Preliminary Water Quality Management Plan

For:

Tract 20473

CITY ID:

Prepared for:

Lone Chang, LLC

14 Castlebar

Irvine, CA 92618

Yen Li Chu Chang

949-733-3925

Prepared by:

Encompass Associates, Inc.

5699 Cousins Place

Rancho Cucamonga, CA 91737

Aaron T. Skeers, P.E.

909-684-0093

Date: December 2, 2021

Approval Date:_____

Project Owner's Certification

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

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

.

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0168-132-05

Owner's Signature		
Owner Name:	Yen Li Chu Chang	
Title	Owner	
Company	Lone Chang, LLC	
Address	14 Castlebar, Irvine, CA 92618	
Email	Eudeen88@yahoo.com	
Telephone #	949-733-3925	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0168-132-05

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

Engineer:	Aaron T. Skeers, P.E.	PE Stamp Below
Title	President	
Company	Encompass Associates, Inc.	
Address	5699 Cousins Place, Rancho Cucamonga, CA, 91737	
Email	askeers@encompasscivil.com	
Telephone #	909-684-0093	
Signature		
Date		

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Forms

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Tract 20473				
Project Owner Contact Name:	Yen Li Chu Chang				
Mailing Address:	14 Castlebar Irvine, CA 92618	E-mail Address:	Eudeen88@yahoo.com	Telephone:	949-733-3925
Permit/Application Number(s):		Tract/Parcel Map Number(s):		APN 0168-132-05	
Additional Information/ Comments:					
Description of Project:	The project is located north of Capri Avenue, east of existing residences and Granite Street, south of San Bernardino Avenue, and west of Wabash Avenue. The project proposes to develop a vacant property into a 98 lot subdivision with related access and open space improvements. Access to the project will be via a new street connection on San Bernardino Avenue to the north and a new street connection on Capri Avenue to the south. Limited off-site improvements include limited street widening and parkway improvements of San Bernardino Avenue, Wabash Avenue and Capri Avenue. A 1.7 acre park is proposed in the middle of the project, anticipated to have approximately 10,967 sf of impervious area and 62,146 sf of pervious area. A 0.5 acre infiltration basin is proposed, approximately 20,650 sf of pervious area. The perimeter of the project will include an approximate 7.9 acre landscaped setback, with about 34,464 sf of impervious area and 310,179 sf of pervious area. Residential buildings are anticipated to be a mix of single and two-stories. The residential lots and streets are anticipated to have approximately 494,976 sf of impervious area and 742,463 sf of pervious area. An infiltration basin has been proposed to treat runoff in the northwest corner of the site. Overflow runoff will continue to the north as it has historically to the existing storm drain in San Bernardino Avenue. At this time, it is anticipated that a CFD will be responsible to operate and manage all BMPs proposed in this report, including the infiltration basin (See Section 6.4 for more information), conditioned upon acceptance of those improvements by the City.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.					

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 ft² or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft² 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 ft² or more
☐ Hillside developments of 5,000 ft² 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 ft² 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 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² 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):	1,675,845	**3** Number of Dwelling Units:	98	**4** SIC Code:	6552

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:

All streets and utilities will be publicly maintained. Street, sewer, storm drain, street light and water improvements will be transferred to the City of Redlands upon completion and acceptance of those improvements. Common spaces, consisting of the perimeter landscape lettered lots and the park will be maintained by the CFD.

The CFD is responsible for the maintenance of the facilities described herein, conditioned upon acceptance of those improvements by the City, including (See Section 6.4 for more information):

- Infiltration Basin (BMP ID 1) in the Lot A.
- Catch Basin inlet filter devices (2 catch basins on "A" Street just south of San Bernardino Avenue.
- Landscape maintenance of common areas as shown on the exhibit in Section 6.4 (to be provided during final review).

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 ☐	Bacterial indicators are routinely detected in pavement runoff. Can be caused by the transport of human or fecal wastes in runoff.
Phosphorous	E ☒	N ☐	Primary sources are from fertilizers and eroded soils. Eroded soils can be deposited by air to the site.
Nitrogen	E ☒	N ☐	Expected pollutant due to on-site landscaping
Sediment	E ☒	N ☐	Expected pollutant due to on-site landscaping
Metals	E ☒	N ☐	The primary source is emissions from brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Expected pollutant due to uncovered parking areas. Petroleum hydrocarbon products for motor vehicles and equipment are the primary source.
Trash/Debris	E ☒	N ☐	Even with good housekeeping practices, random trash and debris can still exist on site after being blown in from adjacent properties, roadways, etc.
Pesticides / Herbicides	E ☒	N ☐	These products can be washed off urban landscapes and hardscapes during storm events.
Organic Compounds	E ☒	N ☐	Expected due to on-site landscaping. Includes solvents.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
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] **50%**	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)			

Section 3 Site and Watershed Description

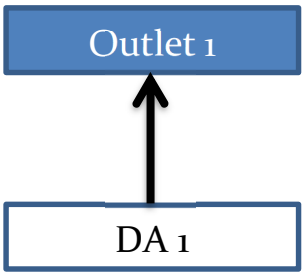
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and 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°04'34.3"N	Longitude 117°08'34.1"W	Thomas Bros Map page 608

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*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA 1 to Outlet 1	Runoff from DA 1 is directed to the infiltration basin

Form 3-2 Existing Hydrologic Characteristics for Drainage Areas

For Drainage Area sub-watershed DMAs, provide the following characteristics	DA 1 DMA A	DA 1 DMA B	DA 1 DMA C	DA 1 DMA D
1 DMA drainage area (ft^2)	1,237,439	73,113	20,650	344,643
2 Existing site impervious area (ft^2)	0	0	0	0
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2	2	2	2
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	A	A	A	A
5 Longest flowpath length (ft)	2400	350	150	2700
6 Longest flowpath slope (ft/ft)	0.02	0.02	0.02	0.01
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren	Barren	Barren	Barren
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*	Fair	Fair	Fair	Fair

Tract 20473

Site Photos

SW Corner (looking NE)

SW Corner (looking NE)

NW Corner (looking SE)

NW Corner (looking SE)

NE Corner (looking SW)

NE Corner (looking SW)

SE Corner (looking NW)

SE Corner (looking NW)

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool -* *http://sbcounty.permitrack.com/WAP* *See 'Drainage Facilities" link at this website*	Santa Ana River Reach 5 (Primary Basin No. 801.52, Secondary Basin No. 801.57) Santa Ana River Reach 4 (Primary Basin No. 801.27, Secondary Basin No. 801.27 and 801.44) Santa Ana River Reach 3 (Primary Basin No. 801.21, Secondary Basin No. 801.27 and 801.25) Santa Ana River Reach 2 (Primary Basin No. 801.11, Secondary Basin No. 801.12) Santa Ana River Reach 1 (Primary Basin No. 801.11) Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River Reach 4 for Pathogens is still required Santa Ana River Reach 3 for Copper and Lead still required Santa Ana River Reach 3 for Pathogens is being addressed by USEPA approved TDML. Santa Ana River Reach 2 for Bacteria is still required
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana River Reach 4, 3 and 2 are impaired by pathogens/bacteria. Santa Ana River Reach 3 is also impaired by metals.
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	no
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	no
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	☒	☐	Developer shall insure first homeowners are familiarized with the BMP's by providing a copy of the educational materials included herein in Attachment C at close of sale. The owner/developer is responsible to ensure homeowners are provided with this information.
N2	Activity Restrictions	☒	☐	Restrictions include: vehicle maintenance, outdoor materials storage, outdoor work or processing areas. All activities are restricted for which a specific BMP has not been included or if in violation of the City of Redlands ordinances for stormwater in Chapter 13.54 of the municipal code.
N3	Landscape Management BMPs	☒	☐	Landscape Management shall include the proper use of pesticides and fertilizer, as needed, proper and optimized watering schedule, replacement of dead plants, repair of irrigation systems and repair of eroded surfaces.
N4	BMP Maintenance	☒	☐	An infiltration basin has been proposed to treat runoff from the lots, streets and open space. 1) Maintenance and regular inspections are important for proper function of the infiltration basin. 2) Inspect all inlets and remove any accumulated debris and sediment at least once per quarter, and prior to the start of the wet season each year (by October 1). 3) Do not wash debris, sediment or trash into the storm drains. 4) Do not dump anything into the storm drains. 5) Limit overspray of landscaping from draining into the storm drain inlets. Excess periodic drainage will result in a shorter useful life for the water quality system. 6) Eliminate standing water to prevent vector breeding 7) Replace mulch as needed to maintain 2-3 inches of cover over soil 8) Replace damaged landscaping 9) Ensure stabilized outlet is in good condition and not susceptible to erosion.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous materials are expected to be stored onsite.
N6	Local Water Quality Ordinances	☒	☐	CFD & Homeowners to comply with the city Stormwater Ordinance (13.54)
N7	Spill Contingency Plan	☐	☒	No hazardous materials are expected to be stored onsite.
N8	Underground Storage Tank Compliance	☐	☒	No proposed USTs
N9	Hazardous Materials Disclosure Compliance	☐	☒	Not applicable to single-family residences

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 hazardous materials are expected to be stored onsite.
N11	Litter/Debris Control Program	☒	☐	Homeowners are responsible to ensure litter and debris are regularly collected and disposed of properly. Regular CFD Maintenance of common and public areas
N12	Employee Training	☐	☒	No employees.
N13	Housekeeping of Loading Docks	☐	☒	No Loading Docks
N14	Catch Basin Inspection Program	☒	☐	CFD is responsible for inspection.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☐	☒	There are no parking lots or private streets included as part of the project.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	
N17	Comply with all other applicable NPDES permits	☒	☐	A SWPPP will be prepared and followed during construction in compliance with the General Construction Permit.

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)	☒	☐	The top of the under-sidewalk drains and catch basins will be painted with a stencil stating "No Dumping, Drains to river", blue on a white background with lettering 2-1/2" in height. - see Catch Basin Marker Exhibit in Attachment C. Legibility will be checked and repainted annually.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor storage areas
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☐	☒	This project does not propose any trash or waste storage areas. Homeowners are responsible for litter control on individual lots.
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)	☒	☐	Irrigation methods shall be utilized to minimize runoff of excess irrigation water across impervious surfaces and into the stormwater conveyance system. Such measures include employing rain-triggered shutoff devises to eliminate or reduce irrigation during and immediately after precipitation, using mulches (such as wood chips) to minimize sediment in runoff and to maintain soil Infiltration capacity, and coordinating design of the irrigation system and landscape to minimize overspray and runoff. Irrigation systems shall use flow reducers or shutoff valves triggered by pressure drop to control water loss in the event of broken sprinkler heads or water supply lines. Water conservation devices such as programmable irrigation timers and soil moisture sensors shall also be considered. Please see the separate installation and maintenance plan by the landscape architect for this project (applicable sheets included in Attachment D). Scrap pipe and extra materials shall be recycled if possible. All non-recyclable wastes shall be landfilled. Hazardous wastes shall be disposed of per County hazardous material disposal regulations.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Where grades allow, finish grade of landscape will be at a minimum of 1-2 inches below top of curb, sidewalk, or pavement. This will be addressed on the Precise Grading Plan, and a detail shown on the WQMP Exhibit.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	This BMP to protect slopes and channels is to be installed at the same time as the grading of infiltration basins and is to be maintained by the CFD, conditioned upon acceptance of those improvements by the City. It should be inspected annually and slope deterioration or damage is to be repaired as soon as possible. This BMP to provide energy dissipation is to be installed at the same time as site grading and is to be maintained by the CFD. It should be inspected annually and missing stones are to be replaced.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered dock areas
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered maintenance bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No covered outdoor processing areas
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No Hillside areas
S14	Wash water control for food preparation areas	☐	☒	No food preparation areas
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks

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: Roads and sidewalks are reduced to the minimum allowable by City and Fire Department standards.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Large open spaces are proposed that will maximize natural infiltration, including the park (1.7 acres) and the groves surrounding the lots (approximately 6.6 acres).
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Drainage pattern and time of concentration have been preserved.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Roof runoff drains to landscaping.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: All areas will be developed
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: All areas that are not proposed hardscape or building will be planted and irrigated, with the exception of back yards.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: No heavy equipment shall be used during construction in the basins.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Due to grade restrictions and hardscape features, it is not feasible to use vegetated swales (minimum side yard setbacks prevent exclusive use of swales; area drains and pipe will be used for lot drainage). Flows from streets are transmitted to the basins via a curb and gutter system.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: The Precise Grading Plan (included in Attachment D) will include measures to reduce unnecessary compaction in common open space areas where feasible, specifically where infiltration basins will be constructed.

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): 1,675,845	**2** Imperviousness after applying preventative site design practices (Imp%): 32%	**3** Runoff Coefficient (Rc): 0.24 *$R_c = 0.858(Imp\%)^{3}-0.78(Imp\%)^{2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): **0.493** *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.73 *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): 48,029 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 2 (ft^2): n/a	**2** Imperviousness after applying preventative site design practices (Imp%): %	**3** Runoff Coefficient (Rc): 0. *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): *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): n/a *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 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://sbcounty.permitrack.com/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 5 – Item 2*	**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 14 * 0.95) – Item 13*								

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

Compute peak runoff for pre- and post-developed conditions **(see hydrology calcs attached)**

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 (ft^2) *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 & 2)

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:

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 9 below.

8 Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒

If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.
If no, then proceed to Item 9, below.

9 All answers to Item 1 through Item 6 are "No":

Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.
Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

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

Form 4.3-2 Site Design Hydrologic Source Control BMPs

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	
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	
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (for paver voids: 10% of 4" depth)			
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 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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 20-2. If no, proceed to Item 24*	DA 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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 barrels/cisterns: Yes☐ No ☒ *If yes, complete Items 27-28; If no, proceed to Item 29*	DA 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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).

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): **48,029** *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 A BMP Type Infiltration Basin	DA DMA 1 BMP Type		
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*	7.09			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.5			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	4.0			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	4.0			
8 Infiltrating surface area, SA_{BMP} (ft²) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	9900			
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*	2.0			
10 Amended soil porosity	30%			
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	-			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3			
14 Above Ground Retention Volume (ft³) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	54,314			
15 Underground Retention Volume (ft³) *(volume determined using manufacturer's specifications and calculations*	-			

16 Total Retention Volume from LID Infiltration BMPs: 54,314 CF *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 0% (over) *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.3 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 cf

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 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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 n/a *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 and 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);

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): 0 *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.* Pathogens, Nitrogen, Sediment, Oil & Grease, Trash/Debris, Pesticides/Herbicides	
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*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain (infiltration) ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 0 *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): 0 *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): n/a *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.*		

- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

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 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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*	*Pathogens, Nitrogen, Sediment, Oil & Grease, Trash/Debris, Pesticides/Herbicides*	*Pathogens, Nitrogen, Sediment, Oil & Grease, Trash/Debris, Pesticides/Herbicides*	
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: 0 sf *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 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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*			

Form 4.3-8 Flow Based Biotreatment (DA 2)

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA 1 DMA A BMP Type	DA 1 DMA B BMP Type	DA 1 DMA C BMP Type
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 1-4 (ft^3): 48,029 *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): 54,314 *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): 0.0 *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 & 2)

1 Volume reduction needed for HCOC performance criteria (ft^3): not applicable
*(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): **0** *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): 0 *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *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	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Education of Property Owners, Tenants, and Occupants on Stormwater BMP's	Developer	The Education of Property Owners BMP will begin when homes are sold. Practical informational materials are provided in this document in Attachment C. These include County of San Bernardino's pamphlets on BMPs and stormwater quality which include general good housekeeping practices that contribute to protection of stormwater quality, and BMPs that eliminate or reduce pollution during property improvements (concrete work, etc). These materials will be made available by the Developer when a new home is purchased with timely distribution at project completion with annual updates thereafter.	Annually
Landscape Management BMPs	Developer & CFD	Implementation of Landscape Management is the responsibility of the CFD, conditioned upon acceptance of improvements by the City, beginning after completion of all site construction and as defined in the CFD, and generally including inspection of basins and inlets before the wet season and after each storm, with cleanup on an as-needed basis.	Weekly for the Developer, then Per CFD
BMP Maintenance (infiltration basins)	Developer & CFD	Implementation of Infiltration Maintenance is the responsibility of the CFD, conditioned upon acceptance of improvements by the City, beginning after completion of all site construction and as defined in the CFD, and generally including inspection of basins and inlets before the wet season and after each storm, with cleanup on an as-needed basis.	Weekly for the Developer, then Per CFD
Litter / Debris Control Program	Developer & CFD	Implementation of the litter/Debris Control Program is the responsibility of the Developer until the CFD takes over, , conditioned upon acceptance of improvements by the City, beginning after completion of all site construction and as defined in the CFD, Homeowners are responsible for litter and debris control on their lot.	Weekly for the Developer, then Per CFD
Catch Basin Inspection	Developer & CFD	Implementation of Catch Basin Inspection is the responsibility of the Developer until the CFD takes over, conditioned upon acceptance of improvements by the City, beginning after completion	Weekly for the Developer,

		of all site construction and as defined in the CFD, and generally including inspection of inlets before the wet season and after each storm, with cleanup on an as-needed basis. Note that filter inserts for trash, sediment and fossil fuels are required and will be installed in each Catch Basin.	then Per CFD
Provide Storm Drain System Stenciling and Signage	Developer & CFD	Implementation of Storm Drain System Stenciling and Signage is the responsibility of the Developer until the CFD takes over, conditioned upon acceptance of improvements by the City, beginning after completion of all site construction and as defined in the CFD, and generally including refreshing of signs on an as-needed basis.	Annually for the Developer, then Per CFD
Protect Slopes and Channels and Provide Energy Dissipation	Developer & CFD	Implementation of Slopes and Channels Protection and Energy Dissipation is the responsibility of the Developer until the CFD takes over, conditioned upon acceptance of improvements by the City, beginning after completion of all site construction and as defined in the CFD,	Quarterly for the Developer, then Per CFD

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.

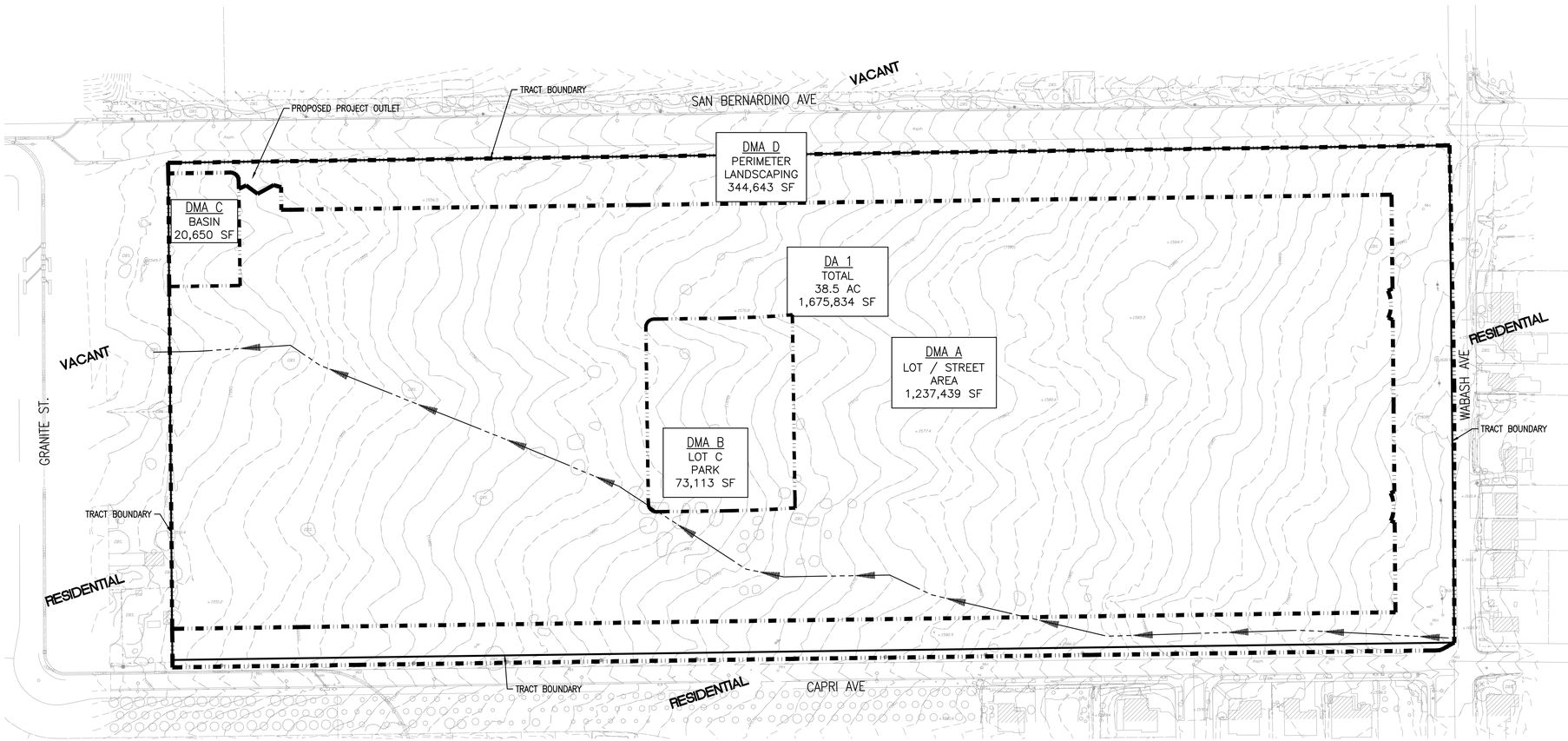
6.4 Other Supporting Documentation

- BMP Educational Materials
- Conceptual Landscape Plan

Attachment A

WQMP Site Plan

TRACT 20473
EXISTING CONDITIONS MAP



GRAPHIC SCALE

100 0 50 100 200

(IN FEET)

1 INCH = 100 FT.

LEGEND

TB	–	TRACT BOUNDARY
PL	–	PROPERTY LINE
R/W	–	RIGHT OF WAY
CL	–	CENTERLINE
EP	–	EDGE OF PAVEMENT
TC		TOP OF CURB
FL	–	FLOWLINE
FS	–	FINISHED SURFACE
GB	–	GRADE BREAK
INV	–	PIPE INVERT
FG	–	FINISH GRADE
ES	–	EXISTING SURFACE
EG	–	EXISTING GROUND
PAD	–	PAD ELEVATION
FF	–	FINISH FLOOR ELEVATION
GF	–	GARAGE FLOOR ELEVATION
HP	–	HIGH POINT
TRW	–	TOP OF RETAINING WALL
TF	–	TOP OF FOOTING
97.61	–	INDICATES PROPOSED ELEVATION
(97.61)	–	INDICATES EXISTING ELEVATION
———SD———		PROPOSED STORM DRAIN
———SD———		EXISTING STORM DRAIN
———W———		PROPOSED WATER LINE
———W———		EXISTING WATER LINE
———F———		PROPOSED FIRE LINE
———F———		EXISTING FIRE LINE
———S———		PROPOSED SEWER LINE
———S———		EXISTING SEWER LINE
		PROPERTY LINE
		RIGHT-OF-WAY
		CENTERLINE
		LIMITS OF SUBAREA

Underground Service Alert

CALL TOLL FREE 1–800 227–2600

TWO WORKING DAYS BEFORE YOU DIG

ENCOMPASS ASSOCIATES, INC.

CONSULTING CIVIL ENGINEERS
5699 COUSINS PLACE
RANCHO CUCAMONGA, CA 91737
(909) 684-0093

Prepared Under The Supervision Of :
Date _____

Aaron T. Skeers, RCE 62183 Expires 9-30-23

REGISTERED PROFESSIONAL ENGINEER
AARON THOMAS SKEERS
No. 62183
Exp: 9-30-23
CIVIL
STATE OF CALIFORNIA

Letter	Description	Date	Initial	Initial

Revisions

CITY OF REDLANDS
Municipal Utilities and Engineering Department

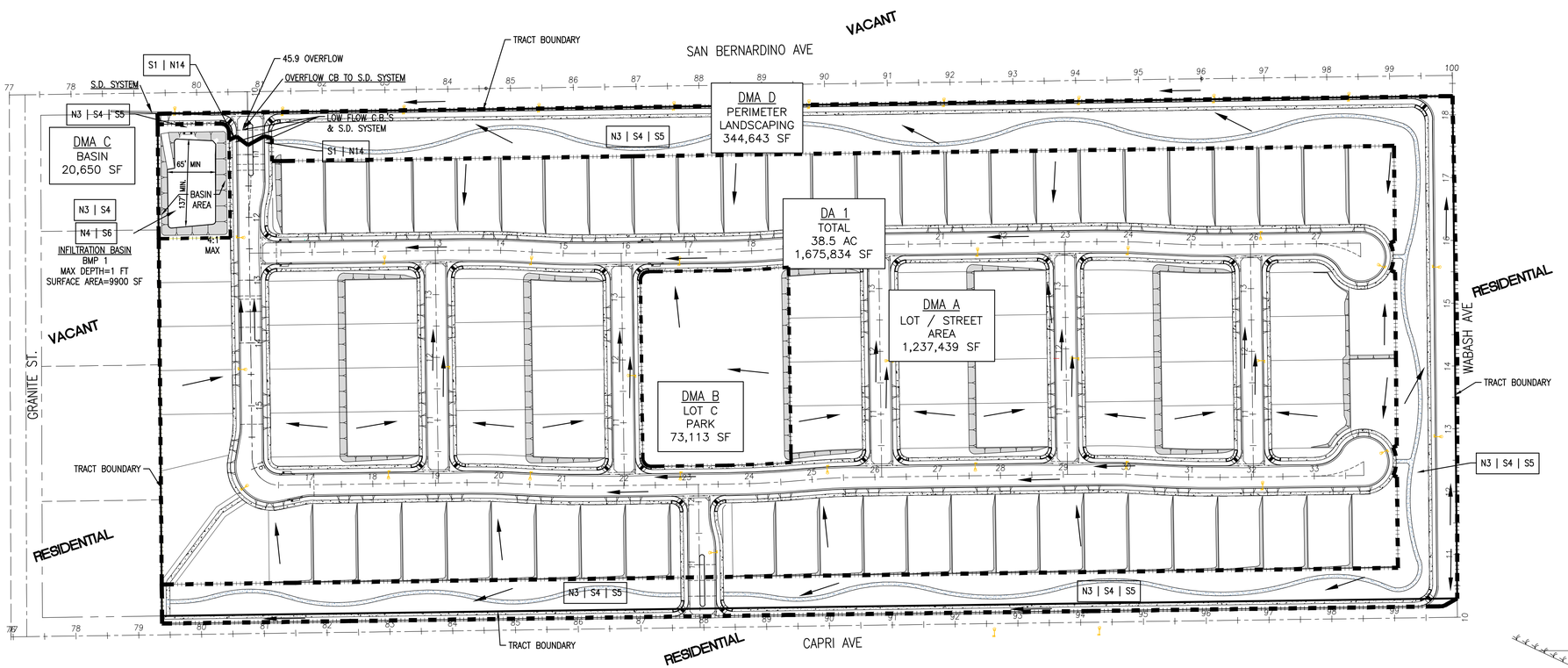
EXISTING CONDITIONS MAP

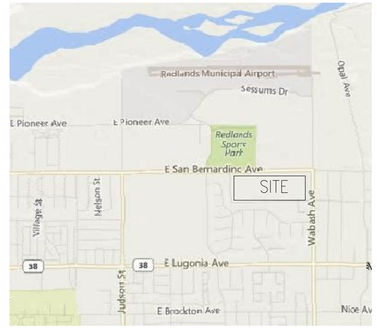
TRACT 20473

Checked by: _____
Date: _____
Checked by: _____
Date: _____
Checked by: _____
Date: _____
Checked by: _____
Date: _____

Sheet 1 of 1 Sheets

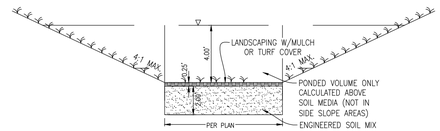
TRACT 20473
WQMP SITE PLAN





VICINITY MAP
SCALE: 1" = 2000'

GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 INCH = 100 FT.



INFILTRATION BASIN - BMP 1
1"=5'

ENGINEERED SOIL MEDIA SPECIFICATION					
COMPOSITION	SAND	SANDY LOAM			COMPOST
		SAND	SILT	CLAY	
VOLUME	65%	20%			15%
WEIGHT	75–80%	10% MAX	3% MAX	5% MAX	

- COMPACTION TO BE NO GREATER THAN 85% AT LANDSCAPED AREAS
- REFER TO LANDSCAPE PLANS FOR PLANT SPECIFICATIONS

LEGEND

TB	–	TRACT BOUNDARY
PL	–	PROPERTY LINE
R/W	–	RIGHT OF WAY
CL	–	CENTERLINE
EP	–	EDGE OF PAVEMENT
TC		TOP OF CURB
FL	–	FLOWLINE
FS	–	FINISHED SURFACE
GB	–	GRADE BREAK
INV	–	PIPE INVERT
FG	–	FINISH GRADE
ES	–	EXISTING SURFACE
EG	–	EXISTING GROUND
PAD	–	PAD ELEVATION
FF	–	FINISH FLOOR ELEVATION
GF	–	GARAGE FLOOR ELEVATION
HP	–	HIGH POINT
TRW	–	TOP OF RETAINING WALL
TF	–	TOP OF FOOTING
97.61	–	INDICATES PROPOSED ELEVATION
(97.61)	–	INDICATES EXISTING ELEVATION
——SD——		PROPOSED STORM DRAIN
——SD——		EXISTING STORM DRAIN
——W——		PROPOSED WATER LINE
——W——		EXISTING WATER LINE
——F——		PROPOSED FIRE LINE
——F——		EXISTING FIRE LINE
——S——		PROPOSED SEWER LINE
——S——		EXISTING SEWER LINE
		PROPERTY LINE
		RIGHT–OF–WAY
		CENTERLINE
		LIMITS OF DMA

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CALL TOLL FREE 1–800 227–2600
TWO WORKING DAYS BEFORE YOU DIG

SOURCE CONTROL BMP LEGEND

IMPLEMENTATION OF ALL BMPS IS THE RESPONSIBILITY OF THE PROPERTY OWNER:

N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs
N2	Activity Restrictions
N3	Landscape Management BMPs
[N4]	BMP Maintenance
N6	Local Water Quality Ordinances
[N11]	Litter/Debris Control Program
N12	Employee Training
[N14]	Catch Basin Inspection Program
[N15]	Vacuum Sweeping of Private Streets and Parking Lots
N17	Comply with all other applicable NPDES permits
[S1]	Provide storm drain system stenciling and signage
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control
[ ]	"BOXED" Item above indicates item is shown on plan and is applicable to that location (typically)

STRUCTURAL BMP SUMMARY TABLE

REF.	DMA/BMP ID	DESCRIPTION	DCV	V–PROVIDED
1	A/1	INFILTRATION BASIN	48,029 CF	54,314 CF

STRUCTURAL WQMP BMP MAINTENANCE

REF.	DESCRIPTION	TASK	SCHEDULE	BY
1	INFILTRATION BASIN	INSPECT/ CLEAN	MONTHLY	OWNER

SUITABILITY OR FEASIBILITY CONSTRAINTS:
- NONE

ENCOMPASS ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
5699 COUSINS PLACE
RANCHO CUCAMONGA, CA 91737
(909) 684-0093

Prepared Under The Supervision Of :
Date _____
Aaron T. Skeers, RCE 62183 Expires 9–30–23

REGISTERED PROFESSIONAL ENGINEER — AARON THOMAS SKEERS — No. 62183 — Exp: 9–30–23 — CIVIL — STATE OF CALIFORNIA

Letter	Description	Date	Initial	Initial

Revisions

CITY OF REDLANDS
Municipal Utilities and Engineering Department

WQMP SITE PLAN

TRACT 20473

Checked by: _____ Date: _____
Checked by: _____ Date: _____
Checked by: _____ Date: _____
Checked by: _____ Date: _____

Sheet 1 of 1 Sheets

Catch Basin Marker

Overall diameter to be 4 inches (minimum) in Blue Paint, with White Paint Background:

Attachment B

Infiltration Test Investigation

REPORT OF TWO DOUBLE RING INFILTROMETER TESTS SOUTHWEST CORNER OF SAN BERNARDINO AVENUE AND WABASH AVENUE CITY OF REDLANDS SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 1129-C18
REPORT NO.: 1

APRIL 6, 2018

SUBMITTED TO:

URBAN ENVIRONS
307 BROOKSIDE AVENUE
REDLANDS, CA 92373

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
786 SOUTH GIFFORD AVENUE
SAN BERNARDINO, CA 92408

HILLTOP GEOTECHNICAL
INCORPORATED

786 S. GIFFORD AVENUE • SAN BERNARDINO • CALIFORNIA 92408
hilltopg@hgeotech.com • FAX 909-890-9055 • **909-890-9079**

April 6, 2018

Urban Environs
307 Brookside Avenue
Redlands, CA 92373

Project No.: 1129-C18
Report No.: 1

Attention: Mr. Patrick J. Meyer - AICP

Subject: **Report of Two Double Ring Infiltrometer Tests, Southwest Corner of San Bernardino Avenue and Wabash Avenue, City of Redlands, San Bernardino County, California.**

In accordance with your request, **Hilltop Geotechnical, Inc.** has performed two double ring infiltrometer tests on the northwest portion of the property, approximately 300 feet east of Granite Street on the south side of San Bernardino Avenue, in the City of Redlands. Submitted herein are results of the findings and conclusions.

We appreciate the opportunity to provide geotechnical services on this project. Should you have any questions regarding this submittal, please do not hesitate to contact us.

Respectfully submitted,
HILLTOP GEOTECHNICAL, INC.

Mark Hulett, C.E.G. 1623
President

Ashley Hulett, GEO No. 9533
Staff Geologist

MH/ah

HILLTOP GEOTECHNICAL, INC.

Attachments:

Distribution:

(4) Submitted to addressee
via US Postal Service
(1) pdf copy via E-Mail
Attn: Mr. Patrick Meyer (environspm@gmail.com)
Attn: Mr. Dan Guerra (info@dgandassoc.com)

REPORT OF TWO DOUBLE RING INFILTROMETER TESTS SOUTHWEST CORNER OF SAN BERNARDINO AVENUE AND WABASH AVENUE CITY OF REDLANDS SAN BERNARDINO COUNTY, CALIFORNIA

LOCATION OF THE PROJECT SITE

This report presents the results of our infiltrometer testing conducted on the subject site for two (2) locations on the northwest portion of the property. The site is located on the southwest corner of San Bernardino Avenue and Wabash Avenue, in the City of Redlands, San Bernardino County, California. The general location of the subject site is indicated on the 'Site Location Map', Figure No. 1.

SITE DESCRIPTION

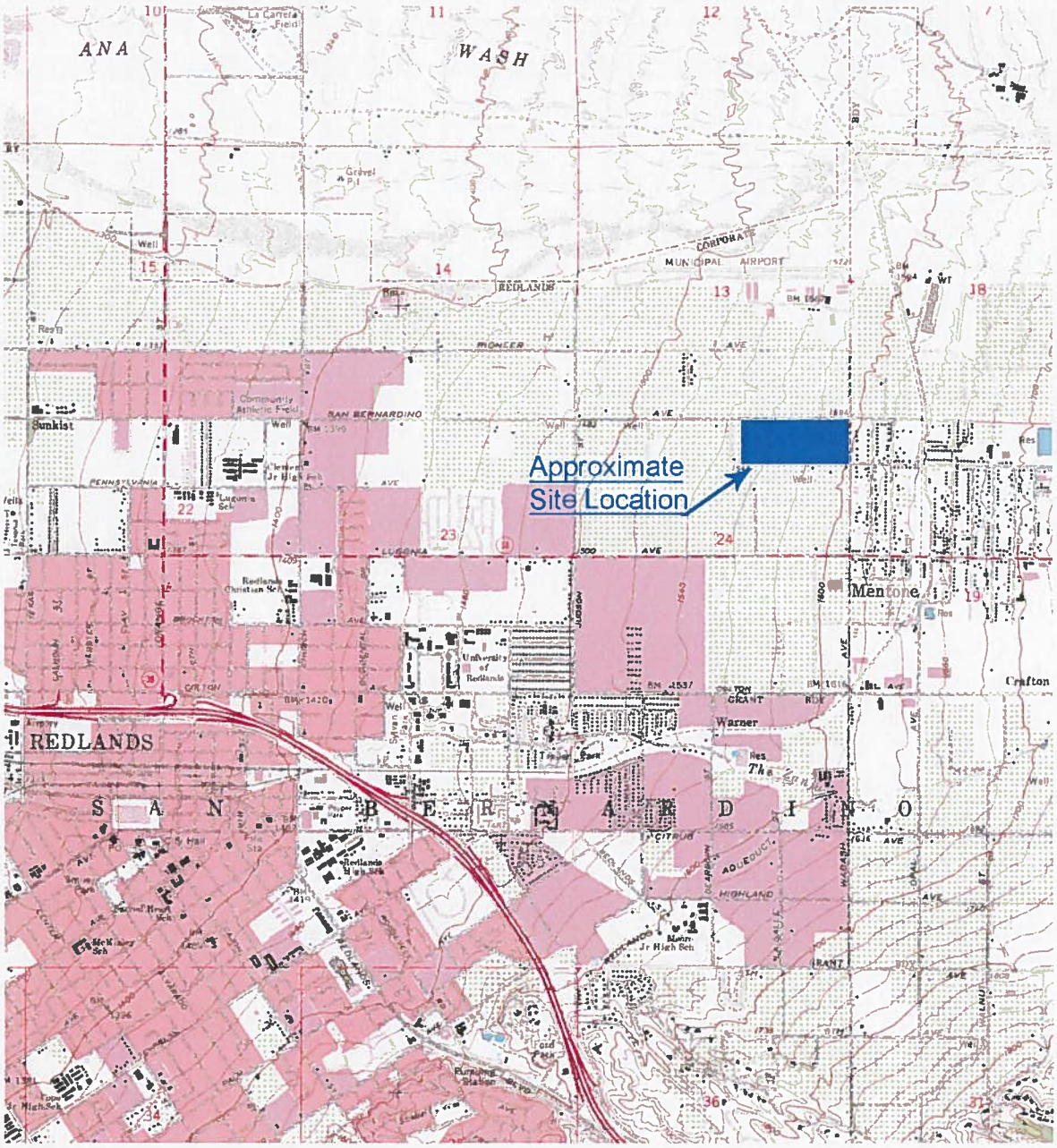
The site was generally vacant land. A few remnant concrete water supply lines, suggesting past orchard use, were located within rows across the site. A few mature trees were located randomly throughout the property. The land was generally flat, and appeared to had been recently disked. Wildflowers were blossoming at the time of field testing.

LOCATION OF INFILTROMETER TESTING

Infiltrometer testing was conducted on the northwest portion of the site at a depth of approximately 10.0 feet below the existing site grades, per the request of Mr. Dan Guerra of Dan Guerra & Associates. A backhoe was used to excavate down to the required depth and proposed bottom elevation of the future system. Due to the coarse grained nature of the materials encountered, the rings were manually hand dug and placed approximately six inches into the ground. The approximate infiltrometer test locations are shown on the 'Infiltrometer Test Location Plan', Plate No. 1.

SOIL CHARACTERISTICS OF THE SUBJECT SITE

- The soil characteristics for the subject site are defined as favorable.



Reference: **United States Department of the Interior, Geologic Survey**, 1967, Photorevised 1988, *Redlands Quadrangle, California, San Bernardino Co.,* 7.5 Minute Topographic Series, Scale 1:24,000.

HILLTOP GEOTECHNICAL
INCORPORATED

SITE LOCATION MAP	
By: AH	Date: 04/2018
Project No.: 1129-C18.1	Figure No.: 1

- There was no visible evidence of shallow groundwater or impervious bedrock materials.

- Current depth to groundwater data for the site area was available through the **California Department of Water Resources** internet web site. The depth to groundwater in State Well No. 01S03W13P001S, located approximately 1,500 feet northwest of the site, was at a depth of 254.7 feet below the ground surface at the well location on December 6, 2017. The surface elevation of this well is approximately 25 feet lower (topographically) than that of the site.

- Historic depth to groundwater data for the site was available for the site by a review of available groundwater contour maps. The map was interpreted to indicated the historical minimum depth to groundwater in the general area has been approximately 100 feet (1985, Matti and Carson).

- Tests performed agreed with visual evidence.

- The natural slope of the ground surface above the proposed water infiltration areas are less than a 2.0 percent gradient.

- Soil conditions for the on-site, water infiltration systems were acceptable in both tested areas.

Soil Profile

- Percolation Hole No. 1: Infiltrometer test (P-1) was located in the northwestern portion of the site and was tested in alluvial deposits. Fill was encountered to a depth of approximately 1.5 feet below existing grade. The fill encountered was a brown, silty fine to coarse grained sand, with a trace of gravel and cobbles (SM) that contained deleterious debris and areas that were loose and locally burrowed. Underlying the fill was generally coarse grained gray to brown alluvium, slightly silty, fine to coarse sand, with little gravel, a little cobbles and a trace of boulders up to fifteen inches in length. A backhoe was used to excavate materials down to a depth of approximately 10.2 feet below existing site grades. A bench was made for safety at a depth of approximately six feet. The trench dimensions were approximately 20 feet by 20 feet by 10 feet in depth due to the cavey coarse nature of the alluvium. The bottom of the test hole was

classified in general accordance with the Unified Soil Classification System as an (SP/SM). After testing was conducted the materials were backfilled with a backhoe.

- Percolation Hole No. 2: Infiltrometer test (P-2) was conducted approximately 120 feet south of infiltrometer test P-2 at a depth of 10 feet below the existing site grade. A backhoe was used for the excavation and backfill process. Artificial fill was found in the upper approximate 2.0 feet of the trench and was classified as a silty, fine to coarse sand, trace gravel, trace cobbles (SM). Native alluvial soils were encountered under the fill and consisted of interbedded light brown to gray brown, moist, slightly silty, fine to coarse sand, with a little gravel, little cobbles and a trace of boulders up to fifteen inches in length. It was noted that cross bedding was observed from approximately 8 feet to 10 feet within the trench walls. The beds were thin and consisted of coarse gained sands and fine to medium grained sand with traces of cobbles. The bottom of the test hole was classified in general accordance with the Unified Soil Classification System as an (SP/SM).

- No large plants or roots were encountered in the infiltrometer test areas.

- There were no wet or saturated soils encountered in the infiltrometer test areas.

- No groundwater was encountered within our infiltrometer test areas.

INFILTROMETER TEST PROCEDURES

Testing was performed in general accordance with ASTM D 3385 procedures. This method consists of driving two (2) open cylinders, one inside the other, into the ground, partially filling the rings with water, maintaining the water at a constant level, and measuring the volume of water required to maintain the constant level. The steel rings used for this project had nominal inside diameters of 11.75 inches and 23.75 inches. The volume of water added to the inner ring to maintain a constant liquid level was the measure of the volume of liquid that infiltrates into the soil. The volume

infiltrated during timed intervals was converted to an incremental infiltration velocity expressed in centimeters per hour, and the results were plotted on a graph versus elapsed time, as shown on Plate Nos. 4 & 5 attached to the rear of this report.

Test locations and depths were chosen by Mr. Dan Guerra of Dan Guerra & Associates prior to testing. The backhoe was used to excavate a safe trench to an approximate depth of 10 feet with the bottom of the trench having an area of similar diameter of the rings. The outer and inner infiltrometer rings were then hand dug and pressed into place to a depth of 6.0 inches into the subsurface. Upon excavation, hand tools were used to prepare a smooth, flat test site free of loose, disturbed, and smeared soils.

Clear municipal water, was poured into the rings while using protective cardboard sheeting to prevent splashing and disturbance of the soil boundary. The pre-selected water test depth was approximately 6.0 inches (15.24cm). Initially, water levels were maintained within 5.0 millimeters of this depth during the test by periodic additions from 1000 milliliter graduated cylinder. However, the rates were fast and additions by use of 5 gallon water bottles were used for measurements. The apparatus was covered with cardboard to minimize evaporative losses from the sun, and protected from the half an hour rain that occurred on the day of testing. No significant wind occurred on the day of testing.

INFILTROMETER TEST RESULTS

The infiltration rates were similar between test holes with a slightly faster rate obtained from infiltration test P-2. The calculated average and steady state rates of the inner-ring infiltration rates and outer-ring infiltration rates can be found below in the tabled results.

	Average Inner Ring Infiltration Rate		Average Outer Ring Infiltration Rate	
	cm/hr	in/hr	cm/hr	in/hr
P-1	21.29	8.39	24.75	9.75
P-2	26.30	10.36	31.20	12.29

	Steady State Inner Ring Infiltration Rate		Steady State Outer Ring Infiltration Rate	
	cm/hr	in/hr	cm/hr	in/hr
P-1	17.99	7.09	18.91	7.45
P-2	24.72	9.74	26.32	10.37

DISCUSSION

The site was located approximately 4,000 feet south of the Santa Ana River and this area of Redlands is commonly underlain by moderately coarse grained alluvial deposits that primarily consist of interbedded sightly silty fine to coarse grained sands with various amounts of gravels, cobbles, and boulders. The rates presented above are generally consistent with the soil classifications in each area tested. Slightly faster infiltrometer rates were obtained in infiltration test P-2. The faster rates were influenced by finer coarse- grained materials beneath the testes area. The less surface area of rock just beneath the test can lead to slightly faster infiltration rates. Infiltration test P-1 also contained a slightly higher amount of silts. Generally, the finer grained the materials the slower the percolation test results. Typically, the inner ring is the most accurate and the slowest of the inner ring rates should be utilized in the design process.

Field infiltration tests are subject to many factors that affect the infiltration rate, including soil texture, the condition of the soil surface, soil-moisture tension or the degree of saturation, the temperature of the water and soil, the percentage of entrapped air in the soil, and the head of the applied water.

INFILTRATION BASIN RECOMMENDATIONS

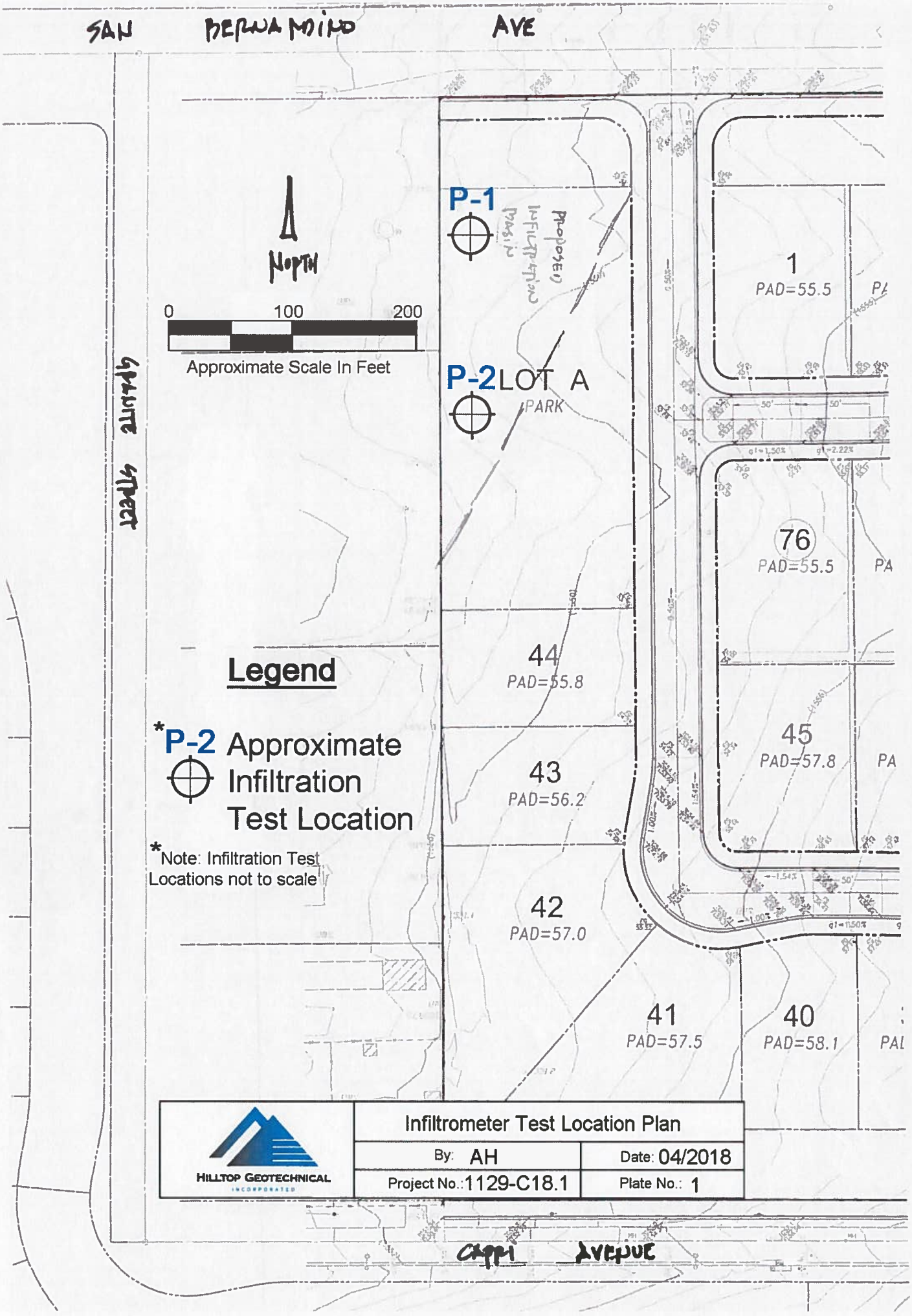
Infiltration testing in the proposed infiltration areas indicated percolation rates that appear to be consistent with respect to there respective on-site soil classification. The Project Civil Engineer should evaluate this information for final infiltration design.

Caution should be used in determining a percolation rate for any proposed infiltration basin or structure. Eventual siltation, water-borne silt from irrigation and

precipitation runoff, and the accumulation of organic material in surface soils due to landscape grass and plant growth, can drastically reduce percolation rates over time. We recommend that suitable methods to prevent siltation be considered in the project design.

CLOSURE

Findings of this report were prepared in accordance with generally accepted professional engineering principles and practice in the field of soil mechanics. The conclusions are based on results of field exploration and testing. If conditions are encountered during construction that appear to be different than those indicated by this report, this firm should be notified.



HILLTOP GEOTECHNICAL INCORPORATED	Infiltrometer Test Location Plan	
	By: AH	Date: 04/2018
	Project No.: 1129-C18.1	Plate No.: 1

INFILTROMETER TEST **P-1** DATE OF TEST 21-Mar-18 DEPTH OF

PROJECT IDENTIFICATION: 1129-C18.1 AREA(CM2) LIQUID (CM)

TEST LOCATION: NORTH INNER 699.6 INNER 15.24

LIQUID USED: Municipal H20 OUTER 2128.5 OUTER 15.24

TESTED BY AH LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)

DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **21.29** IN/H **8.39**

OUTER RING AVERAGE RATE CM/H **24.75** IN/H **9.75**

Increment No.	DATE	TIME START= 11:45 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	FLOW READINGS OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	INCREMENTAL INFILTRATION RATE ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	INCREMENTAL INFILTRATION RATE ANNULAR IN/H	GROUND TEMP = 69 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	21-Mar-2018	12:00	15	5,530	20,340	65	31.62	38.22	12.46	15.06	68, Cloudy
2	21-Mar-2018	12:15	15	3,740	18,510	65	21.38	34.79	8.43	13.71	68, Cloudy
3	21-Mar-2018	12:30	15	3,550	11,850	66	20.30	22.27	8.00	8.77	68, Cloudy
4	21-Mar-2018	12:45	15	4,460	13,570	66	25.50	25.50	10.05	10.05	68, Cloudy
5	21-Mar-2018	1:15	30	6,830	24,440	66	19.53	22.96	7.69	9.05	68, Cloudy
6	21-Mar-2018	1:45	30	7,930	29,930	66	22.67	28.12	8.93	11.08	67, Drizzling
7	21-Mar-2018	2:45	60	10,960	37,850	66	15.67	17.78	6.17	7.01	70, Cloudy
8	21-Mar-2018	3:45	60	13,440	40,850	67	19.21	19.19	7.57	7.56	71, Cloudy
9	21-Mar-2018	4:45	60	12,980	41,675	67	18.55	19.58	7.31	7.71	70, Cloudy
10	21-Mar-2018	5:45	60	12,950	40,590	67	18.51	19.07	7.29	7.51	70, Cloudy

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	18.91	17.99	7.45	7.09

INFILTROMETER TEST **P-2** DATE OF TEST 21-Mar-18 DEPTH OF

PROJECT IDENTIFICATION: 1129-C18.1 AREA(CM2) LIQUID (CM)

TEST LOCATION: SOUTH INNER 699.6 INNER 15.24

LIQUID USED: Municipal H20 OUTER 2128.5 OUTER 15.24

TESTED BY AH LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)

DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **26.30** IN/H **10.36**

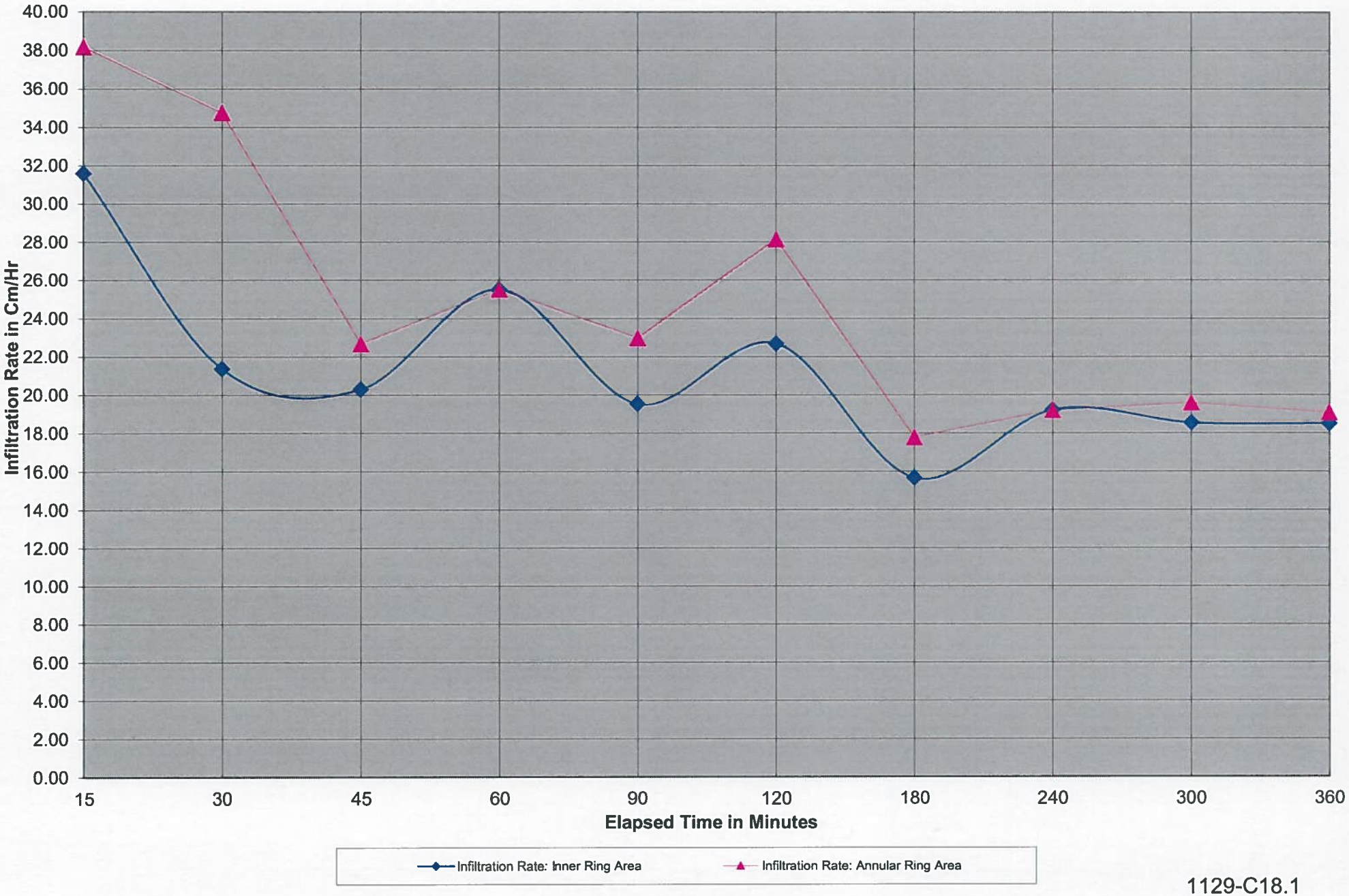
OUTER RING AVERAGE RATE CM/H **31.20** IN/H **12.29**

Increment No.	DATE	TIME START= 12:22 PM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	FLOW READINGS OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	INCREMENTAL INFILTRATION RATE ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	INCREMENTAL INFILTRATION RATE ANNULAR IN/H	GROUND TEMP = 69 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	21-Mar-2018	12:37	15	6,000	25,930	66	34.31	48.73	13.52	19.20	68, Cloudy
2	21-Mar-2018	12:52	15	4,900	18,950	66	28.02	35.61	11.04	14.03	67, Cloudy
3	21-Mar-2018	1:07	15	4,000	17,280	66	22.87	32.47	9.01	12.79	67, Cloudy
4	21-Mar-2018	1:22	15	4,575	14,170	66	26.16	26.63	10.31	10.49	68, Cloudy
5	21-Mar-2018	1:52	30	9,370	34,895	66	26.79	32.79	10.55	12.92	70, Drizzling
6	21-Mar-2018	2:22	30	9,100	32,450	66	26.01	30.49	10.25	12.01	70, Cloudy
7	21-Mar-2018	3:22	60	17,710	56,780	67	25.31	26.68	9.97	10.51	70, Cloudy
8	21-Mar-2018	4:22	60	16,960	55,480	67	24.24	26.07	9.55	10.27	70, Cloudy
9	21-Mar-2018	5:22	60	17,560	56,140	67	25.10	26.38	9.89	10.39	70, Cloudy
10	21-Mar-2018	6:22	60	16,940	55,650	67	24.21	26.15	9.54	10.30	70, Cloudy

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	26.32	24.72	10.37	9.74

PROPOSED INFILTRATION BASIN

Infiltration Graph: Infiltration Rate vs. Time



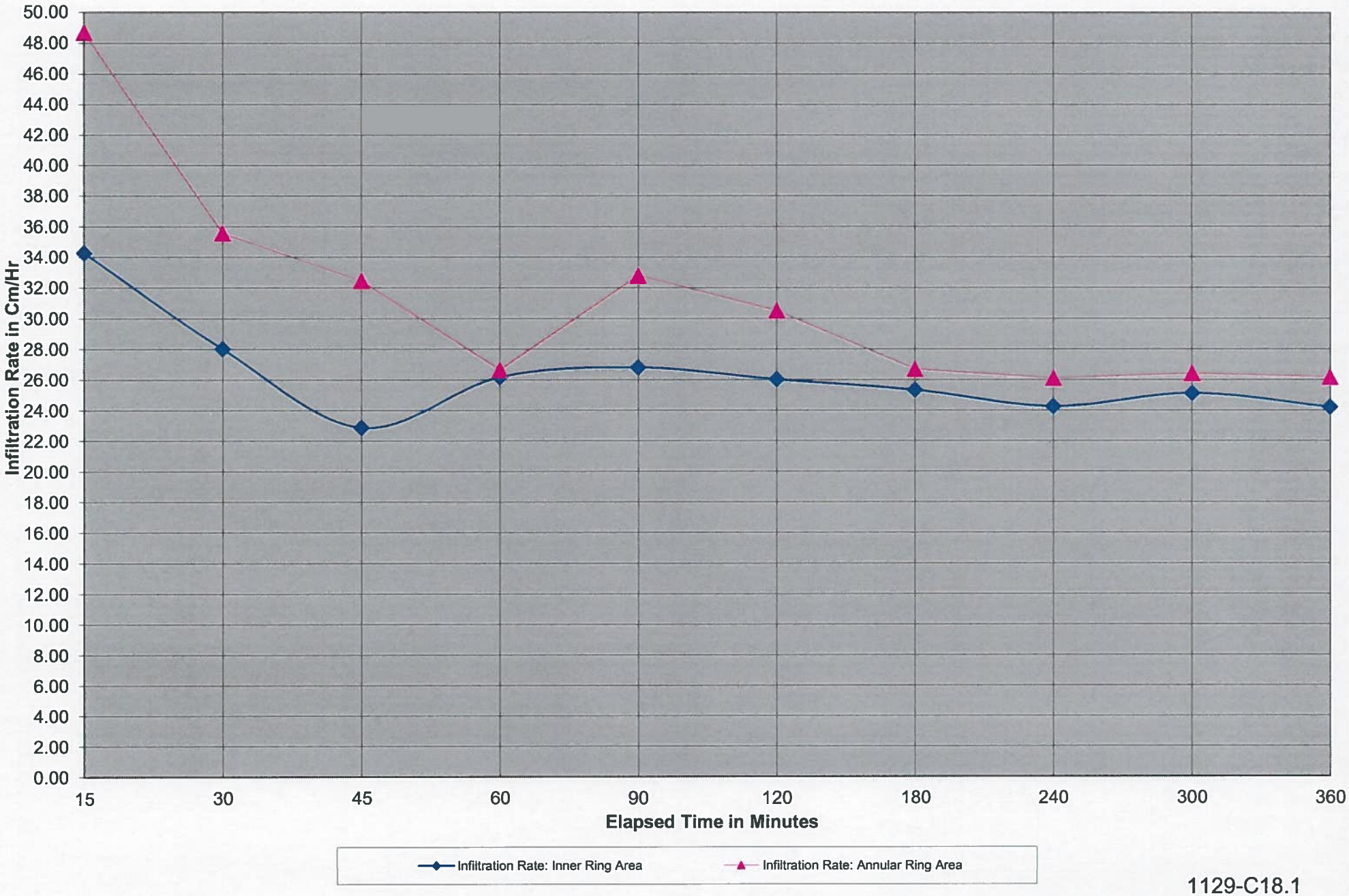
Hilltop Geotechnical, Inc.

INFITROMETER TEST P-1

1129-C18.1
Plate No. 4

PROPOSED INFILTRATION BASIN

Infiltration Graph: Infiltration Rate vs. Time



Hilltop Geotechnical, Inc.

INFITROMETER TEST P-2

1129-C18.1
Plate No. 5

Infiltration BMP - Infiltration Rate Factor of Safety
From Appendix D, TGD, Worksheet H

		Weight	Factor	Weighted Factor
A Suitability Assessment	Soil assessment methods	0.25	1	0.25
	Predominant soil texture	0.25	1	0.25
	Site soil variability	0.25	1	0.25
	Depth to groundwater / impervious layer	0.25	1	0.25
	Suitability Assessment Safety Factor, SA = Σp			1
B Design	Tributary area size	0.25	3	0.75
	Level of pretreatment/ expected sediment loads	0.25	2	0.5
	Redundancy	0.25	2	0.5
	Compaction during construction	0.25	1	0.25
	Design Safety Factor, SB = Σp			2

Combined Safety Factor, STOT= SA x SB 2

(Shall be between 2 and 9), SF= 2

Measured Infiltration Rate, inch/hr, KM 2 in/hr
(corrected for test-specific bias)

Design Infiltration Rate, in/hr, KDESIGN = KM/STOT **1.00** in/hr

Ultimate FS between 2 and 9

Attachment C

BMP Factsheets/Educational Material

(to be provided with final WQMP submittals)

Information to be provided:

Plain-language stormwater pollution fact sheets (From SB County), topics including paint, dog waste, pool maintenance, yard maintenance

CASQA Factsheets, inclulding: SD-10, SD-12, SD-13, TC-11

Attachment D

Reference Plans

(to be provided with final WQMP submittals)

Attachment E

WQMP Maintenance Agreement

(to be provided with final WQMP submittals)