Water Quality Management Plan

For:

Rancho Cucamonga New Yard

12158 Baseline Road, Rancho Cucamonga, California

APN 1089-031-13 & 39

WQMP-2021-00039

Prepared for:

San Bernardino County Project & Facilities Management Department

385 N. Arrowhead Ave.,

San Bernardino, CA, 92415

909-387-5000

Prepared by:

Engineering Resources of Southern California

1861 W. Redlands Blvd. Bldg. 7B

Redlands, CA, 92373

909-890-1255

Submittal Date: 2.21.2021

Revision Date: 5.22.2024

Approval Date:_____

County of San Bernardino
NPDES

THE PLANS & DETAILS HAVE BEEN

REVIEWED

FOR COMPLIANCE

THE APPROVAL OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR ANY VIOLATION OF ANY CODE OR ORDINANCE OF THIS COUNTY

By Jonathan Dillon

Date 06/10/2024

THESE PLANS SHALL BE ON THE JOB FOR ALL REQUESTED INSPECTIONS

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for San Bernardino County Project & Facilities Management Department by Engineering Resources of Southern California. The WQMP is intended to comply with the requirements of San Bernardino County 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):	TBD	Grading Permit Number(s):	GRAD-2021-00080
Tract/Parcel Map Number(s):	N/A	Building Permit Number(s):	NEWNR-2021-00037
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 1089-031-13 & 39

Owner's Signature			
Owner Name: Noel Castillo C/O County of San Bernardino County Flood Control District			
Title	Director of Public Works		
Company	San Bernardino County Flood Control District		
Address	825 East Third Street, San Bernardino, CA 92415		
Email	noel.castillo@dpw.sbcounty.gov		
Telephone #	909-387-7906		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	GRAD-2021-00080
Tract/Parcel Map Number(s):		Building Permit Number(s):	NEWNR-2021-00037
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			1089-031-13 & 39

"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: Matt Brudin		PE Stamp Below
Title	Principal Engineer	
Company	ERSC.Inc	
Address	1861 W Redlands Blvd. Redlands CA	
Email	Matt@erscinc.com	
Telephone #	909 890 1255	
Signature		
Date	5/24/2024	

Table of Contents

Forms

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Rancho Cucamonga New Yard				
Project Owner Contact Name:	Noel Castillo				
Mailing Address:	385 N. Arrowhead Ave., San Bernardino, CA	E-mail Address:	Noel.castillo@dpw.sbcounty.gov	Telephone:	909-601-1165
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):		APN 1089-031-13 & 39
Additional Information/ Comments:	Currently, the County of San Bernardino operates a corporate yard from existing facilities located at 12158 Baseline Road, Rancho Cucamonga California, and is proposing the development of a new building and associated civil site improvements at the project location on a 2.66-acre undeveloped land.				
Description of Project:	The proposed project entails the construction of 3,200 square feet engineered metal building in a 31,869 sq-ft area, including a parking lot, a wash rack, and the extension of the existing access road with approximately 11,910 sq-ft area to the project location. The proposed improvements will add about 44,000 sq-ft of impervious area to the project location. The site in its current condition has approximately 90,000 sq-ft of impervious area. Since the new improvements add less than 50% more impervious area to the project site, only the new improvements will need to be treated. The post development drainage pattern will be differentiating to the pre-development condition of the site. Pre-development conditions have the entire site draining to the South-east corner of the site in sheet flow patterns. The post development condition has the new Northern metal building construction area and Western entrance road area (DA 1) that ultimate drains into BMP infiltration trench. Any overflow conditions have runoff which exits the site on the South where it discharges onto Baseline Road. It is then collected and discharged into Day Creek which flows to Santa Ana River Basin which drains to the Prado Reservoir. The proposed Storm Drain improvements will be designed to achieve compliance.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	Existing BMPs: • Stockpile management, BMP established around stockpiled material. • Spill Prevention kits onsite. • Hardscaping and drainage control for storm run-off. Includes west ingress drainage swale. • Southern concrete drainage curb, for facility/ Lot drainage. • Spill container for liquid materials within storage container. Proposed BMP: • Infiltration Trench				

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☒ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☐ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more
☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☐ Parking lots of 5,000 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day

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

2 Project Area (ft2):	115,680	**3** Number of Dwelling Units:	0	**4** SIC Code:	1541

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

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

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

San Bernardino County Flood Control District as on-site owner and user as a Maintenance Yard.

Contact Information:

Noel Castillo C/O San Bernardino County Flood Control District
Director of Public Works
San Bernardino County Flood Control District
825 East Third Street, San Bernardino, CA 92415
Noel.castillo@dpw.sbcounty.gov
909-387-7906

2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include hydrocarbons and bacteria indicators.
Nutrients - Phosphorous	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Sources from urban runoff include fertilizers and eroded soils.
Sediment	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include eroded soils.
Metals	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include paper, plastic, polystyrene packing foam, and aluminum materials.
Pesticides / Herbicides	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and pesticides.
Organic Compounds	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include solvents and cleaning compounds.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

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

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

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

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

Section 3 Site and Watershed Description

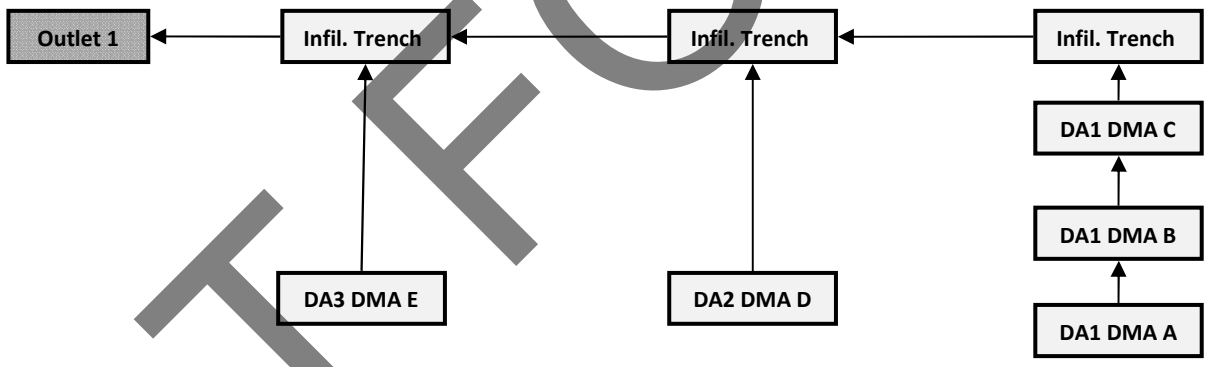
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34d07'25" N	Longitude 117d32'22" W	Thomas Bros Map page 573

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA A, B and C flows to infiltration trench	*Impervious areas drain to infiltration trench then too DA2*
DA2 DMA D flows to infiltration trench	*Impervious areas drain to infiltration trench then too DA3*
DA3 DMA E flows to infiltration trench	*Impervious areas drain to infiltration trench then too Outlet 1*

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	
1 DMA drainage area (ft^2)	65,726	25,648	12,716	
2 Existing site impervious area (ft^2)	0	9,464	0	
3 Antecedent moisture condition *For desert areas, use http://www. .gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II	II	II	
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A	A	A	
5 Longest flowpath length (ft)	315	230	237	
6 Longest flowpath slope (ft/ft)	0.020	0.008	0.005	
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren, sage scrub	Barren	Barren	
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	*Fair 50-75%;*	*Fair 50-75%;*	*Fair 50-75%;*	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2				
For Drainage Area 3's sub-watershed DMA, provide the following characteristics	DMA D			
1 DMA drainage area (ft^2)	5,455			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	30			
6 Longest flowpath slope (ft/ft)	.02			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	*Fair 50-75%;*			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 3				
For Drainage Area 4's sub-watershed DMA, provide the following characteristics	DMA E			
1 DMA drainage area (ft^2)	6,135			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	30			
6 Longest flowpath slope (ft/ft)	.019			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	*Fair 50-75%;*			

Form 3-3 Watershed Description for Drainage Areas

Receiving waters *Refer to Watershed Mapping Tool -* *http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Day Creek Channel, San Sevaine Channel, Santa Ana river reach , Prado Flood Control Basin
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River Reach 3: Pathogens
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana River Reach 3: pathogens, Copper Lead Prado Flood Control Basin: Ph Santa Ana River Reach 2: None
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	Riversidian Alluvial Sage Scrub
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	Santa Ana River
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	San Bernardino County Flood Control District will implement Good Housekeeping practices, will provide practical information materials, and be made aware of the responsibilities and maintenance obligations that will be required. Thereafter such materials will be available through the local jurisdiction's stormwater program.
N2	Activity Restrictions	☒	☐	When using pesticides, contact licensed pesticide applicator to do the application.
N3	Landscape Management BMPs	☒	☐	San Bernardino County Flood Control District will ensure landscaping and irrigation is properly maintained. Application of fertilizers/pesticides by licensed person. All routing landscaping maintenance shall be done in accordance with CASQA BMP SC73, pollution prevention, suggested protocols, planting, waste management, irrigation, fertilizers and pesticide management, and inspection.
N4	BMP Maintenance	☒	☐	San Bernardino County Flood Control District will be responsible for the BMP inspection and maintenance. See section5, Form 5.1 for details on BMP maintenance.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste material will be storage on this project site.
N6	Local Water Quality Ordinances	☒	☐	The project will comply with the MS4 Permit through the implementation of this WQMP
N7	Spill Contingency Plan	☒	☐	Spill Kit: 30Gal Spill Kit, Absorbents, Oil Mats/Trays, self-contained Disposal Drums for used absorbents.
N8	Underground Storage Tank Compliance	☒	☐	This BMP addresses compliance with State regulations dealing with underground storage tanks (septic tank), enforced by County Environmental Health Services on behalf of State. Septic tank is set at least 55' from the treatment control BMP.

Form 4.1-1 Non-Structural Source Control BMPs

N9	Hazardous Materials Disclosure Compliance	☒	☐	Hazardous material currently stored in self-contained 25-foot Conex Box and Fire Cabinets: • Aerosols • Paint under 15 gallons • Motor Oil under 45 gallons (1 Qt. containers) • Transmission Oil under 5 gallons (1 Qt. containers) • Anti-Freeze under 5 gallons (1-gallon Containers) • Lubricants under 5 gallons • Gasoline under 5 gallons (2-gallon & 5-gallon containers).

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	☒	☐	Hazard Waste protection to be enforced by local fire protection agencies, San Bernardino County will be responsible for enforcing hazardous waste regulations.
N11	Litter/Debris Control Program	☒	☐	San Bernardino County Flood Control District shall prepare and implement a trash management program with instructions on spill cleanup, litter control procedures. Implement CASQA BMP SC-60, keep worksites clean and orderly, dispose of wash water, sediments, properly, provide training to employees, have spill cleanup materials readily available and in a known location, cleanup spills immediately, and properly dispose the spill cleanup material.

N12	Employee Training	☒	☐	The owner shall prepare and implement an employment training program. This will occur within 3 months of hire and annually after. • Annual NPDES Training for Yard Location (Last training 01/04/23) • Facility Urban Runoff Pollution Prevention Plan – 12158 Baseline Rd., Rancho Cucamonga. • FURPPP – Storm Water Management Program Municipal Inspection. (Last inspection 01/04/23) • 2014 – Last SWPPP, changed to FURPPPP.
N13	Housekeeping of Loading Docks	☐	☒	No loading docks were proposed in this development.
N14	Catch Basin Inspection Program	☒	☐	Catch Basins shall be cleaned and maintained on an annual basis with 100% of the facilities included in a two-year period. Implement CASQA SC-74.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Onsite private streets and parking areas will be vacuumed and or swept using a vacuum assisted sweeper as part of the BMP Maintenance Plan.
N16	Other Non-structural Measures for Public Agency Projects	☒	☐	Educational materials available through the local jurisdiction's stormwater program. The County has a Facilities Urban Runoff Pollution Prevention Plan in-place for current post construction activities. A copy of the Facilities Urban Runoff Pollution Prevention Plan is available at the site if needed.
N17	Comply with all other applicable NPDES permits	☒	☐	The proposed site will comply with current NPDES permit requirements through implementation of the site specific Storm Water Pollution Prevention Plan (SWPPP) BMPs. Refer to separate SWPPP document. Compliance with the MS4 also required.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	One proposed catch basin with stenciling and signage. Pretreatment filter insert to be installed.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor storage material proposed in this development.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash enclosures shall be paved and have permanent roof or awning. Implement CASQA BMP handbook SD-32 guidance.
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)	☒	☐	Efficient irrigation design and landscape design that will help to cut the costs and conserve use of water, by design timing and application methods of irrigation water to minimize the runoff of excess of irrigation water into the storm water system. To be provided per landscape plans and will incorporate the State and Local requirements for landscaping.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscape areas shall be below top of curb and pavement minimum of 1-2 inches.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	No channel was proposed on this site. Proposed Energy Dissipater (rip-rap) at inlets to the trench.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No docks are proposed on this site.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☒	☐	Maintenance bays are proposed inside the new building. Floor drains lead to a clarifier, then to sand oil interceptor. The sand oil interceptor leads to a sump pump that pumps to a storage tank.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☒	☐	Vehicle wash area is equipped with a wash rack. A valve will be installed between the drain and the sump. Implement CASQA BMP handbook SD-33. The wash area drains to a drainage trench which leads to the sand oil interceptor. The sand oil interceptor leads to a sump pump that pumps to a storage tank.

S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing has been proposed for this site.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☒	☐	Outdoor equipment/accessory washing and steam cleaning activities will be self contained. A valve will be installed between the drain and the sump. Wash area drains to a sand oil interceptor which leads to a sump pump and is ultimately pumped to a storage tank. San Bernardino County Public Works will contract a pumping company and take the waste to a solid waste facility for disposal.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling has been proposed on this project.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscape existing on this project.
S14	Wash water control for food preparation areas	☐	☒	No food preparation has been proposed on this project.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No car washing has been proposed on this project.

4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☐ No ☒ Explanation: The project will utilize infiltration facilities to collect runoff from impervious areas. 38% percent of the total area of the project correspond to impervious areas.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: The Infiltration trench BMP was proposed to improve natural infiltration of the DCV.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Pre-development conditions have the entire site draining to the South-east corner. The post development condition has a building construction area and an entrance road area that ultimate drains into BMP infiltration trench. Time of concentration will not be affected.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: The infiltration facilities will disconnect impervious areas before discharging outside.
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: Existing sensitive areas within the site and post-development vegetation will be protected.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: The assigned landscape areas area shown in the landscape plans.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: No compaction will be performance in the infiltration trench. Vehicle and foot traffic in infiltration areas will be limit, as well as other methods will be implemented by the contractor's discretion during construction, to avoid compaction.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐ Explanation: A shallow excavation located over porous soils and back-filled with stone will be constructed as part of the infiltration trench.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscape areas will be staked off during the grading to avoid/minimize compaction in the landscape areas.

4.2 Project Performance Criteria

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

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

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

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

1 Project area DA 1 (ft^2): 104,090	**2** Imperviousness after applying preventative site design practices (Imp%): 35	**3** Runoff Coefficient (Rc): 0.252 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.601 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.89 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 3,821 CF *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

1 Project area DA 3 (ft^2):	2 Imperviousness after applying preventative site design practices (Imp%):	3 Runoff Coefficient (Rc): 0.44
5,455	64	*$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.601 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.89

*P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*

6 Drawdown Rate

Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.

24-hrs ☐
48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 350 CF

*DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)*
Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)

1 Project area DA 4 (ft^2):	2 Imperviousness after applying preventative site design practices (Imp%):	3 Runoff Coefficient (Rc): 0.485
6,135	69	*$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.601 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.89

*P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*

6 Drawdown Rate

Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.

24-hrs ☐
48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 433 CF

*DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)*
Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2

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

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

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

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

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

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

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

This project is located in HCOC Exempt area.

The site is mapped in the San Bernardino Co Geodatabase HCOC exemption area.
https://sbcountydpw.maps.arcgis.com/apps/webappviewer/index.html?id=302f46bbc77143519782936a535d0cfc

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

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

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

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

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

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

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

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

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

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs):	*Maximum of Item 8, 9, and 10 (including additional forms as needed)*	
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs):	*Maximum of Item 11, 12, and 13 (including additional forms as needed)*	
15 Peak runoff reduction needed to meet HCOC Requirement (cfs):	*$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*	

4.3 Project Conformance Analysis

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

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

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

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

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

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

If Yes, Provide basis: (attach)

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

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 2)

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

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

If Yes, Provide basis: (attach)

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

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 3)

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

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

If Yes, Provide basis: (attach)

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

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

4.3.1 Site Design Hydrologic Source Control BMP

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

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

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

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

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

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

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

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):		$V_{retention}$ *=Sum of Item 4 for all BMPs*	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):		$V_{retention}$ *=Sum of Item 12 for all BMPs*	

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

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

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

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 3)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):		$V_{retention}$ *=Sum of Item 4 for all BMPs*	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):		$V_{retention}$ *=Sum of Item 12 for all BMPs*	

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 3)

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 3)

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

4.3.2 Infiltration BMPs

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

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

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 3,821 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA -A,B,C BMP Type Infiltration Trench	DA 1 DMA -D BMP Type Infiltration Trench	DA 1 DMA -E BMP Type Infiltration Trench
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*	10.1	-	-
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	-	-
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.37	-	-
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	-	-
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	0	-	-
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0	-	-
8 Infiltrating surface area, *SA_{BMP}* (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	625	-	-
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*	5	-	-
12 Gravel porosity	40%	-	-
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	-	-
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	1,777	-	-
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a	-	-
16 Total Retention Volume from LID Infiltration BMPs: 1,777 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 39% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☐ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 350 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 2 DMA -D BMP Type Infiltration Trench	DA 1 DMA -D BMP Type Infiltration Trench	DA 1 DMA -E BMP Type Infiltration Trench
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*	10.1	-	-
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	-	-
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.37	-	-
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	-	-
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	0	-	-
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0	-	-
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	610	-	-
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*	5	-	-
12 Gravel porosity	40%	-	-
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	-	-
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	1,734	-	-
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a	-	-

16 Total Retention Volume from LID Infiltration BMPs: 1,734 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 495% *Retention% = Item 16 / Form 4.2-1 Item 7*

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

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

for the applicable category of development and repeat all above calculations.

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 433 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 3 DMA -E BMP Type Infiltration Trench	DA 1 DMA -D BMP Type Infiltration Trench	DA 1 DMA -E BMP Type Infiltration Trench
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*	10.1	-	-
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	-	-
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.37	-	-
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	-	-
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	0	-	-
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	0	-	-
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	636	-	-
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*	5	-	-
12 Gravel porosity	40%	-	-
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	-	-
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	1,808	-	-
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a	-	-

16 Total Retention Volume from LID Infiltration BMPs: 1,808 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 418% *Retention% = Item 16 / Form 4.2-1 Item 7*

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

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

4.3.3 Harvest and Use BMP

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

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

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

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

4.3.4 Biotreatment BMP

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

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

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

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

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

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

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

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

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

Form 4.3-8 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

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

1 Total LID DCV for the Project DA-1 (ft^3): 3,821 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 1,777 *Copy Item 16 in Form 4.3-3*

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

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

6 Flow capacity provided by flow based biotreatment BMP (cfs): N/A *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 the Project DA-1 (ft^3): 350 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 1,734 *Copy Item 16 in Form 4.3-3*

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

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

6 Flow capacity provided by flow based biotreatment BMP (cfs): N/A *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 3)

1 Total LID DCV for the Project DA-1 (ft^3): 433 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 1,808 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA 1)

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

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

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

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

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

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

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

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

Form 4.3-10 Hydromodification Control BMPs (DA 2)

1 Volume reduction needed for HCOC performance criteria (ft^3): 0
*(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 0 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*

3 Remaining volume for HCOC volume capture (ft^3): 0
Item 1 – Item 2

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

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

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

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

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

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

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

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

Form 4.3-10 Hydromodification Control BMPs (DA 3)

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

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

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

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

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

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

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

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

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Trench	San Bernardino County Flood Control District	Maintain adjacent areas, remove clippings from landscape maintenance activities, remove trash and debris.	Monthly
Infiltration Trench	San Bernardino County Flood Control District	Check for surface ponding, if ponding is above the trench remove and replace pea gravel, check observation well for ponding, if trench became plugged, remove rock material, provide a fresh infiltration surface by excavating and additional 2-4 inches of soil, replace the rock material.	Monthly
Vehicle Washing/ Maintenance	San Bernardino County Flood Control District	Vehicle washing and maintenance will be performed inside the apparatus building. Sand and grease separator will be installed and connected to septic tank. Inspection of drainage will be done monthly.	Monthly
Parking Areas	San Bernardino County Flood Control District	Parking areas to be swept, post "No littering" signs and enforce anti littering laws. Sweep utilizing a vacuum assisted sweeper all parking lots at least once before the onset of the wet season. Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible. Establish frequency of public parking lot sweeping based on the usage and field observations of waste accumulation. Sweep and clean parking lots regularly to minimize	Daily/Weekly

		pollutant transport into storm drains from stormwater runoff.	
Landscape maintenance	San Bernardino County Flood Control District	Mowing and clipping cleaning to maintenance landscape areas and remove and replace landscape as necessary.	Once a week
Littering Control	San Bernardino County Flood Control District	Maintain waste collection areas and sweeping parking areas.	Daily/Weekly
Irrigation	San Bernardino County Flood Control District	Provide high-efficient sprinklers system with rain sensor into the onsite sprinkler system. Sprinklers and sensors will be inspected for damage or defects and will be replaced immediately. Employ rain-triggered shutoff devices to prevent irrigation after precipitation, and design irrigation system 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.	Monthly
Catch Basin	San Bernardino County Flood Control District	Visual Inspection for accumulated debris or sediment, clean when 25% of the unit is filled, inspect monthly.	Monthly
Sand Oil Interceptor	San Bernardino County Flood Control District	Clean out oil/water/sand separators regularly, especially after heavy storms.	Monthly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

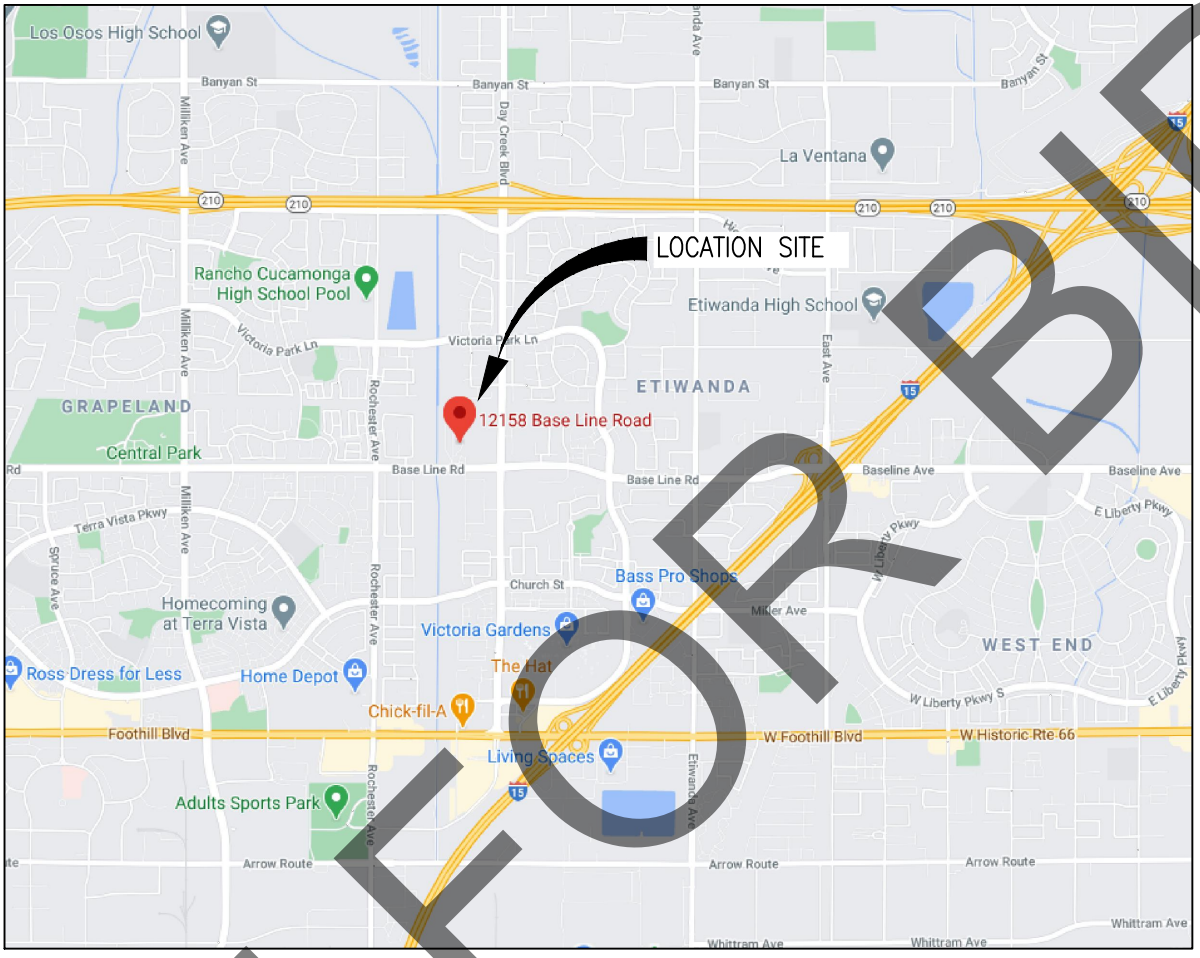
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

Appendix -A
Vicinity map and WQMP Plan

EXHIBIT "A"



DETAIL
NOT TO SCALE

ERSG INC.COM
Engineering Resources of Southern California

1861 W. Redlands Blvd,
Bldg 7B Redlands, Ca. 92373
P: (909) 890-1255
F: (909) 890-0995

RANCHO CUCAMONGA
RANCHO YARD BUILDING
VICINITY MAP

PREPARED UNDER THE SUPERVISION OF:

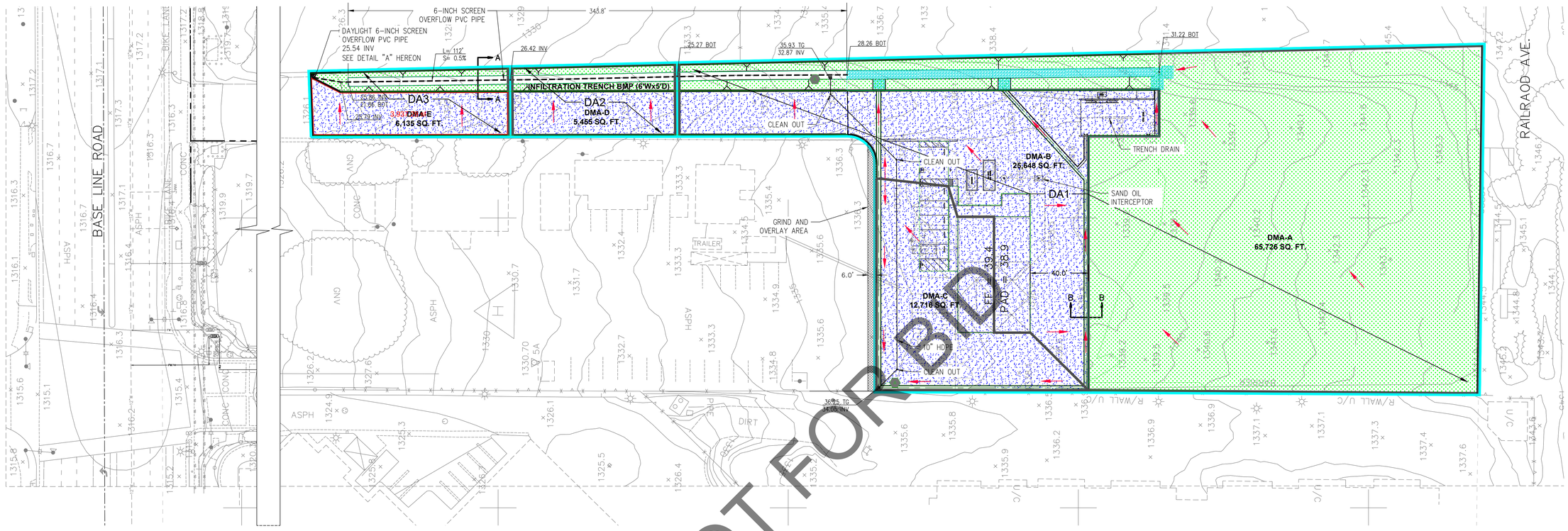
DATE: _____ MATT BRUDIN, R.C.E. NO. 41836

J.N. 09003041 | SCALE: NTS

FILE NO: I:\Projects\09003041-Rancho Cucamonga Yard\DESIGN\REPORTS & STUDIES\WQMP\VICINITY MAP.dwg Nov11,2020

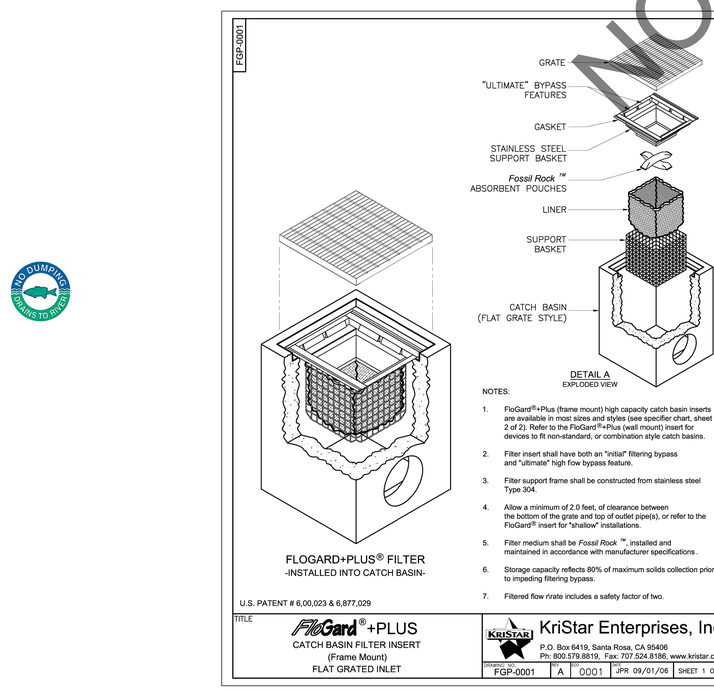
DATE: Nov 11, 2020 | SHEET 1 OF 1

RANCHO CUCAMONGA
RANCHO YARD BUILDING
12158 BASE LINE ROAD, SAN BERNARDINO, CA
WQMP PLAN



LEGEND

DA1	DRAINAGE AREA (DA)
DMA-A	DRAINAGE MANAGEMENT AREA (DMA)
100,000	NET AREA IN SQ.F.
	DIRECTION OF SURFACE FLOW
	DRAINAGE AREA
	DMA BOUNDARY
	PERVIOUS AREA (UNDEVELOPED)
	IMPERVIOUS AREA
	STENCIL AND PRETREATMENT FILTER



0 30 60 Feet

STK
42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780
Phone: 951.296.9110 Fax: 951.296.6079 Email: stk@stkinc.com

CONSULTANT:

ERSG INC.COM
Engineering Resources of Southern California
1861 W. Redlands Blvd, Bldg 7B
Redlands, Ca. 92373
P: (909) 890-1255
F: (909) 890-0995

PROJECT ADMINISTERED BY:
SAN BERNARDINO COUNTY
PROJECT AND FACILITIES MANAGEMENT DEPARTMENT - PROJECT MANAGEMENT DIVISION

385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

PROJECT NAME:
SAN BERNARDINO COUNTY
RANCHO CUCAMONGA
NEW YARD CONSTRUCTION

PROJECT # 10.10.1333

CIP # 23-042

CAFM # ETI005

APN: 1089031390000, 10890311300000

12158 BASE LINE ROAD
RANCHO CUCAMONGA,
CA 91739

ISSUE INFORMATION:

DATE:	INFORMATION:
04-29-21	1st Plan Check
05-25-23	2nd Plan Check

SHEET INFORMATION:
STK PROJECT NO.: 374-134-20
SCALE: AS NOTED
DATE: NOVEMBER 2022
PLOT DATE: –
DRAWING NAME:

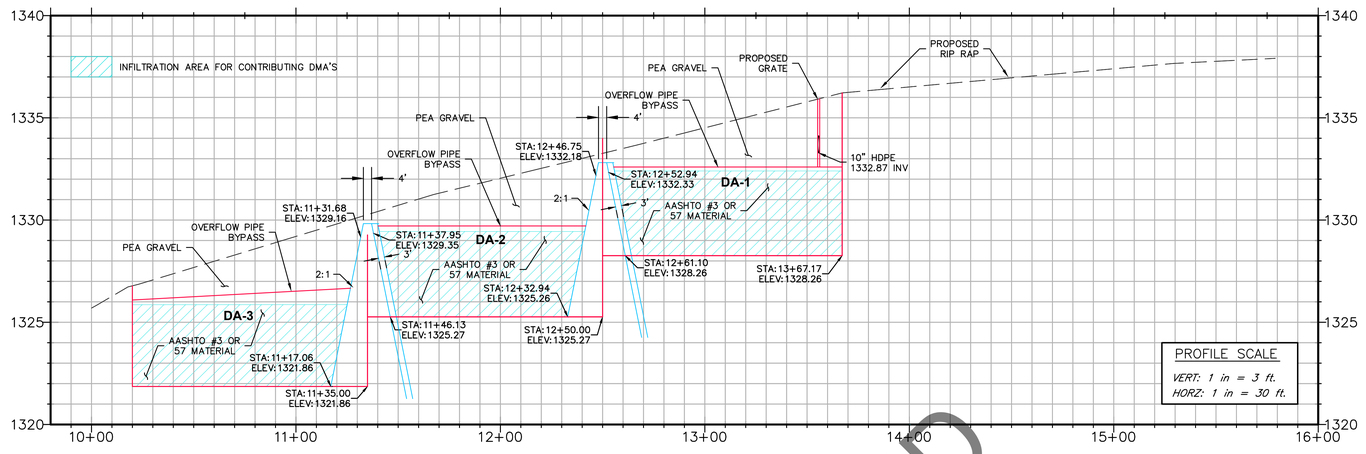
SEAL:
REGISTERED PROFESSIONAL ENGINEER
JOHN P. ROZZELLE
No. 71516
Exp. 3/31/26
CIVIL
STATE OF CALIFORNIA

SHEET TITLE:
WQMP PLAN
COUNTY YARD

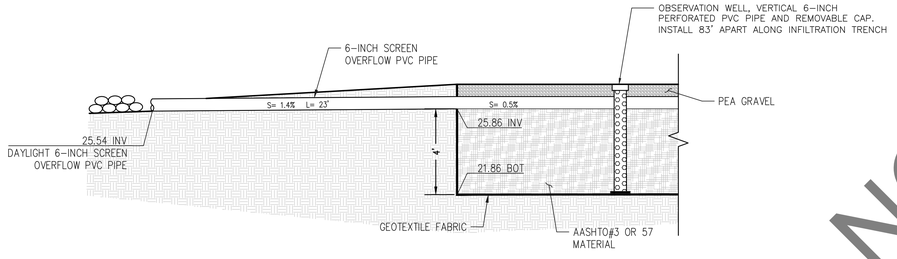
SHEET NO.:
SHEET 1 OF 2

C:\Users\tmoffatt\appdata\local\temp\AcPublish_28000\WQMP-PLAN - 3.1.24.dwg
05/24/2024 3:52PM

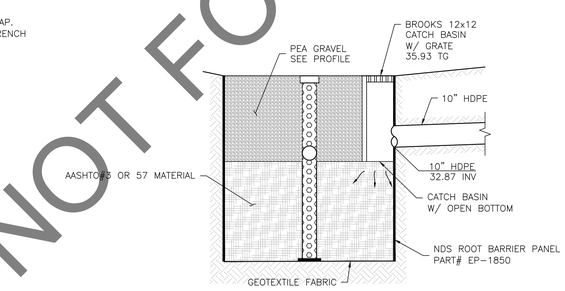
RANCHO CUCAMONGA
RANCHO YARD BUILDING
12158 BASE LINE ROAD, SAN BERNARDINO, CA
WQMP PLAN



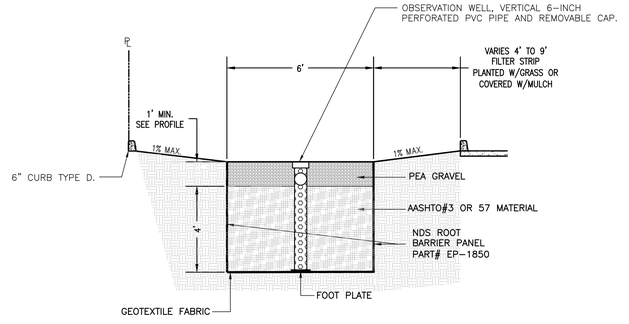
INFILTRATION TRENCH BMP - PROFILE VIEW
NTS



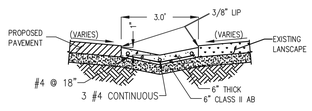
DETAIL A
OVERFLOW PIPE
BYPASS STORM FLOWS LARGER THAN V_{BMP}
NTS



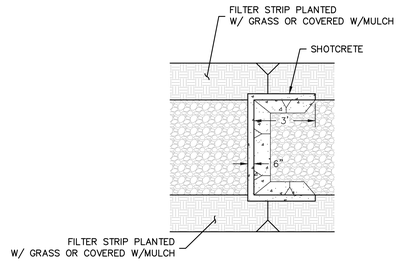
PIPE CONNECTION DETAIL
NTS



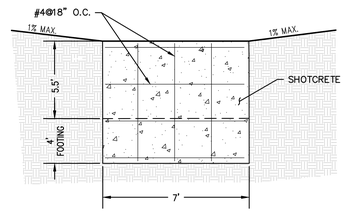
INFILTRATION TRENCH BMP
NTS



SECTION B-B
CROSS GUTTER DETAIL
NTS



DROP STRUCTURE DETAIL
NTS



DROP STRUCTURE
NTS

STK
42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780
Phone: 951.296.9110 Fax: 951.296.6079 Email: stk@stkinc.com

CONSULTANT:

ERSG INC.COM
Engineering Resources of Southern California
1861 W. Redlands Blvd, Bldg 7B
Redlands, Ca. 92373
P: (909) 890-1255
F: (909) 890-0995

PROJECT ADMINISTERED BY:
SAN BERNARDINO COUNTY
PROJECT AND FACILITIES MANAGEMENT DEPARTMENT - PROJECT MANAGEMENT DIVISION

385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

PROJECT NAME:
SAN BERNARDINO COUNTY
RANCHO CUCAMONGA NEW YARD CONSTRUCTION

PROJECT # 10.10.1333

CIP # 23-042

CAFM # ETI005

APN: 1089031390000, 1089031300000

12158 BASE LINE ROAD
RANCHO CUCAMONGA, CA 91739

ISSUE INFORMATION:

DATE:	INFORMATION:
04-29-21	1st Plan Check
05-25-23	2nd Plan Check

SHEET INFORMATION:
STK PROJECT NO.: 374-134-20
SCALE: AS NOTED
DATE: NOVEMBER 2022
PLOT DATE: -
DRAWING NAME:

SEAL:
REGISTERED PROFESSIONAL ENGINEER
No. 73516
Exp. 3/31/26
CIVIL
STATE OF CALIFORNIA

SHEET TITLE:
WQMP PLAN
COUNTY YARD

SHEET NO.:
SHEET 2 OF 2

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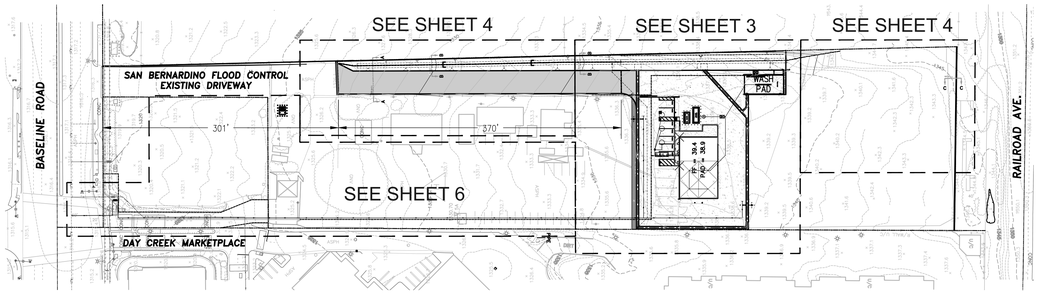
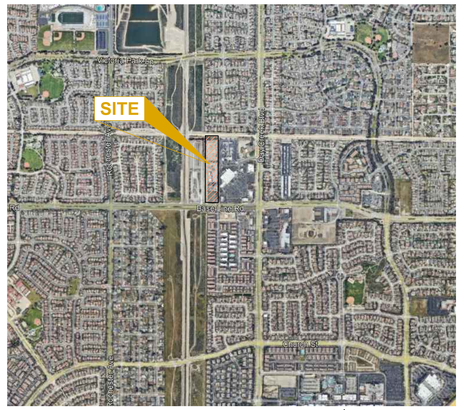
05/24/2024 3:52PM

Appendix -B
Construction Plans

PRECISE GRADING PLAN
SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT
APN 1089-031-13 & 39



INDEX MAP
SCALE: 1" = 80'



VICINITY MAP
NOT TO SCALE

GRADING NOTES

1. ALL GRADING SHALL CONFORM TO THE LATEST CALIFORNIA BUILDING CODE (CBC) CHAPTERS 17, 18, APPENDIX-J AND ALL APPLICABLE SECTIONS.
2. A GRADING PERMIT SHALL BE OBTAINED PRIOR TO COMMENCEMENT OF ANY WORK ON THE SITE.
3. ISSUANCE OF A GRADING PERMIT DOES NOT ELIMINATE THE NEED FOR PERMITS FROM OTHER REGULATORY AGENCIES WITH REGULATORY RESPONSIBILITIES FOR CONSTRUCTION ACTIVITIES ASSOCIATED WITH THE WORK AUTHORIZED IN THIS PLAN.
4. ALL WORK UNDER THIS PERMIT SHALL BE LIMITED TO WORK WITHIN THE PROPERTY LINES. A SEPARATE CONSTRUCTION, EXCAVATION OR ENCROACHMENT PERMIT FROM THE DEPARTMENT OF PUBLIC WORKS MAY BE REQUIRED FOR ANY WORK WITHIN THE COUNTY RIGHT-OF-WAY.
5. APPROVAL OF THESE PLANS DOES NOT AUTHORIZE ANY WORK OR GRADING TO BE PERFORMED UNTIL THE EFFECTIVE PROPERTY OWNER'S PERMISSION HAS BEEN OBTAINED AND VALID GRADING PERMIT HAS BEEN ISSUED.
6. THIS PLAN IS FOR GRADING PURPOSES ONLY AND IS NOT TO BE USED FOR THE PURPOSE OF CONSTRUCTING ONSITE OR OFFSITE IMPROVEMENTS. ISSUANCE OF A PERMIT BASED ON THIS PLAN DOES NOT CONSTITUTE APPROVAL OF DRIVEWAY LOCATIONS OR SIZES, PARKING LOT STRUCTURAL SECTIONS OR LAYOUT, ADA-RELATED REQUIREMENTS, BUILDING LOCATIONS OR FOUNDATIONS, WALLS, CURBING, OFFSITE DRAINAGE FACILITIES OR OTHER ITEMS NOT RELATED DIRECTLY TO THE BASIC GRADING OPERATION. ONSITE IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE TO THE APPROVED BUILDING PERMIT PLANS. OFFSITE IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE TO PLANS APPROVED FOR THIS PURPOSE BY THE PUBLIC WORKS DEPARTMENT.
7. MAXIMUM CUT AND FILL SLOPE = 2:1 (HORIZONTAL TO VERTICAL) AND MAXIMUM VERTICAL HEIGHT = 30 FEET, UNLESS AN APPROVED GEOTECHNICAL REPORT CAN JUSTIFY A STEEPER AND TALLER SLOPE.
8. NO FILL SHALL BE PLACED ON EXISTING GROUND UNTIL THE GROUND HAS BEEN CLEARED OF WEEDS, DEBRIS, TOPSOIL AND OTHER DELETERIOUS MATERIAL.
9. FILL SLOPES SHALL NOT HAVE LESS THAN 90% RELATIVE COMPACTION, OR AS RECOMMENDED ON THE APPROVED GEOTECHNICAL REPORT.
10. IT IS THE GRADING CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ADEQUATE COMPACTION HAS BEEN ATTAINED ON THE ENTIRE GRADING SITE, INCLUDING FILL AREAS OUTSIDE THE BUILDING PADS AND ON ALL FILLSLOPES.
11. UNLESS OTHERWISE RECOMMENDED IN AN APPROVED GEOTECHNICAL REPORT, OVER-EXCAVATION SHALL BE AT LEAST 24 INCHES MINIMUM BELOW THE BOTTOM OF FOOTINGS OR TO COMPETENT NATIVE SOIL OR BEDROCK MATERIALS, WHICHEVER IS DEEPER, AS APPROVED BY THE PROJECT'S GEOTECHNICAL ENGINEER OR GEOLOGIST.
12. EARTHWORK VOLUMES:

    CUT 545 (CY), FILL 1,193 (CY), TOTAL DISTURBED AREA 66,308 (SF)
13. EARTHWORK QUANTITIES ARE SHOWN FOR GRADING PERMIT PURPOSES ONLY, AND SAN BERNARDINO COUNTY IS NOT RESPONSIBLE FOR THEIR ACCURACY.
14. A COPY OF THE GRADING PERMIT AND APPROVED GRADING PLANS MUST BE IN THE POSSESSION OF A RESPONSIBLE PERSON AND AVAILABLE AT THE SITE AT ALL TIMES.
15. ANY ONSITE RETAINING WALLS SHOWN ON THE GRADING PLANS THAT ARE OVER 4' IN HEIGHT, MEASURED FROM TOP OF WALL TO BOTTOM OF FOOTING, ARE FOR REFERENCE ONLY. RETAINING WALLS OVER 4' IN HEIGHT ARE NOT CHECKED, PERMITTED, OR INSPECTED PER THE GRADING PERMIT. A SEPARATE RETAINING WALL PERMIT IS REQUIRED FOR ALL RETAINING WALLS OVER 4' IN HEIGHT.
16. ANY WALLS, FENCES, STRUCTURES AND/OR APPURTENANCES ADJACENT TO THIS PROJECT ARE TO BE PROTECTED IN PLACE. IF GRADING OPERATIONS DAMAGE OR ADVERSELY AFFECT SAID ITEMS IN ANY WAY, THE CONTRACTOR AND/OR DEVELOPER IS RESPONSIBLE FOR WORKING OUT AN ACCEPTABLE SOLUTION TO THE SATISFACTION OF THE AFFECTED PROPERTY OWNER(S).
17. FOR SITES WITH PROTECTED SPECIES OR TREES, THE PROPOSED GRADING MAY BE SUBJECT TO A SEPARATE PERMIT.
18. ADEQUATE FIRE ACCESS AROUND BUILDINGS (INCLUDING GARAGES) SHOULD BE PROVIDED AS APPROVED BY COUNTY FIRE.
19. EXISTING DRAINAGE COURSES SHALL NOT BE OBSTRUCTED, ALTERED, OR DIVERTED WITHOUT PRIOR APPROVAL FROM THE COUNTY OF SAN BERNARDINO, LAND DEVELOPMENT DIVISION. A STREAMBED ALTERATION AGREEMENT MAY ALSO BE REQUIRED FROM THE CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE.
20. DRAINAGE EASEMENTS SHALL NOT BE OBSTRUCTED, ALTERED OR DIVERTED WITHOUT PRIOR APPROVAL OF THE COUNTY OF SAN BERNARDINO, LAND DEVELOPMENT DIVISION.
21. SETBACKS AND BUILDING LOCATIONS SHOWN ON THIS PLAN ARE FOR REFERENCE ONLY AND MUST BE REVIEWED AND APPROVED UNDER A SEPARATE BUILDING PERMIT.
22. UTILITY AND SEPTIC IMPROVEMENTS SHOWN ON THIS PLAN ARE FOR REFERENCE ONLY AND MUST BE REVIEWED AND APPROVED UNDER A SEPARATE BUILDING PERMIT.
23. ON PROJECTS DISTURBING ONE ACRES OR MORE, THE FOLLOWING NOTE MUST BE ADDED: A NOTICE OF INTENT (NOI) HAS BEEN, OR WILL BE FILED WITH THE STATE WATER RESOURCES CONTROL BOARD (SWRCB) AND A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) HAS BEEN OR WILL BE PREPARED IN ACCORDANCE WITH THE REQUIREMENTS OF CALIFORNIA GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY (PERMIT NO. CAS000002) FOR ALL OPERATIONS ASSOCIATED WITH THESE PLANS. THE PERMITTEE SHALL KEEP A COPY OF THE SWPPP ON SITE AND AVAILABLE FOR REVIEW BY COUNTY.
24. IN CONJUNCTION WITH THE CALIFORNIA GENERAL PERMIT FOR PROPOSED DISTURBANCE OVER ONE ACRE, AN ACTIVE WASTEWATER DISCHARGE ID # (WDID) MUST BE INCLUDED ON THE FINAL GRADING PLAN.
25. FOR ENGINEERED GRADING, A FINAL GRADING CERTIFICATION WILL BE COLLECTED BY THE BUILDING INSPECTOR AT THE FINAL BUILDING INSPECTION OR PRIOR A GRADING FINAL STATUS ON THE PERMIT. THE FINAL GRADING CERTIFICATION IS TO BE COMPLETED BY THE ENGINEER OF RECORD ON THE APPROVED GRADING PLANS.
26. ALL FLOOD ZONE REQUIREMENTS MUST BE REFLECTED OR ACCOUNTED FOR ON THE GRADING PLANS. ELEVATIONS OR CONSTRUCTION NOTES MUST BE INCLUDED IN THE PLANS TO ENSURE COMPLIANCE WITH ALL APPLICABLE FIRST FLOOR ELEVATION REQUIREMENTS PER FEMA AND SAN BERNARDINO COUNTY DEVELOPMENT CODE GUIDELINES.

EROSION NOTES

1. IN CASE OF EMERGENCY, CALL RYAN JOHNSON AT 909-387-5000.
2. POLLUTION AND EROSION PREVENTION MEASURES, ALSO KNOWN AS BEST MANAGEMENT PRACTICES (BMPS), MUST BE INSTALLED PRIOR TO GRADING. THESE MEASURES, INCLUDING THE PREVENTION OF SEDIMENTATION OR FLOOD DAMAGE, TO OFFSITE PROPERTY SHALL BE ADEQUATE WHETHER OR NOT AN EROSION CONTROL PERMIT IS REQUIRED.
3. ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ONSITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES, OR WIND.
4. EROSION CONTROL DEVICES SHALL BE FUNCTIONING AT ALL TIMES. IN CASE OF FAILURE, RAPID CONSTRUCTION OF EMERGENCY DEVICES SHALL BE IMPLEMENTED.
5. STOCKPILES OF EARTH AND OTHER CONSTRUCTION-RELATED MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND OR WATER.
6. FUELS, OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING AND ARE NOT TO CONTAMINATE THE SOILS AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MUST BE CLEANED UP IMMEDIATELY AND DISPOSED OF IN A PROPER MANNER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM.
7. EXCESS OR WASTE CONCRETE MUST BE CONTAINED ONSITE. PROVISIONS SHALL BE MADE TO RETAIN CONCRETE WASTES ONSITE UNTIL THEY CAN BE DISPOSED OF AS SOLID WASTE.
8. DEVELOPERS/CONTRACTORS ARE RESPONSIBLE TO ENSURE ALL EROSION CONTROL DEVICES AND BMPS ARE INSTALLED AND FUNCTIONING PROPERLY PER PLAN. PROPER PRECAUTION SHALL BE CONSIDERED WHEN 50% OR GREATER PROBABILITY OF PREDICTED PRECIPITATION, AND AFTER ACTUAL PRECIPITATION. A CONSTRUCTION SITE INSPECTION CHECKLIST AND INSPECTION LOG SHALL BE MAINTAINED AT THE PROJECT SITE AT ALL TIMES AND AVAILABLE FOR REVIEW BY THE BUILDING OFFICIAL.
9. TRASH AND CONSTRUCTION-RELATED SOLID WASTES MUST BE DEPOSITED INTO A COVERED RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND.
10. SEDIMENTS AND OTHER MATERIALS MAY NOT BE TRACKED FROM THE SITE BY VEHICLE TRAFFIC. THE CONSTRUCTION ENTRANCE ROADWAYS MUST BE STABILIZED SO AS TO INHIBIT SEDIMENTS FROM BEING DEPOSITED INTO THE PUBLIC WAY. ACCIDENTAL DEPOSITIONS MUST BE SWEPT UP IMMEDIATELY AND MAY NOT BE WASHED DOWN BY RAIN OR OTHER MEANS.
11. ANY SLOPES WITH DISTURBED SOILS OR DENUDED OF VEGETATION MUST BE STABILIZED SO AS TO INHIBIT EROSION BY WIND AND WATER.
12. ALL SILT AND DEBRIS SHALL BE REMOVED FROM ALL DEVICES WITHIN 24 HOURS AFTER EACH RAINSTORM AND BE DISPOSED OF PROPERLY.
13. ALL STORM WATER CAPTURE DEVICES SHALL BE PROTECTED AT ALL TIMES.

Underground Service Alert
Call: TOLL FREE
1-800-422-4133
TWO WORKING DAYS BEFORE YOU DIG

SURVEYOR
JD COLE & ASSOCIATES, INC.
LAND SURVEYING
11056RAMONA ST.
YUCAIPA, CA 92399
PHONE: (909) 797-2074

OWNER/DEVELOPER
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
825 E. 3rd SREET
SAN BERNARDINO, CA 92415
CONTACT ERWIN FOGERSON
PHONE: (909) 387-7963

SITE DATA
GROSS ACREAGE
=250,257 S.F (5.7 ACRES)
AREA OF DISTURBANCE
=45,570 S.F (1.05 ACRES)

COUNTY PROJECT NUMBERS
SRAD-2021-00080
RELATED DOCUMENTS:
WQMP-2021-00039
REVWR-2021-00037
BREV-2023-00532

ARCHITECT
STK ARCHITECTS, INC.
42095 ZEVO DR., A-15
TEMECULA, CA 92590
CONTACT: J. SAENG NAMVONG
PHONE: (951) 296-9110

ENGINEER OF RECORD
ENGINEERING RESOURCES OF
SOUTHERN CALIFORNIA, INC.
1861 W. REDLANDS BLVD.
REDLANDS, CA 92373
CONTACT MATT BRUDIN
PHONE: (909) 890-1255

SOILS ENGINEER
GEOCON WEST INC.
2015 W. PARK AVE., SUITE 1
REDLANDS, CA 92373
CONTACT: JOHN STAPLETON
PHONE: (909) 884-2175
REFERENCE REPORT:
No. A9816-99-01
PREPARED MARCH 8, 2019

GAS
SEMPRA ENERGY
I3525 12TH STREET
CHINO, CA 91719
PHONE: (909) 613-1531

WATER/ SEWER
CUCAMONGA VALLEY WATER DISTRICT
10440 ASHFORD ST.
RANCHO CUCAMONGA, CA 91730
CONTACT ED HILLS
PHONE: (909) 987-2591

FIBER OPTICS
SPRINT TRANSMISSION DEPTARTMENT
202 SYCAMORE AVENUE
RIALTO, CA 92376
CONTACT MATT BRUDIN
PHONE: (909) 873-8022

TELEPHONE
AT&T
870 MOUNTAIN AVENUE
UPLAND, CA 91786
PHONE: (909) 608-1204

ELECTRIC
SO. CALIFORNIA EDISON
2244 WALNUT GROVE AVENUE
ROSEMEAD, CA 91770
PHONE: (800) 655-4555

CABLE
CHARTER CABLEVISION.
6680 VIEW PARK COURT
RIVERSIDE, CA 92503
CONTACT: JOHN SIMPSON
PHONE: (909) 343-5165

BASIS OF BEARINGS
WEST LINE - SECTION 32
N 00°12'40" E

BENCH MARK
BENCHMARK NUMBER: 10054
ELEV: 1328.075'

LEGAL DESCRIPTION
APN: 1089-031-13
LOT 20 OF ORANGE EMPIRE ACRES, ACCORDING TO MAP FILED IN BOOK 20, PAGE 1 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAN BERNARDINO COUNTY, IN THE CITY OF RANCHO CUCAMONGA, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, EXCEPT THE SOUTH 235.16 FEET
APN: 1089-031-39
ORANGE EMPIRE ACRES PTN LOT 19 LYING ELY OF A LI WHICH COM ON N LI OF SD LOT 19 270 FT ELY MEAS AT R/A FROM W LI OF LOT 18 TH SLY IN A DIRECT LI TO PT ON S LI OF SD LOT 19 WHICH IS 300 FT ELY MEAS AT R/A FROM SD W LI LOT 18 EX THEREFROM THE SLY 20 FT THEREOF

ESTIMATED GRADING CONSTRUCTION DATES
START: APRIL, 2025
FINISH: JUNE, 2025

RAW CUT / FILL QUANTITIES
CUT: 545 C.Y.
FILL: 1193 C.Y.
TOTAL IMPORT: 648 C.Y.

NOTE
SEE ARCHITECTURAL AND LANDSCAPE ARCHITECTS PLANS FOR FENCE AND GATE DETAILS.

CERTIFICATES
1. I HEREBY CERTIFY THAT I HAVE REVIEWED THIS PLAN AND THAT IT SUBSTANTIALLY CONFORMS TO THE SOILS REPORT NO. A9816-99-01, DATED: MARCH 8,2019, PREPARED BY: GEOCON WEST, INC.

JOHN STAPLETON
PRINTED NAME
REGISTRATION NUMBER
SIGNATURE

2. IN REFERENCE TO NPDES REQUIREMENTS THE UNDERSIGNED CERTIFIES ONE OF THE FOLLOWING:
   - ☐ A NOTICE OF INTENT (NOI) IS NOT REQUIRED OF THIS DEVELOPMENT.
   - ☐ A NOTICE OF INTENT (NOI) HAS BEEN FILED AND THE WDID NUMBER IS:

JOHN M. BRUDIN
PRINTED NAME
CIVIL ENGINEER
SIGNATURE

DECLARATION OF ENGINEER OF RECORD
I HEREBY DECLARE THAT THE DESIGN OF THE IMPROVEMENTS SHOWN ON THESE PLANS COMPLIES WITH ALL PROFESSIONAL ENGINEERING STANDARDS AND PRACTICES. AS THE ENGINEER OF RECORD FOR THE PLANS, I ASSUME FULL RESPONSIBILITY FOR THE DESIGN OF THE IMPROVEMENTS. WITH RESPECTS TO THE PLAN CHECK PERFORMED BY THE COUNTY OF SAN BERNARDINO, I UNDERSTAND AND ACKNOWLEDGE THE FOLLOWING: (1) THE PLAN CHECK IS A REVIEW FOR THE LIMITED PURPOSE OF ENSURING THE PLANS COMPLY WITH THE COUNTY'S STANDARDS, PROCEDURES, POLICIES, AND ORDINANCES, (2) THE PLAN CHECK IS NOT A DETERMINATION OF THE TECHNICAL ADEQUACY OF THE DESIGN OF THE IMPROVEMENTS, AND (3) THE PLAN CHECK DOES NOT RELIEVE ME OF MY LEGAL AND PROFESSIONAL RESPONSIBILITY FOR THE DESIGN OF THE IMPROVEMENTS. AS THE ENGINEER OF RECORD, I AGREE TO DEFEND, INDEMNIFY, AND HOLD HARMLESS THE COUNTY, ITS ELECTED OFFICIALS, EMPLOYEES, AND AGENTS FROM ANY AND ALL ACTUAL OR ALLEGED CLAIMS, DEMANDS, CAUSES OF ACTION, LIABILITY, LOSS, DAMAGE, OR INJURY TO PROPERTY OR PERSON, INCLUDING WRONGFUL DEATH, WHETHER IMPOSED BY A COURT OF LAW OR BY ADMINISTRATIVE ACTION OF ANY FEDERAL, STATE, OR LOCAL GOVERNMENTAL AGENCY, ARISING OUT OF OR INCIDENT TO ANY NEGLIGENT ACTS, OMISSIONS, OR ERRORS BY THE ENGINEER OF RECORD, ITS EMPLOYEES, CONSULTANTS, OR AGENTS.

JOHN M. BRUDIN, RCE 41836
DATE

PRIVATE ENGINEER'S NOTE TO CONTRACTOR
THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES, CONDUITS, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN ON THESE DRAWINGS. THE CONTRACTOR FURTHER ASSUMES ALL LIABILITY AND RESPONSIBILITY FOR THE UTILITY PIPES, CONDUITS OR STRUCTURES SHOWN ON THESE DRAWINGS.

CONTRACTOR AGREES THAT HE/SHE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE COUNTY OF SAN BERNARDINO, THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

INDEX OF SHEETS

FEMA FLOOD ZONE
FIRM PANELS: 06071C8635J
MAP EFFECTIVE: 9/26/2014
FLOOD HAZARD ZONES: X / AREA OF 0.2% ANNUAL CHANCE FLOODPLAIN

CONSTRUCTION NOTES

1	CONSTRUCT PCC 6" CURB ONLY PER APWA STD. NO. C-1 OR EQUIV.
2	CONSTRUCT 6" AC BERM PER APWA STD. DC OR EQUIV. WITH CURB CUTS PER DETAIL SHEET 2.
3	CONSTRUCT 3' WIDE CROSS GUTTER PER DETAIL SHEET 2.
4	CONSTRUCT 4" THK. MIN. AC OVER 7" AB PER SOILS REPORT
5	CONSTRUCT 5" THK. CONC. 4" AB W/ #3'S @ 18" O.C.
6	CONSTRUCT SIDEWALK PER SBC STD. 109.
7	INSTALL 6' H. BLOCK WALL PER SAN BERNARDINO COUNTY TRANS. DEPT. STD. 301 ALONG REAR PROPERTY LINE PER DETAIL ON SHEET 2, PER SEPARATE SUBMITTAL AND PERMIT BY CONTRACTOR.
8	REMOVE EXISTING PAVEMENT, CURB, GUTTER OR FENCING
9	INSTALL 12" X 20' L. ZURN # Z882 TRENCH DRAIN WITH TRAFFIC RATED GRATE OR EQUAL
10	SAWCUT & GRIND AND OVERLAY 2" PER DETAIL ON SHEET 2.
11	4" DIA. PVC - SDR 35 PIPE - SEWER DESIGN PER SEPARATE PLAN
12	1" DIA PVC - WATER DESIGN PER UTILITY PLAN
13	2" DIA PVC - WATER DESIGN PER UTILITY PLAN
14	6" DIA. FIRE HYDRANT PROTECTED WITH BOLLARDS PER PRIVATE FIRE UNDERGROUND PLAN.
15	8" DIA. PVC OR APPROVED EQUAL FIRE SERVICE LINE PER PRIVATE FIRE UNDERGROUND PLAN.
16	INSTALL BOLLARD PER DETAIL - SHEET 2
17	¼ TON RIP-RAP 2' THK.
18	8" HOT TAP TO EXISTING 12" WATER MAIN PER CVWD STD. DWG. NO 123, PER REVISED OFF-SITE CVWD PLAN NO. AB11693.
19	8" CML&C STEEL WATERLINE PER CVWD STD. DWG. NO. 123, PER REVISED OFF-SITE CVWD PLAN.
20	REMOVE EXISTING 4" DCDA AND REPLACE WITH 8" DCDA PER REVISED OFF-SITE CVWD PLAN AND PRIVATE FIRE UNDERGROUND PLAN.
21	INSTALL ELBOW.
22	1" DIA HOSE BIBB
23	INSTALL 2x1-INCH TEE
24	INSTALL 2-INCH TEE
25	INSTALL 2x1-INCH PVC REDUCER
26	CONSTRUCT 6" THK. CONCRETE PAD FOR PROPOSED TRANSFORMER
27	CONSTRUCT 24"x24" JENSEN CATCH BASIN MODEL 2424 CB W/ FLOGARD+PLUS FILTER INSERT.
28	INSTALL 10-INCH HDPE.
29	INSTALL 10-INCH CLEAN OUT PER DETAIL - SHEET 2.
1	INSTALL ACCESSIBLE PARKING SIGN PER DETAIL - SHEET 2.
2	PARKING STALLS - SEE DETAIL - SHEET 2.
3	TRUNCATED DOMES - SEE DETAIL - SHEET 2.
4	ACCESSIBLE PARKING EMBLEM - SEE DETAIL - SHEET 2.
5	CONCRETE WHEEL STOP - SEE DETAIL - SHEET 2.

NOTES TO CONTRACTOR
1. USE OF HEAVY EQUIPMENT SHOULD BE LIMITED OR PROHIBITED TO PREVENT COMPACTION OF THE UNDERLYING SOILS INTENDED FOR INFILTRATION.
2. CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ADEQUATE PROVISIONS FOR MONUMENT PRESERVATION HAVE BEEN ADDRESSED CONTRACTUALLY AND IN THE FIELD.

STK
42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780
Phone: 951.296.9110 Fax: 951.296.6079 Email: stk@stkinc.com

CONSULTANT:

ERSG INC.COM
Engineering Resources of Southern California
1861 W. Redlands Blvd, Bldg 7B
Redlands, Ca. 92373
P: (909) 890-1255
F: (909) 890-0995

PROJECT ADMINISTERED BY:
SAN BERNARDINO COUNTY
PROJECT AND FACILITIES MANAGEMENT DEPARTMENT - PROJECT MANAGEMENT DIVISION

385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

PROJECT NAME:
SAN BERNARDINO COUNTY
RANCHO CUCAMONGA
NEW YARD
CONSTRUCTION

PROJECT # 10.10.1333
CIP # 23-042
CAFM # ETI005
APN: 1089031390000, 10890311300000

12158 BASE LINE ROAD
RANCHO CUCAMONGA,
CA 91739

ISSUE INFORMATION:	
DATE:	INFORMATION:
04-29-21	1st Plan Check
05-25-23	2nd Plan Check

SHEET INFORMATION:
STK PROJECT NO.: 374-134-20
SCALE: AS NOTED
DATE: NOVEMBER 2022
PLOT DATE: -
DRAWING NAME:

SEAL:
REGISTERED PROFESSIONAL ENGINEER — JOHN MICHAEL BRUDIN — No. 41836 — Exp. 6/31/26 — CIVIL — STATE OF CALIFORNIA

SHEET TITLE:
PRECISE GRADING PLAN
COUNTY YARD
INDEX SHEET

SHEET NO.:
SHEET 1 OF 6

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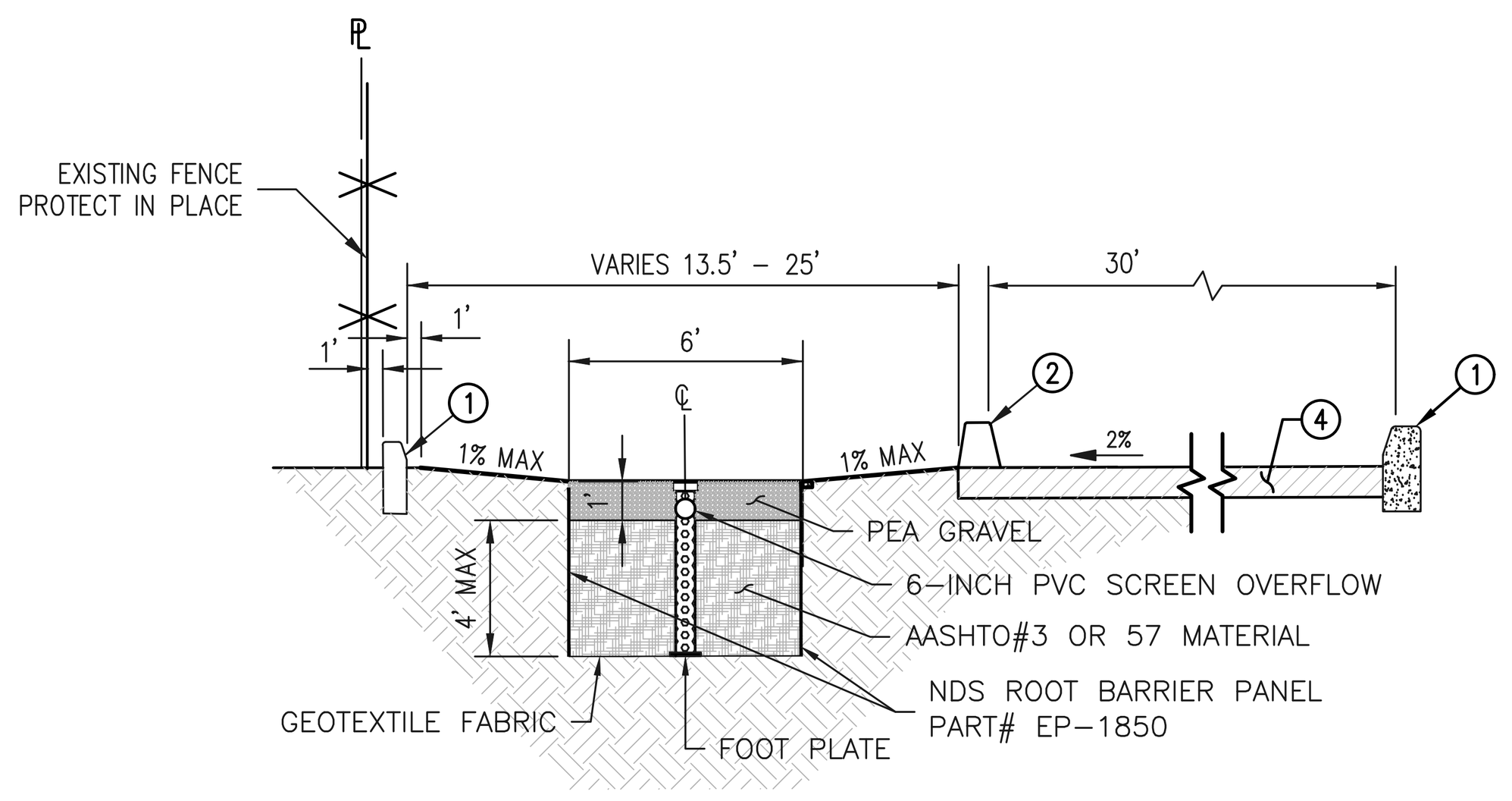
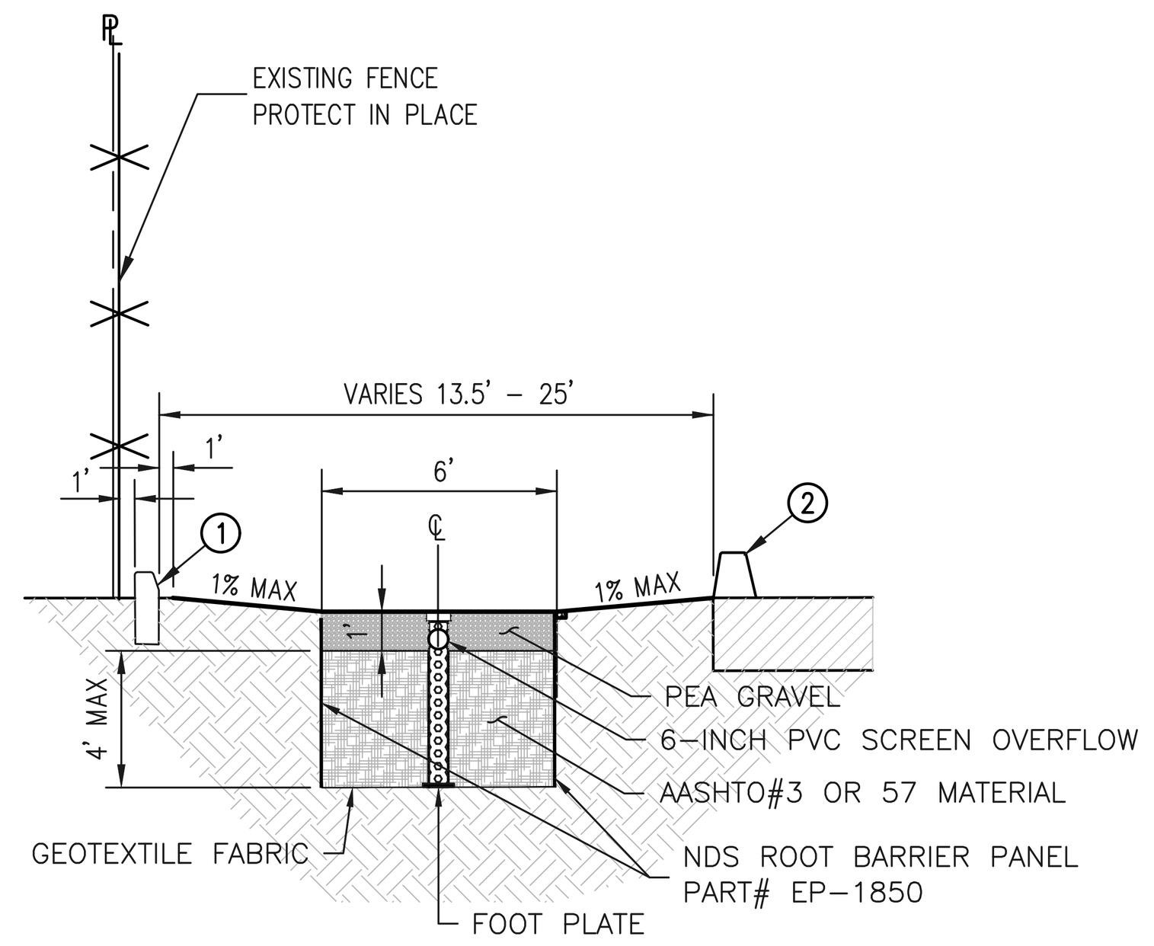


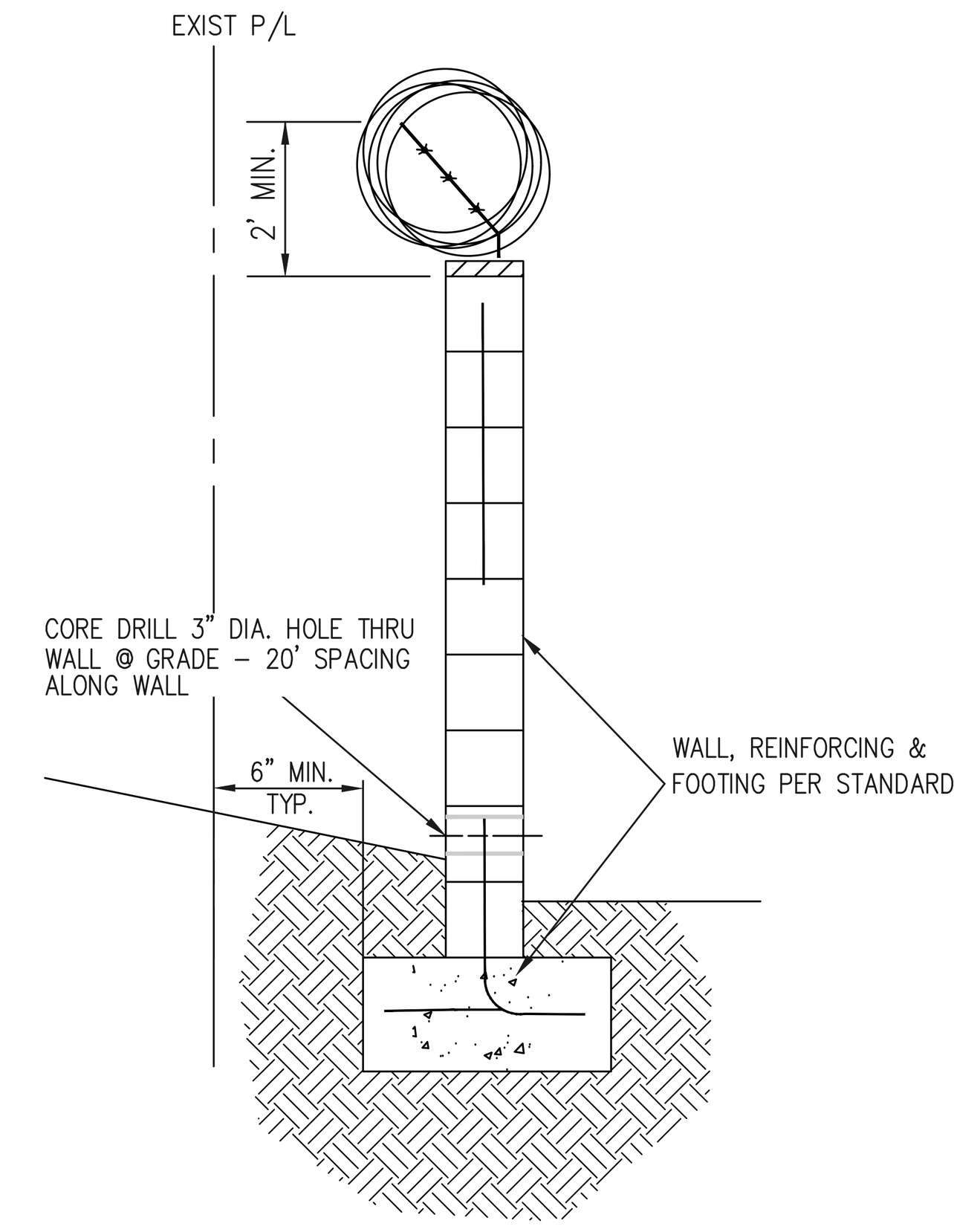
SECTION A-A

NOT TO SCALE



SECTION B-B

NOT TO SCALE



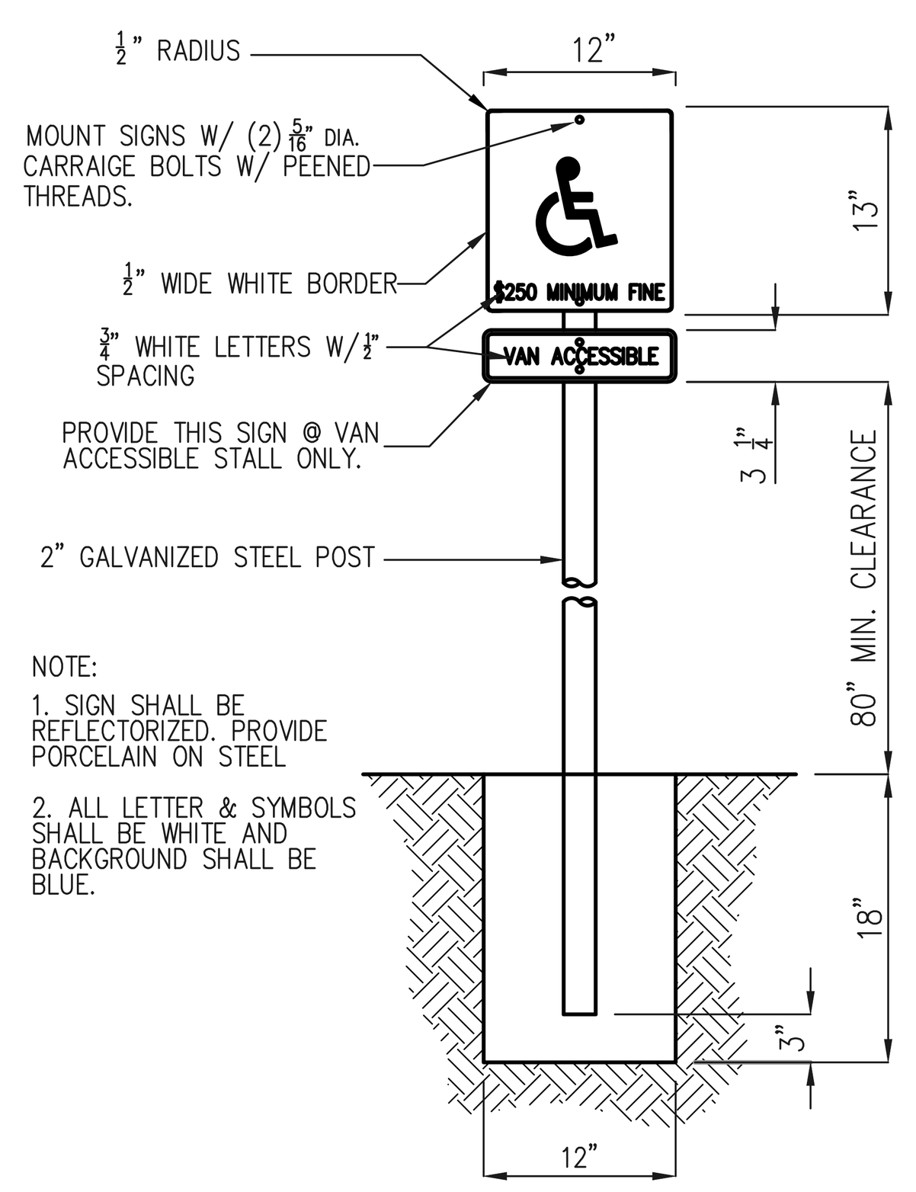
SECTION C-C
BLOCK WALL/FOOTING DETAIL

7

MODIFIED S.B. COUNTY TRANS DEPT. STD. 301
NOT TO SCALE

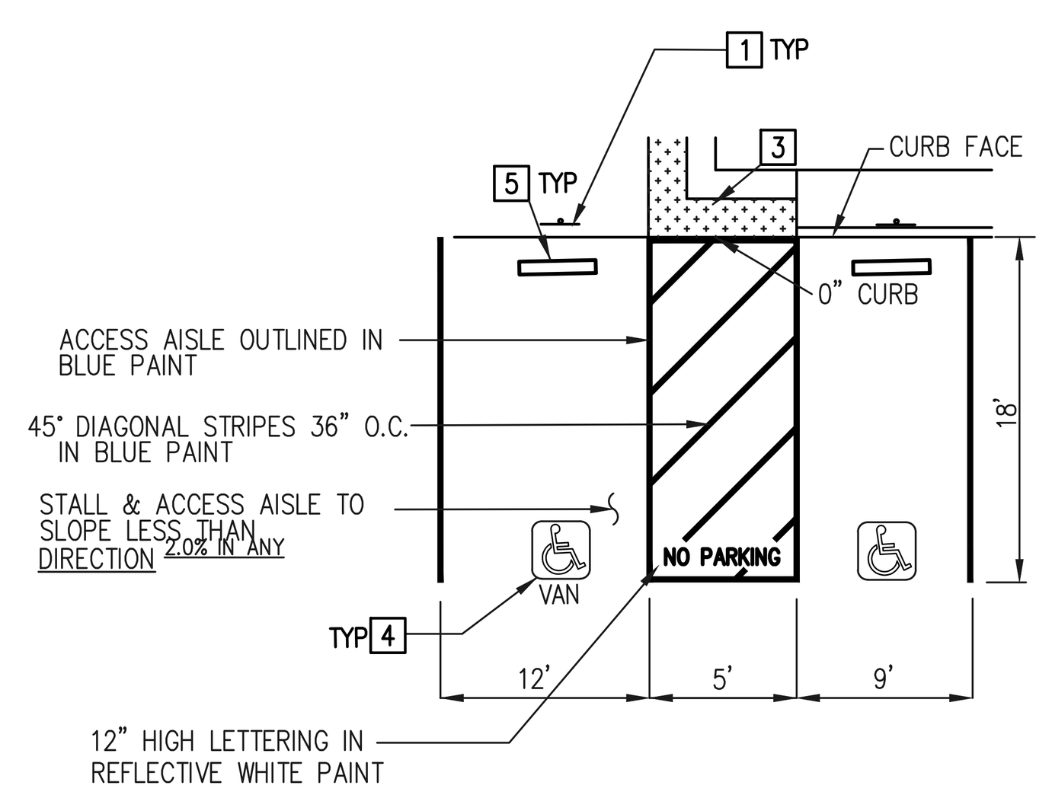
CONSTRUCTION NOTES

1	CONSTRUCT PCC 6" CURB ONLY PER APWA STD. NO. C-1 OR EQUIV.
2	CONSTRUCT 6" AC BERM PER APWA STD. DC OR EQUIV. WITH CURB CUTS PER DETAIL SHEET 2.
3	CONSTRUCT 3' WIDE CROSS GUTTER PER DETAIL SHEET 2.
4	CONSTRUCT 4" THK. MIN. AC OVER 7" AB PER SOILS REPORT
5	CONSTRUCT 5" THK. CONC. 4" AB W/ #3'S @ 18" O.C.
6	CONSTRUCT SIDEWALK PER SBC STD. 109.
7	INSTALL 6' H. BLOCK WALL PER SAN BERNARDINO COUNTY TRANS. DEPT. STD. 301 ALONG REAR PROPERTY LINE PER DETAIL ON SHEET 2, PER SEPARATE SUBMITTAL AND PERMIT BY CONTRACTOR.
8	REMOVE EXISTING PAVEMENT, CURB, GUTTER OR FENCING
9	INSTALL 12" X 20' L. ZURN # Z882 TRENCH DRAIN WITH TRAFFIC RATED GRATE OR EQUAL
10	SAWCUT & GRIND AND OVERLAY 2" PER DETAIL ON SHEET 2.
11	4" DIA. PVC – SDR 35 PIPE – SEWER DESIGN PER SEPARATE PLAN
12	1" DIA PVC – WATER DESIGN PER UTILITY PLAN
13	2" DIA PVC – WATER DESIGN PER UTILITY PLAN
14	6" DIA. FIRE HYDRANT PROTECTED WITH BOLLARDS PER PRIVATE FIRE UNDERGROUND PLAN.
15	8" DIA. PVC OR APPROVED EQUAL FIRE SERVICE LINE PER PRIVATE FIRE UNDERGROUND PLAN.
16	INSTALL BOLLARD PER DETAIL – SHEET 2
17	¼ TON RIP-RAP 2' THK.
18	8" HOT TAP TO EXISTING 12" WATER MAIN PER CVWD STD. DWG. NO 123, PER REVISED OFF-SITE CVWD PLAN NO. AB11693.
19	8" CML&C STEEL WATERLINE PER CVWD STD. DWG. NO. 123, PER REVISED OFF-SITE CVWD PLAN.
20	REMOVE EXISTING 4" DCDA AND REPLACE WITH 8" DCDA PER REVISED OFF-SITE CVWD PLAN AND PRIVATE FIRE UNDERGROUND PLAN.
21	INSTALL ELBOW.
22	1" DIA HOSE BIBB
23	INSTALL 2x1-INCH TEE
24	INSTALL 2-INCH TEE
25	INSTALL 2x1-INCH PVC REDUCER
26	CONSTRUCT 6" THK. CONCRETE PAD FOR PROPOSED TRANSFORMER
27	CONSTRUCT 24"x24" JENSEN CATCH BASIN MODEL 2424 CB W/ FLOGARD+PLUS FILTER INSERT.
28	INSTALL 10-INCH HDPE.
29	INSTALL 10-INCH CLEAN OUT PER DETAIL – SHEET 2.
30	CONSTRUCT 12"x12" JENSEN CATCH BASIN MODEL 2424 CB W/ FLOGARD+PLUS FILTER INSERT AND OPEN BOTTOM.
[1]	INSTALL ACCESSIBLE PARKING SIGN PER DETAIL – SHEET 2.
[2]	PARKING STALLS – SEE DETAIL – SHEET 2.
[3]	TRUNCATED DOMES – SEE DETAIL – SHEET 2.
[4]	ACCESSIBLE PARKING EMBLEM – SEE DETAIL – SHEET 2.
[5]	CONCRETE WHEEL STOP – SEE DETAIL – SHEET 2.



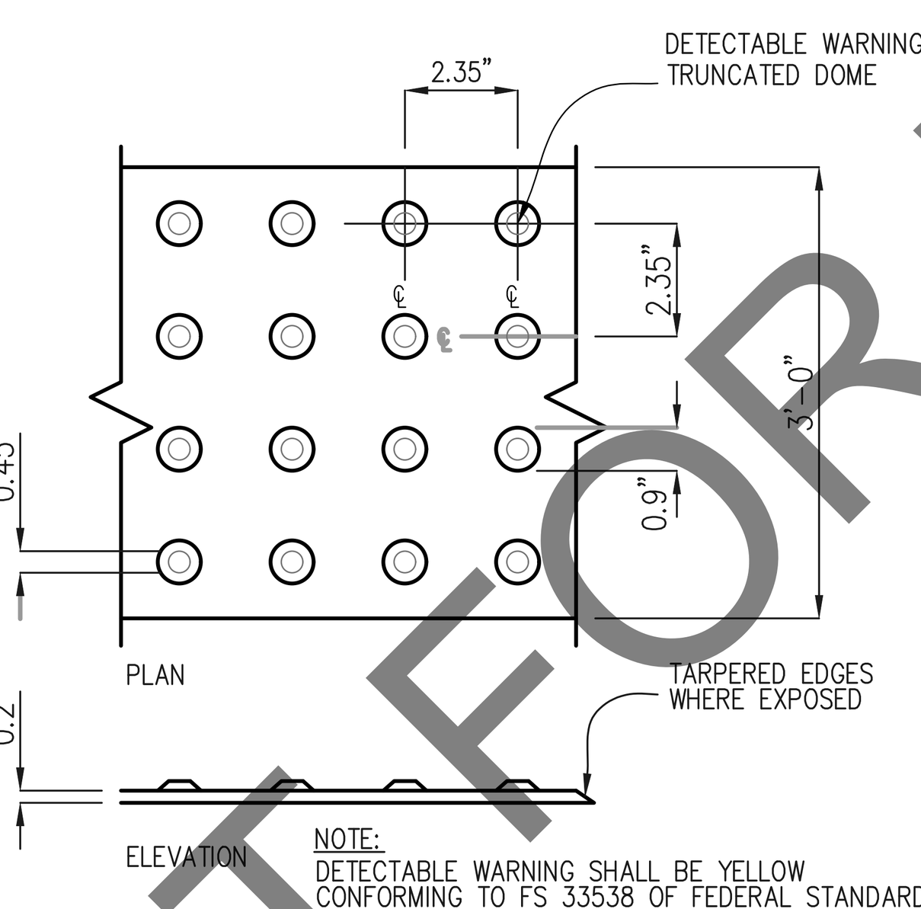
ACCESSIBLE PARKING SIGN

[1] NOT TO SCALE



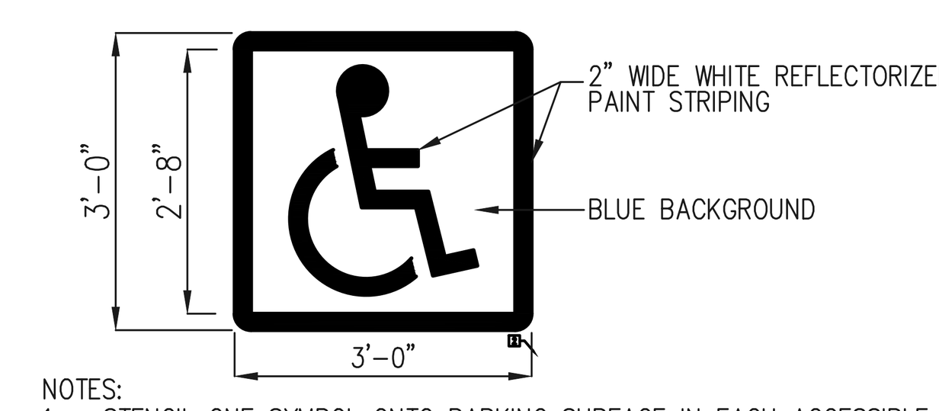
ACCESSIBLE PARKING STALL DETAIL

[2] NOT TO SCALE



TRUNCATED DOMES DETAIL

[3] NOT TO SCALE

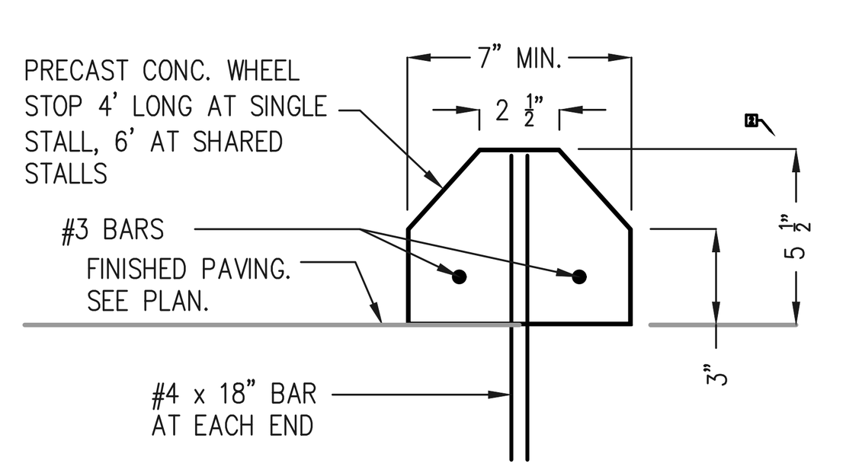


ACCESSIBLE PARKING EMBLEM

[4] NOT TO SCALE

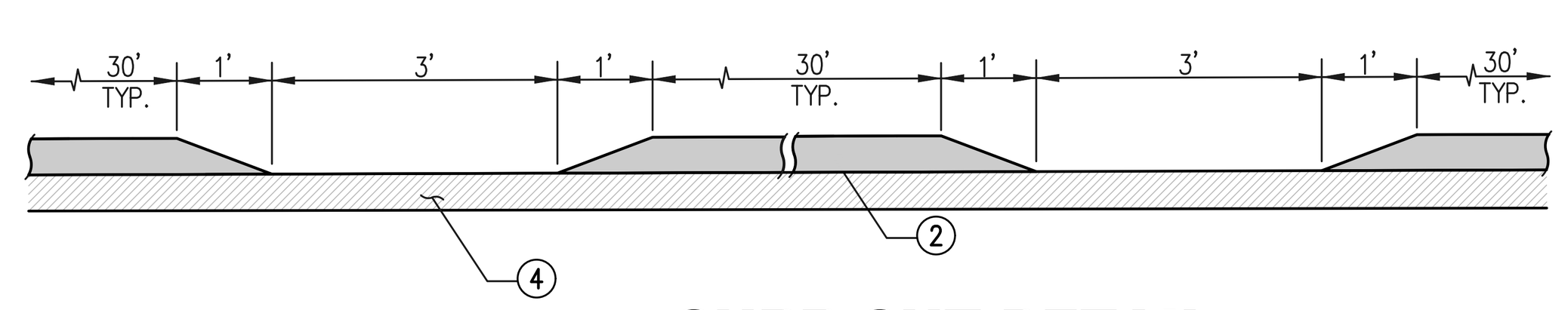
LEGEND

— — —	PROPERTY LINE	FL	FLOW LINE
	PROPOSED CURB	FS	FINISH SURFACE
	PROPOSED CROSS GUTTER	HP	HIGH POINT
		LP	LOW POINT
	SIDEWALK	TC	TOP OF CURB
	ASPHALT CONCRETE PAVING	TS	TOP OF SLOPE
		X.XX	ELEVATION
	CONCRETE PAVING	(X.XX)	(EXISTING ELEVATION)
←	DRAINAGE SLOPE & DIRECTION		
	ADA PATH OF TRAVEL		



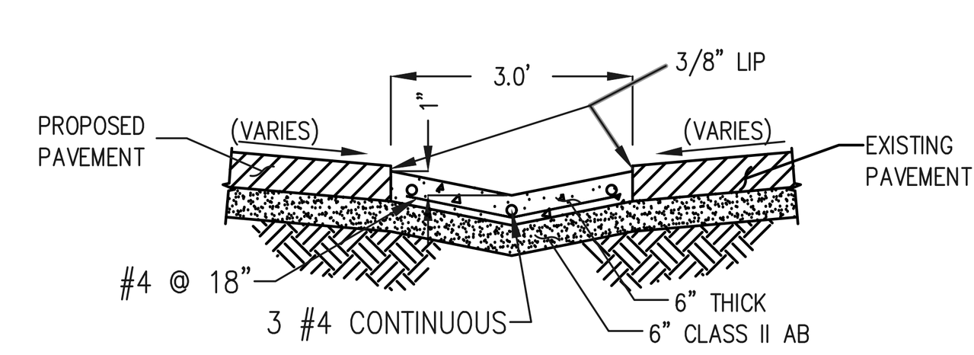
CONCRETE WHEEL STOP

[5] NOT TO SCALE



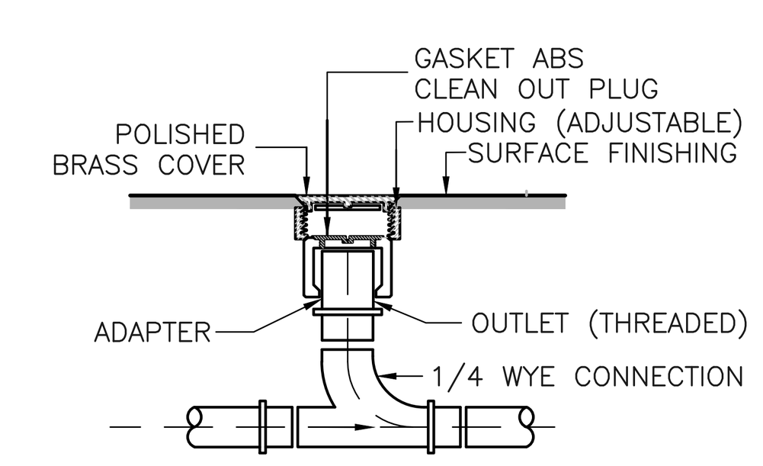
CURB CUT DETAIL

2 NOT TO SCALE



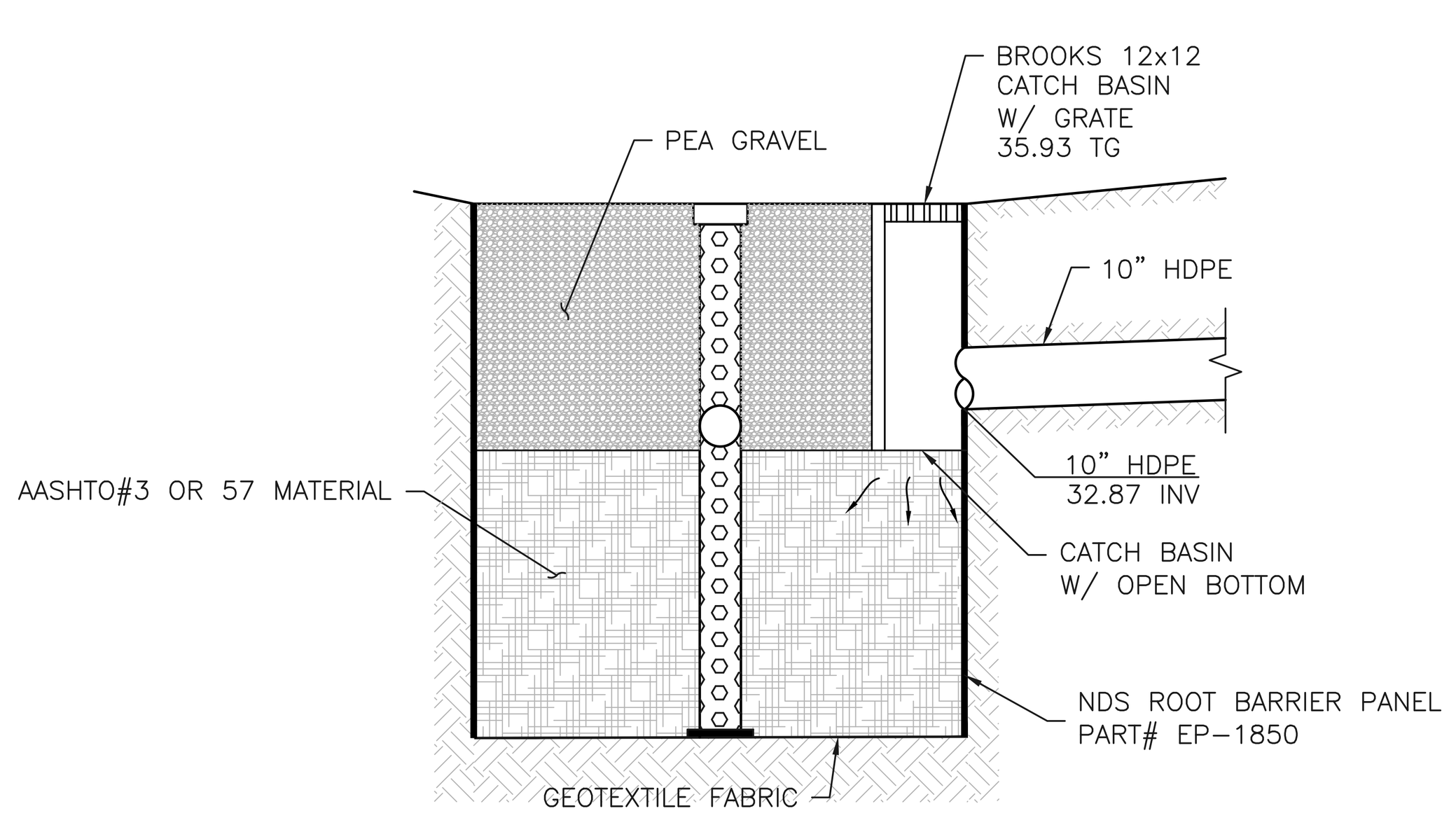
CROSS GUTTER DETAIL

3 NOT TO SCALE



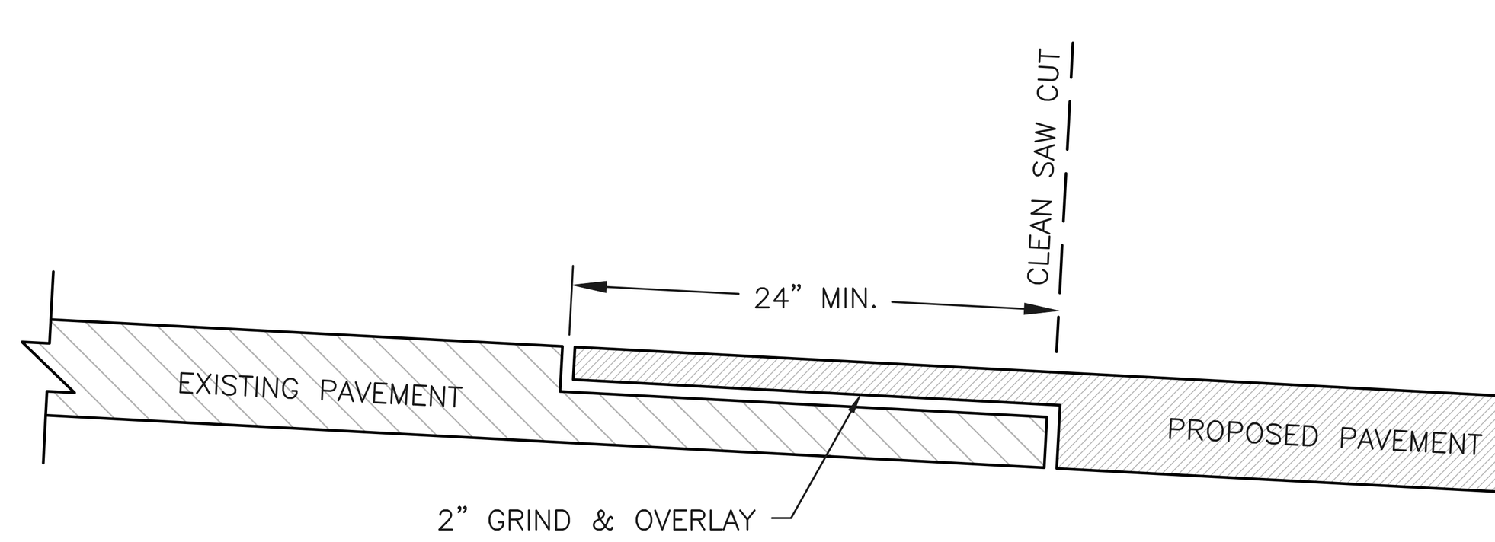
10-INCH CLEANOUT

29 NOT TO SCALE



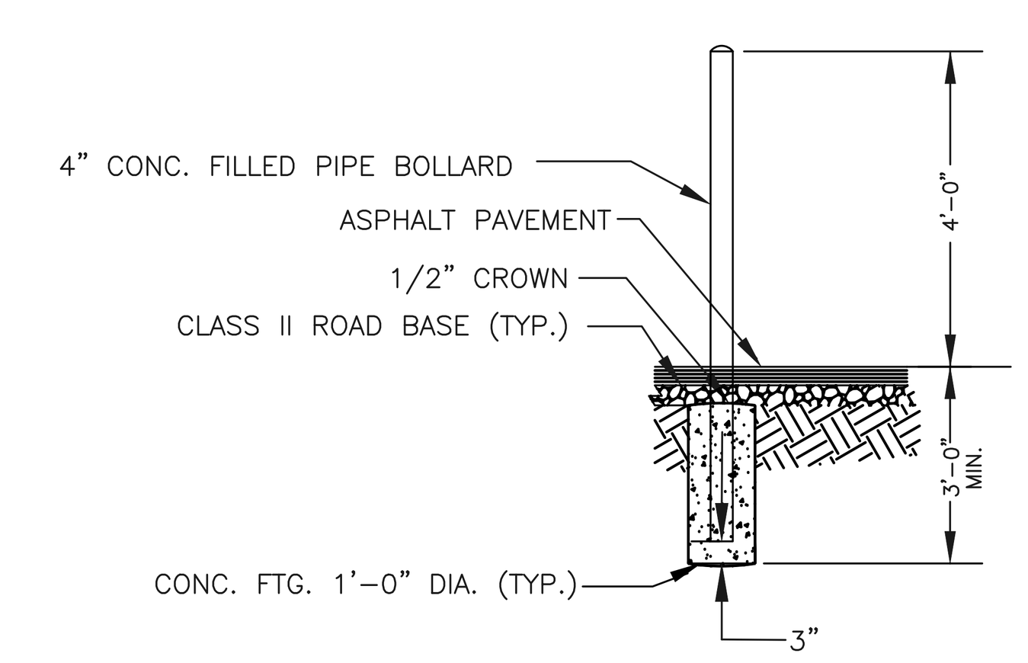
SD PIPE CONNECTION DETAIL

NOT TO SCALE



SAWCUT DETAIL

10 NOT TO SCALE



BOLLARD DETAIL

16 NOT TO SCALE

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1-800-422-4133
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STK ARCHITECTURE, INC.
42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780
Phone: 951.296.9110 Fax: 951.296.6079 Email: stk@stkinc.com

CONSULTANT:

ERSC INC.COM
Engineering Resources of Southern California
1861 W. Redlands Blvd, Bldg 7B
Redlands, Ca. 92373
P: (909) 890-1255
F: (909) 890-0995

PROJECT ADMINISTERED BY:
SAN BERNARDINO COUNTY PROJECT AND FACILITIES MANAGEMENT DEPARTMENT - PROJECT MANAGEMENT DIVISION

385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

PROJECT NAME:
SAN BERNARDINO COUNTY
RANCHO CUCAMONGA NEW YARD CONSTRUCTION

PROJECT # 10.10.1333
CIP # 23-042
CAFM # ETI005
APN: 1089031390000, 10890311300000

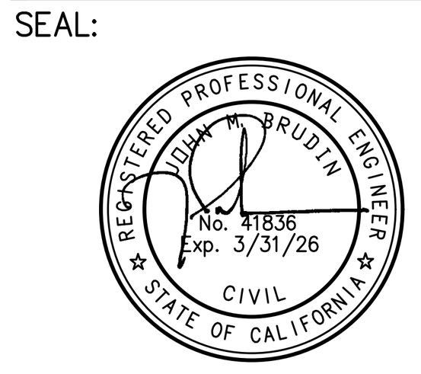
12158 BASE LINE ROAD
RANCHO CUCAMONGA, CA 91739

ISSUE INFORMATION:

DATE:	INFORMATION:
04-29-21	1 1st Plan Check
05-25-23	2 2nd Plan Check

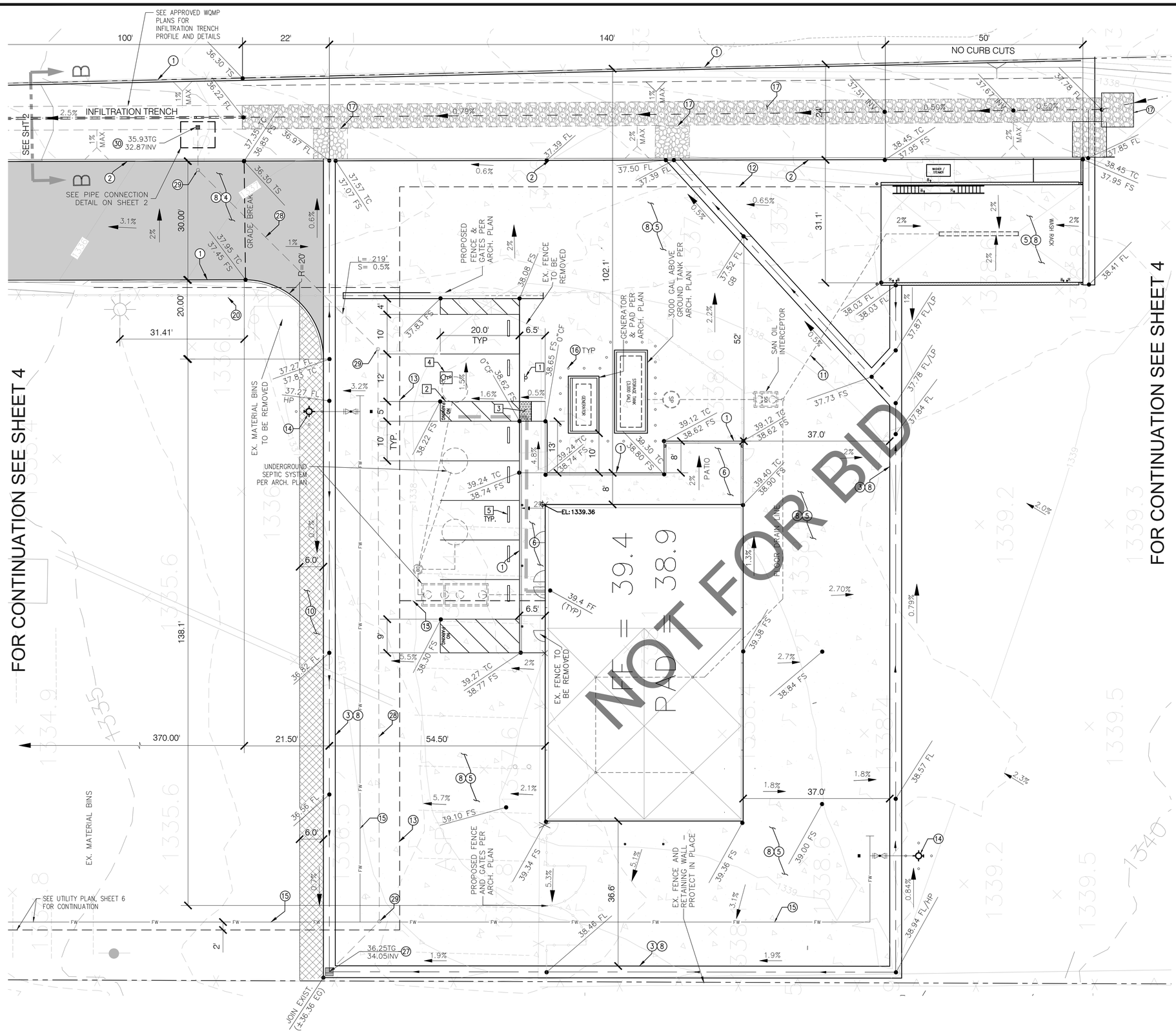
SHEET INFORMATION:
STK PROJECT NO.: 374-134-20
SCALE: AS NOTED
DATE: NOVEMBER 2022
PLOT DATE: -
DRAWING NAME:

SEAL:



SHEET TITLE:
PRECISE GRADING PLAN
COUNTY YARD SECTIONS AND DETAILS

SHEET NO.:



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NOTES TO CONTRACTOR

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2. CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ADEQUATE PROVISIONS FOR MONUMENT PRESERVATION HAVE BEEN ADDRESSED CONTRACTUALLY AND IN THE FIELD.

GRAPHIC SCALE: 1"=10'

STK
42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780
Phone: 951.296.9110 Fax: 951.296.6079 Email: stk@stkinc.com

CONSULTANT:

ERSG INC.COM
Engineering Resources of Southern California
1861 W. Redlands Blvd, Bldg 7B
Redlands, Ca. 92373
P: (909) 890–1255
F: (909) 890–0995

PROJECT ADMINISTERED BY:
SAN BERNARDINO COUNTY PROJECT AND FACILITIES MANAGEMENT DEPARTMENT - PROJECT MANAGEMENT DIVISION

385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

PROJECT NAME:
SAN BERNARDINO COUNTY
RANCHO CUCAMONGA
NEW YARD
CONSTRUCTION

PROJECT # 10.10.1333

CIP # 23–042

CAFM # ETI005

APN: 1089031390000, 10890311300000

12158 BASE LINE ROAD
RANCHO CUCAMONGA,
CA 91739

ISSUE INFORMATION:

DATE:	INFORMATION:
04–29–21	1st Plan Check
05–25–23	2nd Plan Check

SHEET INFORMATION:

STK PROJECT NO.: 374–134–20
SCALE: AS NOTED
DATE: NOVEMBER 2022
PLOT DATE: –
DRAWING NAME:

SEAL:

REGISTERED PROFESSIONAL ENGINEER
JOHN M. BOZAIN
No. 41836
Exp. 3/31/26
CIVIL
STATE OF CALIFORNIA

SHEET TITLE:
PRECISE GRADING PLAN
COUNTY YARD

SHEET NO.:
SHEET 3 OF 6

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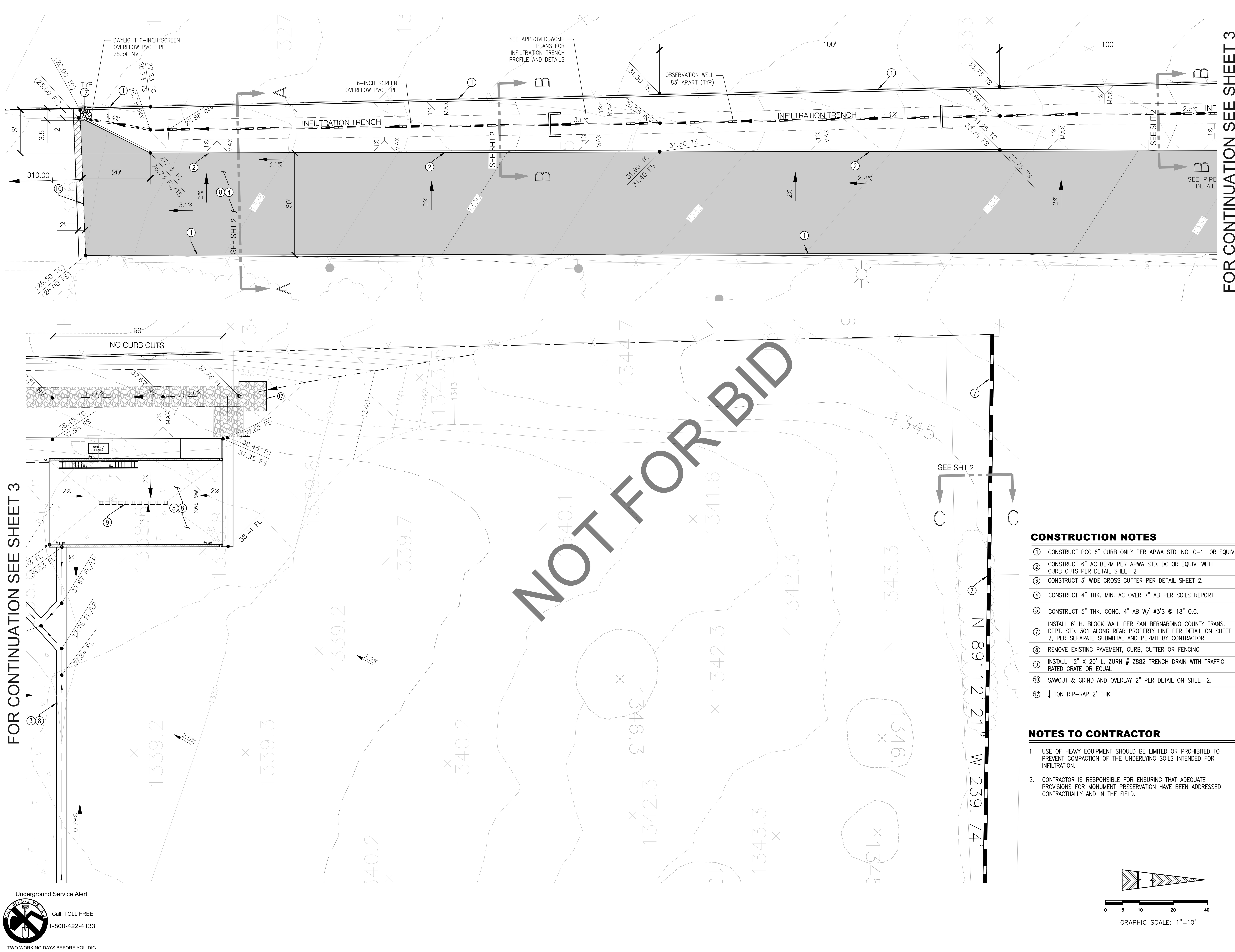

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GRAPHIC SCALE: 1"=10'

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STK ARCHITECTURE, INC.
42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780

CONSULTANT:
ERSC
Engineering Resources of Southern California
1861 W. Redlands Blvd, Bldg 7B
Redlands, Ca. 92373
P: (909) 890-1255
F: (909) 890-0995

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385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

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SAN BERNARDINO COUNTY
RANCHO CUCAMONGA NEW YARD CONSTRUCTION

PROJECT # 10.10.1333
CIP # 23-042
CAFM # ETI005
APN: 1089031390000, 1089031130000

12158 BASE LINE ROAD
RANCHO CUCAMONGA, CA 91739

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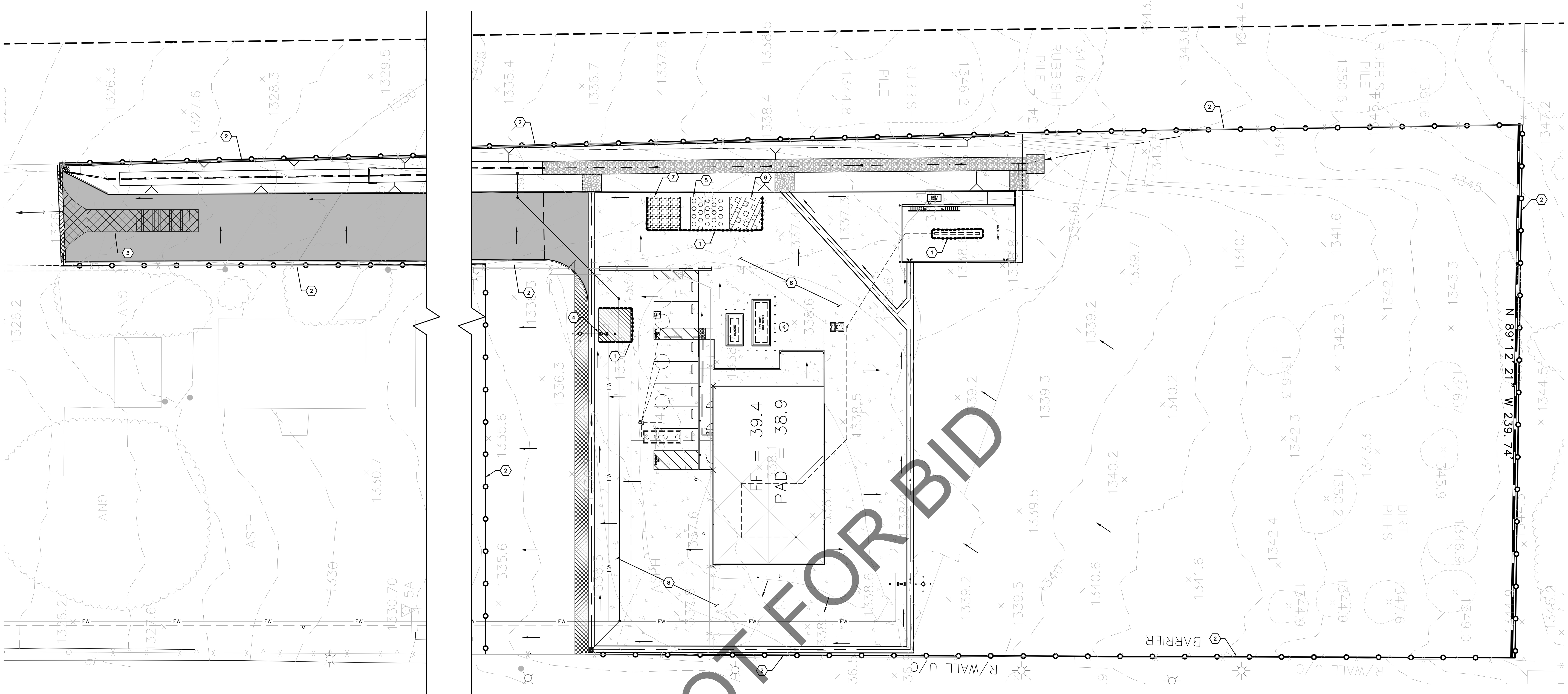
PLOT DATE: -
DRAWING NAME:

SEAL:

SHEET TITLE:
PRECISE GRADING PLAN
COUNTY YARD

SHEET NO.:
SHEET 4 OF 6



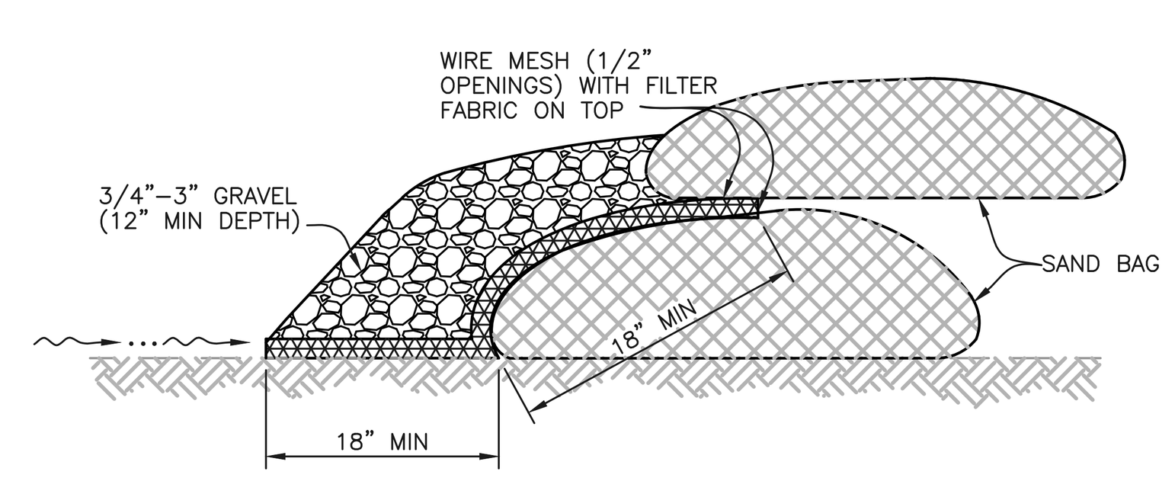
GRAPHIC SCALE: 1"=20'

EROSION CONTROL NOTES

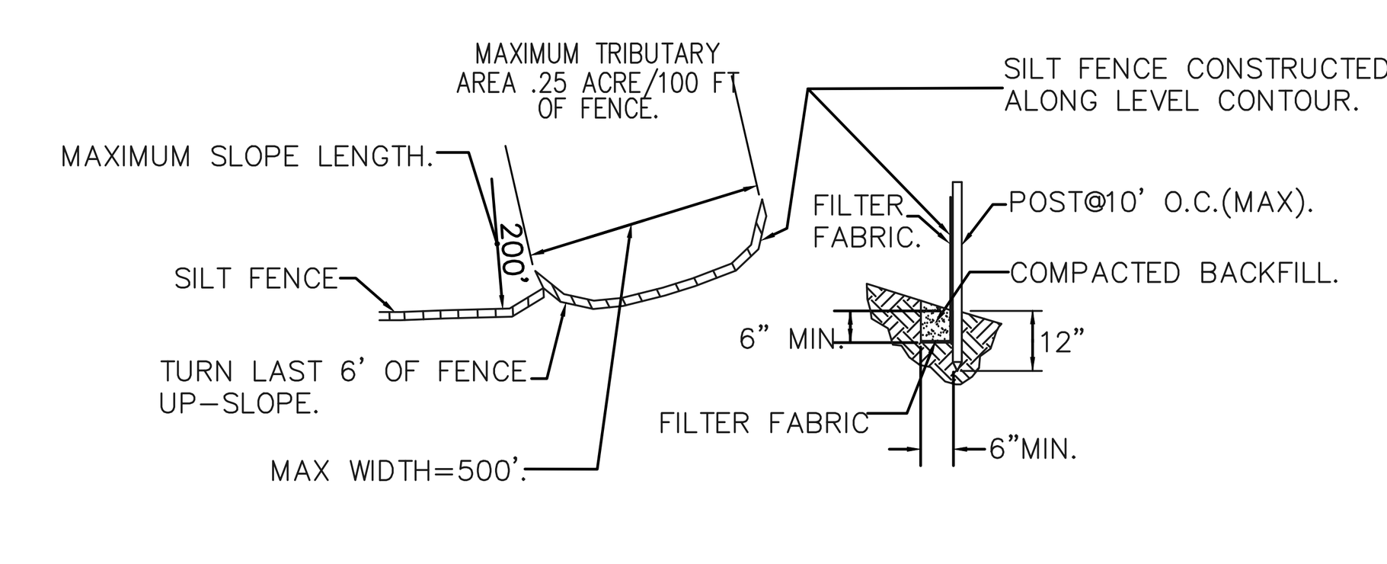
1. SAND BAG BARRIER (SE-8) PER DETAIL "A" HEREON.
2. SLIT FENCE (EC-1) PER DETAIL "B" HEREON.
3. STABILIZED CONSTRUCTION ENTRANCE/EXIT (TC-1) PER DETAIL "C" HEREON.
4. MATERIAL DELIVERY AND STORAGE PER WM-1.
5. VEHICLE STORAGE.
6. WASTE STORAGE AREA PER WM-5.
7. VEHICLE WASHING AND MAINTENANCE AREA PER NS-8, NS-9 & NS-10.
8. IMPLEMENT WIND EROSION CONTROL PER WE-1.

LEGEND

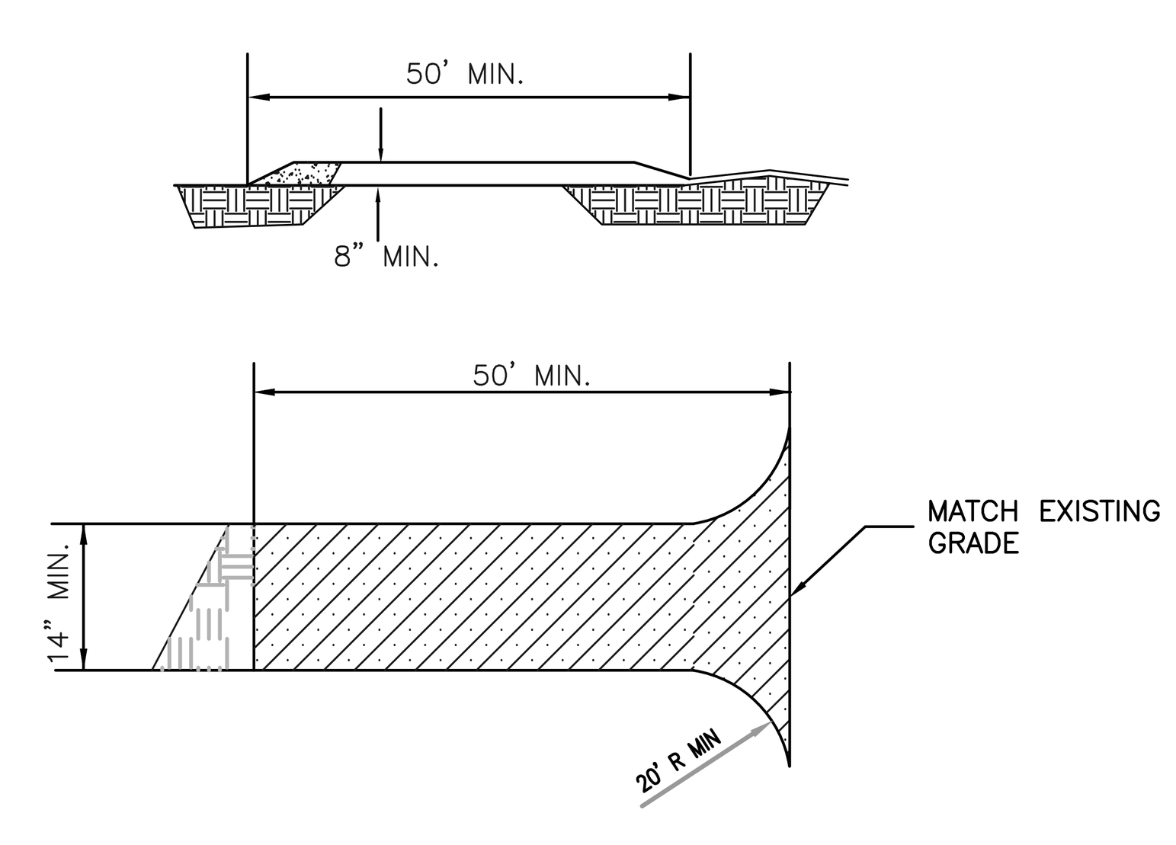
- SAND BAGS
- SILT FENCE
- FLOW PATH
- GRADING LIMITS
- PROP. CMU WALL
- STABILIZED CONSTRUCTION ENTRANCE
- MATERIAL DELIVERY/STORAGE AREA
- VEHICLE STORAGE AND MAINTENANCE AREA
- VEHICLE WASHING AREA
- WASTE STORAGE AREA



1 SAND BAG - DETAIL "A"
NTS



2 SLIT FENCE - DETAIL "B"
NTS



3 STABILIZED CONSTRUCTION ENTRANCE - DETAIL "C"
NTS

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42095 ZEVO DR., TEMECULA, CALIFORNIA 92590-3780
Phone: 951.296.9110 Fax: 951.296.8079 Email: stk@stkinc.com

CONSULTANT:

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385 N. ARROWHEAD AVE.
SAN BERNARDINO, CA 92415

PROJECT NAME:
SAN BERNARDINO COUNTY
RANCHO CUCAMONGA NEW YARD CONSTRUCTION

PROJECT # 10.10.1333
CIP # 23-042
CAFM # ETI005
APN: 1089031390000, 1089031130000

12158 BASE LINE ROAD
RANCHO CUCAMONGA, CA 91739

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DATE: NOVEMBER 2022
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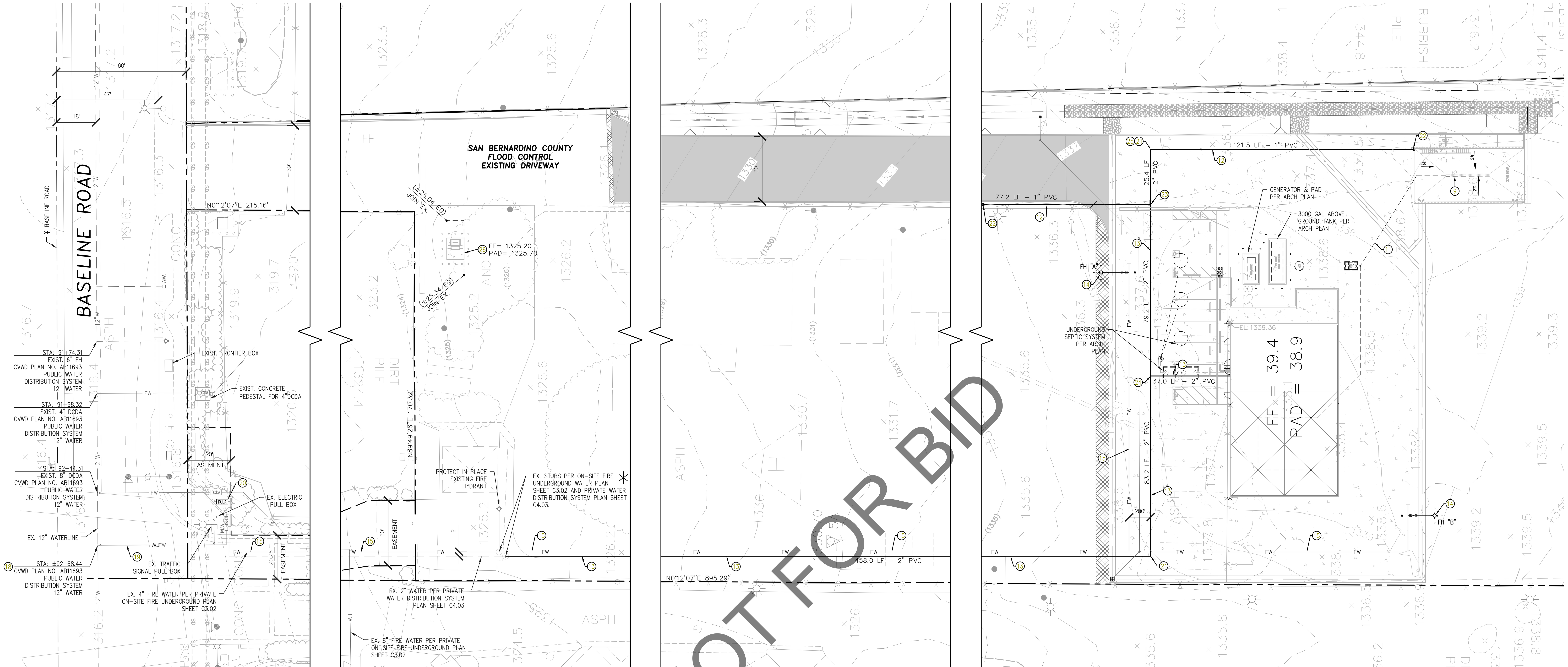
DRAWING NAME:

SEAL:
REGISTERED PROFESSIONAL ENGINEER
No. 41836
Exp. 3/31/26
CIVIL
STATE OF CALIFORNIA

SHEET TITLE:
PRECISE GRADING PLAN
COUNTY YARD EROSION CONTROL PLAN

SHEET NO.:
SHEET 5 OF 6



UTILITY NOTES

9	INSTALL 12" X 20' L. ZURN # Z882 TRENCH DRAIN WITH TRAFFIC RATED GRATE OR EQUAL
11	4" DIA. PVC – SDR 35 SEWER PIPE PER SEPARATE PLAN
12	1" DIA PVC OR APPROVED EQUAL WATERLINE
13	2" DIA PVC OR APPROVED EQUAL WATERLINE
14	6" DIA. FIRE HYDRANT PROTECTED WITH BOLLARDS PER PRIVATE FIRE UNDERGROUND PLAN
15	8" DIA. PVC OR APPROVED EQUAL FIRE SERVICE LINE PER PRIVATE FIRE UNDERGROUND PLAN
18	8" HOT TAP TO EXISTING 12" WATER MAIN PER CVWD STD. DWG. NO 123, PER REVISED OFF-SITE CVWD PLAN NO. AB11693
19	8" CML&C STEEL WATERLINE PER CVWD STD. DWG. NO. 123, PER REVISED OFF-SITE CVWD PLAN
20	REMOVE EXISTING 4" DCDA AND REPLACE WITH 8" DCDA PER REVISED OFF-SITE CVWD PLAN AND PRIVATE FIRE UNDERGROUND PLAN
21	INSTALL ELBOW
22	1" DIA HOSE BIBB
23	INSTALL 2x1-INCH TEE
24	INSTALL 2-INCH TEE
25	INSTALL 2x1-INCH PVC REDUCER
26	CONSTRUCT 6" THK. CONCRETE PAD FOR PROPOSED TRANSFORMER

NOTES TO CONTRACTOR

✳ 1. CONTRACTOR SHALL POTHOLE AND VERIFY THE LOCATION AND ELEVATION OF THE UTILITIES WITHIN CONSTRUCTION AREA, ANY UTILITIES NOT SHOWN OR THAT HAS DISCREPANCY TO THE PLANS SHALL BE IMMEDIATELY REPORTED TO THE ENGINEER PRIOR TO START OF CONSTRUCTION.

2. CONTRACTOR SHALL ACQUIRE ENCROACHMENT PERMITS FOR ALL WORK DONE WITHIN THE PUBLIC RIGHT OF WAY.

3. CONTRACTOR SHALL ACQUIRE ALL NECESSARY PERMITS FROM ALL PUBLIC UTILITY PURVEYORS FOR CONNECTIONS.

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DATE:	INFORMATION:
04-29-21	1 1st Plan Check
05-25-23	2 2nd Plan Check

SHEET INFORMATION:
STK PROJECT NO.: 374-134-20
SCALE: AS NOTED
DATE: NOVEMBER 2022
PLOT DATE: –
DRAWING NAME:

SEAL:
REGISTERED PROFESSIONAL ENGINEER JOHN M. BRUDIN No. 41836 Exp. 3/31/26 CIVIL STATE OF CALIFORNIA

SHEET TITLE:
UTILITY PLAN
COUNTY YARD
INDEX SHEET

SHEET NO.:
SHEET 6 OF 6

Appendix -C
CASQA- Infiltration Trench BMP

Infiltration Trench TC-10

Maintenance Concerns, Objectives, and Goals

- Accumulation of Metals
- Clogged Soil Outlet Structures
- Vegetation/Landscape Maintenance

General Description

An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix. Infiltration trenches perform well for removal of fine sediment and associated pollutants. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of coarse sediment entering the trench which can clog and render the trench ineffective.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	■
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■
☑	Oxygen Demanding	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Inspection/Maintenance Considerations

Frequency of clogging is dependant on effectiveness of pretreatment, such as vegetated buffer strips, at removing sediments. See appropriate maintenance factsheets for associated pretreatment. If the trench clogs, it may be necessary to remove and replace all or part of the filter fabric and possibly the coarse aggregate. Clogged infiltration trenches with surface standing water can become a nuisance due to mosquito breeding. Maintenance efforts associated with infiltration trenches should include frequent inspections to ensure that water infiltrates into the subsurface completely at a recommended infiltration rate of 72 hours or less to prevent creating mosquito and other vector habitats. Most of the maintenance should be concentrated on the pretreatment practices, such as buffer strips and swales upstream of the trench to ensure that sediment does not reach the infiltration trench. Regular inspection should determine if the sediment removal structures require routine maintenance. Infiltration trenches should not be put into operation until the upstream tributary area is stabilized.

Inspection Activities	Suggested Frequency
■ Inspect after every major storm for the first few months to ensure proper functioning. Drain times should be observed to confirm that designed drain times has been achieved.	After construction
■ Inspect facility for signs of wetness or damage to structures, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, standing water, and material buildup. ■ Check for standing water or, if available, check observation wells following 3 days of dry weather to ensure proper drain time. ■ Inspect pretreatment devices and diversion structures for damage, sediment buildup, and structural damage.	Semi-annual and after extreme events
■ Trenches with filter fabric should be inspected for sediment deposits by removing a small section of the top layer. If inspection indicates that the trench is partially or completely clogged, it should be restored to its design condition.	Annual
Maintenance Activities	**Suggested Frequency**
■ Repair undercut and eroded areas at inflow and outflow structures. ■ Remove sediment, debris, and oil/grease from pretreatment devices and overflow structures.	Standard maintenance (as needed)
■ Remove trash, debris, grass clippings, trees, and other large vegetation from the trench perimeter and dispose of properly. ■ Mow and trim vegetation to prevent establishment of woody vegetation, and for aesthetic and vector reasons.	Semi-annual, more often as needed
■ Clean out sediment traps, forebays, inlet/outlet structures, overflow spillway, and trenches if necessary. ■ Remove grass clippings, leaves, and accumulated sediment from the surface of the trench. Replace first layer of aggregate and filter fabric if clogging appears only to be at the surface. ■ Clean trench when loss of infiltrative capacity is observed. If drawdown time is observed to have increased significantly over the design drawdown time, removal of sediment may be necessary. This is an expensive maintenance activity and the need for it can be minimized through prevention of upstream erosion.	Annual
■ If bypass capability is available, it may be possible to regain the infiltration rate in the short term by providing an extended dry period. ■ Seed or sod to restore ground cover.	5-year maintenance
■ Total rehabilitation of the trench should be conducted to maintain storage capacity within 2/3 of the design treatment volume and 72-hour exfiltration rate limit. ■ Trench walls should be excavated to expose clean soil. ■ All of the stone aggregate and filter fabric or media must be removed. Accumulated sediment should be stripped from the trench bottom. At this point the bottom may be scarified or tilled to help induce infiltration. New fabric and clean stone aggregate should be refilled.	Upon failure

Additional Information

Infiltration practices have historically had a high rate of failure compared to other stormwater management practices. One study conducted in Prince George's County, Maryland (Galli, 1992), revealed that less than half of the infiltration trenches investigated (of about 50) were still functioning properly, and less than one-third still functioned properly after 5 years. Many of these practices, however, did not incorporate advanced pretreatment. By carefully selecting the location and improving the design features of infiltration practices, their performance should improve.

It is absolutely critical that settleable particles and floatable organic materials be removed from runoff water before it enters the infiltration trench. The trench will clog and become nonfunctional if excessive particulate matter is allowed to enter the trench.

Cold climate considerations – see http://www.cwp.org/cold-climates.htm

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Housekeeping Practices SC-60

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.
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Drainage System Maintenance SC-74

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to

cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

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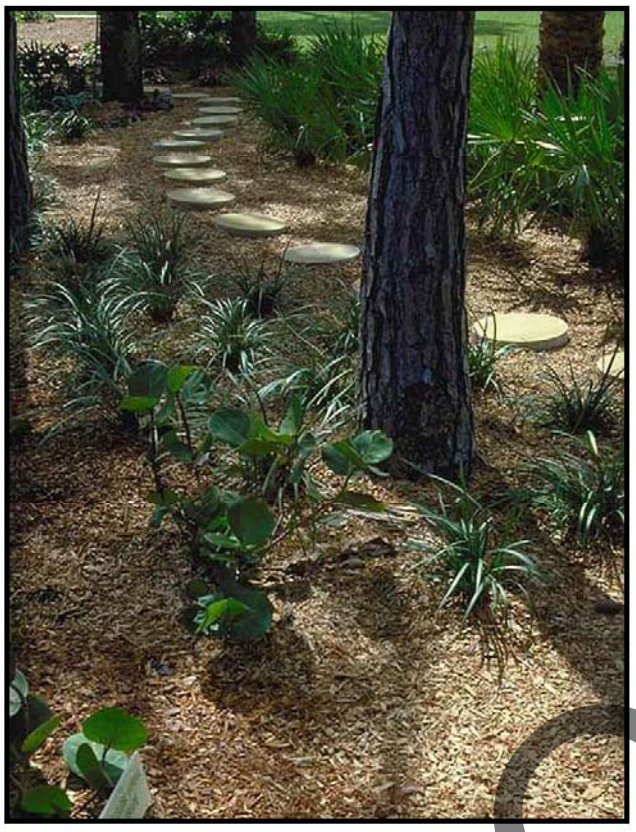
Site Design & Landscape Planning SD-10



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.

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

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.

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.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ 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.

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

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

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.
- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.
- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.
- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.
- Other features may be 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.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Vehicle Washing Areas SD-33

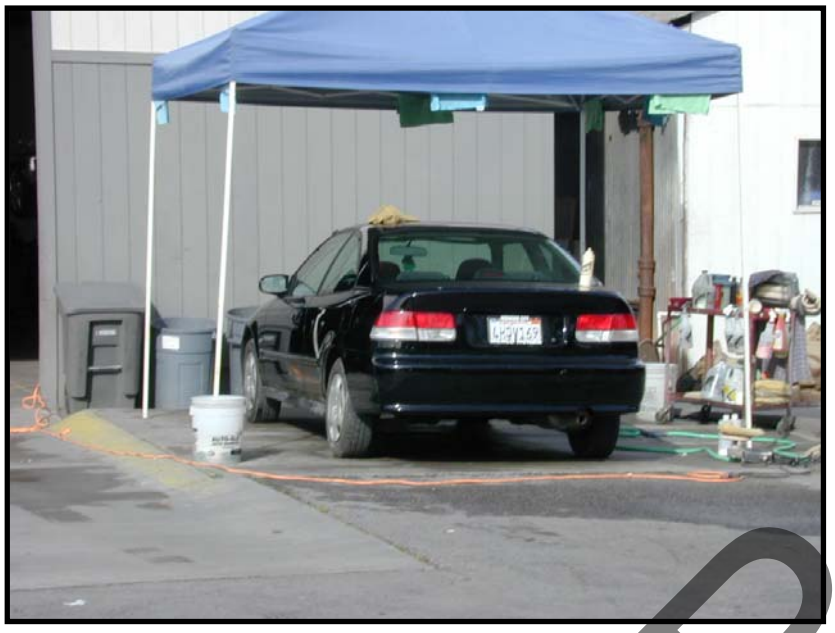


Photo Credit: Geoff Brosseau

Design Objectives

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

Description

Vehicle washing, equipment washing, and steam cleaning may contribute high concentrations of metals, oil and grease, solvents, phosphates, and suspended solids to wash waters that drain to stormwater conveyance systems.

Approach

Project plans should include appropriately designed area(s) for washing-steam cleaning of vehicles and equipment. Depending on the size and other parameters of the wastewater facility, wash water may be conveyed to a sewer, an infiltration system, recycling system or other alternative. Pretreatment may be required for conveyance to a sanitary sewer.

Suitable Applications

Appropriate applications include commercial developments, restaurants, retail gasoline outlets, automotive repair shops and others.

Design Considerations

Design requirements for vehicle maintenance are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. Design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Areas for washing/steam cleaning should incorporate one of the following features:

- Be self-contained and/or covered with a roof or overhang
- Be equipped with a clarifier or other pretreatment facility
- Have a proper connection to a sanitary sewer

- Include other features which are comparable and equally effective

CAR WASH AREAS - Some jurisdictions' stormwater management plans include vehicle-cleaning area source control design requirements for community car wash racks in complexes with a large number of dwelling units. In these cases, wash water from the areas may be directed to the sanitary sewer, to an engineered infiltration system, or to an equally effective alternative. Pre-treatment may also be required.

Depending on the jurisdiction, developers may be directed to divert surface water runoff away from the exposed area around the wash pad (parking lot, storage areas), and wash pad itself to alternatives other than the sanitary sewer. Roofing may be required for exposed wash pads.

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. Jurisdictions may require some form of pretreatment, such as a trap, for these areas.

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.

Additional Information

Maintenance Considerations

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

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.

Appendix -D
Geotechnical and Soils Report

GEOTECHNICAL INVESTIGATION

PROPOSED PUBLIC WORKS YARD IMPROVEMENTS (CIP-19-050)
12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

APN: 108903113; 108903139; 108903138

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

SAN BERNARDINO REAL EASTATE SERVICES DEPARTMENT – PROJECT MANAGEMENTS DIVISION
SAN BERNARDINO, CA

PROJECT NO. A9816-99-01

MARCH 8, 2019

GEOCON
WEST, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. A9816-99-01
March 8, 2019

Ms. Dani Fox
San Bernardino County Real Estate Services Department
Project Management Division
825 East Third Street
San Bernardino, California 92415

Subject: GEOTECHNICAL INVESTIGATION
PROPOSED PUBLIC WORKS YARD IMPROVEMENTS (CIP-19-050)
12158 BASELINE ROAD, RANCHO CUCAMONGA, CALIFORNIA
APN: 108903113; 108903139; 108903138

Dear Ms. Fox:

In accordance with your authorization of our proposal dated January 4, 2019, we have prepared this geotechnical investigation report for the proposed public works yard improvements located at 12158 Baseline Road in the City of Rancho Cucamonga, California. The accompanying report presents the findings of our study, and our conclusions and recommendations pertaining to the geotechnical aspects of proposed design and construction. Based on the results of our investigation, it is our opinion that the site can be developed as proposed, provided the recommendations of this report are followed and implemented during design and construction.

If you have any questions regarding this report, or if we may be of further service, please contact the undersigned.

Very truly yours,

GEOCON WEST, INC.

REGISTERED PROFESSIONAL ENGINEER
JELISA THOMAS ADAMS
GE3092
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
SUSAN FRANZEN KIRKGARD
No. 1754
CERTIFIED ENGINEERING GEOLOGIST
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John Stapleton	Jelisa Thomas Adams	Susan F. Kirkgard
EIT 164283	GE 3092	CEG 1754

(EMAIL) Addressee

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of a geotechnical investigation for the proposed public works yard improvements located at 12158 Baseline Road in the City of Rancho Cucamonga, California (see Vicinity Map, Figure 1). The purpose of the investigation was to evaluate subsurface soil and geologic conditions underlying the site and, based on conditions encountered, to provide conclusions and recommendations pertaining to the geotechnical aspects of design and construction.

The scope of this investigation included a review of published documents for the site, a site reconnaissance, field exploration, laboratory testing, engineering analysis, and the preparation of this report. The site was explored on February 4, 2019, by excavating five 8-inch diameter borings to depths between 5½ and 25½ feet below the existing ground surface using a truck-mounted hollow-stem auger drilling machine. The approximate locations of the exploratory borings are depicted on the Site Plan (see Figure 2). A detailed discussion of the field investigation, including the boring logs, is presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to determine pertinent physical and chemical soil properties. Appendix B presents a summary of the laboratory test results.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. References reviewed to prepare this report are provided in the *List of References* section.

If project details vary significantly from those described herein, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The subject site is located at 12158 Baseline Road, in the City of Rancho Cucamonga, California. The site consists of a relatively level pad, which has not been developed. Currently, the site is occupied by a storage yard and single-story maintenance buildings and storage containers. The site is bounded by an additional storage yard to the west, by a shopping center and Day Creek Boulevard to the east, by Pacific Electric Bike Trail to the north, and by Baseline Road to the south. The site topography is roughly level to gently sloping to the south. Surface water drainage at the site appears to have no discernable pattern. The site is paved with gravel and has no vegetation.

Based on the information provided by the Client, it is our understanding that the proposed development will consist of a 3,300-square-foot metal structure, as well as site improvements such as utility connections, CMU perimeter walls, a heavy equipment yard, lighting, landscaping, and pavement. The existing and proposed site conditions are depicted on the Site Plan (see Figure 2).

Based on the preliminary nature of the design at this time, wall and column loads were not available. It is anticipated that column loads for the proposed structure will be up to 100 kips, and wall loads will be up to 1 kip per linear foot.

Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. Geocon should be contacted to determine the necessity for review and possible revision of this report.

3. GEOLOGIC SETTING

The site is located in the northern portion of the Chino Basin in San Bernardino County, California. The Chino Basin encompasses a broad area of coalescing alluvial fans that extend southward from the San Gabriel Mountains and overlies a down-dropped structural block which is bounded by the Elsinore Fault and the Chino Fault to the southwest, the Red Hill-Etiwanda Avenue Fault to the northwest, the San Gabriel Mountains and Sierra Madre Fault to the north, by the Rialto-Colton Fault to the northeast, and the La Sierra Hills and Jurupa Hills to the southeast. The alluvial deposits within the Chino Basin consist of Holocene age (last 11,700 years old) and Pleistocene age (11,000 to 2 million years old) alluvial sediments. A thin veneer of eolian sand mantles portions of the Chino Basin.

Locally, the site is located on one of the alluvial fans that extends southward from the San Gabriel Mountains, located approximately 3.0 miles north of the site. Day Creek, a southerly flowing drainage bounds the site on the west. Regionally, the Chino Basin is located within the Peninsular Ranges geomorphic province. This province comprises the northwesterly-trending mountains, valleys, and geologic structures extending from the southern Baja Peninsula to the Transverse Ranges in Southern California.

4. SOIL AND GEOLOGIC CONDITIONS

Based on our field investigation and published geologic maps of the area, the site is underlain by previously placed fill and Holocene age alluvial fan deposits consisting predominately of sand and gravel (CGS, 2010). Detailed stratigraphic profiles of the materials encountered at the site are provided on the boring logs in Appendix A.

4.1 Artificial Fill

Artificial fill was encountered in our field explorations to a maximum depth of 4 feet below existing ground surface. The fill generally consists of light brown and brown poorly graded sand and silty sand with varying amounts of gravel. The fill is characterized as dry to moist and loose to medium dense. The fill is the result of past grading and construction activities at the site. Deeper fill may exist between excavations and in other portions of the site that were not directly explored.

4.2 Alluvial Fan Deposits

Holocene age alluvial deposits were encountered beneath the fill. The alluvium was generally light brown to dark brown or dark yellowish brown poorly graded to well-graded sand with gravel, gravel with sand or silty sand with various amounts of cobbles. Although not directly observed in our borings, boulders are common in this geologic environment. The alluvium is characterized as fine- to coarse-grained, dry to moist, and loose to very dense.

5. GROUNDWATER

The site is located in the Chino Basin of the Upper Santa Ana Valley Groundwater Basin (Chino Basin Water Master [CBWM] 2017). A review of groundwater contour maps published by the California Division of Mines and Geology (CDMG, 1976) and the U. S. Geological Survey (Mendenhall, 1904) indicate that the groundwater level in the immediate site vicinity has historically been greater than 250 feet beneath the ground surface since 1904.

Review of the California Department of Water Resources Data Library (CDWR, 2019) indicates the closest groundwater monitoring well to the site is Well Number 341217N1175119W001, located approximately 0.9 mile east of the site. The highest groundwater level recorded for this well for the monitoring period between 2011 and 2018, was in 2012 when groundwater was at a depth of approximately 574 feet beneath the existing ground surface. The most recent groundwater level measurement indicates the depth to water was approximately 582 feet below the surface on November 14, 2018. Based on current groundwater basin management practices, it is unlikely that groundwater levels will ever exceed the historic high levels.

Groundwater was not encountered in the borings drilled to a maximum depth of 25½ feet beneath the existing ground surface. Based on the lack of groundwater observed in our borings, the depth to groundwater as recorded in nearby wells (CDWR, 2019; CBWM, 2017), and the depth of the proposed construction, groundwater is neither expected to be encountered during construction, nor have a detrimental effect on the project. However, it is common for groundwater levels to vary seasonally or for perched groundwater conditions to develop where none previously existed, especially in impermeable fine-grained soils which are subjected to irrigation or precipitation. In addition, recent requirements for stormwater infiltration could result in shallower seepage conditions in the region. Proper surface drainage of irrigation and precipitation will be critical to future performance of the project. Recommendations for drainage are provided in the S*urface Drainage* section of this report (see Section 7.16).

6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in Southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (CGS, 2018). By definition, an active fault is one that has had surface displacement within Holocene time (about the last 11,700 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a state-designated Alquist-Priolo Earthquake Fault Zone (CGS, 2019a; CGS, 2019b) for surface fault rupture hazards. No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is located in the seismically active Southern California region, and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active Southern California faults. The faults in the vicinity of the site are shown in Figure 3, Regional Fault Map.

The closest active fault to the site is the Red Hill Fault located approximately 1.2 miles to the northwest (Ziony and Jones, 1989; USGS, 2006; CDMG, 1995). Other nearby active faults are the Cucamonga Fault, the San Jacinto Fault Zone, the San Andreas Fault Zone, and the Chino Fault located approximately 3.1 miles north, 7.5 miles northeast, 10.9 miles northeast, and 14.5 miles southwest of the site, respectively (Ziony and Jones, 1989).

Several buried thrust faults, commonly referred to as blind thrusts, underlie the greater Los Angeles area at depth. These faults are not exposed at the ground surface and are typically identified at depths greater than 3.0 kilometers. The October 1, 1987, M_w 5.9 Whittier Narrows earthquake and the January 17, 1994, M_w 6.7 Northridge earthquake were a result of movement on the Puente Hills Blind Thrust and the Northridge Thrust, respectively. These deep thrust faults and others in the greater Los Angeles area are not exposed at the surface and do not present a potential surface fault rupture hazard at the site; however, these deep thrust faults are considered active features capable of generating future earthquakes that could result in moderate to significant ground shaking at the site.

6.2 Seismicity

As with all of Southern California, the site has experienced historic earthquakes from various regional faults. The seismicity of the region surrounding the site was formulated based on research of an electronic database of earthquake data. The epicenters of recorded earthquakes with magnitudes equal to or greater than 5.0 in the site vicinity are depicted on Figure 4, Regional Seismicity Map. A partial list of moderate to major magnitude earthquakes that have occurred in the Southern California area within the last 100 years is included in the following table.

LIST OF HISTORIC EARTHQUAKES

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto-Hemet area	April 21, 1918	6.8	40	SE
Near Redlands	July 23, 1923	6.3	19	ESE
Long Beach	March 10, 1933	6.4	43	SW
Tehachapi	July 21, 1952	7.5	103	NW
San Fernando	February 9, 1971	6.6	53	WNW
Whittier Narrows	October 1, 1987	5.9	31	W
Sierra Madre	June 28, 1991	5.8	28	WNW
Landers	June 28, 1992	7.3	63	E
Big Bear	June 28, 1992	6.4	41	E
Northridge	January 17, 1994	6.7	57	W
Hector Mine	October 16, 1999	7.1	80	ENE

The site could be subjected to strong ground shaking in the event of an earthquake. However, this hazard is common in Southern California and the effects of ground shaking can be mitigated if the proposed structures are designed and constructed in conformance with current building codes and engineering practices.

6.3 Seismic Design Criteria

The following table summarizes summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The data was calculated using the computer program *U.S. Seismic Design Maps*, provided by the USGS. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10. The values presented on the following page are for the risk-targeted maximum considered earthquake (MCE_R).

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Table 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.648g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.604g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.0	Table 1613.3.3(1)
Site Coefficient, F_V	1.5	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.648g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0.906g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.099g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.604g	Section 1613.3.4 (Eqn 16-40)

The table below presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10.

ASCE 7-10 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.621g	Figure 22-7
Site Coefficient, F_{PGA}	1.0	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.621g	Section 11.8.3 (Eqn 11.8-1)

The Maximum Considered Earthquake Ground Motion (MCE) is the level of ground motion that has a 2 percent chance of exceedance in 50 years, with a statistical return period of 2,475 years. According to the 2016 California Building Code and ASCE 7-10, the MCE is to be utilized for the evaluation of liquefaction, lateral spreading, seismic settlements, and it is our understanding that the intent of the Building code is to maintain "Life Safety" during a MCE event. The Design Earthquake Ground Motion (DE) is the level of ground motion that has a 10 percent chance of exceedance in 50 years, with a statistical return period of 475 years.

Deaggregation of the MCE peak ground acceleration was performed using the USGS online Unified Hazard Tool, 2008 Conterminous U.S. Dynamic edition. The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a 6.85 magnitude event occurring at a hypocentral distance of 9.85 kilometers from the site.

Deaggregation was also performed for the Design Earthquake (DE) peak ground acceleration, and the result of the analysis indicates that the predominant earthquake contributing to the DE peak ground acceleration is characterized as a 6.90 magnitude occurring at a hypocentral distance of 11.98 kilometers from the site.

Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.4 Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California" and "Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California" requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

According to the County of San Bernardino (2010a) and the City of Rancho Cucamonga Safety Element of the General Plan (2010), the site is not located within an area identified as having a potential for liquefaction. Also, the groundwater level in the immediate site vicinity has been greater than 250 feet since 1904 and is currently greater than 500 feet beneath the site. Based on these considerations, it is our opinion that the potential for liquefaction to occur beneath the site is considered low.

6.5 Slope Stability

The topography at the site and surrounding is relatively level to sloping gently to the south. According to the City of Rancho Cucamonga Safety Element (2010), the site is not within an area identified as having a potential for slope instability. There are no known landslides near the site, nor is the site in the path of any known or potential landslides. Therefore, the potential for slope stability hazards to adversely affect the proposed development is considered low.

6.6 Earthquake-Induced Flooding

Earthquake-induced flooding is inundation caused by failure of dams or other water-retaining structures due to earthquakes. The City of Rancho Cucamonga Safety Element (City of Rancho Cucamonga, 2010) and the County of San Bernardino (2010b) indicate that the site is not located within a dam or debris basin inundation area or flood boundary from any such reservoirs. Therefore, the potential for inundation at the site as a result of an earthquake-induced dam failure is considered low.

6.7 Tsunamis, Seiches, and Flooding

The site is not located within a coastal area. Therefore, tsunamis are not considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Therefore, flooding resulting from a seismically induced seiche is considered unlikely.

The site is within an area of minimal flooding (Zone X) as defined by the Federal Emergency Management Agency (FEMA, 2019; City of Rancho Cucamonga, 2010).

6.8 Oil Fields & Methane Potential

Based on a review of the California Division of Oil, Gas and Geothermal Resources (DOGGR) Well Finder Website, the site is not located within the limits of an oilfield and oil or gas wells are not located in the immediate site vicinity (DOGGR, 2019). However, due to the voluntary nature of record reporting by the oil well drilling companies, wells may be improperly located or not shown on the location map and undocumented wells could be encountered during construction. Any wells encountered during construction will need to be properly abandoned in accordance with the current requirements of the DOGGR.

Since the site is not located within the boundaries of a known oil field, the potential for the presence of methane or other volatile gases at the site is considered low. However, should it be determined that a methane study is required for the proposed development it is recommended that a qualified methane consultant be retained to perform the study and provide mitigation measures as necessary.

6.9 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. The City of Rancho Cucamonga (2010) indicates that regional subsidence is possible within the general area of the site due to the low density of the subsurface soils. However, in the 1970s, the County of San Bernardino initiated a groundwater recharge program that has minimized subsidence in the area. No known large-scale extraction of groundwater, gas, oil, or geothermal energy is occurring or planned at the site or in the general site vicinity. As long as the County maintains the groundwater recharge program, the potential for ground subsidence due to withdrawal of fluids or gases at the site is considered low.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 It is our opinion that neither soil nor geologic conditions were encountered during the investigation that would preclude construction of the proposed project provided the recommendations presented herein are followed and implemented during design and construction.

7.1.2 Up to 4 feet of existing artificial fill was encountered during the site investigation. The fill is likely the result of past grading or construction activities at the site. Deeper fill may exist between excavations and in other portions of the site that were not directly explored. It is our opinion that the existing fill, in its present condition, is not suitable for direct support of proposed foundations or slabs. The existing fill and site soils are suitable for re-use as engineered fill provided the recommendations in the Grading section of this report are followed (see Section 7.4).

7.1.3 The results of the laboratory testing indicate that some of the alluvial soils may be subject to excessive hydro-consolidation upon saturation (see Figure B3). Hydro-consolidation is the tendency of a soil structure to collapse upon saturation, resulting in the overall settlement of the effected soils and any overlying soils or foundations supported therein. The recommendations provided herein are intended to minimize the effects of hydro-consolidation on proposed improvements.

7.1.4 Based on the potential for hydro-consolidation, maintaining proper surface drainage is critical to future performance of foundations. Recommendations for drainage are provided in the S*urface Drainage* section of this report (see Section 7.16).

7.1.5 It is recommended that the upper 4 feet of existing earth materials within the building footprint area be excavated and properly compacted for foundation and slab support. Deeper excavations should be conducted to remove all existing artificial fill or soft soils as necessary at the direction of the Geotechnical Engineer (a representative of Geocon). The excavation should extend laterally a minimum distance of 3 feet beyond the building footprint areas, including building appurtenances, or a distance equal to the depth of fill below the foundation, whichever is greater. The limits of existing fill and/or soft soil removal will be verified by the Geocon representative during site grading activities. Recommendations for earthwork are provided in the *Grading* section of this report (see Section 7.4).

7.1.6 All excavations must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon). Prior to placing any fill, the upper 12 inches of the excavation bottom must be scarified, moistened, and proof-rolled with heavy equipment in the presence of the Geotechnical Engineer (a representative of Geocon West, Inc.).

7.1.7 Subsequent to grading of the site, the proposed structures may be supported on a conventional foundation system deriving support in newly placed engineered fill. All foundation excavations must be observed and approved in writing by the Geotechnical Engineer prior to placement of steel or concrete. Recommendations for the design of a conventional foundation system are provided in Section 7.6.

7.1.8 Where new exterior concrete slab-on-grade is to be constructed, it is recommended that all existing artificial fill and any soils disturbed during construction activities be properly compacted for slab support. Recommendations for earthwork are provided in the *Grading* section of this report (see Section 7.4).

7.1.9 It is anticipated that stable excavations for the recommended grading associated with the proposed structure can be achieved with sloping measures. However, if excavations in close proximity to an adjacent property line and/or an existing structure are required, special excavation measures may be necessary in order to maintain lateral support of offsite improvements. Excavation recommendations are provided in the *Temporary Excavations* section of this report (Section 7.14).

7.1.10 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures, which will not be tied to the proposed structure, may be supported on conventional foundations deriving support on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. It is essential that proper drainage be maintained in order to minimize settlements in the soils and any foundations supported therein. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative. Where excavation and compaction cannot be performed or is undesirable, and due to the depth of previously placed fill at the site, Geocon should be contacted for additional recommendations.

7.1.11 Where new paving is to be placed, it is recommended that unsuitable or soft existing fill and alluvial soils be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all existing fill and soft alluvial soils in the area of new paving is not required; however, paving constructed over existing uncertified fill or unsuitable alluvial soil may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of subgrade soil should be scarified and properly compacted for paving support. Paving recommendations are provided in Preliminary Pavement Recommendations section of this report (see Section 7.13).

7.1.12 Based on the results of percolation testing performed in the upper 10 feet of site soils, a stormwater infiltration system is considered feasible for this project. Additional discussion is provided in the *Stormwater Infiltration* section of this report (see Section 7.15).

7.1.13 Once the design and foundation loading configuration for the proposed structure proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Based on the final foundation loading configurations, the potential for settlement should be reevaluated by this office.

7.1.14 Any changes in the design, location or elevation, as outlined in this report, should be reviewed by this office. Once the design and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, as necessary. Geocon should be contacted to determine the necessity for review and possible revision of this report.

7.1.15 The most recent ASTM standards apply to this project and must be utilized, even if older ASTM standards are indicated in this report.

7.2 Soil and Excavation Characteristics

7.2.1 The in-situ soils can be excavated with moderate effort using conventional excavation equipment. Due to the presence of granular soils, caving should be anticipated in unshored vertical excavations and the contractor should be prepared for caving conditions. Formwork may be required to prevent caving of foundation excavations. In addition, due to the presence of cobbles, the contractor should be prepared for difficult excavation conditions during earthwork activities.

7.2.2 Screening of the earth materials may be required to remove oversize (greater than 6 inches) rock, prior to placement and compaction. Oversized materials should be managed in accordance with the recommendations provided herein.

7.2.3 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

7.2.4 All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures such as sloping and shoring. Excavation recommendations are provided in the *Temporary Excavations* section of this report (see Section 7.14).

7.2.5 The upper 5 feet of existing site soils encountered during the investigation are considered to have a "very low" expansive potential (EI = 0) and are classified as "non-expansive" in accordance with the 2016 California Building Code (CBC) Section 1803.5.3. The recommendations presented herein assume that the building foundations and slabs will derive support in these materials.

7.3 Minimum Resistivity, pH, and Water-Soluble Sulfate

7.3.1 Potential of Hydrogen (pH) and resistivity testing, as well as chloride content testing, were performed on representative samples of on-site material to generally evaluate the corrosion potential to surface utilities. The tests were performed in accordance with California Test Method Nos. 643 and 422 and indicate that the soils are considered "mildly corrosive" with respect to corrosion of buried ferrous metals on site. The results are presented in Appendix B (Figure B7) and should be considered for design of underground structures.

7.3.2 Laboratory tests were performed on representative samples of the site materials to measure the percentage of water-soluble sulfate content. Results from the laboratory water-soluble sulfate tests are presented in Appendix B (Figure B7) and indicate that the on-site materials possess a sulfate exposure class of "S0" to concrete structures as defined by 2016 CBC Section 1904 and ACI 318-14 Table 19.3.1.1.

7.3.3 Geocon West, Inc. does not practice in the field of corrosion engineering and mitigation. If corrosion sensitive improvements are planned, it is recommended that a corrosion engineer be retained to evaluate corrosion test results and incorporate the necessary precautions to avoid premature corrosion of buried metal pipes and concrete structures in direct contact with the soils.

7.4 Grading

7.4.1 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer, geotechnical engineer, and, if applicable, building official in attendance. Special soil handling requirements can be discussed at that time.

7.4.2 Earthwork should be observed, and compacted fill tested by representatives of Geocon West, Inc. The existing fill encountered during exploration is suitable for re-use as an engineered fill, provided any encountered oversize material (greater than 6 inches) and any encountered deleterious debris is removed.

7.4.3 Grading should commence with the removal of all existing vegetation and existing improvements from the area to be graded. Deleterious debris such as wood and root structures should be exported from the site and should not be mixed with the fill soils. Asphalt and concrete should not be mixed with the fill soils unless approved by the Geotechnical Engineer. All existing underground improvements planned for removal should be completely excavated and the resulting depressions properly backfilled in accordance with the procedures described herein. Once a clean excavation bottom has been established it must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.).

7.4.4 As a minimum, it is recommended that the upper 4 feet of existing earth materials within the proposed building footprint area be excavated and properly compacted for foundation and slab support. Deeper excavations should be conducted as necessary to remove all artificial fill or soft alluvial soil at the direction of the Geotechnical Engineer (a representative of Geocon). The excavation should extend laterally a minimum distance of 3 feet beyond the building footprint area, including building appurtenances, or a distance equal to the depth of fill below the foundation, whichever is greater. The limits of existing fill and/or soft alluvial soils removal will be verified by the Geocon representative during site grading activities.

7.4.5 All excavations must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon). Prior to placing any fill, the upper 12 inches of the excavation bottom must be scarified, moistened, and proof-rolled with heavy equipment in the presence of the Geotechnical Engineer (a representative of Geocon West, Inc.).

7.4.6 All fill and backfill soils should be placed in horizontal loose layers approximately 6 to 8 inches thick, moisture conditioned to optimum moisture content and properly compacted to 90 percent of the laboratory maximum dry density in accordance with ASTM D 1557 (latest edition).

7.4.7 It is anticipated that stable excavations for the proposed construction activities can be achieved with sloping measures. However, if excavations in close proximity to an adjacent property line and/or structure are required, special excavation measures may be necessary in order to maintain lateral support of offsite improvements. Excavation recommendations are provided in the *Temporary Excavations* section of this report (Section 7.14).

7.4.8. Where new paving is to be placed, it is recommended that unsuitable or soft existing fill and alluvial soils be excavated and properly compacted for paving support. As a minimum, the upper 12 inches of subgrade soil should be scarified, moisture conditioned to optimum moisture content, and compacted to at least 95 percent relative compaction for paving support. Paving recommendations are provided in *Preliminary Pavement Recommendations* section of this report (see Section 7.13).

7.4.9 Utility trenches should be properly backfilled in accordance with the requirements of the Green Book (latest edition). The pipe should be bedded with clean sands (Sand Equivalent greater than 30) to a depth of at least 1 foot over the pipe, and the bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). The use of gravel is not acceptable unless used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. The use of 2-sack slurry is also acceptable as backfill. Prior to placing any bedding materials or pipes, the excavation bottom must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon).

7.4.10 Although not anticipated for this project, all imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site. Rocks larger than 6 inches in diameter shall not be used in the fill. If necessary, import soils used as structural fill should have an expansion index less than 20 and corrosivity properties that are equally or less detrimental to that of the existing onsite soils (see Figure B7). If import soils will be utilized in the building pad, the soils must be placed uniformly and at equal thickness at the direction of the Geotechnical Engineer (a representative of Geocon West, Inc.). Soils can be borrowed from non-building pad areas and later replaced with imported soils.

7.4.11 All trench and foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon), prior to placing bedding materials, fill, steel, gravel, or concrete.

7.5 Shrinkage

7.5.1 Shrinkage results when a volume of material removed at one density is compacted to a higher density. A shrinkage factor of up to 10 percent should be anticipated when excavating and compacting the upper 5 feet of existing earth materials on the site to an average relative compaction of 92 percent. In addition, additional shrinkage may occur during the required scarification and compaction of the excavation bottom. The grading contractor should verify shrinkage and earthwork yardage estimates.

7.5.2 If import soils will be utilized in the building pad, the soils must be placed uniformly and at equal thickness at the direction of the Geotechnical Engineer (a representative of Geocon West, Inc.). Soils can be borrowed from non-building pad areas and later replaced with imported soils.

7.6 Conventional Foundation Design

7.6.1 Subsequent to the recommended grading, a conventional shallow spread foundation system may be utilized for support of the proposed structure provided foundations derive support in newly placed engineered fill.

7.6.2 Continuous footings may be designed for an allowable bearing capacity of 2,250 pounds per square foot (psf), and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material.

7.6.3 Isolated spread foundations may be designed for an allowable bearing capacity of 2,500 psf, and should be a minimum of 24 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material.

7.6.4 The allowable soil bearing pressure above may be increased by 400 psf and 600 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable soil bearing pressure of 4,000 psf.

7.6.5 The allowable bearing pressures may be increased by one-third for transient loads due to wind or seismic forces.

7.6.6 If depth increases are utilized for perimeter foundations, this office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.

7.6.7 Continuous footings should be reinforced with four No. 4 steel reinforcing bars, two placed near the top of the footing and two near the bottom. Reinforcement for spread footings should be designed by the project structural engineer.

7.6.8 The above foundation dimensions and minimum reinforcement recommendations are based on soil conditions and building code requirements only, and are not intended to be used in lieu of those required for structural purposes.

7.6.9 No special subgrade presaturation is required prior to placement of concrete. However, the slab and foundation subgrade should be sprinkled as necessary; to maintain a moist condition as would be expected in any concrete placement.

7.6.10 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.6.11 This office should be provided a copy of the final construction plans so that the excavation recommendations presented herein could be properly reviewed and revised if necessary.

7.7 Foundation Settlement

7.7.1 The maximum expected static settlement for a structure supported on a conventional foundation system deriving support in the recommended bearing materials and designed with a maximum bearing pressure of 4,000 psf is estimated to be less than 1 inch and occur below the heaviest loaded structural element. Settlement of the foundation system is expected to occur on initial application of loading. Differential settlement is not expected to exceed ½ inch over a distance of 20 feet.

7.7.2 Once the design and foundation loading configurations for the proposed structure proceeds to a more finalized plan, the estimated settlements presented in this report should be reviewed and revised, if necessary. If the final foundation loading configurations are greater than the assumed loading conditions, the potential for settlement should be reevaluated by this office.

7.8 Friction Pile Foundations – Light Standards

7.8.1 Typical light standards are between 10 and 15 feet in height and are supported on pile foundations. Cast-in-place friction piles may be utilized for support of proposed light standards provided foundations derive support in the competent alluvium generally found at or below a depth of 2 feet.

7.8.2 Friction piles should be a minimum of 18 inches in diameter and should be embedded a minimum of 6 feet into the recommended bearing materials. Where not protected from erosion or disturbance, the upper 2 feet of soil should be ignored when calculating axial and lateral capacity.

7.8.3 Friction piles may be designed based on a skin friction capacity of 160 psf. Uplift capacity may be assumed to be ⅔ the axial capacity in compression. Friction piles do not require the complete removal of all loose earth materials from the bottom of the excavation since the end-bearing capacity is not being considered for design. However, a cleanout of the excavation bottom will be required. A one-third increase in the capacity may be used for wind or seismic loads.

7.8.4 For design purposes, an allowable passive value for the soils may be assumed to be 290 psf per foot. The allowable passive value may be doubled for isolated piles placed more than twice the diameter. To develop the full lateral value, provisions should be implemented to assure firm contact between the piles and the surrounding soil. The allowable passive pressure may be increased by up to one-third for transient loads due to wind or seismic forces.

7.8.5 All drilled pile excavations should be continuously observed by personnel of this firm to verify adequate penetration into the recommended bearing materials. The capacity presented is based on the strength of the soils. The compressive and tensile strength of the pile sections should be checked to verify the structural capacity of the piles.

7.9 Deepened Foundation Installation

7.9.1 Casing may be required if caving is experienced in the drilled excavation. The contractor should have casing available prior to commencement of pile excavation. If casing is used, extreme care should be employed so that the pile is not pulled apart as the casing is withdrawn. At no time should the distance between the surface of the concrete and the bottom of the casing be less than 5 feet. Continuous observation of the drilling and pouring of the piles by the Geotechnical Engineer (a representative of Geocon West, Inc.), is required.

7.9.2 Friction piles do not require the complete removal of all loose earth materials from the bottom of the excavation since the end-bearing capacity is not being considered for design. However, a cleanout of the excavation bottom will be required.

7.9.3 Groundwater was not encountered in our field explorations, drilled to a maximum depth of 25½ feet below the existing ground surface. However, should groundwater or seepage be encountered during construction, pile excavations with more than 6 inches of standing water level require the use of a tremie to place the concrete into the bottom of the hole. A tremie shall consist of a water-tight tube, with a hopper at the top. The tube shall be equipped with a device that will close the discharge end and prevent water from entering the tube while it is being charged with concrete. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of the work to prevent water entering the tube and shall be entirely sealed at all times, except when the concrete is being placed. The tremie tube shall be kept full of concrete. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous. The tip of the tremie tube shall always be kept about 5 feet below the surface of the concrete and definite steps and safeguards should be taken to insure that the tip of the tremie tube is never raised above the surface of the concrete.

7.9.4 A special concrete mix should be used for concrete to be placed below water. The design shall provide for concrete with a strength of 1,000 pounds per square inch (psi) over the initial job specification. An admixture that reduces the problem of segregation of paste/aggregates and dilution of paste shall be included. The slump shall be commensurate to any research report for the admixture, provided that it shall also be the minimum for a reasonable consistency for placing when water is present. Extreme care should be employed so that the pile is not pulled

apart as the casing is withdrawn. At no time should the distance between the surface of the concrete and the bottom of the casing be less than 5 feet. Continuous observation of the drilling and pouring of the piles by a representative of this firm is required.

7.9.5 Closely spaced piles should be drilled and filled alternately, with the concrete permitted to set at least 8 hours before drilling an adjacent hole. Pile excavations should be filled with concrete as soon after drilling and inspection as possible; the holes should not be left open overnight unless approved by the Geotechnical Engineer.

7.10 Miscellaneous Foundations

7.10.1 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures which will not be tied to the proposed structure may be supported on conventional foundations bearing on a minimum of 12 inches of newly placed engineered fill which extends laterally at least 12 inches beyond the foundation area. It is essential that proper drainage be maintained in order to minimize settlements in the soils and any foundations supported therein. Where excavation and compaction cannot be performed or is undesirable, and due to the depth of previously placed fill at the site, Geocon should be contacted for additional recommendations.

7.10.2 If the soils exposed in the excavation bottom are soft, compaction of the soft soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative. Miscellaneous foundations may be designed for a bearing value of 1,500 psf, and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade and 12 inches into the recommended bearing material. The allowable bearing pressure may be increased by up to one-third for transient loads due to wind or seismic forces.

7.10.3 Foundation excavations should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated.

7.11 Lateral Design

7.11.1 Resistance to lateral loading may be provided by friction acting at the base of foundations, slabs and by passive earth pressure. An allowable coefficient of friction of 0.45 may be used with the dead load forces in the undisturbed alluvial soils or newly placed engineered fill.

7.11.2 Passive earth pressure for the sides of foundations and slabs poured against undisturbed alluvial soils or newly placed engineered fill soils may be computed as an equivalent fluid having a density of 290 pounds per cubic foot (pcf) with a maximum earth pressure of 2,900 psf. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third.

7.12 Concrete Slabs-On-Grade

7.12.1 Concrete slabs-on-grade subject to vehicle loading should be designed in accordance with the recommendations in the *Preliminary Pavement Recommendations* section of this report (Section 7.13).

7.12.2 Subsequent to the recommended grading, concrete slabs-on-grade for structures, not subject to vehicle loading, should be a minimum of 4 inches thick and minimum slab reinforcement should consist of No. 4 steel reinforcing bars placed 16 inches on center in both horizontal directions. Steel reinforcing should be positioned vertically near the slab midpoint. The finished subgrade for the concrete slab-on-grade must be observed and approved in writing prior to placement of a vapor retarder, reinforcing steel, or concrete.

7.12.3 Slabs-on-grade at the ground surface that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder placed directly beneath the slab. The vapor retarder and acceptable permeance should be specified by the project architect or developer based on the type of floor covering that will be installed. The vapor retarder design should be consistent with the guidelines presented in Section 9.3 of the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06) and should be installed in general conformance with ASTM E 1643 (latest edition) and the manufacturer's recommendations. A minimum thickness of 15 mils extruded polyolefin plastic is recommended; vapor retarders which contain recycled content or woven materials are not recommended. The vapor retarder should have a permeance of less than 0.01 perms demonstrated by testing before and after mandatory conditioning. The vapor retarder should be installed in direct contact with the concrete slab with proper perimeter seal. If the California Green Building Code requirements apply to this project, the vapor retarder should be underlain by 4 inches of clean aggregate. It is important that the vapor retarder be puncture resistant since it will be in direct contact with angular gravel. As an alternative to the clean aggregate suggested in the California Green Building Code, it is our opinion that the concrete slab-on-grade may be underlain by a vapor retarder over 4 inches of clean sand (sand equivalent greater than 30), since the sand will serve a capillary break and will minimize the potential for punctures and damage to the vapor barrier.

7.12.4 For seismic design purposes, a coefficient of friction of 0.45 may be utilized between concrete slabs and subgrade soils without a moisture barrier, and 0.15 for slabs underlain by a moisture barrier.

7.12.5 Exterior slabs for walkways or flatwork, not subject to traffic loads, should be at least 4 inches thick and reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions, positioned near the slab midpoint. Prior to construction of slabs, the upper 12 inches of subgrade should be moistened to optimum moisture content and properly compacted to at least 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition). Crack control joints should be spaced at intervals not greater than 10 feet and should be constructed using saw-cuts or other methods as soon as practical following concrete placement. Crack control joints should extend a minimum depth of one-fourth the slab thickness. The project structural engineer should design construction joints as necessary.

7.12.6 The recommendations of this report are intended to reduce the potential for cracking of slabs due to settlement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to minor soil movement and/or concrete shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.13 Preliminary Pavement Recommendations

7.13.1 Where new paving is to be placed, it is recommended that unsuitable or soft existing fill and alluvial soils be excavated and properly compacted for paving support. The client should be aware that excavation and compaction of all existing fill and soft alluvial soils in the area of new paving is not required; however, paving constructed over existing unsuitable material may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of paving subgrade should be scarified, moisture conditioned to optimum moisture content, and properly compacted to at least 95 percent relative compaction, as determined by ASTM Test Method D 1557 (latest edition).

7.13.2 The following pavement sections are based on an assumed R-Value of 40. Once site grading activities are complete, it is recommended that laboratory testing confirm the properties of the soils serving as paving subgrade prior to placing pavement.

7.13.3 The Traffic Indices listed below are estimates. Geocon does not practice in the field of traffic engineering. The actual Traffic Index for each area should be determined by the project civil engineer. If pavement sections for Traffic Indices other than those listed below are required, Geocon should be contacted to provide additional recommendations. Pavement thicknesses were determined following procedures outlined in the *California Highway Design Manual* (Caltrans). It is anticipated that the majority of traffic will consist of automobile and large truck traffic.

PRELIMINARY PAVEMENT DESIGN SECTIONS

Location	Estimated Traffic Index (TI)	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Automobile Parking and Driveways	4	4.0	4.0
Trash Truck & Fire Lanes	7	4.0	7.0

7.13.4 Asphalt concrete should conform to Section 203-6 of the "*Standard Specifications for Public Works Construction"* (Green Book). Class 2 aggregate base materials should conform to Section 26-1.02A of the "*Standard Specifications of the State of California, Department of Transportation"* (Caltrans). Crushed Miscellaneous Base should conform to Section 200-2.4 of the "*Standard Specifications for Public Works Construction"* (Green Book).

7.13.5 Unless specifically designed and evaluated by the project structural engineer, where exterior concrete paving will be utilized for support of vehicles, it is recommended that the concrete be a minimum of 5 inches of concrete reinforced with No. 3 steel reinforcing bars placed 18 inches on center in both horizontal directions. Concrete paving supporting vehicular traffic should be underlain by a minimum of 4 inches of aggregate base and a properly compacted subgrade. The subgrade and base material should be compacted to 95 percent relative compaction as determined by ASTM Test Method D 1557 (latest edition).

7.13.6 The performance of pavements is highly dependent upon providing positive surface drainage away from the edge of pavements. Ponding of water on or adjacent to the pavement will likely result in saturation of the subgrade materials and subsequent cracking, subsidence and pavement distress. If planters are planned adjacent to paving, it is recommended that the perimeter curb be extended at least 12 inches below the bottom of the aggregate base to minimize the introduction of water beneath the paving.

7.14 Temporary Excavations

7.14.1 Excavations on the order of 5 feet in height are anticipated during grading operations and construction of the foundation excavations. The excavations are expected to expose fill and alluvial soils, which may be subject to caving. Due to the potential for cobbles, the contractor should be prepared for difficult excavation conditions. Vertical excavations up to 5 feet in height may be attempted where not surcharged; however, the contractor should be prepared for caving, sloughing, and raveling in open excavations. Due to the granular nature of soils and potential for caving, the contractor should also be prepared to form foundation excavations at the excavation bottom.

7.14.2 Vertical excavations greater than 5 feet will require sloping and/or shoring measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged slopes could be sloped back at a uniform 1:1 slope gradient or flatter, up to a maximum of 10 feet in height. A uniform slope does not have a vertical portion.

7.14.3 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. Geocon personnel should inspect the soils exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur. All excavations should be stabilized within 30 days of initial excavation.

7.15 Stormwater Infiltration

7.15.1 During the February 4, 2019, site exploration, boring B3 was utilized to perform percolation testing. The boring was advanced to the depth listed in the table below. Slotted casing was placed in the boring, and the annular space between the casing and excavation was filled with filter pack. The boring was then filled with water to pre-saturate the soils. On February 5, 2019, the casing was refilled with water and percolation test readings were performed after repeated flooding of the cased excavation. Based on the test results, the measured percolation rate and design infiltration rate, for the earth materials encountered, are provided in the following table. Based on the test results, the average infiltration rate (adjusted percolation rate) for the earth materials encountered is provided in the following table. The field-measured percolation rate has been adjusted to infiltration rates in accordance with the County of San Bernardino *Technical Guidance Document for Water Quality Management Plans* (June 2013). Additional correction factors may be required and should be applied by the engineer in responsible charge of the design of the stormwater infiltration system and based on applicable guidelines. The percolation test data sheet is provided as Figure 5.

Boring	Soil Type	Infiltration Depth (ft)	Average Infiltration Rate (in / hour)
B3	Sand (SP)	5-10	10.1

7.15.2 The results of the percolation testing indicate that soils at the location and depths listed in the table above are conductive to infiltration, and it is our opinion that the site is suitable for infiltration of stormwater at the location tested above. Due to the presence of hydro-collapsible soils located in boring B2, infiltration should not be conducted near this boring. If infiltration is planned for any location other than where the above testing was performed, additional onsite and laboratory testing may be required.

7.15.3 It is our further opinion that infiltration of stormwater and will not induce excessive hydro-consolidation at the location of percolation testing (see Figure B5), will not create a perched groundwater condition, will not affect soil structure interaction of existing or proposed foundations due to expansive soils, will not saturate soils supported by existing retaining walls, and will not increase the potential for liquefaction. Resulting settlements are anticipated to be less than ¼ inch, if any. If infiltration is planned for any location other than where the above testing was performed, additional onsite and laboratory testing may be required.

7.15.4 The infiltration system must be located such that the closest distance between an adjacent foundation is at least 10 feet in all directions from the zone of saturation. The zone of saturation may be assumed to project downward from the discharge of the infiltration facility at a gradient of 1:1. Additional property line or foundation setbacks may be required by the governing jurisdiction and should be incorporated into the stormwater infiltration system design as necessary.

7.15.5 Subsequent to the placement of the infiltration system, it is acceptable to backfill the resulting void space between the excavation sidewalls and the infiltration system with minimum two-sack slurry provided the slurry is not placed in the infiltration zone. It is recommended that pea gravel be utilized adjacent to the infiltration zone so communication of water to the soil is not hindered.

7.15.6 The design drawings should be reviewed and approved by the Geotechnical Engineer. The installation of the stormwater infiltration system should be observed and approved in writing by the Geotechnical Engineer (a representative of Geocon).

7.16 Surface Drainage

7.16.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the original designed engineering properties. Proper drainage should be maintained at all times.

7.16.2 All site drainage should be collected and controlled in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation or retaining wall. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, drainage should not be allowed to flow uncontrolled over any descending slope. Discharge from downspouts, roof drains and scuppers are not recommended onto unprotected soils within 5 feet of the building perimeter. Planters which are located adjacent to foundations should be sealed to prevent moisture intrusion into the soils providing foundation support. Landscape irrigation is not recommended within 5 feet of the building perimeter footings except when enclosed in protected planters.

7.16.3 Positive site drainage should be provided away from structures, pavement, and the tops of slopes to swales or other controlled drainage structures. The building pad and pavement areas should be fine graded such that water is not allowed to pond.

7.16.4 Landscaping planters immediately adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Either a subdrain, which collects excess irrigation water and transmits it to drainage structures, or an impervious above-grade planter boxes should be used. In addition, where landscaping is planned adjacent to the pavement, it is recommended that consideration be given to providing a cutoff wall along the edge of the pavement that extends at least 12 inches below the base material.

7.17 Plan Review

7.17.1 Grading, shoring, and foundation plans should be reviewed by the Geotechnical Engineer (a representative of Geocon West, Inc.), prior to finalization to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon West, Inc. should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon West, Inc.

2. This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

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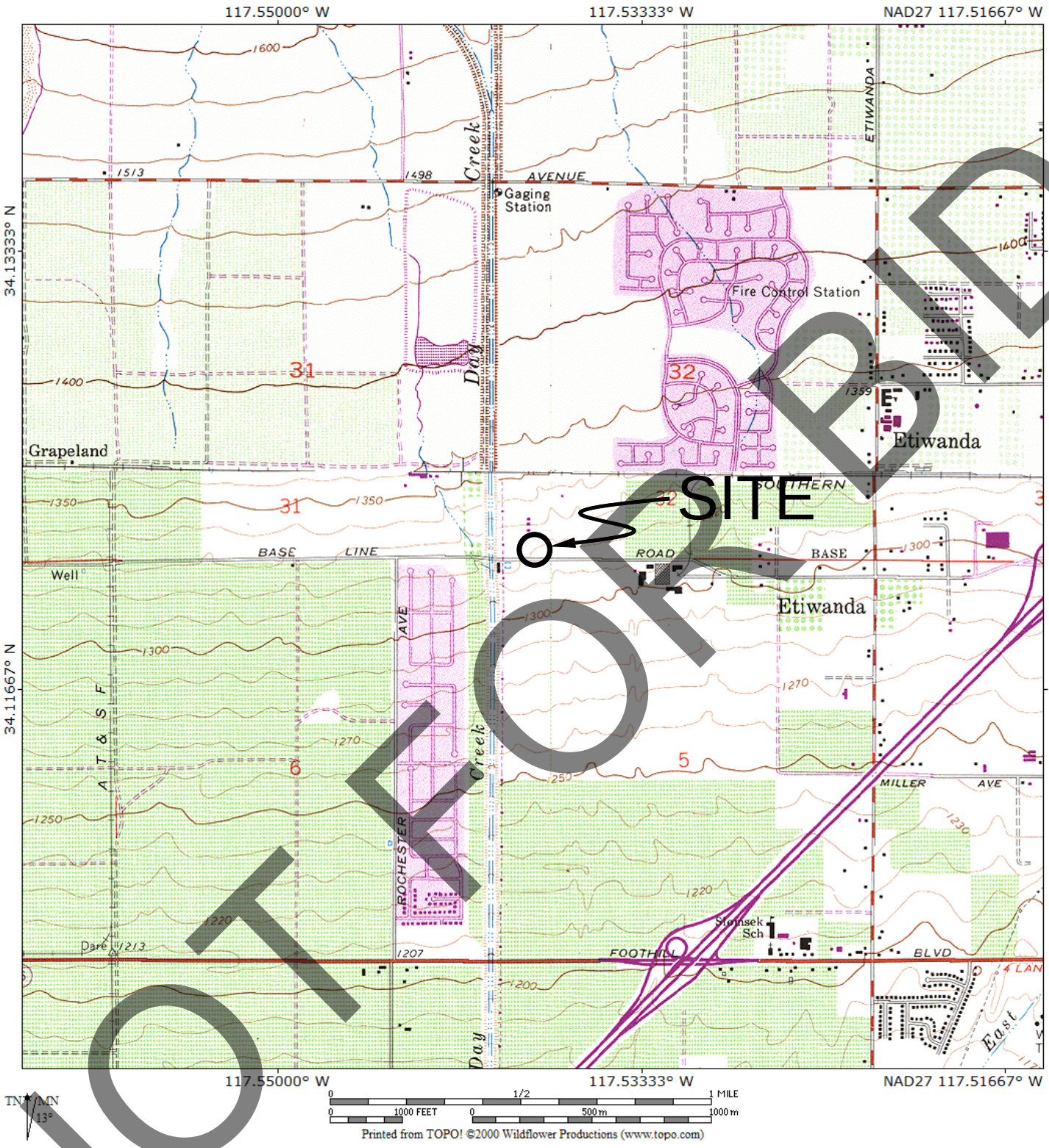

U.S.G.S. TOPOGRAPHIC MAPS, 7.5 MINUTE SERIES, GUASTI, CA QUADRANGLE

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DRAFTED BY: CB | CHECKED BY: SFK

VICINITY MAP

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019 | PROJECT NO. A9816-99-01 | FIG. 1

LEGEND

B5 Approximate Location of Boring

Approximate Limits of Proposed Improvements

Approximate Location of Proposed Structure

0 80' 160'

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SITE PLAN

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019	PROJECT NO. A9816-99-01	FIG. 2

Reference: Jennings, C.W. and Bryant, W. A., 2010, Fault Activity Map of California, California Geological Survey Geologic Data Map No. 6.

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION: ON LAND	DESCRIPTION: OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	200			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	11,700			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary		700,000			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			1,600,000* / 4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

0 12 24 Miles

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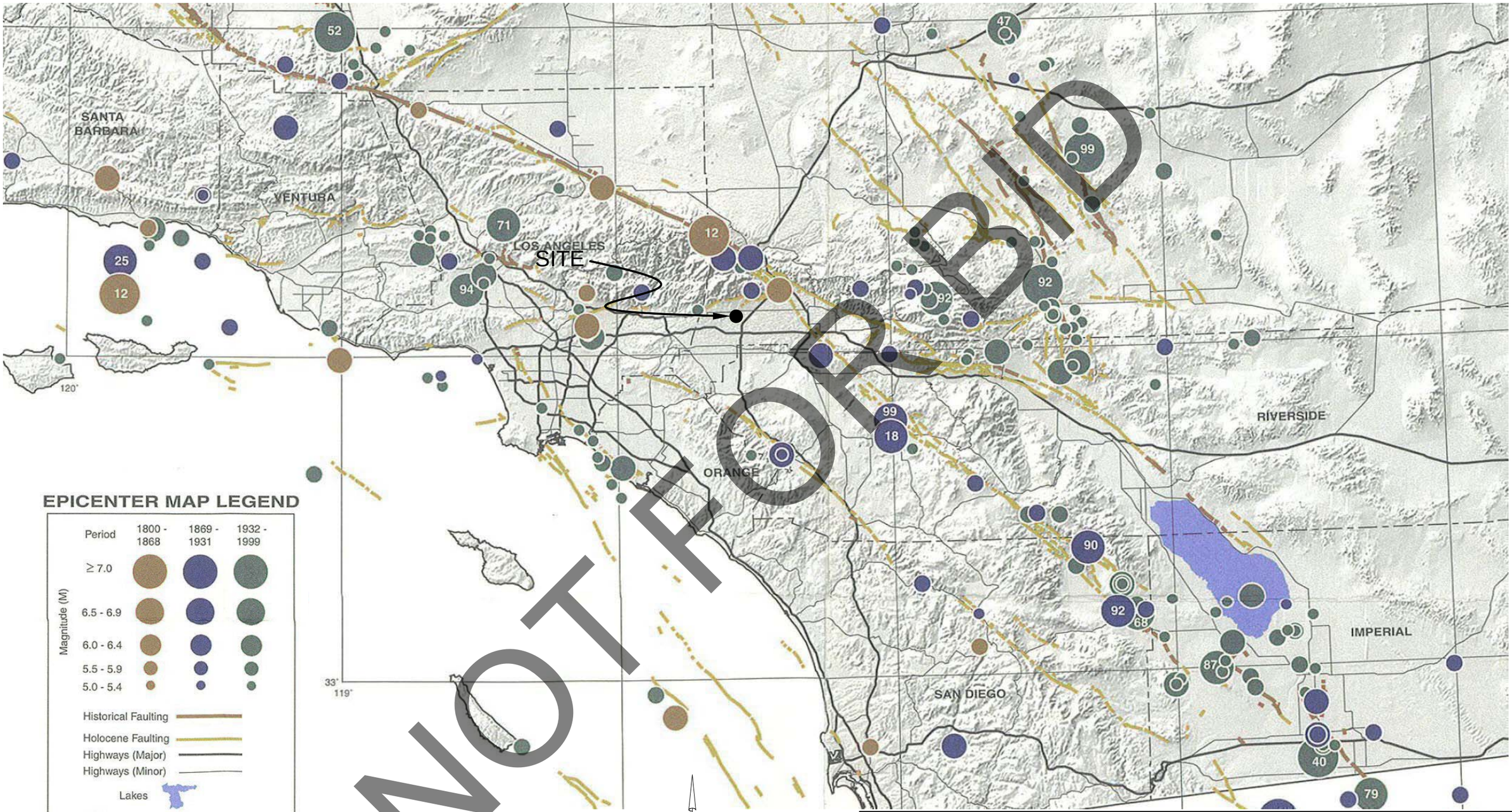
REGIONAL FAULT MAP

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019 | PROJECT NO. A9816-99-01 | FIG. 3



EPICENTER MAP LEGEND

Period	1800 - 1868	1869 - 1931	1932 - 1999
Magnitude (M) ≥ 7.0			
6.5 - 6.9			
6.0 - 6.4			
5.5 - 5.9			
5.0 - 5.4			

Historical Faulting

Holocene Faulting

Highways (Major)

Highways (Minor)

Lakes

65 Last two digits of M ≥ 6.5 earthquake year

Reference: Toppozada, T., Branum, D., Petersen, M., Hallstrom, C., Cramer, C., and Reichle, M., 2000, Epicenters and Areas Damaged by M≥5 California Earthquakes, 1800 - 1999, California Geological Survey, Map Sheet 49.

N

0 20 40 Miles

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REGIONAL SEISMICITY MAP

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019 | PROJECT NO. A9916-99-01 | FIG.4

PERCOLATION TEST DATA SHEET

Project:	Rancho Public Works Yard	Project No:	A9816-99-01	Date:	2/5/2019
Test Hole No:	B3	Tested By:	JS		
Depth of Test Hole, D_T:	10	USCS Soil Classification:	SP with gravel		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round) =	8	Sides (if rectangular) =	---	---	

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (in)	D_f Final Depth to Water (in)	ΔD Change in Water Level (in)	Greater than or Equal to 6"? (y/n)
1	8:09	8:34	25	71.4	111.4	40.0	yes
2	8:38	9:03	25	63.6	109.6	46.0	yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements, taken every 10 minutes. Otherwise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_0 Initial Depth to Water (in)	D_f Final Depth to Water (in)	ΔD Change in Water Level (in)	Percolation Rate (min/in)
1	9:05	9:15	10	56.8	99.0	42.2	341
2	9:17	9:27	10	64.6	99.8	35.3	408
3	9:30	9:40	10	64.0	99.4	35.4	407
4	9:42	9:52	10	65.4	98.9	33.5	430
5	9:55	10:05	10	63.2	98.9	35.6	404
6	10:07	10:17	10	63.2	98.4	35.2	410

Infiltration Rate Calculation:

Time Interval, Δt =	10	minutes	Ho =	54.6	inches
Final Depth to Water, Df =	98.9	inches	Hf =	21.1	inches
Test Hole Radius, r =	4	inches	ΔH =	33.5	inches
Initial Depth to Water, Do =	65.4	inches	Havg =	37.9	inches
Total Depth of Test Hole, DT =	120.0	inches			

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

Infiltration Rate, It = **10.1** inches/hour

FIGURE 5

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The site was explored on February 4, 2019, by excavating five 8-inch diameter borings to depths between 5½ and 25½ feet below the existing ground surface utilizing a truck-mounted hollow-stem auger drilling machine. Representative and relatively undisturbed samples were obtained by driving a 3-inch O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound auto-hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch high by 2⅜-inch diameter brass rings to facilitate soil removal and testing. Bulk samples were also obtained.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). The logs of the borings are presented on Figures A1 though A5. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the logs were revised based on subsequent laboratory testing. The locations of the borings are shown on Figure 2.

PROJECT NO. A9816-99-01

BORING 1

ELEV. (MSL.) -- DATE COMPLETED **02/04/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**UNPAVED, SAND WITH FINE TO COARSE GRAVEL** **ARTIFICIAL FILL** Sand, poorly graded, medium dense, moist, brown, fine- to medium-grained, trace fine to medium gravel.			
2	B1@2.5'				**ALLUVIUM** Poorly Graded Sand with Gravel, medium dense, brown, moist, medium- to coarse-grained, fine to medium gravel.	48	124.5	3.9
4								
6	B1@5'			SP		26	115.5	4.2
8	BULK 7-11' B1@7.5'				- light brown	41	116.0	2.0
10	B1@10'				Gravel with Sand, dense, slightly moist, light brown, fine- to medium-grained, fine to coarse gravel.	55	105.5	1.3
12	B1@12.5'				- yellowish brown, coarse gravel, cobble fragments	68	124.0	3.2
14								
16	B1@15'			GW	- very dense, light brown, coarse-grained	50(6")	124.2	2.4
18								
20	B1@20'				- no recovery	50(2")		

Total depth of boring: 20.5 feet.
Fill to 1.5 feet.
No groundwater encountered.
Backfilled with soil cuttings.
Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

A9816-99-01 BORING LOGS.GPJ

Figure A1,
Log of Boring 1, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. A9816-99-01

BORING 2

ELEV. (MSL.) -- DATE COMPLETED **02/04/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**GRAVEL, FINE TO COARSE GRAINED, SOME COBBLES ARTIFICIAL FILL** Sand, poorly graded, medium dense slighty moist, brown, fine- to medium-grained, fine to medium gravel.			
2								
4	B2@3'				- loose	7	98.1	6.6
					ALLUVIUM Silty Sand, medium dense, slightly moist to moist, brown, fine-grained.			
6	B2@6'			SM		36	123.6	4.5
8					Poorly Graded Sand and Gravel, dense, slightly moist, light brown, coarse-grained sand, fine gravel, cobble fragment.			
10	B2@9'					67	125.8	3.4
12	B2@12'			SP	- very dense, some cobble fragments	50(6")		0.9
14								
16	B2@15'					50(4")		1.1
	B2@17'				- no recovery	50(3")		
18								
20	B2@20'			SP	Sand, poorly graded, medium dense, moist, brown, fine-grained, fine to coarse gravel, some clay.	32	110.6	16.3

Total depth of boring: 20.5 feet.
Fill to 4 feet.
No groundwater encountered.
Backfilled with soil cuttings.
Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

A9816-99-01 BORING LOGS.GPJ

Figure A2,
Log of Boring 2, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◪ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. A9816-99-01

BORING 3

ELEV. (MSL.) -- DATE COMPLETED **02/04/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**GRAVEL, COARSE GRAINED, COBBLES**			
					ARTIFICIAL FILL			
2					Silty Sand, medium dense, dry, light brown, fine-grained, trace fine gravel.			
	B3@2.5'			SW	**ALLUVIUM** Well-Graded Sand with Gravel, medium dense, dry to slightly moist, light brown, well-graded sand, fine gravel.	27	111.1	1.2
4					Sand, poorly graded, medium dense, dry to slightly moist, light brown, fine- to medium-grained, some fine gravel.			
	B3@5'					45	107.9	3.2
6								
8								
10	B3@10'				- very dense, some cobble fragments	50(4")		0.5
12								
				SP				
14								
	B3@15'					50(5")		0.3
16								
18								
20	B3@20'				- dense, moist, dark yellowish brown, medium- to coarse-grained	79	121.6	5.7
22								
					Clayey Sand, dense, moist, dark yellowish brown, fine-grained.			
24				SC				
	B3@25'			SP	Sand, poorly graded, very dense, moist, light brown, coarse-grained.	50(4")	112.2	10.0
					Total depth of boring: 25.5 feet.			
					Fill to 1.5 feet.			
					No groundwater encountered.			
					Percolation testing performed.			
					Backfilled with soil cuttings.			
					Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.			

A9816-99-01 BORING LOGS.GPJ

Figure A3,
Log of Boring 3, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. A9816-99-01

BORING 4

ELEV. (MSL.) -- DATE COMPLETED **02/04/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**2" AC** **ARTIFICIALL FILL** Silty Sand, medium dense, moist, brown, fine-grained.			
2	B4@2.5'			SP	**ALLUVIUM** Poorly Graded Sand with Gravel, dense, slightly moist, brown, coarse-grained, fine to coarse gravel, trace cobble fragments.	72	105.5	10.5
4	B4@5'				- medium- to coarse-grained	57		2.1

Total depth of boring: 5.5 feet.
Fill to 1.5 feet.
No groundwater encountered.
Backfilled with soil cuttings.
Surface restored.
Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

A9816-99-01 BORING LOGS.GPJ

Figure A4,
Log of Boring 4, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◥ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. A9816-99-01

BORING 5

ELEV. (MSL.) -- DATE COMPLETED **02/04/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JS**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT)*	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**COARSE GRAVEL, COBBLES** **ARTIFICIAL FILL** Silty Sand, medium dense, moist, brown, fine- to medium-grained, some fine gravel.			
2	B5@2.5'			SP	**ALLUVIUM** Poorly Graded Sand with Gravel, dense, moist, dark brown, medium- to coarse-grained, fine gravel.	72	110.8	8.2
4	B5@5'			SP	Sand, poorly graded, medium dense, slightly moist, brown, fine- to medium-grained, some fine gravel.	37	115.5	3.2

Total depth of boring: 5.5 feet.
Fill to 1.75 feet.
No groundwater encountered.
Backilled with soil cuttings.
Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

A9816-99-01 BORING LOGS.GPJ

Figure A5,
Log of Boring 5, Page 1 of 1

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ◧ ... STANDARD PENETRATION TEST
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◹ ... CHUNK SAMPLE
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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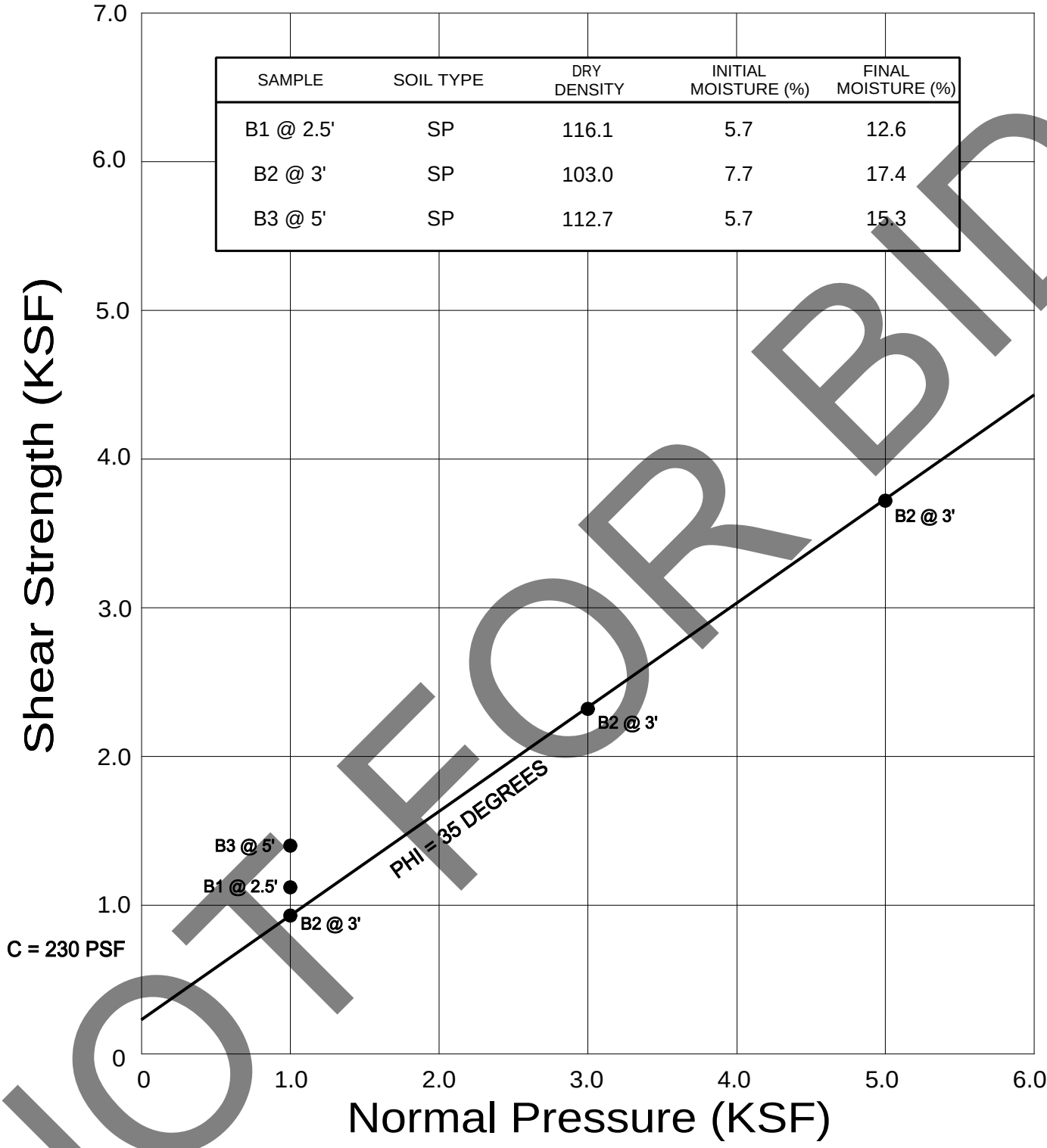
APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the "American Society for Testing and Materials (ASTM)", or other suggested procedures. Selected samples were tested for direct shear strength, moisture density relationship, corrosivity and in-place dry density and moisture content. The results of the laboratory tests are summarized in Figures B1 through B7. The in-place dry density and moisture content of the samples tested are presented on the boring logs, Appendix A.

SAMPLE	SOIL TYPE	DRY DENSITY	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1 @ 2.5'	SP	116.1	5.7	12.6
B2 @ 3'	SP	103.0	7.7	17.4
B3 @ 5'	SP	112.7	5.7	15.3



● Direct Shear, Saturated

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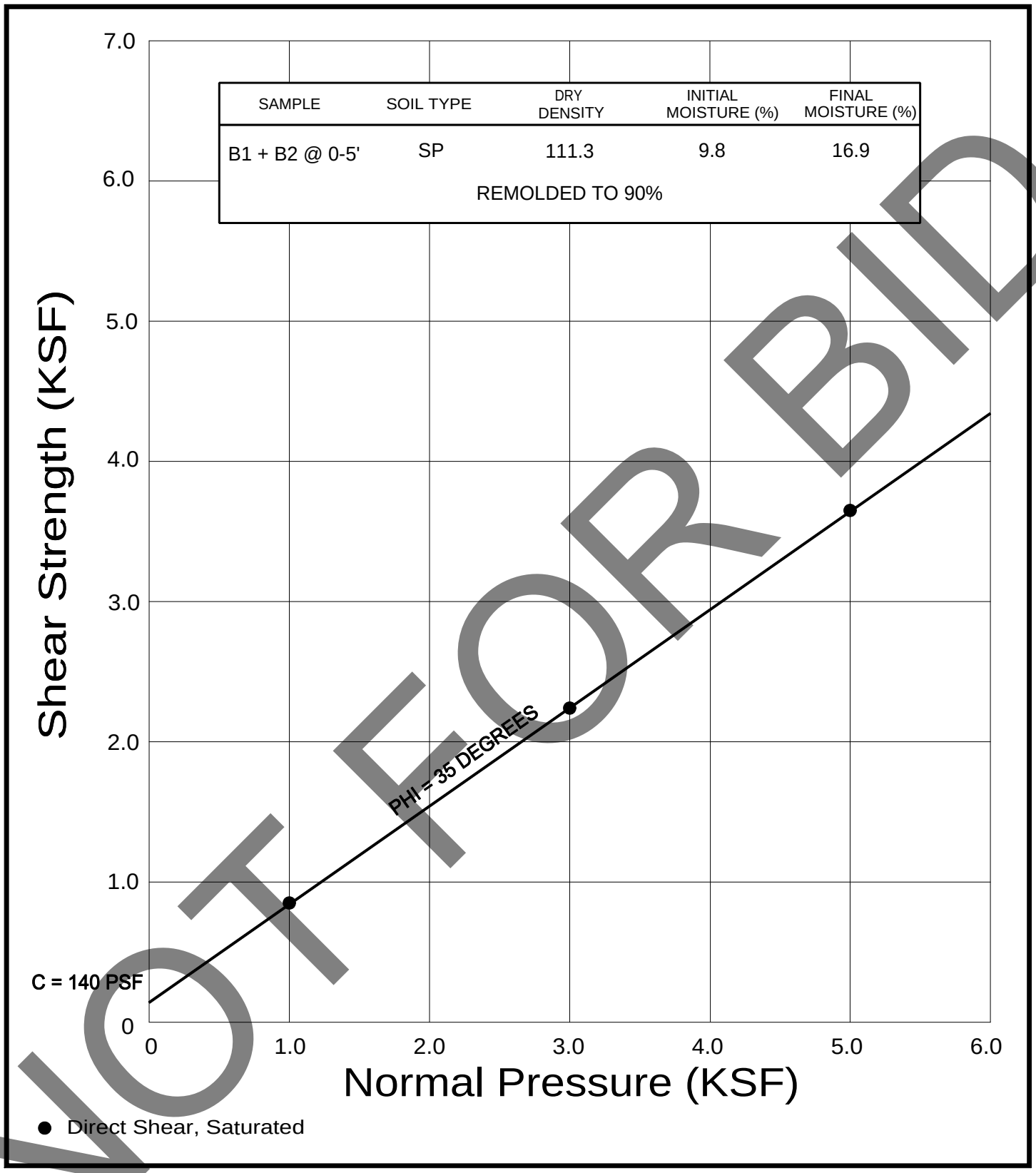
DRAFTED BY: JS | CHECKED BY: JTA

DIRECT SHEAR TEST RESULTS

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019 | PROJECT NO. A9816-99-01 | FIG. B1



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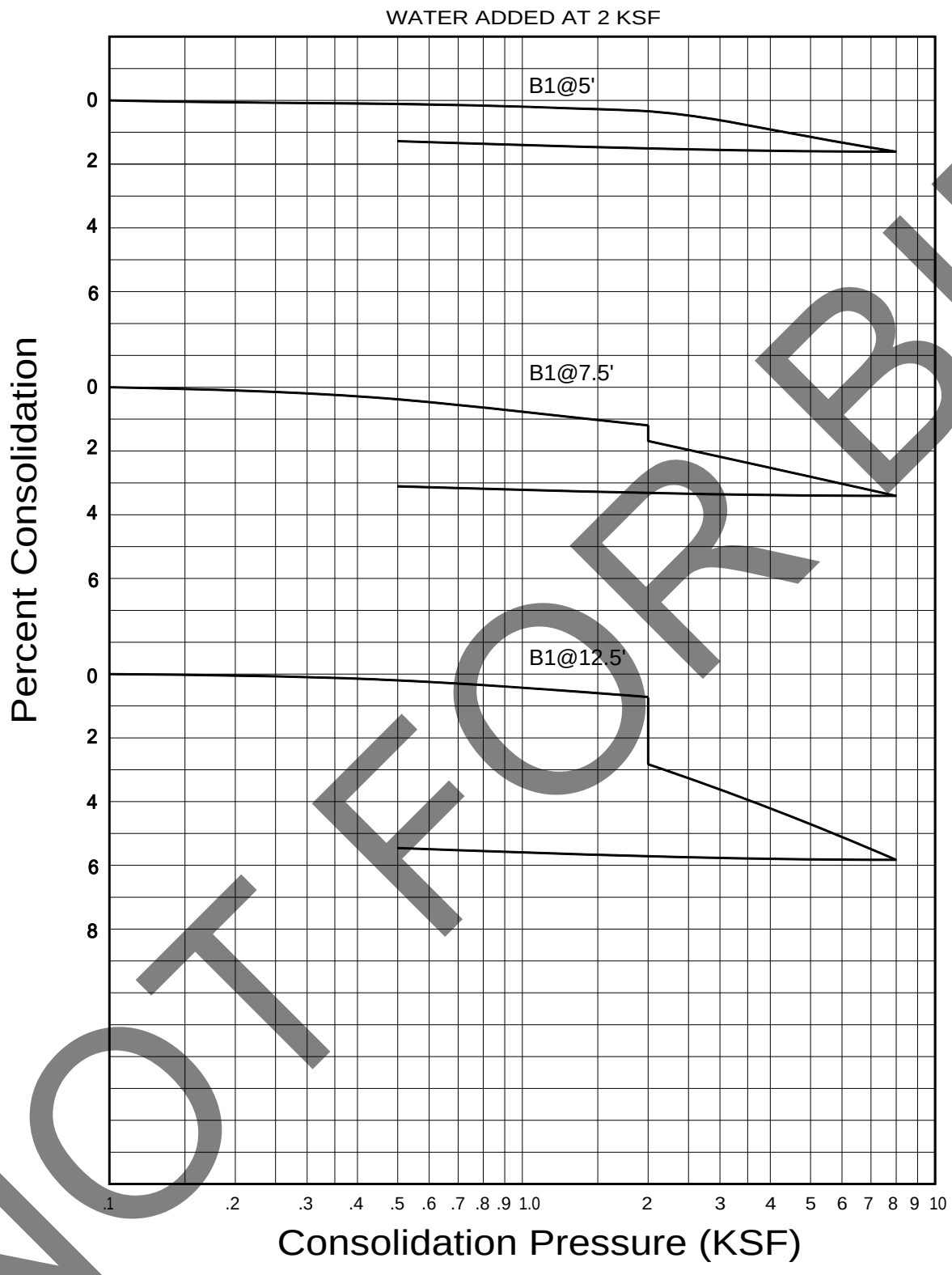
DIRECT SHEAR TEST RESULTS

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019	PROJECT NO. A9816-99-01	FIG. B2



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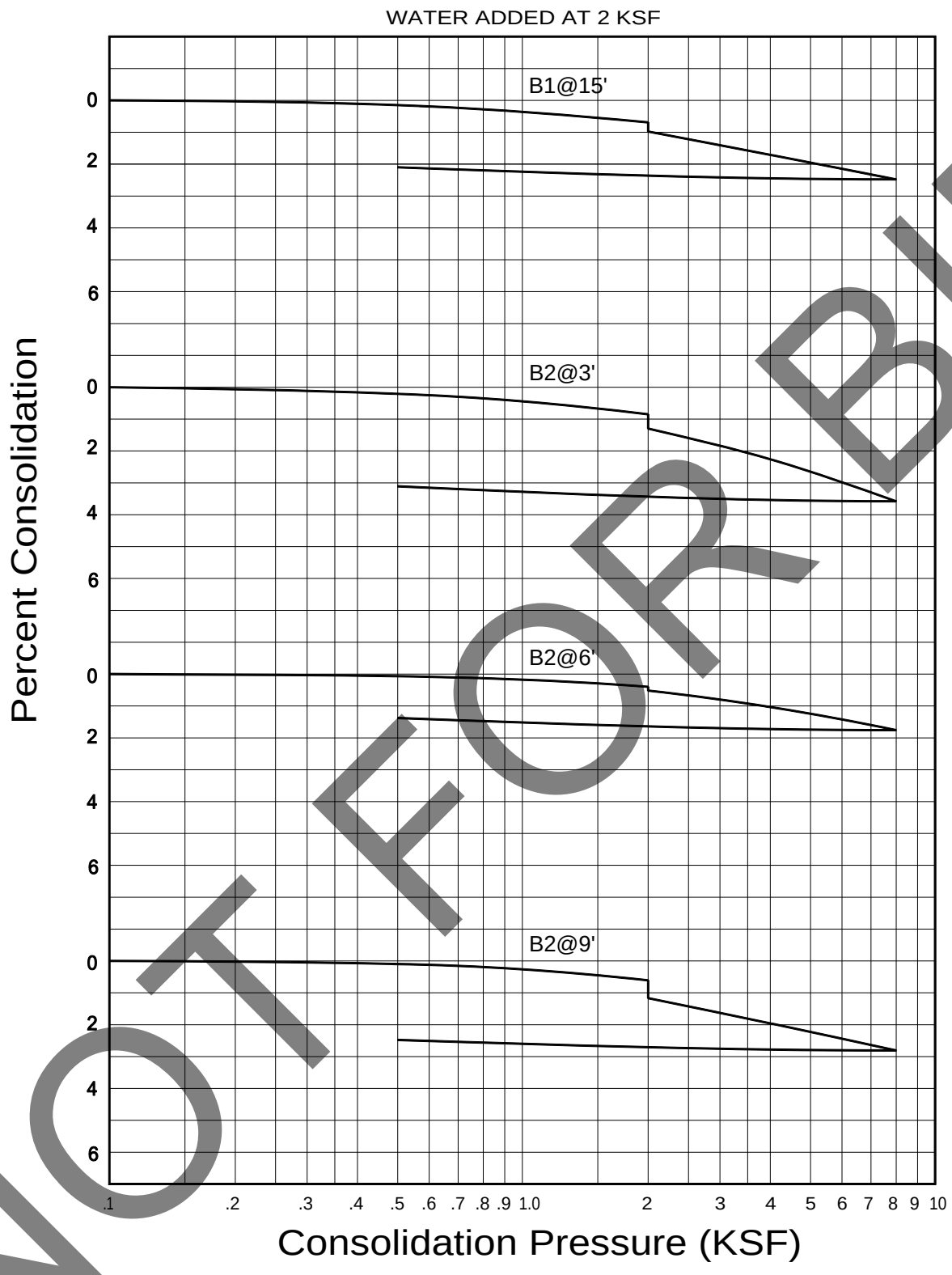
CONSOLIDATION TEST RESULTS

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019	PROJECT NO. A9816-99-01	FIG. B3



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CONSOLIDATION TEST RESULTS

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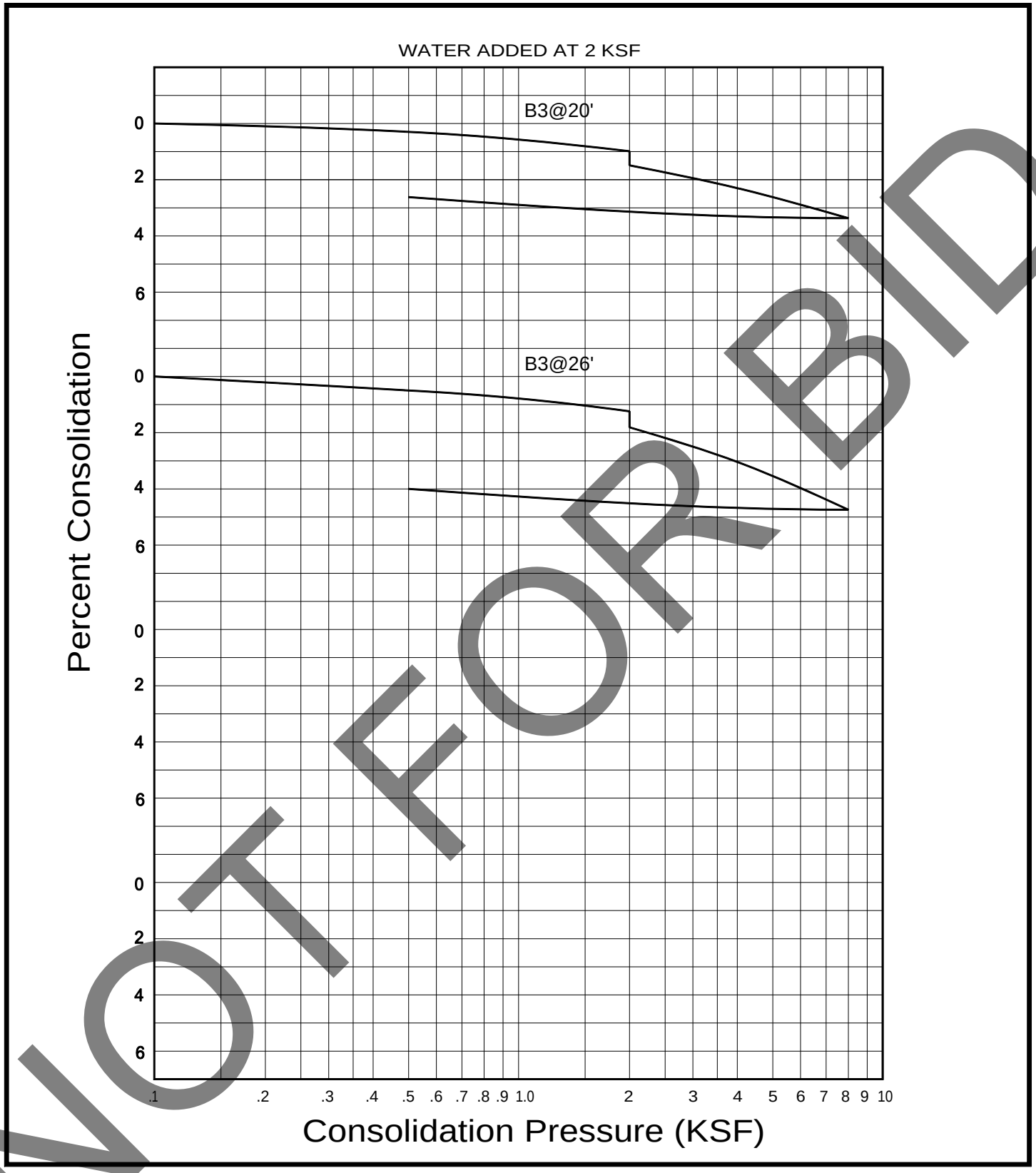
MARCH 2019	PROJECT NO. A9816-99-01	FIG. B4



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CONSOLIDATION TEST RESULTS

12158 BASELINE ROAD
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MARCH 2019	PROJECT NO. A9816-99-01	FIG. B5

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829-11

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	*UBC Classification	**CBC Classification
	Before	After				
B1 & B2 MIX @ 0-5'	7.6	12.7	118.2	0	Very Low	Non-Expansive

* Reference: 1997 Uniform Building Code, Table 18-I-B.

** Reference: 2016 California Building Code, Section 1803.5.3

SUMMARY OF LABORATORY MAXIMUM DENSITY AND AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557-12

Sample No.	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture (%)
B1 & B2 MIX @ 0-5'	Olive Brown Poorly Graded Sand with Silt & Gravel	132.5	6.0

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LABORATORY TEST RESULTS

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019 | PROJECT NO. A9816-99-01 | FIG. B6

SUMMARY OF LABORATORY POTENTIAL OF HYDROGEN (pH) AND RESISTIVITY TEST RESULTS CALIFORNIA TEST NO. 643

Sample No.	pH	Resistivity (ohm centimeters)
B1 & B2 MIX @ 0-5'	7.84	13,000 (Mildly Corrosive)

SUMMARY OF LABORATORY CHLORIDE CONTENT TEST RESULTS EPA NO. 325.3

Sample No.	Chloride Ion Content (%)
B1 & B2 MIX @ 0-5'	0.006

SUMMARY OF LABORATORY WATER SOLUBLE SULFATE TEST RESULTS CALIFORNIA TEST NO. 417

Sample No.	Water Soluble Sulfate (% SO_4)	Sulfate Exposure*
B1 & B2 MIX @ 0-5'	0.002	S0

* Reference: 2016 California Building Code, Section 1904.3 and ACI 318-11 Section 4.3.

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CORROSIVITY TEST RESULTS

12158 BASELINE ROAD
RANCHO CUCAMONGA, CALIFORNIA

MARCH 2019 | PROJECT NO. A9816-99-01 | FIG. B7

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Bernardino County Southwestern Part, California

November 4, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

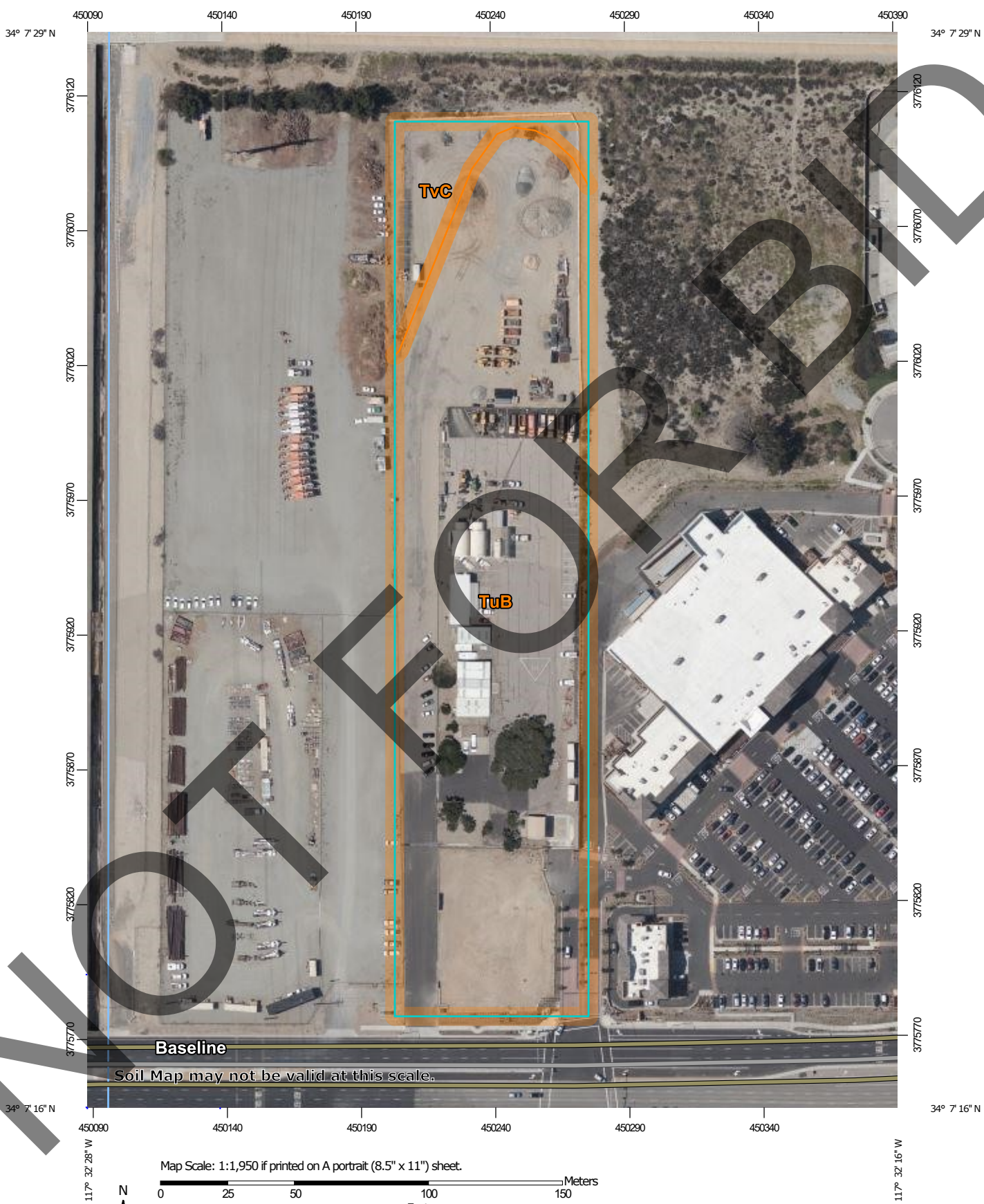
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:1,950 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 12, May 27, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 10, 2018—Jun 5, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
TuB	Tujunga loamy sand, 0 to 5 percent slopes	5.5	92.1%
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	0.5	7.9%
Totals for Area of Interest		**5.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County Southwestern Part, California

TuB—Tujunga loamy sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2sx6y
Elevation: 650 to 3,110 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 62 to 65 degrees F
Frost-free period: 325 to 365 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Tujunga, loamy sand, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga, Loamy Sand

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

A - 0 to 6 inches: loamy sand
C1 - 6 to 18 inches: loamy sand
C2 - 18 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Tujunga, gravelly loamy sand

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: No

Hanford, sandy loam

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: hcl2
Elevation: 10 to 1,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Tujunga and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 36 inches: gravelly loamy sand
H2 - 36 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 5 percent
Landform: Drainageways
Hydric soil rating: Yes

Soboba, gravelly loamy sand

Percent of map unit: 5 percent
Hydric soil rating: No

Delhi, fine sand

Percent of map unit: 5 percent
Hydric soil rating: No

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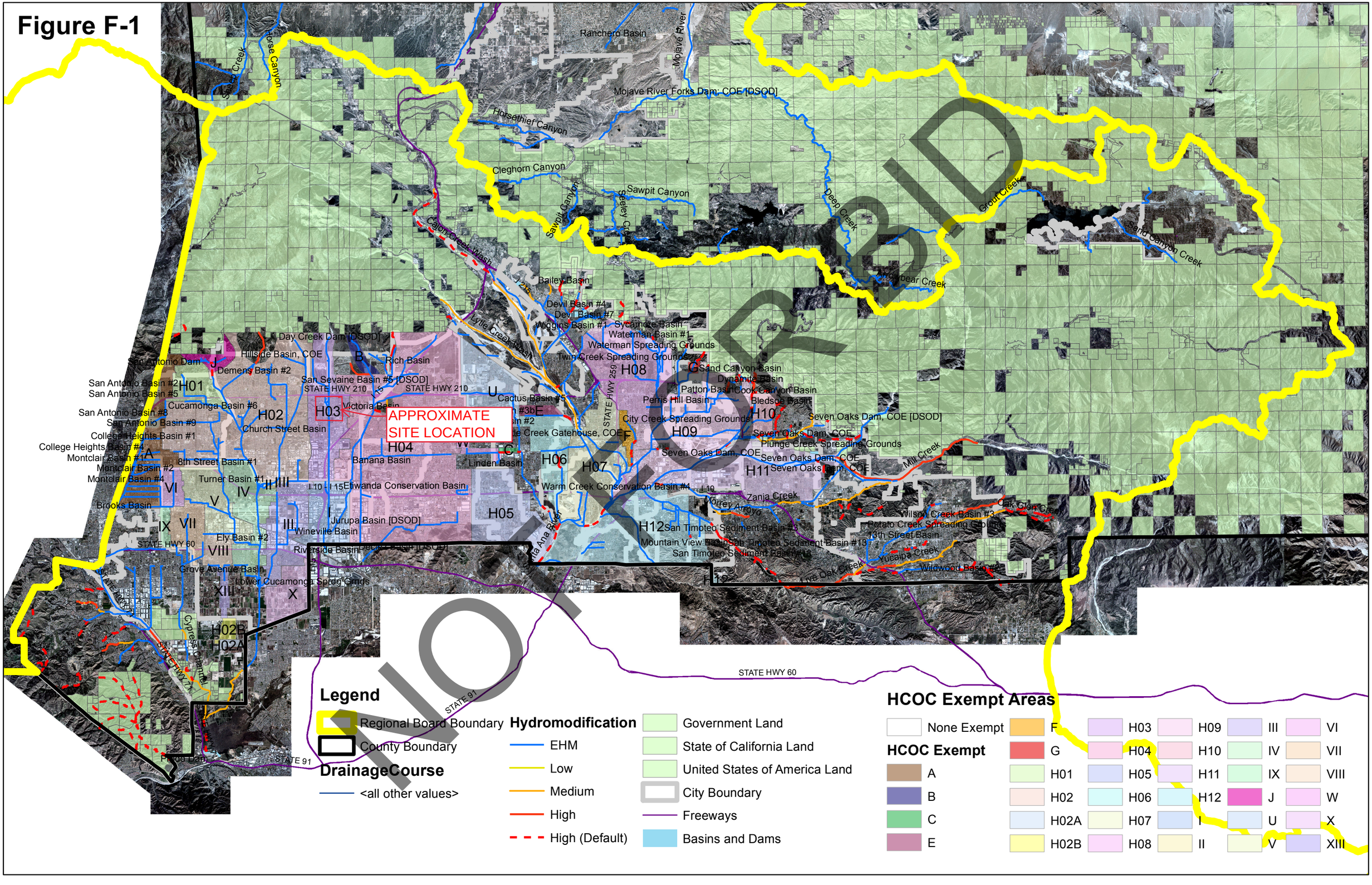
Appendix -E
HCOC Exemption Map

Figure F-1


APPROXIMATE SITE LOCATION
Ranchero Basin
Mojave River
Mojave River Forks Dam, COE [DSOD]
Horsethief Canyon
Cleghorn Canyon
Sawpit Canyon
Deep Creek
Grout Creek
Bear Canyon Creek
Big Bear Creek
Caion Creek Wash
Lytle Creek Wash
Bailey Basin
Devil Basin #4
Devil Basin #7
Wiggins Basin #1
Sycamore Basin
Waterman Basin #1
Waterman Spreading Grounds
Twin Creek Spreading Grounds
Day Creek Dam [DSOD]
Hillside Basin, COE
San Antonio Dam
Demens Basin #2
Rich Basin
San Sevaine Basin #5 [DSOD]
STATE HWY 210
San Antonio Basin #2
San Antonio Basin #5
Cucamonga Basin #6
San Antonio Basin #8
San Antonio Basin #9
College Heights Basin #1
College Heights Basin #4
Montclair Basin #1
Montclair Basin #2
Montclair Basin #4
Church Street Basin
8th Street Basin #1
Turner Basin #1
Victoria Basin
Cactus Basin #5
Cactus Basin #3b
Basin #2
Lytle Creek Gatehouse, COE
Banana Basin
Linden Basin
Etiwanda Conservation Basin
Warm Creek Conservation Basin #4
Jurupa Basin [DSOD]
Wineville Basin
Riverside Basin
Declez Basin [DSOD]
Ely Basin #2
Grove Avenue Basin
Lower Cucamonga Spreading Grnds
Brooks Basin
STATE HWY 60
Cypress Channel
STATE HWY 71
Prado Dam
STATE 91
I 10
I 15
I 215
STATE HWY 259
Sand Canyon Basin
Dynamite Basin
Patton Basin
Cook Canyon Basin
Perris Hill Basin
Bledsoe Basin
City Creek Spreading Grounds
Seven Oaks Dam, COE [DSOD]
Seven Oaks Dam, COE
Plunge Creek Spreading Grounds
Mill Creek
Zania Creek
Morrey Arroyo
Oak Glen Creek
Wilson Creek Basin #3
Potato Creek Spreading Grounds
13th Street Basin
San Timoteo Sediment Basin #9
Mountain View Basin
San Timoteo Sediment Basin #19
San Timoteo Sediment Basin #8
Yucaipa Creek
Wildwood Basin #2
Live Oak Creek
Santa Ana River
STATE HWY 60
STATE 91
Legend
Regional Board Boundary
County Boundary
DrainageCourse
<all other values>
Hydromodification
EHM
Low
Medium
High
High (Default)
Government Land
State of California Land
United States of America Land
City Boundary
Freeways
Basins and Dams
HCOC Exempt Areas
None Exempt
HCOC Exempt
A
B
C
E
F
G
H01
H02
H02A
H02B
H03
H04
H05
H06
H07
H08
H09
H10
H11
H12
I
II
III
IV
V
VI
VII
VIII
IX
J
U
W
X
XIII
DRAFT
NOT

Hydromodification

Project is exempt

Appendix -F
NOAA 14 Point of Precipitation Frequency

NOAA Atlas 14, Volume 6, Version 2
Location name: Rancho Cucamonga, California, USA*
Latitude: 34.1236°, Longitude: -117.539°
Elevation: 1337.07 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.123** (0.103-0.149)	**0.162** (0.135-0.197)	**0.213** (0.177-0.259)	**0.254** (0.209-0.311)	**0.308** (0.245-0.392)	**0.350** (0.272-0.455)	**0.392** (0.297-0.522)	**0.435** (0.321-0.597)	**0.493** (0.348-0.706)	**0.538** (0.367-0.799)
10-min	**0.176** (0.147-0.214)	**0.233** (0.193-0.282)	**0.305** (0.253-0.371)	**0.363** (0.299-0.446)	**0.442** (0.351-0.562)	**0.502** (0.390-0.652)	**0.562** (0.426-0.749)	**0.624** (0.460-0.856)	**0.707** (0.499-1.01)	**0.772** (0.525-1.15)
15-min	**0.213** (0.178-0.259)	**0.281** (0.234-0.341)	**0.369** (0.306-0.449)	**0.439** (0.362-0.540)	**0.534** (0.425-0.679)	**0.607** (0.472-0.788)	**0.680** (0.515-0.906)	**0.755** (0.556-1.03)	**0.855** (0.603-1.23)	**0.933** (0.635-1.39)
30-min	**0.311** (0.259-0.377)	**0.410** (0.341-0.498)	**0.537** (0.446-0.654)	**0.640** (0.527-0.786)	**0.779** (0.619-0.990)	**0.884** (0.687-1.15)	**0.991** (0.751-1.32)	**1.10** (0.810-1.51)	**1.25** (0.879-1.78)	**1.36** (0.926-2.02)
60-min	**0.456** (0.380-0.553)	**0.601** (0.500-0.730)	**0.789** (0.654-0.960)	**0.940** (0.773-1.15)	**1.14** (0.908-1.45)	**1.30** (1.01-1.69)	**1.45** (1.10-1.94)	**1.61** (1.19-2.21)	**1.83** (1.29-2.62)	**2.00** (1.36-2.96)
2-hr	**0.707** (0.589-0.858)	**0.929** (0.772-1.13)	**1.21** (1.00-1.47)	**1.43** (1.18-1.75)	**1.72** (1.36-2.18)	**1.93** (1.50-2.51)	**2.14** (1.63-2.86)	**2.36** (1.74-3.23)	**2.64** (1.86-3.78)	**2.85** (1.94-4.23)
3-hr	**0.915** (0.762-1.11)	**1.20** (0.997-1.46)	**1.55** (1.29-1.89)	**1.83** (1.51-2.25)	**2.19** (1.74-2.78)	**2.45** (1.91-3.19)	**2.71** (2.06-3.61)	**2.97** (2.19-4.07)	**3.30** (2.33-4.73)	**3.55** (2.42-5.27)
6-hr	**1.35** (1.12-1.64)	**1.77** (1.47-2.14)	**2.28** (1.89-2.77)	**2.67** (2.20-3.28)	**3.18** (2.53-4.04)	**3.55** (2.76-4.61)	**3.91** (2.96-5.20)	**4.26** (3.13-5.84)	**4.71** (3.32-6.74)	**5.04** (3.43-7.48)
12-hr	**1.84** (1.53-2.23)	**2.41** (2.00-2.93)	**3.11** (2.58-3.78)	**3.64** (3.00-4.47)	**4.32** (3.44-5.50)	**4.81** (3.74-6.25)	**5.29** (4.01-7.04)	**5.74** (4.23-7.88)	**6.33** (4.46-9.06)	**6.75** (4.60-10.0)
24-hr	**2.50** (2.21-2.88)	**3.31** (2.93-3.82)	**4.30** (3.79-4.97)	**5.06** (4.43-5.90)	**6.03** (5.11-7.27)	**6.73** (5.58-8.27)	**7.40** (5.99-9.32)	**8.05** (6.34-10.4)	**8.88** (6.72-12.0)	**9.48** (6.94-13.2)
2-day	**3.05** (2.70-3.51)	**4.13** (3.65-4.76)	**5.49** (4.84-6.35)	**6.56** (5.74-7.65)	**7.95** (6.74-9.58)	**8.99** (7.45-11.1)	**10.00** (8.10-12.6)	**11.0** (8.68-14.3)	**12.3** (9.33-16.6)	**13.3** (9.74-18.6)
3-day	**3.23** (2.86-3.72)	**4.45** (3.93-5.13)	**6.01** (5.30-6.96)	**7.27** (6.36-8.48)	**8.95** (7.58-10.8)	**10.2** (8.48-12.6)	**11.5** (9.32-14.5)	**12.8** (10.1-16.6)	**14.5** (11.0-19.6)	**15.9** (11.6-22.1)
4-day	**3.49** (3.09-4.02)	**4.85** (4.29-5.60)	**6.63** (5.85-7.67)	**8.07** (7.06-9.41)	**10.0** (8.48-12.1)	**11.5** (9.55-14.2)	**13.0** (10.5-16.4)	**14.6** (11.5-18.9)	**16.7** (12.6-22.5)	**18.3** (13.4-25.6)
7-day	**4.01** (3.55-4.62)	**5.62** (4.97-6.49)	**7.75** (6.84-8.97)	**9.50** (8.31-11.1)	**11.9** (10.1-14.3)	**13.7** (11.4-16.9)	**15.6** (12.7-19.7)	**17.6** (13.9-22.8)	**20.3** (15.3-27.4)	**22.4** (16.4-31.3)
10-day	**4.37** (3.87-5.04)	**6.18** (5.46-7.13)	**8.56** (7.55-9.91)	**10.5** (9.21-12.3)	**13.2** (11.2-16.0)	**15.4** (12.7-18.9)	**17.5** (14.2-22.1)	**19.8** (15.6-25.6)	**22.9** (17.3-30.9)	**25.4** (18.6-35.4)
20-day	**5.09** (4.50-5.86)	**7.28** (6.44-8.40)	**10.2** (9.04-11.9)	**12.7** (11.1-14.8)	**16.2** (13.7-19.5)	**18.9** (15.7-23.3)	**21.8** (17.7-27.5)	**24.8** (19.6-32.2)	**29.1** (22.0-39.2)	**32.5** (23.7-45.3)
30-day	**6.01** (5.32-6.92)	**8.63** (7.63-9.95)	**12.2** (10.8-14.1)	**15.2** (13.3-17.7)	**19.5** (16.5-23.5)	**22.9** (19.0-28.1)	**26.5** (21.4-33.4)	**30.3** (23.9-39.2)	**35.7** (27.0-48.2)	**40.1** (29.3-56.0)
45-day	**7.16** (6.34-8.26)	**10.2** (9.05-11.8)	**14.5** (12.8-16.7)	**18.1** (15.8-21.1)	**23.2** (19.7-28.0)	**27.4** (22.7-33.7)	**31.8** (25.8-40.1)	**36.6** (28.8-47.4)	**43.4** (32.8-58.6)	**49.0** (35.8-68.4)
60-day	**8.35** (7.39-9.62)	**11.8** (10.4-13.6)	**16.6** (14.6-19.2)	**20.7** (18.1-24.1)	**26.6** (22.5-32.1)	**31.4** (26.1-38.7)	**36.6** (29.7-46.1)	**42.2** (33.3-54.7)	**50.3** (38.1-67.9)	**57.0** (41.7-79.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

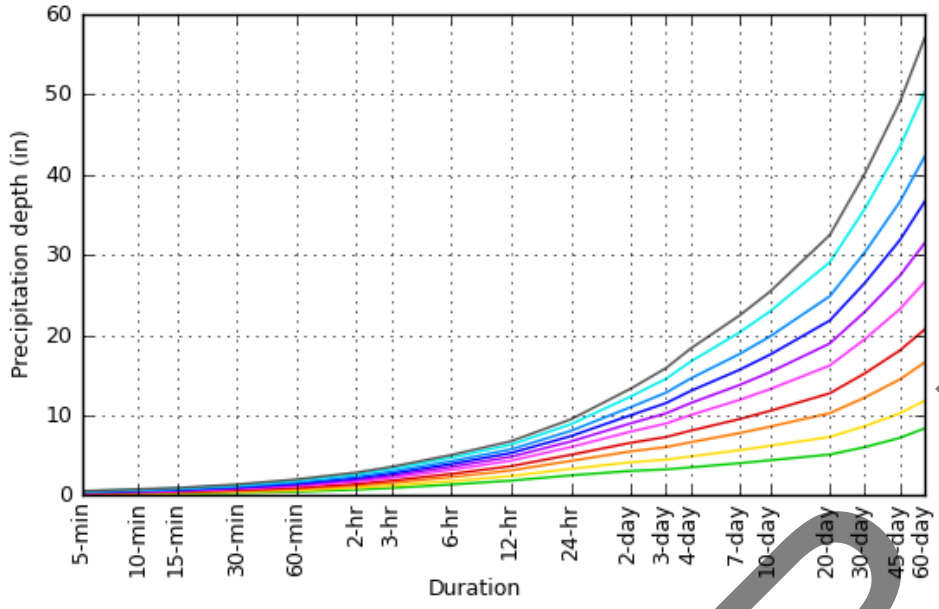
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

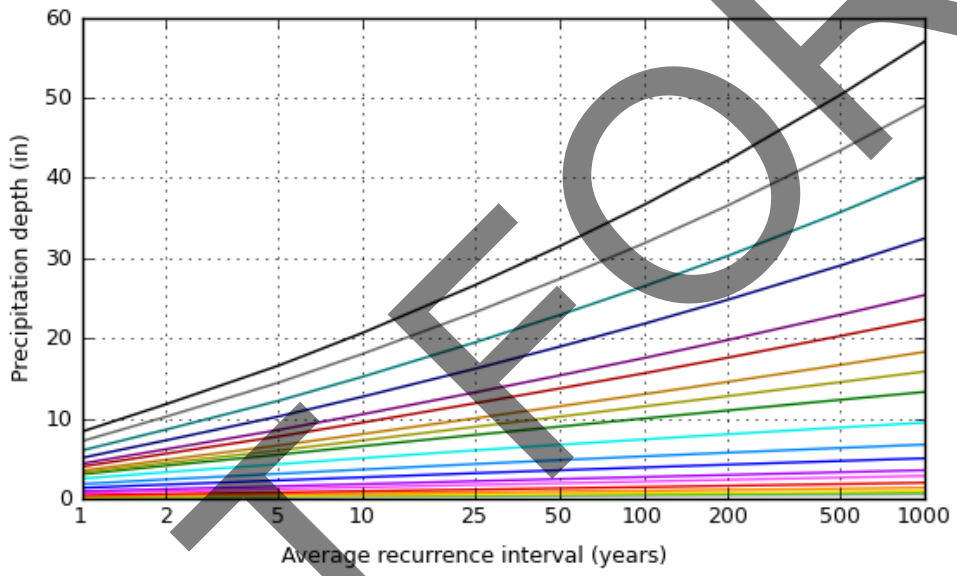
Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.1236°, Longitude: -117.5390°





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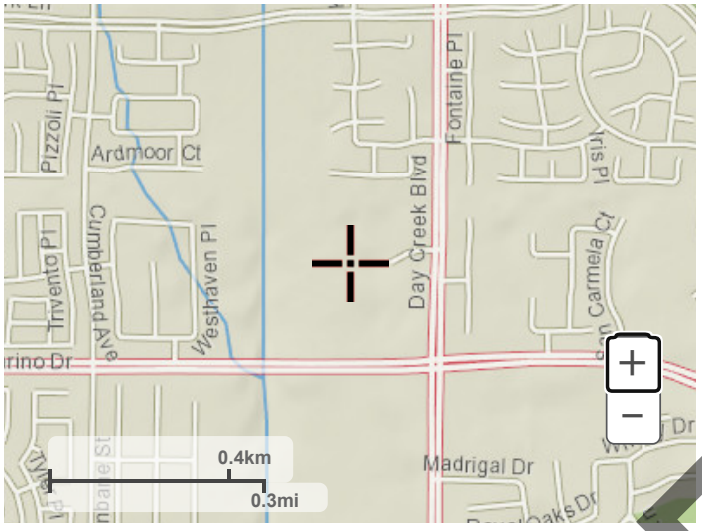
Back to Top

Maps & aerials

Small scale terrain



Large scale terrain

Large scale map

Large scale aerial

Back to Top

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

Disclaimer

Appendix -G
Factor of Safety Sheet

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

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	2	0.5
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.75
B	Design	Tributary area size	0.25	2	0.5
		Level of pretreatment/ expected sediment loads	0.25	2	0.5
		Redundancy	0.25	2	0.5
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					3
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					10.1
Design Infiltration Rate, in/hr, K_{DESIGN} = Km/Stot					3.37

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Level of Pretreatment: Medium concern was used for this project because filter strips with mulch are utilized on both sides of the infiltration trench. The project site also has low traffic and mild slopes.

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