



EDEN MIXED-USE

Preliminary Water Quality Management Plan (PWQMP)

Prepared for:
Orbis Schaefer, LLC & Clark Schaefer Partners, LLC
280 Newport Center Drive, Suite 240
Newport Beach, California 92660
949.688.6931

Prepared By
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Project Manager
Samantha Fabing, PE

Date Prepared: February 27, 2024

Project Number: 04126-001-01

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For:

Eden Mixed-Use

PL22-0074 (Special Conditional Use Permit) & PL22-0075 (Site Approval)

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Submittal Date: June 9, 2023

Revision Date: December 19, 2023

February 27, 2024

Approval Date: _____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Orbis Schaefer, LLC & Clark Schaefer Partners, LLC by Fuscoe Engineering, Inc.. The WQMP is intended to comply with the requirements of the City of Chino 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):	PL22-0074 PL22-0075	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	1052-581-03 & 1052-581-04	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1052-581-03 & 1052-581-04
Owner's Signature			
Owner Name: Grant Ross			
Title	Managing Partner		
Company	Orbis Schaefer, LLC & Clark Schaefer Partners, LLC		
Address	280 Newport Center Drive, Suite 240 Newport Beach, CA 92660		
Email	GRoss@OrbisREP.com		
Telephone #	949-688-6931		
Signature			Date

Preparer's Certification

Project Data			
Permit/Application Number(s):	PL22-0074 PL22-0075	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	1052-581-03 & 1052-581-04	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1052-581-03 & 1052-581-04

“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: Samantha Fabing		PE Stamp Below
Title	Project Manager	
Company	Fuscoe Engineering, Inc.	
Address	15535 Sand Canyon Ave, Suite 100 Irvine, CA 92618	
Email	sfabing@fuscoe.com	
Telephone #	(949) 474-1960	
Signature		
Date		

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Eden			
Project Owner Contact Name:		Grant Ross			
Mailing Address:	280 Newport Center Drive, Suite 240 Newport Beach, CA 92660	E-mail Address:	GRoss@OrbisREP.com	Telephone:	949-688-6931
Permit/Application Number(s):		PL22-0074 PL22-0075	Tract/Parcel Map Number(s):	1052-581-03 & 1052-581-04	
Additional Information/ Comments:		N/A			
Description of Project:		<p>The 7050 Schaefer Ave project is a proposed mixed-use development on an approximately 10.51-acre site. After dedications and deductions for public streets, including those on Fern Avenue, the site total is thus referred to as approximately 10.29-acres The project is located within the City of Chino, San Bernardino County, within a general commercial land use. The site is bounded on the south by Schaefer Avenue, on the east by Euclid Avenue, and on the west by Fern Avenue. The northern portion of the site is bounded by a private road and residential community. Single-family residential structures are located to the west and north, agricultural lots to the east, and a commercial center to the south.</p> <p>The proposed northerly private road's ownership is split between the northerly and southerly site. The drainage for this road follows the property line dividing the road and drains onsite for treatment.</p> <p>Infiltration for the project site is deemed infeasible for the westerly portion of the site (DA 1), due to an infiltration rate of 0.0 in/hr. Proprietary biotreatment systems will be used to treat the water quality flow rate, while a detention system will be used to mitigate HCOC and high flows.</p> <p>Infiltration for the project site is deemed preliminarily feasible for the easterly portion of the site (DA 2). An infiltration rate of 1.0 in/hr is assumed for the BMP design. After applying a safety factor of 3, a design infiltration rate of 0.33 in/hr is used. In final design, infiltration testing will be conducted at the location and depths of any proposed infiltration galleries. A retention system will be used to infiltrate the DCV, HCOC volume, and mitigate high flows.</p> <p>Treated flows will discharge to the proposed 42" storm drain in Schaefer Avenue, which will ultimately connect to an existing 60" storm drain Schaefer Avenue.</p>			
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.		N/A			

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project					
1 Development Category (Select all that apply):					
<input type="checkbox"/> Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input checked="" type="checkbox"/> New development involving the creation of 10,000 ft ² or more of impervious surface collectively over entire site	<input type="checkbox"/> Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	<input checked="" type="checkbox"/> Restaurants (with SIC code 5812) where the land area of development is 5,000 ft ² or more		
<input type="checkbox"/> Hillside developments of 5,000 ft ² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	<input type="checkbox"/> Developments of 2,500 ft ² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	<input checked="" type="checkbox"/> Parking lots of 5,000 ft ² or more exposed to storm water	<input type="checkbox"/> Retail gasoline outlets that are either 5,000 ft ² or more, or have a projected average daily traffic of 100 or more vehicles per day		
<input type="checkbox"/> Non-Priority / Non-Category Project <i>May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</i>					
2 Project Area (ft ²):	448,205 (10.29 acres)	3 Number of Dwelling Units:	282	4 SIC Code:	4225, 5812, 5999
5 Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					
6 Does Project include roads? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)</i>					

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
Orbis Schaefer, LLC & Clark Schaefer Partners, LLC 280 Newport Center Drive, Suite 240 Newport Beach, CA 92660 Phone: 949-688-6931 Contact: Grant Ross

2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern		
Pollutant	Please check: E=Expected, N=Not Expected	Additional Information and Comments
Pathogens (Bacterial / Virus)	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Nutrients - Phosphorous	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Nutrients - Nitrogen	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Noxious Aquatic Plants	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Sediment	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Metals	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Oil and Grease	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Trash/Debris	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Pesticides / Herbicides	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report
Organic Compounds	E <input checked="" type="checkbox"/> N <input type="checkbox"/>	Will be provided with the final report

2.4 Water Quality Credits

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

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

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features			
Site coordinates <i>take GPS measurement at approximate center of site</i>	Latitude: 34.005598	Longitude: -117.65259	Thomas Bros Map: Page 682
<p>¹ San Bernardino County climatic region: <input checked="" type="checkbox"/> Valley <input type="checkbox"/> Mountain</p>			
<p>² Does the site have more than one drainage area (DA): Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached</i></p>			
<pre> graph TD OUTLET1[OUTLET #1] DETENTION1[DETENTION #1] RETENTION1[RETENTION #1] MWS1A[MWS #1A] MWS1B[MWS #1B] MWS1C[MWS #1C] MWS1D[MWS #1D] CDS2A[CDS #2A] CDS2B[CDS #2B] CDS2C[CDS #2C] DA1DMAA[DA 1 DMA A] DA1DMAB[DA 1 DMA B] DA1DMAC[DA 1 DMA C] DA1DMAD[DA 1 DMA D] DA2DMAA[DA 2 DMA A] DA2DMAB[DA 2 DMA B] DA2DMAC[DA 2 DMA C] DA1DMAA --> MWS1A DA1DMAB --> MWS1B DA1DMAC --> MWS1C DA1DMAD --> MWS1D MWS1A --> DETENTION1 MWS1B --> DETENTION1 MWS1C --> DETENTION1 MWS1D --> DETENTION1 DETENTION1 --> OUTLET1 DA2DMAA --> CDS2A DA2DMAB --> CDS2B DA2DMAC --> CDS2C CDS2A --> RETENTION1 CDS2B --> RETENTION1 CDS2C --> RETENTION1 RETENTION1 --> OUTLET1 </pre>			
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA		
DA 1 flows to MWS units, Detention #1, then Outlet 1	DA 1 will drain to MWS units to treat the water quality flow rate, then a detention system to mitigate HCOC and high flows before discharging to Outlet 1.		
DA 2 flows to CDS units, Retention #1, then Outlet 1	DA 2 will drain to retention system to infiltrate the DCV and HCOC volume, and mitigate high flows before discharging to Outlet 1.		

Form 3-2 Existing Hydrologic Characteristics		
For each Drainage Area's sub-watershed DMA, provide the following characteristics	A-1	A-2
1 DMA drainage area (ft ²)	237,838 (5.46 ac)	210,395 (4.83 ac)
2 Existing site impervious area (ft ²)	0	0
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	AMC I	AMC I
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/</i>	C	C
5 Longest flowpath length (ft)	707	412
6 Longest flowpath slope (ft/ft)	0.0113	0.0061
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Agricultural	Agricultural
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Good	Good

Form 3-3 Watershed Description for Drainage Area	
Receiving waters <i>Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See "Drainage Facilities" link at this website</i>	Cypress Channel Prado Basin Management Zone Chino Creek, Reach 1B Chino Creek, Reach 1A Santa Ana River, Reach 2 Santa Ana River, Reach 1 Pacific Ocean
Applicable TMDLs <i>Refer to Local Implementation Plan</i>	Cypress Channel: None Prado Basin Management Zone: None Chino Creek, Reach 1B: Indicator Bacteria Chino Creek, Reach 1A: Indicator Bacteria Santa Ana River, Reach 2: Indicator Bacteria Santa Ana River, Reach 1: Indicator Bacteria Pacific Ocean: None
303(d) listed impairments <i>Refer to Local Implementation Plan and Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website - http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml</i>	Cypress Channel: None Prado Basin Management Zone: pH Chino Creek, Reach 1B: Chemical oxygen demand (COD), Indicator Bacteria, Nutrients Chino Creek, Reach 1A: Indicator Bacteria, Nutrients Santa Ana River, Reach 2: None Santa Ana River, Reach 1: None Pacific Ocean: None
Environmentally Sensitive Areas (ESA) <i>Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/</i>	N/A
Unlined Downstream Water Bodies <i>Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/</i>	Santa Ana River
Hydrologic Conditions of Concern	<input checked="" type="checkbox"/> 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 <input type="checkbox"/> No (see attachment -- for applicability map)
Watershed-based BMP included in a RWQCB approved WAP	<input type="checkbox"/> Yes Attach verification of regional BMP evaluation criteria in WAP <ul style="list-style-type: none"> • 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 <input checked="" type="checkbox"/> 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Property owner will familiarize themselves with the educational materials in Attachment "C" and the contents of the WQMP.
N2	Activity Restrictions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No outdoor work, processing, storage, or wash areas.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Irrigation must be consistent with the local agency's Water Conservation Ordinance. Fertilizer and pesticide usage will be consistent with local agency's Management Guidelines for Use of Fertilizers and Pesticides.
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	BMP maintenance, implementation schedules, and responsible parties are included with each specific BMP narrative.
N5	Title 22 CCR Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous wastes onsite.
N6	Local Water Quality Ordinances	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No local water quality ordinances.
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No storage of liquid materials or wastes proposed onsite.
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No underground storage tank proposed onsite.
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No hazardous materials onsite.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner will comply with Article 80 of the Uniform Fire Code enforced by the fire protection agency.
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The Owner will be responsible for performing trash pickup and sweeping of littered common areas on a weekly basis or whenever necessary.
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The owner will ensure that tenants are also familiar with onsite BMPs and necessary maintenance required of the tenants. Owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.
N13	Housekeeping of Loading Docks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No loading docks on site.
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All on-site catch basin inlets and drainage facilities shall be inspected and maintained by the Owner at least once a year, prior to the rainy season, no later than October 1st of each year.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The Owner shall be responsible for sweeping all on-site streets, drive aisles, and/or uncovered parking areas within the project on a quarterly basis.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a public agency project.
N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Will comply with the Construction General 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 stenciling and signage (CASQA New Development BMP Handbook SD-13)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	"No Dumping – Drains to River" stencils will be applied. Legibility of stencil will be maintained on a yearly basis.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no outdoor material storage areas onsite.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent off-site transport of trash. Provide solid roof or awning to prevent direct contact with rainfall.
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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The Owner will be responsible for the installation and maintenance of all common landscape areas utilizing similar planting materials with similar water requirements to reduce excess irrigation runoff. The Owner will be responsible for implementing all efficient irrigation systems for common area landscaping including, but not limited to, provisions for water sensors and programmable irrigation cycles. This includes smart timers, rain sensors, and moisture shut-off valves. The irrigation systems shall be in conformance with water efficiency guidelines. Systems shall be tested twice per year, and water used during testing/flushing shall not be discharged to the storm drain system.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Landscaped areas will be depressed in order to increase retention of stormwater/irrigation water and promote infiltration.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no slopes or channels to protect.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no dock areas onsite.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no slopes or channels to protect.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no vehicle wash areas onsite.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no outdoor processing areas outside.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no equipment wash areas onsite.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no fueling areas onsite.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no hillside landscaping onsite.
S14	Wash water control for food preparation areas	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All wash water from food prep areas will be controlled and proper staff training conducted by the site operator. Food preparation facilities shall meet all health and safety, building and safety and any other applicable regulations, codes requirements, including installation of a grease interceptor where required. Sinks shall be contained with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable; no community car wash racks onsite.

4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist
<p>Site Design Practices <i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Impervious surfaces have been minimized by incorporating landscaped areas throughout the site surrounding the proposed building. Landscaping will be provided throughout the site within the common areas as well as around the perimeter of the building.</p>
<p>Maximize natural infiltration capacity: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Infiltration is preliminarily recommended for easterly portion of the project site due to an infiltration rate of 1.0 in/hr assumed for the BMP design and a safety rate of 3 bringing the design infiltration rate to 0.33 in/hr for the proposed infiltration galleries. Refer to Form 4.3-1 for details.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Post-development drainage patterns will mimic pre-development conditions.</p>
<p>Disconnect impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Landscaping will be provided adjacent to sidewalks and between the proposed buildings. Low-flows and first-flush runoff will drain to landscaped MWS units for water quality treatment.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: There are no existing vegetated or sensitive areas to preserve on the project site. All disturbed areas will either be paved or landscaped.</p>
<p>Re-vegetate disturbed areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: All disturbed areas will either be paved or landscaped.</p>
<p>Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Not applicable, no infiltration is proposed onsite.</p>
<p>Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Underground piping is located in traffic areas and could not be substituted with a vegetated swale.</p>
<p>Stake off areas that will be used for landscaping to minimize compaction during construction : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Landscaped areas will be staked to minimize unnecessary compaction during construction.</p>

4.2 Project Performance Criteria

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1 DMA A)	
1 Project area (ft ²): 60,732	2 Imperviousness after applying preventative site design practices (Imp%): 85%
3 Runoff Coefficient (Rc): 0.661 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$	
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.590 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html	
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.874 $P_6 = \text{Item 4} * C_1$, 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 <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>	24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 5,739 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C ₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) <i>Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>	

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1 DMA B)		
1 Project area (ft ²): 38,311	2 Imperviousness after applying preventative site design practices (Imp%): 85%	3 Runoff Coefficient (Rc): 0.661 <i>R_c = 0.858(Imp%)³-0.78(Imp%)²+0.774(Imp%)+0.04</i>
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.590 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.874 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 3,620 <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C₂], where C₂ 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</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1 DMA C)		
1 Project area (ft ²): 45,547	2 Imperviousness after applying preventative site design practices (Imp%): 100%	3 Runoff Coefficient (Rc): 0.892 <i>R_c = 0.858(Imp%)³-0.78(Imp%)²+0.774(Imp%)+0.04</i>
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.590 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.874 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 5,806 <i>DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C₂], where C₂ 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</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1 DMA D)		
1 Project area (ft ²): 58,176	2 Imperviousness after applying preventative site design practices (Imp%): 85%	3 Runoff Coefficient (Rc): 0.661 <i>$R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$</i>
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.590 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.874 <i>$P_6 = \text{Item 4} * C_1$, 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)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 5,498 <i>$DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)		
1 Project area (ft ²): 245,439	2 Imperviousness after applying preventative site design practices (Imp%): 85%	3 Runoff Coefficient (Rc): 0.661 <i>$R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$</i>
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.590 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.874 <i>$P_6 = \text{Item 4} * C_1$, 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)</i>		
6 Drawdown Rate <i>Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 23,194 <i>$DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

Form 4.2-2 Summary of HCOC Assessment

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

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

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

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

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	¹ 21,614 <i>Form 4.2-3 Item 12</i>	² 37.76 <i>Form 4.2-4 Item 13</i>	³ 2.11 <i>Form 4.2-5 Item 10</i>
Post-developed	⁴ 85,765 <i>Form 4.2-3 Item 13</i>	⁵ 7.76 <i>Form 4.2-4 Item 14</i>	⁶ 14.88 <i>Form 4.2-5 Item 14</i>
Difference	⁷ 64,151 <i>Item 4 – Item 1</i>	⁸ 30.00 <i>Item 2 – Item 5</i>	⁹ 12.77 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	¹⁰ 297% <i>Item 7 / Item 1</i>	¹¹ 79% <i>Item 8 / Item 2</i>	¹² 605% <i>Item 9 / Item 3</i>

DA 1- DA 1 cannot mitigate the HCOC volume since it is not an infiltrating system. A 6” orifice was set at the bottom of the detention system to control the 2-yr, 24-hr storm event discharge rate to meet hydromodification requirements. A 12” orifice set to 4’ from the bottom of the detention system to allow for mitigation of the other storm event peak discharges to remain within the existing condition peak discharge rate.

DA 2- The bottom 1’ of the system will be utilized to infiltrate the water quality volume and the runoff volume difference between the existing and proposed conditions for the 2-yr 24-hr storm event (33,602 cu-ft) to meet water quality and hydromodification requirements. A 6” orifice was set at 1’ and an 8” orifice was set to 4’ from the bottom of the detention system to allow for mitigation of the other storm event peak discharges to remain within the existing condition peak discharge rate.

For the overall discharge from the site from Outlet 1, the 2-yr 24-hr runoff is mitigated to 1.46 cfs (70% of existing peak runoff). HCOC calculations were performed using AES, refer to Attachment E for calculations.

Form 4.2-3 HCOC Assessment for Runoff Volume								
Weighted Curve Number Determination for:	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil								
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:	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil								
3b DMA Area, ft ² sum of areas of DMA should equal area of DA								
4b Curve Number (CN) use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP								
5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item 5}) - 10$				9 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item 7}$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$				10 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item 8}$			
11 Precipitation for 2 yr, 24 hr storm (in): Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html								
12 Pre-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
13 Post-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): $V_{HCOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

The HCOC calculations were performed using AES, refer to Attachment E for calculations.

Form 4.2-4 HCOC Assessment for Time of Concentration						
Compute time of concentration for pre and post developed conditions for each DA <i>(For projects using the Hydrology Manual complete the form below)</i>						
Variables	Pre-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>						
2 Change in elevation (ft)						
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$						
4 Land cover						
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>						
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>						
7 Cross-sectional area of channel (ft ²)						
8 Wetted perimeter of channel (ft)						
9 Manning's roughness of channel (n)						
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7}/\text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$						
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$						
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$						
13 Pre-developed time of concentration (min):	<i>Minimum of Item 12 pre-developed DMA</i>					
14 Post-developed time of concentration (min):	<i>Minimum of Item 12 post-developed DMA</i>					
15 Additional time of concentration needed to meet HCOC requirement (min):	$T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$					

The HCOC calculations were performed using AES, refer to Attachment E for calculations.

Form 4.2-5 HCOC Assessment for Peak Runoff

Compute peak runoff for pre- and post-developed conditions

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

The HCOC calculations were performed using AES, refer to Attachment E for calculations.

4.3 Project Conformance Analysis

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

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

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

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)	
Feasibility Criterion – Complete evaluation for each DA on the Project Site	
<p>¹ Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):</p> <ul style="list-style-type: none"> • 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. 	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>³ Would infiltration of runoff on a Project site violate downstream water rights?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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)?</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If Yes, Provide basis: The infiltration rate at the location of the proposed detention system was 0.0 in/hr.	
<p>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? <i>See Section 3.5 of the TGD for WQMP and WAP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>⁷ Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁸ Any answer from Item 4 through Item 6 is “Yes”: <i>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.</i></p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<p>⁹ All answers to Item 1 through Item 6 are “No”: <i>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.</i></p>	

Form 4.3-1 Infiltration BMP Feasibility (DA 2)	
Feasibility Criterion – Complete evaluation for each DA on the Project Site	
<p>¹ Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):</p> <ul style="list-style-type: none"> • 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. 	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>³ Would infiltration of runoff on a Project site violate downstream water rights?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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)?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis:	
<p>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? <i>See Section 3.5 of the TGD for WQMP and WAP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>⁷ Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁸ Any answer from Item 4 through Item 6 is “Yes”: <i>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.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁹ All answers to Item 1 through Item 6 are “No”: <i>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.</i></p>	

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 <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 2-5; If no, proceed to Item 6</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
2 Total impervious area draining to pervious area (ft ²)	N/A	N/A	N/A
3 Ratio of pervious area receiving runoff to impervious area	N/A	N/A	N/A
4 Retention volume achieved from impervious area dispersion (ft ³) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff	N/A	N/A	N/A
5 Sum of retention volume achieved from impervious area dispersion (ft ³): 0 $V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; if no, proceed to Item 14</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
7 Ponding surface area (ft ²)	N/A	N/A	N/A
8 Ponding depth (ft)	N/A	N/A	N/A
9 Surface area of amended soil/gravel (ft ²)	N/A	N/A	N/A
10 Average depth of amended soil/gravel (ft)	N/A	N/A	N/A
11 Average porosity of amended soil/gravel	N/A	N/A	N/A
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$	N/A	N/A	N/A
13 Runoff volume retention from on-lot infiltration (ft ³): 0. $V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs			
14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 15-20. If no, proceed to Item 21</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Rooftop area planned for ET BMP (ft ²)	N/A	N/A	N/A
16 Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i>	N/A	N/A	N/A
17 Daily ET demand (ft ³ /day) <i>Item 15 * (Item 16 / 12)</i>	N/A	N/A	N/A
18 Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i>	N/A	N/A	N/A
19 Retention Volume (ft ³) <i>V_{retention} = Item 17 * (Item 18 / 24)</i>	N/A	N/A	N/A
20 Runoff volume retention from evapotranspiration BMPs (ft ³): 0 <i>V_{retention} = Sum of Item 19 for all BMPs</i>			
21 Implementation of Street Trees: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 22-25. If no, proceed to Item 26</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
22 Number of Street Trees	N/A	N/A	N/A
23 Average canopy cover over impervious area (ft ²)	N/A	N/A	N/A
24 Runoff volume retention from street trees (ft ³) <i>V_{retention} = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i>	N/A	N/A	N/A
25 Runoff volume retention from street tree BMPs (ft ³): 0 <i>V_{retention} = Sum of Item 24 for all BMPs</i>			
26 Implementation of residential rain barrel/cisterns: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 27-29; If no, proceed to Item 30</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
27 Number of rain barrels/cisterns	N/A	N/A	N/A
28 Runoff volume retention from rain barrels/cisterns (ft ³) <i>V_{retention} = Item 27 * 3</i>	N/A	N/A	N/A
29 Runoff volume retention from residential rain barrels/Cisterns (ft ³): 0 <i>V_{retention} = Sum of Item 28 for all BMPs</i>			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 <i>Sum of Items 5, 13, 20, 25 and 29</i>			

4.3.2 Infiltration BMPs

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

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

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

Form 4.3-3 Infiltration LID BMP - including underground BMPs	
1 Remaining LID DCV not met by site design HSC BMP (ft ³): 20,663 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$	
BMP Type <i>Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs</i>	DA 1
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods</i>	0.0
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>	2.0
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	0.0
5 Pondered water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>	N/A
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>	N/A
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	N/A
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>	N/A
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>	N/A
10 Amended soil porosity	N/A
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>	N/A
12 Gravel porosity	N/A
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	N/A
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	N/A
15 Underground Retention Volume (ft ³) <i>Volume determined using manufacturer's specifications and calculations</i>	N/A
16 Total Retention Volume from LID Infiltration BMPs: 0 <i>(Sum of Items 14 and 15 for all infiltration BMP included in plan)</i>	
17 Fraction of DCV achieved with infiltration BMP: 0% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$	
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10; if no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.</i>	

Form 4.3-3 Infiltration LID BMP - including underground BMPs	
1 Remaining LID DCV not met by site design HSC BMP (ft ³): 23,194 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$	
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 2
2 Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods	1.0
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	3.0
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	0.33
5 Pondered 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	1.33
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	1.33
8 Infiltrating surface area, SA_{BMP} (ft ²) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	17,396
9 Amended soil depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details	N/A
10 Amended soil porosity	N/A
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	0.50
12 Gravel porosity	0.40
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	N/A
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	N/A
15 Underground Retention Volume (ft ³) Volume determined using manufacturer's specifications and calculations	33,602
16 Total Retention Volume from LID Infiltration BMPs: 33,602* (Sum of Items 14 and 15 for all infiltration BMP included in plan)	
17 Fraction of DCV achieved with infiltration BMP: 145% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$	
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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.	

*Volume provided is the runoff volume difference between the existing and proposed conditions for the 2-yr 24-hr storm event for DA 2.

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 DMA A)		
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft ³): 0 <i>V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 - Form 4.3-3 Item 16</i>		
BMP Type(s) <i>Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs</i>	DA 1	DA 2
2 Describe cistern or runoff detention facility	N/A	N/A
3 Storage volume for proposed detention type (ft ³) <i>Volume of cistern</i>	N/A	N/A
4 Landscaped area planned for use of harvested stormwater (ft ²)	N/A	N/A
5 Average wet season daily irrigation demand (in/day) <i>Use local values, typical ~ 0.1 in/day</i>	N/A	N/A
6 Daily water demand (ft ³ /day) <i>Item 4 * (Item 5 / 12)</i>	N/A	N/A
7 Drawdown time (hrs) <i>Copy Item 6 from Form 4.2-1</i>	N/A	N/A
8 Retention Volume (ft ³) <i>V_{retention} = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))</i>	N/A	N/A
9 Total Retention Volume (ft ³) from Harvest and Use BMP: 0 <i>Sum of Item 8 for all harvest and use BMP included in plan</i>		
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.</i>		

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1 DMA A)		
<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 5,739 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>	<p>List pollutants of concern See Form 2.3-1.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p>Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p>Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input checked="" type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): N/A Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): N/A Item 1 – Item 3</p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 100% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): 0.175 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)</p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP. 		

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

<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 3,620 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>	<p>List pollutants of concern See Form 2.3-1.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input checked="" type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): N/A Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): N/A Item 1 – Item 3</p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 100% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): 0.115 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)</p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP. 		

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

<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 5,806 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>	<p>List pollutants of concern See Form 2.3-1.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input checked="" type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): N/A Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): N/A Item 1 – Item 3</p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 100% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): 0.144 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)</p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP. 		

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

<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 5,498 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</p>	<p>List pollutants of concern See Form 2.3-1.</p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p style="text-align: center;">Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p> <p><input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p style="text-align: center;">Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p> <p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input checked="" type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): N/A Form 4.3-6 Item 15 + Form 4.3-7 Item 13</p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): N/A Item 1 – Item 3</p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 100% Item 4 / Item 1</p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): 0.175 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)</p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP. 		

Form 4.3-6 Volume Based Biotreatment – Bioretention and Planter Boxes with Underdrains		
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DA 1	DA 2
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>	N/A	N/A
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>	N/A	N/A
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>	N/A	N/A
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	N/A	N/A
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>	N/A	N/A
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	N/A	N/A
8 Amended soil surface area (ft ²)	N/A	N/A
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A
10 Amended soil porosity, <i>n</i>	N/A	N/A
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A
12 Gravel porosity, <i>n</i>	N/A	N/A
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	N/A	N/A
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7}/2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	N/A	N/A
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 <i>Sum of Item 14 for all volume-based BMPs included in this form</i>		

Form 4.3-7 Volume Based Biotreatment – Constructed Wetlands and Extended Detention				
Biotreatment BMP Type <i>Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.</i>	DA 1		DA 2	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>	N/A	N/A	N/A	N/A
2 Bottom width (ft)	N/A	N/A	N/A	N/A
3 Bottom length (ft)	N/A	N/A	N/A	N/A
4 Bottom area (ft ²) $A_{bottom} = \text{Item 2} * \text{Item 3}$	N/A	N/A	N/A	N/A
5 Side slope (ft/ft)	N/A	N/A	N/A	N/A
6 Depth of storage (ft)	N/A	N/A	N/A	N/A
7 Water surface area (ft ²) $A_{surface} = (\text{Item 2} + (2 * \text{Item 5} * \text{Item 6})) * (\text{Item 3} + (2 * \text{Item 5} * \text{Item 6}))$	N/A	N/A	N/A	N/A
8 Storage volume (ft ³) <i>For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i> $V = \text{Item 6} / 3 * [\text{Item 4} + \text{Item 7} + (\text{Item 4} * \text{Item 7})^{0.5}]$	N/A	N/A	N/A	N/A
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>	N/A		N/A	
10 Outflow rate (cfs) $Q_{BMP} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) / (\text{Item 9} * 3600)$	N/A		N/A	
11 Duration of design storm event (hrs)	N/A		N/A	
12 Biotreated Volume (ft ³) $V_{biotreated} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) + (\text{Item 10} * \text{Item 11} * 3600)$	N/A		N/A	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 <i>(Sum of Item 12 for all BMP included in plan)</i>				

Form 4.3-8 Flow Based Biotreatment				
Biotreatment BMP Type <i>Vegetated swale, vegetated filter strip, or other comparable proprietary BMP</i>	DA 1 DMA A	DA 1 DMA B	DA 1 DMA C	DA 1 DMA D
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5</i>	N/A	N/A	N/A	N/A
2 Flow depth for water quality treatment (ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A	N/A
3 Bed slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A	N/A
4 Manning's roughness coefficient	N/A	N/A	N/A	N/A
5 Bottom width (ft) <i>$b_w = (\text{Form 4.3-5 Item 6} * \text{Item 4}) / (1.49 * \text{Item 2}^{1.67} * \text{Item 3}^{0.5})$</i>	N/A	N/A	N/A	N/A
6 Side Slope (ft/ft) <i>BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A	N/A
7 Cross sectional area (ft ²) <i>$A = (\text{Item 5} * \text{Item 2}) + (\text{Item 6} * \text{Item 2}^2)$</i>	N/A	N/A	N/A	N/A
8 Water quality flow velocity (ft/sec) <i>$V = \text{Form 4.3-5 Item 6} / \text{Item 7}$</i>	N/A	N/A	N/A	N/A
9 Hydraulic residence time (min) <i>Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>	N/A	N/A	N/A	N/A
10 Length of flow-based BMP (ft) <i>$L = \text{Item 8} * \text{Item 9} * 60$</i>	N/A	N/A	N/A	N/A
11 Water surface area at water quality flow depth (ft ²) <i>$SA_{top} = (\text{Item 5} + (2 * \text{Item 2} * \text{Item 6})) * \text{Item 10}$</i>	N/A	N/A	N/A	N/A
Required Treatment Flowrate (cfs)	0.160	0.101	0.141	0.153
Provided Treatment Flowrate (cfs)	0.175	0.115	0.144	0.175

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 DMA A)	
1	Total LID DCV for DA 1 DMA A (ft ³): 5,739 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design hydrologic source control LID BMP (ft ³): 0 <i>Copy Item 30 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 0 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site retention with LID harvest and use BMP (ft ³): 0 <i>Copy Item 9 in Form 4.3-4</i>
5	On-site biotreatment with volume based biotreatment BMP (ft ³): 0 <i>Copy Item 3 in Form 4.3-5</i>
6	Flow capacity provided by flow based biotreatment BMP (cfs): 0.175 <i>Copy Item 6 in Form 4.3-5</i>
7	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> • Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3-5 Item 6 and Items 2, 3 and 4 are maximized</i> ▪ On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
8	<p>If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:</p> <ul style="list-style-type: none"> • Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> • An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: <input type="checkbox"/> <i>Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed</i>

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

1 Total LID DCV for DA 1 DMA A (ft³): 3,620 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 0 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0.115 *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

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

1 Total LID DCV for DA 1 DMA A (ft³): 5,806 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 0 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0.144 *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

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

1 Total LID DCV for DA 1 DMA A (ft³): 5,498 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 0 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0.175 *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

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for DA 1 DMA A (ft³): 23,194 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 0 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): 33,602 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): 0 *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes No
If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes No
If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3-5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes No
If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs	
<p>1 Volume reduction needed for HCOC performance criteria (ft³): 59,863 <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i></p>	<p>2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): 33,602 <i>Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i></p>
<p>3 Remaining volume for HCOC volume capture (ft³): 26,261 <i>Item 1 – Item 2</i></p>	<p>4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): 0 <i>Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</i></p>
<p>5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification <input type="checkbox"/> <i>Attach in-stream control BMP selection and evaluation to this WQMP</i></p>	
<p>6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p><i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP <input checked="" type="checkbox"/> <i>BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)</i> • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities <input type="checkbox"/> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	
<p>7 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p><i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs <input checked="" type="checkbox"/> <i>BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)</i> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	

DA 1 cannot mitigate the HCOC volume since it is not an infiltrating system. For DA 2, the bottom 1' of the system will be utilized to infiltrate the water quality volume and the runoff volume difference between the existing and proposed conditions for the 2-yr 24-hr storm event (33,602 cu-ft) to meet water quality and hydromodification requirements. For the overall discharge from the site from Outlet 1, the 2-yr 24-hr runoff is mitigated to 1.46 cfs (70% of existing peak runoff). HCOC calculations were performed using AES, refer to Attachment E for calculations.

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			
BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Underground Retention/Detention System	Owner	Inspect access entry covers, check for leaks, minor sediment in cistern bottom, vector control issues. Clean out screenings and first flush diverter. Inspect from clean out port and remove sediment, trash, debris, and oil. Identify any needed corrective maintenance that will require site specific design.	Four times per year during the wet season (preferably after rain events), and once during the dry season (ideally in September).
Flow Based Bioretention	Owner	Maintenance activities should include clearing of the accumulation of sediment and debris. Additional media/filter replacement determined by manufacturer maintenance procedures.	Once every 6 months, prior to the start of the rainy season (October 1st), and after major storm events.
N1 - Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Owner	Property owner will familiarize themselves with the educational materials in Attachment "C" and the contents of the WQMP.	Annually for all employees and within 2 months for new hires.
N3 - Landscape Management BMPs	Owner	Irrigation must be consistent with the local agency's Water Conservation Ordinance. Fertilizer and pesticide usage will be consistent with local agency's Management Guidelines for Use of Fertilizers and Pesticides.	Ongoing
N4 - BMP Maintenance	Owner	BMP maintenance, implementation schedules, and responsible parties are included with each specific BMP narrative.	As described in each BMP
N10 - Uniform Fire Code Implementation	Owner	Owner will comply with Article 80 of the Uniform Fire Code enforced by the fire protection agency.	Ongoing
N11 - Litter/Debris Control Program	Owner	Contract with their landscape and maintenance firm to provide this service during regularly schedule maintenance.	Weekly
N12 - Employee Training	Owner	The owner will ensure that tenants are also familiar with onsite BMPs and necessary maintenance required of the tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. Owner will check with City and County at least once a year to obtain new or updated educational materials and provide these	Annually for all employees and within 2 months for new hires.

Water Quality Management Plan (WQMP)

		materials to tenants. Employees shall be trained to clean up spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.	
N14 – Catch Basin Inspection Program	Owner	Monthly inspection by property owner’s designee. Vacuum basin when sediment or trash becomes 2-inches deep and dispose of properly.	Monthly inspection and maintain as necessary.
N15 - Vacuum Sweeping of Private Streets and Parking Lots	Owner	All landscape maintenance contractors will be required to sweep up all landscape cuttings, mowings and fertilizer materials off paved areas weekly and dispose of properly. Parking areas and drive ways will be swept monthly by sweeping contractor.	Monthly
N17 - Comply with all other applicable NPDES permits	Owner	Will comply with Construction General Permit	Ongoing
S1 - Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	Owner	“No Dumping – Drains to River” stencils will be applied. Legibility of stencil will be maintained on a yearly basis.	Annually
S3 - Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	Owner	Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent off-site transport of trash. Provide solid roof or awning to prevent direct contact with rainfall.	Annually
S4 - Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	Owner	Irrigation systems shall include reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. Timers will be used to avoid over watering and watering cycles and duration shall be adjusted seasonally by the landscape maintenance contractor. The landscaping areas will be grouped with plants that have similar water requirements. Native or drought tolerant species shall also be used where appropriate to reduce excess irrigation runoff and promote surface filtration.	Adjust watering cycles and duration seasonally / quarterly.
S5 - Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	Owner	Landscaped areas will be suppressed in order to increase retention of stormwater/irrigation water and promote infiltration.	Ongoing
S14 - Wash water control for food preparation areas	Owner	All wash water from food prep areas will be controlled and proper staff training conducted by the site operator. Food preparation facilities shall meet all health and safety, building and safety and any other applicable regulations, codes requirements, including installation of a grease interceptor where required. Sinks shall be contained with sanitary sewer connections for disposal of wash waters containing kitchen and food wastes.	Ongoing

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

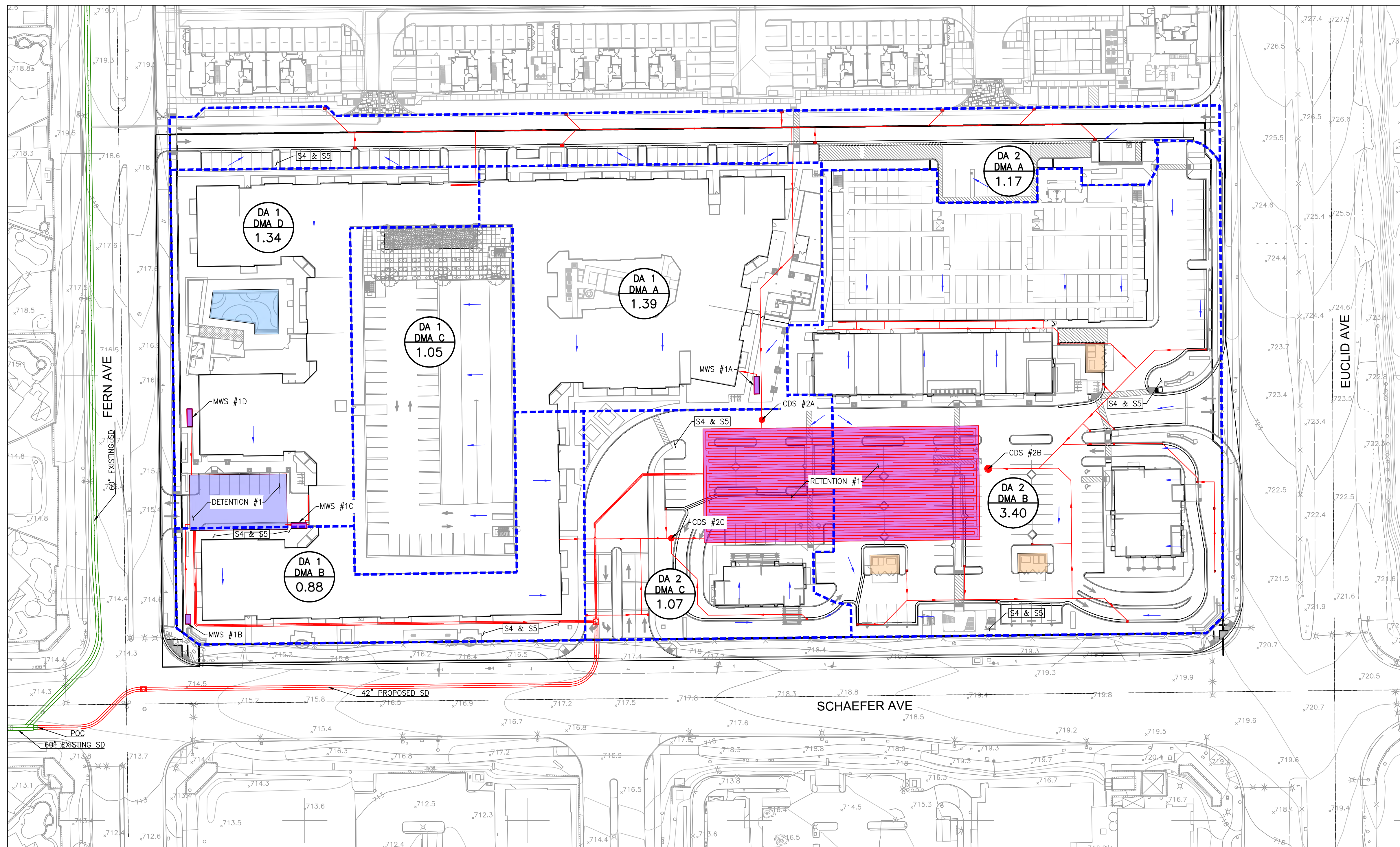
Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents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

6.3 Post Construction

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

6.4 Other Supporting Documentation

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



SITE AREA DETAILS
 TOTAL AREA = 10.29 AC
 IMPERVIOUS AREA = 8.75 AC
 PERVIOUS AREA = 1.54 AC

SUITABILITY/FEASIBILITY CONSTRAINTS
 FOR DA 1, INFILTRATION FOR THE PROJECT SITE WAS DEEMED PRELIMINARILY INFEASIBLE DUE TO AN INFILTRATION RATE OF 0.0 IN/HR.
 FOR DA 2, INFILTRATION FOR THE PROJECT SITE WAS DEEMED PRELIMINARILY FEASIBLE DUE TO AN INFILTRATION RATE OF 1.0 IN/HR AFTER APPLYING A SAFETY FACTOR OF 3, RESULTING IN A DESIGN RATE OF 0.33 IN/HR FOR THE PROPOSED INFILTRATION GALLERIES.

- LEGEND**
- PROPERTY LINE / RIGHT OF WAY
 - STREET CENTER LINE
 - EXISTING STORM DRAIN
 - PROPOSED STORM DRAIN
 - BMP DRAINAGE AREA BOUNDARY
 - DA 4 DMA G 1.00 DRAINAGE MANAGEMENT AREA
 - DIRECTION OF PIPED FLOW
 - DIRECTION OF SURFACE FLOW
 - PROPOSED POOL/SPA (DRAINS TO SEWER)
 - PROPOSED TRASH ENCLOSURE (S3)
 - CATCH BASIN STENCILING & MAINTENANCE (N14, S1)
 - PROPOSED RETENTION SYSTEM FOR DCV, HCOC, AND PEAK FLOWS
 - PROPOSED DETENTION SYSTEM FOR HCOC, AND PEAK FLOWS
 - PROPOSED MODULAR WETLANDS SYSTEM (BIO-7)

- NON-STRUCTURAL SOURCE CONTROL BMP'S**
- N1 EDUCATION OF PROPERTY OWNERS, TENANTS, AND OCCUPANTS ON STORMWATER BMP'S
 - N2 ACTIVITY RESTRICTIONS
 - N3 LANDSCAPE MANAGEMENT BMP'S
 - N4 BMP MAINTENANCE
 - N10 UNIFORM FIRE CODE IMPLEMENTATION
 - 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

- STRUCTURAL SOURCE CONTROL BMP'S**
- S1 PROVIDE STORM DRAIN SYSTEM STENCILING AND SIGNAGE
 - S3 DESIGN AND CONSTRUCT TRASH AND WASTE STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION
 - S4 USE EFFICIENT IRRIGATION SYSTEMS & LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, AND SOURCE CONTROL
 - S5 FINISH GRADE OF LANDSCAPED AREAS AT A MINIMUM OF 1-2 INCHES BELOW TOP OF CURB, SIDEWALK, OR PAVEMENT

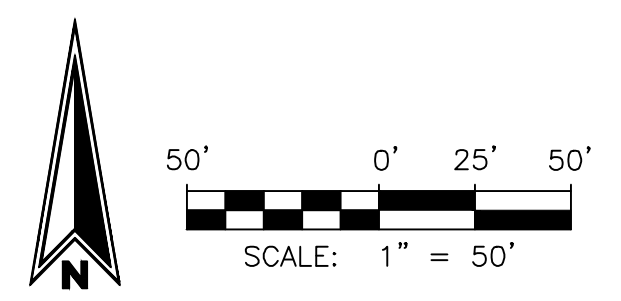
- LID BMP'S**
- INF-7 UNDERGROUND INFILTRATION
 - BIO-7 PROPRIETARY BIOTREATMENT

Area (ac)	DA 1				HCOC Detention
	DA 1 DMA A	DA 1 DMA B	DA 1 DMA C	DA 1 DMA D	
1.39	0.88	1.05	1.34		
Required Q (cfs)	0.160	0.101	0.141	0.153	N/A
MWS Model	MWS-L-4-15	MWS-L-4-8	MWS-L-4-13	MWS-L-4-15	
Number of Units	1.00	1.00	1.00	1.00	
Treatment Q Provided (cfs)	0.175	0.115	0.144	0.175	
GIS Coordinates	34.005564, -117.652432	34.004992, -117.654123	34.005220, -117.653791	34.005486, -117.654114	34.005280, -117.653967

Area (ac)	DA 2		
	DA 2 DMA A	DA 2 DMA B	DA 2 DMA C
1.17	3.40	1.07	
Required Q (cfs)	0.455	1.328	0.416
Hydrodynamic Separator Model	CDS2015-4	CDS2025-5	CDS2015-4
Treatment Q Provided (cfs)	0.70	1.60	0.70
Required V (cf)		23,194	
Infiltration Model	60" CMP		
Treatment V Provided (cf)	33,602		
GIS Coordinates	34.005479, -117.652415	34.005358, -117.651745	34.005186, -117.652686



CATCH BASIN STENCILING SAMPLE S1
 SCALE: NTS



ATTACHMENT A

BMP DESIGN CALCULATIONS

NOAA's National Weather Service
Hydrometeorological Design Studies Center
 Precipitation Frequency Data Server (PFDS)



Home Site Map Organization Search All NOAA

General Information

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- [Progress Reports](#)
- [FAQ](#)
- [Glossary](#)

Precipitation Frequency

- [Data Server](#)
- [GIS Grids](#)
- [Maps](#)
- [Time Series](#)
- [Temporals](#)
- [Documents](#)

Probable Maximum Precipitation

- [Documents](#)

Miscellaneous

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- [Storm Analysis](#)
- [Record Precipitation](#)

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NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Units: Time series type:

Select location

1) Manually:

- a) **By location** (decimal degrees, use "-" for S and W): Latitude: Longitude:
- b) **By station** (list of CA stations):
- c) **By address**

2) Use map:

a) Select location
Move crosshair or double click

b) Click on station icon
 Show stations on map

Location information:
Name: Chino, California, USA*
Latitude: 34.0056°
Longitude: -117.6526°
Elevation: ** 📏

* Source: ESRI Maps
 ** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION NOAA Atlas 14, Volume 6, Version 2

[PF tabular](#) [PF graphical](#) [Supplementary information](#) [Print page](#)

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.116 (0.097-0.140)	0.152 (0.126-0.184)	0.198 (0.165-0.241)	0.237 (0.195-0.290)	0.289 (0.230-0.366)	0.329 (0.256-0.426)	0.370 (0.281-0.492)	0.412 (0.304-0.564)	0.470 (0.332-0.672)	0.515 (0.351-0.764)
10-min	0.166 (0.138-0.201)	0.217 (0.181-0.263)	0.284 (0.236-0.345)	0.339 (0.280-0.415)	0.414 (0.329-0.525)	0.471 (0.367-0.611)	0.530 (0.402-0.705)	0.590 (0.435-0.809)	0.673 (0.475-0.963)	0.738 (0.502-1.09)
15-min	0.201 (0.167-0.243)	0.263 (0.219-0.318)	0.344 (0.286-0.418)	0.410 (0.338-0.502)	0.500 (0.398-0.635)	0.570 (0.444-0.739)	0.641 (0.486-0.852)	0.714 (0.526-0.978)	0.814 (0.575-1.17)	0.892 (0.608-1.32)
30-min	0.302 (0.252-0.365)	0.395 (0.330-0.479)	0.518 (0.431-0.629)	0.617 (0.509-0.756)	0.753 (0.600-0.955)	0.858 (0.668-1.11)	0.964 (0.732-1.28)	1.08 (0.792-1.47)	1.23 (0.865-1.75)	1.34 (0.915-1.99)
60-min	0.450 (0.376-0.545)	0.590 (0.492-0.715)	0.772 (0.642-0.938)	0.921 (0.759-1.13)	1.12 (0.894-1.43)	1.28 (0.996-1.66)	1.44 (1.09-1.91)	1.60 (1.18-2.20)	1.83 (1.29-2.62)	2.00 (1.37-2.97)
2-hr	0.674 (0.563-0.816)	0.884 (0.737-1.07)	1.15 (0.955-1.40)	1.36 (1.12-1.67)	1.64 (1.30-2.07)	1.84 (1.43-2.39)	2.05 (1.55-2.72)	2.25 (1.66-3.08)	2.52 (1.78-3.60)	2.72 (1.85-4.04)
3-hr	0.849 (0.709-1.03)	1.11 (0.927-1.35)	1.44 (1.20-1.75)	1.70 (1.40-2.08)	2.04 (1.62-2.58)	2.29 (1.78-2.96)	2.53 (1.92-3.37)	2.77 (2.04-3.80)	3.09 (2.18-4.42)	3.33 (2.26-4.93)

6-hr	1.18 (0.985-1.43)	1.54 (1.29-1.87)	1.99 (1.66-2.42)	2.35 (1.94-2.88)	2.80 (2.23-3.56)	3.14 (2.44-4.07)	3.47 (2.63-4.61)	3.79 (2.79-5.19)	4.21 (2.97-6.02)	4.52 (3.08-6.70)
12-hr	1.54 (1.29-1.86)	2.01 (1.68-2.44)	2.61 (2.17-3.17)	3.08 (2.54-3.77)	3.70 (2.94-4.69)	4.15 (3.23-5.39)	4.60 (3.49-6.12)	5.05 (3.73-6.92)	5.64 (3.98-8.07)	6.09 (4.14-9.03)
24-hr	2.00 (1.77-2.31)	2.63 (2.33-3.04)	3.44 (3.04-3.99)	4.10 (3.58-4.78)	4.97 (4.21-5.99)	5.64 (4.67-6.93)	6.30 (5.10-7.94)	6.98 (5.50-9.04)	7.89 (5.97-10.6)	8.59 (6.28-12.0)
2-day	2.40 (2.12-2.77)	3.21 (2.84-3.71)	4.29 (3.78-4.97)	5.18 (4.53-6.04)	6.40 (5.42-7.71)	7.35 (6.09-9.04)	8.32 (6.74-10.5)	9.34 (7.36-12.1)	10.7 (8.12-14.5)	11.8 (8.65-16.5)
3-day	2.57 (2.27-2.96)	3.49 (3.08-4.03)	4.72 (4.16-5.47)	5.75 (5.03-6.71)	7.17 (6.07-8.65)	8.30 (6.88-10.2)	9.46 (7.66-11.9)	10.7 (8.42-13.8)	12.4 (9.38-16.7)	13.8 (10.1-19.2)
4-day	2.77 (2.45-3.20)	3.80 (3.35-4.38)	5.17 (4.56-5.98)	6.31 (5.52-7.36)	7.89 (6.68-9.51)	9.14 (7.58-11.2)	10.4 (8.45-13.1)	11.8 (9.29-15.3)	13.7 (10.4-18.5)	15.2 (11.1-21.2)
7-day	3.20 (2.83-3.69)	4.40 (3.89-5.08)	5.99 (5.28-6.94)	7.31 (6.39-8.53)	9.12 (7.72-11.0)	10.5 (8.73-13.0)	12.0 (9.70-15.1)	13.5 (10.6-17.5)	15.6 (11.8-21.0)	17.2 (12.6-24.0)
10-day	3.50 (3.10-4.03)	4.82 (4.26-5.57)	6.57 (5.79-7.61)	8.01 (7.00-9.34)	9.98 (8.45-12.0)	11.5 (9.54-14.2)	13.1 (10.6-16.5)	14.7 (11.6-19.0)	16.9 (12.8-22.8)	18.6 (13.6-26.0)
20-day	4.23 (3.74-4.88)	5.90 (5.21-6.81)	8.11 (7.15-9.39)	9.94 (8.70-11.6)	12.5 (10.6-15.0)	14.4 (12.0-17.8)	16.5 (13.3-20.7)	18.6 (14.6-24.1)	21.5 (16.2-29.0)	23.8 (17.4-33.1)
30-day	5.00 (4.42-5.76)	6.99 (6.18-8.07)	9.69 (8.54-11.2)	11.9 (10.4-13.9)	15.1 (12.8-18.2)	17.6 (14.6-21.6)	20.2 (16.3-25.4)	22.9 (18.0-29.6)	26.7 (20.2-36.0)	29.7 (21.7-41.4)
45-day	5.95 (5.27-6.86)	8.31 (7.34-9.59)	11.6 (10.2-13.4)	14.3 (12.5-16.7)	18.3 (15.5-22.0)	21.4 (17.8-26.4)	24.8 (20.1-31.2)	28.4 (22.4-36.7)	33.5 (25.3-45.1)	37.6 (27.5-52.5)
60-day	6.89 (6.09-7.94)	9.54 (8.43-11.0)	13.3 (11.7-15.4)	16.5 (14.4-19.2)	21.2 (17.9-25.5)	25.0 (20.7-30.8)	29.1 (23.6-36.7)	33.6 (26.5-43.5)	40.1 (30.3-54.1)	45.4 (33.2-63.4)

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

Estimates from the table in CSV format:

Main Link Categories:

[Home](#) | [OWP](#)

US Department of Commerce
 National Oceanic and Atmospheric Administration
 National Weather Service
 Office of Water Prediction (OWP)
 1325 East West Highway
 Silver Spring, MD 20910
 Page Author: [HDSC webmaster](#)
 Page last modified: April 21, 2017

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Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet – DA 2

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	3	0.75
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \sum p$				1.50
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \sum p$				2.00
Combined Safety Factor, $S_{TOT} = S_A \times S_B$				3.00	
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)				1.0	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$				0.33	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A site-specific infiltration test was conducted at the project site to support a minimum measured infiltration rate of 1.0 in/hr. The design infiltration rate will be 0.33 in/hr after applying the appropriate safety factor. This design rate is preliminarily suitable for infiltration facilities. In final design, infiltration testing will be conducted at the location and depths of any proposed infiltration galleries.

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

DCV Calculations

	DA 1 DMA A	DA 1 DMA B	DA 1 DMA C	DA 1 DMA D	DA 2	
Region	Valley	Valley	Valley	Valley	Valley	
Drainage Area	60,732	38,311	45,547	58,176	245,439	sq-ft
Drainage Area	1.39	0.88	1.05	1.34	5.64	acres
Impervious Coeff	0.85	0.85	1.00	0.85	0.85	< 1.0
Runoff Coeff	0.661	0.661	0.892	0.661	0.661	
1-hr 2-yr from NOAA	0.590	0.590	0.590	0.590	0.590	in
P6 Coeff	1.4807	1.4807	1.4807	1.4807	1.4807	
Mean 6-hr (P6)	0.874	0.874	0.874	0.874	0.874	
Drawdown Rate (a)	1.963	1.963	1.963	1.963	1.963	
DCV	5,739	3,620	5,806	5,498	23,194	cu-ft
DCV	0.132	0.083	0.133	0.126	0.532	acre-ft

i =
C =

Pretreatment Calculations

	DA 2 DMA A	DA 2 DMA B	DA 2 DMA C	
Region	Valley	Valley	Valley	
Drainage Area	50,799	148,236	46,405	sq-ft
Drainage Area	1.17	3.40	1.07	acres
Impervious Coeff	0.85	0.85	0.85	< 1.0
Runoff Coeff	0.661	0.661	0.661	
1-hr 2-yr from NOAA	0.590	0.590	0.590	in
Required flow rate	0.455	1.328	0.416	cfs
Unit Model	CDS2015-4	CDS2025-5	CDS2015-4	
Unit Provided Flowrate	0.7	1.6	0.7	cfs

MWS Sizing

		DA 1 DMA A	DA 1 DMA B	DA 1 DMA C	DA 1 DMA D	
Region		Valley	Valley	Valley	Valley	
DCV Infiltrated		0.00	0.00	0.00	0.00	cu-ft
DCV Biotreated		0.00	0.00	0.00	0.00	cu-ft
Remaining DCV		5,739	3,620	5,806	5,498	cu-ft
Fraction of DCV for Flow-based Sizing		100%	100%	100%	100%	
Flow-based capacity required		0.135	0.135	0.135	0.135	cfs/Imp. Acre
Impervious Acreage	A_I	1.19	0.75	1.05	1.14	ac
Required flow rate	Q_R	0.160	0.101	0.141	0.153	cfs
Unit Model		MWS-L-4-15	MWS-L-4-8	MWS-L-4-13	MWS-L-4-15	
Unit Provided Flowrate		0.175	0.115	0.144	0.175	cfs
Number of Units		1	1	1	1	
Total Treatment Flowrate	Q_p	0.175	0.115	0.144	0.175	cfs

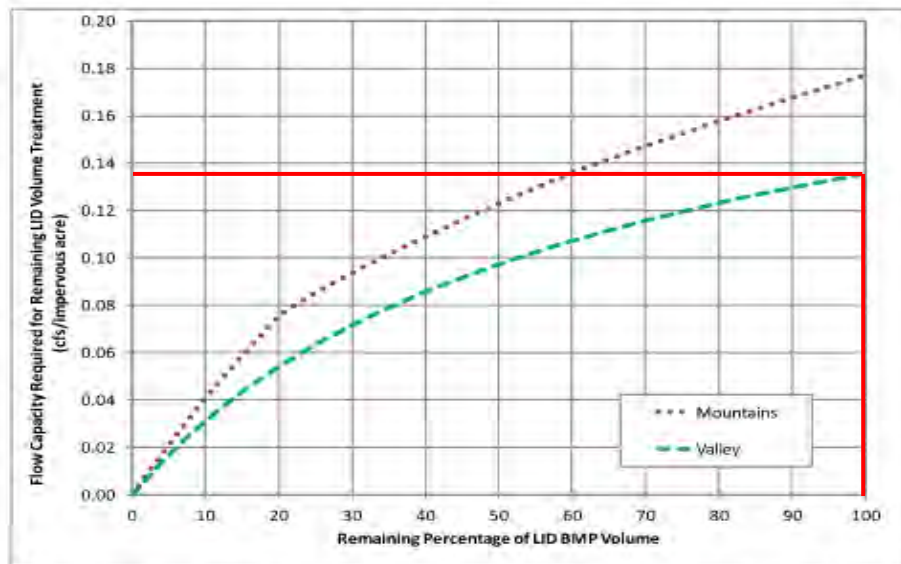


Figure 5-2. Nomograph for Determining Flow-based BMP Capacity Requirement to meet Remaining Unmet DCV

ATTACHMENT B

MAINTENANCE AGREEMENT

RECORDING REQUESTED BY:

County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:

County of San Bernardino
Department of Public Works
825 E. Third Street, Room 117
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

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

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

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

OWNER NAME: _____

PROPERTY ADDRESS: _____

APN: _____

THIS AGREEMENT is made and entered into in

_____, California, this _____ day of

_____, by and between

_____, hereinafter

referred to as Owner, and the COUNTY OF SAN BERNARDINO, a political subdivision of the State of California, hereinafter referred to as "the County";

WHEREAS, the Owner owns real property ("Property") in the County of San Bernardino, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference; and

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

_____ within the Property described herein, the County required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

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

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

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

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

1. Owner shall comply with the WQMP.
2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.
3. Owner hereby provides the County's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the County Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the County may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay County for all costs incurred by County in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of County invoice.
4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the County, the Owner shall provide the County with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.
5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the County, the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the County Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay County within thirty (30) calendar days of County invoice.
6. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

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

interest in all or part of the Property. Owner shall provide a copy of such notice to the County at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.
16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.
17. Owner agrees to indemnify, defend (with counsel reasonably approved by the County) and hold harmless the County and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the County on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the County's "active" as well as "passive" negligence but does not apply to the County's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the County under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO COUNTY :

Director of Public Works _____

825 E. Third Street, Room 117 _____

San Bernardino, CA 92415-0835 _____

IF TO OWNER:

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

OWNER:

Company/Trust: _____

Signature: _____

Name: _____

Title: _____

Date: _____

FOR: Maintenance Agreement, dated

_____, for the

project known as

(APN) _____,

As described in the WQMP dated

_____.

OWNER:

Company/Trust: _____

Signature: _____

Name: _____

Title: _____

Date: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

BRENDON BIGGS, M.S., P.E., Director of Public Works

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/illustration)

ATTACHMENT C

EDUCATION MATERIALS

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, annual inspections. Sites with high trash load or small outlet control orifices may need more frequent inspections. The rate at which the system collects pollutants will depend more on-site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

Maintenance

CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice. Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Annual inspections are best practice for all underground systems. During this inspection if evidence of salting/de-icing agents is observed within the system, it is best practice for the system to be rinsed, including above the spring line soon after the spring thaw as part of the maintenance program for the system.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.



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CONTECH®
CMP DETENTION SYSTEMS

CONTECH®
ENGINEERED SOLUTIONS

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CDS[®] Inspection and Maintenance Guide



Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allow both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine whether the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y ³	m ³
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities



Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

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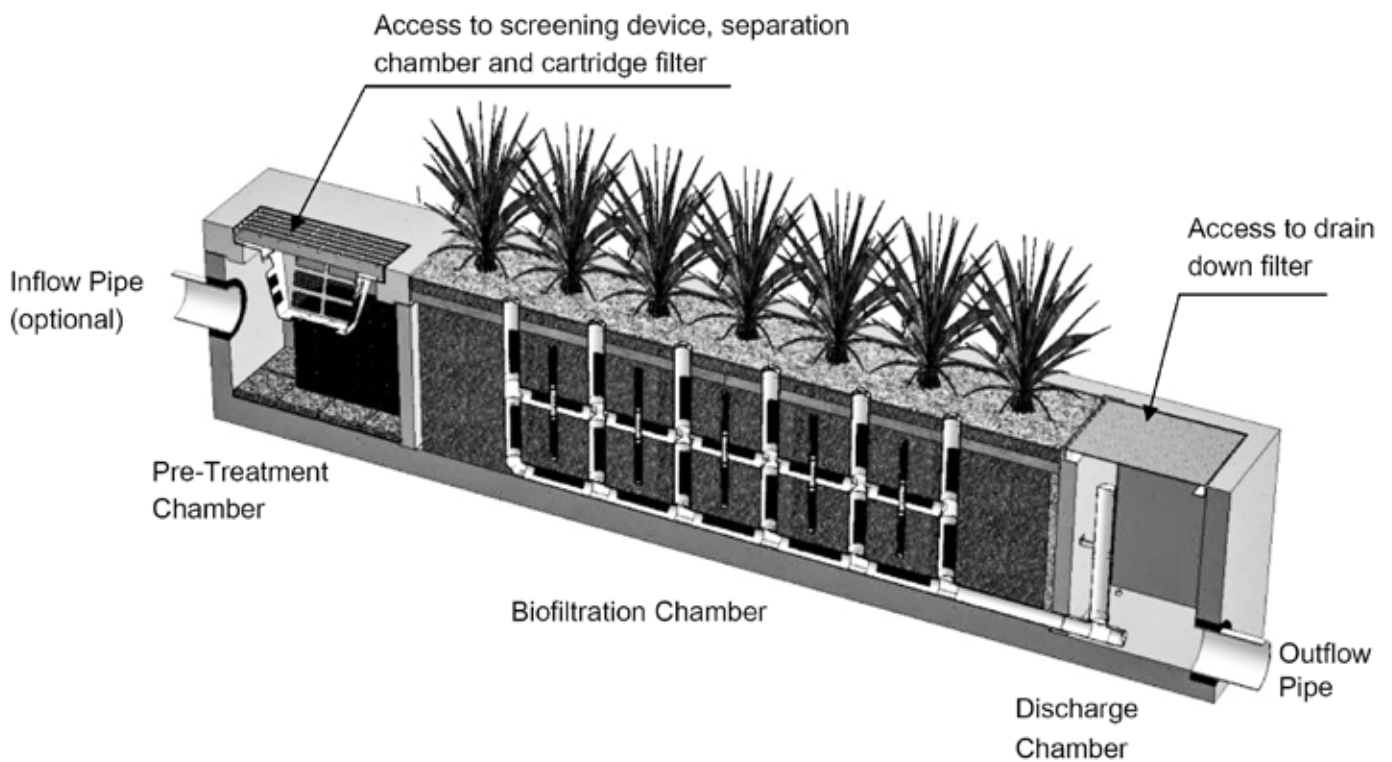
The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.

Modular Wetlands[®] Linear Operation & Maintenance Manual



Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
 - (5 minute average service time).
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
 - (10 minute average service time).
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
 - (10-15 minute per cartridge average service time).
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
 - (5 minute average service time).
- Trim Vegetation – average maintenance interval is 6 to 12 months.
 - (Service time varies).



System Diagram

Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre- Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer, spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber. Entry into chambers may require confined space training based on state and local regulations.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the Biofiltration Chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

Maintenance Procedure Illustration

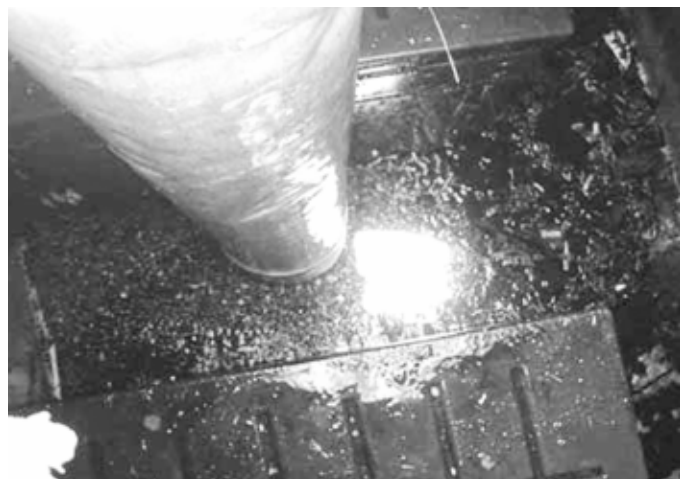
Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.



Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.



Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.



Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.





Inspection Report Modular Wetlands Linear

Project Name _____

For Office Use Only
(Reviewed By) _____
(Date) _____ Office personnel to complete section to the left.

Project Address _____ (city) (Zip Code)

Owner / Management Company _____

Contact _____

Phone () - _____

Inspector Name _____

Date ____ / ____ / ____

Time _____ AM / PM

Type of Inspection Routine Follow Up Complaint Storm Storm Event in Last 72-hours? No Yes

Weather Condition _____

Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	Yes	No	Comments
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth: _____
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber: _____
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____



Cleaning and Maintenance Report Modular Wetlands Linear

Project Name _____

For Office Use Only

Project Address _____
(city) (Zip Code)

(Reviewed By)

Owner / Management Company _____

(Date)

Office personnel to complete section to the left.

Contact _____

Phone () - _____

Inspector Name _____

Date ____ / ____ / ____ Time _____ AM / PM

Type of Inspection Routine Follow Up Complaint

Storm Storm Event in Last 72-hours? No Yes

Weather Condition _____

Additional Notes _____

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: _____ Long: _____	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:



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SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

Modular Wetlands Maintenance Guide 08/22


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A SAFE GARDEN: A LOT DEPENDS ON IT.



Protect your family and community
when using pesticides and fertilizers.

- **STRATEGICALLY** apply products on your lawn only when rain is not expected.
 - **SPOT-APPLY** directly on the problem instead of the whole area.
 - **SAFELY** dispose of unwanted products. The County of San Bernardino offers 9 HHW Centers that accept pesticides, fertilizers and other toxic waste **FREE** of charge.
- 

To report illegal dumping, call
(877) WASTE18 or visit
sbcountystormwater.org

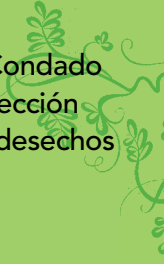




UN JARDÍN SANO: MUCHO DEPENDE DE ÉL.



Proteja a su familia y a su comunidad cuando utilice pesticidas y fertilizantes.

- **ESTRATÉGICAMENTE** aplique productos en su césped solamente cuando no se espera lluvia.
 - **ESCASAMENTE** aplique los productos directamente en el área en donde exista el problema en lugar de distribuirlo en todo el jardín.
 - **ELIMINE** productos tóxicos sanamente. El Condado de San Bernardino ofrece 9 centros de recolección que aceptan pesticidas, fertilizantes y otros desechos tóxicos **GRATUITAMENTE**.
- 

Para reportar actividades ilegales llamar al
(877) WASTE18 o visite
sbcountystormwater.org



TOO TOXIC TO TRASH

Dispose of your **HOUSEHOLD HAZARDOUS WASTE** (HHW) at a **FREE** HHW Center near you. Examples of items collected: pesticides, fertilizers, paints, cleaners, antifreeze, batteries, motor oil, oil filters, and electronic waste.

SERVICE AREA	LOCATION	DAYS OPEN	HOURS
Big Bear Lake <small>(does not accept E-waste)</small>	42040 Garstin Dr. (cross: Big Bear Blvd.)	Saturdays	9 a.m. - 2 p.m.
Chino	5050 Schaefer Ave. (cross: 4th St.)	2 nd & 4 th Sat.	8 a.m. - 1 p.m.
Fontana (Fontana residents only)	16454 Orange Way (cross: Cypress Ave.) <small>Note: Provide a trash bill and a driver's license as proof of residency.</small>	Saturdays	8 a.m. - 12 p.m.
Ontario	1430 S. Cucamonga Ave. (cross: Belmont St.)	Fri. & Sat.	9 a.m. - 2 p.m.
Rancho Cucamonga	8794 Lion Street. (Off 9th St, between Vineyard and Hellman)	Saturdays	8 a.m. - 12 p.m.
Redlands	500 Kansas St. (cross: Park Ave.)	Saturdays	9:30 a.m. - 12:30 p.m.
Rialto <small>(does not accept E-waste)</small>	246 Willow Ave. (cross: Rialto Ave.)	2 nd & 4 th Fri. & Sat.	8 a.m. - 12 p.m.
San Bernardino	2824 East 'W' St., 302 (cross: Victoria Ave.)	Mon. - Fri.	9 a.m. - 4 p.m.
Upland	1370 N. Benson Ave. (cross: 14th St.)	Saturdays	9 a.m. - 2 p.m.



To report illegal dumping, call **(877) WASTE18**
or visit sbcountystormwater.org

Artwork Courtesy of the City of Los Angeles Stormwater Program. Printed on recycled paper.

TAKE ONE

MUY TÓXICO PARA LA BASURA

Deshágase de sus **DESECHOS PELIGROSOS** gratuitamente en un centro de recolección cerca de usted. Ejemplos de artículos que se aceptan: pesticidas, fertilizantes, pinturas, limpiadores, anticongelante, baterías, aceite de motores y filtros, y aparatos electrónicos.

ÁREA DE SERVICIO	UBICACIÓN	ABIERTO	HORARIO
Big Bear Lake <small>(no se acepta materiales electronicas)</small>	42040 Garstin Dr. (Big Bear Blvd.)	Sábado	9 a.m. - 2 p.m.
Chino	5050 Schaefer Ave. (4th St.)	2 nd & 4 th Sábado	8 a.m. - 1 p.m.
Fontana <small>(residentes de Fontana solamente)</small>	16454 Orange Way (Cypress Ave.)	Sábado	8 a.m. - 12 p.m.
	<small>Nota: Presentar un recibo de basura y licencia de conducir como prueba de residencia.</small>		
Ontario	1430 S. Cucamonga Ave. (Belmont St.)	Viernes & Sábado	9 a.m. - 2 p.m.
Rancho Cucamonga	8794 Lion Street (Off 9th St, between Vineyard & Hellman)	Sábado	8 a.m. - 12 p.m.
Redlands	500 Kansas St. (Park Ave.)	Sábado	9:30 a.m. - 12:30 p.m.
Rialto <small>(no se acepta materiales electronicas)</small>	246 Willow Ave. (Rialto Ave.)	2 nd & 4 th Viernes & Sábado	8 a.m. - 12 p.m.
San Bernardino	2824 East 'W' St., 302 (Victoria Ave.)	Lunes - Viernes	9 a.m. - 4 p.m.
Upland	1370 N. Benson Ave. (14th St.)	Sábado	9 a.m. - 2 p.m.



Para reportar actividades ilegales llamar al **(877) WASTE18**
o visite sbcountystormwater.org

Arte Cortesía del Programa de Agua Pluvial de la Ciudad de Los Angeles. Impreso en papel reciclado.

TOME UNO

LANDSCAPE MAINTENANCE

DISCHARGE TO THE STORM DRAIN, ACCIDENTAL OR NOT, COULD LEAD TO ENFORCEMENT ACTIONS, WHICH COULD INCLUDE FINES.

Follow the best practices below to **prevent water pollution from landscaping activities.**

RECYCLE YARD WASTE



- ✓ Recycle leaves, grass clippings and other yard waste.
- ✓ Do not blow, sweep, rake or hose yard waste into the street or catch basin.
- ✓ **Try grasscycling:** the natural recycling of grass by leaving clippings on the lawn when mowing.

For more information, please visit:
www.calrecycle.ca.gov/organics/grasscycling

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY



- ✓ Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural and non-toxic alternatives as often as possible.
- ✓ If you must use chemical fertilizers, herbicides or pesticides:
 - Spot apply, rather than blanketing entire areas.
 - Avoid applying near curbs and driveways, and **never** before a rain.
 - Apply fertilizers as needed: when plants could best use it and when the potential runoff would be low.
 - Follow the manufacturer's instructions carefully—this will not only give the best results, but will save money.

USE WATER WISELY



- ✓ Control the amount of water and direction of sprinklers. Sprinklers should only be on long enough to allow water to soak into the ground, but not so long as to cause runoff.
- ✓ Periodically inspect, fix leaks and realign sprinkler heads.
- ✓ Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.

! HOMEOWNERS

KEEP THESE TIPS IN MIND WHEN HIRING PROFESSIONAL LANDSCAPERS AND REMIND AS NECESSARY.



Leftover pesticides, fertilizers, and herbicides contaminate landfills and should be disposed of through a Hazardous Waste Facility.

For more information on proper disposal call,
(909) 382-5401 or 1-800-OILY CAT.

*FREE for San Bernardino County residents only. Businesses can call for cost inquiries and to schedule an appointment.



To report illegal dumping, call (877) WASTE18 or visit sbcountystormwater.org
To report toxic spills, call 1(800) 33 TOXIC
To dispose of hazardous waste, call 1(800) OILY CAT

sbcountystormwater.org

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MANTENIMIENTO DE JARDINERÍA

LAS DESCARGAS A LOS DESAGUES PLUVIALES, DE MANERA ACCIDENTAL O NO, PUEDEN INDUCIR A LA APLICACIÓN DE MULTAS Y OTRAS MEDIDAS.

Siga las mejores prácticas descritas debajo para evitar la contaminación del agua por actividades de jardinería.

RECICLAJE DE LOS DESECHOS DE JARDÍN



- ✓ Reciclar las hojas, recortes de césped y otros desechos de jardín.
- ✓ No soplar, barrer, o usar la manguera para empujar los desechos de jardín a la calle.
- ✓ **Poner a prueba el reciclaje de césped (grasscycling): la manera natural de reciclar el césped dejando los recortes sobre el césped cuando son cortados. Para más información, visite la página web: www.calrecycle.ca.gov/organics/grasscycling**

USAR FERTILIZANTES, HERBICIDAS Y PESTICIDAS DE MANERA SEGURA



- ✓ Los fertilizantes, herbicidas y pesticidas son arrastrados con frecuencia hacia el sistema de desagüe pluvial mediante el escurrimiento de los rociadores. Use alternativas naturales no tóxicas siempre que sea posible.
- ✓ Si tiene que usar fertilizantes, herbicidas o pesticidas químicos: Aplicar solo en el sitio necesario, en lugar de cubrir todas las áreas. Evitar aplicar cerca de los bordillos y las calzadas, y nunca antes de que llueva. Aplicar los fertilizantes cuando sea necesario: esto es, cuando las plantas mejor podrían usarlo y el posible escurrimiento sea bajo. Seguir las instrucciones del fabricante cuidadosamente – esto no solo le proporcionará los mejores resultados, pero le permitirá ahorrar dinero.

USAR EL AGUA DE MANERA PRUDENTE



- ✓ Controlar la cantidad de agua y la orientación de los rociadores. Los rociadores deben ser **solo lo suficientemente largos como para permitir que el agua remoje el suelo, pero no tan largos que causen un escurrimiento.**
- ✓ Inspeccione, repare los escapes y alinee los aspersores periódicamente.
- ✓ Siembre plantas nativas para reducir el uso de agua, fertilizantes, herbicidas y pesticidas.

! PROPIETARIOS DE HOGARES

Tengan en cuenta estos consejos cuando contraten a paisajistas profesionales y recuérdenselos según sea necesario.



Los sobrantes de pesticidas, fertilizantes y herbicidas contaminan los vertederos y deben ser desechados a través de Plantas de Tratamiento para Residuos Peligrosos.

*WASTE únicamente para los residentes del Condado de San Bernardino. Las empresas pueden llamar para indagar sobre los costos y requisitos para el envío.

Para más información sobre el manejo adecuado de residuos peligrosos, llame a (909) 382-5401 o 1-800-OILY CAT.



Para denunciar el vertido ilegal de basura, llame al (877) WASTE18 o visite sbcountystormwater.org
Para denunciar derrames tóxicos, llame al 1(800) 33 TOXIC
Para desechar residuos peligrosos, llame al 1(800) OILY CAT

sbcountystormwater.org

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Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

Site Design & Landscape Planning SD-10

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

SD-10 Site Design & Landscape Planning

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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



Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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



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

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

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say $\frac{1}{4}$ to $\frac{1}{2}$ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

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

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



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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



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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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



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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

Supplemental Information

Examples

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

Other Resources

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

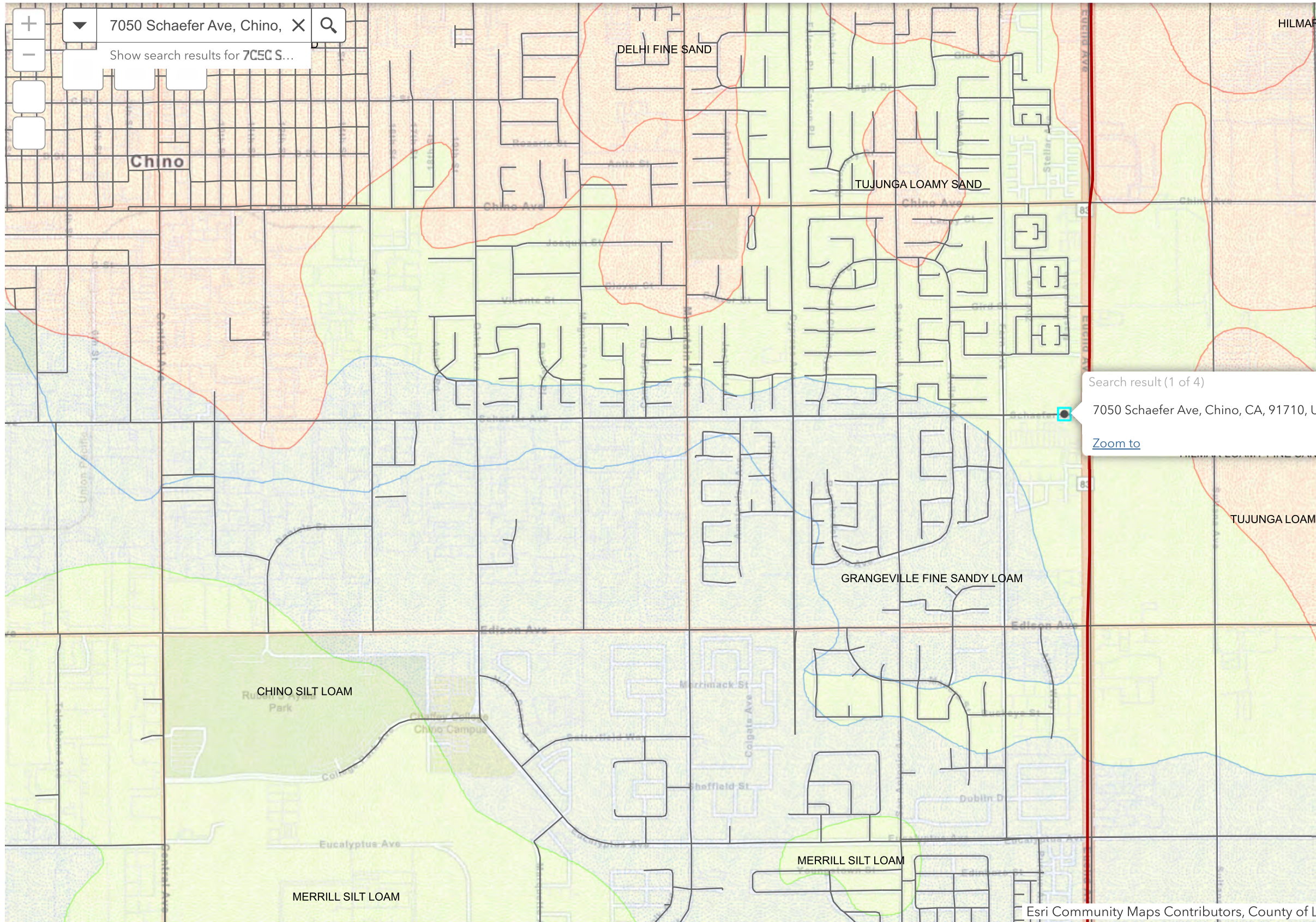
Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

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

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

ATTACHMENT D

SOILS AND INFILTRATION



Layers

Base Data

- Parcels
- County Owned Parcels
- Highways

Stormwater Data

- Soils
 - Soils - Hydro Group A
 - Soils - Hydro Group B
 - Soils - Hydro Group C
 - Soils - Hydro Group D
 - Soils - No Hydra Group

Habitat/Species

- Arroyo Toad
- Mtn Yellow Legged Frog
- Desert Tortoise

Buffered Layers

- Fws Arroyo Toad Buffer 200ft
- Ash Gray Indian Paintbrush Buffer 200ft
- Bear Valley Sandwort Buffer 200ft

Search result (1 of 4)

7050 Schaefer Ave, Chino, CA, 91710, USA

[Zoom to](#)

0.3mi
-117.638 34.002 Degrees

December 8, 2022

Orbis Real Estate Partners
280 Newport Center Drive, Suite 240
Newport Beach, California 92660



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**
A California Corporation

Attention: Mr. Grant Ross

Project No.: **22G118-4**

Subject: **Results of Infiltration Testing**
Proposed Retail/Commercial Development
NWC Euclid Avenue and Schaefer Avenue
Chino, California

References: 1) Geotechnical Feasibility Study, Proposed Retail/Commercial Development, NWC Euclid Avenue and Schaefer Avenue, Chino, California, prepared for Orbis Real Estate Partners (OREP), by Southern California Geotechnical, Inc. (SCG), SCG Project No. 22G118-1, dated March 29, 2022.

2) Results of Preliminary Infiltration Testing, Proposed Retail/Commercial Development, NWC Euclid Avenue and Schaefer Avenue, Chino, California, prepared for OREP, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 22G118-2, dated March 30, 2022.

3) Geotechnical Investigation, Proposed Retail/Commercial Development, NWC Euclid Avenue and Schaefer Avenue, Chino, California, prepared for OREP, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 22G118-3.

Mr. Ross:

In accordance with your request, we have conducted additional infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 22P112-2, dated October 18, 2022. The scope of services included visual site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils for the stormwater disposal system. The infiltration testing was performed using a constant-head infiltration test.

Site Description

The site is located at the northwest corner of Schaefer Avenue and South Euclid Avenue (Highway 83) in Chino, California. The site is bounded to the north by a generally vacant lot that appears to have been used for farming, to the east by South Euclid Avenue, to the south

by Schaefer Avenue and to the west by Fern Avenue. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 of this report.

The site consists of a rectangular-shaped parcel, 9.5± acres in size. At the time of the referenced feasibility study, the majority of the site was covered with row crops. However, at the time of our recent subsurface investigation for this report, row crops were only present in the southeastern portion of the site. With the exception of the area in the southeast portion of the site that is presently planted, the ground surface cover generally consists of exposed soil and is generally remains furrowed in the areas where crops were formerly planted. Two (2) fruit stand structures, 250 and 600± ft² in size are present at the southeast corner of the site.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations, the overall site is generally flat with a slight slope to the southwest. The slope has an overall average gradient of about ½ percent and an elevation differential of approximately 4± feet.

Proposed Development

SCG was provided with site plan prepared by AO Architecture. Based on this plan, the site will be developed with the following:

Structure Type	Footprint (ft²)	Location
Multi-Family Residential with Parking Structure (4 Stories)	135,000	West
4-Level Self-Storage	150,000	Northeast Corner
Retail/Food Shops	15,000	East-Central
Food Shops	4,500	Southeast
Fast Food Restaurant	2,500	South-Central

We expect that the buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, and limited areas of concrete flatwork and landscape planters throughout.

Based on conversations with representatives of Huitt-Zollars, Inc., the project civil engineer, the site may utilize on-site stormwater disposal. The proposed infiltration system will consist of a dry-well extending to depths of 80 to 100 feet below existing site grades. We have been requested to perform infiltration testing in the proposed infiltration system location.

Previous Studies

Southern California Geotechnical, Inc. (SCG) previously performed a geotechnical feasibility study at the subject site (Reference 1). As a part of this study, nine (9) borings were advanced to depths of 20 to 25± feet below the previously existing site grades. Artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 2 to 6½± feet below ground surface. The fill soils generally consisted of loose to medium dense silty fine sands. Occasional layers of loose fine sands and fine sandy silts were also encountered. Native alluvium was encountered beneath the fill at all of the boring locations, extending to at least the maximum depth explored of 25± feet below ground surface. The alluvial soils generally consisted of loose to dense silty fine sands, fine sandy silts, fine sands and clayey fine

sands, as well as stiff to very stiff clayey silts, silty clays and fine sandy clays. The alluvial soils generally possess trace to some iron oxide staining and calcareous nodules and veining. Free water was not encountered during drilling of any of the borings. Based on the lack of water within the borings and trenches the groundwater was considered to have existed at a depth in excess of 25± feet at the time of our subsurface exploration.

SCG previously performed preliminary infiltration testing at the subject site (Reference 2). As a part of this study, four (4) infiltration borings were advanced to a depth of 10± feet below the existing site grades. Artificial fill soils were encountered at the ground surface at all of the infiltration boring locations, extending to a depth of 3± feet below the existing site grades. The fill soils generally consist of loose to medium dense silty fine sands and stiff/loose intermixed clayey fine sands and fine sandy clays. The fill soils possess a disturbed mottled appearance, with some samples possessing trace plastic fragments, resulting in their classification as artificial fill. Native alluvial soils were encountered beneath the fill soils at all of the infiltration boring locations, extending to at least the maximum depth explored of 10± feet. The alluvium generally consists of loose to medium dense silty fine to medium sands, fine to medium sandy silts, clayey fine sands, stiff to very stiff silty clays and fine sandy clays. Infiltration rates reported were between 0.0 to 3.0 inches per hour.

SCG also performed a design-level geotechnical investigation at the subject site (Reference 3). As a part of this investigation, eight (8) borings were advanced to depths of 20 to 80± feet below ground surface. Artificial fill soils were encountered at the ground surface extending to depths of 2½ to 8½± feet below the existing site grades. The fill soils consist of loose to medium dense silty fine sands and medium stiff to stiff clayey silts and silty clays. Alluvial soils were encountered extending beneath the fill soils to at least the maximum depth explored of 80± feet at all of the boring locations. The alluvial soils consist of interbedded loose to medium dense silty fine sands, silty fine to medium sands, fine sandy silts, and fine to medium sands and medium stiff to stiff silty clays, clayey silts, and clayey fine to medium sands. Free water was not encountered during drilling of any of the borings. Based on the lack of water within the borings and trenches the groundwater was considered to have existed at a depth in excess of 80± feet at the time of our subsurface exploration.

Subsurface Exploration

The subsurface exploration performed for the infiltration testing consisted of one (1) deep infiltration test boring (Boring No. DW-1). The deep infiltration test boring was advanced to a depth of 80± feet below the existing site grades for the dry well infiltration systems. In addition to the infiltration boring, one (1) exploratory soil boring (Boring No. CB-1), drilled within 5± feet of the deep infiltration test boring, was advanced to a depth of 100± feet below the existing site grades. Samples were collected from 80 to 100± feet below ground surface. The purpose of the exploratory boring is to identify the type of soils beneath the bottom of the proposed dry well system and to confirm that groundwater is greater than 20 feet below the bottom of the proposed dry well system. The borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow stem augers and were logged during drilling by a member of our staff. The approximate locations of the borings (identified as Boring No. DW-1/CB-1) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, each infiltration test boring was filled with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was

then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Artificial fill was encountered at the ground surface of Boring Nos. DW-1/CB-1, extending to a depth of 7± feet below ground surface. The fill soil generally consisted of fine sandy clays with little silt. The fill soils possess a disturbed and mottle appearance, resulting in its classification as artificial fill. Native alluvium was encountered beneath the fill, extending to at least the maximum depth explored of 100± feet below ground surface. The native alluvium generally consists of loose to very dense silty fine sands, fine sandy silts, silty fine to medium sands, fine to medium sandy silts, and occasional layers of fine to medium sand and clayey fine to medium sand. The Boring Logs, which illustrate the conditions encountered at the borings, are included with this report.

Free water was not encountered during drilling of any of our infiltration borings. Based on the lack of water within the borings, the groundwater was considered to have existed at a depth in excess of 100± feet at the time of our subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, <http://www.water.ca.gov/waterdatalibrary/>. The nearest monitoring well is located approximately 0.6 mile to the east from the site. Water level readings within this monitoring well indicates high groundwater levels of 138± feet (October 2021) below the ground surface.

Infiltration Testing

As previously mentioned, the infiltration testing was performed in accordance with a modified constant-head infiltration test as requested by the project civil engineer, the designer of the proposed dry well system.

Pre-soaking

The pre-soaking process consisted of filling the test boring with water to approximately 10 feet below the ground surface. The pre-soaking was completed after all of the water had percolated through the test hole, at least 15 hours since initiating the pre-soak.

Dry Wells

Following the pre-soaking process, the constant-head infiltration test method was utilized to test the rates of deeper soils. This method consisted of filling the borings to a maximum water level of 10± feet below the ground surface, based on the soil conditions encountered. Once the hole was filled, the inflow of water was controlled via a ball valve in order to maintain the water level constant below ground surface. It was necessary to constantly monitor this depth due to varying inflows from the water source and the change in infiltration rate with time. Readings were taken every ten minutes using a water level meter. The ball valve was used to make adjustments by increasing or decreasing the inflow of water when slight changes in depth

occurred. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rate from the deep infiltration test is tabulated in gallons per square foot per day.

<u>Infiltration Test No.</u>	<u>Depth (feet)</u>	<u>Infiltration Rate (inches per hour)</u>	<u>Percolation Rate (gal/ft²/day)</u>
DW-1	80	0.59	8.8

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the bottom of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-15 of this report.

Design Recommendations

One (1) deep infiltration test was performed at the subject site using a constant-head test method. As noted above, the infiltration rate was 8.8 gallons per square foot per day. The primary factors affecting the infiltration rate is the varying relative densities and the silt/clay content of the encountered soils, which vary at different depths within the boring.

Based on the results of the deep infiltration tests, we recommend a design infiltration rate of 0.6 inches per hour or 8.8 gallons per square foot per day be used for the proposed dry wells extending to a depth of 80± feet below existing grades at these locations.

The design of the proposed storm water infiltration system should be performed by the project civil engineer, in accordance with the City of Chino and/or County of San Bernardino guidelines. However, it is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the effective infiltration rate. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above are based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended

infiltration rates are based on infiltration testing at one (1) discrete locations and the overall infiltration rates of the storm water infiltration systems could vary considerably.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Therefore, the subgrade soils within proposed infiltration system areas should not be overexcavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the composition of the soil at the base of each chamber system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report. If the soil conditions at the base of the system differ from those at the test locations, the performance of the system may be inconsistent with the recommended infiltration rates provided herein.

Infiltration versus Permeability

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. The infiltration rates presented herein were determined in accordance with the ASTM Test Method D-3385-03 standard and are considered valid for the time and place of the actual test. Changes in soil moisture content will affect these infiltration rates. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration areas could potentially be damaged due to saturation of subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building, it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rates contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between trench locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

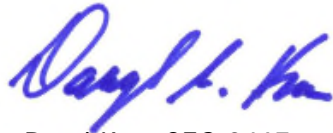
We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.



Jamie Hayward
Staff Geologist



Daryl Kas, CEG 2467
Senior Geologist

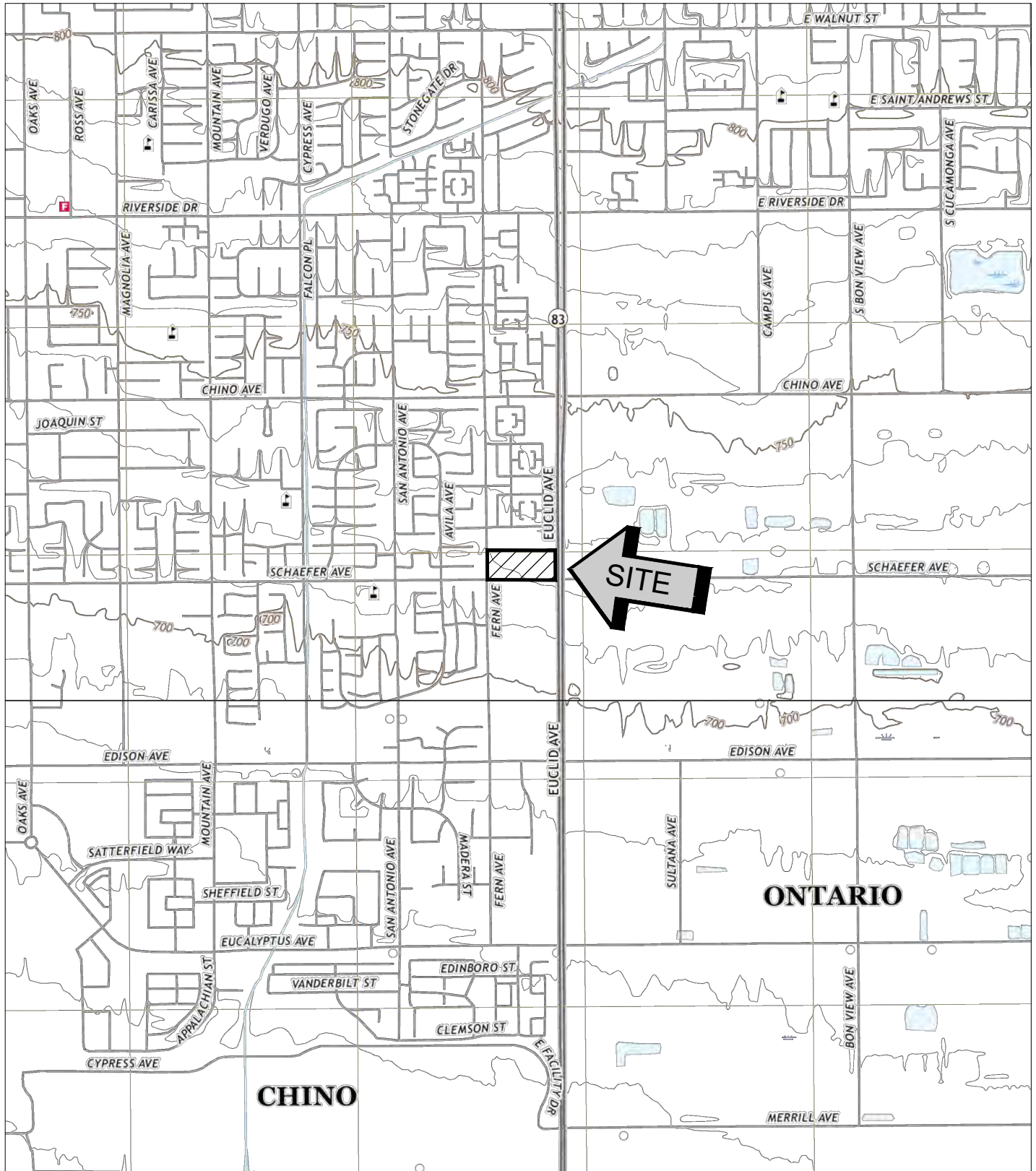


Robert G. Trazo, GE 2655
Principal Engineer



Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (5 pages)
Infiltration Test Results Spreadsheets (1 page)
Grain Size Distribution Graphs (15 pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF THE ONTARIO AND PRADO DAM QUADRANGLES, ORANGE COUNTY, CALIFORNIA, 2021 & 2022.



SITE LOCATION MAP
PROPOSED RETAIL/COMMERCIAL DEVELOPMENT
CHINO, CALIFORNIA

SCALE: 1" = 2000'

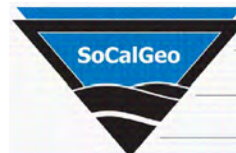
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CHKD: RGT

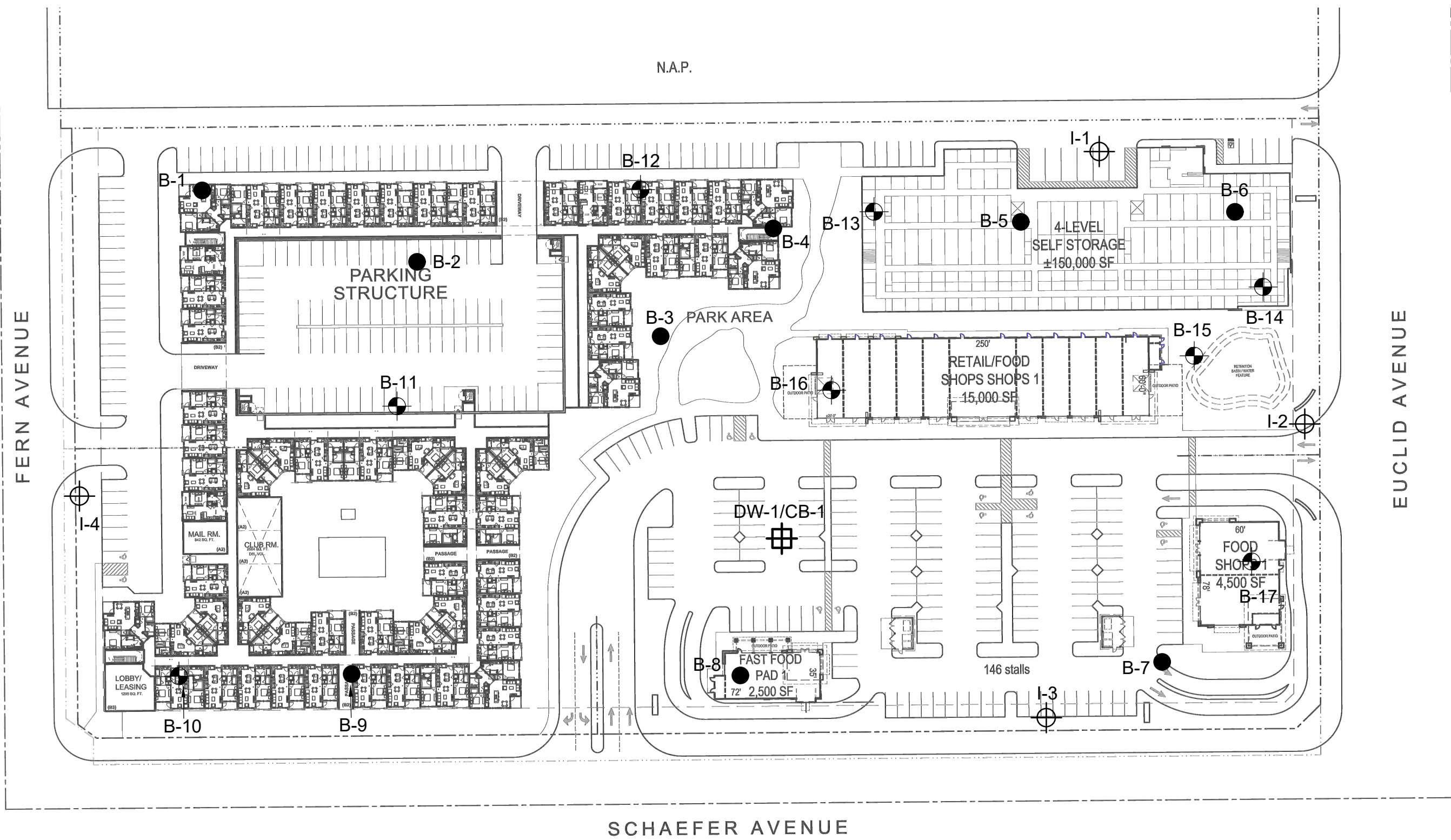
SCG PROJECT

22G118-4





PLATE 1

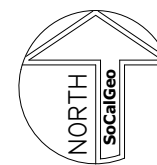


SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND


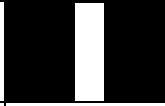

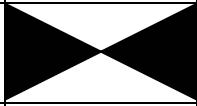

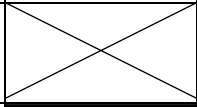


-  APPROXIMATE DRY WELL/CONFIRMATION BORING LOCATION
-  APPROXIMATE BORING LOCATION (SCG PROJECT NO. 22G118-3)
-  PREVIOUS INFILTRATION BORING LOCATION (SCG PROJECT NO. 22G118-2)
-  PREVIOUS BORING LOCATION (SCG PROJECT NO. 22G118-1)



NOTE: BASE MAP PREPARED BY AO ARCHITECTURE.

DRY WELL TEST LOCATION PLAN	
PROPOSED RETAIL/COMMERCIAL DEVELOPMENT CHINO, CALIFORNIA	
SCALE: 1" = 80' DRAWN: JAH CHKD: DRK SCG PROJECT 22G118-4 PLATE 2	 SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS		
			GRAPH	LETTER			
<p>COARSE GRAINED SOILS</p> <p>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</p>	<p>GRAVEL AND GRAVELLY SOILS</p>	<p>CLEAN GRAVELS</p> <p>(LITTLE OR NO FINES)</p>		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES		
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES		
		<p>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE</p>	<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		<p>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE</p>	<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	<p>SAND AND SANDY SOILS</p>	<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES		
		<p>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE</p>	<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		SM	SILTY SANDS, SAND - SILT MIXTURES	
					SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
			<p>FINE GRAINED SOILS</p> <p>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE</p>	<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT LESS THAN 50</p>		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
						CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY					
<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT GREATER THAN 50</p>		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS			
		CH		INORGANIC CLAYS OF HIGH PLASTICITY			
		OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
<p>HIGHLY ORGANIC SOILS</p>				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS		

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



JOB NO.: 22G118-4	DRILLING DATE: 10/24/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 51 feet
LOCATION: Chino, California	LOGGED BY: Joey Hernandez	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: --- MSL												
5		18		FILL: Light Gray Brown fine Sandy Clay, little Silt, trace medium Sand, little Calcareous nodules, very stiff-moist		18			75		El = 11 @ 0 to 5 feet	
10		18		ALLUVIUM: Light Brown Silty fine Sand, trace medium Sand, medium dense-damp		7			25			
15		10		Light Gray Brown fine Sandy Silt, little Clay, trace medium Sand, loose to medium dense-moist		18			54			
20		20		Brown Silty fine to medium Sand, trace coarse Sand, trace fine Gravel, medium dense-moist		14			36			
25		39		Brown fine to medium Sandy Silt, trace coarse Sand, dense-moist		15						
30		41		Brown fine to medium Sand, little Silt, little fine Gravel, dense-damp		5			7			
				Gray Brown fine Sandy Silt, trace Clay, trace medium Sand, medium dense-moist		18			69			
		22	1.0									

TBL 22G118-4.GPJ, SOCALGEO.GDT, 12/22/22



JOB NO.: 22G118-4	DRILLING DATE: 10/24/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 51 feet
LOCATION: Chino, California	LOGGED BY: Joey Hernandez	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION (Continued)	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
40		23	3.0	Gray Brown fine Sandy Silt, trace Clay, trace medium Sand, medium dense-moist		27			26			
45		28		Gray Brown Silty fine to medium Sand, trace coarse Sand, medium dense-very moist								
50		21	4.5	Brown fine Sandy Silt, medium dense-very moist		30			60			
55		24		Brown Silty fine to medium Sand, trace Clay, medium dense-moist		10			38			
60		18	3.0	Brown fine to medium Sandy Silt, medium dense-very moist		31			56			
65		21	4.5	Brown Clayey fine to medium Sand, trace Silt, medium dense-damp		5			33			
		55		Brown fine Sandy Silt, little Clay, trace medium Sand, medium dense-damp to moist		9			61			
				@ 68½ feet, no Clay		10			70			

TBL 22G118-4.GPJ_SOCALGEO.GDT 12/22/22



JOB NO.: 22G118-4	DRILLING DATE: 10/24/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 51 feet
LOCATION: Chino, California	LOGGED BY: Joey Hernandez	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION (Continued)	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
75		39			Brown fine Sandy Silt, little Clay, trace medium Sand, medium dense-damp to moist							
					Brown fine Sandy Silt to Silty fine Sand, trace medium Sand, dense-very moist		46			50		
80		28			Brown fine Sandy Silt, trace Clay, trace medium Sand, medium dense-very moist		22			75		
85		52			Brown Silty fine Sand, very dense-damp to moist		10					@ 80 to 100 feet, samples were collected from the immediately adjacent confirmation boring (CB-1)
90		35			@ 88½ feet, dense		9					
95		80/11"			Brown fine Sandy Silt, trace medium Sand, very dense-moist		14					
100		38			Brown Silty fine to medium Sand, trace coarse Sand, dense-moist		10					
Boring Terminated at 100'												

TBL 22G118-4.GPJ_SOCALGEO.GDT 12/22/22

PERCOLATION CALCULATIONS

Project Name	Prop. Retail-Commercial Development
Project Location	Chino, CA
Project Number	22G118-4
Engineer	RB

Borehole Diameter	8
Borehole Depth	80
Water Depth from Ground Surface	10

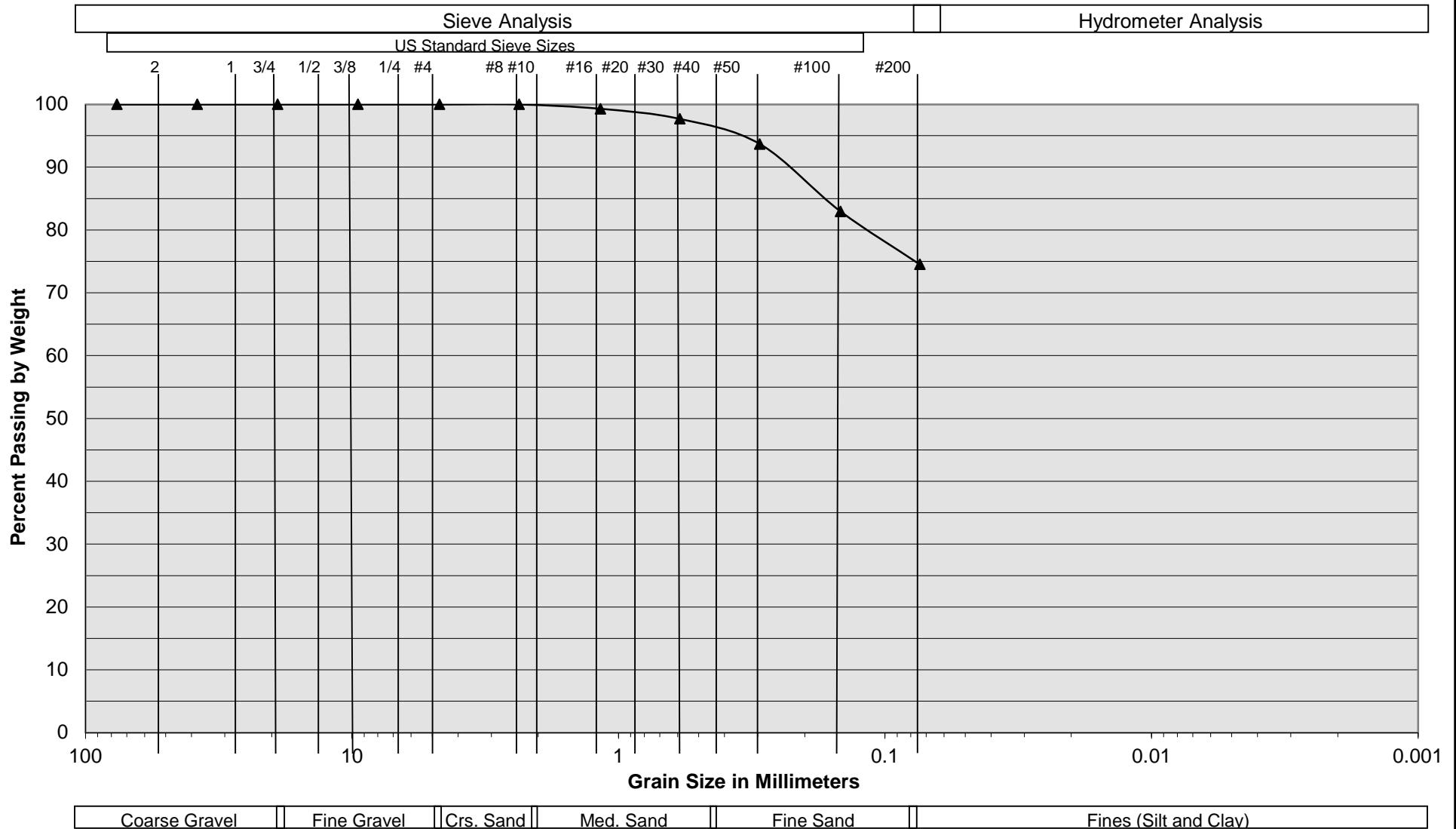
Percolation Boring No. DW-1

Interval Number		Time	Time Interval (hrs)	Average Wetted Depth for Interval (ft)	Inflow Meter Readings (gallons)	Volume of Outflow (gallons)	Percolation Rate Q (gallons/minute)	Percolation Rate Q (gal/ft ² /day)
1	Initial	10:40 AM	0.1667	70.00	3692.0	11.0	1.10	10.80
	Final	10:50 AM			3703.0			
2	Initial	10:50 AM	0.1667	70.00	3700.0	11.0	1.10	10.80
	Final	11:00 AM			3711.0			
3	Initial	11:00 AM	0.1667	70.00	3711.0	10.0	1.00	9.82
	Final	11:10 AM			3721.0			
4	Initial	11:10 AM	0.1667	70.00	3721.0	9.0	0.90	8.84
	Final	11:20 AM			3730.0			
5	Initial	11:20 AM	0.1667	70.00	3730.0	9.0	0.90	8.84
	Final	11:30 AM			3739.0			
6	Initial	11:30 AM	0.1667	70.00	3739.0	9.0	0.90	8.84
	Final	11:40 AM			3748.0			
7	Initial	11:40 AM	0.1667	70.00	3748.0	10.0	1.00	9.82
	Final	11:50 AM			3758.0			
8	Initial	11:50 AM	0.1667	70.00	3758.0	9.0	0.90	8.84
	Final	12:00 PM			3767.0			
9	Initial	12:00 PM	0.1667	70.00	3767.0	10.0	1.00	9.82
	Final	12:10 PM			3777.0			
10	Initial	12:10 PM	0.1667	70.00	3777.0	9.0	0.90	8.84
	Final	12:20 PM			3786.0			
11	Initial	12:20 PM	0.1667	70.00	3786.0	9.0	0.90	8.84
	Final	12:30 PM			3795.0			
12	Initial	12:30 PM	0.1667	70.00	3795.0	9.0	0.90	8.84
	Final	12:40 PM			3804.0			
13	Initial	12:40 PM	0.1667	70.00	3804.0	9.0	0.90	8.84
	Final	12:50 PM			3813.0			
14	Initial	12:50 PM	0.1667	70.00	3813.0	9.0	0.90	8.84
	Final	1:00 PM			3822.0			
15	Initial	1:00 PM	0.1667	70.00	3822.0	9.0	0.90	8.84
	Final	1:10 PM			3831.0			
16	Initial	1:10 PM	0.1667	70.00	3831.0	9.0	0.90	8.84
	Final	1:20 PM			3840.00			
17	Initial	1:20 PM	0.1667	70.00	3840.00	9.0	0.90	8.84
	Final	1:30 PM			3849.00			
18	Initial	1:30 PM	0.1667	70.00	3849.00	9.0	0.90	8.84
	Final	1:40 PM			3858.00			
19	Initial	1:40 PM	0.1667	70.00	3858.00	9.0	0.90	8.84
	Final	1:50 PM			3867.00			

Rate 54.0 gal/hr
 Rate 7.22 cubic ft/hr
 Surface Area 147.31 square ft
 Rate/Surface Area 0.05 ft/hr

Rate	0.59 in/hr
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Grain Size Distribution



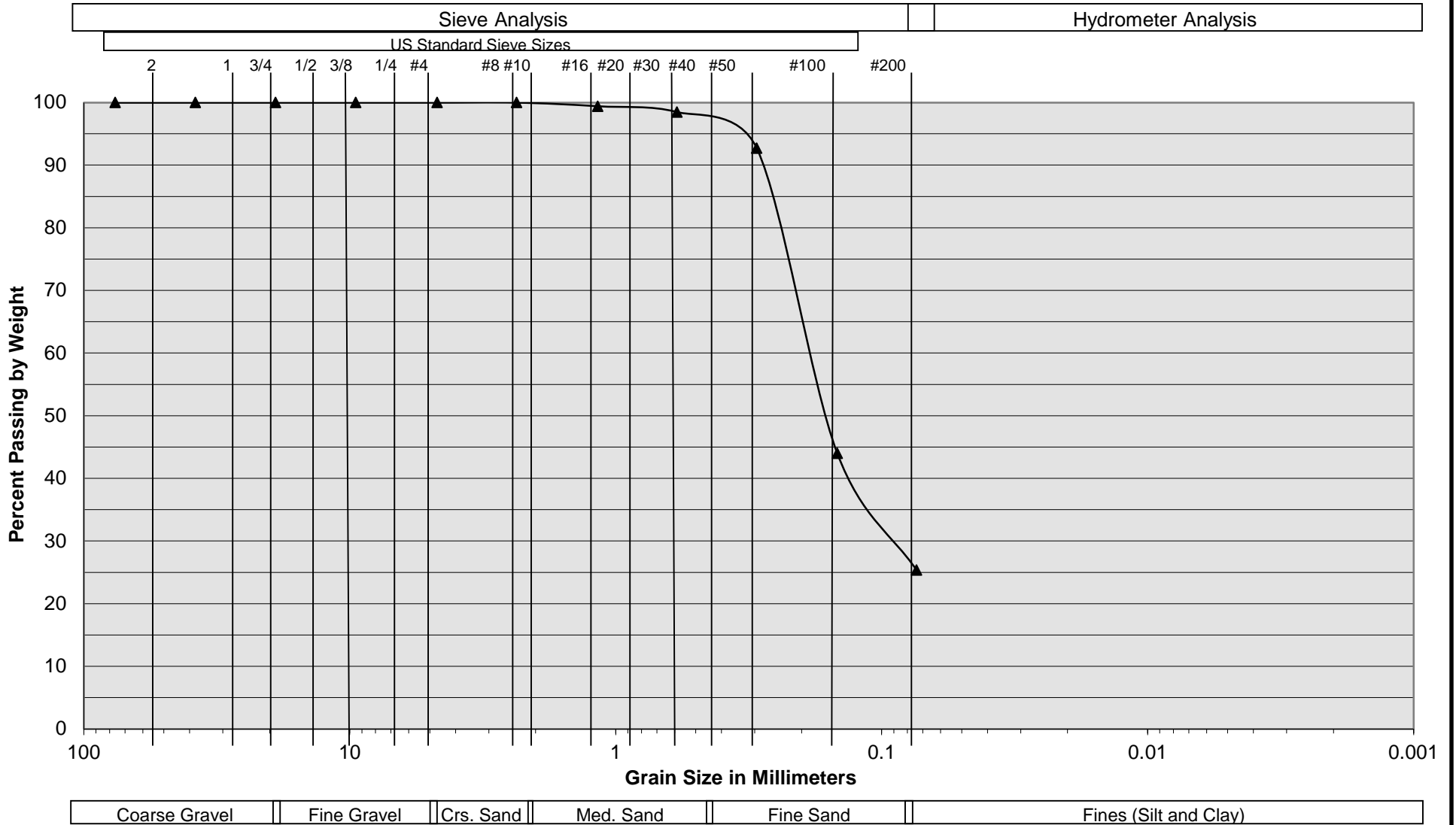
Sample Description	DW-1 @ 3½ feet
Soil Classification	Fine Sandy Clay, little Silt, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 1



SOUTHERN CALIFORNIA GEOTECHNICAL
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Grain Size Distribution



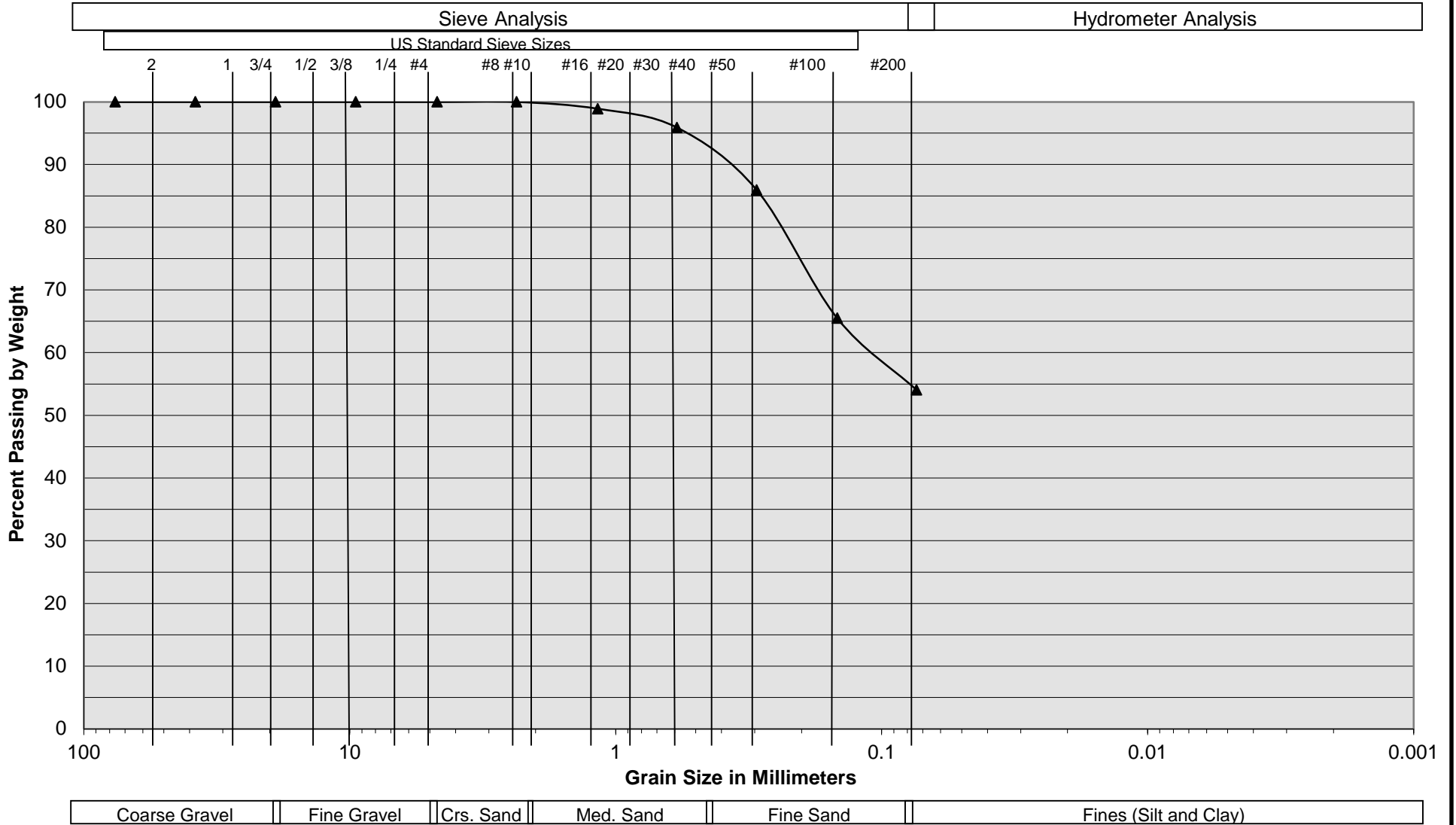
Sample Description	DW-1 @ 8½ feet
Soil Classification	Silty fine Sand, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 2



SOUTHERN CALIFORNIA GEOTECHNICAL
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Grain Size Distribution



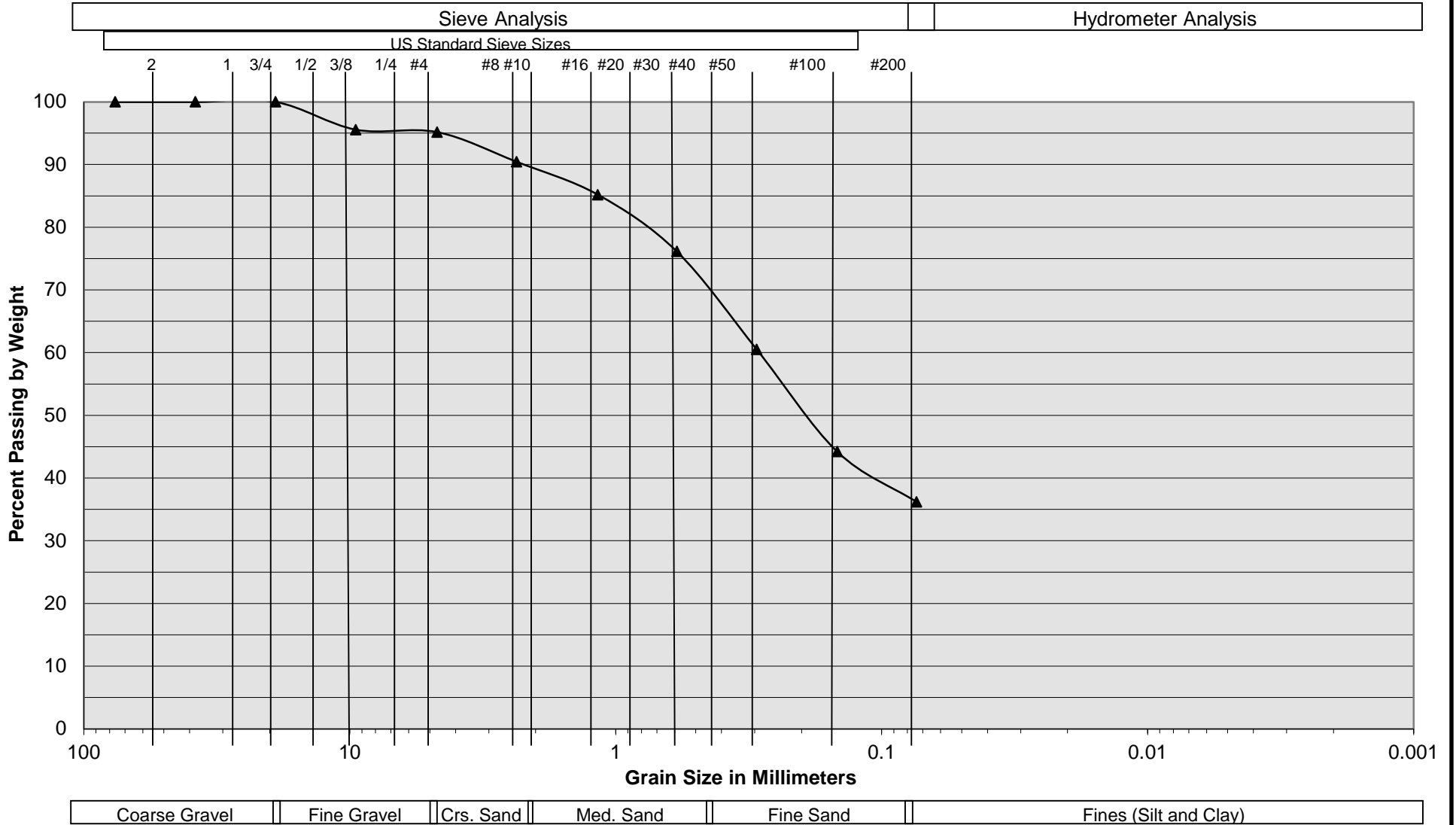
Sample Description	DW-1 @ 13½ feet
Soil Classification	Fine Sandy Silt, little Clay, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 3



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



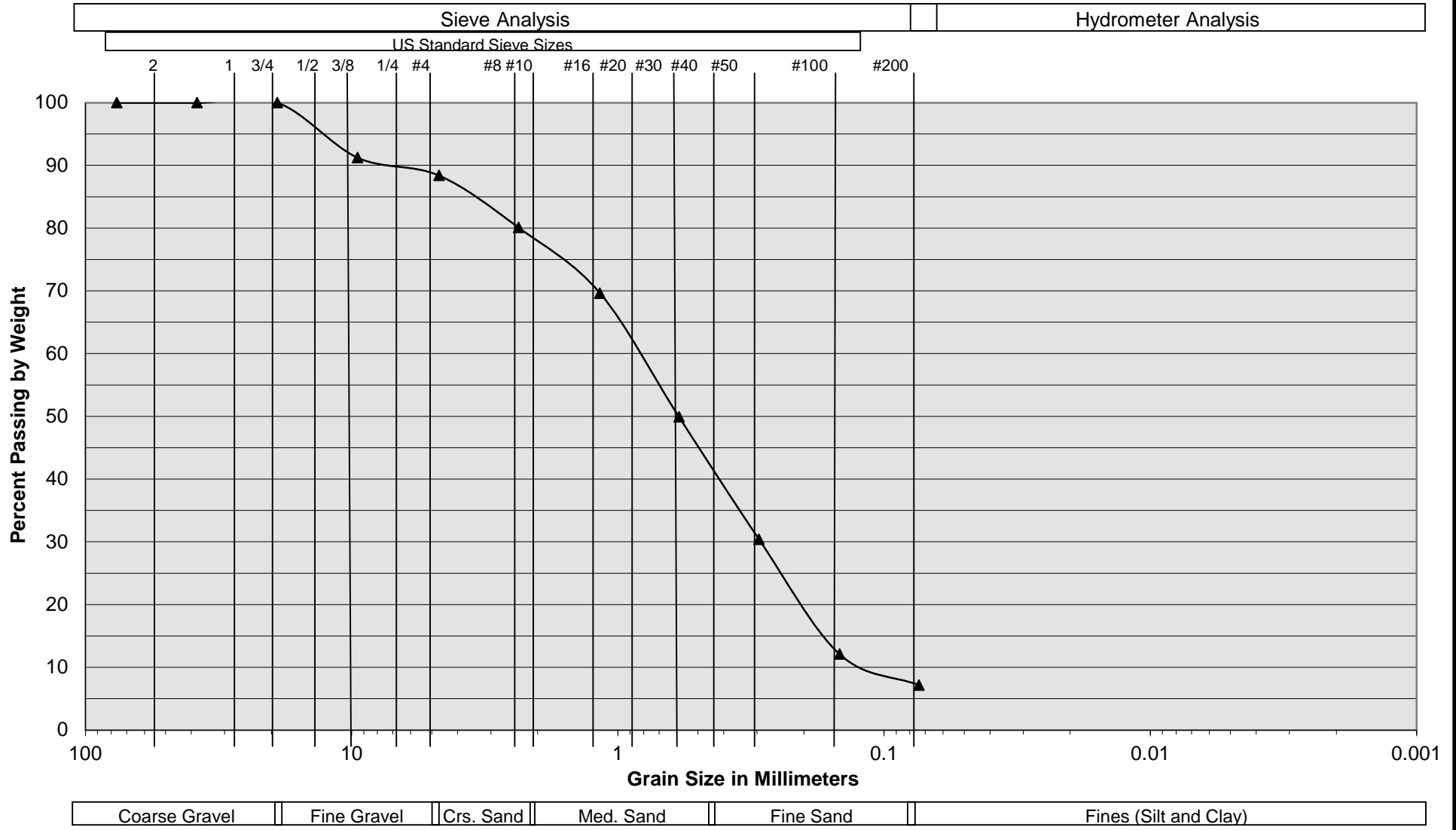
Sample Description	DW-1 @ 18½ feet
Soil Classification	Silty fine to medium Sand, trace coarse Sand, trace fine Gravel

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 4



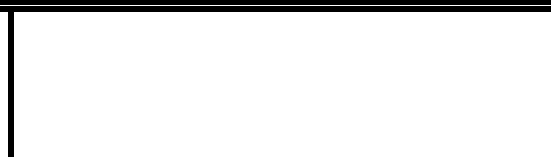
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



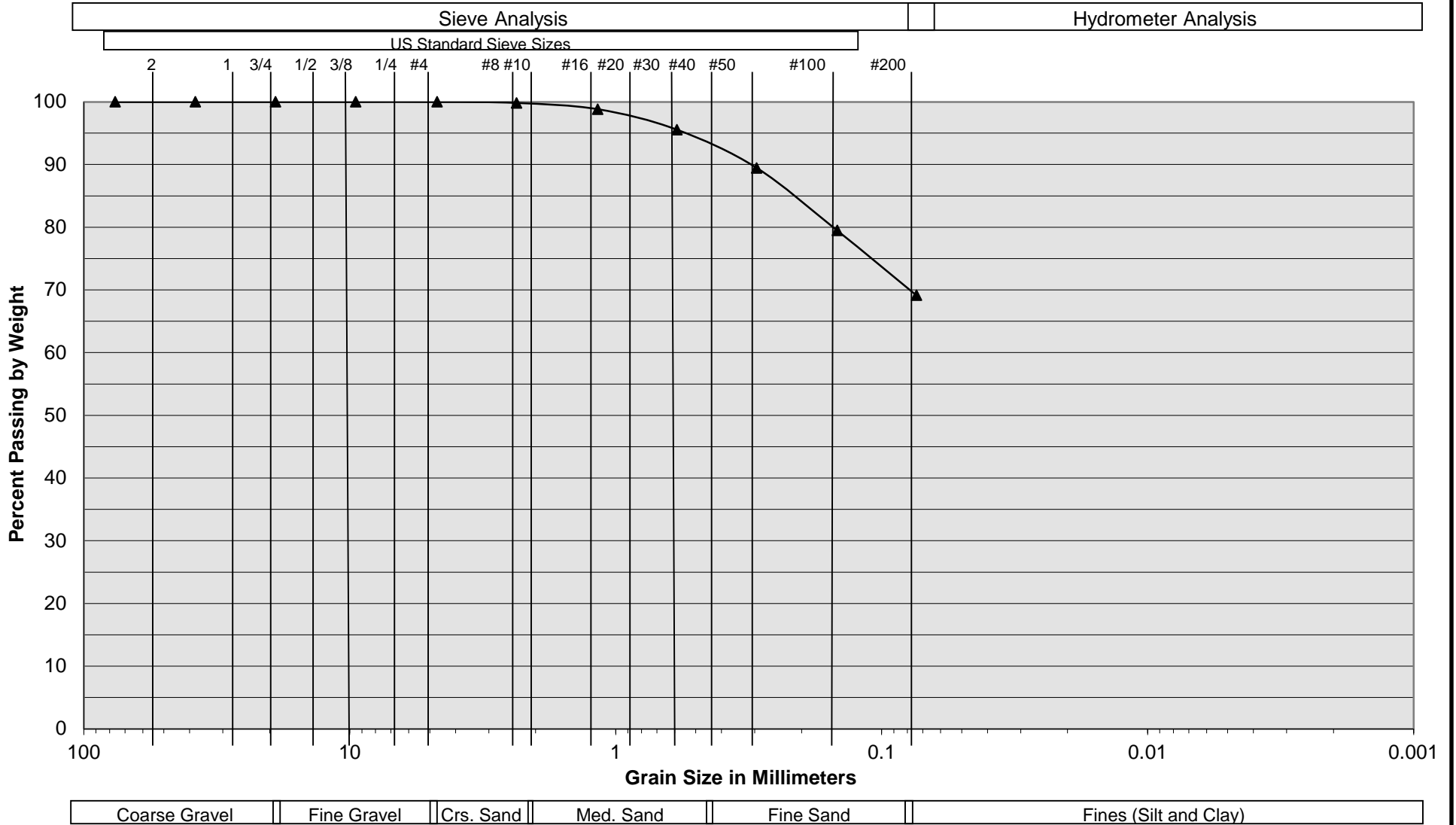
Sample Description	DW-1 @ 28½ feet
Soil Classification	Fine to medium Sand, little Silt, little fine Gravel

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 5



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



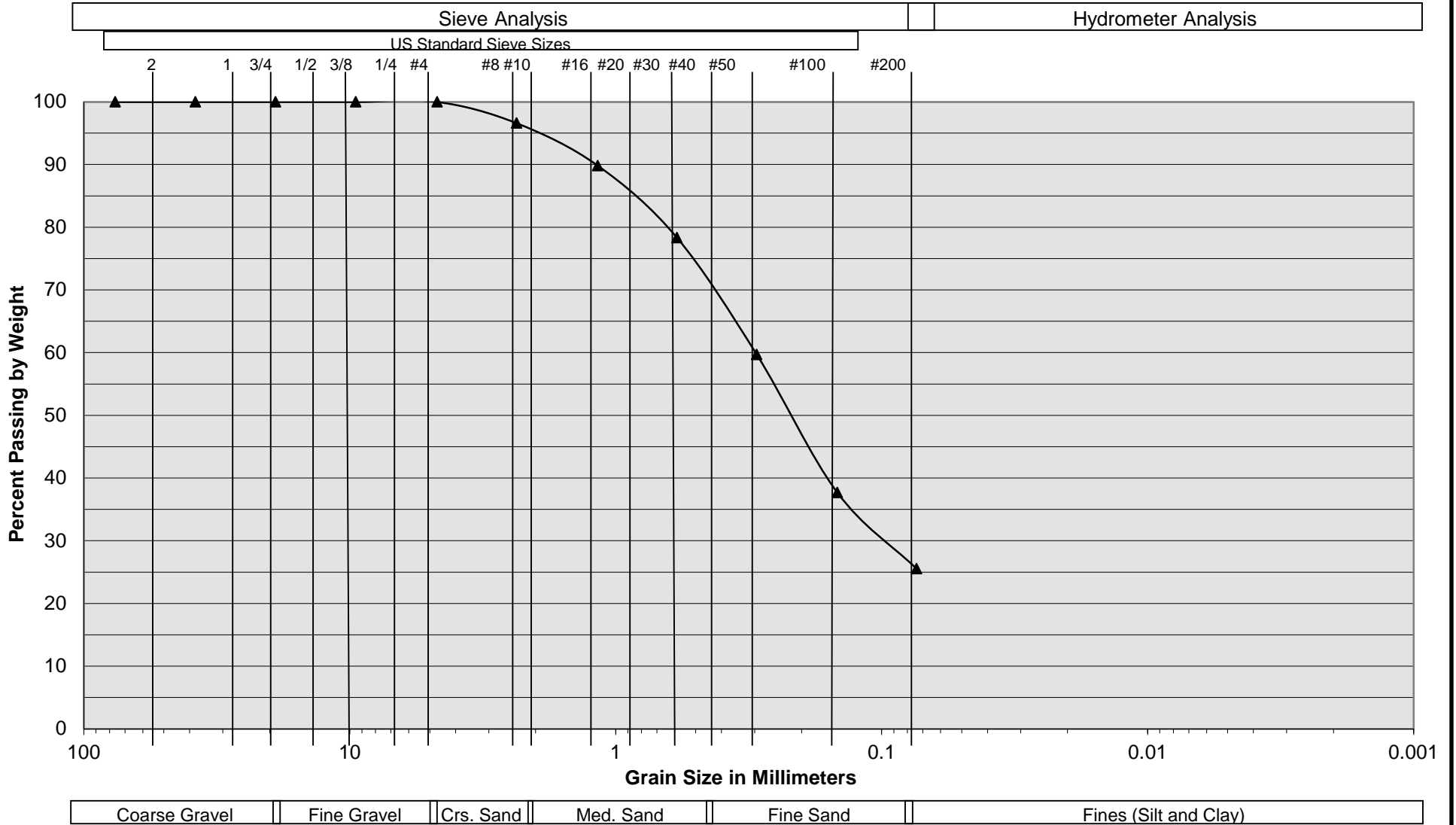
Sample Description	DW-1 @ 33½ feet
Soil Classification	Fine Sandy Silt, trace Clay, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 6



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

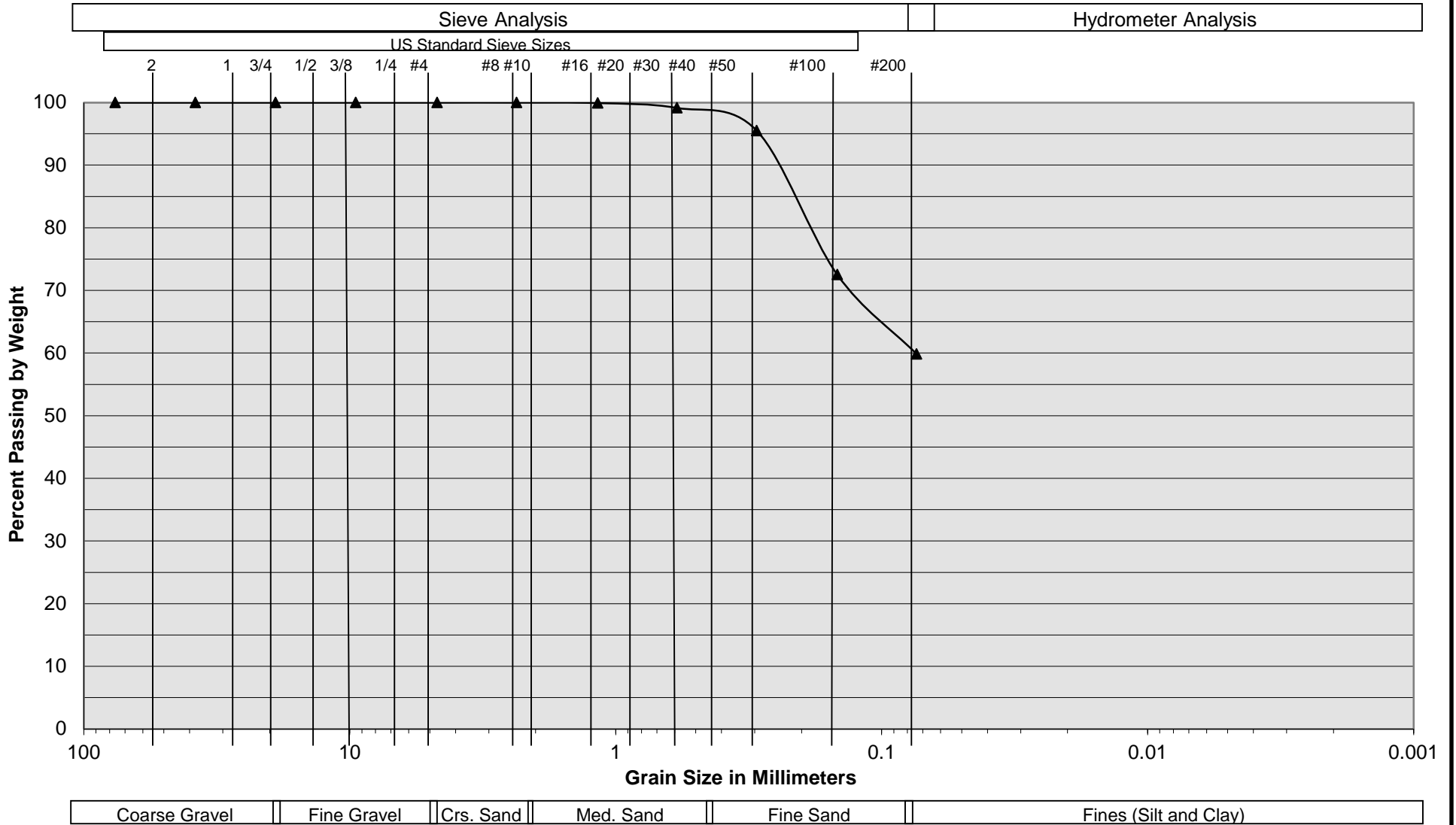


Sample Description	DW-1 @ 38½ feet
Soil Classification	Silty fine to medium Sand, trace coarse Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C-7

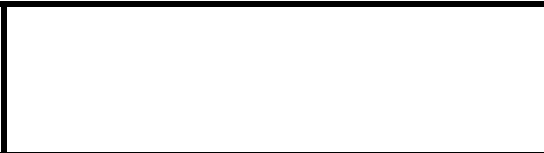


Grain Size Distribution



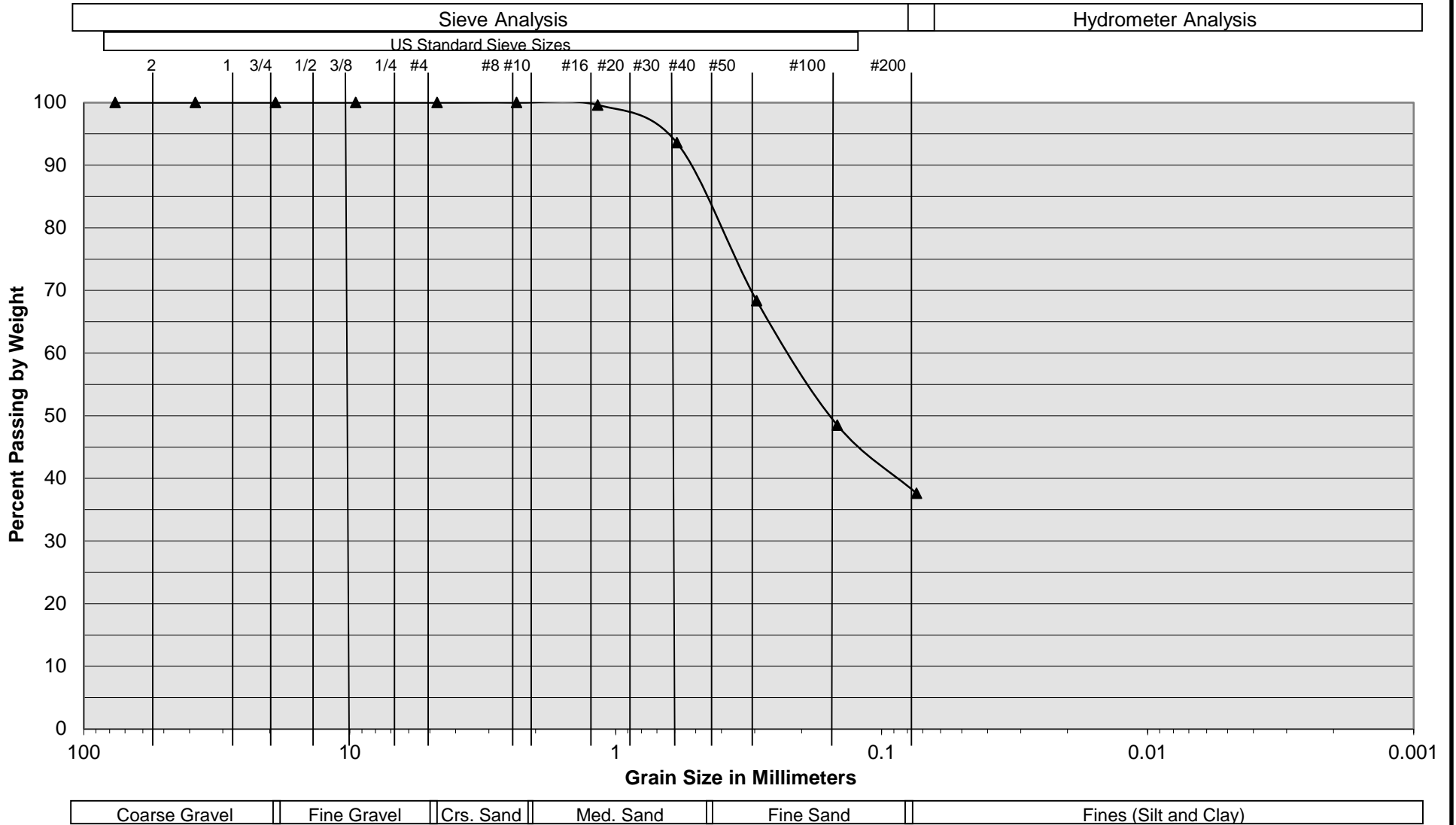
Sample Description	DW-1 @ 43½ feet
Soil Classification	Fine Sandy Silt

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 8



SOUTHERN CALIFORNIA GEOTECHNICAL
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Grain Size Distribution



Sample Description	DW-1 @ 48½ feet
Soil Classification	Silty fine to medium Sand, trace Clay

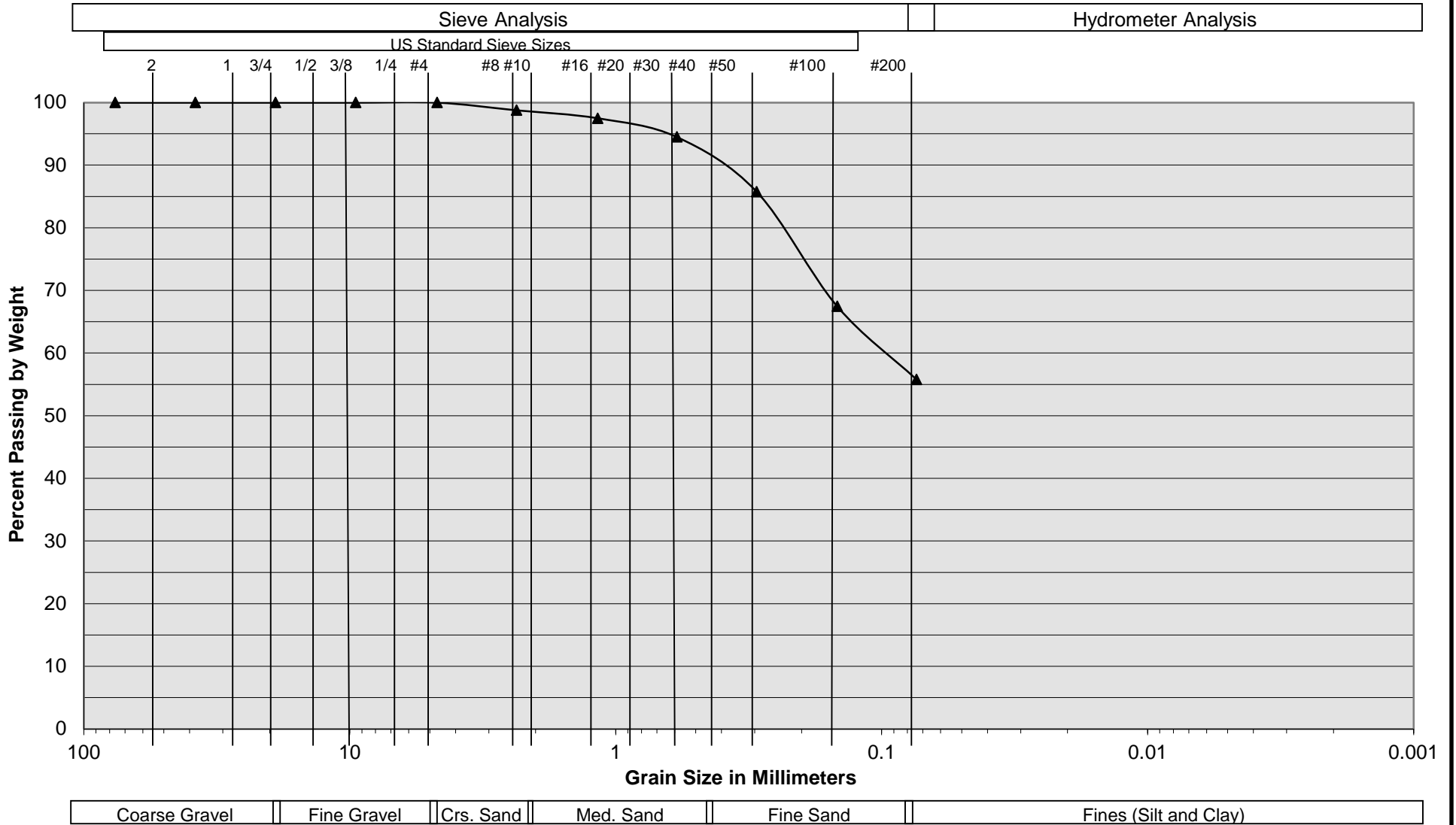
Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 9





SOUTHERN CALIFORNIA GEOTECHNICAL
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Grain Size Distribution

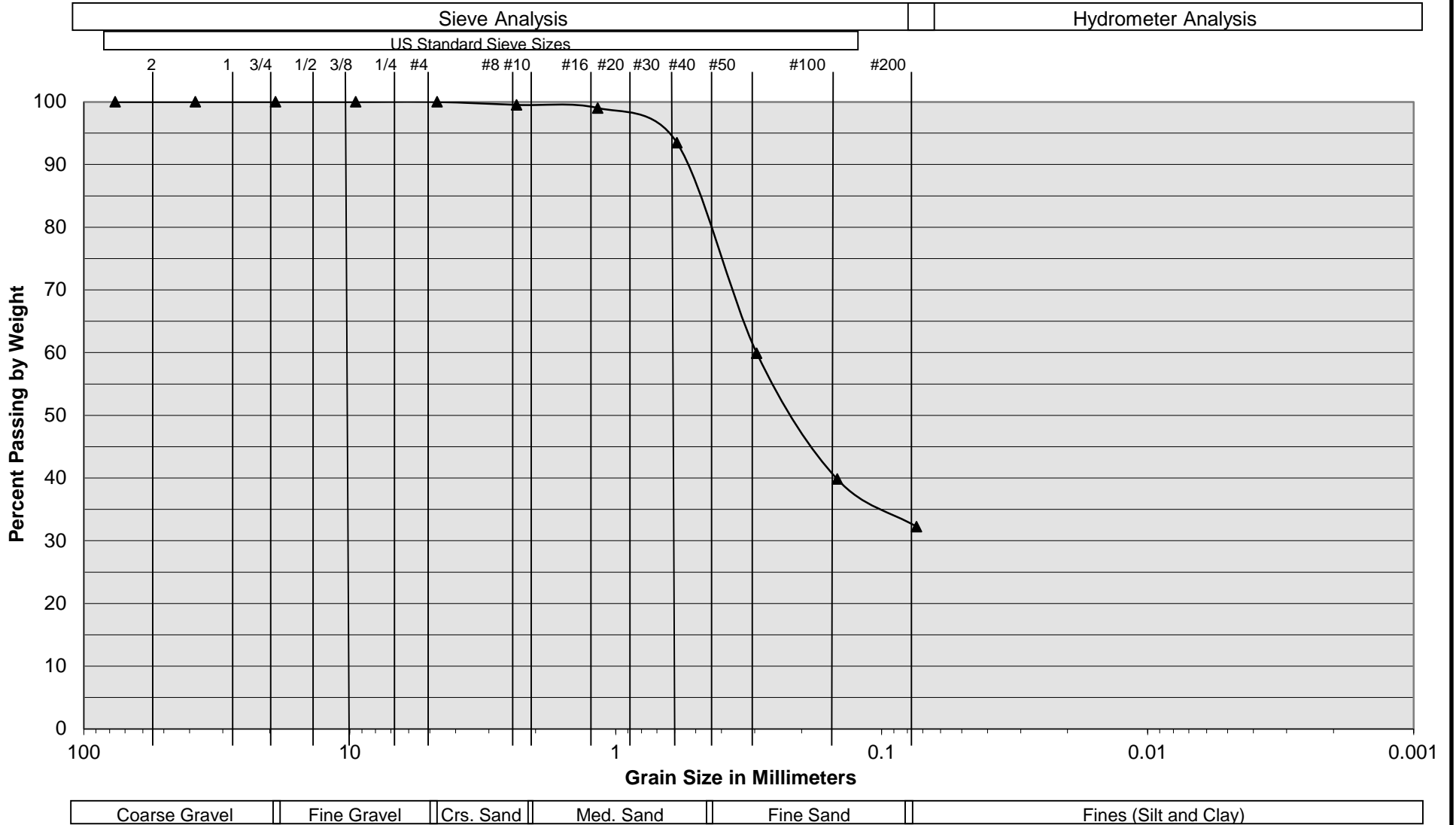


Sample Description	DW-1 @ 53½ feet
Soil Classification	Fine to medium Sandy Silt

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 10



Grain Size Distribution



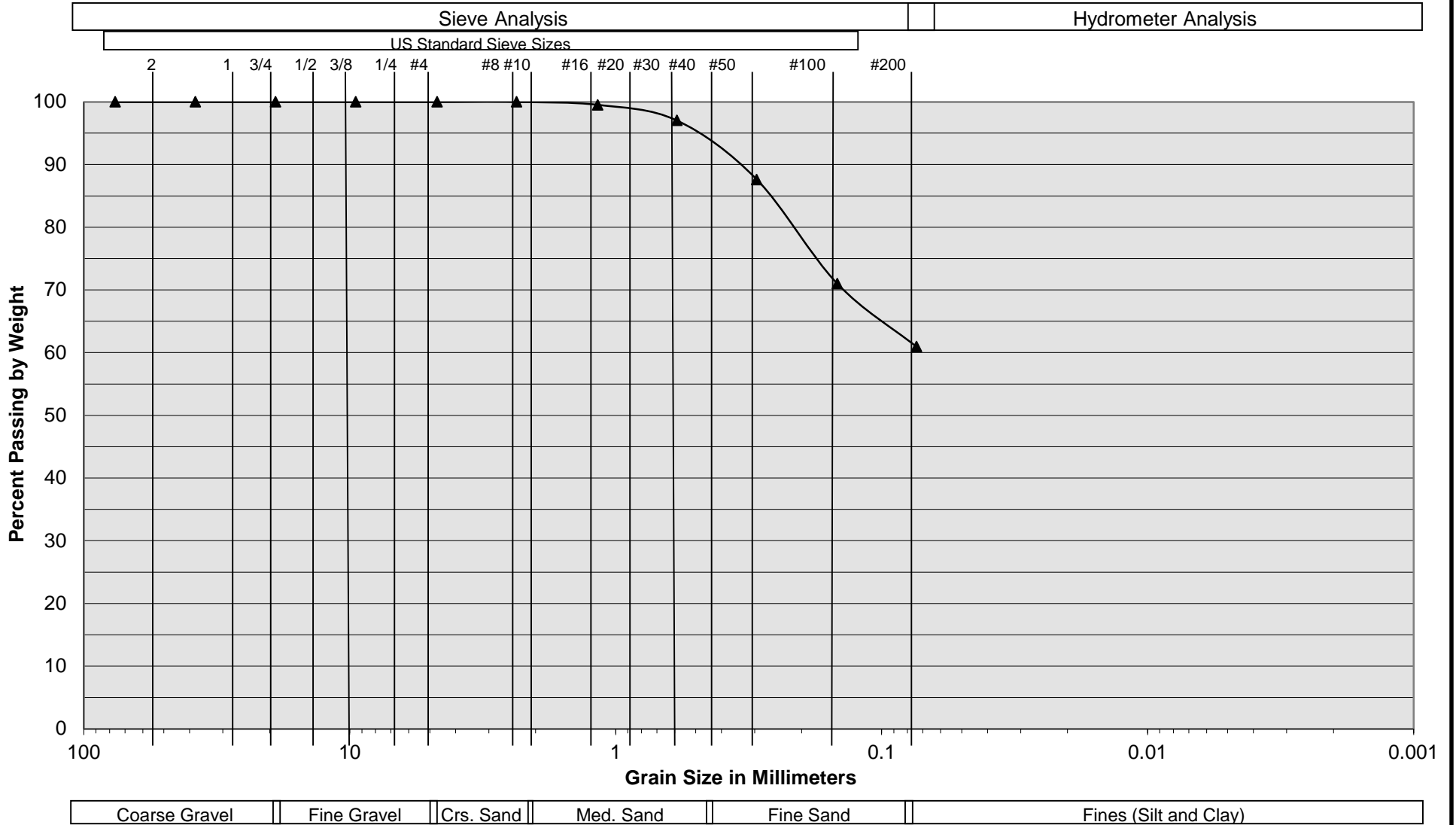
Sample Description	DW-1 @ 58½ feet
Soil Classification	Clayey fine to medium Sand, trace Silt

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 11



SOUTHERN CALIFORNIA GEOTECHNICAL
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Grain Size Distribution



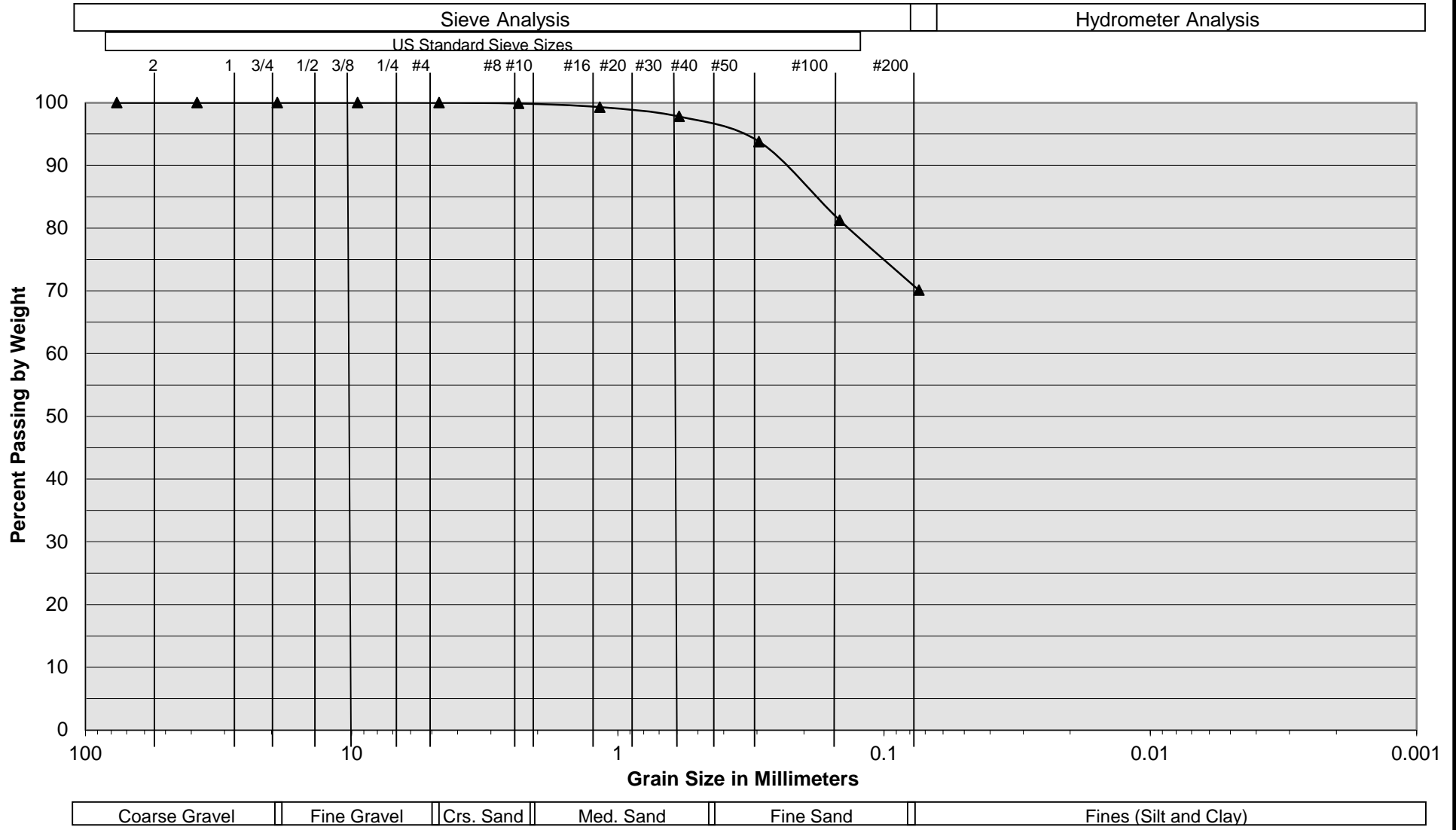
Sample Description	DW-1 @ 63½ feet
Soil Classification	Fine Sandy Silt, little Clay, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 12



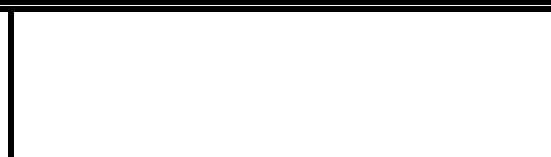
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



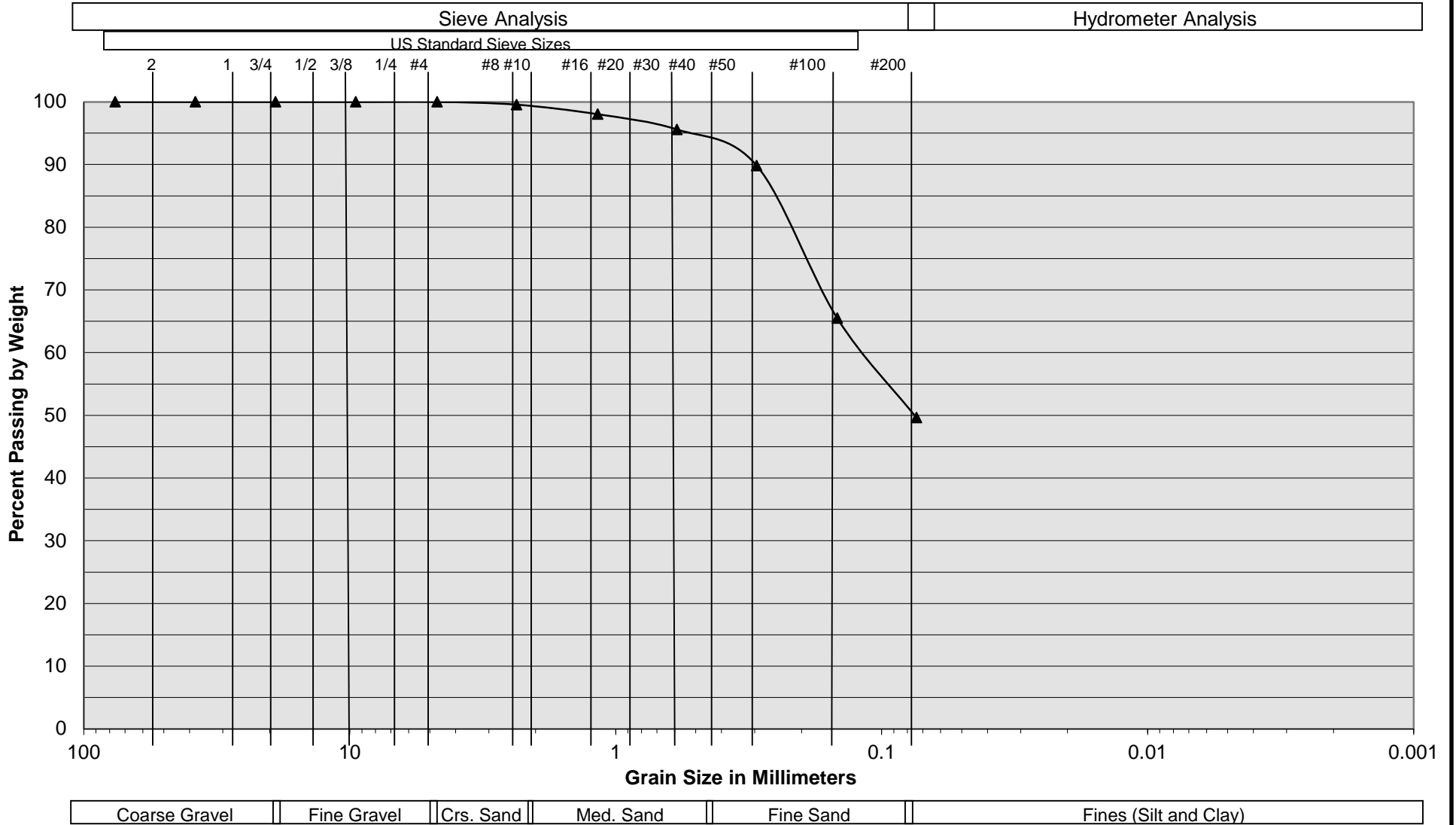
Sample Description	DW-1 @ 68½ feet
Soil Classification	Fine Sandy Silt, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 13



SOUTHERN CALIFORNIA GEOTECHNICAL
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Grain Size Distribution



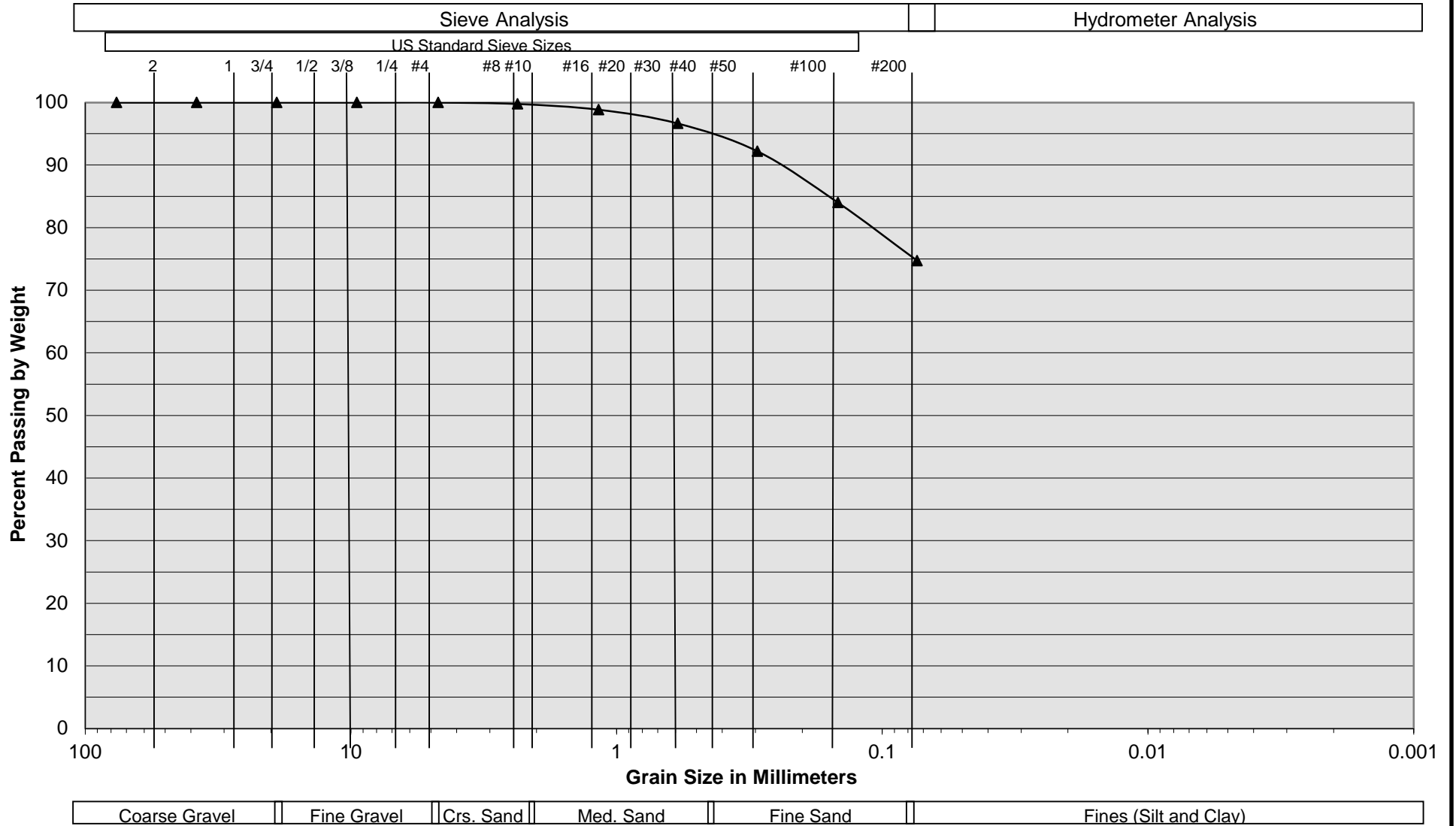
Sample Description	DW-1 @ 73½ feet
Soil Classification	Fine Sandy Silt to Silty fine Sand, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 14



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Grain Size Distribution



Sample Description	DW-1 @ 78½ feet
Soil Classification	Fine Sandy Silt, trace Clay, trace medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-4
PLATE C- 15



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

March 30, 2022

Orbis Real Estate Partners
280 Newport Center Drive, Suite 240
Newport Beach, California 92660



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**
A California Corporation

Attention: Jason Huber, PE
VP Development

Project No.: **22G118-2**

Subject: **Results of Preliminary Infiltration Testing**
Proposed Retail/Commercial Development
NWC Euclid Avenue and Schaefer Avenue
Chino, California

Reference: Geotechnical Feasibility Study, Proposed Retail/Commercial Development, NWC Euclid Avenue and Schaefer Avenue, Chino, California, prepared by Southern California Geotechnical, Inc. (SCG) for Orbis Real Estate Partners, SCG Project No. 22G118-1, dated March 29, 2022.

Mr. Huber:

In accordance with your request, we have conducted preliminary infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 22P112R, dated February 25, 2022. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

This report is not a design-level investigation. Future studies, including additional infiltration testing, will be necessary to refine or confirm the preliminary infiltration rates that are presented within this report.

Site and Project Description

The site is located at the northwest corner of Schaefer Avenue and South Euclid Avenue (Highway 83) in Chino, California. The site is also referenced by the street address 7050 Schaefer Avenue. The site is bounded to the north by vacant farm land, to the east by South Euclid Avenue, to the south by Schaefer Avenue and to the west by Fern Avenue. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of a rectangular-shaped parcel, 9.5± acres in size. The site is currently being utilized for agricultural purposes. The majority of the site is presently planted with strawberries. A fruit-stand, 500± ft² in size, located in the southeast corner of the site. Ground surface cover around the row crops consists of plastic sheeting and exposed soil. A few large trees are present near the fruit-stand.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations made at the time of the subsurface investigation, the site slopes downward to the southwest at a gradient of 1± percent. The maximum elevation differential across the site is estimated to be 8 to 10± feet.

Proposed Development

SCG was provided with conceptual site plan prepared by AO Architecture. Based on this plan, the site will be developed with the following:

<u>Building Type/Use</u>	<u>Size (ft²)</u>	<u>Location</u>
Car Wash	3,700	Northwest
Fitness	10,000	North-Central
Retail/Food 1	10,000	North-Central
Market	23,256	North-Central
Retail Shops	9,000	North-Central
Quick-Service Restaurant 1	3,300	Northeast
Retail/Food 2	8,000	Southeast
Quick-Service Restaurant 2	3,500	South-Central
Gas Station	3,000	Southwest

Dock-high doors will be constructed along a portion of the north building wall of the market. It is expected that the buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck court areas and areas of concrete flatwork and landscape planters throughout the site.

The proposed development will include on-site stormwater infiltration. Based on our conversations with the project civil engineer, the infiltration system will consist of four (4) below-grade chambers. The bottoms of the infiltration systems will be 10± feet below the existing site grades. It should be noted that due to the existing row crops, the infiltration tests were **not** performed within the proposed chamber locations. The infiltration tests were offset to accessible areas. Therefore, additional confirmation infiltration tests will be necessary once the infiltration areas are confirmed and become accessible.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, nine (9) borings (identified as Boring Nos. B-1 through B-9) were advanced to depths of 20 to 25± feet below the existing site grades.

Artificial fill soils were encountered at the ground surface at all boring locations, extending to depths of 2 to 6½± feet below ground surface. The fill soils generally consist of loose to medium silty fine sands. Occasional layers of loose fine sands and fine sandy silts were encountered. Native alluvium was encountered beneath the fill at all of the boring locations, extending to at least the maximum depth explored of 25± feet below ground surface. The alluvial soils generally consist of loose to dense silty fine sands, fine sandy silts, clayey fine sands, clayey silts, fine sands, medium stiff to very stiff silty clays and fine sandy clays. The alluvial soils generally possess trace to some iron oxide staining and calcareous nodules and veining.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

Recent water level data was obtained from the California Department of Water Resources website, <http://www.water.ca.gov/waterdatalibrary/>. One monitoring well on record is located 3,168± feet east of the site. Water level readings within this monitoring well indicate a high groundwater level of 136± feet below the ground surface in April 2020.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of four (4) infiltration test borings, advanced to a depth of 10± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and were logged during drilling by a member of our staff. The approximate locations of the borings (identified as I-1 through I-4) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Artificial fill soils were encountered at the ground surface at all of the infiltration boring locations, extending to a depth of 3± feet below the existing site grades. The fill soils generally consist of

loose to medium dense silty fine sands and stiff/loose intermixed clayey fine sands and fine sandy clays. The fill soils possess a disturbed mottled appearance, with some samples possessing trace plastic fragments, resulting in their classification as artificial fill. Native alluvial soils were encountered beneath the fill soils at all of the infiltration boring locations, extending to at least the maximum depth explored of 10± feet. The alluvium generally consists of loose to medium dense silty fine to medium sands, fine to medium sandy silts, clayey fine sands, stiff to very stiff silty clays and fine sandy clays. The alluvial soils generally possess trace to little iron oxide staining and calcareous nodules and veining. Occasional samples possess slight porosity. The Boring Logs, which illustrate the conditions encountered at the boring locations, are included with this report.

Infiltration Testing

The infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, all infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of filling the borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water flow into the hole holds **constant at a level at least 5 times the hole's radius above the gravel at the bottom of each hole**. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing

Following the pre-soaking process, SCG performed the infiltration testing. Each test hole was filled **with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the** test holes. In accordance with the county guidelines, since **"sandy soils" (where 6 inches of water** infiltrated into the surrounding soils in less than 25 minutes for two consecutive readings) were encountered at the bottom of the Infiltration Boring No. I-1, readings were taken at 10-minute intervals for a total of 1 hour. Infiltration Boring Nos. I-2 through I-4 **encountered "non-sandy soils" (where 6 inches of water did not infiltrate into the surrounding soils in less than 25 minutes** for two consecutive readings), therefore readings were taken at 30-minute intervals for a total of 6 hours. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

<u>Infiltration Test No.</u>	<u>Depth (feet)</u>	<u>Soil Description</u>	<u>Measured Infiltration Rate (inches/hour)</u>
I-1	10	Brown Silty fine to medium Sand	3.0
I-2	10	Light Gray Brown fine to medium Sandy Silt	0.9
I-3	10	Light Gray Brown fine Sandy Silt, trace medium Sand, little Clay	1.0
I-4	10	Gray fine Sandy Clay, trace medium Sand, little Silt	0.0

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-4 of this report.

Design Recommendations

Four (4) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations vary from 0.0 to 3.0 inches per hour. The major factor affecting the difference in infiltration rates at the infiltration test locations is the presence of silt and clay in the soils at the tested depths.

Based on the results of the infiltration testing, the following infiltration rates should be used in the preliminary design of the infiltration systems in their respective locations and depths:

<u>Infiltration System</u>	<u>Design Infiltration Rate (inches/hour)</u>
Northeast	3.0
East	0.9
Southeast	1.0
West	0.0

As previously stated, these infiltration rates are preliminary and additional confirmation infiltration tests will need to be performed within the areas of the proposed infiltration systems. The design of the storm water infiltration systems should be

performed by the project civil engineer, in accordance with the City of Chino and/or County of San Bernardino guidelines. It is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.** It should be noted that the recommended infiltration rates are based on infiltration testing at four (4) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein was determined in accordance with the county guidelines and are considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rates presented above. The infiltration rates will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rates.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rates reported herein.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the soils at the bases of the chambers, or at levels lower than 2 feet above the bottom of the system. As such, the bottom 24 inches of the infiltration systems should be excavated with non-rubber-tired equipment, such as excavators.

Infiltration Chamber Maintenance

The proposed project includes below-grade chamber systems. Water flowing into these systems will carry some level of sediment. Wind-blown sediments will also contribute to sediment deposition at the bottom of the chamber. This layer has the potential to significantly reduce the infiltration rate of the chamber subgrade soils. Therefore, a formal chamber maintenance program should be established to ensure that these silt and clay deposits are removed from the system on a regular basis.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The

design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance **on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.**

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

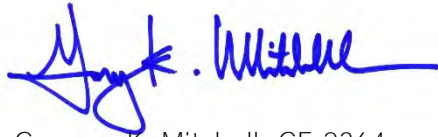
We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.



Jamie Hayward
Staff Geologist

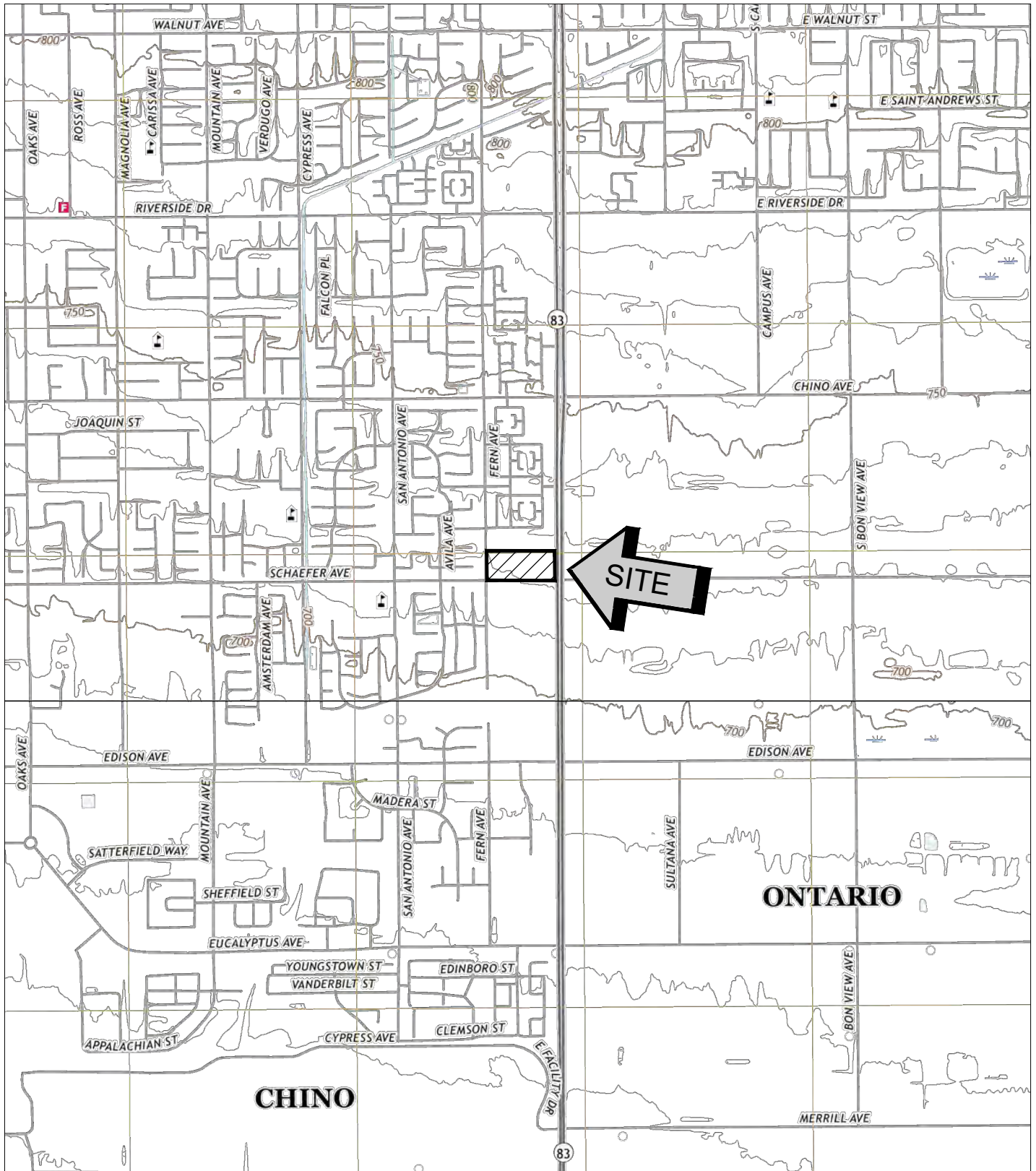


Gregory K. Mitchell, GE 2364
Principal Engineer



Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (6 pages)
Infiltration Test Results Spreadsheets (4 pages)
Grain Size Distribution Graphs (4 pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF THE ONTARIO AND PRADO DAM QUADRANGLES, ORANGE COUNTY, CALIFORNIA, 2018.



SITE LOCATION MAP
PROPOSED RETAIL/COMMERCIAL DEVELOPMENT
CHINO, CALIFORNIA

SCALE: 1" = 2000'

DRAWN: JAH
 CHKD: RGT

SCG PROJECT
 22G118-2

PLATE 1



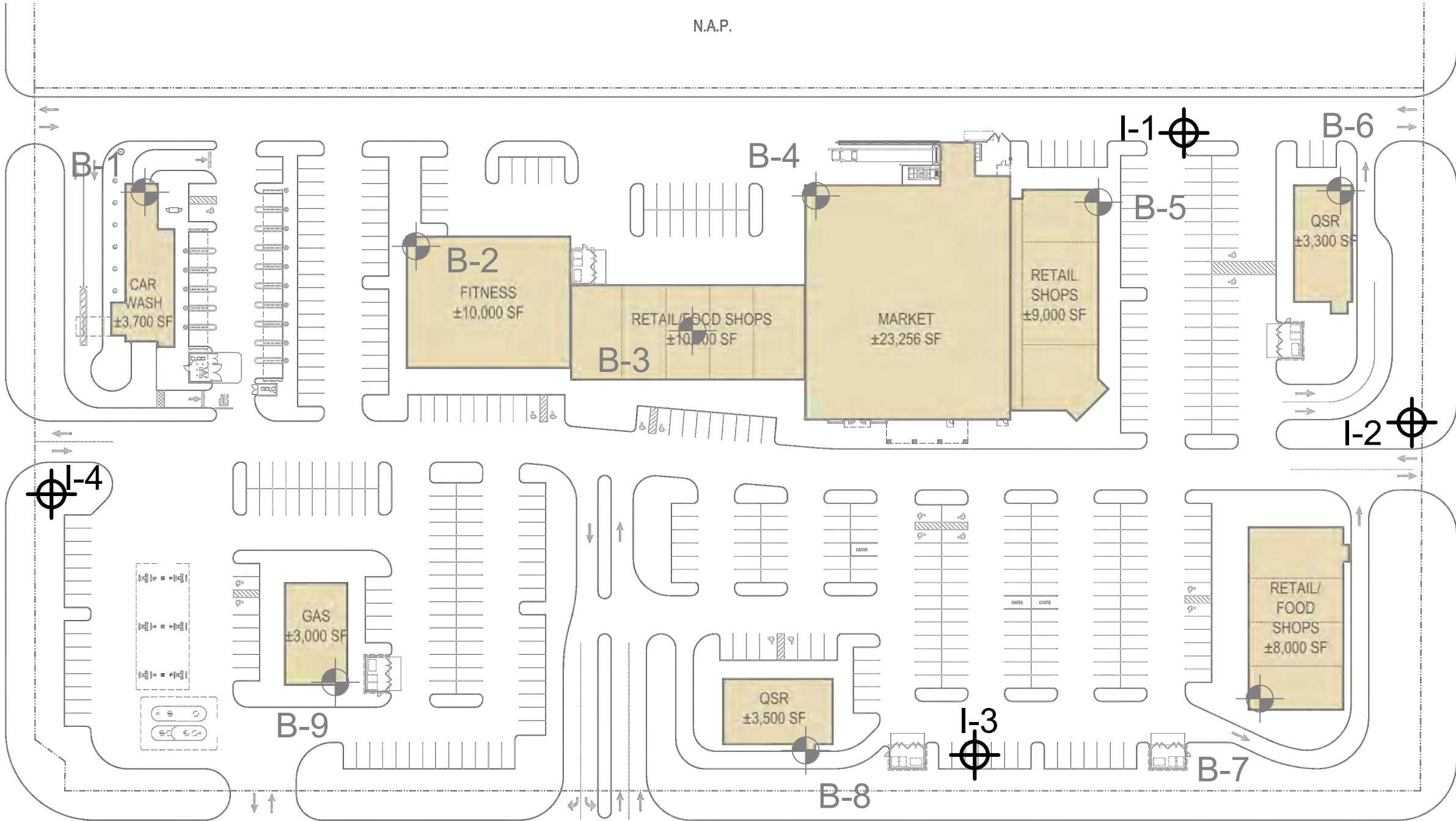
SOUTHERN CALIFORNIA GEOTECHNICAL

N.A.P.



FERN AVENUE

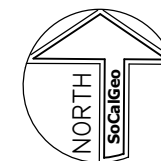
EUCLID AVENUE

SCHAEFER AVENUE



GEOTECHNICAL LEGEND


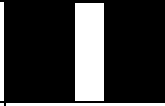

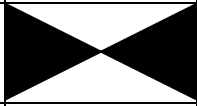

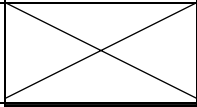


-  APPROXIMATE INFILTRATION LOCATION
-  APPROXIMATE BORING LOCATION
(CONCURRENT SCG PROJECT NO. 22G118-1)



NOTE: CONCEPTUAL SITE PLAN PREPARED BY AO ARCHITECTURE.

INFILTRATION TEST LOCATION PLAN	
PROPOSED RETAIL/COMMERCIAL DEVELOPMENT	
CHINO, CALIFORNIA	
SCALE: 1" = 80'	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAH	
CHKD: RGT	
SCG PROJECT 22G118-2	
PLATE 2	

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS	
			GRAPH	LETTER		
<p>COARSE GRAINED SOILS</p> <p>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE</p>	<p>GRAVEL AND GRAVELLY SOILS</p>	<p>CLEAN GRAVELS</p> <p>(LITTLE OR NO FINES)</p>		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES	
		<p>GRAVELS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES	
	<p>SAND AND SANDY SOILS</p>	<p>CLEAN SANDS</p> <p>(LITTLE OR NO FINES)</p>		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES	
		<p>SANDS WITH FINES</p> <p>(APPRECIABLE AMOUNT OF FINES)</p>		SM	SILTY SANDS, SAND - SILT MIXTURES	
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES	
			<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT LESS THAN 50</p>		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
					CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
<p>SILTS AND CLAYS</p> <p>LIQUID LIMIT GREATER THAN 50</p>		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY			
		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS			
		CH	INORGANIC CLAYS OF HIGH PLASTICITY			
<p>HIGHLY ORGANIC SOILS</p>		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS			

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

JOB NO.: 22G118-2	DRILLING DATE: 2/28/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: ---
LOCATION: Chino, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
SURFACE ELEVATION: MSL											
		8		[Symbol]	<u>FILL</u> : Brown Silty fine Sand, trace Clay, slightly mottled, loose-moist		9				
5		18	4.5	[Symbol]	<u>ALLUVIUM</u> : Gray Silty Clay, trace fine Sand, little Calcareous veining, stiff to very stiff-moist to very moist		14				
		12	4	[Symbol]			17				
		11		[Symbol]	Brown Silty fine to medium Sand, medium dense-damp		7		26		
10				[Symbol]							
Boring Terminated at 10'											

TBL_22G118-2.GPJ_SOCALGEO.GDT_3/31/22

JOB NO.: 22G118-2	DRILLING DATE: 2/28/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: ---
LOCATION: Chino, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
SURFACE ELEVATION: MSL											
		7			<u>FILL</u> : Gray Brown Silty fine Sand, trace fine Gravel, mottled, loose-moist		11				
5		22	3		<u>ALLUVIUM</u> : Gray Brown Clayey fine Sand, little Silt, abundant Calcareous veining, little Iron oxide staining. medium dense-moist to very moist		14				
		15	4				16				
		12			Light Gray Brown fine to medium Sandy Silt, trace Calcareous veining, little Iron oxide staining, medium dense-very moist		25		73		
10					Boring Terminated at 10'						

TBL 22G118-2.GPJ_SOCALGEO.GDT 3/31/22



JOB NO.: 22G118-2	DRILLING DATE: 2/28/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: ---
LOCATION: Chino, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
SURFACE ELEVATION: MSL											
				<p><u>FILL</u>: Brown Silty fine Sand, trace plastic fragments, medium dense-moist</p>		11					
5			3.5	<p><u>ALLUVIUM</u>: Gray Brown fine Sandy Clay, trace medium Sand, slightly porous, abundant Calcareous veining, trace Iron oxide staining, stiff-moist to very moist</p>		14					
			3			19					
			9	<p>Light Gray Brown fine Sandy Silt, trace medium Sand, little Clay, trace Calcareous veining, trace Iron oxide staining, loose-very moist</p>		27			67		
10				<p>Boring Terminated at 10'</p>							

TBL_22G118-2.GPJ_SOCALGEO.GDT_3/31/22



JOB NO.: 22G118-2	DRILLING DATE: 2/28/22	WATER DEPTH: Dry
PROJECT: Proposed Retail Commercial Dev.	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: ---
LOCATION: Chino, California	LOGGED BY: Jamie Hayward	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: MSL												
		9			<u>FILL</u> : Intermixed Gray Brown Clayey fine Sand and fine Sandy Clay, trace medium to coarse Sand, mottled, loose/stiff-moist		13					
5		12			<u>ALLUVIUM</u> : Gray Brown Silty fine Sand, trace Clay, trace Calcareous veining, trace Iron oxide staining, medium dense-moist to very moist		14					
		10					23					
		11	4		Gray fine Sandy Clay, trace medium Sand, little Silt, some Calcareous veining, trace Iron oxide staining, slightly porous, very stiff-very moist		26		73			
10					Boring Terminated at 10'							

TBL 22G118-2.GPJ_SOCALGEO.GDT 3/31/22

INFILTRATION CALCULATIONS

Project Name	Proposed Retail/Commercial Development
Project Location	Chino, California
Project Number	22G118-2
Engineer	JH

Test Hole Radius	4 (in)
Test Depth	10.00 (ft)

Infiltration Test Hole	I-1
------------------------	-----

Soil Criteria Test							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	7:20 AM	25.00	8.13	24.12	YES	SANDY SOILS
	Final	7:45 AM		10.14			
2	Initial	7:46 AM	25.00	8.13	24.12	YES	SANDY SOILS
	Final	8:11 AM		10.14			

Test Data							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:13 AM	10.00	8.28	0.57	1.44	4.27
	Final	8:23 AM		8.85			
2	Initial	8:24 AM	10.00	8.28	0.52	1.46	3.84
	Final	8:34 AM		8.80			
3	Initial	8:35 AM	10.00	8.28	0.44	1.50	3.17
	Final	8:45 AM		8.72			
4	Initial	8:46 AM	10.00	8.28	0.43	1.51	3.09
	Final	8:56 AM		8.71			
5	Initial	8:57 AM	10.00	8.28	0.42	1.51	3.01
	Final	9:07 AM		8.70			
6	Initial	9:08 AM	10.00	8.28	0.42	1.51	3.01
	Final	9:18 AM		8.70			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

- Where:
- Q = Infiltration Rate (in inches per hour)
 - ΔH = Change in Height (Water Level) over the time interval
 - r = Test Hole (Borehole) Radius
 - Δt = Time Interval
 - H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Retail/Commercial Development
Project Location	Chino, California
Project Number	22G118-2
Engineer	JH

Test Hole Radius	4 (in)
Test Depth	10.00 (ft)

Infiltration Test Hole	I-2
------------------------	-----

Soil Criteria Test							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	7:30 AM	25.00	8.21	1.56	NO	NON-SANDY SOILS
	Final	7:55 AM		8.34			
2	Initial	8:05 AM	25.00	8.21	3.36	NO	NON-SANDY SOILS
	Final	8:30 AM		8.49			

Test Data							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:31 AM	30.00	8.49	0.38	1.32	1.02
	Final	9:01 AM		8.87			
2	Initial	9:02 AM	30.00	8.49	0.38	1.32	1.02
	Final	9:32 AM		8.87			
3	Initial	9:33 AM	30.00	8.49	0.36	1.33	0.96
	Final	10:03 AM		8.85			
4	Initial	10:04 AM	30.00	8.49	0.36	1.33	0.96
	Final	10:34 AM		8.85			
5	Initial	10:35 AM	30.00	8.49	0.35	1.34	0.93
	Final	11:05 AM		8.84			
6	Initial	11:06 AM	30.00	8.49	0.35	1.34	0.93
	Final	11:36 AM		8.84			
7	Initial	11:37 AM	30.00	8.49	0.35	1.34	0.93
	Final	12:07 PM		8.84			
8	Initial	12:08 PM	30.00	8.49	0.35	1.34	0.93
	Final	12:38 PM		8.84			
9	Initial	12:39 PM	30.00	8.49	0.35	1.34	0.93
	Final	1:09 PM		8.84			
10	Initial	1:10 PM	30.00	8.49	0.35	1.34	0.93
	Final	1:40 PM		8.84			
11	Initial	1:41 PM	30.00	8.49	0.35	1.34	0.93
	Final	2:11 PM		8.84			
12	Initial	2:12 PM	30.00	8.49	0.35	1.34	0.93
	Final	2:42 PM		8.84			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

- Where:
- Q = Infiltration Rate (in inches per hour)
 - ΔH = Change in Height (Water Level) over the time interval
 - r = Test Hole (Borehole) Radius
 - Δt = Time Interval
 - H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Retail/Commercial Development
Project Location	Chino, California
Project Number	22G118-2
Engineer	JH

Test Hole Radius	4 (in)
Test Depth	10.00 (ft)

Infiltration Test Hole	I-3
------------------------	-----

Soil Criteria Test							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:10 AM	25.00	8.21	1.56	NO	NON-SANDY SOILS
	Final	8:35 AM		8.34			
2	Initial	8:40 AM	25.00	8.21	3.36	NO	NON-SANDY SOILS
	Final	9:05 AM		8.49			

Test Data							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:10 AM	30.00	7.66	0.68	2.00	1.26
	Final	9:40 AM		8.34			
2	Initial	9:41 AM	30.00	7.66	0.67	2.01	1.23
	Final	10:11 AM		8.33			
3	Initial	10:12 AM	30.00	7.66	0.64	2.02	1.17
	Final	10:42 AM		8.30			
4	Initial	10:43 AM	30.00	7.66	0.62	2.03	1.13
	Final	11:13 AM		8.28			
5	Initial	11:14 AM	30.00	7.66	0.59	2.05	1.07
	Final	11:44 AM		8.25			
6	Initial	11:45 AM	30.00	7.66	0.59	2.05	1.07
	Final	12:15 PM		8.25			
7	Initial	12:16 PM	30.00	7.66	0.59	2.05	1.07
	Final	12:46 PM		8.25			
8	Initial	12:47 PM	30.00	7.66	0.58	2.05	1.05
	Final	1:17 PM		8.24			
9	Initial	1:18 PM	30.00	7.66	0.57	2.06	1.03
	Final	1:48 PM		8.23			
10	Initial	1:49 PM	30.00	7.66	0.57	2.06	1.03
	Final	2:19 PM		8.23			
11	Initial	2:20 PM	30.00	7.66	0.57	2.06	1.03
	Final	2:50 PM		8.23			
12	Initial	2:51 PM	30.00	7.66	0.57	2.06	1.03
	Final	3:21 PM		8.23			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

- Where:
- Q = Infiltration Rate (in inches per hour)
 - ΔH = Change in Height (Water Level) over the time interval
 - r = Test Hole (Borehole) Radius
 - Δt = Time Interval
 - H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Retail/Commercial Development
Project Location	Chino, California
Project Number	22G118-2
Engineer	JH

Test Hole Radius	4 (in)
Test Depth	10.00 (ft)

Infiltration Test Hole	I-4
------------------------	-----

Soil Criteria Test							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:17 AM	25.00	7.93	0.24	NO	NON-SANDY SOILS
	Final	8:42 AM		7.95			
2	Initial	8:43 AM	25.00	7.93	0.12	NO	NON-SANDY SOILS
	Final	9:08 AM		7.94			

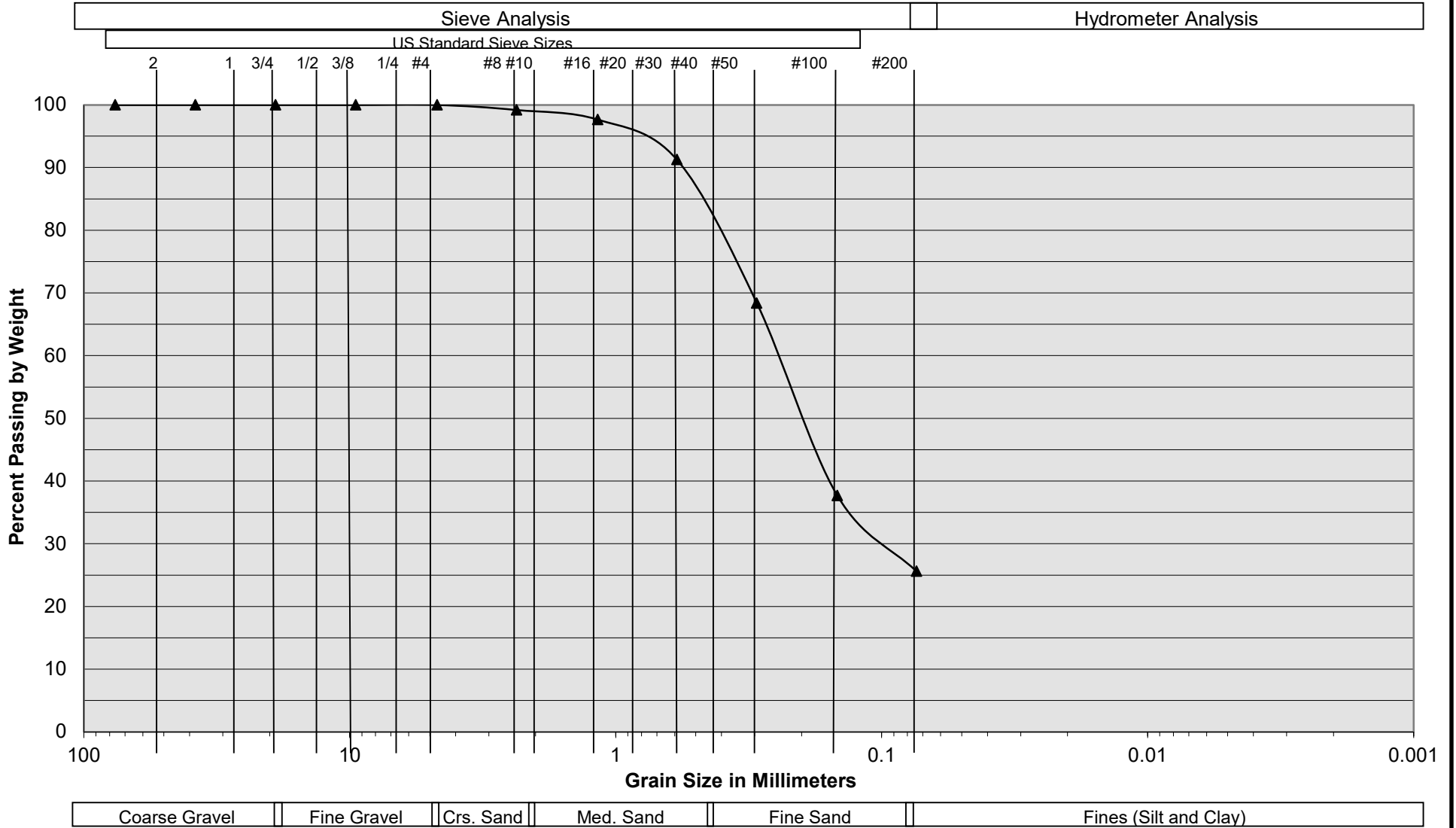
Test Data							
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:15 AM	30.00	7.95	0.04	2.03	0.07
	Final	9:45 AM		7.99			
2	Initial	9:47 AM	30.00	7.95	0.03	2.04	0.05
	Final	10:17 AM		7.98			
3	Initial	10:19 AM	30.00	7.95	0.03	2.04	0.05
	Final	10:49 AM		7.98			
4	Initial	10:51 AM	30.00	7.95	0.02	2.04	0.04
	Final	11:21 AM		7.97			
5	Initial	11:23 AM	30.00	7.95	0.01	2.05	0.02
	Final	11:53 AM		7.96			
6	Initial	11:55 AM	30.00	7.95	0.01	2.05	0.02
	Final	12:25 PM		7.96			
7	Initial	12:27 PM	30.00	7.95	0.01	2.05	0.02
	Final	12:57 PM		7.96			
8	Initial	12:59 PM	30.00	7.95	0.01	2.05	0.02
	Final	1:29 PM		7.96			
9	Initial	1:31 PM	30.00	7.95	0.01	2.05	0.02
	Final	2:01 PM		7.96			
10	Initial	2:03 PM	20.00	7.95	0.01	2.05	0.03
	Final	2:23 PM		7.96			
11	Initial	2:25 PM	30.00	7.95	0.01	2.05	0.02
	Final	2:55 PM		7.96			
12	Initial	2:57 PM	30.00	7.95	0.01	2.05	0.02
	Final	3:27 PM		7.96			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

- Where:
- Q = Infiltration Rate (in inches per hour)
 - ΔH = Change in Height (Water Level) over the time interval
 - r = Test Hole (Borehole) Radius
 - Δt = Time Interval
 - H_{avg} = Average Head Height over the time interval

Grain Size Distribution



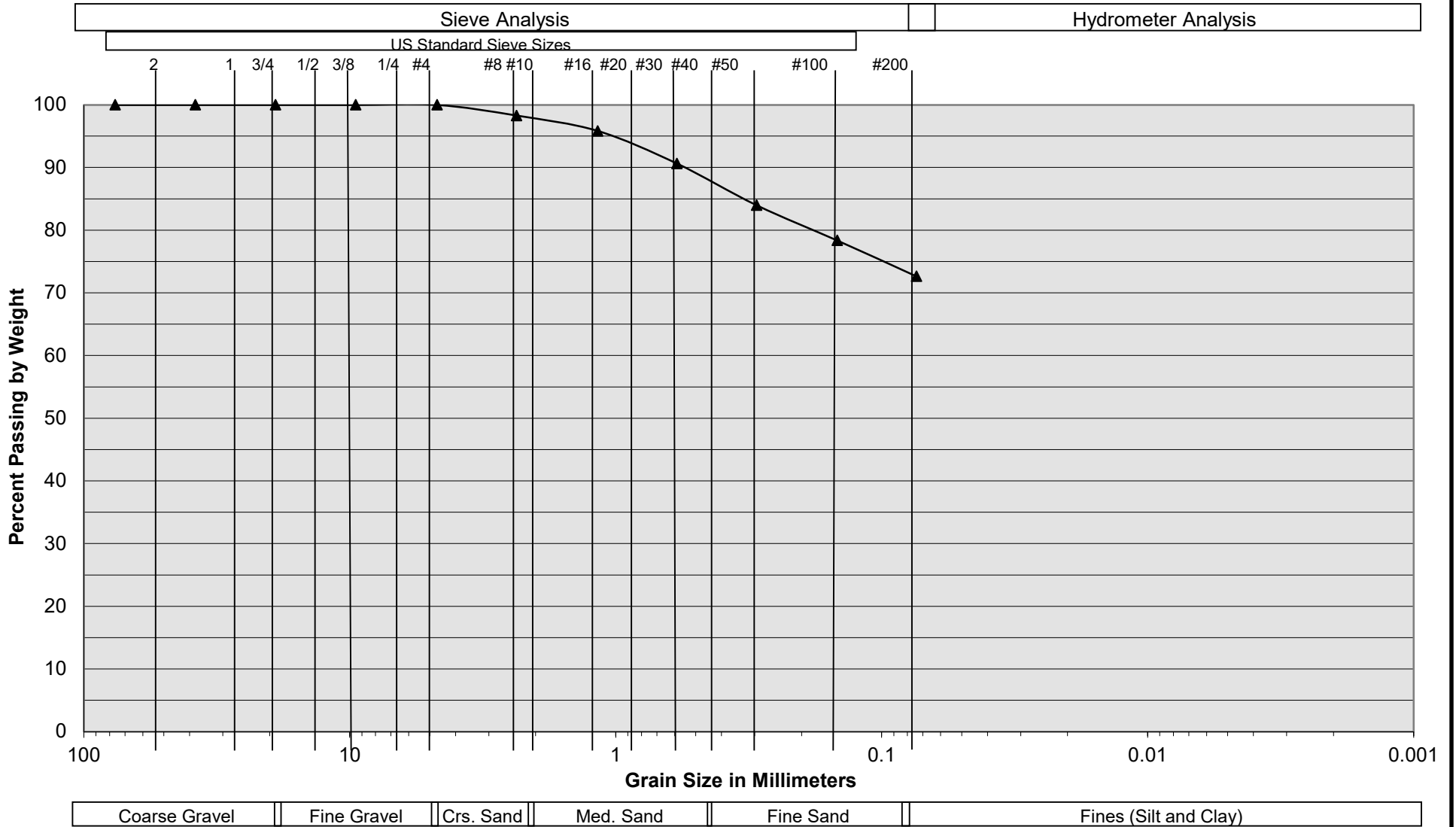
Sample Description	I-1 @ 8.5 to 10'
Soil Classification	Brown Silty fine to medium Sand

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-2
PLATE C- 1




SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



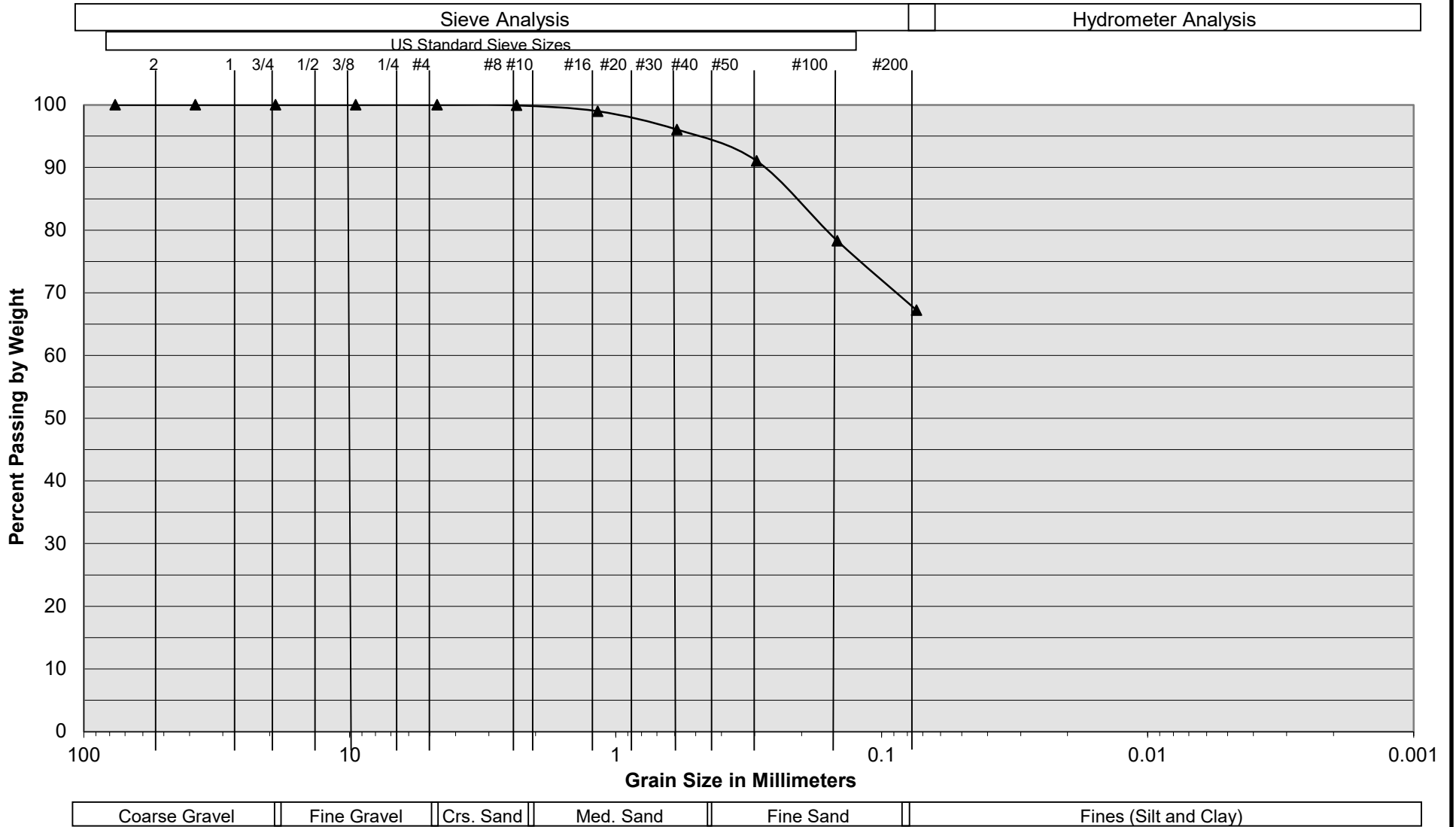
Sample Description	I-2 @ 8.5 to 10'
Soil Classification	Light Gray Brown fine to medium Sandy Silt

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-2
PLATE C- 2



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



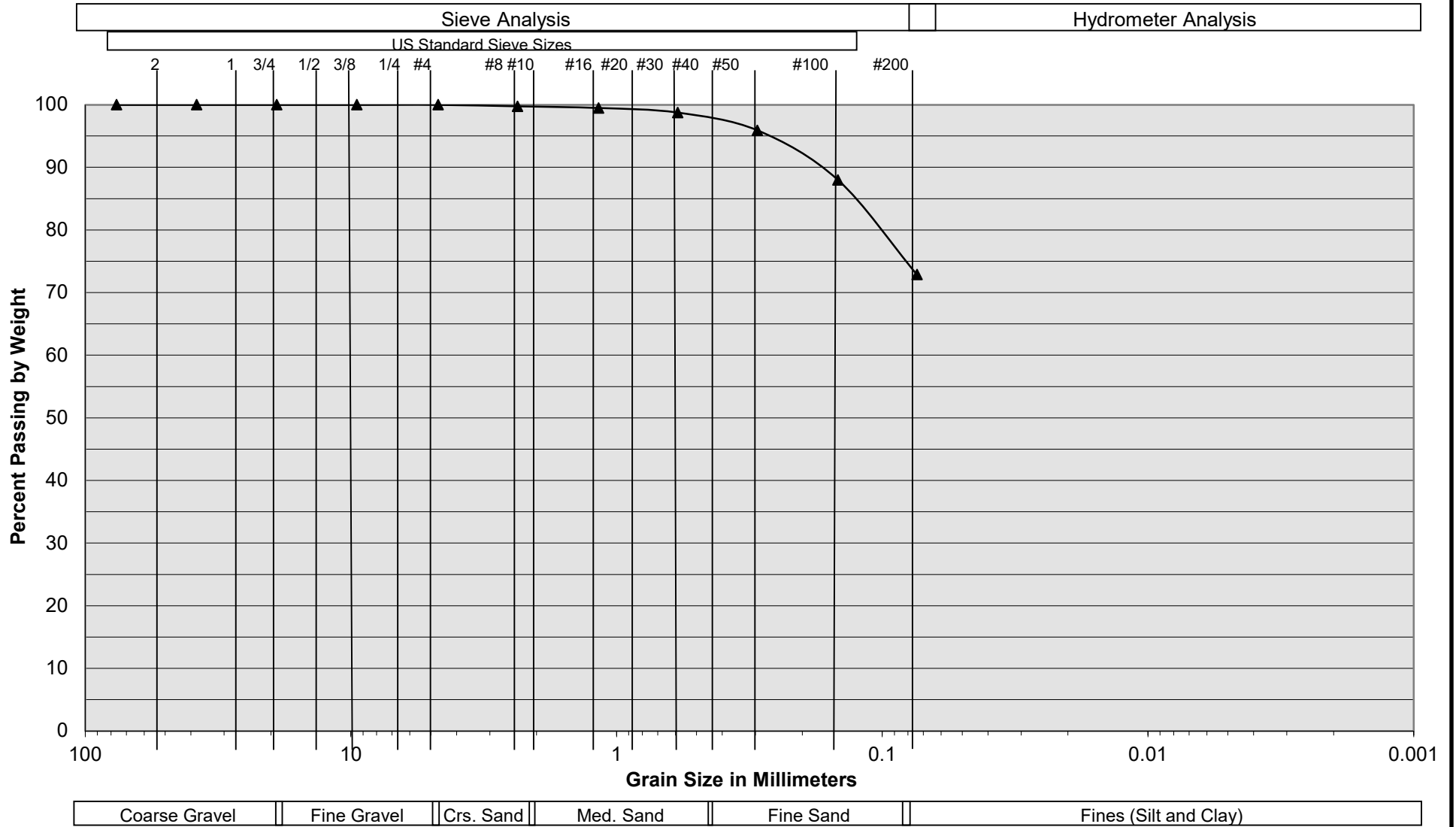
Sample Description	I-3 @ 8.5 to 10'
Soil Classification	Light Gray Brown fine Sandy Silt, trace medium Sand, little Clay

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-2
PLATE C- 3



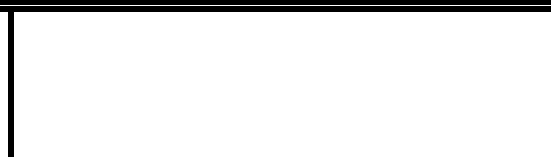
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-4 @ 8.5 to 10'
Soil Classification	Gray fine Sandy Clay, trace medium Sand, little Silt

Proposed Retail/Commercial Development
 Chino, California
 Project No. 22G118-2
PLATE C- 4

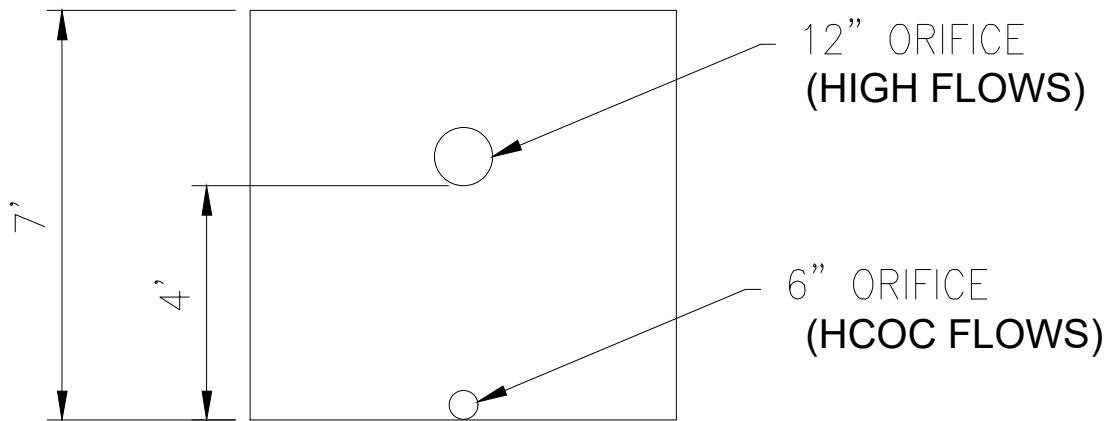


SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

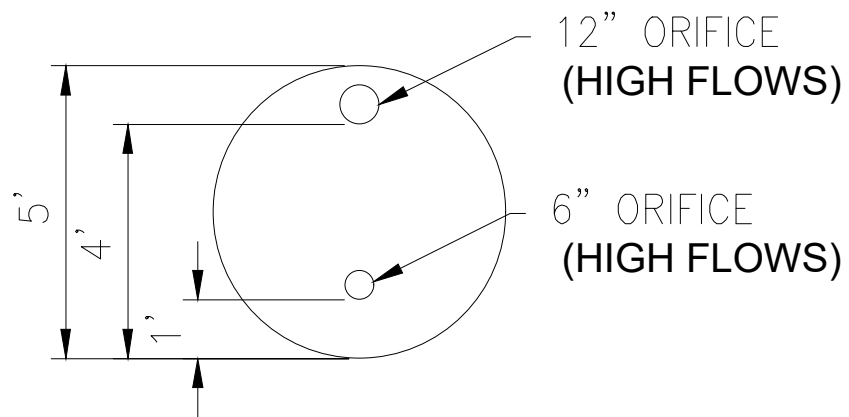
ATTACHMENT E

HCOC CALCULATIONS

DA 1



DA 2



RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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Analysis prepared by:

Fuscoe Engineering, Inc.
15535 Sand Canyon Ave
Suite 100
Irvine, CA 92618

***** DESCRIPTION OF STUDY *****
* CHINO EUCLID *
* 2 YEAR STORM EVENT *
* EXISTING CONDITION *

FILE NAME: CH10EX.DAT
TIME/DATE OF STUDY: 15:38 02/13/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET- / SIDE / SIDE/ WAY	CROSSFALL (FT)	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	LIP HIKE (FT)	GEOMETRIES: MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 707.00
ELEVATION DATA: UPSTREAM(FEET) = 726.00 DOWNSTREAM(FEET) = 718.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 31.612
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 0.867
SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
AGRICULTURAL GOOD COVER "SMALL GRAIN,STRAIGHT ROW"	C	5.46	0.57	1.000	67	31.61

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 SUBAREA RUNOFF(CFS) = 1.46
 TOTAL AREA(ACRES) = 5.46 PEAK FLOW RATE(CFS) = 1.46

FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 718.00 DOWNSTREAM(FEET) = 715.50
 CHANNEL LENGTH THRU SUBAREA(FEET) = 412.00 CHANNEL SLOPE = 0.0061
 CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 3.000
 MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 3.00
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 0.779

SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
-------------------------------	-------------------	-----------------	-----------------	-----------------	-----------

AGRICULTURAL GOOD COVER
 "ROW CROPS,STRAIGHT ROW" C 4.83 0.53 1.000 70

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.53
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.00
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.12
 AVERAGE FLOW DEPTH(FEET) = 0.17 TRAVEL TIME(MIN.) = 6.15
 Tc(MIN.) = 37.76
 SUBAREA AREA(ACRES) = 4.83 SUBAREA RUNOFF(CFS) = 1.08
 EFFECTIVE AREA(ACRES) = 10.29 AREA-AVERAGED Fm(INCH/HR) = 0.55
 AREA-AVERAGED Fp(INCH/HR) = 0.55 AREA-AVERAGED Ap = 1.00
 TOTAL AREA(ACRES) = 10.3 PEAK FLOW RATE(CFS) = 2.11

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) = 0.17 FLOW VELOCITY(FEET/SEC.) = 1.16
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 1119.00 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES)	=	10.3	TC(MIN.)	=	37.76
EFFECTIVE AREA(ACRES)	=	10.29	AREA-AVERAGED Fm(INCH/HR)	=	0.55
AREA-AVERAGED Fp(INCH/HR)	=	0.55	AREA-AVERAGED Ap	=	1.000
PEAK FLOW RATE(CFS)	=	2.11			

=====

END OF RATIONAL METHOD ANALYSIS



NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS

=====

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Analysis prepared by:

Fusco Engineering
16795 Von Karman Ave Ste100
Irvine CA
92606

Problem Descriptions:

EDEN MIXED USE
2 YEAR STORM EVENT
EXISTING CONDITION

=====

*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.63 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	10.29	100.00	85.(AMC II)	0.530	0.197

TOTAL AREA (Acres) = 10.29

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.530

AREA-AVERAGED LOW LOSS FRACTION, \bar{Y} = 0.803

=====

Problem Descriptions:

EDEN MIXED USE
2 YEAR STORM EVENT
EXISTING CONDITION

RATIONAL METHOD CALIBRATION COEFFICIENT = 1.05
TOTAL CATCHMENT AREA(ACRES) = 10.29
SOIL-LOSS RATE, F_m , (INCH/HR) = 0.530
LOW LOSS FRACTION = 0.803
TIME OF CONCENTRATION(MIN.) = 37.76
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY(YEARS) = 2
5-MINUTE POINT RAINFALL VALUE(INCHES) = 0.15
30-MINUTE POINT RAINFALL VALUE(INCHES) = 0.40
1-HOUR POINT RAINFALL VALUE(INCHES) = 0.59

3-HOUR POINT RAINFALL VALUE(INCHES) = 1.11
 6-HOUR POINT RAINFALL VALUE(INCHES) = 1.54
 24-HOUR POINT RAINFALL VALUE(INCHES) = 2.63

 TOTAL CATCHMENT RUNOFF VOLUME(ACRE-FEET) = 0.50
 TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 1.76

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	2.5	5.0	7.5	10.0
0.27	0.0010	0.09	Q	.	.	.	.
0.90	0.0057	0.09	Q	.	.	.	.
1.53	0.0106	0.09	Q	.	.	.	.
2.15	0.0155	0.10	Q	.	.	.	.
2.78	0.0206	0.10	Q	.	.	.	.
3.41	0.0259	0.10	Q	.	.	.	.
4.04	0.0313	0.11	Q	.	.	.	.
4.67	0.0368	0.11	Q	.	.	.	.
5.30	0.0426	0.11	Q	.	.	.	.
5.93	0.0485	0.12	Q	.	.	.	.
6.56	0.0547	0.12	Q	.	.	.	.
7.19	0.0611	0.13	Q	.	.	.	.
7.82	0.0678	0.13	Q	.	.	.	.
8.45	0.0748	0.14	Q	.	.	.	.
9.08	0.0822	0.15	Q	.	.	.	.
9.71	0.0899	0.15	Q	.	.	.	.
10.34	0.0981	0.16	Q	.	.	.	.
10.97	0.1068	0.17	Q	.	.	.	.
11.59	0.1162	0.19	Q	.	.	.	.
12.22	0.1263	0.20	Q	.	.	.	.
12.85	0.1387	0.28	.Q	.	.	.	.
13.48	0.1535	0.29	.Q	.	.	.	.
14.11	0.1702	0.35	.Q	.	.	.	.
14.74	0.1909	0.45	.Q	.	.	.	.
15.37	0.2181	0.60	. Q	.	.	.	.
16.00	0.2531	0.74	. Q	.	.	.	.
16.63	0.3269	2.10	.	Q	.	.	.
17.26	0.3949	0.52	. Q	.	.	.	.
17.89	0.4167	0.32	.Q	.	.	.	.
18.52	0.4312	0.24	Q	.	.	.	.
19.15	0.4420	0.18	Q	.	.	.	.
19.78	0.4508	0.16	Q	.	.	.	.
20.41	0.4585	0.14	Q	.	.	.	.
21.03	0.4656	0.13	Q	.	.	.	.
21.66	0.4720	0.12	Q	.	.	.	.
22.29	0.4780	0.11	Q	.	.	.	.
22.92	0.4835	0.10	Q	.	.	.	.
23.55	0.4888	0.10	Q	.	.	.	.
24.18	0.4937	0.09	Q	.	.	.	.
24.81	0.4962	0.00	Q	.	.	.	.

 TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:

(Note: 100% of Peak Flow Rate estimate assumed to have an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
=====	=====
0%	1472.6
10%	377.6
20%	188.8
30%	75.5
40%	37.8
50%	37.8
60%	37.8
70%	37.8
80%	37.8
90%	37.8

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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Ver. 23.0 Release Date: 07/01/2016 License ID 1355

Analysis prepared by:

Fuscoe Engineering, Inc.
15535 Sand Canyon Ave
Suite 100
Irvine, CA 92618

***** DESCRIPTION OF STUDY *****
* EDEN APARTMENTS *
* 2 YEAR STORM EVENT *
* PROPOSED CONDITION *

FILE NAME: CH2PR.DAT
TIME/DATE OF STUDY: 12:08 02/15/2024

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET- / SIDE / SIDE / WAY	CROSSFALL (FT)	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	LIP HIKE (FT)	GEOMETRIES: MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 385.00
ELEVATION DATA: UPSTREAM(FEET) = 723.00 DOWNSTREAM(FEET) = 721.10

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.515
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.781
SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	C	0.69	0.81	0.100	50	9.51
APARTMENTS	C	0.69	0.81	0.200	50	10.14

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA RUNOFF(CFS) = 2.08
 TOTAL AREA(ACRES) = 1.39 PEAK FLOW RATE(CFS) = 2.08

FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 713.20 DOWNSTREAM(FEET) = 710.10
 FLOW LENGTH(FEET) = 632.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.40
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.08
 PIPE TRAVEL TIME(MIN.) = 3.10 Tc(MIN.) = 12.61
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 1017.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 12.61
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.504
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.44	0.81	0.100	50
APARTMENTS	C	0.44	0.81	0.200	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA AREA(ACRES) = 0.88 SUBAREA RUNOFF(CFS) = 1.09
 EFFECTIVE AREA(ACRES) = 2.27 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 2.3 PEAK FLOW RATE(CFS) = 2.82

FLOW PROCESS FROM NODE 12.00 TO NODE 12.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 12.61
 RAINFALL INTENSITY(INCH/HR) = 1.50
 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81
 AREA-AVERAGED Ap = 0.15
 EFFECTIVE STREAM AREA(ACRES) = 2.27
 TOTAL STREAM AREA(ACRES) = 2.27
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.82

FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 378.00
 ELEVATION DATA: UPSTREAM(FEET) = 720.00 DOWNSTREAM(FEET) = 718.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.315
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.804
 SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ SCS SOIL	AREA	Fp	Ap	SCS	Tc
-------------------------------	------	----	----	-----	----

LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 COMMERCIAL C 0.52 0.81 0.100 50 9.31
 APARTMENTS C 0.52 0.81 0.200 50 9.93
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA RUNOFF(CFS) = 1.59
 TOTAL AREA(ACRES) = 1.05 PEAK FLOW RATE(CFS) = 1.59

 FLOW PROCESS FROM NODE 14.00 TO NODE 12.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.31
 RAINFALL INTENSITY(INCH/HR) = 1.80
 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81
 AREA-AVERAGED Ap = 0.15
 EFFECTIVE STREAM AREA(ACRES) = 1.05
 TOTAL STREAM AREA(ACRES) = 1.05
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.59

 FLOW PROCESS FROM NODE 25.00 TO NODE 14.00 IS CODE = 21

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 438.00
 ELEVATION DATA: UPSTREAM(FEET) = 722.00 DOWNSTREAM(FEET) = 718.00

 $T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.858
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.859
 SUBAREA Tc AND LOSS RATE DATA(AMC I):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 COMMERCIAL C 0.67 0.81 0.100 50 8.86
 APARTMENTS C 0.67 0.81 0.200 50 9.44
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA RUNOFF(CFS) = 2.08
 TOTAL AREA(ACRES) = 1.33 PEAK FLOW RATE(CFS) = 2.08

 FLOW PROCESS FROM NODE 14.00 TO NODE 12.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
 TIME OF CONCENTRATION(MIN.) = 8.86
 RAINFALL INTENSITY(INCH/HR) = 1.86
 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81
 AREA-AVERAGED Ap = 0.15
 EFFECTIVE STREAM AREA(ACRES) = 1.33
 TOTAL STREAM AREA(ACRES) = 1.33
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.08

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	2.82	12.61	1.504	0.81(0.12)	0.15	2.3	10.00
2	1.59	9.31	1.804	0.81(0.12)	0.15	1.0	13.00
3	2.08	8.86	1.859	0.81(0.12)	0.15	1.3	25.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.13	8.86	1.859	0.81(0.12)	0.15	3.9	25.00
2	6.14	9.31	1.804	0.81(0.12)	0.15	4.1	13.00
3	5.78	12.61	1.504	0.81(0.12)	0.15	4.7	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 6.14 Tc(MIN.) = 9.31
 EFFECTIVE AREA(ACRES) = 4.06 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 4.7
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 1017.00 FEET.

FLOW PROCESS FROM NODE 12.00 TO NODE 15.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 710.10 DOWNSTREAM(FEET) = 707.70
 FLOW LENGTH(FEET) = 464.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 12.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.56
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 6.14
 PIPE TRAVEL TIME(MIN.) = 1.70 Tc(MIN.) = 11.01
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 1481.00 FEET.

FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 212.00
 ELEVATION DATA: UPSTREAM(FEET) = 725.00 DOWNSTREAM(FEET) = 722.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.200
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.303
 SUBAREA Tc AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	C	0.12	0.81	0.100	50	6.20
APARTMENTS	C	0.12	0.81	0.200	50	6.61

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA RUNOFF(CFS) = 0.49
 TOTAL AREA(ACRES) = 0.25 PEAK FLOW RATE(CFS) = 0.49

FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 718.80 DOWNSTREAM(FEET) = 717.50
 FLOW LENGTH(FEET) = 80.00 MANNING'S N = 0.013

DEPTH OF FLOW IN 6.0 INCH PIPE IS 3.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.75
 ESTIMATED PIPE DIAMETER(INCH) = 6.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 0.49
 PIPE TRAVEL TIME(MIN.) = 0.36 Tc(MIN.) = 6.56
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 292.00 FEET.

FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 6.56
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.227
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.60	0.81	0.100	50
APARTMENTS	C	0.60	0.81	0.200	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA AREA(ACRES) = 1.19 SUBAREA RUNOFF(CFS) = 2.25
 EFFECTIVE AREA(ACRES) = 1.44 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 2.73

FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 6.56
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.227
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.19	0.81	0.100	50
APARTMENTS	C	0.19	0.81	0.200	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA AREA(ACRES) = 0.37 SUBAREA RUNOFF(CFS) = 0.70
 EFFECTIVE AREA(ACRES) = 1.81 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 1.8 PEAK FLOW RATE(CFS) = 3.43

FLOW PROCESS FROM NODE 22.00 TO NODE 23.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 717.50 DOWNSTREAM(FEET) = 714.70
 FLOW LENGTH(FEET) = 171.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.10
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 3.43
 PIPE TRAVEL TIME(MIN.) = 0.47 Tc(MIN.) = 7.02
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 23.00 = 463.00 FEET.

FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 7.02
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.137
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.19	0.81	0.100	50
APARTMENTS	C	0.19	0.81	0.200	50

LAND USE	GROUP	(ACRES)	(INCH/HR)	(DECIMAL)	CN
COMMERCIAL	C	0.80	0.81	0.100	50
APARTMENTS	C	0.80	0.81	0.200	50

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA AREA(ACRES) = 1.59 SUBAREA RUNOFF(CFS) = 2.88
 EFFECTIVE AREA(ACRES) = 3.40 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 3.4 PEAK FLOW RATE(CFS) = 6.17

 FLOW PROCESS FROM NODE 23.00 TO NODE 24.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 714.70 DOWNSTREAM(FEET) = 713.60
 FLOW LENGTH(FEET) = 78.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.65
 ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 6.17
 PIPE TRAVEL TIME(MIN.) = 0.20 Tc(MIN.) = 7.22
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 24.00 = 541.00 FEET.

 FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 7.22
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.102
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	C	0.54	0.81	0.100	50
APARTMENTS	C	0.54	0.81	0.200	50

 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.150
 SUBAREA AREA(ACRES) = 1.07 SUBAREA RUNOFF(CFS) = 1.91
 EFFECTIVE AREA(ACRES) = 4.47 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
 TOTAL AREA(ACRES) = 4.5 PEAK FLOW RATE(CFS) = 7.97

 FLOW PROCESS FROM NODE 24.00 TO NODE 24.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 7.22
 RAINFALL INTENSITY(INCH/HR) = 2.10
 AREA-AVERAGED Fm(INCH/HR) = 0.12
 AREA-AVERAGED Fp(INCH/HR) = 0.81
 AREA-AVERAGED Ap = 0.15
 EFFECTIVE STREAM AREA(ACRES) = 4.47
 TOTAL STREAM AREA(ACRES) = 4.47
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.97

 FLOW PROCESS FROM NODE 25.00 TO NODE 26.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 333.00
 ELEVATION DATA: UPSTREAM(FEET) = 722.00 DOWNSTREAM(FEET) = 720.00

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 8.632
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.888
 SUBAREA T_c AND LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	C	0.20	0.81	0.100	50	8.63
APARTMENTS	C	0.20	0.81	0.200	50	9.20

 SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.150
 SUBAREA RUNOFF(CFS) = 0.65
 TOTAL AREA(ACRES) = 0.41 PEAK FLOW RATE(CFS) = 0.65

FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====
 ELEVATION DATA: UPSTREAM(FEET) = 713.00 DOWNSTREAM(FEET) = 712.00
 FLOW LENGTH(FEET) = 215.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 9.0 INCH PIPE IS 5.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 2.54
 ESTIMATED PIPE DIAMETER(INCH) = 9.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 0.65
 PIPE TRAVEL TIME(MIN.) = 1.41 T_c (MIN.) = 10.04
 LONGEST FLOWPATH FROM NODE 25.00 TO NODE 27.00 = 548.00 FEET.

FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====
 MAINLINE T_c (MIN.) = 10.04
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.724
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	C	0.11	0.81	0.100	50
APARTMENTS	C	0.11	0.81	0.200	50

 SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.150
 SUBAREA AREA(ACRES) = 0.22 SUBAREA RUNOFF(CFS) = 0.32
 EFFECTIVE AREA(ACRES) = 0.63 AREA-AVERAGED F_m (INCH/HR) = 0.12
 AREA-AVERAGED F_p (INCH/HR) = 0.81 AREA-AVERAGED A_p = 0.15
 TOTAL AREA(ACRES) = 0.6 PEAK FLOW RATE(CFS) = 0.91

FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====
 MAINLINE T_c (MIN.) = 10.04
 * 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.724
 SUBAREA LOSS RATE DATA(AMC I):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN
COMMERCIAL	C	0.27	0.81	0.100	50
APARTMENTS	C	0.27	0.81	0.200	50

 SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.81
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.150
 SUBAREA AREA(ACRES) = 0.54 SUBAREA RUNOFF(CFS) = 0.78
 EFFECTIVE AREA(ACRES) = 1.17 AREA-AVERAGED F_m (INCH/HR) = 0.12
 AREA-AVERAGED F_p (INCH/HR) = 0.81 AREA-AVERAGED A_p = 0.15
 TOTAL AREA(ACRES) = 1.2 PEAK FLOW RATE(CFS) = 1.69

FLOW PROCESS FROM NODE 27.00 TO NODE 28.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 712.00 DOWNSTREAM(FEET) = 709.20
FLOW LENGTH(FEET) = 359.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 12.0 INCH PIPE IS 6.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 3.92
ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 1.69
PIPE TRAVEL TIME(MIN.) = 1.53 Tc(MIN.) = 11.57
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 28.00 = 907.00 FEET.

FLOW PROCESS FROM NODE 28.00 TO NODE 24.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 11.57
RAINFALL INTENSITY(INCH/HR) = 1.58
AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.81
AREA-AVERAGED Ap = 0.15
EFFECTIVE STREAM AREA(ACRES) = 1.17
TOTAL STREAM AREA(ACRES) = 1.17
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.69

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	7.97	7.22	2.102	0.81(0.12)	0.15	4.5	20.00
2	1.69	11.57	1.584	0.81(0.12)	0.15	1.2	25.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	9.39	7.22	2.102	0.81(0.12)	0.15	5.2	20.00
2	7.57	11.57	1.584	0.81(0.12)	0.15	5.6	25.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 9.39 Tc(MIN.) = 7.22
EFFECTIVE AREA(ACRES) = 5.20 AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 5.6
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 24.00 = 907.00 FEET.

FLOW PROCESS FROM NODE 28.00 TO NODE 15.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 709.20 DOWNSTREAM(FEET) = 707.70
FLOW LENGTH(FEET) = 180.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.14
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 9.39
PIPE TRAVEL TIME(MIN.) = 0.49 Tc(MIN.) = 7.71
LONGEST FLOWPATH FROM NODE 25.00 TO NODE 15.00 = 1087.00 FEET.

FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	9.39	7.71	2.021	0.81(0.12)	0.15	5.2	20.00
2	7.57	12.09	1.543	0.81(0.12)	0.15	5.6	25.00

LONGEST FLOWPATH FROM NODE 25.00 TO NODE 15.00 = 1087.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.13	10.55	1.674	0.81(0.12)	0.15	3.9	25.00
2	6.14	11.01	1.632	0.81(0.12)	0.15	4.1	13.00
3	5.78	14.33	1.393	0.81(0.12)	0.15	4.7	10.00

LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 1481.00 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	14.88	7.71	2.021	0.81(0.12)	0.15	8.1	20.00
2	14.34	10.55	1.674	0.81(0.12)	0.15	9.4	25.00
3	14.16	11.01	1.632	0.81(0.12)	0.15	9.6	13.00
4	13.59	12.09	1.543	0.81(0.12)	0.15	9.9	25.00
5	12.56	14.33	1.393	0.81(0.12)	0.15	10.3	10.00

TOTAL AREA(ACRES) = 10.3

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 14.88 Tc(MIN.) = 7.707
EFFECTIVE AREA(ACRES) = 8.06 AREA-AVERAGED Fm(INCH/HR) = 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.15
TOTAL AREA(ACRES) = 10.3
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 1481.00 FEET.

FLOW PROCESS FROM NODE 15.00 TO NODE 29.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 707.70 DOWNSTREAM(FEET) = 707.60
FLOW LENGTH(FEET) = 18.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 24.0 INCH PIPE IS 18.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.79
ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 14.88
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 7.76
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 29.00 = 1499.00 FEET.

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 10.3 TC(MIN.) = 7.76
EFFECTIVE AREA(ACRES) = 8.06 AREA-AVERAGED Fm(INCH/HR)= 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.81 AREA-AVERAGED Ap = 0.150
PEAK FLOW RATE(CFS) = 14.88

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	14.88	7.76	2.013	0.81(0.12)	0.15	8.1	20.00
2	14.34	10.61	1.669	0.81(0.12)	0.15	9.4	25.00
3	14.16	11.06	1.627	0.81(0.12)	0.15	9.6	13.00
4	13.59	12.14	1.539	0.81(0.12)	0.15	9.9	25.00
5	12.56	14.38	1.390	0.81(0.12)	0.15	10.3	10.00

END OF RATIONAL METHOD ANALYSIS



NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS

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Analysis prepared by:

Fusco Engineering, Inc.
15535 Sand Canyon Ave
Suite 100
Irvine, CA 92618

Problem Descriptions:

DA 1

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*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.63 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	4.65	15.00	69.(AMC II)	0.812	0.778

TOTAL AREA (Acres) = 4.65

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.122

AREA-AVERAGED LOW LOSS FRACTION, \bar{Y} = 0.222

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Problem Descriptions:

RATIONAL METHOD CALIBRATION COEFFICIENT = 1.16
TOTAL CATCHMENT AREA(ACRES) = 4.65
SOIL-LOSS RATE, F_m , (INCH/HR) = 0.122
LOW LOSS FRACTION = 0.222
TIME OF CONCENTRATION(MIN.) = 11.01
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY(YEARS) = 2
5-MINUTE POINT RAINFALL VALUE(INCHES) = 0.15
30-MINUTE POINT RAINFALL VALUE(INCHES) = 0.40
1-HOUR POINT RAINFALL VALUE(INCHES) = 0.59

3-HOUR POINT RAINFALL VALUE(INCHES) = 1.11
 6-HOUR POINT RAINFALL VALUE(INCHES) = 1.54
 24-HOUR POINT RAINFALL VALUE(INCHES) = 2.63

 TOTAL CATCHMENT RUNOFF VOLUME(ACRE-FEET) = 0.93
 TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 0.09

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	2.5	5.0	7.5	10.0
0.04	0.0000	0.00	Q	.	.	.	.
0.22	0.0014	0.18	Q	.	.	.	.
0.40	0.0041	0.18	Q	.	.	.	.
0.59	0.0068	0.18	Q	.	.	.	.
0.77	0.0096	0.18	Q	.	.	.	.
0.95	0.0123	0.18	Q	.	.	.	.
1.14	0.0151	0.19	Q	.	.	.	.
1.32	0.0179	0.19	Q	.	.	.	.
1.50	0.0208	0.19	Q	.	.	.	.
1.69	0.0236	0.19	Q	.	.	.	.
1.87	0.0265	0.19	Q	.	.	.	.
2.05	0.0294	0.19	Q	.	.	.	.
2.24	0.0324	0.19	Q	.	.	.	.
2.42	0.0353	0.20	Q	.	.	.	.
2.60	0.0383	0.20	Q	.	.	.	.
2.79	0.0413	0.20	Q	.	.	.	.
2.97	0.0443	0.20	Q	.	.	.	.
3.15	0.0474	0.20	Q	.	.	.	.
3.34	0.0505	0.20	Q	.	.	.	.
3.52	0.0536	0.21	Q	.	.	.	.
3.71	0.0567	0.21	Q	.	.	.	.
3.89	0.0599	0.21	Q	.	.	.	.
4.07	0.0631	0.21	Q	.	.	.	.
4.26	0.0663	0.21	Q	.	.	.	.
4.44	0.0695	0.22	Q	.	.	.	.
4.62	0.0728	0.22	Q	.	.	.	.
4.81	0.0761	0.22	Q	.	.	.	.
4.99	0.0795	0.22	Q	.	.	.	.
5.17	0.0829	0.22	Q	.	.	.	.
5.36	0.0863	0.23	Q	.	.	.	.
5.54	0.0897	0.23	Q	.	.	.	.
5.72	0.0932	0.23	Q	.	.	.	.
5.91	0.0968	0.23	Q	.	.	.	.
6.09	0.1003	0.24	Q	.	.	.	.
6.27	0.1039	0.24	Q	.	.	.	.
6.46	0.1076	0.24	Q	.	.	.	.
6.64	0.1113	0.25	Q	.	.	.	.
6.82	0.1150	0.25	Q	.	.	.	.
7.01	0.1188	0.25	.Q	.	.	.	.
7.19	0.1226	0.25	.Q	.	.	.	.
7.38	0.1265	0.26	.Q	.	.	.	.
7.56	0.1304	0.26	.Q	.	.	.	.
7.74	0.1344	0.26	.Q	.	.	.	.
7.93	0.1385	0.27	.Q	.	.	.	.

8.11	0.1425	0.27	.Q	.	.	.	.
8.29	0.1467	0.27	.Q	.	.	.	.
8.48	0.1509	0.28	.Q	.	.	.	.
8.66	0.1552	0.28	.Q	.	.	.	.
8.84	0.1595	0.29	.Q	.	.	.	.
9.03	0.1639	0.29	.Q	.	.	.	.
9.21	0.1684	0.30	.Q	.	.	.	.
9.39	0.1729	0.30	.Q	.	.	.	.
9.58	0.1775	0.31	.Q	.	.	.	.
9.76	0.1822	0.31	.Q	.	.	.	.
9.94	0.1870	0.32	.Q	.	.	.	.
10.13	0.1919	0.32	.Q	.	.	.	.
10.31	0.1969	0.33	.Q	.	.	.	.
10.49	0.2019	0.34	.Q	.	.	.	.
10.68	0.2071	0.35	.Q	.	.	.	.
10.86	0.2124	0.35	.Q	.	.	.	.
11.05	0.2177	0.36	.Q	.	.	.	.
11.23	0.2232	0.37	.Q	.	.	.	.
11.41	0.2289	0.38	.Q	.	.	.	.
11.60	0.2346	0.38	.Q	.	.	.	.
11.78	0.2406	0.40	.Q	.	.	.	.
11.96	0.2466	0.40	.Q	.	.	.	.
12.15	0.2533	0.48	.Q	.	.	.	.
12.33	0.2610	0.52	. Q	.	.	.	.
12.51	0.2690	0.54	. Q	.	.	.	.
12.70	0.2772	0.55	. Q	.	.	.	.
12.88	0.2857	0.57	. Q	.	.	.	.
13.06	0.2944	0.58	. Q	.	.	.	.
13.25	0.3035	0.61	. Q	.	.	.	.
13.43	0.3128	0.62	. Q	.	.	.	.
13.61	0.3224	0.65	. Q	.	.	.	.
13.80	0.3325	0.67	. Q	.	.	.	.
13.98	0.3429	0.71	. Q	.	.	.	.
14.16	0.3543	0.79	. Q	.	.	.	.
14.35	0.3674	0.94	. Q	.	.	.	.
14.53	0.3819	0.97	. Q	.	.	.	.
14.72	0.3972	1.04	. Q	.	.	.	.
14.90	0.4132	1.08	. Q	.	.	.	.
15.08	0.4304	1.18	. Q	.	.	.	.
15.27	0.4488	1.25	. Q	.	.	.	.
15.45	0.4690	1.41	. Q	.	.	.	.
15.63	0.4911	1.52	. Q	.	.	.	.
15.82	0.5173	1.94	. Q	.	.	.	.
16.00	0.5508	2.48	. Q.	.	.	.	.
16.18	0.6163	6.15	.	.	Q	.	.
16.37	0.6758	1.69	. Q	.	.	.	.
16.55	0.6987	1.33	. Q	.	.	.	.
16.73	0.7173	1.13	. Q	.	.	.	.
16.92	0.7335	1.00	. Q	.	.	.	.
17.10	0.7480	0.92	. Q	.	.	.	.
17.28	0.7602	0.69	. Q	.	.	.	.
17.47	0.7702	0.64	. Q	.	.	.	.
17.65	0.7796	0.59	. Q	.	.	.	.
17.83	0.7883	0.56	. Q	.	.	.	.
18.02	0.7966	0.53	. Q	.	.	.	.
18.20	0.8037	0.41	.Q	.	.	.	.
18.39	0.8098	0.39	.Q	.	.	.	.

18.57	0.8155	0.37	.Q	.	.	.	.
18.75	0.8210	0.35	.Q	.	.	.	.
18.94	0.8263	0.34	.Q	.	.	.	.
19.12	0.8314	0.33	.Q	.	.	.	.
19.30	0.8362	0.32	.Q	.	.	.	.
19.49	0.8409	0.30	.Q	.	.	.	.
19.67	0.8455	0.29	.Q	.	.	.	.
19.85	0.8499	0.29	.Q	.	.	.	.
20.04	0.8542	0.28	.Q	.	.	.	.
20.22	0.8583	0.27	.Q	.	.	.	.
20.40	0.8623	0.26	.Q	.	.	.	.
20.59	0.8663	0.26	.Q	.	.	.	.
20.77	0.8701	0.25	Q	.	.	.	.
20.95	0.8738	0.24	Q	.	.	.	.
21.14	0.8775	0.24	Q	.	.	.	.
21.32	0.8811	0.23	Q	.	.	.	.
21.51	0.8845	0.23	Q	.	.	.	.
21.69	0.8880	0.22	Q	.	.	.	.
21.87	0.8913	0.22	Q	.	.	.	.
22.06	0.8946	0.21	Q	.	.	.	.
22.24	0.8978	0.21	Q	.	.	.	.
22.42	0.9010	0.21	Q	.	.	.	.
22.61	0.9041	0.20	Q	.	.	.	.
22.79	0.9072	0.20	Q	.	.	.	.
22.97	0.9102	0.20	Q	.	.	.	.
23.16	0.9131	0.19	Q	.	.	.	.
23.34	0.9160	0.19	Q	.	.	.	.
23.52	0.9189	0.19	Q	.	.	.	.
23.71	0.9217	0.18	Q	.	.	.	.
23.89	0.9245	0.18	Q	.	.	.	.
24.07	0.9272	0.18	Q	.	.	.	.
24.26	0.9286	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
=====	=====
0%	1442.3
10%	253.2
20%	88.1
30%	33.0
40%	22.0
50%	11.0
60%	11.0
70%	11.0
80%	11.0
90%	11.0

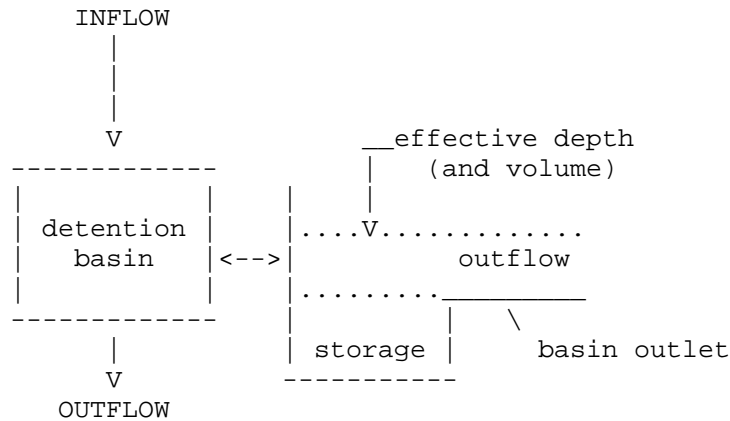
Problem Descriptions:
Lot 1 - 2 yr

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FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:

CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 11.010
 DEAD STORAGE(AF) = 0.00
 SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
 ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00



DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:

TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 16

* (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	** (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	*
* 0.000	0.000	0.000	** 0.260	0.022	0.180	*
* 0.500	0.042	0.470	** 1.000	0.083	0.820	*
* 1.500	0.125	1.060	** 2.000	0.167	1.250	*
* 2.500	0.208	1.420	** 3.000	0.250	1.570	*
* 3.500	0.291	1.700	** 4.000	0.333	1.830	*
* 4.500	0.375	2.630	** 5.000	0.416	3.430	*
* 5.500	0.458	3.980	** 6.000	0.500	4.440	*
* 6.500	0.541	4.840	** 7.000	0.583	5.200	*

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.26	0.02064	0.02336
3	0.50	0.03844	0.04556
4	1.00	0.07678	0.08922
5	1.50	0.11696	0.13304
6	2.00	0.15752	0.17648
7	2.50	0.19723	0.21877
8	3.00	0.23810	0.26190
9	3.50	0.27811	0.30389
10	4.00	0.31912	0.34688
11	4.50	0.35506	0.39494
12	5.00	0.38999	0.44201

13	5.50	0.42782	0.48818
14	6.00	0.46633	0.53367
15	6.50	0.50430	0.57770
16	7.00	0.54357	0.62243

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
 OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
 AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.035	0.000	0.00	0.00	0.00	0.000
0.219	0.000	0.18	0.03	0.01	0.003
0.402	0.000	0.18	0.06	0.03	0.005
0.586	0.000	0.18	0.08	0.05	0.007
0.769	0.000	0.18	0.10	0.06	0.009
0.953	0.000	0.18	0.12	0.08	0.010
1.136	0.000	0.19	0.14	0.09	0.012
1.320	0.000	0.19	0.15	0.10	0.013
1.503	0.000	0.19	0.17	0.11	0.014
1.687	0.000	0.19	0.18	0.12	0.015
1.870	0.000	0.19	0.19	0.13	0.016
2.054	0.000	0.19	0.20	0.14	0.017
2.237	0.000	0.19	0.21	0.14	0.018
2.421	0.000	0.20	0.22	0.15	0.019
2.604	0.000	0.20	0.23	0.15	0.019
2.788	0.000	0.20	0.23	0.16	0.020
2.971	0.000	0.20	0.24	0.16	0.020
3.155	0.000	0.20	0.25	0.17	0.021
3.338	0.000	0.20	0.25	0.17	0.021
3.522	0.000	0.21	0.26	0.18	0.022
3.705	0.000	0.21	0.26	0.18	0.022
3.889	0.000	0.21	0.27	0.19	0.023
4.072	0.000	0.21	0.27	0.19	0.023
4.256	0.000	0.21	0.27	0.19	0.023
4.439	0.000	0.22	0.28	0.20	0.023
4.623	0.000	0.22	0.28	0.20	0.024
4.806	0.000	0.22	0.28	0.21	0.024
4.990	0.000	0.22	0.28	0.21	0.024
5.173	0.000	0.22	0.29	0.21	0.024
5.357	0.000	0.23	0.29	0.21	0.024
5.540	0.000	0.23	0.29	0.22	0.025
5.724	0.000	0.23	0.29	0.22	0.025
5.907	0.000	0.23	0.30	0.22	0.025
6.091	0.000	0.24	0.30	0.22	0.025
6.274	0.000	0.24	0.30	0.23	0.025
6.458	0.000	0.24	0.30	0.23	0.026
6.641	0.000	0.25	0.30	0.23	0.026
6.825	0.000	0.25	0.31	0.24	0.026
7.008	0.000	0.25	0.31	0.24	0.026
7.192	0.000	0.25	0.31	0.24	0.026
7.376	0.000	0.26	0.31	0.24	0.027
7.559	0.000	0.26	0.32	0.25	0.027
7.742	0.000	0.26	0.32	0.25	0.027

7.926	0.000	0.27	0.32	0.25	0.027
8.109	0.000	0.27	0.32	0.26	0.027
8.293	0.000	0.27	0.33	0.26	0.028
8.476	0.000	0.28	0.33	0.26	0.028
8.660	0.000	0.28	0.33	0.27	0.028
8.844	0.000	0.29	0.34	0.27	0.028
9.027	0.000	0.29	0.34	0.27	0.029
9.210	0.000	0.30	0.34	0.28	0.029
9.394	0.000	0.30	0.35	0.28	0.029
9.577	0.000	0.31	0.35	0.29	0.030
9.761	0.000	0.31	0.35	0.29	0.030
9.944	0.000	0.32	0.36	0.30	0.030
10.128	0.000	0.32	0.36	0.30	0.031
10.311	0.000	0.33	0.37	0.31	0.031
10.495	0.000	0.34	0.37	0.31	0.031
10.679	0.000	0.35	0.38	0.32	0.032
10.862	0.000	0.35	0.38	0.32	0.032
11.045	0.000	0.36	0.39	0.33	0.033
11.229	0.000	0.37	0.39	0.34	0.033
11.413	0.000	0.38	0.40	0.34	0.034
11.596	0.000	0.38	0.40	0.35	0.034
11.780	0.000	0.40	0.41	0.36	0.035
11.963	0.000	0.40	0.42	0.37	0.035
12.146	0.000	0.48	0.44	0.38	0.037
12.330	0.000	0.52	0.46	0.41	0.038
12.514	0.000	0.54	0.48	0.43	0.040
12.697	0.000	0.55	0.49	0.45	0.042
12.880	0.000	0.57	0.51	0.47	0.043
13.064	0.000	0.58	0.53	0.49	0.044
13.247	0.000	0.61	0.55	0.50	0.046
13.431	0.000	0.62	0.57	0.51	0.048
13.615	0.000	0.65	0.59	0.53	0.050
13.798	0.000	0.67	0.62	0.54	0.052
13.982	0.000	0.71	0.64	0.56	0.054
14.165	0.000	0.79	0.68	0.58	0.057
14.348	0.000	0.94	0.74	0.62	0.062
14.532	0.000	0.97	0.80	0.66	0.067
14.715	0.000	1.04	0.86	0.70	0.072
14.899	0.000	1.08	0.92	0.75	0.077
15.083	0.000	1.18	1.00	0.79	0.083
15.266	0.000	1.25	1.07	0.84	0.089
15.449	0.000	1.41	1.17	0.88	0.097
15.633	0.000	1.52	1.27	0.93	0.106
15.816	0.000	1.94	1.44	0.99	0.120
16.000	0.000	2.48	1.70	1.08	0.142
16.184	0.000	6.15	2.59	1.29	0.215
16.367	0.000	1.69	2.63	1.45	0.219
16.551	0.000	1.33	2.61	1.46	0.217
16.734	0.000	1.13	2.55	1.44	0.212
16.917	0.000	1.00	2.47	1.42	0.206
17.101	0.000	0.92	2.38	1.40	0.199
17.284	0.000	0.69	2.26	1.36	0.188
17.468	0.000	0.64	2.13	1.32	0.178
17.651	0.000	0.59	2.01	1.27	0.168
17.835	0.000	0.56	1.89	1.23	0.158
18.018	0.000	0.53	1.77	1.18	0.148
18.202	0.000	0.41	1.64	1.14	0.137

18.385	0.000	0.39	1.51	1.09	0.126
18.569	0.000	0.37	1.39	1.04	0.116
18.753	0.000	0.35	1.28	0.98	0.106
18.936	0.000	0.34	1.17	0.93	0.097
19.120	0.000	0.33	1.07	0.88	0.089
19.303	0.000	0.32	0.98	0.83	0.081
19.487	0.000	0.30	0.89	0.78	0.074
19.670	0.000	0.29	0.81	0.72	0.068
19.853	0.000	0.29	0.74	0.67	0.062
20.037	0.000	0.28	0.68	0.62	0.057
20.220	0.000	0.27	0.62	0.58	0.052
20.404	0.000	0.26	0.57	0.54	0.048
20.587	0.000	0.26	0.53	0.50	0.044
20.771	0.000	0.25	0.49	0.47	0.041
20.955	0.000	0.24	0.45	0.43	0.038
21.138	0.000	0.24	0.42	0.39	0.036
21.322	0.000	0.23	0.40	0.36	0.034
21.505	0.000	0.23	0.38	0.34	0.032
21.689	0.000	0.22	0.36	0.31	0.031
21.872	0.000	0.22	0.35	0.30	0.029
22.056	0.000	0.21	0.34	0.28	0.028
22.239	0.000	0.21	0.33	0.27	0.028
22.422	0.000	0.21	0.32	0.26	0.027
22.606	0.000	0.20	0.31	0.25	0.026
22.789	0.000	0.20	0.30	0.24	0.026
22.973	0.000	0.20	0.30	0.23	0.025
23.156	0.000	0.19	0.29	0.22	0.025
23.340	0.000	0.19	0.29	0.22	0.024
23.524	0.000	0.19	0.28	0.21	0.024
23.707	0.000	0.18	0.28	0.21	0.024
23.891	0.000	0.18	0.28	0.20	0.023
24.074	0.000	0.18	0.27	0.20	0.023
24.258	0.000	0.00	0.24	0.18	0.020
24.441	0.000	0.00	0.21	0.16	0.018
24.625	0.000	0.00	0.19	0.14	0.016
24.808	0.000	0.00	0.17	0.12	0.014
24.992	0.000	0.00	0.15	0.11	0.012
25.175	0.000	0.00	0.13	0.10	0.011
25.359	0.000	0.00	0.11	0.08	0.010
25.542	0.000	0.00	0.10	0.07	0.009
25.726	0.000	0.00	0.09	0.07	0.008
25.909	0.000	0.00	0.08	0.06	0.007
26.093	0.000	0.00	0.07	0.05	0.006
26.276	0.000	0.00	0.06	0.05	0.005
26.460	0.000	0.00	0.05	0.04	0.005
26.643	0.000	0.00	0.05	0.04	0.004
26.827	0.000	0.00	0.04	0.03	0.004
27.010	0.000	0.00	0.04	0.03	0.003
27.194	0.000	0.00	0.03	0.02	0.003
27.377	0.000	0.00	0.03	0.02	0.002
27.561	0.000	0.00	0.03	0.02	0.002
27.744	0.000	0.00	0.02	0.02	0.002
27.928	0.000	0.00	0.02	0.01	0.002
28.111	0.000	0.00	0.02	0.01	0.001
28.295	0.000	0.00	0.02	0.01	0.001
28.478	0.000	0.00	0.01	0.01	0.001
28.662	0.000	0.00	0.01	0.01	0.001

SMALL AREA UNIT HYDROGRAPH MODEL

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Analysis prepared by:

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15535 Sand Canyon Ave
Suite 100
Irvine, CA 92618

Problem Descriptions:

DA 2

RATIONAL METHOD CALIBRATION COEFFICIENT = 1.23
TOTAL CATCHMENT AREA(ACRES) = 5.64
SOIL-LOSS RATE, Fm, (INCH/HR) = 0.122
LOW LOSS FRACTION = 0.222
TIME OF CONCENTRATION(MIN.) = 7.71
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY(YEARS) = 2
5-MINUTE POINT RAINFALL VALUE(INCHES) = 0.15
30-MINUTE POINT RAINFALL VALUE(INCHES) = 0.40
1-HOUR POINT RAINFALL VALUE(INCHES) = 0.59
3-HOUR POINT RAINFALL VALUE(INCHES) = 1.11
6-HOUR POINT RAINFALL VALUE(INCHES) = 1.54
24-HOUR POINT RAINFALL VALUE(INCHES) = 2.30

TOTAL CATCHMENT RUNOFF VOLUME(ACRE-FEET) = 1.04
TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 0.04

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	2.5	5.0	7.5	10.0
0.07	0.0000	0.00	Q	.	.	.	.
0.19	0.0008	0.15	Q	.	.	.	.
0.32	0.0024	0.15	Q	.	.	.	.
0.45	0.0040	0.15	Q	.	.	.	.
0.58	0.0056	0.15	Q	.	.	.	.
0.71	0.0072	0.15	Q	.	.	.	.
0.84	0.0089	0.15	Q	.	.	.	.
0.97	0.0105	0.16	Q	.	.	.	.
1.09	0.0122	0.16	Q	.	.	.	.

1.22	0.0138	0.16	Q	.	.	.	.
1.35	0.0155	0.16	Q	.	.	.	.
1.48	0.0172	0.16	Q	.	.	.	.
1.61	0.0189	0.16	Q	.	.	.	.
1.74	0.0206	0.16	Q	.	.	.	.
1.86	0.0223	0.16	Q	.	.	.	.
1.99	0.0240	0.16	Q	.	.	.	.
2.12	0.0258	0.16	Q	.	.	.	.
2.25	0.0275	0.17	Q	.	.	.	.
2.38	0.0293	0.17	Q	.	.	.	.
2.51	0.0310	0.17	Q	.	.	.	.
2.64	0.0328	0.17	Q	.	.	.	.
2.76	0.0346	0.17	Q	.	.	.	.
2.89	0.0364	0.17	Q	.	.	.	.
3.02	0.0382	0.17	Q	.	.	.	.
3.15	0.0401	0.17	Q	.	.	.	.
3.28	0.0419	0.17	Q	.	.	.	.
3.41	0.0438	0.18	Q	.	.	.	.
3.54	0.0457	0.18	Q	.	.	.	.
3.66	0.0475	0.18	Q	.	.	.	.
3.79	0.0495	0.18	Q	.	.	.	.
3.92	0.0514	0.18	Q	.	.	.	.
4.05	0.0533	0.18	Q	.	.	.	.
4.18	0.0552	0.18	Q	.	.	.	.
4.31	0.0572	0.19	Q	.	.	.	.
4.43	0.0592	0.19	Q	.	.	.	.
4.56	0.0612	0.19	Q	.	.	.	.
4.69	0.0632	0.19	Q	.	.	.	.
4.82	0.0652	0.19	Q	.	.	.	.
4.95	0.0672	0.19	Q	.	.	.	.
5.08	0.0693	0.19	Q	.	.	.	.
5.21	0.0714	0.20	Q	.	.	.	.
5.33	0.0734	0.20	Q	.	.	.	.
5.46	0.0756	0.20	Q	.	.	.	.
5.59	0.0777	0.20	Q	.	.	.	.
5.72	0.0798	0.20	Q	.	.	.	.
5.85	0.0820	0.20	Q	.	.	.	.
5.98	0.0842	0.21	Q	.	.	.	.
6.11	0.0864	0.21	Q	.	.	.	.
6.23	0.0886	0.21	Q	.	.	.	.
6.36	0.0908	0.21	Q	.	.	.	.
6.49	0.0931	0.21	Q	.	.	.	.
6.62	0.0954	0.22	Q	.	.	.	.
6.75	0.0977	0.22	Q	.	.	.	.
6.88	0.1000	0.22	Q	.	.	.	.
7.00	0.1024	0.22	Q	.	.	.	.
7.13	0.1048	0.23	Q	.	.	.	.
7.26	0.1072	0.23	Q	.	.	.	.
7.39	0.1096	0.23	Q	.	.	.	.
7.52	0.1120	0.23	Q	.	.	.	.
7.65	0.1145	0.24	Q	.	.	.	.
7.78	0.1170	0.24	Q	.	.	.	.
7.90	0.1196	0.24	Q	.	.	.	.
8.03	0.1221	0.24	Q	.	.	.	.
8.16	0.1247	0.25	Q	.	.	.	.
8.29	0.1273	0.25	Q	.	.	.	.
8.42	0.1300	0.25	.Q	.	.	.	.

8.55	0.1327	0.25	.Q	.	.	.	.
8.68	0.1354	0.26	.Q	.	.	.	.
8.80	0.1381	0.26	.Q	.	.	.	.
8.93	0.1409	0.26	.Q	.	.	.	.
9.06	0.1437	0.27	.Q	.	.	.	.
9.19	0.1466	0.27	.Q	.	.	.	.
9.32	0.1495	0.27	.Q	.	.	.	.
9.45	0.1524	0.28	.Q	.	.	.	.
9.57	0.1554	0.28	.Q	.	.	.	.
9.70	0.1584	0.29	.Q	.	.	.	.
9.83	0.1615	0.29	.Q	.	.	.	.
9.96	0.1646	0.30	.Q	.	.	.	.
10.09	0.1677	0.30	.Q	.	.	.	.
10.22	0.1709	0.30	.Q	.	.	.	.
10.35	0.1742	0.31	.Q	.	.	.	.
10.47	0.1775	0.31	.Q	.	.	.	.
10.60	0.1808	0.32	.Q	.	.	.	.
10.73	0.1842	0.32	.Q	.	.	.	.
10.86	0.1877	0.33	.Q	.	.	.	.
10.99	0.1912	0.34	.Q	.	.	.	.
11.12	0.1948	0.34	.Q	.	.	.	.
11.25	0.1985	0.35	.Q	.	.	.	.
11.37	0.2022	0.35	.Q	.	.	.	.
11.50	0.2060	0.36	.Q	.	.	.	.
11.63	0.2099	0.37	.Q	.	.	.	.
11.76	0.2138	0.38	.Q	.	.	.	.
11.89	0.2179	0.38	.Q	.	.	.	.
12.02	0.2220	0.39	.Q	.	.	.	.
12.15	0.2272	0.58	. Q	.	.	.	.
12.27	0.2338	0.67	. Q	.	.	.	.
12.40	0.2409	0.68	. Q	.	.	.	.
12.53	0.2482	0.69	. Q	.	.	.	.
12.66	0.2556	0.70	. Q	.	.	.	.
12.79	0.2632	0.72	. Q	.	.	.	.
12.92	0.2709	0.73	. Q	.	.	.	.
13.04	0.2788	0.75	. Q	.	.	.	.
13.17	0.2869	0.77	. Q	.	.	.	.
13.30	0.2951	0.79	. Q	.	.	.	.
13.43	0.3036	0.80	. Q	.	.	.	.
13.56	0.3123	0.83	. Q	.	.	.	.
13.69	0.3212	0.85	. Q	.	.	.	.
13.82	0.3303	0.88	. Q	.	.	.	.
13.94	0.3398	0.90	. Q	.	.	.	.
14.07	0.3499	1.01	. Q	.	.	.	.
14.20	0.3614	1.16	. Q	.	.	.	.
14.33	0.3740	1.21	. Q	.	.	.	.
14.46	0.3870	1.24	. Q	.	.	.	.
14.59	0.4004	1.29	. Q	.	.	.	.
14.72	0.4144	1.33	. Q	.	.	.	.
14.84	0.4289	1.40	. Q	.	.	.	.
14.97	0.4440	1.45	. Q	.	.	.	.
15.10	0.4599	1.55	. Q	.	.	.	.
15.23	0.4766	1.61	. Q	.	.	.	.
15.36	0.4945	1.76	. Q	.	.	.	.
15.49	0.5135	1.82	. Q	.	.	.	.
15.61	0.5342	2.07	. Q	.	.	.	.
15.74	0.5572	2.27	. Q.	.	.	.	.

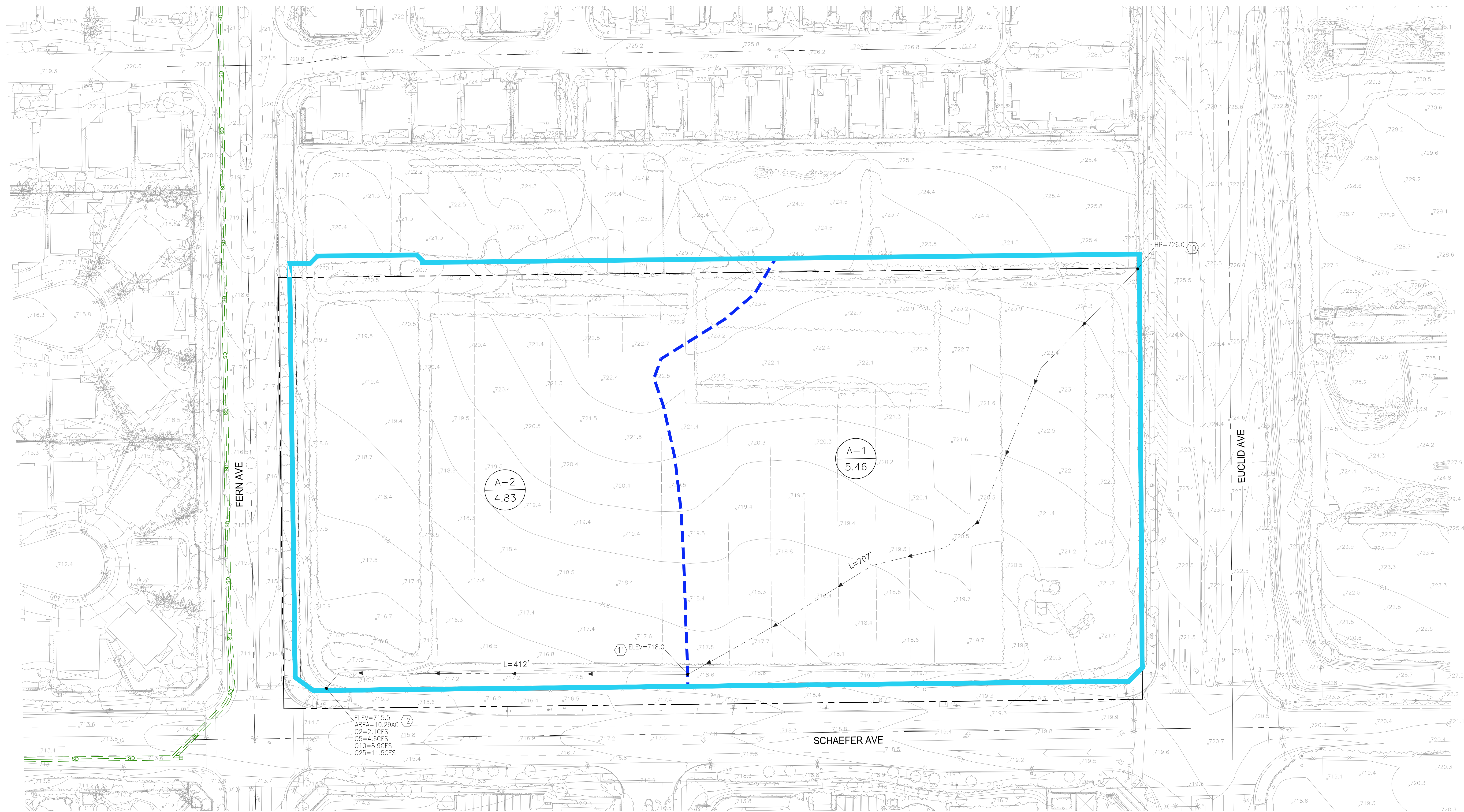
15.87	0.5846	2.89	.	.	.Q	.	.	.
16.00	0.6206	3.88	.	.	.	Q	.	.
16.13	0.6910	9.39	.	.	.	.	.	Q
16.26	0.7540	2.48	.	.	Q.	.	.	.
16.39	0.7775	1.93	.	.	Q	.	.	.
16.51	0.7966	1.68	.	.	Q	.	.	.
16.64	0.8134	1.49	.	.	Q	.	.	.
16.77	0.8286	1.36	.	.	Q	.	.	.
16.90	0.8425	1.26	.	.	Q	.	.	.
17.03	0.8556	1.19	.	.	Q	.	.	.
17.16	0.8667	0.92	.	Q	.	.	.	.
17.28	0.8762	0.86	.	Q	.	.	.	.
17.41	0.8851	0.82	.	Q	.	.	.	.
17.54	0.8935	0.78	.	Q	.	.	.	.
17.67	0.9016	0.74	.	Q	.	.	.	.
17.80	0.9093	0.71	.	Q	.	.	.	.
17.93	0.9168	0.69	.	Q	.	.	.	.
18.06	0.9239	0.66	.	Q	.	.	.	.
18.18	0.9295	0.39	.Q	.	.	.	.	.
18.31	0.9335	0.37	.Q	.	.	.	.	.
18.44	0.9374	0.36	.Q	.	.	.	.	.
18.57	0.9411	0.34	.Q	.	.	.	.	.
18.70	0.9447	0.33	.Q	.	.	.	.	.
18.83	0.9482	0.32	.Q	.	.	.	.	.
18.96	0.9516	0.31	.Q	.	.	.	.	.
19.08	0.9548	0.30	.Q	.	.	.	.	.
19.21	0.9580	0.29	.Q	.	.	.	.	.
19.34	0.9610	0.28	.Q	.	.	.	.	.
19.47	0.9640	0.28	.Q	.	.	.	.	.
19.60	0.9669	0.27	.Q	.	.	.	.	.
19.73	0.9697	0.26	.Q	.	.	.	.	.
19.86	0.9725	0.26	.Q	.	.	.	.	.
19.98	0.9751	0.25	Q	.	.	.	.	.
20.11	0.9778	0.24	Q	.	.	.	.	.
20.24	0.9803	0.24	Q	.	.	.	.	.
20.37	0.9828	0.23	Q	.	.	.	.	.
20.50	0.9853	0.23	Q	.	.	.	.	.
20.63	0.9877	0.22	Q	.	.	.	.	.
20.75	0.9900	0.22	Q	.	.	.	.	.
20.88	0.9923	0.22	Q	.	.	.	.	.
21.01	0.9946	0.21	Q	.	.	.	.	.
21.14	0.9968	0.21	Q	.	.	.	.	.
21.27	0.9990	0.20	Q	.	.	.	.	.
21.40	1.0012	0.20	Q	.	.	.	.	.
21.53	1.0033	0.20	Q	.	.	.	.	.
21.65	1.0053	0.19	Q	.	.	.	.	.
21.78	1.0074	0.19	Q	.	.	.	.	.
21.91	1.0094	0.19	Q	.	.	.	.	.
22.04	1.0114	0.18	Q	.	.	.	.	.
22.17	1.0133	0.18	Q	.	.	.	.	.
22.30	1.0152	0.18	Q	.	.	.	.	.
22.42	1.0171	0.18	Q	.	.	.	.	.
22.55	1.0190	0.17	Q	.	.	.	.	.
22.68	1.0208	0.17	Q	.	.	.	.	.
22.81	1.0226	0.17	Q	.	.	.	.	.
22.94	1.0244	0.17	Q	.	.	.	.	.
23.07	1.0262	0.16	Q	.	.	.	.	.

23.20	1.0279	0.16	Q	.	.	.	.
23.32	1.0296	0.16	Q	.	.	.	.
23.45	1.0313	0.16	Q	.	.	.	.
23.58	1.0330	0.16	Q	.	.	.	.
23.71	1.0346	0.15	Q	.	.	.	.
23.84	1.0363	0.15	Q	.	.	.	.
23.97	1.0379	0.15	Q	.	.	.	.
24.10	1.0395	0.15	Q	.	.	.	.
24.22	1.0403	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
 (Note: 100% of Peak Flow Rate estimate assumed to have
 an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
=====	=====
0%	1441.8
10%	185.0
20%	54.0
30%	23.1
40%	15.4
50%	7.7
60%	7.7
70%	7.7
80%	7.7
90%	7.7

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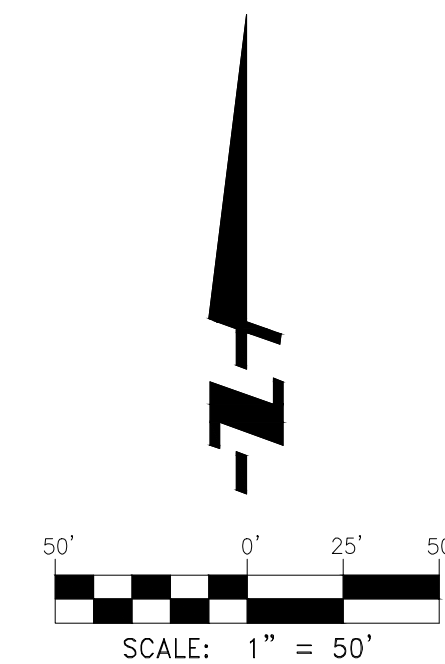


LEGEND

- DRAINAGE BOUNDARY
- DRAINAGE SUB-BOUNDARY
- NODE
- TIME OF CONCENTRATION FLOW PATH
- FLOW PATH LENGTH
- DRAINAGE BOUNDARY DESIGNATION AND AREA
- EXISTING STORM DRAIN

NOTES:
 SOIL TYPE C
 IMPERVIOUS PERCENTAGE - 0%
 LAND USE - AGRICULTURAL, ROW CROPS, STRAIGHT ROW

EXISTING CONDITION SUMMARY TABLE										
DRAINAGE AREA	DISCHARGE NODE	Q ₂ (CFS)	Q ₄ (CFS)	Q ₁₀ (CFS)	Q ₂₅ (CFS)	AREA (ACRES)	T _{C2} (MIN)	T _{C4} (MIN)	T _{C10} (MIN)	T _{C25} (MIN)
A	12	2.1	4.6	8.9	11.5	10.29	37.76	36.64	35.39	35.09



**CHINO EUCLID
 HYDROLOGY MAP
 EXISTING CONDITION**

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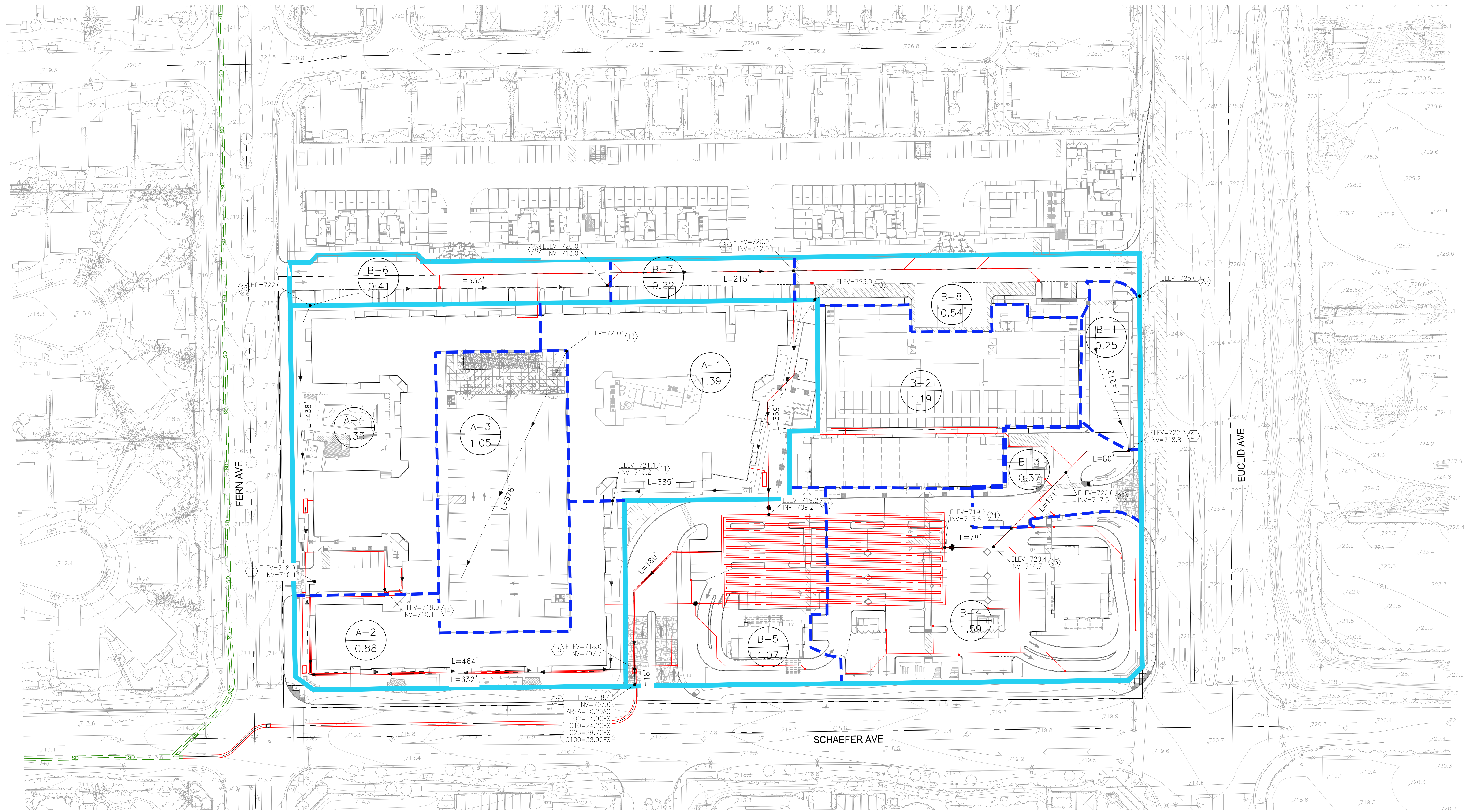
15535 Sand Canyon Ave 949.474.1960
 Suite 100
 Irvine California 92618 fuscoe.com

JOB NO.
4126-001

DRAWN BY:
SA

SHEET
1 of 1

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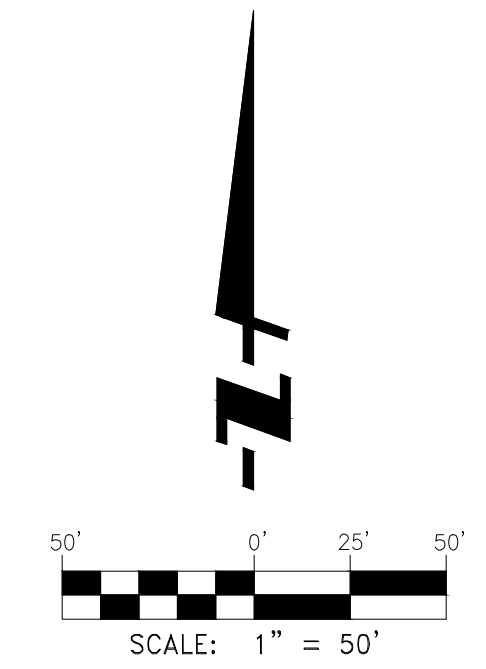


LEGEND

- DRAINAGE BOUNDARY
- - - DRAINAGE SUB-BOUNDARY
- XX NODE
- $L=XXX'$ TIME OF CONCENTRATION FLOW PATH FLOW PATH LENGTH
- DA-#
AC DRAINAGE BOUNDARY DESIGNATION AND AREA
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN

NOTES:
 SOIL TYPE C
 IMPERVIOUS PERCENTAGE - 85%
 LAND USE - MIXED USE

PROPOSED CONDITION SUMMARY TABLE										
DRAINAGE AREA	DISCHARGE NODE	Q ₂ (CFS)	Q ₁₀ (CFS)	Q ₂₅ (CFS)	Q ₁₀₀ (CFS)	AREA (ACRES)	T _{C2} (MIN)	T _{C10} (MIN)	T _{C25} (MIN)	T _{C100} (MIN)
A	29	14.9	24.2	29.7	38.9	10.3	7.8	7.6	7.5	7.4
B										



**CHINO EUCLID
 HYDROLOGY MAP
 PROPOSED CONDITION**

 FULL CIRCLE THINKING® 15535 Sand Canyon Ave 949.474.1960 Suite 100 Irvine California 92618 fuscoe.com	JOB NO. 4126-001
	DRAWN BY: SA
	SHEET 1 of 1