
6 Longest flowpath slope (ft/ft)	0.02			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Open Brush			
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 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
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*				

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See 'Drainage Facilities" link at this website*	Regional Board: 6V / Lahontan/Mojave River (below Lower Narrows)
Applicable TMDLs *Refer to Local Implementation Plan*	303(d) list (Tetrachloroethylene/PCE, Trichloroethylene/TCE, Ammonia, Chloride, Sulfates in the Mojave River) based on 2018 updated Integrated Report.
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Toxic Organics; SALINITY/TOTAL DISSOLVED SOLIDS/CHLORIDES/SULFATES; nutrients
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Desert Tortoise Habitat Cat 3
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	N/A
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Property owner shall review and become familiar with site specific WQMP. Additional education materials for day to day operations are contained in Section 6.4
N2	Activity Restrictions	☒	☐	No vehicle washing, no car maintenance & no equipment washing will be allowed . All pesticide applications when absolute necessary shall be performed by a licensed contractor certified by the California Department regulating pesticides.
N3	Landscape Management BMPs	☒	☐	A licensed landscape contractor shall maintain landscape and Infiltration Basin to remove trash/ debris, maintain irrigation system and follow fertilizer and pesticides application guideline by the county.
N4	BMP Maintenance	☒	☐	BMP Maintenance shall be performed in accordance with Section 5 of this report, the Operations & Maintenance Plan in the section 6.4. of this report, or the currently accepted Maintenance Procedures at the time of maintenance.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No CC&R
N6	Local Water Quality Ordinances	☒	☐	"Project to comply with City of Hesperia Water Quality Ordinance"
N7	Spill Contingency Plan	☐	☒	No spill contingency plan
N8	Underground Storage Tank Compliance	☐	☒	No Underground Storage Tank
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous material disclosure compliance

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	☐	☒	No uniform fire code implementation
N11	Litter/Debris Control Program	☒	☐	It shall be the Owner's responsibility to provide proper litter control per CASQA BMP SC-60. Litter controls shall be provided during regularly scheduled landscape maintenance, or as needed to prevent transportation of trash & debris from the site.
N12	Employee Training	☐	☒	N/A
N13	Housekeeping of Loading Docks	☐	☒	No loading docks
N14	Catch Basin Inspection Program	☒	☐	Check catch basins for trash and debris after storm event.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	All landscape maintenance contractors will be required to sweep up all landscape cuttings, mowing and fertilizer materials off paved areas weekly and dispose of properly.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	N/A
N17	Comply with all other applicable NPDES permits	☒	☐	Construction General Permit during construction.

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)	☒	☐	Signs stating “drains to the ocean” will be placed above storm drain inlets to warn the public of prohibitions against waste disposal. Owners will be responsible of maintenance.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	N/A
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	See education material at the end of report.
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)	☒	☐	Owner shall be required to adhere to the California Statewide "Model Water Efficient Landscape Ordinance". This will include the implementation of smart irrigation controllers to maximize water conservation. See brochure in Section 6.4: Educational Material
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	See education material at the end of report.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	N/A
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	no dock areas
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Vehicle Wash Areas Proposed
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No Covered outdoor processing areas proposed

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Equipment Wash areas are proposed
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No Fueling areas are proposed
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping
S14	Wash water control for food preparation areas	☐	☒	No Commercial Food Preparation Areas are Proposed
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No Community Car Wash Racks are Proposed

4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist

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: Proposed sidewalk and driveway areas have been designed to minimize widths.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Avoid locating constructed elements on highly permeable areas
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Site will be design to maintain the historic drainage path of travel
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Roof downspouts will outlet to vegetated swale.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The whole site will be developed.
Re-vegetate disturbed areas: Yes ☐ No ☒ Explanation: The whole site will be developed.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The proposed underground storage/infiltration system is to be excavated only. No compaction is permitted within its limits. The limit of the infiltration facility is to be marked off during construction.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐ Explanation: All proposed flow will be via underground pipe, see WQMP site plan in section 6.1 for locations.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscaped areas will be staked to minimize unnecessary compaction during

4.2 Project Performance Criteria

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

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 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 HCOC performance criteria.

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)

1 Project area DA 1 (ft^2): 174,242	**2** Imperviousness after applying preventative site design practices (Imp %): 0.81	**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): 0.422 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.52 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; 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): 9,041.18 *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*		

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.428°, Longitude: -117.323°
Elevation: 3265 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.087** (0.072-0.106)	**0.121** (0.100-0.148)	**0.168** (0.138-0.205)	**0.206** (0.168-0.255)	**0.260** (0.205-0.332)	**0.302** (0.234-0.394)	**0.346** (0.261-0.462)	**0.392** (0.288-0.539)	**0.455** (0.321-0.653)	**0.506** (0.344-0.751)
10-min	**0.124** (0.103-0.152)	**0.174** (0.143-0.212)	**0.240** (0.198-0.294)	**0.295** (0.241-0.365)	**0.372** (0.294-0.476)	**0.433** (0.335-0.565)	**0.495** (0.374-0.663)	**0.561** (0.412-0.772)	**0.653** (0.460-0.936)	**0.725** (0.493-1.08)
15-min	**0.150** (0.124-0.183)	**0.210** (0.174-0.257)	**0.290** (0.239-0.356)	**0.357** (0.292-0.441)	**0.450** (0.356-0.575)	**0.523** (0.405-0.683)	**0.599** (0.453-0.801)	**0.679** (0.498-0.934)	**0.789** (0.556-1.13)	**0.877** (0.597-1.30)
30-min	**0.221** (0.183-0.270)	**0.309** (0.256-0.378)	**0.428** (0.353-0.524)	**0.526** (0.430-0.650)	**0.663** (0.524-0.847)	**0.771** (0.596-1.01)	**0.883** (0.667-1.18)	**1.00** (0.734-1.38)	**1.16** (0.819-1.67)	**1.29** (0.879-1.92)
60-min	**0.301** (0.249-0.368)	**0.422** (0.348-0.516)	**0.583** (0.480-0.715)	**0.717** (0.586-0.886)	**0.903** (0.714-1.16)	**1.05** (0.813-1.37)	**1.20** (0.909-1.61)	**1.36** (1.00-1.87)	**1.58** (1.12-2.27)	**1.76** (1.20-2.61)
2-hr	**0.433** (0.358-0.528)	**0.581** (0.480-0.710)	**0.782** (0.644-0.958)	**0.951** (0.777-1.18)	**1.19** (0.940-1.52)	**1.38** (1.07-1.80)	**1.58** (1.19-2.11)	**1.79** (1.32-2.46)	**2.08** (1.47-2.99)	**2.32** (1.58-3.44)
3-hr	**0.540** (0.446-0.659)	**0.715** (0.590-0.874)	**0.953** (0.786-1.17)	**1.16** (0.945-1.43)	**1.44** (1.14-1.84)	**1.67** (1.30-2.18)	**1.92** (1.45-2.56)	**2.17** (1.60-2.99)	**2.54** (1.79-3.64)	**2.83** (1.92-4.20)
6-hr	**0.753** (0.623-0.919)	**0.989** (0.817-1.21)	**1.31** (1.08-1.61)	**1.59** (1.30-1.96)	**1.98** (1.57-2.53)	**2.30** (1.78-3.00)	**2.64** (1.99-3.53)	**3.00** (2.20-4.12)	**3.51** (2.47-5.03)	**3.93** (2.67-5.83)
12-hr	**0.972** (0.804-1.19)	**1.31** (1.08-1.60)	**1.77** (1.46-2.17)	**2.16** (1.76-2.67)	**2.71** (2.14-3.46)	**3.16** (2.44-4.12)	**3.63** (2.74-4.85)	**4.13** (3.03-5.68)	**4.85** (3.42-6.95)	**5.43** (3.70-8.06)
24-hr	**1.31** (1.16-1.51)	**1.82** (1.61-2.09)	**2.51** (2.21-2.90)	**3.09** (2.71-3.60)	**3.92** (3.32-4.72)	**4.58** (3.80-5.63)	**5.28** (4.28-6.65)	**6.03** (4.75-7.81)	**7.09** (5.36-9.57)	**7.95** (5.81-11.1)
2-day	**1.50** (1.32-1.72)	**2.08** (1.85-2.40)	**2.90** (2.56-3.35)	**3.59** (3.14-4.18)	**4.58** (3.88-5.52)	**5.38** (4.47-6.62)	**6.23** (5.05-7.85)	**7.15** (5.64-9.26)	**8.47** (6.40-11.4)	**9.55** (6.98-13.3)
3-day	**1.60** (1.42-1.85)	**2.24** (1.99-2.58)	**3.13** (2.76-3.62)	**3.89** (3.40-4.53)	**4.97** (4.22-5.99)	**5.86** (4.86-7.20)	**6.81** (5.51-8.57)	**7.83** (6.17-10.1)	**9.31** (7.04-12.6)	**10.5** (7.70-14.7)
4-day	**1.72** (1.53-1.98)	**2.41** (2.14-2.78)	**3.37** (2.97-3.89)	**4.19** (3.67-4.88)	**5.36** (4.54-6.46)	**6.32** (5.25-7.77)	**7.35** (5.95-9.26)	**8.46** (6.67-11.0)	**10.1** (7.61-13.6)	**11.4** (8.33-15.9)
7-day	**1.92** (1.70-2.20)	**2.67** (2.36-3.07)	**3.71** (3.27-4.28)	**4.60** (4.03-5.36)	**5.88** (4.98-7.08)	**6.92** (5.74-8.50)	**8.03** (6.50-10.1)	**9.23** (7.27-12.0)	**11.0** (8.28-14.8)	**12.4** (9.04-17.3)
10-day	**2.05** (1.82-2.36)	**2.84** (2.52-3.28)	**3.94** (3.48-4.56)	**4.88** (4.28-5.69)	**6.24** (5.28-7.51)	**7.33** (6.08-9.01)	**8.50** (6.88-10.7)	**9.76** (7.69-12.6)	**11.6** (8.75-15.6)	**13.1** (9.54-18.2)
20-day	**2.45** (2.17-2.82)	**3.41** (3.02-3.92)	**4.72** (4.17-5.46)	**5.85** (5.12-6.82)	**7.47** (6.33-9.00)	**8.78** (7.29-10.8)	**10.2** (8.25-12.8)	**11.7** (9.21-15.1)	**13.8** (10.5-18.7)	**15.6** (11.4-21.8)
30-day	**2.87** (2.54-3.30)	**3.97** (3.52-4.58)	**5.50** (4.86-6.36)	**6.81** (5.97-7.94)	**8.70** (7.37-10.5)	**10.2** (8.49-12.6)	**11.9** (9.60-14.9)	**13.6** (10.7-17.6)	**16.1** (12.2-21.8)	**18.2** (13.3-25.4)
45-day	**3.40** (3.01-3.91)	**4.67** (4.13-5.38)	**6.43** (5.68-7.44)	**7.96** (6.97-9.27)	**10.2** (8.60-12.2)	**11.9** (9.91-14.7)	**13.9** (11.2-17.5)	**15.9** (12.6-20.6)	**18.9** (14.3-25.5)	**21.4** (15.6-29.8)
60-day	**3.85** (3.41-4.43)	**5.23** (4.63-6.02)	**7.15** (6.31-8.26)	**8.81** (7.71-10.3)	**11.2** (9.50-13.5)	**13.2** (10.9-16.2)	**15.3** (12.4-19.3)	**17.6** (13.9-22.8)	**20.9** (15.8-28.2)	**23.7** (17.3-33.1)

[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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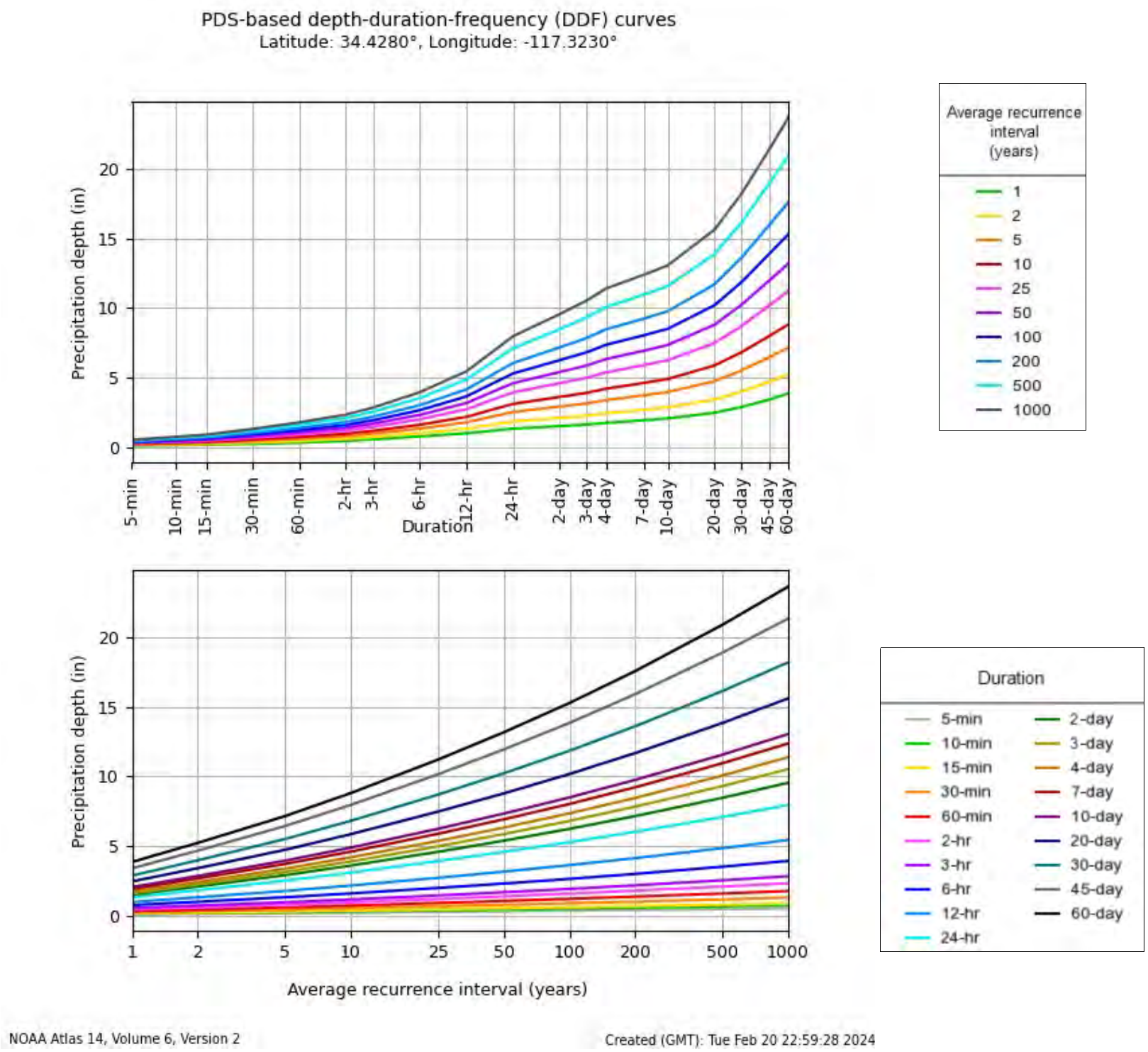
PF graphical



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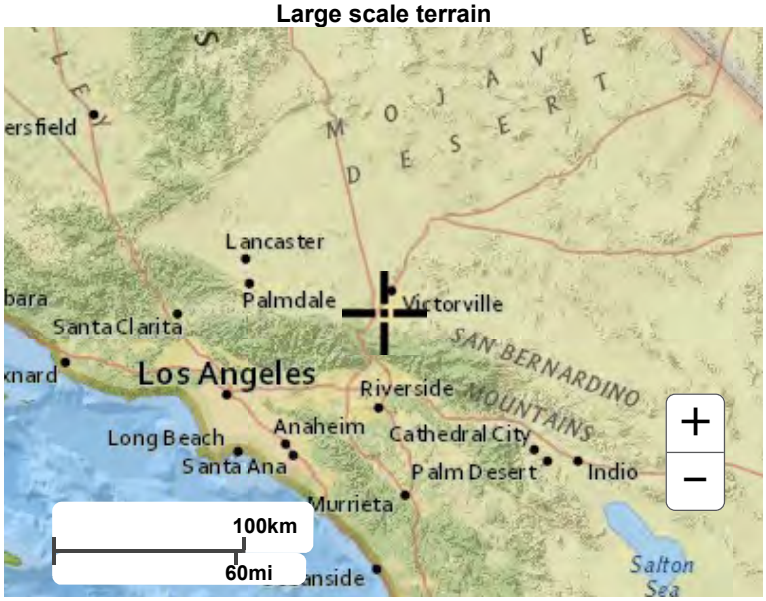
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

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

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

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

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

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

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

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*

10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*

14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet HCOC Requirement (cfs): $Q_{p\text{-}HCOC}$ = *(Item 14 * 0.95) – Item 10*

4.3 Project Conformance Analysis

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

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

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

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

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

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

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment**.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

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

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

If Yes, Provide basis: (attach)

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

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

4.3.1 Site Design Hydrologic Source Control BMP

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

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ 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): 0 $V_{retention}$ *=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)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): 0 $V_{retention}$ *=Sum of Item 12 for all BMPs*			

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

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) $V_{retention}$ *= Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): 0 $V_{retention}$ *=Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ *= Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): 0 $V_{retention}$ *= Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ *= Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): 0 $V_{retention}$ *=Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

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

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

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 9,041.18 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

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 DMA 1 BMP Type Storm tech system	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	1.98		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.18		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.91		
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*	0		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0		
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*	2,849.65		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	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))]*	0		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	9,338.23		

16 Total Retention Volume from LID Infiltration BMPs: 9,338.23 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 103% *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.

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	JN 3520 Mazi
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	9042 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(20 ft. x 180 ft.)

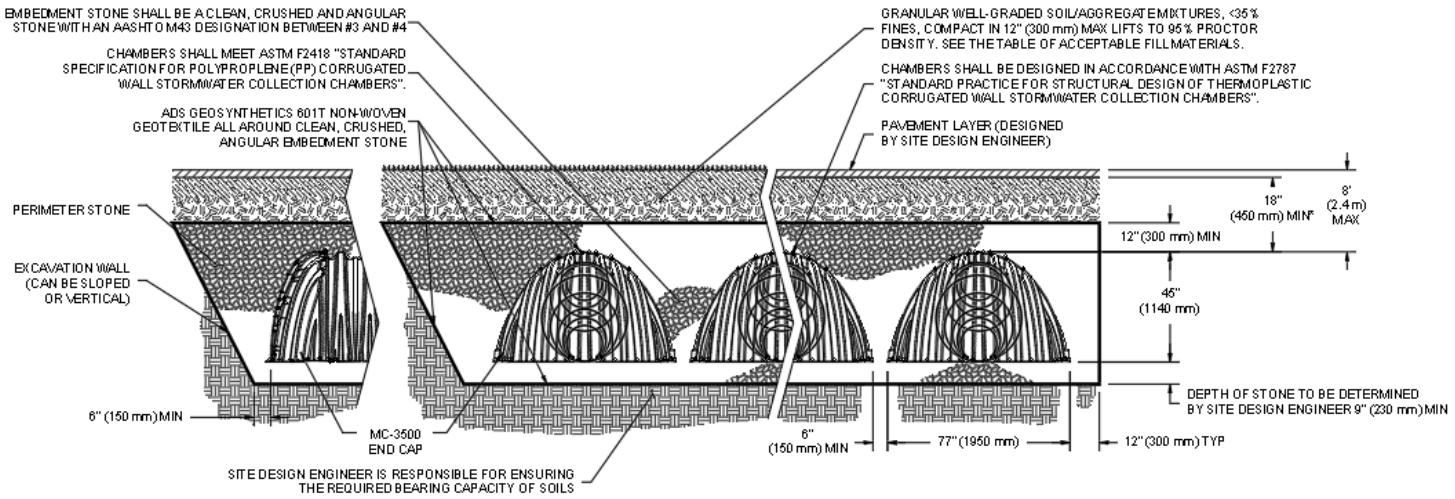
Results

System Volume and Bed Size

Installed Storage Volume:	9338.23 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	46
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	178.85 ft.
Maximum Width:	15.93 ft.
Approx. Bed Size Required:	2849.65 square ft.

System Components

Amount Of Stone Required:	392 cubic yards
Volume Of Excavation (Not Including Fill):	581 cubic yards
Total Non-woven Geotextile Required:	1046 square yards
Woven Geotextile Required (excluding Isolator Row):	1 square yards
Woven Geotextile Required (Isolator Row):	197 square yards
Total Woven Geotextile Required:	197 square yards
Impervious Liner Required:	0 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24"

4.3.3 Harvest and Use BMP

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

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

Form 4.3-4 Harvest and Use BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0

V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16

BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			

9 Total Retention Volume (ft^3) from Harvest and Use BMP 0 *Sum of Item 8 for all harvest and use BMP included in plan*

10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☐ No ☐

If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
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 4.3-6 and 4.3-7 to compute treated volume* ☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume* ☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-6 Item 15 + Form 4.3-7 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): *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.*		

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

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

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

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

Form 4.3-8 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 9,041.18 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 9,338.23 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

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

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use 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 and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for HCOC performance criteria (ft^3): 0 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Stormtech system	Mazi Hossein Trust	Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming . For more information see stormtech isolator row O&M manual in section 6.4.	Shall be inspected monthly during the rainy season (October-May) and before and after each storm to ensure proper operation.
N1 Education for property owners	Mazi Hossein Trust	Practical informational materials will be provided by owner to employees regarding practices that contribute to protection of storm water quality. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharges to gutters, catch basins, and storm drains. Property owner will provide these materials through an education program. This program must be maintained, enforced, and updated periodically by the owner. Educational materials including, but not limited to, the materials included in Section 6.4 will be made available to the employees periodically thereafter.	annually

N2 Activity restrictions	Mazi Hossein Trust	No type of any maintenance will be allowed to the vehicles, also lot may not be washed down and no chemicals can be used in the parking stalls. Pesticide Controls: Pesticides and Herbicides shall be applied in accordance with the California Department of Pesticides requirements. Must be done by a state certified applicator.	As needed
N3 Landscape management	Mazi Hossein Trust	The Landscape crews shall inspect the irrigation system and shall report all drainage problems to the owner. All routine landscaping maintenance shall be done in conformance with County Ordinances. See Commercial Landscape maintenance in Section 6.4.	Weekly at minimum.
N4 BMP Maintenance	Mazi Hossein Trust	Remove accumulated trash and debris in the basin at the start and end of the wet season. Inspect for standing water at the end of the wet season.	Twice a year
N6 Local water quality ordinance compliance	Mazi Hossein Trust	"Project to comply with City of Hesperia Water Quality Ordinance"	Weekly at minimum.
N11 Litter control	Mazi Hossein Trust	Owner is responsible to hire a maintenance person or contact with a landscape service for litter patrol. A program shall be implemented to pick up litter and sweep and clean the trash enclosure on a daily basis. Trash enclosures are designed to divert all flows around the enclosure. A permanent awning is required over the trash enclosure area. All dumpsters will have lids installed and will be inspected to ensure that the dumpsters remain covered and leak-proof. The owner shall contract with a refuse company to have the dumpsters emptied on a weekly basis, at a minimum.	Trash enclosure should be kept clean from litter and be swept on a daily basis. Lids to be inspected weekly. Trash to be removed by refuse company weekly.
N14 Catch basin inspection program	Mazi Hossein Trust	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 owner 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	Shall be inspected monthly during the rainy season (October-May) and before and after each

		into on-site drains. Also inspect catch basins for standing water in addition to trash.	storm to ensure proper operation.
N15 Vacuum sweeping of private streets and parking lots	Mazi Hossein Trust	Street shall be swept using a vacuum assisted sweeper (is required) weekly to prevent sediment, garden waste, and trash, or other pollutants from entering on-site drains and public storm channels. Sweeping will be done by a landscape contractor or other contractor provided by the owner.	Shall be swept weekly.
S1 Provide storm drain system stenciling and signage	Mazi Hossein Trust	A painted message "No Dumping- drains to river" stencil shall be blue on a white background with lettering 2-1/2" in height or a catch basin curb marker, circular or rectangular, at least 4" in height or diameter, may be used.	Shall be inspected annually and repainted as necessary.
S5 Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	Mazi Hossein Trust	Landscape to be depressed 1-2" below finish surface of concrete curbs and concrete sidewalks. See detail on WQMP Exhibit in section 6.1.	Weekly at minimum.

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 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.

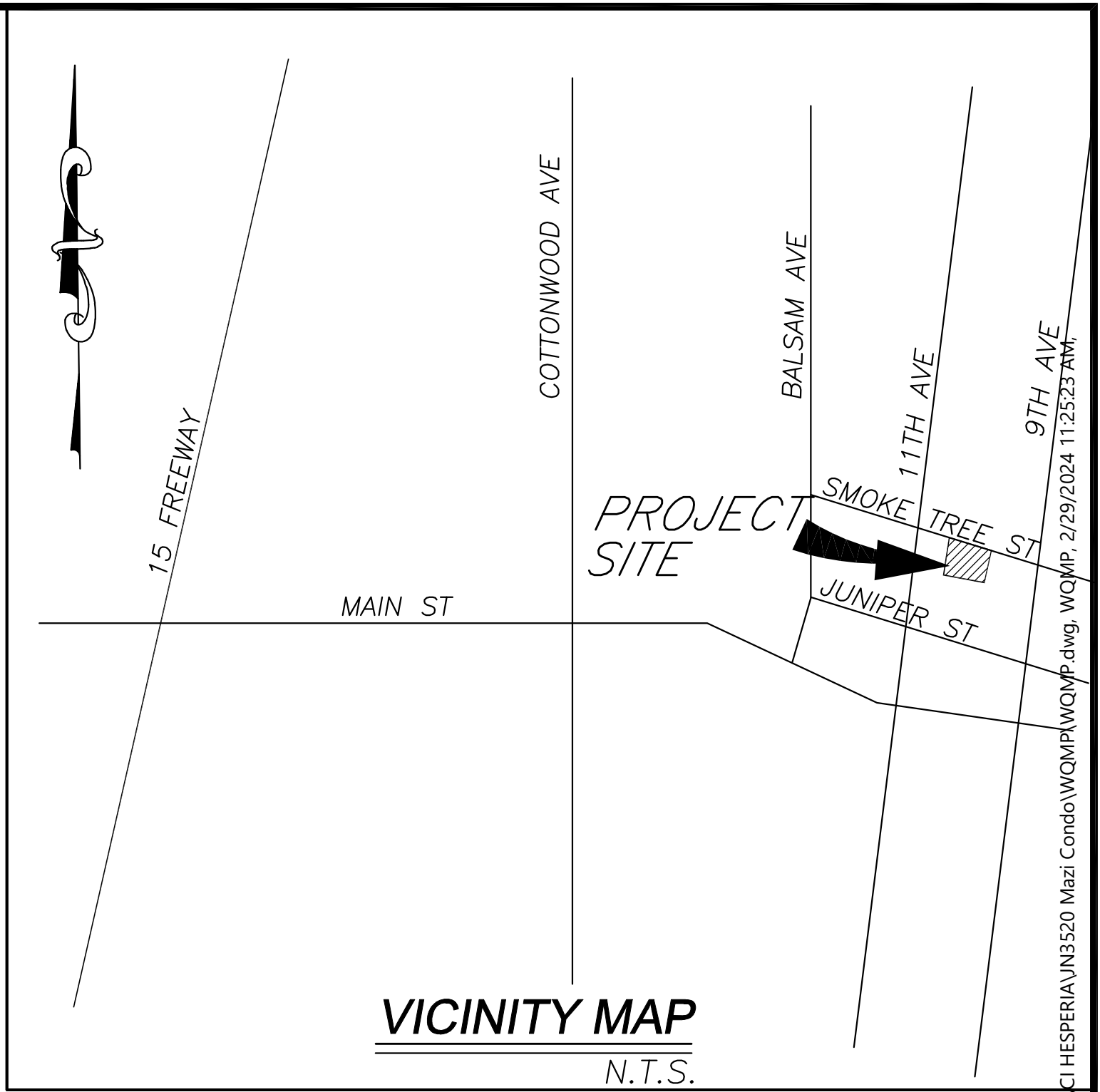
6.3 Post Construction

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

6.1. Site Plan and Drainage Plan



VICINITY MAP

N.T.S.

THOMAS GUIDE MAP PAGE 346/B6

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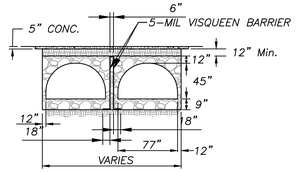
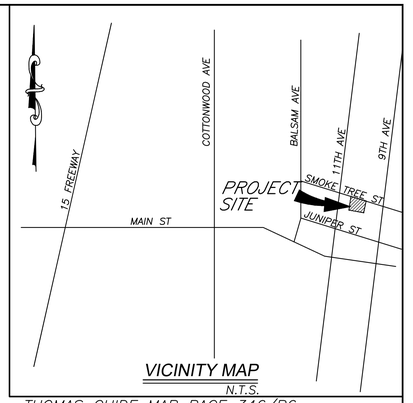
WATER QUALITY MANAGEMENT PLAN
PLOT PLAN



STORM TECH DETAIL:
NTS



VICINITY MAP
N.T.S.

THOMAS GUIDE MAP PAGE 346/B6

OWNER/DEVELOPER:

MAZI HOSSEIN TRUST
HOSSEIN MAZI
8440 SVL BOX
VICTORVILLE, CA 92395
760-954-1551 PH.

ENGINEER:

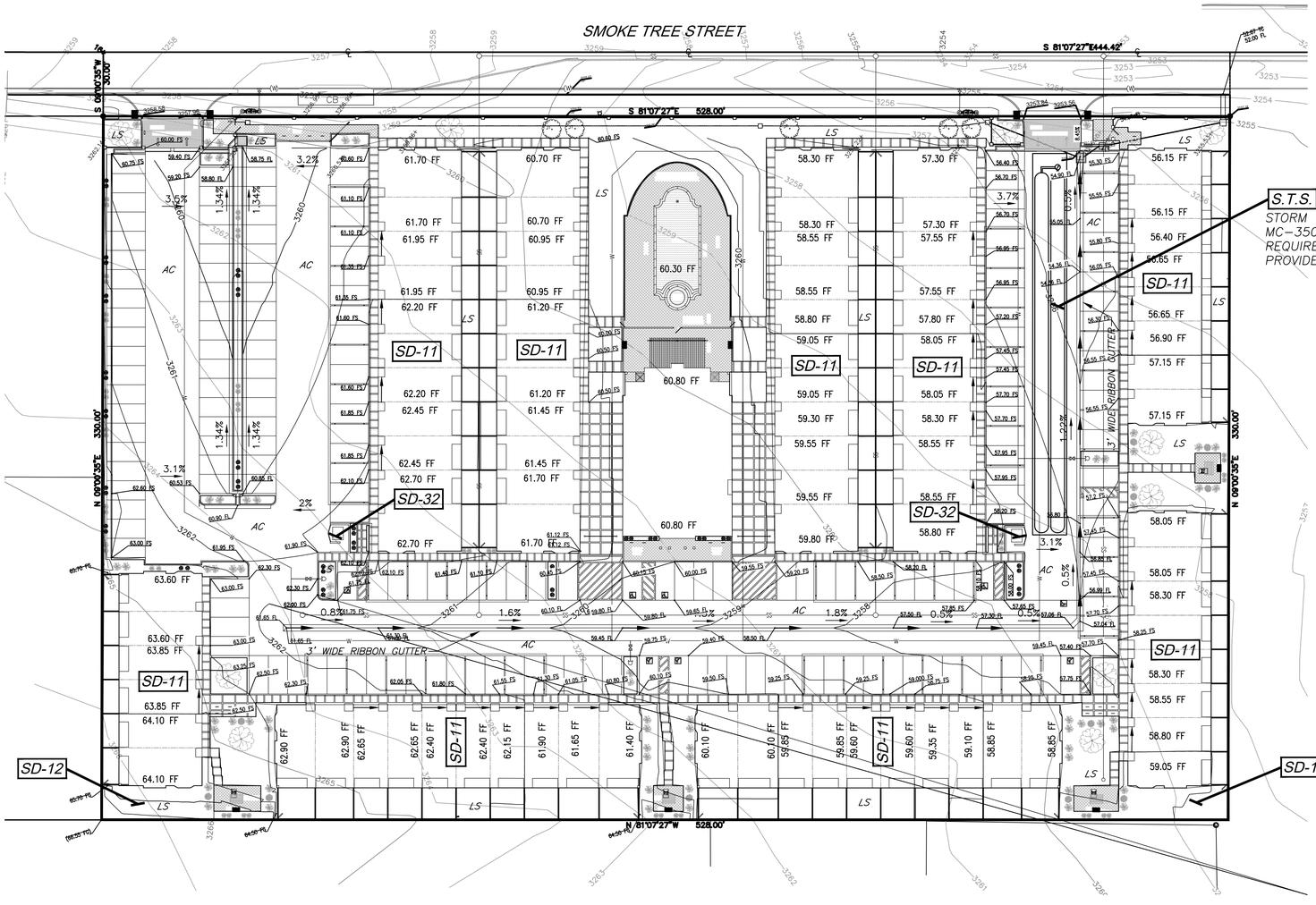
SAKE ENGINEERS, INC.
400 S. RAMONA AVE. STE. 202
CORONA, CA 92879
(951)279-4041 PH.

ASSESSORS PARCEL NO.:

0407-251-12-0000

TOTAL ACREAGE:

TOTAL AREA = 4.00 AC (174,242 SF)
IMPERVIOUS AREA = 3.24 AC (141,182 SF) 81%
PERVIOUS AREA = 0.76 AC (33,060 SF) 19%



LEGEND:	APPLICATION:
SD-11	ROOF RUNOFF CONTROLS
SD-12	LANDSCAPE AREA
SD-32	TRASH ENCLOSURE
S.T.S.	STORM TECH SYSTEM

0 30 60
1 inch = 30 ft.

REGISTERED PROFESSIONAL ENGINEER
SAM AKBARPOUR
C053038
CIVIL
STATE OF CALIFORNIA

SAKE ENGINEERS, INC.
www.sakeengineers.com
ENGINEERING ● SURVEYING ● LAND DEVELOPMENT
400 S. RAMONA AVE., STE. 202
CORONA, CALIFORNIA 92879
(951) 279-4041

CITY OF HESPERIA

WATER QUALITY MANAGEMENT PLAN
FOR
PLOT PLAN
SITE PLAN

SCALE: AS SHOWN ON PLAN

SHEET NO. 1 OF 1 SHEETS
FILE NO.

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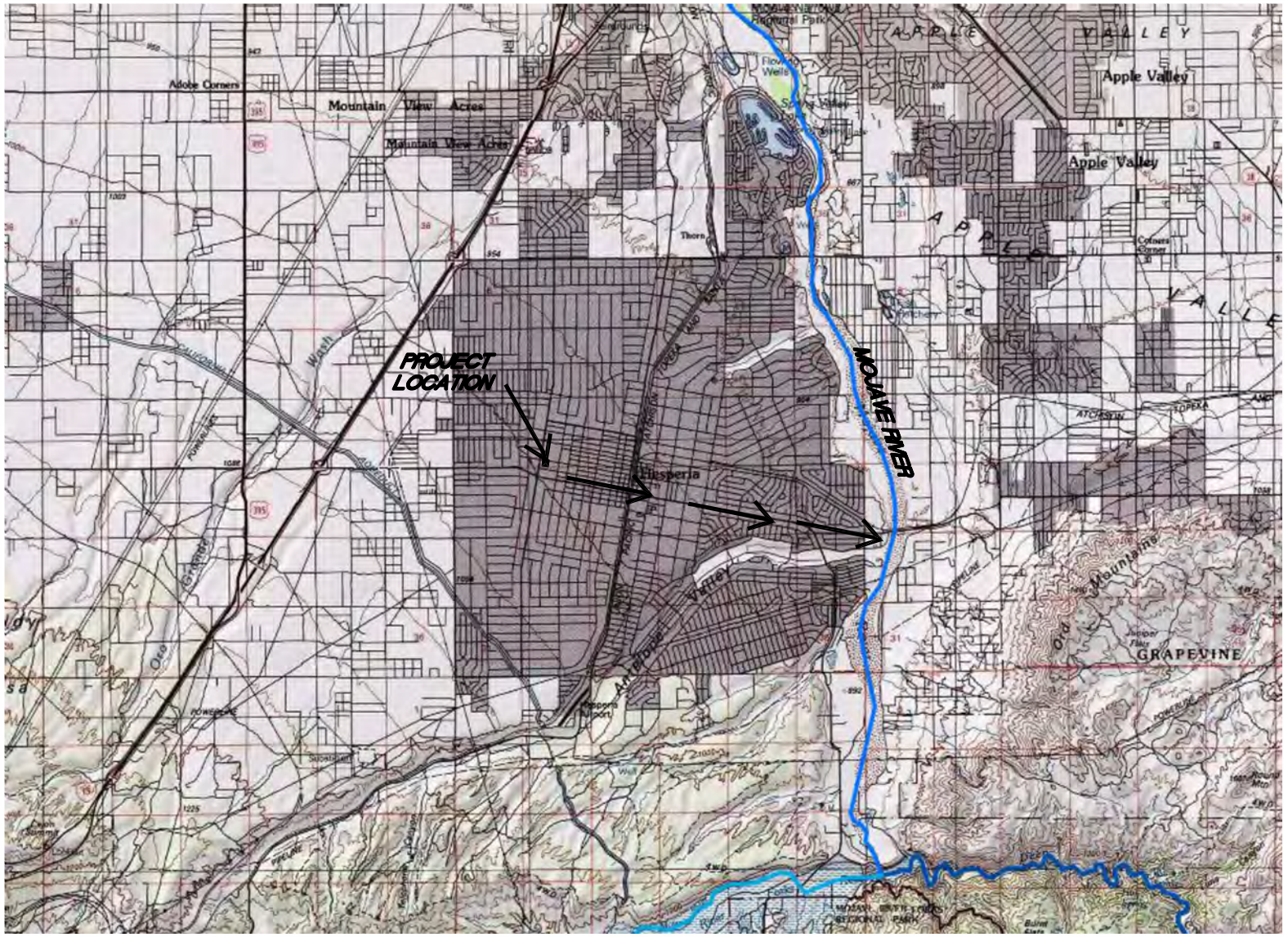

2'

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1:30

6.2 Electronic Data Submittal

Will be submitted at Final WQMP.

6.3 Post Construction

O&M Plans and Maintenance Agreements

6.4 Other Supporting Documentation

- BMP Educational Materials
- Infiltration Test/ Soils report

Educational Materials Included

The following is a list of educational materials included in this WQMP.

- Home & Garden
- Landscape Maintenance
- SC-60 Housekeeping Practices
- SD-11 Roof Runoff Controls
- SD-12 Efficient Irrigation
- SD-32 Trash enclosure
- Storm tech system

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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

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

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

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

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

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Subsurface Stormwater Management℠

Isolator™ Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator™ Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patent pending technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR™ ROW

The Isolator Row is a row of StormTech chambers, either SC-740 or SC-310 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

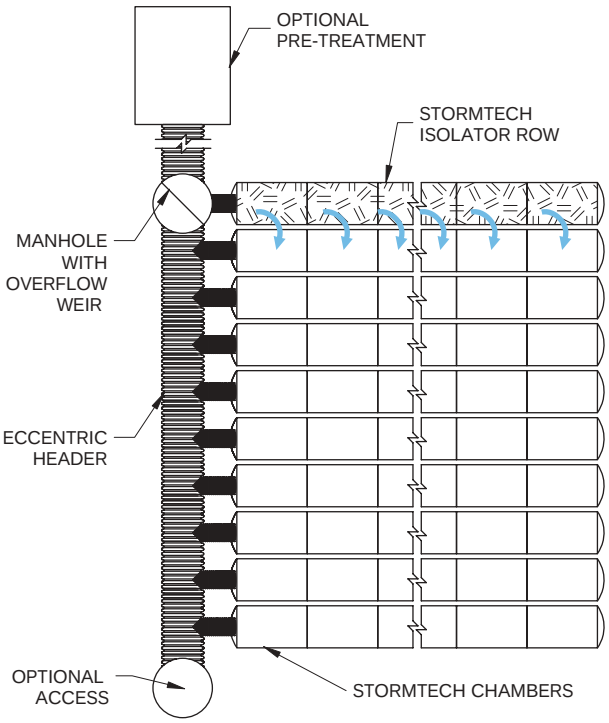
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

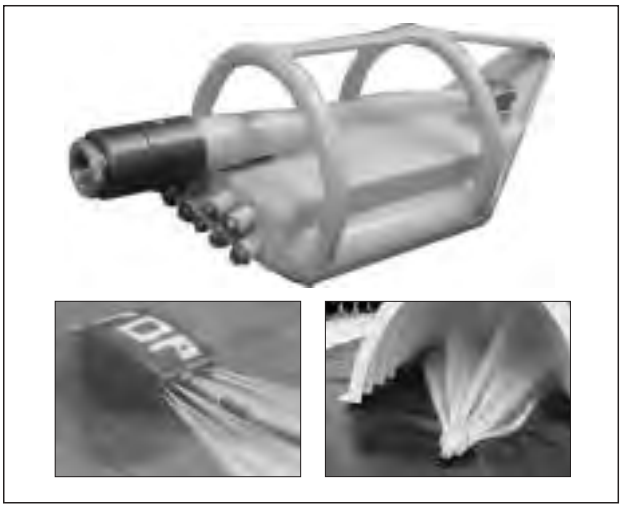
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

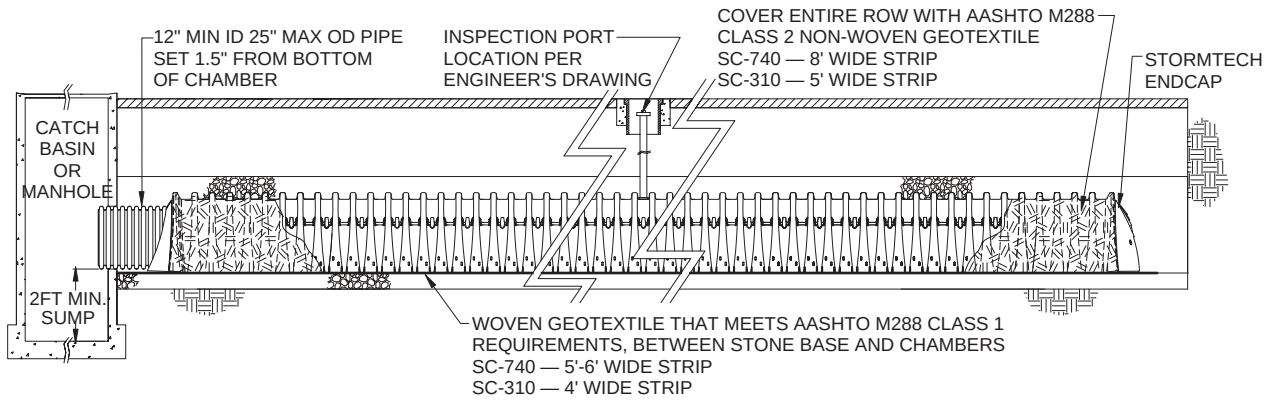
The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

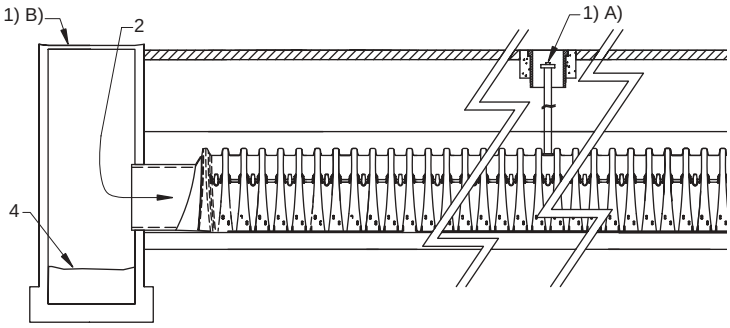
i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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StormTech products are covered by one or more of the following patents: U.S. Patents: 5,401,459; 5,511,903; 5,716,163; 5,588,778; 5,839,844; Canadian Patents: 2,158,418 Other U.S. and Foreign Patents PendingPrinted in U.S.A.

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Infiltration Test/ Soils report

GEOBODEN, INC.
Geotechnical Consultants

June 14, 2022 Smoke Tree-2-01

Attention: MAZI, HOSSEIN TRUST

Subject: Infiltration/Percolation Testing for Stormwater Retention
Proposed Residential Development
APN: 040725112
15639 Smoke Tree Street
Hesperia, California

As requested, we have performed percolation/infiltration testing on the subject site in order to determine the infiltration potential of the surface soils. The percolation rates determined should be useful in assessing stormwater retention needs. It is our understanding that on-site stormwater retention will be required. It is proposed to collect the stormwater runoff within subsurface percolation pits. This report presents the results of our study, discussion of our findings, and provides percolation rates for the subject system.

PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to determine the general percolation rates and physical characteristics of the onsite soils in order to provide design parameters for the proposed onsite infiltration system. Services provided for this study are in accordance with our agreement and consisted of the following:

- Site exploration consisting of the excavation and logging of two test holes;
- Percolation testing in the borings (B-1 through B-5), performed in general accordance with the County of San Bernardino, Stormwater Quality Best Management Practice Design;
- Compilation of this report, which presents the results of our study and provides percolation rates for the design of an onsite infiltration system.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The site is located in Hesperia, California. The subject property is presently occupied by a vacant land. Based on our review of published geologic maps and area experience, the site is underlain by alluvial deposits. Further information regarding proposed development and test hole locations is shown on Figure 1, *Boring Location Map*.

FIELD INVESTIGATION

Our field investigation consisted of excavating two shallow exploratory test holes, which were also used as percolation borings. Hollow stem auger equipment was utilized to excavate the exploratory test holes. An engineer logged and observed the test holes excavations. Soil classification was based on visual observation. The approximate locations of the exploratory and percolation test holes are shown on Figure 1 (*Boring Location Map*). Logs of the exploratory borings are presented in Appendix A.

SUBSURFACE SOILS CONDITIONS

SOIL PROFILE

Observed subsurface native soils consisted of sand with silt and silty sand to the maximum explored depth of 5 feet below ground surface (bgs). A more detailed description of these materials is provided in the exploratory boring logs included in the enclosed Appendix A. Soils encountered were classified according to the Unified Soil Classification System (USCS).

GROUNDWATER

Groundwater was not encountered within the exploratory test holes to the maximum explored depth of 5 feet below ground surface (bgs). Based on information from the Department of Water Resources, Water Data Library, ground water level in the site vicinity is at a depth of greater than 50 feet beneath the existing ground surface.

PERCOLATION TESTING AND PROCEDURE

Percolation testing was performed in general accordance with the procedures of the County of San Bernardino Storm Water Best Management Practice. The purpose of our testing was to assess the general percolation rates of the onsite soils for the design of an onsite infiltration system.

The continuous pre-soak (falling-head) test procedure was utilized for testing. Water was allowed to presoak in each test hole prior to obtaining test readings. Following the presoak period, the drop in water level in each hole was monitored every 10 minutes to determine the appropriate method for testing. Test holes were refilled following each reading or when the water depth was below 6 inches. The drop in water level was recorded to the nearest $1/10^{th}$ inch to produce conservative water level readings.

SUMMARY OF INFILTRATION TEST RESULTS

Tests results are summarized below:

Test Hole No.	Rate (inch/hr)
1	3.24
2	3.37

Based on the obtained field data, the most conservative rate of 3.24 inch per hour should be utilized in the design of the proposed onsite drain system. The base of the system should be founded into natural alluvial soils. Factor of safety 3.0 shall be incorporated in design.

It should be noted that the infiltration rates determined are ultimate rates based upon field test results. An appropriate safety factor should be applied to account for subsoil inconsistencies and potential silting of the percolating soils. The safety factor should be determined with consideration to other factors in the stormwater retention system design (particularly stormwater volume estimates) and the safety factors associated with those design components.

The Storm water Manager's Resource Center (SMRC) web site (http://www.stormwatercenter.net/) includes guidelines for disposal of storm water with respect to setback of structures. It is included in the criteria that infiltration facilities should be setback 5 feet down-gradient from structures. In order to avoid potential adversely impacting any existing structures, we recommend that any infiltration system be kept a horizontal distance of at least 5 feet from the edge of new buildings and the property line.

LIMITATIONS

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principals and practice within our opinion at this time in Southern California. Our conclusions and recommendations are based on the results of the field investigations, combined with an interpolation of subsurface conditions between and beyond exploration locations.

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As the project evolves, our continued consultation and construction monitoring should be considered. GeoBoden should review plans and specifications to ensure the recommendations presented herein have been appropriately interpreted, and that the design assumptions used in this study are valid. Where significant design changes occur, GeoBoden may be required to augment or modify these recommendations. Subsurface conditions may differ in some locations from those encountered in the explorations, and may require additional analyses and/or modified recommendations. This report was written for the Orin Group, and the design team members, and only for the proposed development described herein. We are not responsible for technical interpretations made by others, or exploratory information that has not been described or documented in this report. Specific questions or interpretations concerning our findings and conclusions may require written clarification.

We appreciate the opportunity to provide service to you on this project. If you have questions regarding this letter or the data included, please contact the undersigned.

Respectfully submitted,
GEOBODEN, INC.

Shahrokh (Cyrus) E Radvar,
Principal Engineer, G.E. 2742

Copies: 2/Addressee

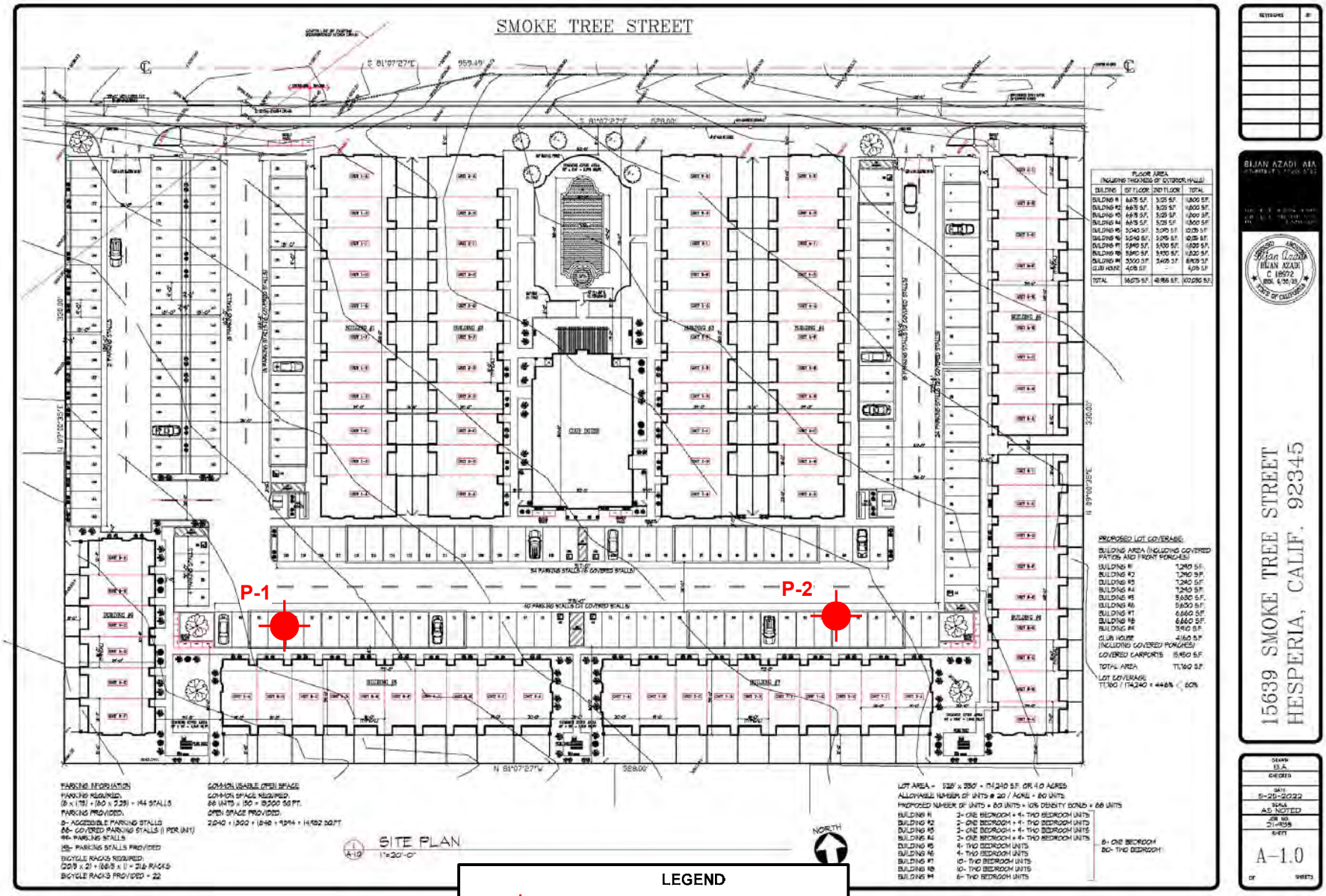
Attachments:

Figure 1 – Test Hole Location Map
Appendix A – Test Borings Logs

REFERENCES

Technical Guidance Document for Water Quality Management Plans, The County of San Bernardino Areawide Stormwater Program NPDES No. CAS618036, ORDER No. R8-2010-0036 Submitted To: California Water Quality Control Board – Santa Ana Region, June 7, 2013

http://www.water.ca.gov/waterdatalibrary/



GEOBODEN INC.

Geotechnical Consultants

PERCOLATION BORINGS LOCATION PLAN
Proposed Residential Development
APN: 040725112
15639 Smoke Tree Street
Hesperia, California

Figure By S.R.	Project No. Smoke Tree-1-01
Map No. XX	Figure No. 2
Date 06-14-22	

Geoboden, Inc.

BORING NUMBER P-1

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development - Stormwater Retention
PROJECT NUMBER Smoke Tree-2-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/3/22 **COMPLETED** 5/3/22
GROUND ELEVATION _____ **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY C.R. **CHECKED BY** _____
AT END OF DRILLING ---
NOTES _____
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		SAND w. SILT (SP-SM): yellowish brown, moist										
2.5		SILTY SAND (SM): light yellowish brown, moist, fine sand										
5.0		Bottom of borehole at 5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling. Bottom of borehole at 5.0 feet.										

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Geoboden, Inc.

BORING NUMBER P-2

CLIENT Mazi, Hossein Trust
PROJECT NAME Proposed Residential Development - Stormwater Retention
PROJECT NUMBER Smoke Tree-2-01
PROJECT LOCATION 15639 Smoke Tree Street, Hesperia, CA
DATE STARTED 5/3/22 **COMPLETED** 5/3/22
GROUND ELEVATION _____ **HOLE SIZE** 8 inches
DRILLING CONTRACTOR Geoboden, Inc.
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY C.R. **CHECKED BY** _____
AT END OF DRILLING ---
NOTES _____
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0.0		SAND w. SILT (SP-SM): light brown, dry, fine sand										
2.5		SILTY SAND (SM): light brown, moist										
5.0		Bottom of borehole at 5 feet below ground surface. Boring was backfilled with cuttings. No groundwater was encountered at the time of drilling. Bottom of borehole at 5.0 feet.										

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Boring Percolation Testing Field Log P-1

Project No.: Smoke Tree-1-01
Project Name: Proposed Residential Development
Project Location: APN: 040725112, Hesperia
Earth Description: alluvium
Tested by: CR
Liquid Description: Clear Clean Water

Date: 05/03/22- 05/03/22

Boring/Test Number: P-1
Diameter of Boring, inches: 8
Diameter of Casing, inches: 2
Depth of Boring, feet: 5
Depth to Invert of BMP, feet:
Depth to Groundwater, feet: NE
Depth to Initial Water Depth, (d_1) feet: 3.50

Start Time for Pre-Soak: 5/3/22 8:00
Start Time for Standard: 5/3/22 8:20
Standard Time Interval Between Readings, 10 mins.

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Depth (feet)[1]	Water Drop, Δd (feet)	Water Drop, Δd (inch)	Percolation Rate (in/hr)	Initial Height of Water (ft)	Initial Height of Water (in)	Final Height of Water (ft)	Final Height of Water (in)	Change in Height of Water, ΔH (inch)	Average Head Height of Water over Interval	Infiltration Rate (in/hr)	Notes
1	8:20	10	3.50	1.32	15.8	95.0	1.5	18.0	0.2	2.2	15.8	10.1	15.74	Refilled to initial water depth every 30 minutes
	8:30		4.82											
2	8:30	10	3.50	1.24	14.9	89.3	1.5	18.0	0.3	3.1	14.9	10.6	14.22	
	8:40		4.74											
3	8:40	10	3.50	1.18	14.2	85.0	1.5	18.0	0.3	3.8	14.2	10.9	13.15	
	8:50		4.68											
4	8:50	10	3.50	1.12	13.4	80.6	1.5	18.0	0.4	4.6	13.4	11.3	12.14	
	9:00		4.62											
5	9:00	10	3.50	1.02	12.2	73.4	1.5	18.0	0.5	5.8	12.2	11.9	10.58	
	9:10		4.52											
6	9:10	10	3.50	0.98	11.8	70.6	1.5	18.0	0.5	6.2	11.8	12.1	9.99	
	9:20		4.48											
7	9:20	10	3.50	0.86	10.3	61.9	1.5	18.0	0.6	7.7	10.3	12.8	8.35	
	9:30		4.36											
8	9:30	10	3.50	0.73	8.8	52.6	1.5	18.0	0.8	9.2	8.8	13.6	6.73	
	9:40		4.23											
9	9:40	10	3.50	0.62	7.4	44.6	1.5	18.0	0.9	10.6	7.4	14.3	5.48	
	9:50		4.12											
10	9:50	10	3.50	0.35	4.2	25.2	1.5	18.0	1.2	13.8	4.2	15.9	2.82	
	10:00		3.85											
11	10:00	10	3.50	0.35	4.2	25.2	1.5	18.0	1.2	13.8	4.2	15.9	2.82	
	10:10		3.85											
12	10:10	10	3.50	0.46	5.5	33.1	1.5	18.0	1.0	12.5	5.5	15.2	3.84	Final Reading used to caluclate the infiltration rate.
	10:20		3.96											

[1] Water depth below ground surface

Infiltration Rate: **3.24 in/hr**

Boring Percolation Testing Field Log P-2

Project No.: Smoke Tree-1-01
Project Name: Proposed Residential Development
Project Location: APN: 040725112, Hesperia
Earth Description: alluvium
Tested by: CR
Liquid Description: Clear Clean Water

Date: 05/03/22 - 05/03/22

Boring/Test Number: P-2
Diameter of Boring, inches: 8
Diameter of Casing, inches: 2
Depth of Boring, feet: 5
Depth to Invert of BMP, feet:
Depth to Groundwater, feet: NE
Depth to Initial Water Depth, (d_1) feet: 3.50

Start Time for Pre-Soak: 4/17/20 8:10
Start Time for Standard: 4/17/20 9:27
Standard Time Interval Between Readings, 10 mins.

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Depth (feet)[1]	Water Drop, Δd (feet)	Water Drop, Δd (inch)	Percolation Rate (in/hr)	Initial Height of Water (ft)	Initial Height of Water (in)	Final Height of Water (ft)	Final Height of Water (in)	Change in Height of Water, ΔH (inch)	Average Head Height of Water over Interval	Infiltration Rate (in/hr)	Notes
1	9:27	10	3.50	1.42	17.0	102.2	1.5	18.0	0.1	1.0	17.0	9.5	17.81	Refilled to initial water depth every 30 minutes
	9:37		4.92											
2	9:37	10	3.50	1.32	15.8	95.0	1.5	18.0	0.2	2.2	15.8	10.1	15.74	
	9:47		4.82											
3	9:47	10	3.50	1.24	14.9	89.3	1.5	18.0	0.3	3.1	14.9	10.6	14.22	
	9:57		4.74											
4	9:57	10	3.50	1.12	13.4	80.6	1.5	18.0	0.4	4.6	13.4	11.3	12.14	
	10:07		4.62											
5	10:07	10	3.50	0.95	11.4	68.4	1.5	18.0	0.6	6.6	11.4	12.3	9.57	
	10:17		4.45											
6	10:17	10	3.50	0.89	10.7	64.1	1.5	18.0	0.6	7.3	10.7	12.7	8.74	
	10:27		4.39											
7	10:27	10	3.50	0.82	9.8	59.0	1.5	18.0	0.7	8.2	9.8	13.1	7.83	
	10:37		4.32											
8	10:37	10	3.50	0.73	8.8	52.6	1.5	18.0	0.8	9.2	8.8	13.6	6.73	
	10:47		4.23											
9	10:47	10	3.50	0.62	7.4	44.6	1.5	18.0	0.9	10.6	7.4	14.3	5.48	
	10:57		4.12											
10	10:57	10	3.50	0.47	5.6	33.8	1.5	18.0	1.0	12.4	5.6	15.2	3.94	
	11:07		3.97											
11	11:07	10	3.50	0.47	5.6	33.8	1.5	18.0	1.0	12.4	5.6	15.2	3.94	
	11:17		3.97											
12	11:17	10	3.50	0.47	5.6	33.8	1.5	18.0	1.0	12.4	5.6	15.2	3.94	Final Reading used to caluclate the infiltration rate.
	11:27		3.97											

[1] Water depth below ground surface

Infiltration Rate: **3.37 in/hr**