Appendix J

Preliminary Water Quality Management Plan

Preliminary Water Quality Management Plan

for

County Project No. _____

Alder Avenue Industrial

APN: 0252-131-03, -04, -36, -41, -43

Prepared for

SRPF B/10336 ALDER, LLC
2001 Ross Avenue, Suite 400
Dallas, TX 75201
Michael Johnson, Contact
(786) 200-9681

Prepared by

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Temecula, California 92590
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(951) 695-8900

SB&O Job Number 74432.65

Published May 22, 2019

County of San Bernardino
BUILDING AND SAFETY
PRELIMINARY
APPROVAL
THE APPROVAL OF THIS REPORT SHALL NOT BE CONSTRUED TO BE A PERMIT FOR ANY DEVELOPMENT OR SITE IMPROVEMENT.
By
Date 09/03/2019
This report has Preliminary Approval. Prior to Final Approval the report, all outstanding comments/ requirements shall be met.

Preliminary WQMP Approval Date: _____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Lake Creek Industrial, LLC by SB&O, Inc. The WQMP is intended to comply with the requirements of the County of San Bernardino 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."

P201900293

Project Data			
Permit/Application Number(s):	Not available at time of WQMP publication	Grading Permit Number(s):	Not available at time of WQMP publication
Tract/Parcel Map Number(s):	n/a	Building Permit Number(s):	Not available at time of WQMP publication
APN (Specify Lot Numbers if Portions of Tract):			0252-131-03, -04, -36, -41, -43

Owner's Signature			
Owner Representative: Michael Johnson			
Title	Principal		
Company	Lake Creek Industrial, LLC		
Address	17551 Norwood Park Place, Tustin, CA 92780		
Email	mj@lakecreekindustrial.com		
Telephone #	(786) 200-9681		
Signature	TO BE SIGNED BY OWNER WHEN F-WQMP APPROVED (ONCE)	Date	

ok however, keep the owners appraised of any changes or responsibilities they will be taking on.

Preparer's Certification

P201900293

Project Data			
Permit/Application Number(s):	Not available at time of WQMP publication	Grading Permit Number(s):	Not available at time of WQMP publication
Tract/Parcel Map Number(s):	N/A	Building Permit Number(s):	Not available at time of WQMP publication
APN (Specify Lot Numbers if Portions of Tract):			0252-131-03, -04, -36, -41, -43

"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: Bradley C. Knepp, P.E. CPESC, QSD/QSP	
Title	Project Engineer
Company	SB&O, Inc.
Address	41689 Enterprise Circle North, Suite 126
Email	brad.knepp@sboinc.com
Telephone #	951-695-8900
Signature	
Date	May 22, 2019

PE Stamp Below



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Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Alder Avenue Industrial				
Project Owner Contact Name:	Michael Johnson				
Mailing Address:	17551 Norwood Park Place Tustin, CA 92780	E-mail Address:	mj@lakecreekindustrial.com	Telephone:	(786) 200-9681
Permit/Application Number(s):	Not available at time of WQMP publication	Tract/Parcel Map Number(s):	n/a		
Additional Information/ Comments:	Per County staff instructions, all template content has been retained in this WQMP even though the following forms (and related template text) are not applicable to this WQMP: Form 2.4-1, Form 4.2-3, Form 4.2-4, Form 4.2-5, Form 4.3-4, Form 4.3-5, Form 4.3-6, Form 4.3-7, Form 4.3-8, and Form 4.3-10. All above forms and related narrative template text should be ignored by the owner/reader as they have no bearing on this specific WQMP.				
Description of Project:	The existing 8.96-acre (8.73-acre net proposed) property is located on the west side of Alder Avenue about 600 feet north of Slover Avenue in the community of Bloomington, in the County of San Bernardino. The property is bounded to the north by a Southern Pacific Railroad easement, to the west by a railroad yard, to the south by a steel facility and several single-family homes and to the east by Alder Avenue. The project consists of an 8.7-acre truck-dock industrial distribution building, associated truck parking, employee parking, and stormwater quality infiltration and detention system (detention has only to do with County 100-year flood requirements – see project Drainage Report by SB&O, Inc., for more information on detention requirements). The existing site is 96.6% impervious and the proposed site is 82.9% impervious. However due to missing County records regarding permitted uses of the existing project site, even though the existing site is 96.6% impervious in its existing state, the County requires the existing state of the site be assumed undeveloped for design purposes. ~~The owner should be aware this required assumption results in additional cost for design and construction of 100-year stormwater detention and mitigation facilities.~~ All stormwater not infiltrated into native soils onsite per this WQMP discharge into Alder Avenue and Slover Avenue and thence eastward in Slover Avenue as there are no improved storm drain facilities in this area of the County. There is no Hydrologic Condition of Concern per County-provided mapping (see also Form 4.2-1 in Section 4.1.2 on Page 4-16 of this WQMP).				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	This section is only applicable if previous "Conceptual WQMP conditions" have been previously submitted; no such conceptual WQMP conditions have ever been submitted. This is a "Preliminary WQMP."				

P201900293

not relevant to this WQMP as the WQMP deals with the 2 year storm event only.

Not missing records. Professional Consultation Application (PCA) P201900029 revealed that no prior entitlement were found in any of the project parcels. As such, this project is considered new.

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):	380,232 sf	**3** Number of Dwelling Units:	n/a	**4** SIC Code:	4214, 4225, 4226 & 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:

The owner indicated below is responsible for the long term maintenance and management of the site and its stormwater facilities including all onsite storm drain piping, structures, BMPs, above ground or below ground infiltration systems, and all source control BMPs identified in this WQMP so long as the property is owned by the owner indicated below:
First Owner:

SRPF B/10336 ALDER, LLC
2001 Ross Avenue, Suite 400
Dallas, TX 75201
Michael Johnson, Contact
(786) 200-9681

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 ☐	Ubiquitous bird and animal waste, human refuse
Nutrients - Phosphorous	E ☒	N ☐	Fertilizers, food waste, refuse
Nutrients - Nitrogen	E ☒	N ☐	Fertilizers, food waste, refuse
Noxious Aquatic Plants	E ☒	N ☐	Certain weeds
Sediment	E ☒	N ☐	Driveways, rooftops, sidewalks
Metals	E ☒	N ☐	Car and truck use: Santa Ana River, Reach 3
Oil and Grease	E ☒	N ☐	Car and truck use
Trash/Debris	E ☒	N ☐	Trash receptacles, parking lot
Pesticides / Herbicides	E ☒	N ☐	Landscape use
Organic Compounds	E ☒	N ☐	Landscape use, fertilizers
Petroleum Hydrocarbons	E ☒	N ☐	Car and truck use
Solvents	E ☒	N ☐	Car and truck use
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

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

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

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

Description of Water Quality Credit Eligibility (if applicable)	n/a

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.065556°N	Longitude -117.419344°W	Thomas Bros Map page 605

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*

N/A per No. 2 above.

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
N/A, per No. 2 above.	**N/A, per No. 2 above.**

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DA1	n/a
1 DMA drainage area (ft^2)	380,232 sf	
2 Existing site impervious area (ft^2)	0 sf (assumed, 367,304± sf actual)	
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	I	
4 Hydrologic soil group *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	A	
5 Longest flowpath length (ft)	503	
6 Longest flowpath slope (ft/ft)	0.0121 ft/ft	
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Due to lack of records, County requires to assume no previous development: Barren graded land per Figure C-3	
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*	Assumed no previous development: Barren graded land per Figure C-3	

Good, Fair, or Poor?

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See 'Drainage Facilities" link at this website*	Slover Avenue gutter Rialto Channel Santa Ana River, Reach 4 Santa Ana River, Reach 3 and Prado Basin Management Zone Santa Ana River Reach 2 Santa Ana River Reach 1 Pacific Ocean, near- and off-shore zones
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River Reach 4: ~~Pathogens~~ Santa Ana River Reach 3: ~~Nitrate and~~ Pathogens Prado Basin Management Zone: ~~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 4: Pathogens, ~~Salinity/TDS/Chlorides~~ Santa Ana River, Reach 3: Copper, Lead, Pathogens Prado Basin Management Zone: ~~Nutrients and Pathogens~~ Santa Ana River Reach 2: ~~Indicator Bacteria~~
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Delhi Sands (flies)
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Santa Ana River, Reaches 4 and 3, but these are adequate sumps
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

completed and None

not impairments

PH

delisted

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Property Owner shall provide to all employees and persons/entities that will be contracted to perform services for the development, BMP training and educational materials. Materials provided through the San Bernardino County Area-Wide Storm Water Program Public Education Program can be downloaded at: (http://www.co.san-bernardino.ca.us/flood/npdes). Training will be required within 6 months of hire dates for new employees, and then annually thereafter.
N2	Activity Restrictions	☒	☐	Restrictions will include requiring dumpster lids to be closed at all times and prohibiting the blowing, sweeping, or hosing of debris into streets, storm drain inlets, and other stormwater conveyances. In particular, pesticide application in areas must be performed by an applicator certified by the California Department of Pesticide Regulation. Outdoor industrial processes, outdoor storage of equipment or materials, vehicle and equipment cleaning and repair/maintenance or fuel dispensing shall not be permitted.
N3	Landscape Management BMPs (See SD-10 & SC-73)	☒	☐	Landscape planning shall employ strategies to maximize water storage and conservation and minimize runoff, promote infiltration, and protect slopes from erosion. Such strategies include extensive mulching, low water use shrubs, and grouping of plants with similar water requirements. Maintenance personnel will regularly mow, remove all sediment, inspect and keep any equipment in good repair, i.e. broken sprinkler heads, etc. Any repairs will be done promptly. In addition, fertilizer and pesticide use will be consistent with instructions contained on product labels and with the regulations administered by the State Department of Pesticide Regulation.
N4	BMP Maintenance	☒	☐	Create regularly scheduled times for inspection and maintenance of infiltration system. The frequency shall meet the current minimum County standard but shall be at a minimum once per three months. A time in the late summer or early fall, prior to the storm season (October 1 to May 1), shall also be part of this schedule to reduce the amount of sediment, landscaping waste, and trash entering the storm drain system.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Hazardous waste is not known to be used, generated, transported or treated onsite during at the publication of this report. In the future, if any hazardous waste materials and wastes are identified, they shall be collected and stored in covered containers in designated areas. In addition, signs shall be placed to ensure all hazardous waste is collected, removed and disposed of only at authorized disposal areas. Inspection shall be conducted regularly to check all containers and other equipment used in handling hazardous waste, to minimize potential leaks and spills. Regular maintenance of all equipment will be conducted and repairs will be carried out promptly after identification. Owner shall ensure all operations are in conformance with Title 22 Division 4.5 Environmental Health Standards for the Management of Hazardous Materials. Notification to local Fire Department and other appropriate agencies is required if any hazardous waste is accumulated onsite.
N6	Local Water Quality Ordinances	☒	☐	This WQMP meets or exceeds water quality ordinances of the County of San Bernardino.
N7	Spill Contingency Plan (See SC-11)	☒	☐	A spill prevention and control plan is applicable to any site where hazardous material(s) are stored or used. At the time of preparation of this WQMP, no hazardous materials or wastes are known to be generated, used or treated onsite. In the future, if any hazardous waste is identified, a Spill Contingency Plan shall be determined by the property

revise spill contingency plan for spills within loading doc areas and oil leaks within parking lot.

Form 4.1-1 Non-Structural Source Control BMPs

				owner prior to occupancy. See SC-11 "Spill Prevention, Control, and Cleanup," sample Spill Contingency Template, and SC-10 "Non-Storm water Discharges" in "BMP Fact Sheets" for guidance and recommended procedures.
N8	Underground Storage Tank Compliance	☐	☒	There are no proposed underground storage tanks on the project property.
N9	Hazardous Materials Disclosure Compliance	☒	☐	At the time of preparation of this WQMP, no hazardous materials or wastes are known to be generated, used or treated onsite. In the future, if any hazardous waste is identified, the owner shall ensure compliance with local ordinances for the management of hazardous materials. Compliance is typically enforced by local fire protection agencies. San Bernardino County, health care agencies, and/or other appropriate agencies (i.e. Department of Toxics Substances Control) are typically responsible for enforcing hazardous materials and waste handling and disposal regulations.

Verify, septic system shown on site plan.

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	☒	☐	At the time of preparation of this WQMP, no hazardous materials or waste are known to be generated, used or treated on-site. In the future, if any hazardous waste is identified, Owner shall ensure all operations are in conformance with the Uniform Fire Code Article 80. Additional information can be found in the San Bernardino County Fire Department website, Hazardous Materials Division: http://www.sbcfire.org/hazmat/cupa.aspx#Hazardous%20Materials%20Management%20Plans%20and%20Inventory%20Statements.
N11	Litter/Debris Control Program (See SC-60)	☒	☐	For industrial/commercial developments the owner is required to implement litter control and trash management procedures in the common areas aimed at reducing pollution of drainage waters. The owner may contract a landscape/maintenance company to provide surface cleaning during regularly scheduled maintenance, which should consist of litter collection and removal, emptying of trash receptacles in common areas, and noting trash disposal violations by tenants or businesses and reporting the violations to the owner. Additional information for pollution control, suggested protocols for good housekeeping, training requirements and other considerations can be found in BMP SC-60 in Attachment E.
N12	Employee Training	☒	☐	The developer shall prepare manual(s) based on the educational program described in N1 for initial purchasers or for a development that is constructed for an unspecified use. Property owner is responsible for the employee training which will be required within 6 months of hire dates for new employees, and then annually thereafter.

This doesn't provide a plan. Coordinate with the owner on a litter debris plan to be implemented through this WQMP

Provide manual in appendices of this WQMP

This doesn't provide an implementation, rather stating what it should have. What will it have for this project? Revise.

N13	Housekeeping of Loading Docks (See SD-31)	☒	☐	Loading docks typically found at large retail and warehouse-type commercial and industrial facilities should be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers. Cleanup procedures should minimize or eliminate the use of water. If wash water is used, it must be disposed of in an approved manner and not discharged to the storm drain system. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only if allowed by the local sewerage agency through a permitted connection. Employees shall be trained in loading/unloading procedures as well as proper spill containment and cleanup per the applicable recommendations in BMP Fact Sheet SD-31 for loading docks. No maintenance bays are proposed for this project. Maintenance records shall be kept to ensure regular maintenance and inspection of all loading docks.
N14	Catch Basin Inspection Program (See SC-74)	☒	☐	Storm drain pipes and drainage inlets shall be inspected semi-annually, in late Summer or early Fall, and at the end of the rainy season, and cleaned as needed, and also cleaned if accumulated sediment/debris is present anytime. All portions of the drainage facilities will be evaluated annually to determine the adequacy of the inspection and maintenance frequency.
N15	Vacuum Sweeping of Private Streets and Parking Lots (See SC-43 and SC-70)	☒	☐	The owner is responsible for contracting a maintenance company for regularly scheduled sweeping of drive isles and parking lot areas. The frequency ~~should meet the current minimum County standard but~~ shall be at a minimum once a month. A time in late Summer or early Fall, prior to the storm season (October 1 to May 1), shall also be part of this schedule to reduce the amount of sediment, garden waste, and trash entering the storm drain system and/or underground infiltration system.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	This project is not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	During construction, the applicant shall apply for coverage under the Statewide General Construction Permit for Storm Water Discharges and all future occupants shall apply for coverage under the Statewide General Industrial Permit, as required. Comply with all other applicable NPDES permits.

specify Vacuum sweeping

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 per options and guidance in SD-13.	☒	☐	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Maintain and periodically repaint or replace inlet signage/markings. Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything into storm drains or to store or deposit materials so as to create a potential discharge into storm drains."
S2	Design and construct outdoor material storage areas to reduce pollution introduction (See SD-34)	☐	☒	At the time of preparation of this WQMP, no hazardous materials or waste are known to be generated, used or treated onsite. No outdoor storage areas for storage of hazardous materials are proposed for this project. In the future, if any hazardous waste is identified, owner shall ensure that hazardous materials with the potential to contaminate urban runoff shall either be: (a) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the MS4; or (b) protected by secondary containment structures (not double wall containers) such as berms, dikes or curbs; The storage area shall be paved and sufficiently impervious to contain leaks and spills; the storage area shall have a roof or awning to minimize direct precipitation and exposure, and collection of stormwater within the secondary containment area; any stormwater retained within the containment structure must not be discharged to the street or storm drain system. See Stormwater Handbook Section 3.2.6 and BMP Fact Sheet SD-34 for additional information.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (See SD-32)	☒	☐	Proposed trash container areas meet the following requirements: Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent off-site transport of trash; solid roof or awning to prevent exposure to direct precipitation is provided. See Stormwater Handbook Section 3.2.9 and BMP Fact Sheet SD-32 for additional information.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (State-wide Model Landscape Ordinance; See SD-12)	☒	☐	In general, the following methods to reduce excessive irrigation runoff shall be considered and incorporated for all landscaped areas: employing rain shutoff devices to prevent irrigation after precipitation; designing irrigation systems to each landscape area's specific water requirements; using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines; the timing and application methods of irrigation water shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain system; group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration; choose plants with low irrigation requirements; choo that minimize or eliminate the use of fertilizer or pesticides to sustain growth; use mulches (such as w or shredded wood products) in planter areas without ground cover to minimize sediment in runoff. Maintenance personnel will regularly inspect and keep in good repair all irrigation system componen broken sprinkler heads, etc. will be repaired promptly. See SD-12 in Attachment E.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, pvmt	☒	☐	Landscape areas are proposed to be depressed as required by the County though SB&O believes such depressions behind curbs are unsafe tripping hazards for human beings on industrial sites like this as often such depressed areas are located proximate to fire exits. Also, depressed areas close to the building promote infiltration often close to structural building or other improvement footers which can damage the building structure if certain types of soil conditions are present.

please specify what will be used for this project.

what should the owner be looking for in SD-12? Also not provided.

S6	Protect slopes and channels and provide energy dissipation (See SD-10)	☒	☐	All sloped areas will be protected from erosion with landscaping in accordance with the recommendations of Fact Sheet SD-10: runoff shall be conveyed safely from the top of slopes; disturbed slopes should be stabilized as quickly as possible; slopes shall be vegetated with native or drought tolerant vegetation; energy dissipation measures shall be installed at any surface flow outlet where required.
S7	Covered dock areas (See SD-31)	☒	☐	Loading/unloading dock areas shall be covered (and shown only on final design building architect's plans) so the materials that are loaded and unloaded do not have the potential to contribute to stormwater pollution. Good housekeeping of the dock areas shall conform to the applicable recommendations of Fact Sheet SD-31. No below grade loading docks (truck wells) are proposed for this project.
S8	Covered maintenance bays with spill containment plans (See SD-31)	☐	☒	There are no outdoor maintenance bays proposed for this project.
S9	Vehicle wash areas with spill containment plans (See SD-33)	☐	☒	There are no vehicle wash ~~areas~~ proposed for this project.
S10	Covered outdoor processing areas (See SD-36)	☐	☒	There are no outdoor processing areas proposed for this project.

what are the applicable recommendations. State them here

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 (See SD-33)	☐	☒	There are no equipment wash ~~areas~~ proposed for this project.
S12	Fueling areas (See SD-30)	☐	☒	There are no fueling ~~areas~~ proposed for this project.
S13	Hillside landscaping (See SD-10)	☐	☒	There are no hillside areas that are disturbed by the proposed project.
S14	Wash water control for food preparation areas	☐	☒	This project is not a food preparation establishment.
S15	Community car wash racks (See SD-33)	☐	☒	No ~~community~~ car wash ~~areas are~~ proposed for 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: This project has maximized the open landscaped areas to the maximum extent practicable

describe how this was done

Maximize natural infiltration capacity: Yes ☒ No ☐

Explanation: Infiltration is employed to permanently retain the DCV.

add: Landscaping areas will be depressed to promote infiltration.

Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐

Explanation: The existing drainage patterns will be maintained and the post-developed time of concentration is significantly greater than the pre-developed due to onsite retention of the DCV as well as reduced imperviousness in the proposed condition.

Disconnect impervious areas: Yes ☒ No ☐

Explanation: Infiltration basins disconnect all impervious areas from downstream storm drain facilities.

Verify multiple.

Protect existing vegetation and sensitive areas: Yes ☐ No ☒

Explanation: The very limited (formerly residential) existing poor vegetative cover will be destroyed and replaced with planned, efficiently irrigated vegetation. Delhi Sands (flies) are mapped on the County's Stormwater Mapping Tool website (http://permitrack.sbcounty.gov/wap/).

how will they be protected?

Re-vegetate disturbed areas: Yes ☒ No ☐

Explanation: Commercial landscaping with efficient irrigation will be used.

the entire site will be reconstructed and

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐

Explanation: A note to this effect appears on Grading Plans.

state what the note will say.

Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒

Explanation: Due to site design constraints, vegetated swales are not used. Ground surface infiltration is maximized and all impervious areas are disconnected from downstream storm drain facilities.

state how.

Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐

Explanation: A note to this effect appears on Grading Plans.

What constraints prevent the use of swales, indicate them here.

Will it be staked off? What will the note say.

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): 380,232 sf	**2** Imperviousness after applying preventative site design practices (Imp%): 82.99%	**3** Runoff Coefficient (Rc): 0.6356 (unitless) *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.543 inches http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.804 inches (Valley) *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): 31,784 *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** n/a all remaining cells in this table *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** *Item 4 – Item 1*	**8** *Item 2 – Item 5*	**9** *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** % *Item 7 / Item 1*	**11** % *Item 8 / Item 2*	**12** % *Item 9 / Item 3*

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

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	n/a form							
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)

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*	n/a form							
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)

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)*		n/a form					
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 measured infiltration rate below proposed facility less than 0.3 in/hr (per Permit guidance, Appendix D, page VII-4)? Yes ☐ No ☒

If Yes, Provide basis: See Permit guidance, Appendix D, page VII-4 and Form 1.1 narrative.

[6] Would on-site infiltration or reduction of runoff over existing 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 1 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 cf $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): 0 cf $V_{retention}$ *=Sum of Item 12 for all BMPs*			

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

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

4.3.2 Infiltration BMPs

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

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

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): 31,784 cf *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 BMP Type Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	4 in/hr		
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*	1.33 in/hr		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48 hrs		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	3.5 ft		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	3.5 ft		
8 Infiltrating surface area, SA_{BMP} (ft²) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	6,692 sf		
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*	n/a		
12 Gravel porosity	n/a		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3 hrs		
14 Above Ground Retention Volume (ft³) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	35,179 cf see BMP spreadsheet		
15 Underground Retention Volume (ft³) *Volume determined using manufacturer's specifications and calculations*	0 cf		

16 Total Retention Volume from LID Infiltration BMPs: 35,179 cf *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 111% *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.

This ponding depth does not support the stated basin volume. Please revise.

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 (n/a form)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0 cf (n/a form)
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	n/a form		
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			

9 Total Retention Volume (ft^3) from Harvest and Use BMP 0 cf (n/a form) *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 (n/a form)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 cf (n/a form) *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.* n/a form	
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 (n/a form) – 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*	n/a form		
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 cf (n/a form) *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 Volume Based Biotreatment (n/a form) – 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*	n/a form			
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 : 0 cf (n/a form) *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-8 Flow Based Biotreatment (n/a form)

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*	n/a form		
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)*		n/a form	
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): **31,784 cf** *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): **35,179 cf** *Copy Item 16 in Form 4.3-3*

Verify. See comments on Form 4.3-3

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

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

6 Flow capacity provided by flow based biotreatment BMP (cfs): n/a 0 cf *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 (n/a form)

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

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

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

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

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

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

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

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

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Form 5-1 BMP Inspection and Maintenance

BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Property Owner	Owner shall provide annually to tenant and contractors training materials on the proper storage and use of fertilizers and pesticides, lawn care, the implementation of hazardous spill contingency plans, litter control, and activity restrictions including prohibited activities that would be harmful to the quality of storm water runoff: outdoor storage of hazardous wastes or materials; Washing of vehicles on the premises; Dumping of vehicular fluids such as antifreeze, radiator water or flushing, or oils; Maintenance of trucks or engines on the premises; and Unloading of trucks outside the unloading areas.	Upon first occupancy, annually, and at each change of ownership, tenant(s) or contractors.
Landscape Management	Property Owner	Pesticides and fertilizers will be used minimally as needed according to the manufacturer's instructions. Grass clipping and landscape refuse shall be picked up and removed. Inspect all storm drain inlet and outlet structures. All irrigation systems shall be inspected and maintained to operate efficiently per landscape plans and WQMP design requirements. Bare areas shall be re-vegetated.	Vegetation refuse to be collected as created, every two weeks at minimum. Storm drain inlets and outlets and irrigation systems shall be inspected weekly.
Litter/Debris Program	Property Owner	Inspect areas for accumulation of trash and debris and haul trash off-site to local/regional refuse. Dumpster areas shall be cleaned and inspected to prevent accumulation of debris and decomposition.	Check daily and empty/haul as needed.

This is a restriction from N2.

Housekeeping of Loading Docks	Property Owner	Loading docks shall be kept in a clean and orderly condition through sweeping and litter control. Broken containers/spills shall be cleaned up promptly.	Check daily and clean up as needed.
Storm Drain Structures and Surface Infiltration Basin	Property Owner	In addition to weekly removal of surface debris and litter from catch basins (storm drain inlets), the owner is required to provide for the opening, inspection and cleaning of any/all storm drain inlets, inlet filter inserts, manholes, and outlet structures every September. Any/all rip rap and basin slopes shall be inspected and maintained for original line and grade (and vegetation for slopes) before and after large storm events and every September. If basin fails to infiltrate water, the soil is fouled with fine sediment accumulations. If removal of accumulated sediments fails to allow water to drain within 48 hours after a significant storm event, the basin bottom may require removal and replacement of fouled soil with non-fouled non-compacted native (good-infiltrating) soils to a depth of 2 to 6 inches.	As indicted at left
Vacuum Sweeping of Private Drives and Parking Lots	Property Owner	All paved areas shall be swept using a vacuum assisted sweeper to remove dust, fine sediments, and other debris. Special attention should be paid to sweeping around pavement joints around all storm drain inlets, clean-outs and manholes.	Monthly
Storm Drain System Stenciling and Signage	Property Owner	Provide for stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, with prohibitive language (such as: “No Dumping – Only Rain in the Drain”) and/or graphical icons to discourage illegal dumping. Post signs and prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points beside onsite basin. The owner shall ensure legibility of stencils and signs is maintained.	Annually, and as replacement/ repair is required

Section 6 Attachments

Attachment A – Maps
- Aerial Map
- County Stormwater Facility Mapping Tool Report
- County HCOC Exempt Area Map
- NOAA Site Location Precipitation Table
- WQMP Site Map showing, at minimum: project location, boundry, land use and covers; suitability/feasibility constraints; structural source control BMP locations; site design hydrologic source control BMP locations; LID BMP details; surface drainage management area delineations and surface flow direction arrows; and permanent connections to public storm drainage facilities.

Attachment B – DCV & BMP Design Calculations

Attachment C – NRCS and Geotechnical Engineer Soils Reports

Attachment D – Geotechnical Engineer Infiltration Testing and Civil Engineer Factor of Safety Determination

Attachment E – BMP Educational Materials

Attachment F – O&M Information, CC&Rs, and Maintenance Agreement (included at approval of Final WQMP)

Attachment A

Maps

Aerial Map
County Stormwater Facility Mapping Tool Report
County HCOC Exempt Area Map
NOAA Site Location Precipitation
WQMP Site Map

DCT Alder Distribution Building





WQMP Project Report

County of San Bernardino Stormwater Program

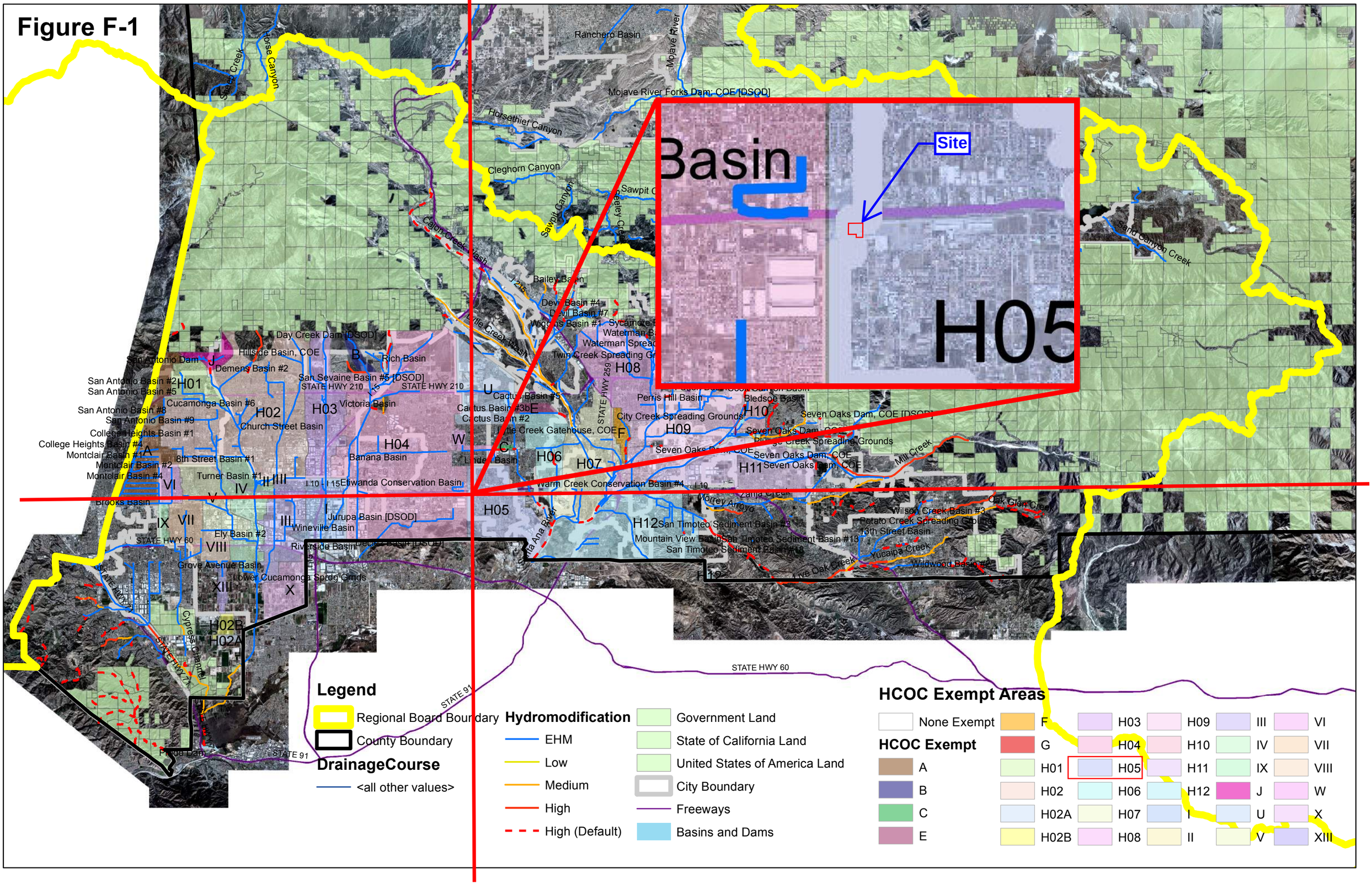
Santa Ana River Watershed Geodatabase

Thursday, June 07, 2018

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	025213103, 025213136, 025213143, 025213104, 025213141
Project Site Acreage:	9.068
HCOC Exempt Area:	Yes. Verify that the project is completely with the HCOC exemption area.
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - **Facility Name** - Mulberry Channel **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	EHM
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	No
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A
Environmentally Sensitive Areas within 200':	DELHI SANDS
Groundwater Depth (FT):	-308
Parcels with potential septic tanks within 1000':	No
Known Groundwater Contamination Plumes within 1000':	No
Studies and Reports Related to Project Site:	Chino Basin Recharge Master Plan Chino Basin Water Master 32nd Annual Report Cactus Basin CSDP 3-3 Rialto Channel Drainage Area Volume I CSDP 3-3 Rialto Channel Drainage Area Volume II CSDP 3-3 Rialto Channel Drainage Area Volume III CSDP 3-3 Rialto Channel Drainage Area Volume I CSDP 3-3 Rialto Channel Drainage Area Volume IV CSDP 3-3 Rialto Channel Drainage Area Volume V CSDP 3-4 100yr Hydrology Update CSDP 3-4 Engineers Report Volume 1 CSDP 3-4 Hydrology Study West Portion Only CSDP 3-4 Hydrology Study East Portion CSDP 3 CALC SHEET FOR HYDRO CSDP 3-3 Rialto Channel Drain Area Draft Hydrology Study Project 3-4 East Portion Hydrology Study Project 3-4 West portion Only Project Report Mulberry Creek Project #3-4 100yr Hydrology Update Sept1997 San Sevaine - Boyle Map 0001 San Sevaine - Boyle Map 0002 San Sevaine - Boyle Map 0003 SBCounty CSDP Project No.2 Volume 1 SBCounty CSDP Project No.2 Volume 2 Volume 2 Map SBCounty CSDP Project No.3 Volume I SBCounty CSDP Project No.3 Volume II SBVMWD High Groundwater / Pressure Zone Area

Figure F-1


Basin
Site
H05
Ranchero Basin
Mojave River
Mojave River Forks Dam; COE [DSOD]
Horsethief Canyon
Cleghorn Canyon
Sawpit Canyon
Cajon Creek
Lytle Creek Wash
Bailey Basin
Devil Basin #4
Devil Basin #7
Wiggins Basin #1
Sycamore
Waterman Basin
Waterman Spread
Twin Creek Spreading Gr
Day Creek Dam [DSOD]
Hillside Basin, COE
Rich Basin
Demens Basin #2
San Antonio Dam
San Antonio Basin #2
San Antonio Basin #5
San Sevaine Basin #5 [DSOD]
STATE HWY 210
Cucamonga Basin #6
Victoria Basin
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
Banana Basin
Etiwanda Conservation Basin
Brooks Basin
Jurupa Basin [DSOD]
Wineville Basin
Ely Basin #2
Riverside Basin
Grove Avenue Basin
Lower Cucamonga Spdg Grnds
Cactus Basin #5
Cactus Basin #3b
Cactus Basin #2
Lytle Creek Gatehouse, COE
Linden Basin
Warm Creek Conservation Basin #4
Perris Hill Basin
City Creek Spreading Grounds
Bledsoe Basin
Seven Oaks Dam, COE [DSOD]
Seven Oaks Dam, COE
Seven Oaks Dam, COE
Mill Creek
Zanja Creek
Morrey Arroyo
Santa Ana River
San Timoteo Sediment Basin #8
Mountain View Basin
San Timoteo Sediment Basin #13
San Timoteo Sediment Basin #13
Potato Creek Spreading Grounds
13th Street Basin
Wilson Creek Basin #3
Oak Glen Creek
Yucaipa Creek
Wildwood Basin #2
Ive Oak Creek
Sand Canyon Creek
Cypress Channel
Prado Dam
STATE HWY 71
STATE HWY 60
STATE 91
I 10
I 15
I 215
STATE HWY 259
H01
H02
H02A
H02B
H03
H04
H05
H06
H07
H08
H09
H10
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H12
H13
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VII
VIII
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XIII
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J
U
W
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
W
X
XIII

NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0656°, Longitude: -117.4193°
Elevation: 1096.17 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	**0.110** (0.092-0.133)	**0.143** (0.119-0.174)	**0.188** (0.156-0.228)	**0.225** (0.185-0.277)	**0.278** (0.221-0.353)	**0.320** (0.249-0.416)	**0.364** (0.276-0.485)	**0.412** (0.303-0.564)	**0.479** (0.338-0.685)	**0.533** (0.363-0.791)
10-min	**0.158** (0.132-0.191)	**0.205** (0.171-0.249)	**0.269** (0.223-0.327)	**0.323** (0.266-0.396)	**0.398** (0.317-0.506)	**0.459** (0.357-0.596)	**0.522** (0.396-0.695)	**0.590** (0.435-0.809)	**0.686** (0.484-0.982)	**0.765** (0.521-1.13)
15-min	**0.191** (0.159-0.231)	**0.248** (0.206-0.301)	**0.325** (0.270-0.396)	**0.390** (0.321-0.479)	**0.482** (0.383-0.612)	**0.555** (0.432-0.720)	**0.631** (0.479-0.841)	**0.713** (0.526-0.978)	**0.830** (0.586-1.19)	**0.925** (0.630-1.37)
30-min	**0.285** (0.238-0.346)	**0.371** (0.308-0.450)	**0.486** (0.403-0.591)	**0.583** (0.480-0.716)	**0.720** (0.572-0.914)	**0.829** (0.644-1.08)	**0.943** (0.715-1.26)	**1.07** (0.785-1.46)	**1.24** (0.875-1.77)	**1.38** (0.941-2.05)
60-min	**0.418** (0.348-0.506)	**0.543** (0.452-0.659)	**0.712** (0.591-0.866)	**0.854** (0.703-1.05)	**1.05** (0.838-1.34)	**1.21** (0.944-1.58)	**1.38** (1.05-1.84)	**1.56** (1.15-2.14)	**1.82** (1.28-2.60)	**2.02** (1.38-3.00)
2-hr	**0.618** (0.515-0.749)	**0.796** (0.662-0.966)	**1.03** (0.856-1.26)	**1.23** (1.01-1.51)	**1.50** (1.19-1.90)	**1.70** (1.33-2.21)	**1.92** (1.46-2.56)	**2.15** (1.58-2.95)	**2.47** (1.74-3.53)	**2.72** (1.85-4.04)
3-hr	**0.777** (0.647-0.942)	**0.998** (0.830-1.21)	**1.29** (1.07-1.57)	**1.53** (1.25-1.87)	**1.85** (1.47-2.35)	**2.10** (1.63-2.73)	**2.36** (1.79-3.14)	**2.63** (1.93-3.60)	**3.00** (2.11-4.29)	**3.29** (2.24-4.88)
6-hr	**1.11** (0.920-1.34)	**1.42** (1.18-1.72)	**1.83** (1.52-2.22)	**2.16** (1.78-2.65)	**2.60** (2.07-3.30)	**2.94** (2.29-3.82)	**3.28** (2.49-4.37)	**3.64** (2.68-4.98)	**4.11** (2.90-5.89)	**4.49** (3.06-6.65)
12-hr	**1.47** (1.23-1.78)	**1.90** (1.58-2.31)	**2.45** (2.04-2.99)	**2.89** (2.38-3.55)	**3.48** (2.77-4.42)	**3.92** (3.05-5.09)	**4.36** (3.31-5.81)	**4.81** (3.55-6.60)	**5.41** (3.82-7.75)	**5.88** (4.00-8.72)
24-hr	**1.97** (1.75-2.27)	**2.58** (2.28-2.98)	**3.36** (2.96-3.88)	**3.97** (3.48-4.63)	**4.79** (4.06-5.77)	**5.40** (4.48-6.64)	**6.01** (4.87-7.57)	**6.62** (5.22-8.57)	**7.44** (5.63-10.0)	**8.06** (5.90-11.2)
2-day	**2.39** (2.12-2.76)	**3.19** (2.82-3.69)	**4.22** (3.72-4.89)	**5.05** (4.42-5.89)	**6.15** (5.21-7.41)	**6.99** (5.80-8.60)	**7.83** (6.34-9.86)	**8.69** (6.84-11.2)	**9.83** (7.44-13.3)	**10.7** (7.84-15.0)
3-day	**2.57** (2.28-2.96)	**3.49** (3.08-4.02)	**4.67** (4.12-5.41)	**5.64** (4.93-6.58)	**6.95** (5.88-8.37)	**7.95** (6.59-9.77)	**8.96** (7.26-11.3)	**10.0** (7.89-13.0)	**11.4** (8.64-15.4)	**12.5** (9.16-17.5)
4-day	**2.76** (2.44-3.18)	**3.78** (3.35-4.37)	**5.12** (4.51-5.92)	**6.21** (5.43-7.24)	**7.70** (6.52-9.27)	**8.84** (7.34-10.9)	**10.0** (8.11-12.6)	**11.2** (8.84-14.5)	**12.9** (9.74-17.4)	**14.2** (10.4-19.8)
7-day	**3.15** (2.79-3.63)	**4.38** (3.87-5.05)	**5.98** (5.28-6.92)	**7.30** (6.39-8.52)	**9.11** (7.72-11.0)	**10.5** (8.73-12.9)	**12.0** (9.69-15.1)	**13.5** (10.6-17.4)	**15.5** (11.8-21.0)	**17.2** (12.6-24.0)
10-day	**3.42** (3.03-3.94)	**4.78** (4.23-5.52)	**6.58** (5.80-7.61)	**8.06** (7.05-9.40)	**10.1** (8.55-12.2)	**11.7** (9.71-14.4)	**13.3** (10.8-16.8)	**15.1** (11.9-19.5)	**17.5** (13.2-23.5)	**19.3** (14.1-27.0)
20-day	**4.12** (3.65-4.75)	**5.81** (5.14-6.71)	**8.08** (7.12-9.35)	**9.97** (8.72-11.6)	**12.6** (10.7-15.2)	**14.7** (12.2-18.1)	**16.9** (13.7-21.3)	**19.2** (15.1-24.8)	**22.4** (17.0-30.3)	**25.0** (18.3-34.9)
30-day	**4.87** (4.31-5.61)	**6.87** (6.07-7.92)	**9.56** (8.43-11.1)	**11.8** (10.4-13.8)	**15.0** (12.7-18.1)	**17.6** (14.6-21.6)	**20.3** (16.4-25.6)	**23.2** (18.3-30.0)	**27.3** (20.6-36.8)	**30.6** (22.4-42.7)
45-day	**5.81** (5.14-6.69)	**8.11** (7.18-9.36)	**11.3** (9.94-13.0)	**13.9** (12.2-16.3)	**17.7** (15.0-21.4)	**20.8** (17.3-25.6)	**24.1** (19.5-30.3)	**27.6** (21.8-35.8)	**32.7** (24.7-44.1)	**36.9** (27.0-51.4)
60-day	**6.81** (6.03-7.84)	**9.40** (8.31-10.8)	**13.0** (11.4-15.0)	**16.0** (14.0-18.7)	**20.4** (17.2-24.5)	**23.9** (19.8-29.4)	**27.7** (22.4-34.9)	**31.9** (25.1-41.2)	**37.8** (28.6-51.0)	**42.8** (31.3-59.7)

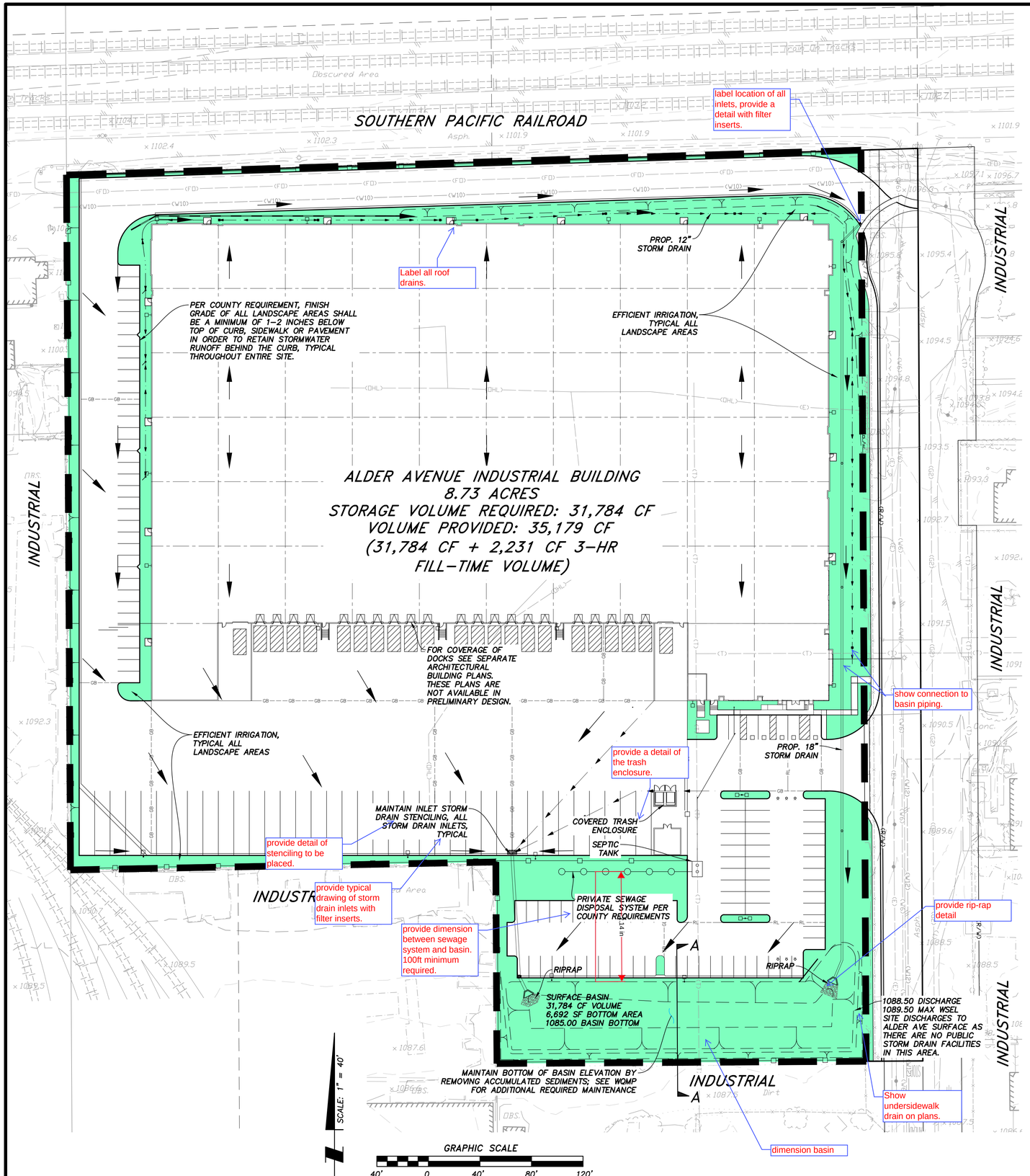
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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



INFILTRATION BASIN STAGE STORAGE		
STAGE (elev.)	AREA (sq. ft.)	STORAGE (cu. ft.)
85.00	6,691.76	0.00
85.10	6,838.33	676.50
85.20	6,985.71	1367.71
85.30	7,133.89	2073.69
85.40	7,282.87	2794.53
85.50	7,432.66	3530.30
85.60	7,583.24	4281.10
85.70	7,734.63	5046.99
85.80	7,886.82	5828.06
85.90	8,039.81	6624.39
86.00	8,193.61	7436.07
86.10	8,348.21	8263.16
86.20	8,503.61	9105.75
86.30	8,659.81	9963.92
86.40	8,816.81	10837.75
86.50	8,974.62	11727.32
86.60	9,133.23	12632.71
86.70	9,292.64	13554.01
86.80	9,452.85	14491.28
86.90	9,613.87	15444.62
87.00	9,775.69	16414.10
87.10	9,938.31	17399.80
87.20	10,101.73	18401.80
87.30	10,265.96	19420.18
87.40	10,430.98	20455.03
87.50	10,596.81	21506.42
87.60	10,763.44	22574.43
87.70	10,930.88	23659.15
87.80	11,099.11	24760.65
87.90	11,268.15	25879.01
88.00	11,437.99	27014.32
88.10	11,608.64	28166.65
88.20	11,780.08	29336.09
88.30	11,952.33	30522.71
88.40	12,125.38	31726.59
88.50	12,299.23	32947.82

WATER QUALITY NOTES

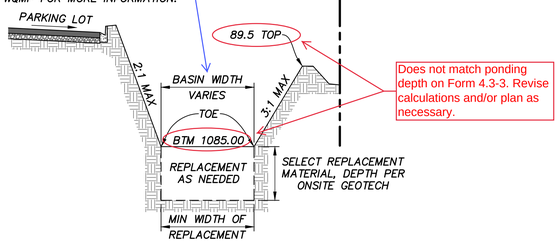
1. CONSTRUCTION DOCUMENTS (CDs) RELATED TO TEMPORARY AND/OR PERMANENT (POST-CONSTRUCTION) WATER QUALITY BMPS INCLUDE CIVIL GRADING AND/OR STORM DRAIN PLANS, STORM WATER POLLUTION PREVENTION PLAN (SWPPP), WATER QUALITY MANAGEMENT PLAN (WQMP) AND LANDSCAPE PLANS. IF LANDSCAPE PLANS CONFLICT WITH THE WQMP OR GRADING AND/OR STORM DRAIN PLANS, CONTRACTOR SHALL NOTIFY THE ENGINEER OF RECORD (EOR) AND/OR QUALIFIED SWPPP DEVELOPER (QSD) IMMEDIATELY.
2. CONTRACTOR SHALL IMPLEMENT THE SWPPP AND PLAN CONSTRUCTION ACTIVITIES SO THAT ALL PERMANENT WATER QUALITY BMPS ARE CLEAN AND FUNCTIONAL AT TERMINATION OF THE STATE CONSTRUCTION GENERAL PERMIT (CGP) AND ALL PERMANENT WATER QUALITY REQUIREMENTS ARE CONSTRUCTED PER THE WQMP AND ALL CDs.
3. DURING CONSTRUCTION AND PRIOR TO CGP TERMINATION, CONTRACTOR SHALL PREVENT FOULING OF PERMANENT WATER QUALITY BMP AREAS INCLUDING ABOVE- OR BELOW-GROUND INFILTRATION, RETENTION, BIOFILTRATION, BIOTREATMENT BASINS OR AREAS. FOULING OCCURS WHEN SOILS AND/OR MEDIA DESIGNED TO INFILTRATE POST-CONSTRUCTION STORMWATER ARE COMPACTED DURING CONSTRUCTION AND/OR WHEN FINES AND OTHER SEDIMENTS ARE DEPOSITED TO ANY PORTION OF A PLANNED PERMANENT WATER QUALITY BMP. FOULING SEDIMENT DEPOSITS OCCUR VIA STORMWATER (CONSTRUCTION PHASE EROSION AND SEDIMENT CONTROL BMP FAILURES), NON-STORMWATER (WATERING, TEMPORATY HIGH-LINE AND/OR WATER LINE TESTING FAILURES) AND/OR TEMPORARY FILL/STOCKPILING AND OTHER DIRECT GRADING AND COMPACTION OPERATIONS.
4. WHEN FOULING OCCURS CONTRACTOR SHALL NOT IMMEDIATELY CLEAN UP THE AREA EXCEPT AS REQUIRED FOR SAFETY, BUT SHALL IMMEDIATELY NOTIFY THE QSD. THE FOULED AREA WILL BE EVALUATED AND REPAIRS SHALL BE REQUIRED AT THE EXPENSE OF THE CONTRACTOR UP TO REMOVAL AND REPLACEMENT OF ALL BMP COMPONENTS (SOIL, MEDIA, FABRICS, ETC.) INCLUDING SUBGRADE SOILS.
5. CONTRACTOR SHALL ENSURE HEAVY CONSTRUCTION EQUIPMENT DOES NOT TRAVERSE NOR COMPACT ANY PLANNED BMP AREA WHILE THE CGP IS ACTIVE EXCEPT AS REQUIRED AND DIRECTED BY THE PROJECT GEOTECHNICAL ENGINEER. PRIOR TO GRADING, ALL BMP AREAS SHALL BE STAKED OFF TO PREVENT COMPACTION.
6. THE PROJECT GEOTECHNICAL ENGINEER MAY REQUIRE EXCAVATION AND REPLACEMENT OF POOR INFILTRATING SOILS WITHIN THE BMP INFILTRATION AREA FOOTPRINT WITH SELECT INFILTRATING SOILS TO DEPTHS DIRECTED BY THE GEOTECHNICAL ENGINEER AND WITH SOIL(S) SPECIFIED BY THE GEOTECHNICAL ENGINEER IN ORDER TO PROVIDE HYDRAULIC CONDUCTIVITY THROUGH THE INFILTRATION FOOTPRINT.
7. WHERE NOT OTHERWISE SPECIFIED, MEANS AND METHODS FOR SATISFYING ALL CGP AND PERMANENT WATER QUALITY REQUIREMENTS NOTED OR REFERENCED ABOVE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

NOTE:

ALL SITE PROPERTY, INCLUDING THE SOUTH DRIVEWAY AND ADA PARKING AREA THAT DRAINS TO ALDER AVENUE DUE TO GRADING CONSTRAINTS, IS INCLUDED FOR SITE DESIGN CAPTURE VOLUME CALCULATIONS. RIGHT OF WAY PARKWAY WILL RECEIVE NEW LANDSCAPING WITH EFFICIENT IRRIGATION. FLOWS FROM THE RAILROAD ARE DIVERTED INTO PROPOSED IMPROVED ALDER AVENUE BY AN ONSITE DITCH AT THE NORTH PROPERTY LINE (TO BE LOCATED BETWEEN THE NORTH PROPERTY LINE AND THE PROPOSED NORTH CURB OF THE NORTH ACCESS DRIVE).

provide a range dimension of top and bottom width.

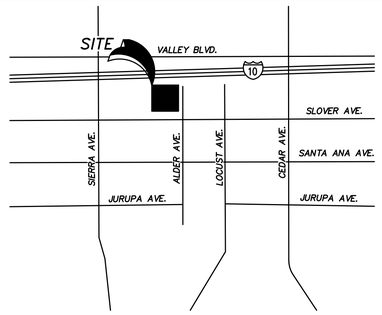
DURING CONSTRUCTION, ONSITE SOILS ENGINEER TO OVERSEE REMOVAL AND REPLACEMENT WITH SELECT AVAILABLE GRAVELLY SANDS BELOW BASIN BOTTOM AS SHOWN BELOW. SEE WATER QUALITY NOTE 6 ABOVE; AND SEE SOILS INFILTRATION REPORT (DATED 11/15/2018) AND FACTOR OF SAFETY DETERMINATION IN WQMP FOR MORE INFORMATION.



Does not match ponding depth on Form 4.3-3. Revise calculations and/or plan as necessary.

SECTION A-A

SCALE: H:1"=20' V:1"=4'



VICINITY MAP

OWNER

SRPF B/10336 ALDER, LLC
2001 ROSS AVE, SUITE 400
DALLAS, TX
APPLICANT CONTACT:
MICHAEL JOHNSON
(786)200-9681

APN

0252-131-03, 0252-131-04, 0252-131-36, 0252-131-41, 0252-131-43

RECEIVING WATERS

PROXIMATE: RIALTO CHANNEL
DOWNSTREAM: SANTA ANA RIVER REACH 4

LEGEND

- PROJECT BOUNDARY
- PROPOSED STORM DRAIN
- DIRECTION OF SURFACE DRAINAGE
- LANDSCAPE AREA

SB&O INC. PLANNING ENGINEERING SURVEYING

Alder Avenue Industrial — Job No: 74432
DCV & BMP Calculations — By: BCK
Sheet: 1 of 1 — Date: 5/21/2019

Design Capture Volume (DCV) Calculations:

DMA	Area (sf)	Area (ac)	Pervious Area (sf)	Pervious Percent (%)	Imperv Area (sf)	Imperv Percent (%)	Runoff Coeff Rc	Precip 2-yr 1-hr (NOAA) (in)	Mean 6-hr Precip: (Valley 1.4807) (in)	Max Draw-down Time (hrs)	DCV Required (C2 = 1.963) (cf)
Site	380,232	8.7289	64,672	17.01%	315,560	82.99%	0.6356	0.843	0.804	48	31,784

Volume in cubic feet provided per BMP design below: 35,179

Design Infiltration Rate Calculations used for infiltration BMPs:

Geotechnical Engineer measured infiltration rate within infiltration footprint: 4.0 in/hr
Factor of Safety (FS): 3.0
Design Infiltration Rate: 1.333 in/hr

Infiltration Basin Volume Calculations, Entire Site:

DMA	Permit Requried DCV (cf)	Surface Basin Footprint Area (sf)	Design Infiltration Rate (in/hr)	Surface Basin Volume (cf)	3-Hour Fill-Time Volume (cf)	Infiltration Volume Provided (cf)	Drawdown Time (< 48) (hrs)
Site	31,784	6,692	1.33	32,948	2,231	35,179	44.3

SB&O INC.
PLANNING ENGINEERING SURVEYING
41689 Enterprise Circle North, Suite 126
Temecula, Ca. 92590
951-695-8900
951-695-8901 Fax

ALDER AVENUE INDUSTRIAL

WQMP SITE MAP

5/22/2019 — SHEET 1 OF 1

J:\74432 ALDER AVE INDUSTRIAL\DWG\Z-74432-ZMM.DWG 5/22/2019 6:08:46 PM

Attachment B

DCV & BMP Design Calculations

SB&O INC.
PLANNING ENGINEERING SURVEYING

Alder Avenue Industrial — Job No: 74432
DCV & BMP Calculations — By: BCK
Sheet: 1 of 1 — Date: 5/21/2019

Design Capture Volume (DCV) Calculations:

DMA	Area (sf)	Area (ac)	Pervious Area (sf)	Pervious Percent (%)	Imperv Area (sf)	Imperv Percent (%)	Runoff Coeff Rc	Precip 2-yr 1-hr (NOAA) (in)	Mean 6-hr Precip: (Valley 1.4807) (in)	Max Draw-down Time (hrs)	DCV Required (C2 = 1.963) (cf)
Site	380,232	8.7289	64,672	17.01%	315,560	82.99%	0.6356	0.543	0.804	48	31,784

Volume in cubic feet provided per BMP design below: 35,179

Design Infiltration Rate Calculations used for infiltration BMPs:

Geotechnical Engineer measured infiltration rate within infiltration footprint:	4.0	in/hr
Factor of Safety (FS):	3.0	
Design Infiltration Rate:	1.333	in/hr

Infiltration Basin Volume Calculations, Entire Site:

DMA	Permit Requried DCV (cf)	Surface Basin Footprint Area (sf)	Design Infiltration Rate (in/hr)	Surface Basin Volume (cf)	3-Hour Fill-Time Volume (cf)	Infiltration Volume Provided (cf)	Drawdown Time (< 48) (hrs)
Site	31,784	6,692	1.33	32,948	2,231	35,179	44.3

Attachment C

NRCS and Geotechnical Engineer Soils Reports

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

Alder Avenue Industrial Building



June 4, 2018

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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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.

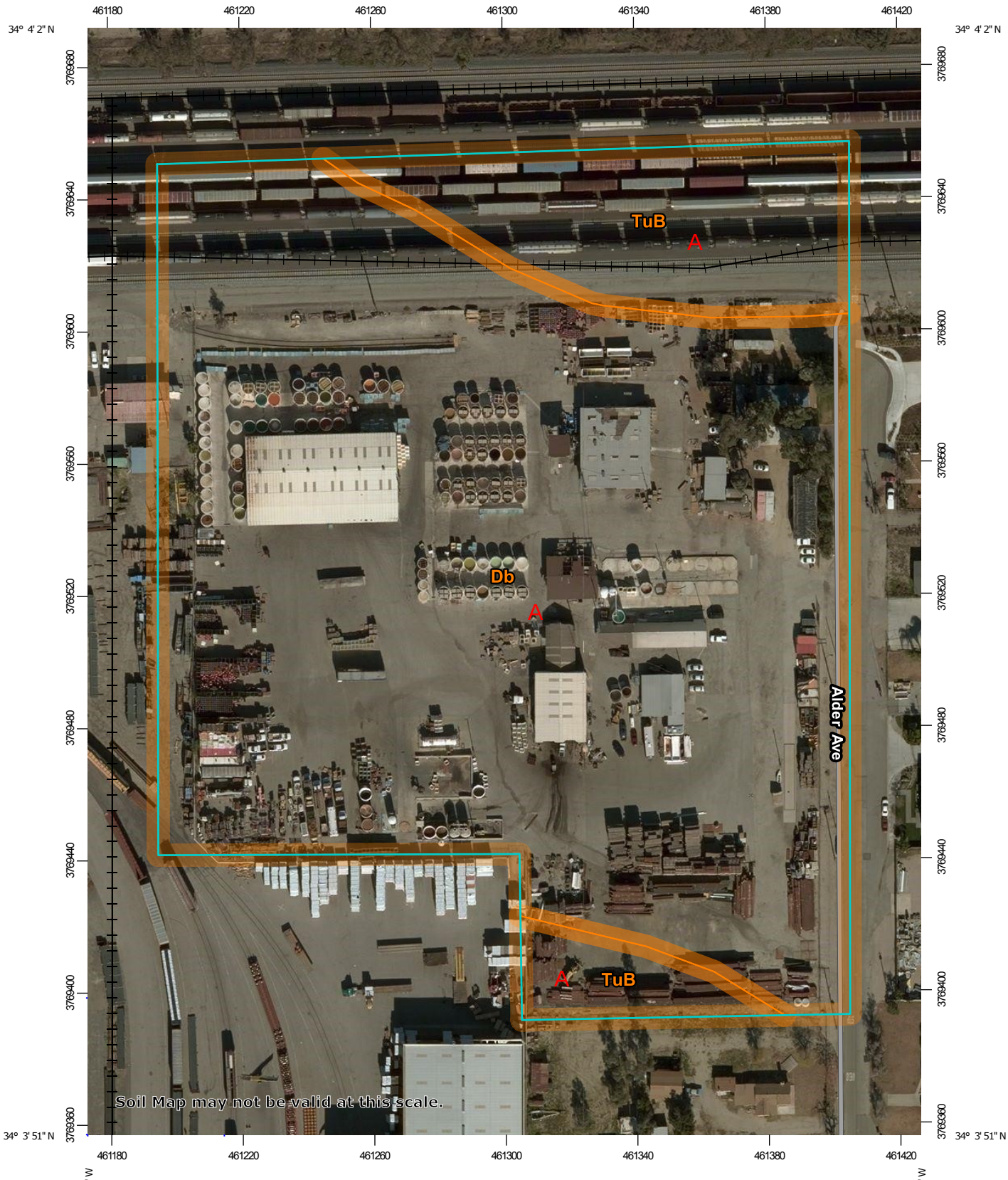
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,630 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

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 9, Sep 11, 2017

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

Date(s) aerial images were photographed: Jan 5, 2015—Jan 18, 2015

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
Db	Delhi fine sand	10.4	84.9%
TuB	Tujunga loamy sand, 0 to 5 percent slopes	1.9	15.1%
Totals for Area of Interest		**12.3**	**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

Db—Delhi fine sand

Map Unit Setting

National map unit symbol: hcjq
Elevation: 30 to 1,400 feet
Mean annual precipitation: 10 to 16 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 225 to 310 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Delhi

Setting

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

Typical profile

H1 - 0 to 18 inches: fine sand
H2 - 18 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Negligible
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: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Unnamed

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

Tujunga, loamy sand
Percent of map unit: 5 percent
Hydric soil rating: No

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

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
Natural 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 storage in profile: 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

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UPDATED GEOTECHNICAL INVESTIGATION
PROPOSED ALDER LOGISTICS CENTER

10336 Alder Avenue
San Bernardino County, California
for
Lake Creek Industrial

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

November 15, 2018

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Lake Creek Industrial
17551 Norwood Street
Tustin, California 92780

Attention: Mr. Michael Johnson
Principal

Project No.: **18G218-1**

Subject: **Updated Geotechnical Investigation**
Proposed Alder Logistics Center
10336 Alder Avenue
San Bernardino County, California

Dear Mr. Johnson:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Joseph Lozano Leon
Staff Engineer

REGISTERED PROFESSIONAL ENGINEER
GREGORY K. MITCHELL
No. 2364
GEOTECHNICAL
STATE OF CALIFORNIA

Gregory K. Mitchell, GE 2364
Principal Engineer

Distribution: (1) Addressee

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APPENDICES

A Plate 1: Site Location Map
Plate 2: Boring Location Plan
B Boring Logs
C Laboratory Test Results
D Grading Guide Specifications
E Seismic Design Parameters

1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Site Preparation

- Demolition should include all foundations, floor slabs, septic systems, utilities and any other subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should be disposed of off-site. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2-inch particle size, well mixed with the on-site soils, and incorporated into new structural fills or it may be crushed and made into crushed miscellaneous base (CMB), if desired.
- The site is generally underlain by undocumented artificial fill soils, extending to depths of 1½ to 4½± feet. The existing fill soils possess unfavorable consolidation/collapse characteristics. In addition, the near-surface alluvium also varies in density and possesses low strengths. Based on these conditions, remedial grading is considered warranted within the proposed building area in order to remove all of the undocumented fill soils in their entirety as well as a portion of the near-surface native alluvial soils, and replace these materials as compacted fill soils.
- It is recommended that the proposed building pad area be overexcavated to a depth of at least 4 feet below existing grade and to a depth of at least 4 feet below proposed pad grade. The overexcavation should also extend to a sufficient depth to remove all of the artificial fill materials. Overexcavation within the foundation areas is recommended to extend to a depth of at least 3 feet below proposed foundation bearing grade. The soils that will remain below the recommended depth of overexcavation generally possess greater relative densities and more favorable strengths.
- After overexcavation has been completed, the subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated. The resulting subgrade should then be scarified to a depth of 12 inches, thoroughly moisture conditioned and recompacted. The previously excavated soils may then be replaced as compacted structural fill.
- The new pavement and flatwork subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

- Conventional shallow foundations, supported in newly placed structural fill soils.
- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum reinforcement consisting of at least two (2) No. 5 rebars (1 top and 1 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab

- Conventional Slab-on-Grade, minimum 6 inches thick.
- Modulus of Subgrade Reaction: 150 psi/in.

- Reinforcement is not considered necessary, for geotechnical considerations.
- The actual floor slab reinforcement should be determined by the structural engineer, based on the imposed slab loading.

Pavements

ASPHALT PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Automobile Parking and Drives (TI = 4.0 & 5.0)	Truck Traffic		
		(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3½	4	5
Aggregate Base	3	4	5	5
Compacted Subgrade	12	12	12	12

ASPHALT PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Automobile Parking and Drives (TI = 4.0 & 5.0)	Truck Traffic		
		(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3½	4	5
Aggregate Base	3	4	5	5
Compacted Subgrade	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 18P444 dated November 2, 2018. The scope of services included a visual site reconnaissance and the review of the previously prepared geotechnical report to provide criteria for preparing the design of the building foundations, building floor slab, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The site is located on the west side of Alder Avenue, 600± feet north of Slover Avenue in Bloomington, at the address of 10336 Alder Avenue in an unincorporated area within San Bernardino County, California. The site is bounded to the north by a Southern Pacific Railroad easement, to the west by a railroad yard, to the south by a steel facility and to the east by Alder Avenue. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The subject site consists of an assemblage of five parcels which total 8.50± acres. The site is currently developed as the Gene Belk Fruit Packers and Briners facility. This facility includes a metal-frame building located in the northeastern corner of the site. This building is approximately 10,000 square feet and is of metal-frame construction with sheet-metal siding, presumably supported on a shallow foundation system with a concrete slab-on-grade floor. This building is currently being utilized for produce processing. The existing facility also includes numerous smaller structures and brine tanks throughout the site as well as a single-story single-family residence of wood-frame construction presumably supported on a shallow foundation system with a concrete slab-on-grade floor. Groundcover generally consists of heavily weathered asphaltic concrete pavements with isolated areas of exposed soil and aggregate base, and Portland cement concrete pavements surrounding the brine tanks.

It should be noted that the current owner of property has provided the approximate locations of existing underground improvements. The existing underground improvements include, but are not limited to, a 10,000-gallon rain storage tank located in the southern region of the site, and two (2) septic systems in the western and eastern regions. The underground improvements presumably extend to a depth of 12± feet below the existing site grades. In addition, each septic system includes a 40±-foot deep 4±-foot diameter seepage pit. The existing underground improvements are depicted on Plate 2 in Appendix A of this report.

Topographic information was obtained from a conceptual grading plan prepared by SB&O, Inc., the project civil engineer. Based on our review of this plan, the existing site topography generally slopes downward to the south to southeast at a gradient of 1 to 2 percent. The elevation at the subject site ranges from 1100± feet mean sea level (msl) at the northwest corner of the site to 1088± feet msl in the southeast corner of the site. There is approximately 12 feet of elevation differential across on subject site.

3.2 Proposed Development

Based on a preliminary site plan prepared by Douglas Franz Architects, Inc., the site will be developed with a 172,780± ft^2 commercial/industrial building located in the northcentral region of the site. The new building will include a 2,000± ft^2 mezzanine. The new building will be constructed with dock-high doors along the southern building wall. The building is expected to

be surrounded by asphaltic concrete pavements in the parking and drive lane areas, Portland cement concrete pavements in the loading dock areas, and concrete flatwork and landscaped planters located throughout the site.

Detailed structural information has not been provided. It is assumed that the new building will be a single-story structure of tilt-up concrete construction. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the conceptual grading plan prepared by SB&O, Inc., maximum cuts and fills of 1 to 3± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of six (6) borings, advanced to depths of 5 to 20± feet below currently existing site grades. The borings for this project were drilled on February 22, 2018. All of the borings were logged during drilling by a member of our staff.

All borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and in-situ soil samples were taken during drilling. Relatively undisturbed in-situ samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. In-situ samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Pavements

Asphaltic concrete pavements were encountered at the ground surface at most of the boring locations. The pavements consist of 2± inches of asphaltic concrete with no underlying layer of aggregate base. However, Boring No B-5 was drilled in an area covered with aggregate base at the ground surface. At this location, the aggregate base is 6 inches thick.

Artificial Fill

Artificial fill soils were encountered below the pavements and/or aggregate base at all of the boring locations. The fill soils extend to depths of 1½ to 4½± feet below the existing site grades. The fill soils generally consist of loose to medium dense silty fine sands and medium to coarse sands, with varying fine to coarse gravel content and occasional cobbles. The fill soils possess a disturbed, mottled, appearance, resulting in their classification as artificial fill.

Alluvium

Native alluvial soils were encountered below the fill soils at all of the boring locations, extending to the maximum depth explored of 20± feet below the existing site grades. The alluvial soils generally consist of medium dense to very dense silty fine to medium sands, gravelly fine to coarse sands, fine to coarse sandy gravel, and fine sandy silts, with occasional to extensive cobbles.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 20± feet at the time of the subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the recent high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well (Well 340661N1174301W001) is located approximately 3,000 feet west of the site. Water level readings within this monitoring well indicate a historic high water level of 268± feet (January 2010) below the existing site grades.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. Field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	ACI-318 Classification
B-1 @ 0 to 5 feet	0.015	Not Applicable (S0)
B-3 @ 0 to 5 feet	0.047	Not Applicable (S0)

Consolidation

Selected soil samples have been tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-4 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-5 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

Seismic Design Parameters

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure

including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

The 2016 CBC Seismic Design Parameters have been generated using U.S. Seismic Design Maps, a web-based software application developed by the United States Geological Survey. This software application, available at the USGS web site, calculates seismic design parameters in accordance with the 2016 CBC, utilizing a database of deterministic site accelerations at 0.01 degree intervals. The table below is a compilation of the data provided by the USGS application. A copy of the output generated from this program is included in Appendix E of this report. A copy of the Design Response Spectrum, as generated by the USGS application is also included in Appendix E. Based on this output, the following parameters may be utilized for the subject site:

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.500
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.608
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.912
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.608

Liquefaction

Liquefaction is the loss of the strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles (d<0.005mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The California Geological Survey (CGS) has not yet conducted detailed seismic hazards mapping in the area of the subject site. The general liquefaction susceptibility of the site was determined by research of the San Bernardino County Official Land Use Plan, General Plan, Geologic Hazard Overlays. Map FH29 C for the Fontana Quadrangle indicates that the subject site is not located within an area of liquefaction susceptibility. Based on the mapping performed by the County of San Bernardino and the subsurface conditions encountered at the boring locations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

All of the borings encountered artificial fill materials at the ground surface. The fill soils extend to depths of 1½ to 4½± feet at the borings performed within the proposed building area. Based on a lack of documentation regarding the placement and compaction of the existing fill materials, these soils are considered to consist of undocumented fill, and are not suitable for the support of the foundation loads of the proposed building. In addition, the near-surface alluvial soils possess varying strengths and densities. Finally, the near-surface soils will become significantly disturbed during demolition of the existing structures. Remedial grading is considered warranted within the proposed building area to remove the artificial fill soils in their entirety and an upper portion of the near-surface native alluvium, and replace these soils as compacted structural fill.

Settlement

The recommended remedial grading will remove the existing undocumented fill soils and a portion of the near-surface native alluvial soils and replace these materials as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation will not be subject to significant stress increases from the foundations of the new structure. Therefore, following completion of the recommended grading, post-construction settlements are expected to be within tolerable limits.

Soluble Sulfates

The results of the soluble sulfate testing indicate soluble sulfate concentrations of 0.015 to 0.047 percent within the tested soil samples. These concentrations are considered to be not applicable (S0) with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building area.

Expansion

The near-surface soils generally consist of silty fine sands and medium to coarse sands, with varying fine to coarse gravel content and occasional cobbles. These materials have been visually classified as very low to non-expansive. Therefore, no design considerations related to expansive soils are considered warranted for this site.

Shrinkage/Subsidence

Based on the results of the laboratory testing, removal and recompaction of the near-surface fill soils is estimated to result in an average shrinkage of 10 to 14 percent. Removal and replacement of the near-surface native alluvium will likely result in an average shrinkage of 6 to 10 percent. However, the estimated shrinkage of the individual soil layers at the site is highly variable, locally ranging from a minimum shrinkage value of 1 percent to a maximum shrinkage of 19 percent at

varying sample depths and locations. It should be noted that the potential shrinkage estimate is based on dry density testing performed on small-diameter samples taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1 feet.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

Grading and foundation plans were not available at the time of this report. It is therefore recommended that we be provided with copies of the preliminary grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping and Demolition

Demolition of the existing structures and pavements will be necessary in order to facilitate the construction of the proposed development. Demolition should include all foundations, floor slabs, septic systems, rainwater storage tank, utilities and any other subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should be disposed of off-site. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2-inch particle size, well mixed with the on-site soils, and incorporated into new structural fills or it may be crushed and made into crushed miscellaneous base (CMB), if desired.

Demolition of the existing septic systems should include the removal of the sewer septic tanks, in their entirety, and the abandonment of the existing seepage pits. The seepage pit structures should be removed to a depth of at least 1 foot below the base of the recommended overexcavation within the proposed building pad area (as presented in the next section of this report) and to at least 3 feet below the proposed subgrade elevations outside the building pad area. The remaining section of the seepage pit should then be backfilled with a 2-sack cement slurry mix. The existing rainwater storage tank should be removed in its entirety.

Initial site stripping should include removal of any surficial vegetation from the site. Stripping should include any shrubs, trees and any organic top soils located in the landscaped planter areas. Root balls associated with the trees should be removed in their entirety, and the resultant excavations should be backfilled with compacted structural fill soils. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pad

Remedial grading should be performed within the proposed building area in order to remove the existing undocumented fill soils, which extend to depths of 1½ to 4½± feet, at the boring locations. The existing soils within the proposed building area are also recommended to be overexcavated to a depth of at least 4 feet below existing grade and to a depth of at least 4 feet below proposed building pad subgrade elevation, whichever is greater, to provide a uniform layer of compacted fill below the new structure. **The overexcavation should also extend to a sufficient depth to remove the undocumented fill soils in their entirety**.

Additional overexcavation should be performed within the influence zones of the new foundations, to provide for a new layer of compacted structural fill extending to a depth of 3 feet below proposed bearing grade.

The overexcavation areas should extend at least 5 feet beyond the building and foundation perimeters, and to an extent equal to the depth of fill placed below the foundation bearing grade, whichever is greater. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the building area should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. **Some localized areas of deeper excavation may be required if additional fill materials or loose, porous, or low density native soils are encountered at the base of the overexcavation**.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches, moisture treated to 0 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of any proposed retaining walls and non-retaining site walls should be overexcavated to a depth of 3 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pad. Any undocumented fill soils within any of these foundation areas should be removed in their entirety. The overexcavation areas should extend at least 5 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Please note that erection pads are

considered to be part of the foundation system. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning, and recompacting the upper 12 inches of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

Treatment of Existing Soils: Flatwork, Parking and Drive Areas

Based on economic considerations, overexcavation of the existing near-surface existing soils in the new flatwork, parking and drive areas is not considered warranted, with the exception of areas where lower strength or unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new flatwork, parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above the optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed flatwork, parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within these areas. The grading recommendations presented above do not mitigate the extent of undocumented fill or compressible/collapsible native alluvium in the flatwork, parking and drive areas. As such, some settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the flatwork, parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2016 CBC and the grading code of the County of San Bernardino.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Selective Grading and Oversized Material Placement

The existing soils beginning from the ground surface possess moderate cobble content. It is expected that large scrapers (Caterpillar 657 or equivalent) will be adequate to move the cobble containing soils as well as some of the soils containing smaller boulders. Although not readily observed in the boring locations, some large boulders (2± feet in size) are expected to encountered at the subject site. It will likely be necessary to move such larger boulders individually, and place them as oversized materials in accordance with the Grading Guide Specifications, in Appendix D of this report.

Since the proposed grading will require excavation of cobble and boulder containing soils, it may be desirable to selectively grade the proposed building pad area. The presence of particles greater than 3 inches in diameter within the upper 1 to 3 feet of the building pad subgrade will impact the utility and foundation excavations. Depending on the depths of fills required within the proposed parking areas, it may be feasible to sort the on-site soils, placing the materials greater than 3 inches in diameter within the lower depths of the fills, and limiting the upper 1 to 3 feet of soils to materials less than 3 inches in size. Oversized materials could also be placed within the lower depths of the recommended overexcavations. In order to achieve this grading, it would likely be necessary to use rock buckets and/or rock sieves to separate the oversized materials from the remaining soil. Although such selective grading will facilitate further construction activities, it is not considered mandatory and a suitable subgrade could be achieved without such extensive sorting. However, in any case it is recommended that all materials greater than 6 inches in size be excluded from the upper 1 foot of the surface of any compacted fills. **The placement of any oversized materials should be performed in accordance with the grading guide specifications included in Appendix D of this report**. If disposal of oversized materials is required, rock blankets or windrows should be used and such areas should be observed during construction and placement by a representative of the geotechnical engineer.

Imported Structural Fill

All imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. It is recommended that materials in excess of 3 inches in size not be used for utility trench backfill. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by County of San Bernardino. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Moisture Sensitive Subgrade Soils

Some of the near surface soils possess appreciable silt content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

Excavation Considerations

The near surface soils generally consist of loose to medium dense silty sands and fine to medium sands. These materials are expected to be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, temporary excavation slopes should be no steeper than 2h:1v. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Groundwater

Based on the lack of any free water at the boring locations, the static groundwater table at this site is considered to exist at a depth in excess of 20± feet. Therefore, groundwater is not expected to impact grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pad will be underlain by structural fill soils used to replace existing undocumented fill soils and the upper-portion of the alluvium. These new structural fill soils are expected to extend to depths of at least 3 feet below proposed foundation bearing grade, underlain by 1± foot of additional soil that has been densified and moisture conditioned in place. Based on this subsurface profile, the proposed structure may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).

- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.

- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on geotechnical considerations; additional reinforcement may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Soils suitable for direct foundation support should consist of newly placed structural fill, compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill or suitable native alluvium (where reduced bearing pressures are utilized), with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 0 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 50-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 300 lbs/ft^3
- Friction Coefficient: 0.30

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill. The maximum allowable passive pressure is 2,500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floor of the new structure may be constructed as a conventional slab-on-grade supported on newly placed structural fill, extending to a depth of at least 4 feet below proposed finished grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 6 inches.

- Minimum slab reinforcement: Not required for geotechnical considerations. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Modulus of Subgrade Reaction: 150 psi/in.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where such moisture sensitive floor coverings are expected. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as 15 mil Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Moisture condition the floor slab subgrade soils to 0 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Retaining Wall Design and Construction

Based on the proposed use of the site, it is expected that some small retaining walls (less than 5 feet in height) will be required in the area of the new truck docks. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. We have provided parameters assuming the use of on-site soils for retaining wall backfill. The near surface soils generally consist of silty sands and fine to medium sands. Based on their classifications, the on-site soils are expected to possess a friction angle of at least 30 degrees when compacted to 90 percent of the ASTM-1557 maximum dry density.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		**Soil Type**
		On-Site Silty Sands and Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		130 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	44 lbs/ft^3
	Active Condition (2h:1v backfill)	69 lbs/ft^3
	At-Rest Condition (level backfill)	65 lbs/ft^3

Regardless of the backfill type, the walls should be designed using a soil-footing coefficient of friction of 0.30 and an equivalent passive pressure of 300 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Seismic Lateral Earth Pressures

In accordance with the 2016 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 3 feet below the proposed bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

On-site soils may be used to backfill the retaining walls. However, all backfill material placed within 3 feet of the back wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls be used. If the drainage composite material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The drainage composite should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 4-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the

wall and at an approximate 8-foot on-center spacing. The weep holes should include a pocket of gravel, 2± cubic feet in size, surrounded by a geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system.

6.8 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of silty sands and fine to coarse sands with varying gravel content. These soils are considered to possess excellent pavement support characteristics with estimated R-values of 50 to 60. Since R-value testing was not included in the scope of services for this project, the subsequent pavement design is based upon an assumed R-value of 50. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20 year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Automobile Parking and Drives (TI = 4.0 & 5.0)	Truck Traffic		
		(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3½	4	5
Aggregate Base	3	4	5	5
Compacted Subgrade	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the Marshall maximum density, as determined by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 50)			
Materials	**Thickness (inches)**		
	Automobile and Light Truck Traffic (TI = 5.0 & 6.0)	Moderate Truck Traffic (TI =7.0)	Heavy Truck Traffic (TI =8.0)
PCC	5	6	7
Compacted Subgrade (95% minimum compaction)	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness.

7.0 GENERAL COMMENTS

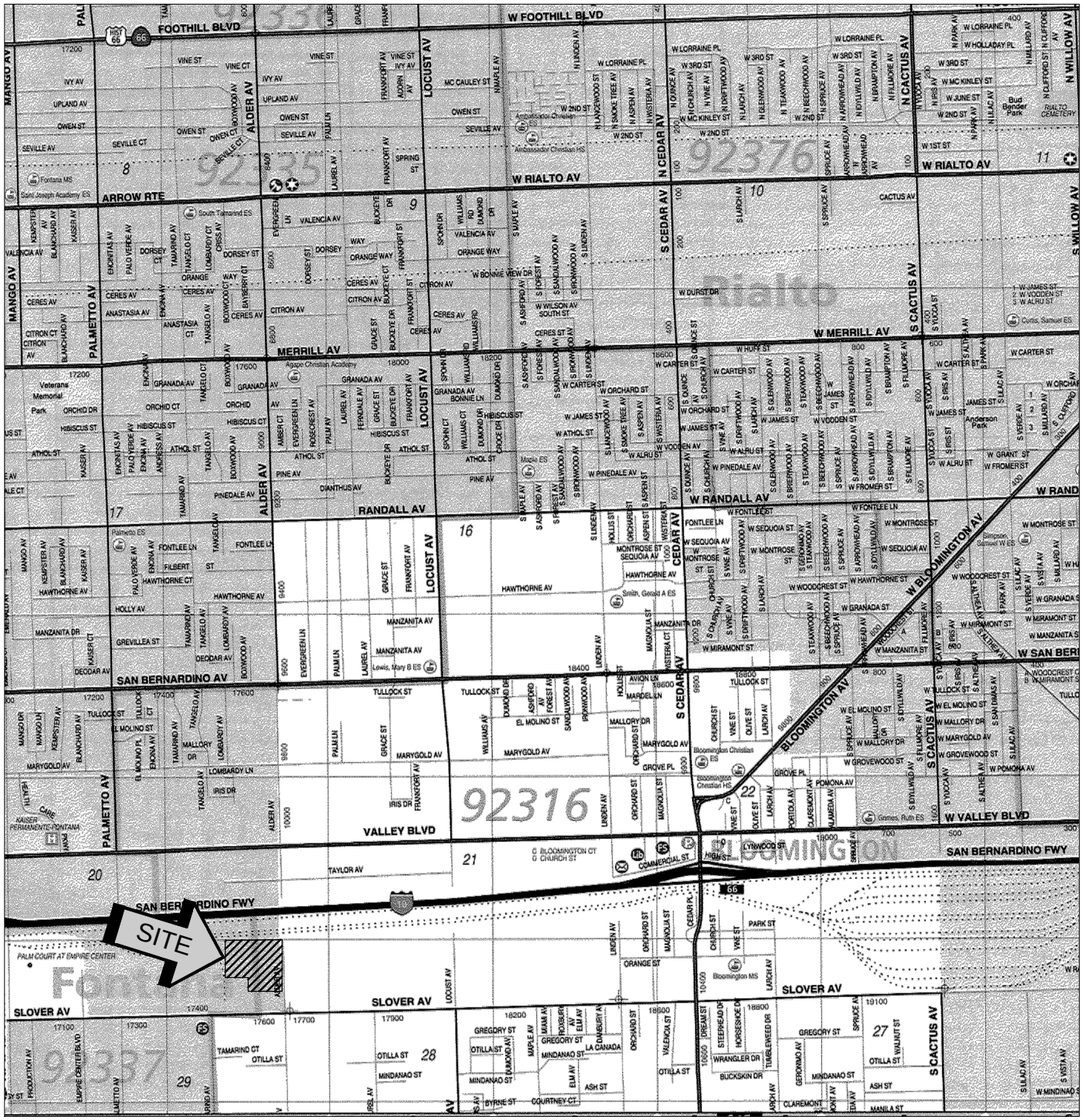
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

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

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SITE LOCATION MAP

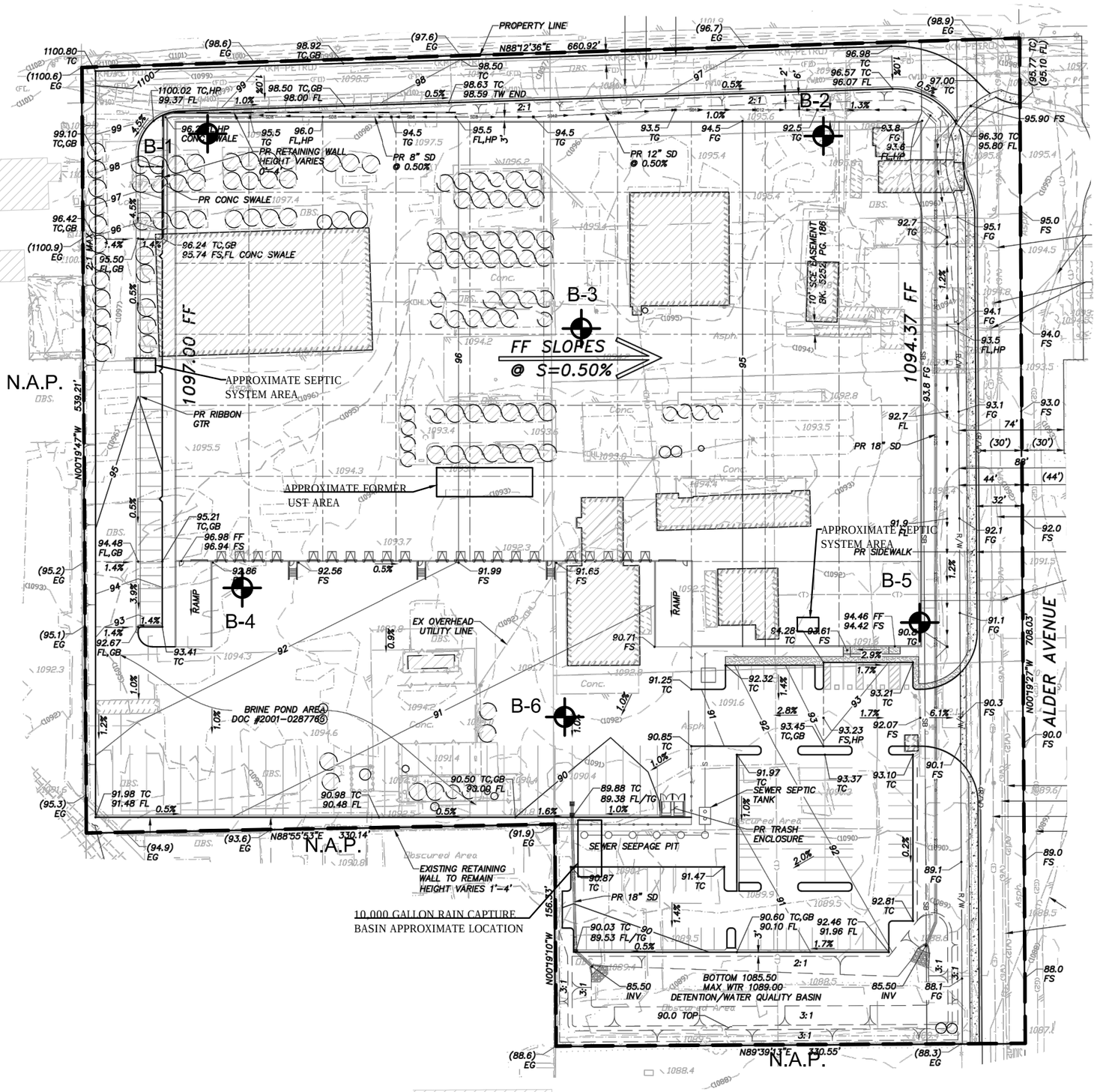
PROPOSED ALDER LOGISTICS CENTER

SAN BERNARDINO COUNTY, CALIFORNIA

SCALE: 1" = 2400'	
DRAWN: JLL CHKD: GKM	
SCG PROJECT 18G218-1	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



NORTH
SoCalGeo

GEOTECHNICAL LEGEND

- APPROXIMATE BORING LOCATION FROM PREVIOUS STUDY (SCG PROJECT NO. 18G112-1)
- EXISTING BUILDINGS AND BRINE TANKS TO BE DEMOLISHED

NOTE: SITE PLAN PREPARED BY SB&O, INC.

BORING LOCATION PLAN

PROPOSED ALDER LOGISTICS CENTER

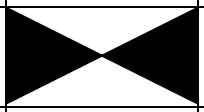
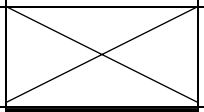
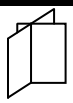
SAN BERNARDINO COUNTY, CALIFORNIA

SCALE: 1" = 80'	
DRAWN: JLL CHKD: GKM	
SCG PROJECT 18G218-1	
PLATE 2	

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

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

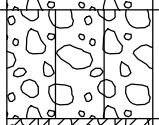
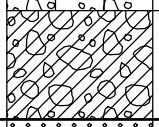
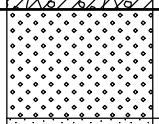
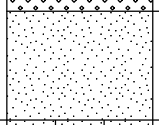
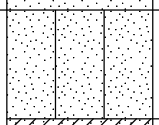
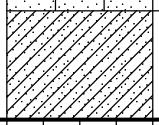
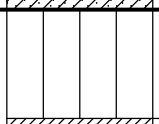
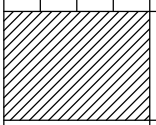
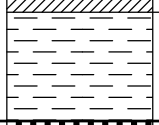
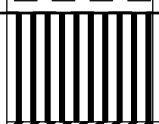
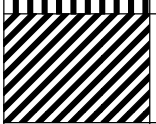
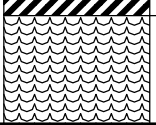
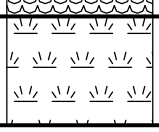
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 18G112
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 2/22/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jason Hiskey

WATER DEPTH: Dry
CAVE DEPTH: 5 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					3± inches Asphaltic concrete, no discernible Aggregate base							
		10			FILL: Brown to Gray Brown Silty fine Sand, trace coarse Sand, loose-damp to moist	102	6					
		7				97	9					
5		47			ALLUVIUM: Light Gray Brown fine to coarse Sandy Gravel, trace to little Silt, extensive Cobbles, dense-damp to moist	114	5					
		17			Brown Silty fine Sand, trace fine Gravel, occasional Cobbles, medium dense-damp to moist	109	7					
		20				118	7					
10					Light Gray Brown Silty fine to coarse Sand, little fine Gravel, occasional Cobbles, medum dense-damp to moist							
		50			Light Gray Brown fine to coarse Sand, trace Silt, little fine to coarse Gravel, dense to very dense-damp		3					
15												
		67					3					
20					Boring Terminated at 20'							

TBL 18G112.GPJ SOCALGEO.GDT 3/6/18

TEST BORING LOG **PLATE B-1**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 18G112
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 2/22/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jason Hiskey

WATER DEPTH: Dry
CAVE DEPTH: 6 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					2± inches Asphaltic concrete, no discernible Aggregate base							
		6			FILL: Gray Brown Silty fine Sand, trace medium to coarse Sand, loose-moist		9					
		22			ALLUVIUM: Light Gray Brown Gravelly fine to coarse Sand, occasional Cobbles, medium dense-damp		3					
5		15			Gray Brown fine Sandy Silt, trace fine Gravel, medium dense-very moist		16					
		20			Light Gray Brown to Gray fine to coarse Sand, little fine Gravel, trace Silt, occasional Cobbles, medium dense to very dense-damp		3					
10												
		75					4					
15					Boring Terminated at 15'							

TBL 18G112.GPJ SOCALGEO.GDT 3/6/18

TEST BORING LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 18G112
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 2/22/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jason Hiskey

WATER DEPTH: Dry
CAVE DEPTH: 6 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					2± inches Asphaltic concrete, no discernible Aggregate base							
		15			FILL: Brown Silty fine Sand, trace coarse Sand, trace fine Gravel, occasional Cobbles, trace Asphaltic concrete fragments, loose to medium dense-moist	103	8					
		29			ALLUVIUM: Light Brown fine to coarse Sandy Gravel, trace Silt, occasional Cobbles, medium dense-damp	121	3					
5		30			Light Gray Brown to Light Gray fine to medium Sand, little coarse Sand, little fine Gravel, medium dense-damp	100	3					
		14			Brown Silty fine Sand, trace fine Gravel, medium dense-moist	105	10					
		16				112	8					
10					Light Brown Silty fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, medium dense-moist							
		41			Light Gray Brown fine to coarse Sand, little Silt, litte fine to coarse Gravel, occasional Cobbles, dense-damp		3					
15												
		21			Light Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, medium dense-moist to very moist		12					
20					Boring Terminated at 20'							

TBL 18G112.GPJ SOCALGEO.GDT 3/6/18

TEST BORING LOG **PLATE B-3**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 18G112
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 2/22/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jason Hiskey

WATER DEPTH: Dry
CAVE DEPTH: 5 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					2± inches Asphaltic concrete, no discernible Aggregate base							
		7			FILL: Brown Silty fine Sand, trace medium to coarse Sand, loose-moist		8					
		9			ALLUVIUM: Light Brown fine to medium Sand, little Silt, trace coarse Sand, little fine to coarse Gravel, loose-damp		3					
5		10			Brown Silty fine Sand, trace coarse Sand, little fine Gravel, medium dense-damp		6					
		32			Light Gray Brown Silty fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense-damp		3					
10												
		43					2					
15												
		35					3					
20					Boring Terminated at 20'							

TBL 18G112.GPJ SOCALGEO.GDT 3/6/18

TEST BORING LOG **PLATE B-4**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 18G112
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 2/22/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jason Hiskey

WATER DEPTH: Dry
CAVE DEPTH: 2 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					6± inches Aggregate base							
		38			FILL: Light Gray Brown Silty fine to coarse Sand, little fine to coarse Gravel, occasional Cobbles, medium dense-damp	123	3					
		28			ALLUVIUM: Gray Brown fine to coarse Sandy Gravel, extensive Cobbles, medium dense-dry to damp	119	2					
5		22			Gray Gravelly fine to coarse Sand, occasional Cobbles, medium dense-dry	113	1					
		53			Gray Brown Silty fine to medium Sand, little coarse Sand, little fine to coarse Gravel, occasional Cobbles, dense-damp	122	3					
		60			Dark Gray Gravelly fine to coarse Sand, trace Silt, dense-dry to damp	122	2					
10												
		26				120	3					
15					Brown Silty fine Sand to fine Sandy Silt, little fine to coarse Gravel, little Iron oxide staining, medium dense-very moist							
					Light Brown Silty fine Sand, medium dense-damp to moist							
		21					7					
20					Boring Terminated at 20'							

TBL 18G112.GPJ SOCALGEO.GDT 3/6/18

TEST BORING LOG

PLATE B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 18G112 | DRILLING DATE: 2/22/18 | WATER DEPTH: Dry
PROJECT: Proposed Warehouse | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: 2 feet
LOCATION: San Bernardino County, California | LOGGED BY: Jason Hiskey | READING TAKEN: At Completion

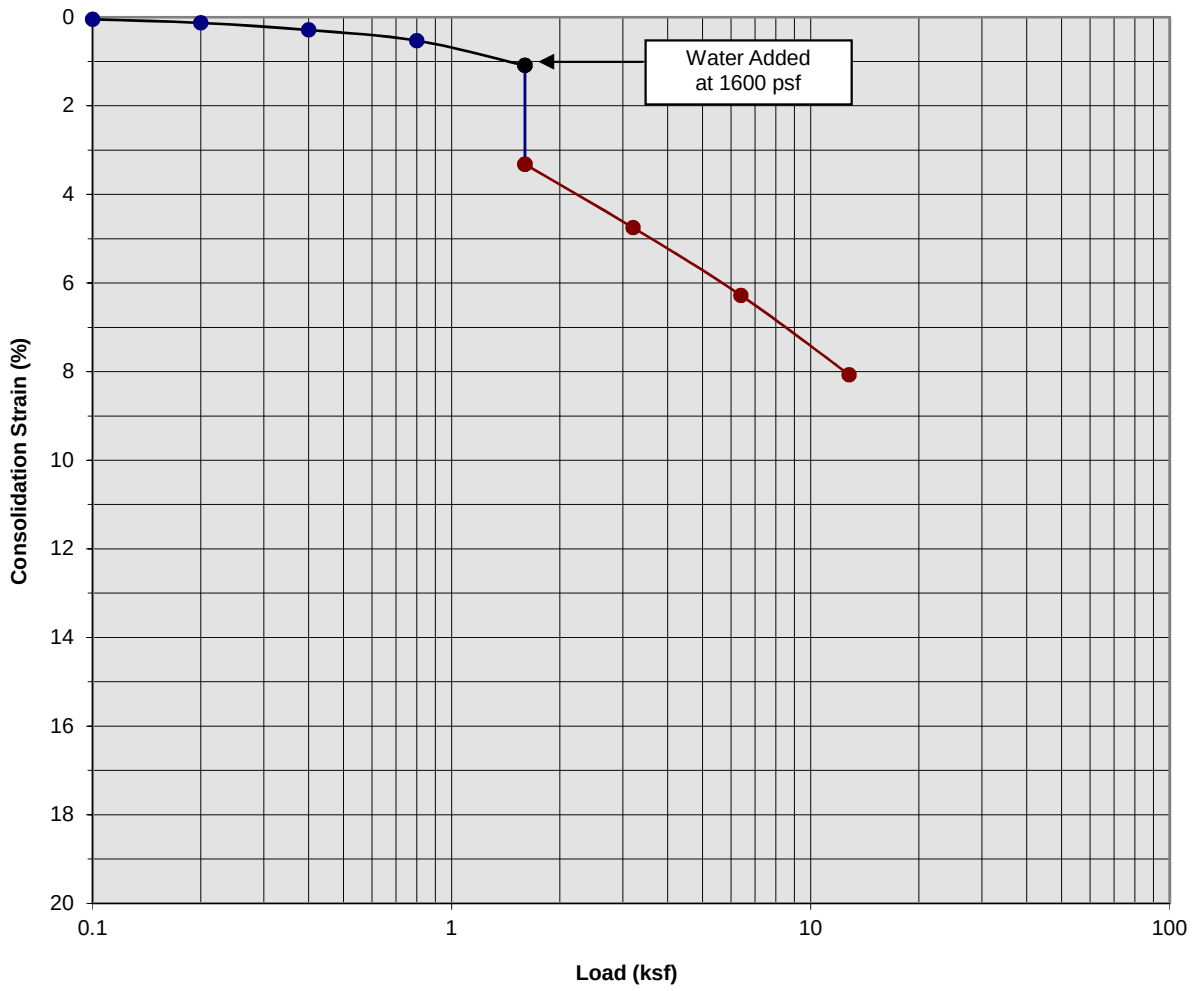
FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	UNCONFINED SHEAR (TSF)	COMMENTS
					2± inches Asphaltic concrete, no discernible Aggregate base							
		6			FILL: Brown Silty fine Sand, little fine Gravel, loose-moist		7					
		20			ALLUVIUM: Light Gray Brown Silty fine to medium Sand, little coarse Sand, little fine to coarse Gravel, medium dense-damp		6					
5					Boring Terminated at 5'							

TBL 18G112.GPJ SOCALGEO.GDT 3/6/18

TEST BORING LOG **PLATE B-6**

APPENDIX C

Consolidation/Collapse Test Results



Classification: FILL: Brown to Gray Brown Silty fine Sand, trace coarse Sand

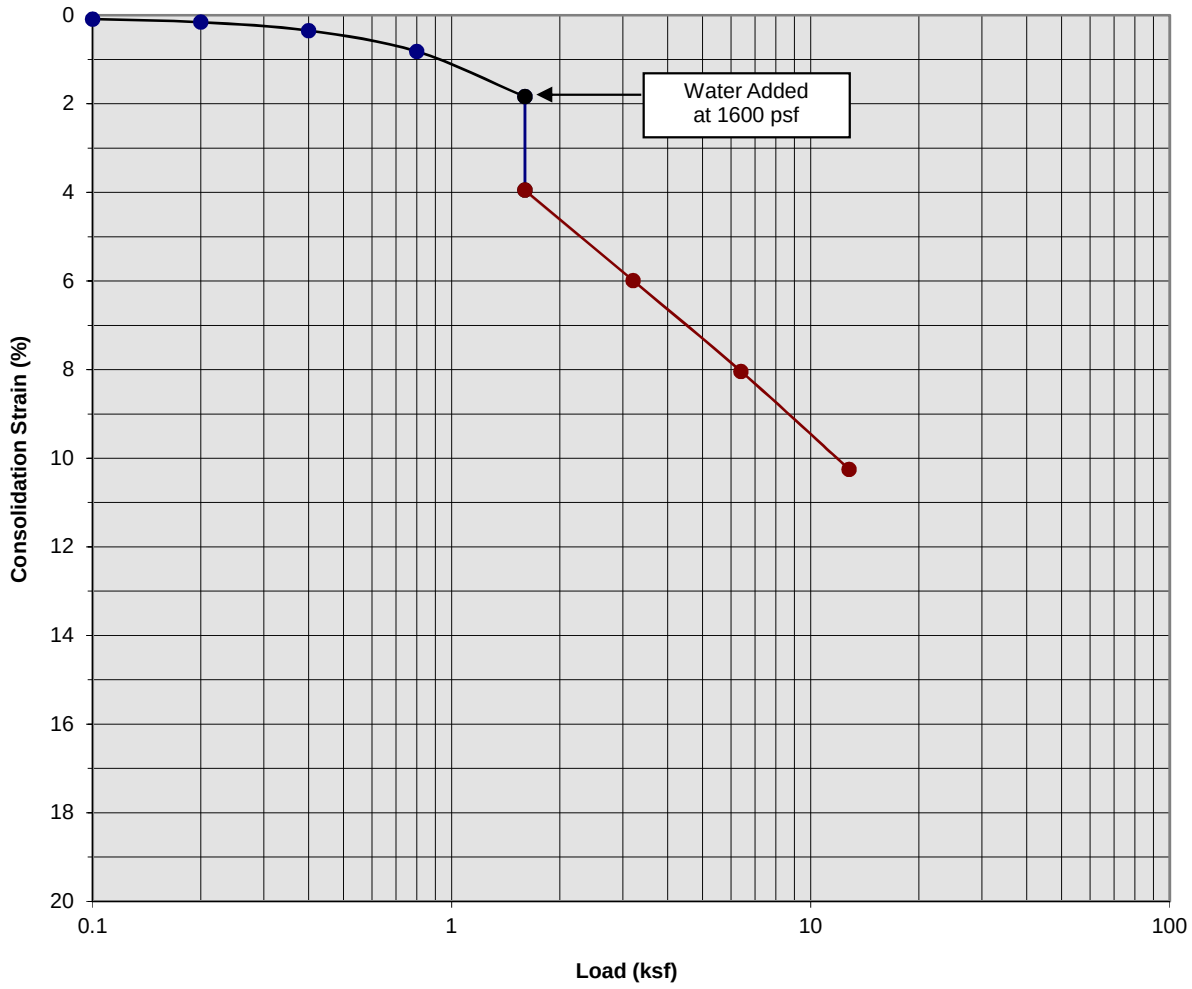
Boring Number:	B-1	Initial Moisture Content (%)	6
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	1 to 2	Initial Dry Density (pcf)	101.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	110.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.23

Proposed Warehouse
San Bernardino County, California
Project No. 18G112

PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: FILL: Brown to Gray Brown Silty fine Sand, trace coarse Sand

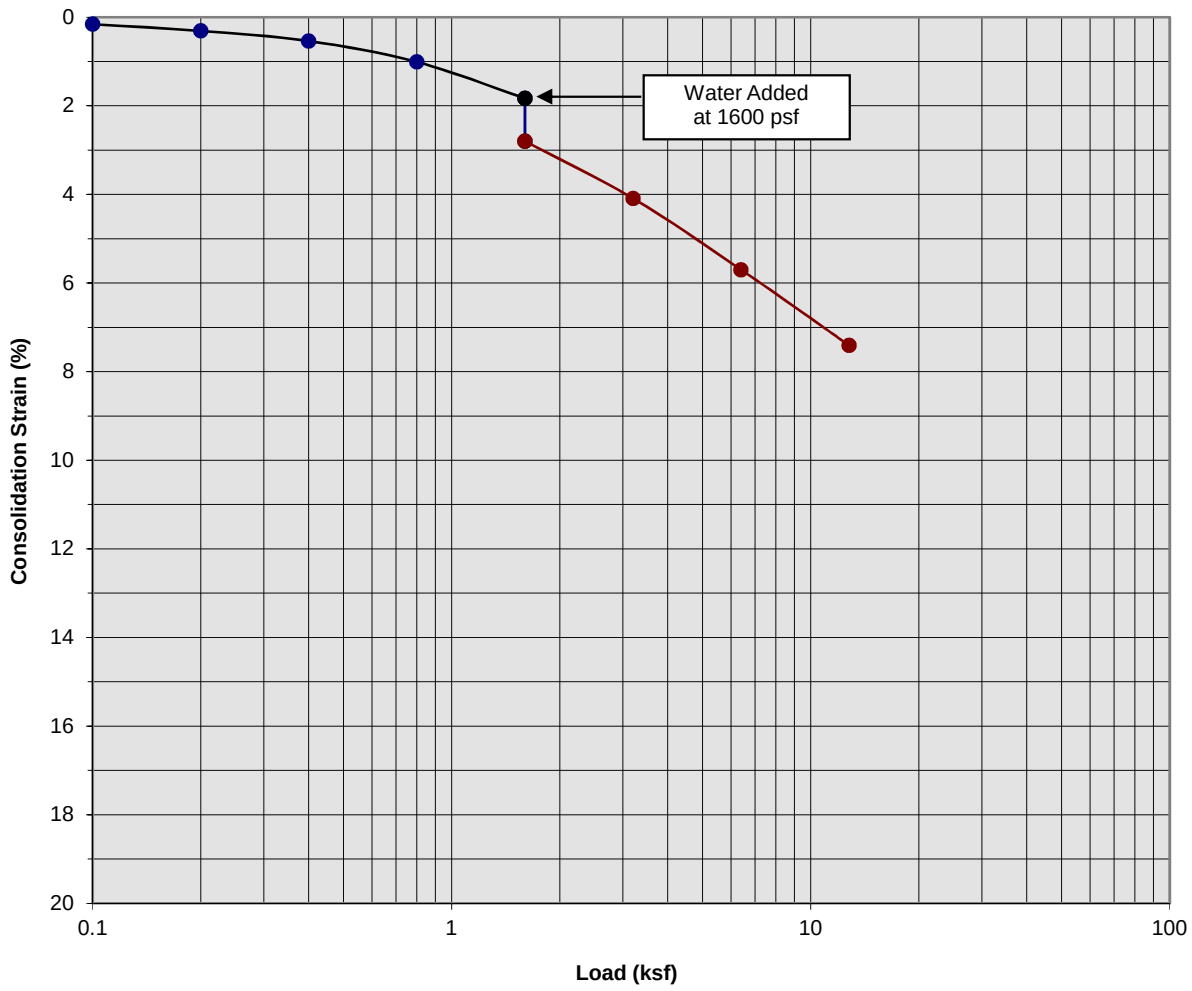
Boring Number:	B-1	Initial Moisture Content (%)	9
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	3 to 4	Initial Dry Density (pcf)	97.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	107.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.11

Proposed Warehouse
San Bernardino County, California
Project No. 18G112

PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Light Gray Brown fine to coarse Sandy Gravel, trace to little Silt

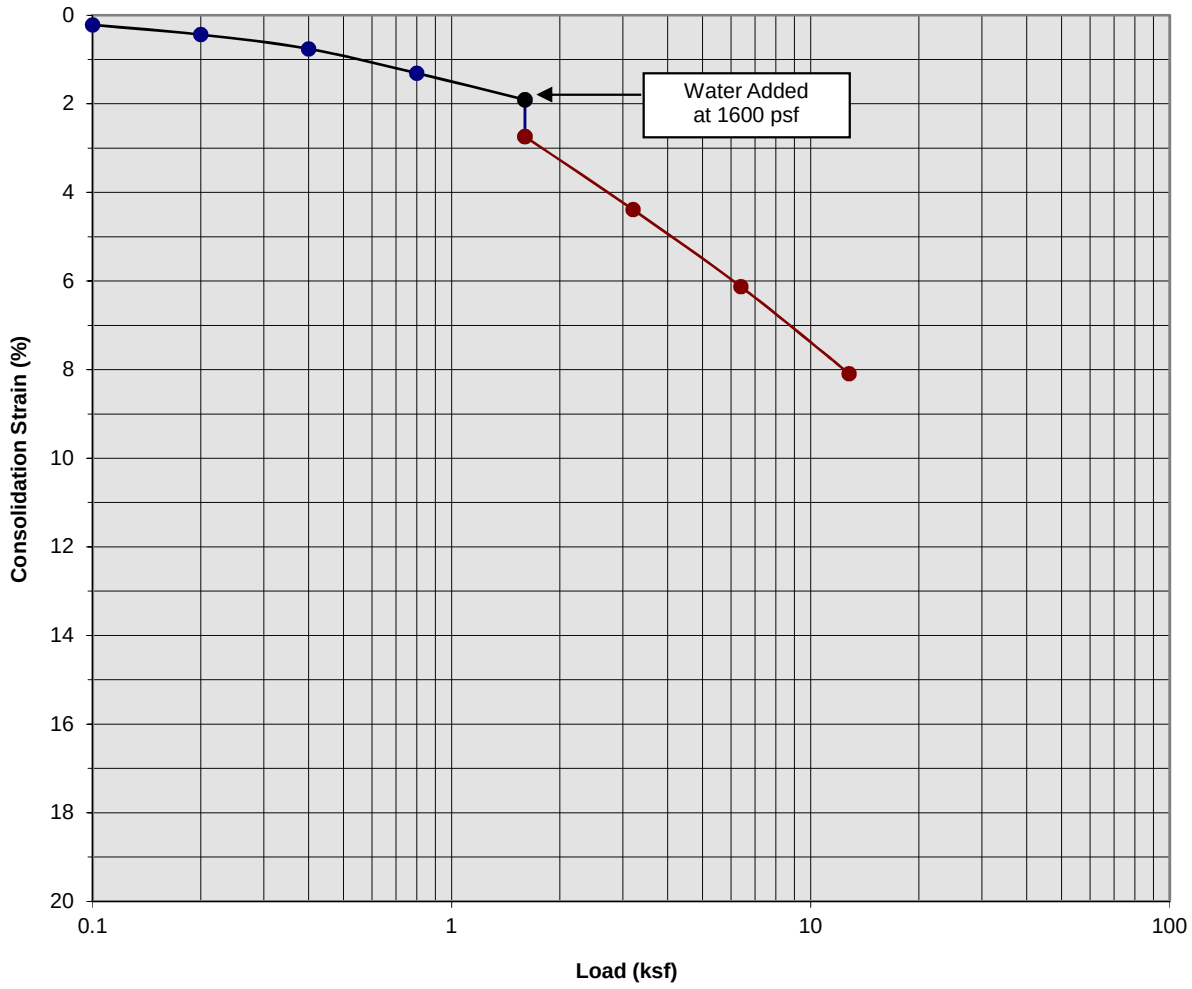
Boring Number:	B-1	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	5 to 6	Initial Dry Density (pcf)	114.4
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	123.5
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.97

Proposed Warehouse
San Bernardino County, California
Project No. 18G112

PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown Silty fine Sand, trace fine Gravel, occasional Cobbles

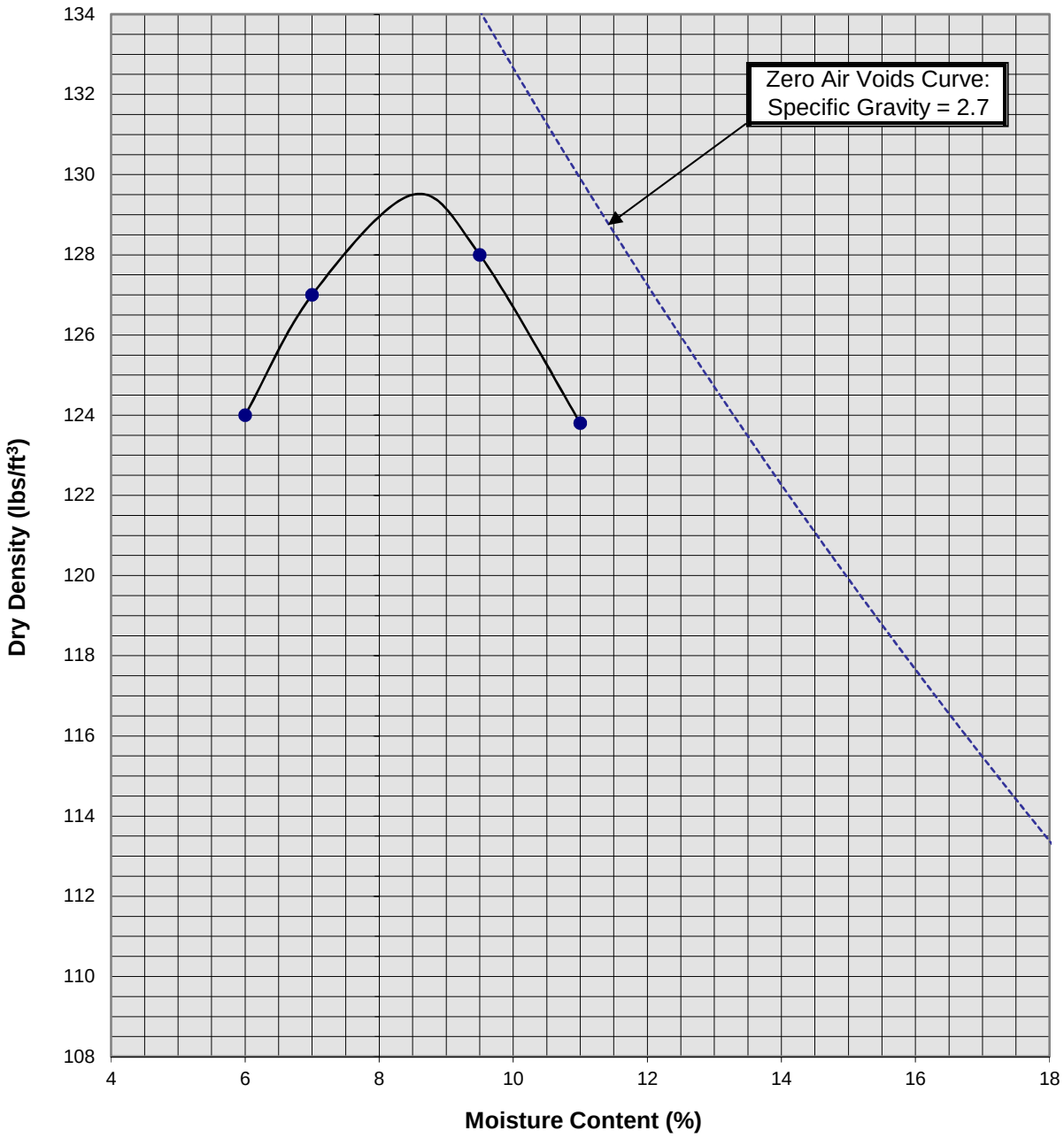
Boring Number:	B-1	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	7 to 8	Initial Dry Density (pcf)	109.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	118.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.83

Proposed Warehouse
San Bernardino County, California
Project No. 18G112

PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Moisture/Density Relationship
ASTM D-1557



Soil ID Number	B-3 @ 0 to 5'
Optimum Moisture (%)	8.5
Maximum Dry Density (pcf)	129.5
Soil Classification	Brown Silty fine Sand, little fine to coarse Gravel

Proposed Warehouse
San Bernardino County, California
Project No. 18G112

PLATE C-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as “contaminated,” and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

    - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

    - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

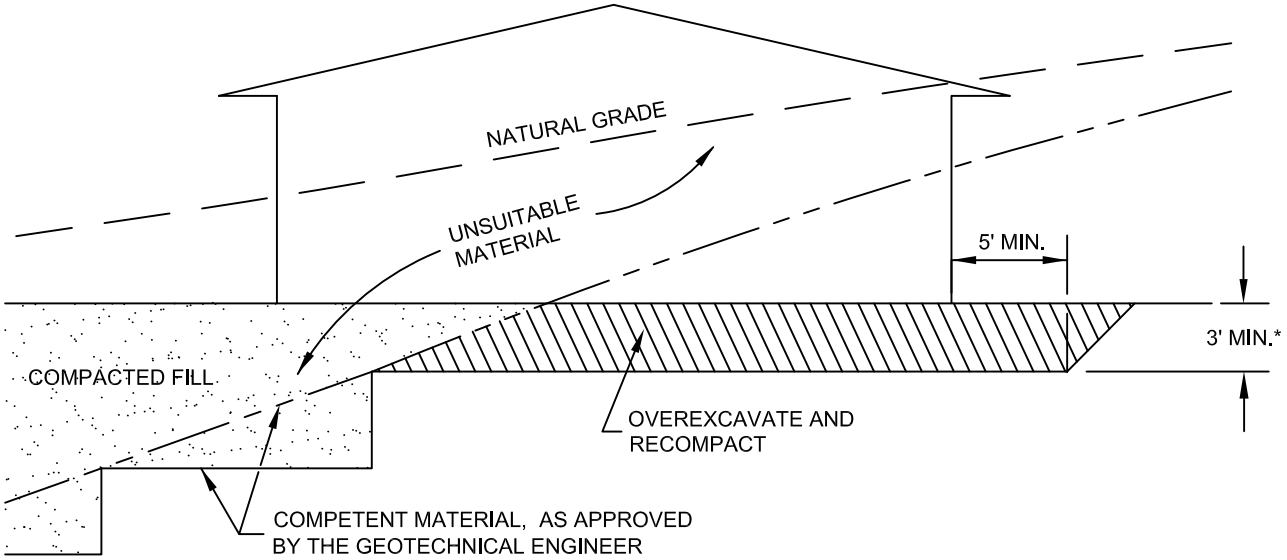
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

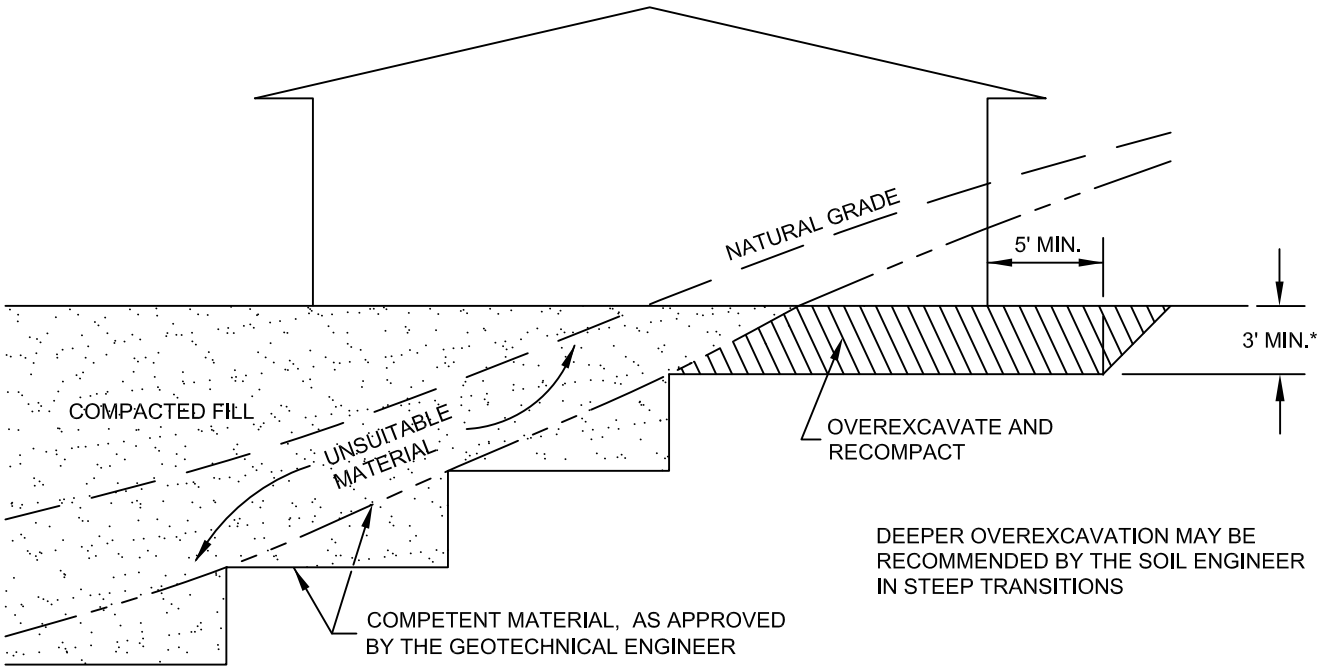
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION. ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

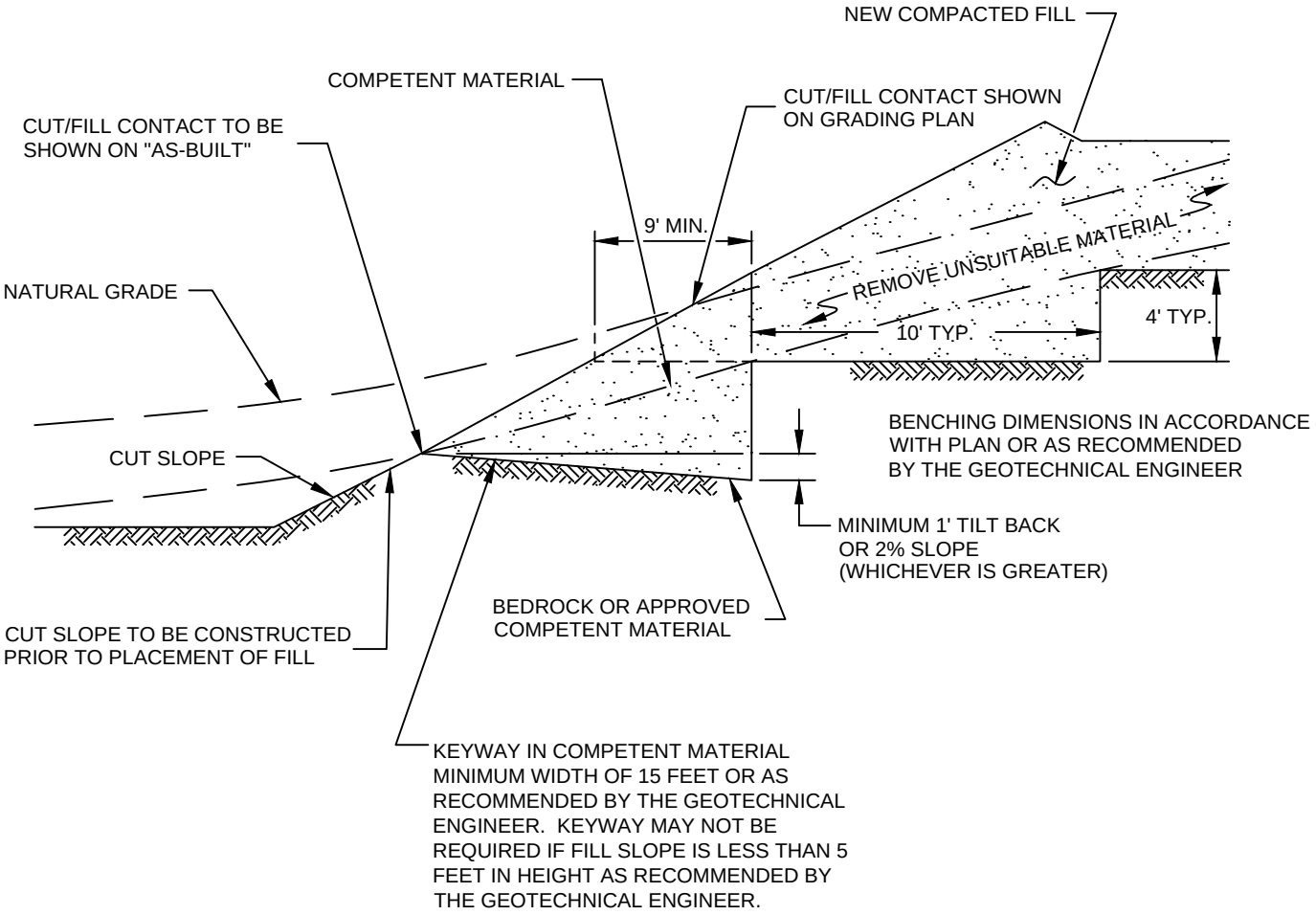
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

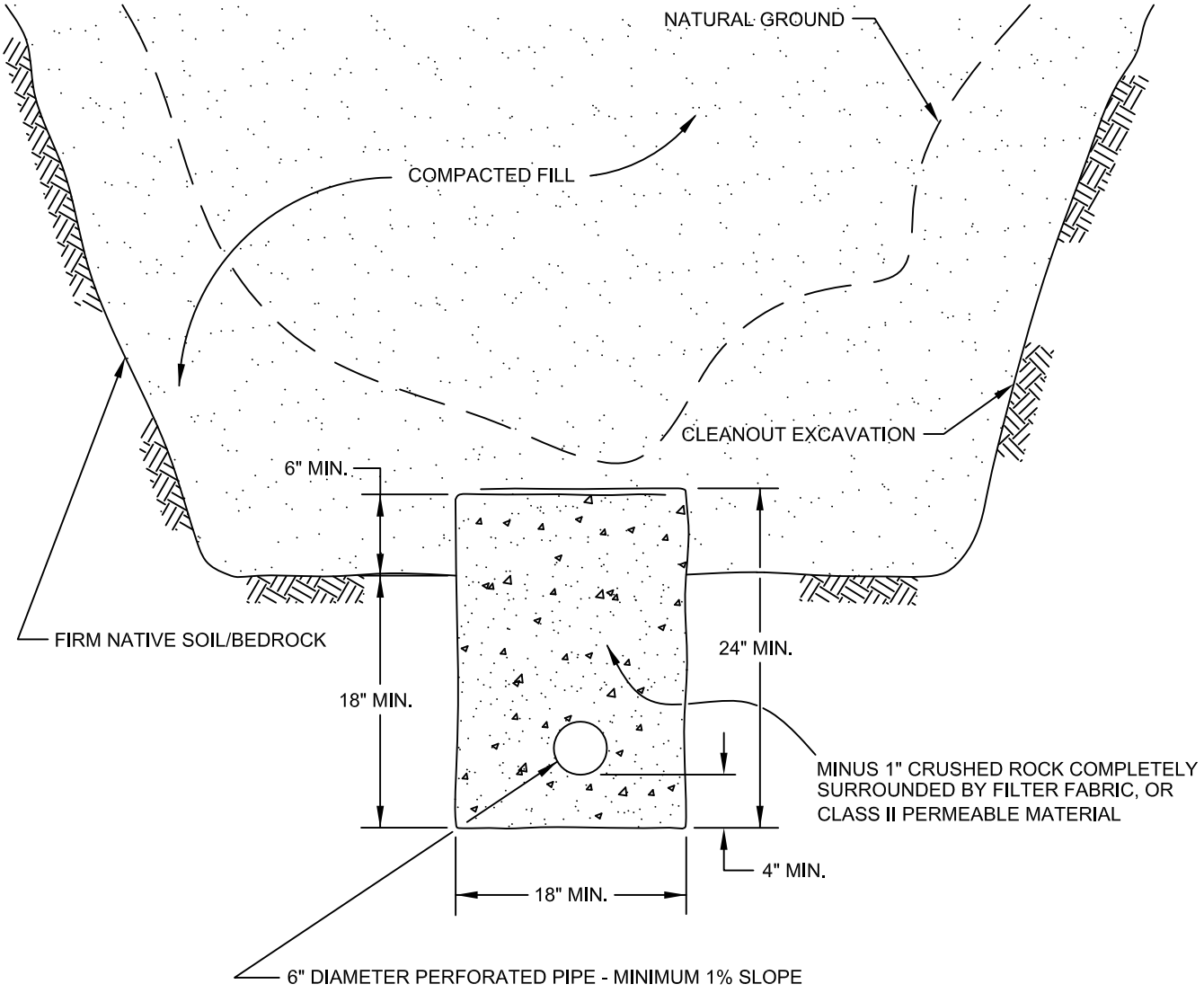
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

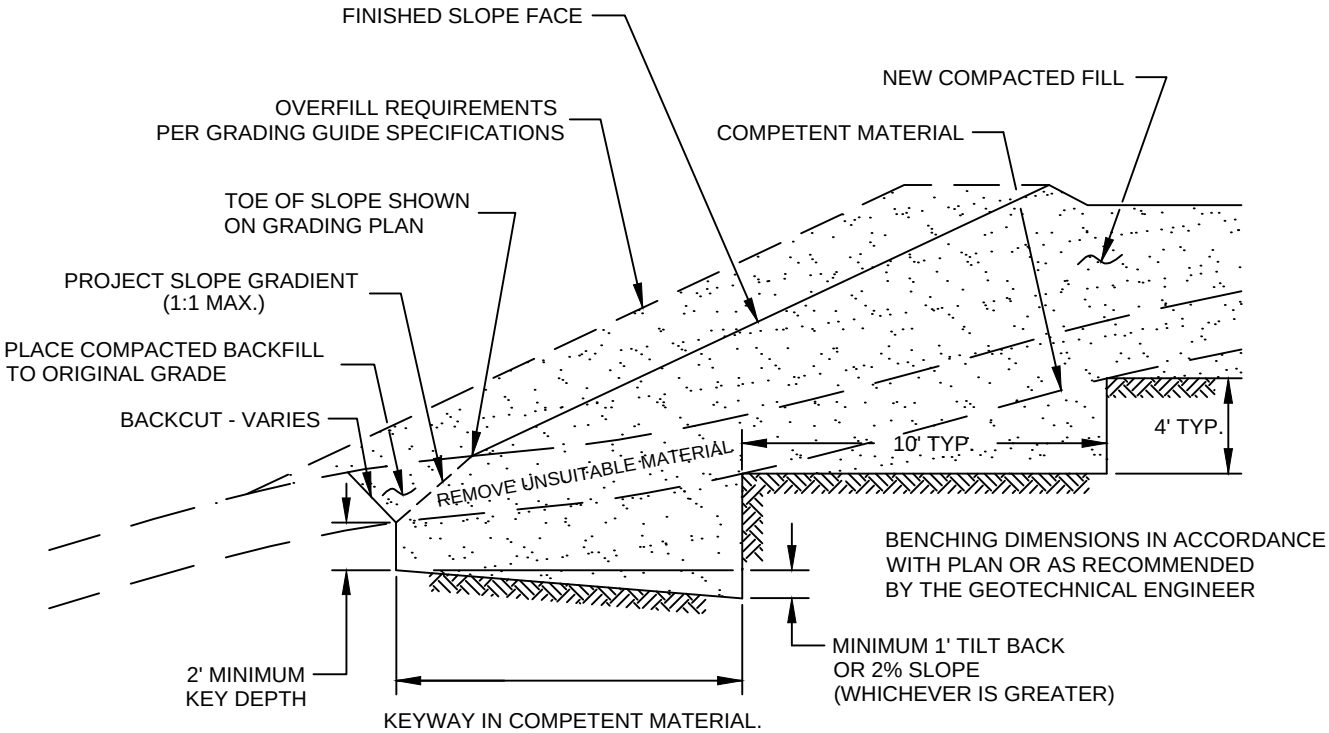
SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE
DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL

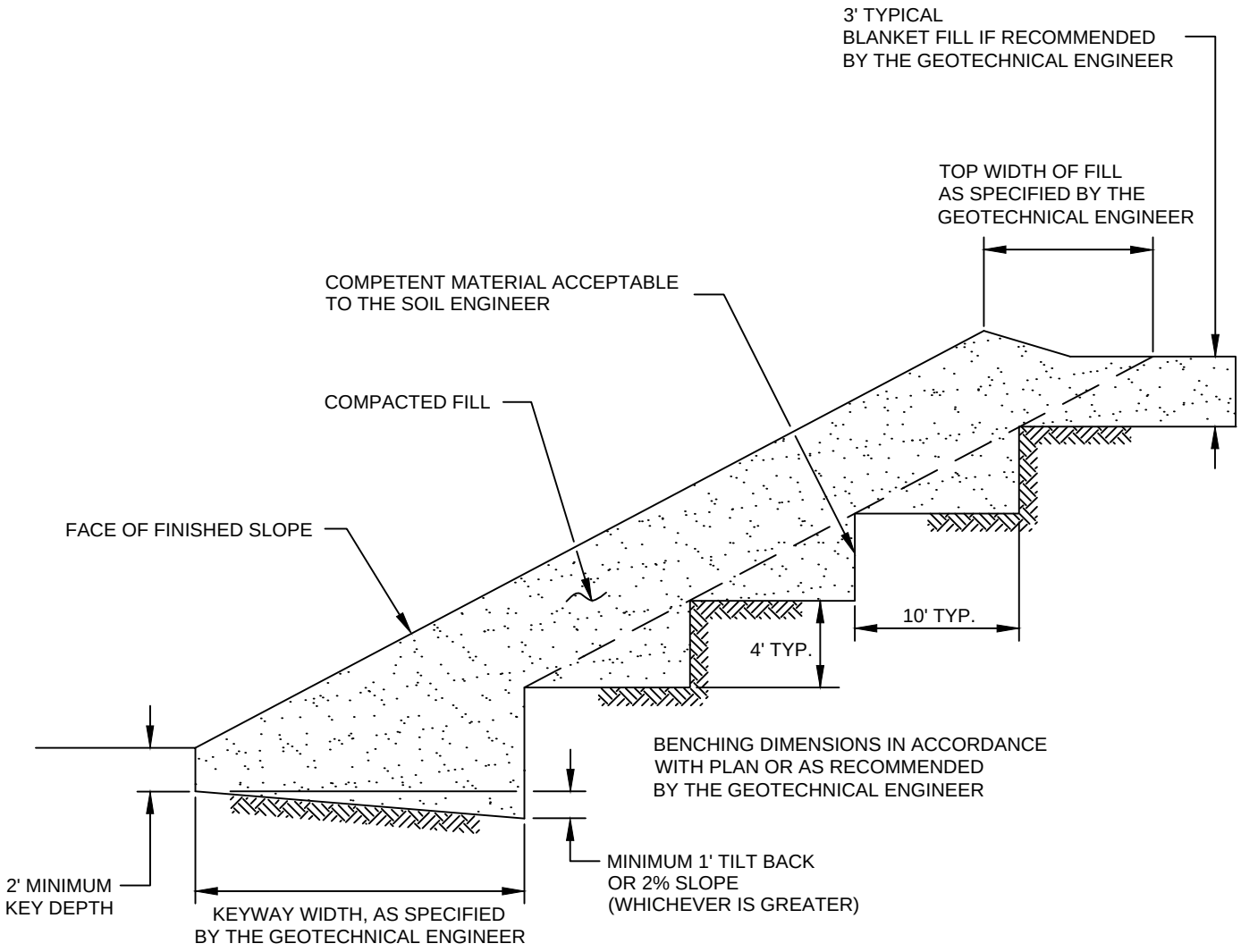
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

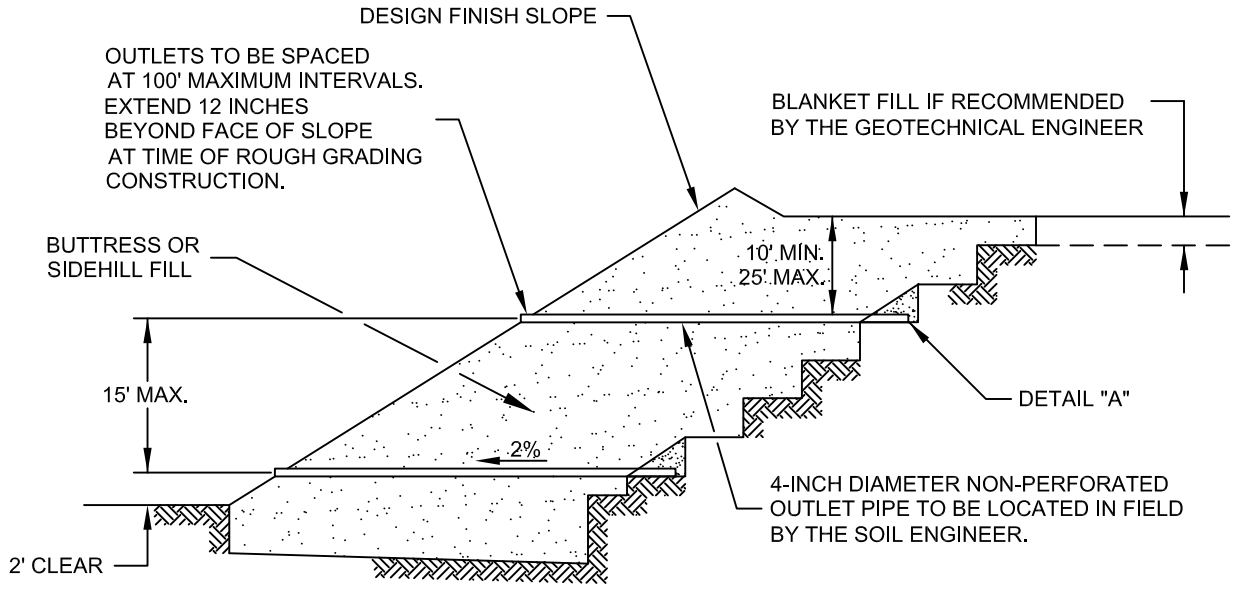
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



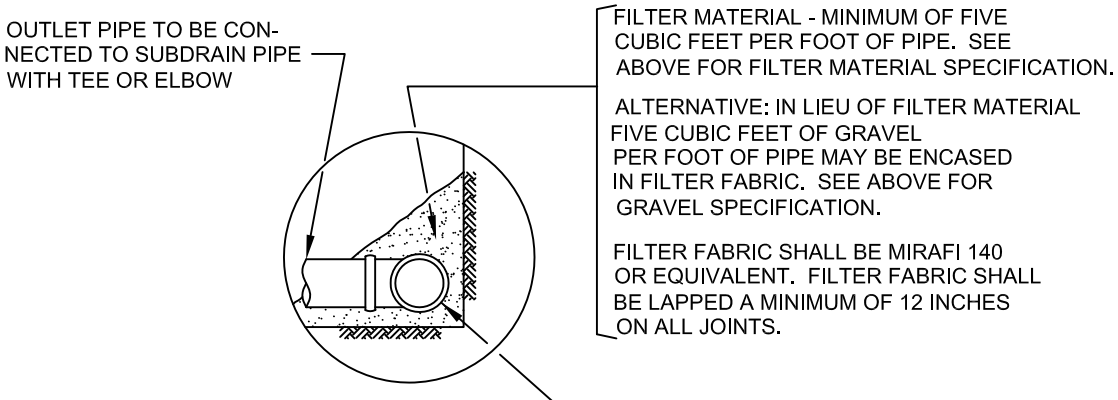
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

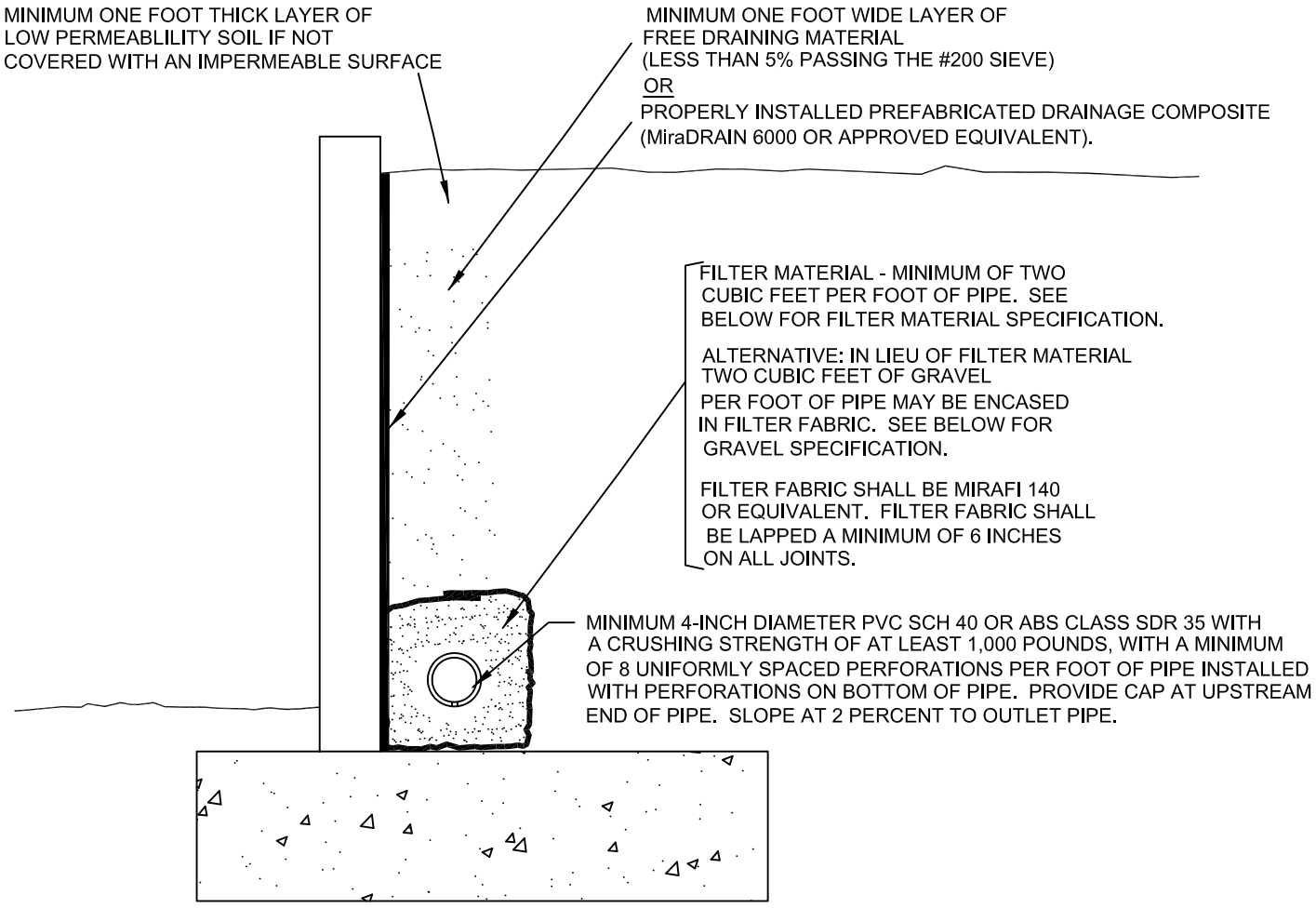
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

GRADING GUIDE SPECIFICATIONS

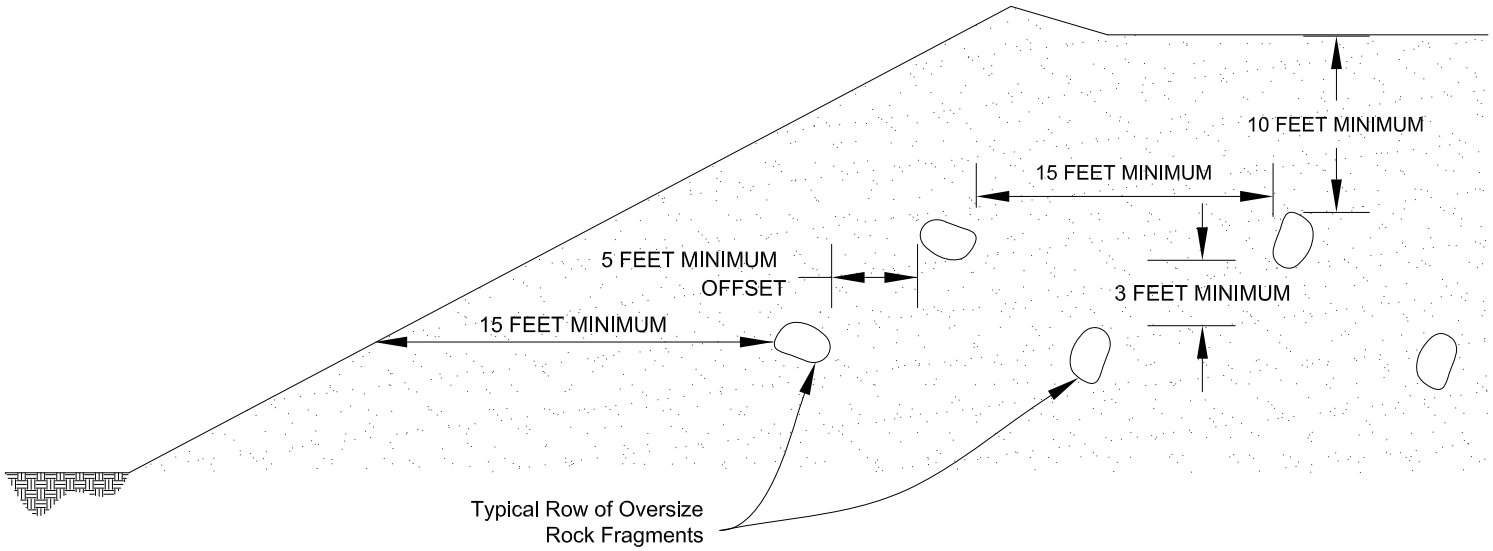
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

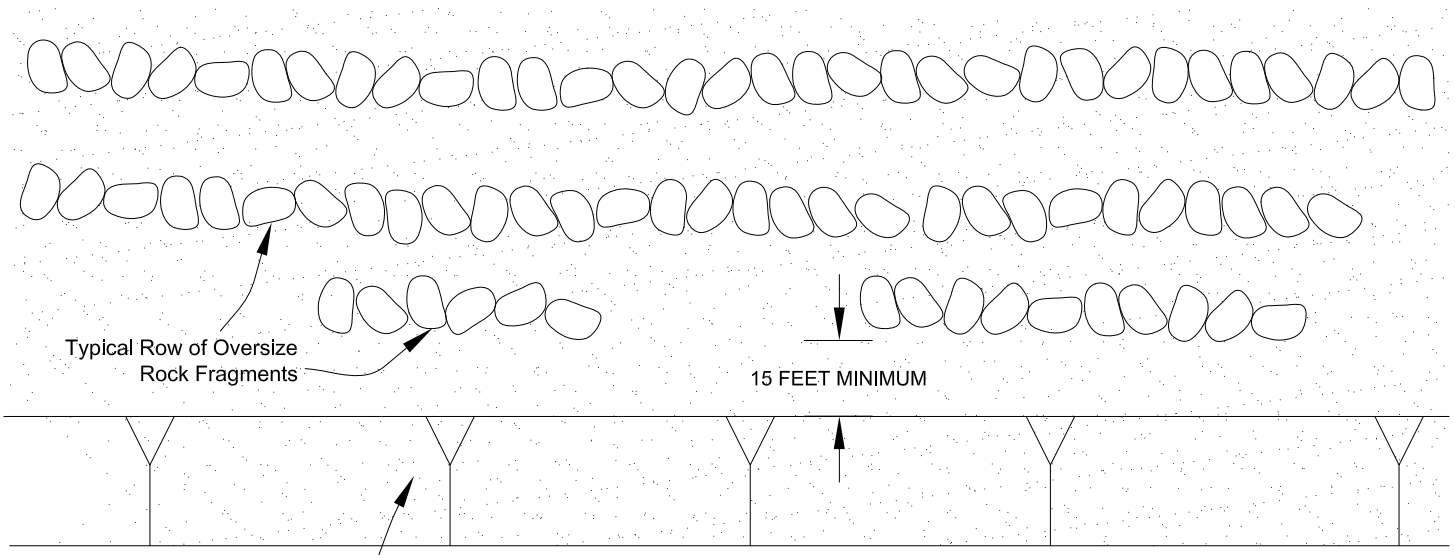
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8

SoCalGeo

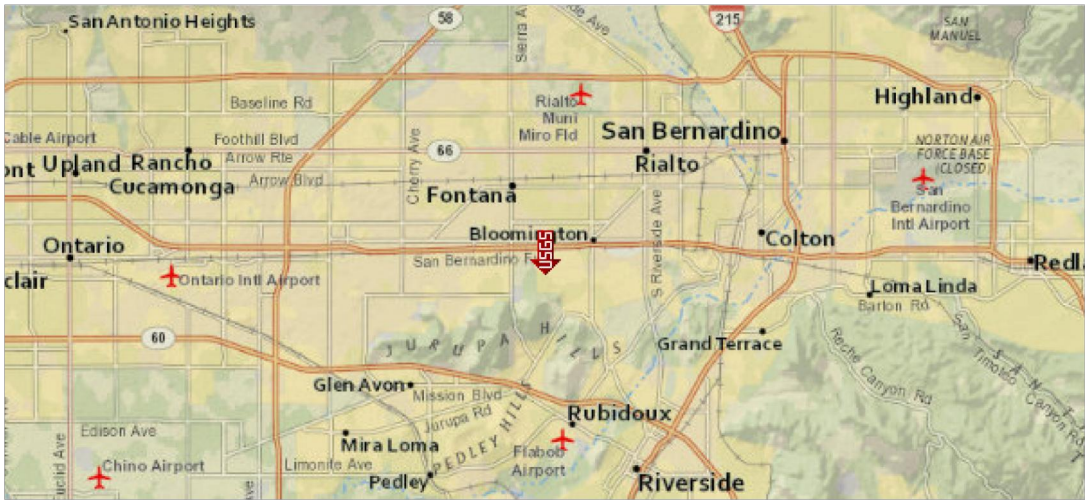
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

USGS Design Maps Summary Report

User–Specified Input

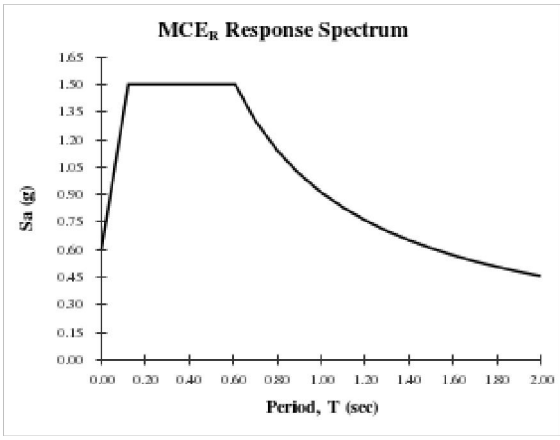
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.06575°N, 117.41931°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

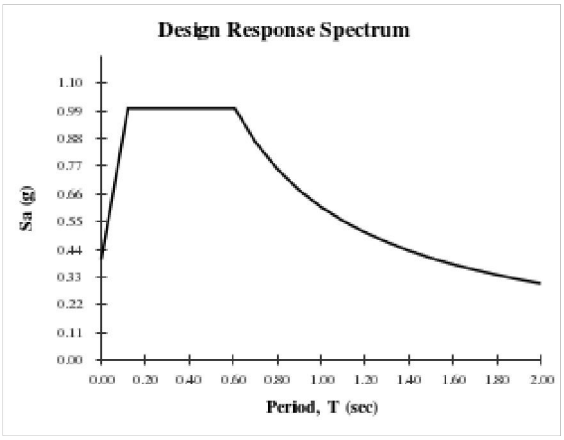


USGS–Provided Output

S_S =	1.500 g	S_{MS} =	1.500 g	S_{DS} =	1.000 g
S_1 =	0.608 g	S_{M1} =	0.912 g	S_{D1} =	0.608 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





SOURCE: U.S. GEOLOGICAL SURVEY (USGS)
<http://geohazards.usgs.gov/designmaps/us/application.php>

SEISMIC DESIGN PARAMETERS
PROPOSED ALDER LOGISTICS CENTER
SAN BERNARDINO COUNTY, CALIFORNIA

DRAWN: JLL
CHKD: GKM
SCG PROJECT 18G218-1
PLATE E-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

Attachment D

Geotechnical Engineer Infiltration Testing and
Civil Engineer Factor of Safety Determination

November 15, 2018

Lake Creek Industrial
17551 Norwood Street
Tustin, California 92780

Attention: Mr. Michael Johnson
Principal

Project No.: **18G218-2**

Subject: **Updated Results of Infiltration Testing**
Proposed Alder Logistics Center
10336 Alder Avenue
San Bernardino County, California

Reference: Updated Geotechnical Investigation, Proposed Alder Logistics Center, 10336 Alder Avenue, San Bernardino County, California, prepared by Southern California Geotechnical, Inc. (SCG), for Lake Creek Industrial, SCG Project No. 18G218-1, dated November 15, 2018.

Dear Mr. Johnson:

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

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 18P444 dated November 2, 2018. The scope of services included a visual site reconnaissance and the review of the previously prepared infiltration report to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the Technical Guidance Document for Water Quality Management Plans prepared for the County of San Bernardino Areawide Stormwater Program dated June 7, 2013. The San Bernardino County standards defer to guidelines published by the Riverside County Department of Environmental Health (RCDEH).

Site and Project Description

The site is located on the west side of Alder Avenue, 600± feet north of Slover Avenue, at the address of 10336 Alder Avenue in an unincorporated area within San Bernardino County, California. The site is bounded to the north by a Southern Pacific Railroad easement, to the west by a railroad yard, to the south by a steel facility and to the east by Alder Avenue. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The subject site consists of an assemblage of five parcels which total 8.50± acres. The site is currently developed as the Gene Belk Fruit Packers and Briners facility. This facility includes a metal-frame building located in the northeastern corner of the site. This building is

approximately 10,000 square feet and is of metal-frame construction with sheet-metal siding, presumably supported on a shallow foundation system with a concrete slab-on-grade floor. This building is currently being utilized for produce processing. The existing facility also includes numerous smaller structures and brine tanks throughout the site as well as a single-story single-family residence of wood-frame construction presumably supported on a shallow foundation system with a concrete slab-on-grade floor. Groundcover generally consists of heavily weathered asphaltic concrete pavements with isolated areas of exposed soil and aggregate base, and Portland cement concrete pavements surrounding the brine tanks.

It should be noted that the current owner of the property has provided the approximate locations of existing underground improvements. The existing underground improvements include, but are not limited to, a 10,000-gallon rain storage tank located in the southern region of the site, and two (2) septic systems in the western and eastern regions. The underground improvements presumably extend to a depth of 12± feet below the existing site grades. In addition, each septic system includes a 40±-foot deep 4±-foot diameter seepage pit. The existing underground improvements are depicted on Plate 2 in Appendix A of this report.

Topographic information was obtained from a conceptual grading plan prepared by SB&O, Inc., the project civil engineer. Based on our review of this plan, the existing site topography generally slopes downward to the south to southeast at a gradient of 1 to 2 percent. The elevation at the subject site ranges from 1100± feet mean sea level (msl) at the northwest corner of the site to 1088± feet msl in the southeast corner of the site. There is approximately 12 feet of elevation differential across on subject site.

Proposed Development

The site plan provided to our office by the client indicates that the new development will consist of a 172,780± ft^2 commercial/industrial building located in the northcentral region of the site. The new building will include a 2,000± ft^2 mezzanine. The new building will be constructed with dock-high doors along the southern building wall. The building is expected to be surrounded by asphaltic concrete pavements in the parking and drive lane areas, Portland cement concrete pavements in the loading dock areas, and concrete flatwork and landscaped planters located throughout the site.

We understand that the proposed development will include on-site infiltration to dispose of storm water. Based on conversations with SB&O, Inc., and the conceptual precise grading plan provided, the new storm water infiltration systems will consist of an infiltration/detention basin and a below-grade chamber system located in the southeastern area of the subject site. Based on the information provided by SB&O, Inc. the bottom of the proposed infiltration system will be at an elevation of 1085.5± feet mean sea level (msl). The bottom elevation of the below-grade chamber system and precise location were not available at the time of this report.

Previous Study

SCG previously performed a geotechnical investigation at the subject site, which is referenced above. As part of this investigation, six (6) borings were advanced to depths of 5 to 20± feet below the existing site grades. Asphaltic concrete pavements were encountered at the ground surface at most of the boring locations. The pavements consist of 2± inches of asphaltic

concrete with no underlying layer of aggregate base. However, one of the borings was drilled in an area covered with 6± inches of aggregate base at the ground surface. Artificial fill soils were encountered below the pavements and/or aggregate base at all of the boring locations. The fill soils extend to depths of 1½ to 4½± feet below the existing site grades. The fill soils generally consisted of loose to medium dense silty fine sands and medium to coarse sands, with varying fine to coarse gravel content and occasional cobbles. Native alluvial soils were encountered below the fill soils at all of the boring locations, extending to at least the maximum depth explored of 20± feet below the existing site grades. The alluvial soils generally consisted of medium dense to very dense silty fine to medium sands, gravelly fine to coarse sands, fine to coarse sandy gravel, and fine sandy silts, with occasional cobbles.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 20± feet at the time of the subsurface exploration. As part of our research, we reviewed available groundwater data in order to determine the recent high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well (Well 340661N1174301W001) is located approximately 3,000 feet west of the site. Water level readings within this monitoring well indicate a historic high water level of 268± feet (January 2010) below the existing site grades.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of six (6) infiltration test borings, advanced to depths of 4 to 15± feet below the existing site grades. The borings for this project were drilled on May 29, 2018. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch diameter hollow stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as I-1 through I-6) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

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

Geotechnical Conditions

Asphaltic concrete pavements were encountered at the ground surface at Infiltration Boring Nos. I-1, I-2, I-4, and I-6. The pavements consist of 2 to 5± inches of asphaltic concrete with 2 to 4± inches of underlying aggregate base. Artificial fill soils were encountered beneath the pavements, and at the ground surface at the remaining boring locations, extending to depths of

2 to 4± feet. The fill soils extended to a depth of 12± feet at Boring No. I-6. Boring Nos. I-2 and I-6 were both terminated within the artificial fill soils, at depths of 4 and 12± feet below existing site grades. The fill soils generally consist of loose to very dense silty fine sands and fine sandy silts with varying medium to coarse sands and fine to coarse gravel content. The fill soils possess a disturbed, mottled appearance resulting in their classification as artificial fill. Native alluvial soils were encountered beneath the fill soils at all of the boring locations, except Boring Nos. I-2 and I-6, extending to the maximum depth explored of 15± feet below the existing site grades. The alluvial soils generally consist of medium dense to very dense silty fine sands, fine to coarse sands, and gravelly fine to coarse sands with varying silt and gravel content. Free water was not encountered during the drilling of any of the borings. The Boring Logs, which illustrate the conditions encountered at the boring locations, are included with this report.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the proposed storm water infiltration systems that will be used to dispose of storm water at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with Technical Guidance Document for Water Quality Management Plans, prepared for the County of San Bernardino Areawide Stormwater Program.

Pre-soaking

The first phase of the infiltration testing consisted of pre-soaking all six (6) of the infiltration test holes. The pre-soaking process for the borings consisted of filling each test boring by inverting a full 5-gallon bottle of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of each infiltration boring. Pre-soaking was completed after all of the water had percolated through each test hole or after 15 hours since initiating the pre-soak.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test holes prior to each test interval. In accordance with the San Bernardino County guidelines, since "sandy soils" were encountered at the bottom of Infiltration Boring Nos. I-1 and I-3 through I-5 (where 6 inches of water infiltrated into the surrounding soils for two-consecutive 25-minute readings), readings were taken at 10-minute intervals for a total of 1 hour at these four (4) infiltration test locations. Since "non-sandy soils" were encountered at the bottom of Infiltration Boring Nos. I-2 and I-6, readings were taken at 30-minute intervals for a total of 6 hours at these two (2) infiltration test locations. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter

part of the infiltration test be used as the design infiltration rate. The rates are summarized below:

Infiltration Test No.	Test Depth (msl)	Soil Description	Infiltration Rate (inches/hour)
I-1	1078.0	Gravelly fine to coarse Sand, little Silt	2.6
I-2	1085.0	Silty fine Sand, trace medium to coarse Sand, trace fine Gravel	0.9
I-3	1081.5	Gravelly fine to coarse Sand, little Silt	4.2
I-4	1081.5	Gravelly fine to coarse Sand, little Silt	3.0
I-5	1075.0	Gravelly fine to coarse Sand, little Silt	2.4
I-6	1080.0	Silty fine Sand to fine Sandy Silt, little medium Sand	0.6

Laboratory Testing

In-situ Moisture Content

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

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-6 of this report.

Design Recommendations

A total of six (6) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 0.6 to 4.2 inches per hour. The primary factor affecting the infiltration rates are the varying relative densities and the silt content of the encountered soils, which vary at different depths and locations at the subject site. In general, higher silt content was observed within the soil exposed at the bottom of Infiltration Test Nos. I-2 and I-6, which exhibited significant slower infiltration rates than the ones obtained at the remaining infiltration test locations.

Based on the result of Infiltration Test No. I-2, we recommend a design infiltration rate of 1 inch per hour be used for the proposed infiltration/detention basin with a bottom system elevation of 1085.5 msl. However, a design infiltration rate of 4 inches per hour can be used if the bottom of the proposed infiltration/detention basin is extended into the native underlying gravelly sands, which were encountered at elevations below 1081.5 msl at Infiltration Test No. I-3.

Based on the results of Infiltration Test Nos. I-1, I-4 and I-5, we recommend a design infiltration rate of 2.5 inches per hour be used for the proposed below-grade chamber system located within the proposed southeastern parking lot of the subject site. However, stormwater infiltration is not recommended in the area of Infiltration Test No. I-6, which was terminated within existing silty artificial fill soils at a depth of 12 feet below the existing site grades.

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

The design of the proposed storm water infiltration systems should be performed by the project civil engineer, in accordance with the County of San Bernardino guidelines. However, it is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rate. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above are based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rates are based on infiltration testing at six (6) discrete locations and the overall infiltration rates of the storm water infiltration systems could vary considerably.

Infiltration versus Permeability

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

Location of Infiltration Systems

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

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rates contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

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

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in

accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

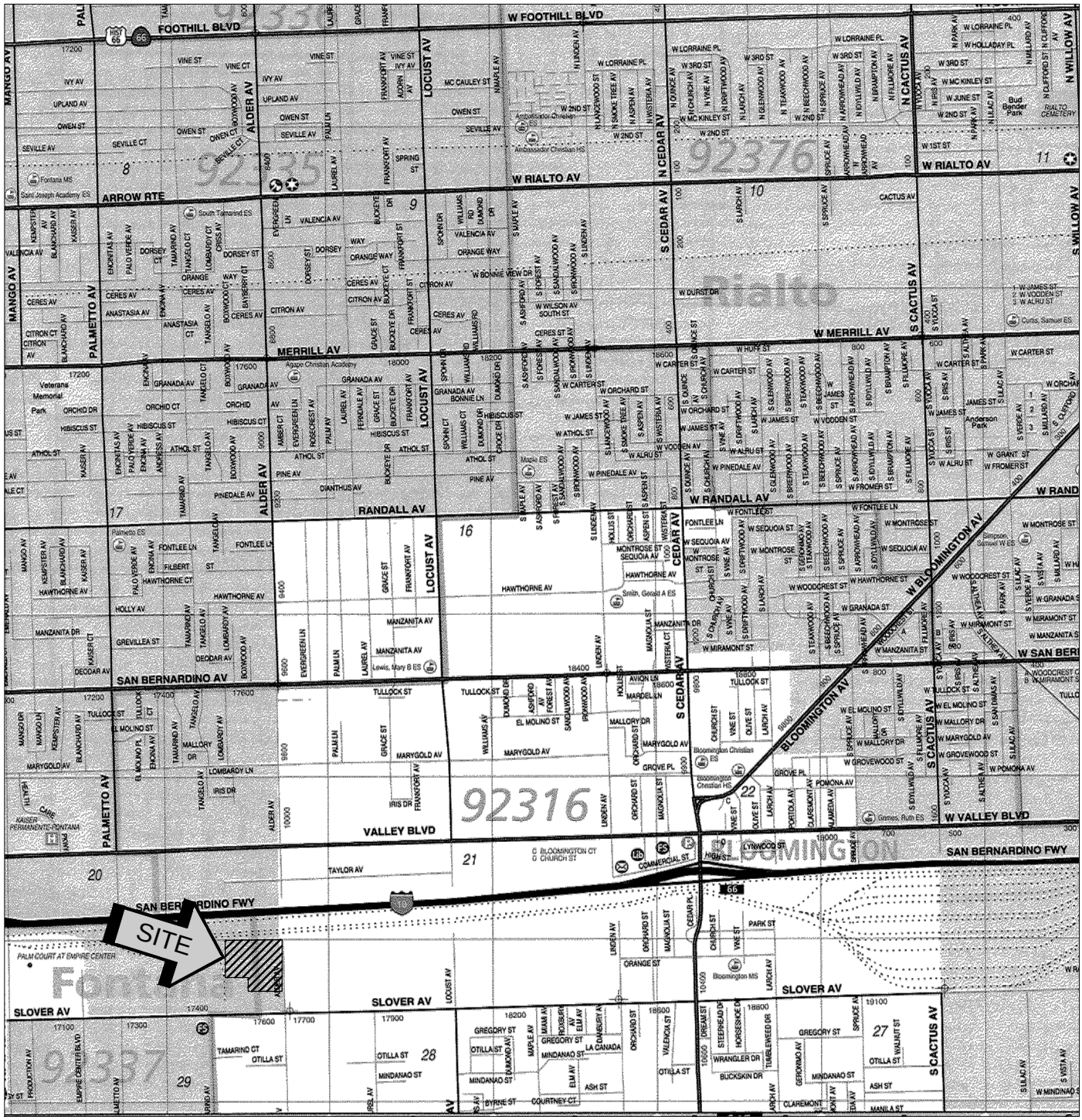
Joseph Lozano Leon
Staff Engineer

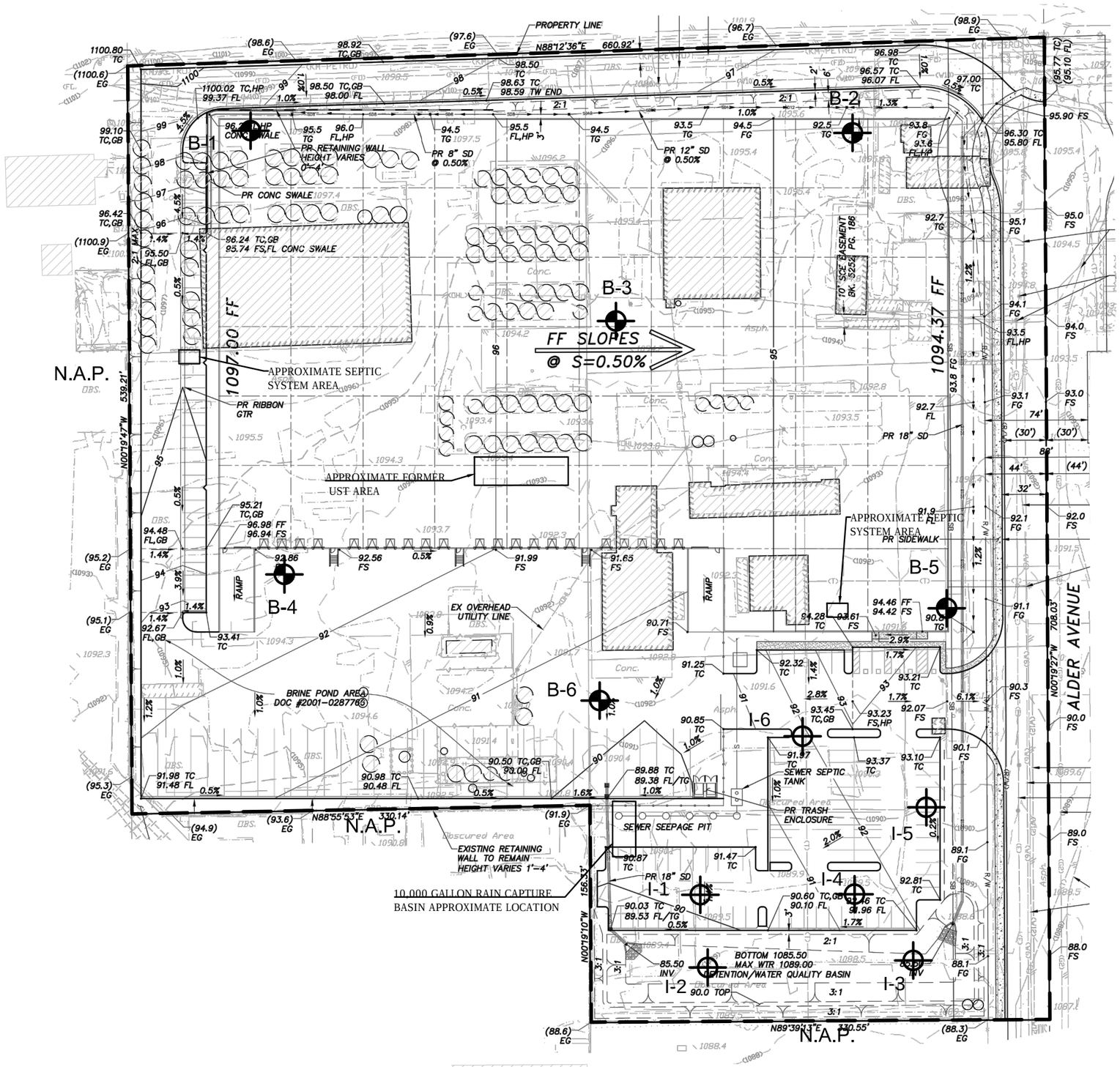
Gregory K. Mitchell, GE 2364
Principal Engineer



Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (8 pages)
Infiltration Test Results Spreadsheets (6 pages)
Grain Size Distribution Graphs (6 pages)


SITE
FOOTHILL BLVD
W FOOTHILL BLVD
W RIALTO AV
ARROW RTE
MERRILL AV
W MERRILL AV
RANDALL AV
W RANDALL AV
SAN BERNARDINO AV
VALLEY BLVD
W VALLEY BLVD
SAN BERNARDINO FWY
SLOVER AV
MANGO AV
PALMETTO AV
ALDER AV
LOCUST AV
CEDAR AV
S CEDAR AV
N CEDAR AV
CACTUS AV
S CACTUS AV
N CACTUS AV
BLOOMINGTON AV
W BLOOMINGTON AV
N WILLOW AV
S WILLOW AV
92376
92335
92316
92337
Rialto
Fontana
BLOOMINGTON
PALM COURT AT EMPIRE CENTER
Fontana MS
Sant Joseph Academy ES
South Tamarind ES
Veterans Memorial Park
Agape Christian Academy
Palmetto ES
Ambassador Christian ES
Ambassador Christian HS
Maple ES
Smith, Gerard A ES
Lewis, Mary B ES
Bloomington Christian ES
Bloomington Christian HS
Gomes, Ruth ES
Bloomington MS
Curtis, Samuel ES
Simpson, Samuel W ES
Anderson Park
Bud Bender Park
RIALTO CEMETERY
KAISER PERMANENTE-FONTANA
Fontana Water Co
Ambulance Chase
Ambulance Chase
Ambulance Chase



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION FROM PREVIOUS STUDY (SCG PROJECT NO. 18G112-3)
- APPROXIMATE BORING LOCATION FROM PREVIOUS STUDY (SCG PROJECT NO. 18G112-1)
- EXISTING BUILDINGS AND BRINE TANKS TO BE DEMOLISHED

NOTE: SITE PLAN PREPARED BY SB&O, INC.

INFILTRATION TEST LOCATION PLAN

PROPOSED ALDER LOGISTICS CENTER

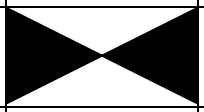
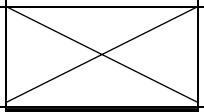
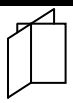
SAN BERNARDINO COUNTY, CALIFORNIA

SCALE: 1" = 80'	
DRAWN: JLL CHKD: GKM	
SCG PROJECT 18G218-2	
PLATE 2	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

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

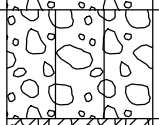
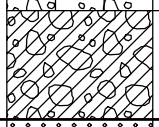
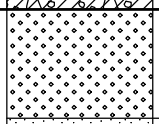
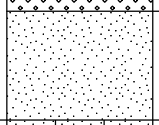
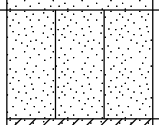
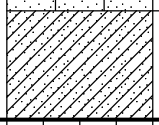
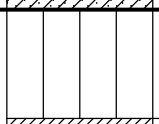
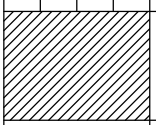
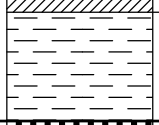
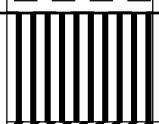
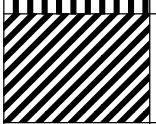
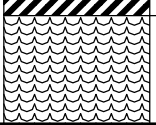
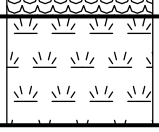
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-1

JOB NO.: 18G112-3 | DRILLING DATE: 5/29/18 | WATER DEPTH: Dry
PROJECT: Proposed Warehouse | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: ---
LOCATION: San Bernardino County, California | LOGGED BY: Joseph Lozano Leon | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1090 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					5± inches Asphaltic concrete, 2± inches Aggregate base							
					FILL: Gray Brown Silty fine Sand, little fine to coarse Gravel, mottled, very dense-damp							
		53					4					
					ALLUVIUM: Light Gray Brown to Gray Brown fine to coarse Sand, trace Silt, trace fine to coarse Gravel, very dense-damp		3					
5		42			Gray fine to coarse Sand, little Silt, little fine Gravel, dense-dry to damp		3					
		30			Brown Silty fine Sand, trace Iron oxide staining, dense-damp to moist		8					
10		67			Gray Brown Gravelly fine to coarse Sand, little Silt, very dense-damp		5					
					Boring Terminated at 12'							

TBL 18G112-3.GPJ SOCALGEO.GDT 6/13/18

TEST BORING LOG **PLATE I-1**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-2

JOB NO.: 18G112-3 | DRILLING DATE: 5/29/18 | WATER DEPTH: Dry
PROJECT: Proposed Warehouse | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: ---
LOCATION: San Bernardino County, California | LOGGED BY: Joseph Lozano Leon | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1089 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					3± inches Asphaltic concrete, 4± inches Aggregate base							
	X	8			FILL: Dark Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, mottled, loose-moist to very moist		15			30		
					Boring Terminated at 4'							

TBL 18G112-3.GPJ SOCALGEO.GDT 6/13/18

TEST BORING LOG **PLATE I-2**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-3

JOB NO.: 18G112-3
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 5/29/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1088.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		22			FILL: Brown Silty fine to medium Sand, trace fine Gravel, medium dense-damp		5					
		32			ALLUVIUM: Gray Brown Gravelly fine to coarse Sand, little Silt, dense-dry to damp		2					
5							2					
		41					3			13		
					Boring Terminated at 7'							

TBL 18G112-3.GPJ SOCALGEO.GDT 6/13/18

TEST BORING LOG **PLATE I-3**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-4

JOB NO.: 18G112-3
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 5/29/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1089.5 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					2± inches Asphaltic concrete, 4± inches Aggregate base							
		25			FILL: Dark Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, medium dense-damp		6					
					ALLUVIUM: Dark Gray Brown fine to medium Sand, little Silt, trace coarse Sand, trace fine to coarse Gravel, medium dense-damp		4					
5		47			Brown Silty fine Sand, trace to little medium to coarse Sand, trace fine Gravel, dense-damp to moist		8					
		47			Gray Brown Gravelly fine to coarse Sand, little Silt, dense-damp		3			8		
					Boring Terminated at 8'							

TBL 18G112-3.GPJ SOCALGEO.GDT 6/13/18

TEST BORING LOG

PLATE I-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-5

JOB NO.: 18G112-3 | DRILLING DATE: 5/29/18 | WATER DEPTH: Dry
PROJECT: Proposed Warehouse | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: ---
LOCATION: San Bernardino County, California | LOGGED BY: Joseph Lozano Leon | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1090 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		39			FILL: Brown Silty fine Sand, little fine to coarse Gravel, dense-dry to damp		2					
					ALLUVIUM: Light Gray Brown Gravelly fine to medium Sand, little coarse Gravel, dense-damp		2					
		22			Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, medium dense-damp to moist		5					
5		28					8					
		75/9"			Gray Brown Gravelly fine to coarse Sand, little Silt, very dense-dry to damp		2					
10												
		80/11"					4			12		
15					Boring Terminated at 15'							

TBL 18G112-3.GPJ SOCALGEO.GDT 6/13/18

TEST BORING LOG **PLATE I-5**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-6

JOB NO.: 18G112-3
PROJECT: Proposed Warehouse
LOCATION: San Bernardino County, California

DRILLING DATE: 5/29/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: 1092 feet MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					3± inches Asphaltic concrete, 2± inches Aggregate base							
		14			FILL: Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, medium dense-damp to moist		7					
5		25			FILL: Dark Gray Brown to Black fine to coarse Sand, little fine Gravel, strong Organic odor, medium dense-moist		9					
		24			FILL: Dark Brown Silty fine Sand, trace medium Sand, strong Organic odor, medium dense-damp		5					
10		17			FILL: Dark Gray to Black Silty fine Sand to fine Sandy Silt, little medium Sand, medium dense-moist		15			50		
					Boring Terminated at 12'							

TBL 18G112-3.GPJ SOCALGEO.GDT 6/13/18

TEST BORING LOG

PLATE I-6

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	San Bernardino County, CA
Project Number	18G112-3
Engineer	Scott McCann

Test Hole Radius	4	(in)
Test Depth	12.1	(ft)

Infiltration Test Hole	I-1

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)	
P1	Initial	8:00 AM	25.0	9.30	1.28	2.16	2.64	Pre-Sat
	Final	8:25 AM		10.58				
P2	Initial	8:26 AM	25.0	10.33	0.90	1.32	2.91	
	Final	8:51 AM		11.23				
1	Initial	8:52 AM	10.0	10.28	0.42	1.61	2.84	Infiltration Testing
	Final	9:02 AM		10.70				
2	Initial	9:03 AM	10.0	10.30	0.43	1.59	2.95	
	Final	9:13 AM		10.73				
3	Initial	9:14 AM	10.0	10.35	0.40	1.55	2.80	
	Final	9:24 AM		10.75				
4	Initial	9:25 AM	10.0	10.37	0.37	1.55	2.59	
	Final	9:35 AM		10.74				
5	Initial	9:36 AM	10.0	10.40	0.36	1.52	2.56	
	Final	9:46 AM		10.76				
6	Initial	9:47 AM	10.0	10.40	0.36	1.52	2.56	
	Final	9:57 AM		10.76				

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval H above GS= 0
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	San Bernardino County, CA
Project Number	18G112-3
Engineer	Scott McCann

Test Hole Radius	4	(in)
Test Depth	4.0	(ft)

Infiltration Test Hole: I-2

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:03 AM	30.0	2.10	0.47	1.67	1.03
	Final	8:33 AM		2.57			
2	Initial	8:33 AM	30.0	2.06	0.44	1.72	0.93
	Final	9:03 AM		2.50			
3	Initial	9:03 AM	30.0	2.10	0.40	1.70	0.86
	Final	9:33 AM		2.50			
4	Initial	9:33 AM	60.0	2.25	0.38	1.56	0.44
	Final	10:33 AM		2.63			
5	Initial	10:33 AM	30.0	2.28	0.38	1.53	0.90
	Final	11:03 AM		2.66			
6	Initial	11:03 AM	30.0	2.29	0.37	1.53	0.87
	Final	11:33 AM		2.66			
7	Initial	11:33 AM	30.0	2.29	0.37	1.53	0.87
	Final	12:03 PM		2.66			
8	Initial	12:03 PM	30.0	2.30	0.37	1.52	0.88
	Final	12:33 PM		2.67			
9	Initial	12:33 PM	30.0	2.28	0.38	1.53	0.90
	Final	1:03 PM		2.66			
10	Initial	1:03 PM	30.0	2.30	0.37	1.52	0.88
	Final	1:33 PM		2.67			
11	Initial	1:33 PM	30.0	2.29	0.37	1.53	0.87
	Final	2:03 PM		2.66			
12	Initial	2:03 PM	30.0	2.29	0.37	1.53	0.87
	Final	2:33 PM		2.66			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval H above GS= 0.0
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	San Bernardino County, CA
Project Number	18G112-3
Engineer	Scott McCann

Test Hole Radius	4	(in)
Test Depth	7.1	(ft)

Infiltration Test Hole	I-3

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)	
P1	Initial	10:00 AM	25.0	5.30	1.06	1.27	3.54	Pre-Sat
	Final	10:25 AM		6.36				
P2	Initial	10:26 AM	25.0	5.40	0.96	1.22	3.32	
	Final	10:51 AM		6.36				
1	Initial	10:52 AM	10.0	5.30	0.59	1.51	4.24	Infiltration Testing
	Final	11:02 AM		5.89				
2	Initial	11:03 AM	10.0	5.37	0.58	1.44	4.33	
	Final	11:13 AM		5.95				
3	Initial	11:14 AM	10.0	5.34	0.57	1.48	4.17	
	Final	11:24 AM		5.91				
4	Initial	11:25 AM	10.0	5.33	0.57	1.49	4.14	
	Final	11:35 AM		5.90				
5	Initial	11:36 AM	10.0	5.32	0.57	1.50	4.12	
	Final	11:46 AM		5.89				
6	Initial	11:47 AM	10.0	5.36	0.57	1.46	4.22	
	Final	11:57 AM		5.93				

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval H above GS= 0
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	San Bernardino County, CA
Project Number	18G112-3
Engineer	Scott McCann

Test Hole Radius	4	(in)
Test Depth	8.1	(ft)

Infiltration Test Hole	I-4

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)	
P1	Initial	1:00 PM	25.0	6.37	0.94	1.26	3.16	Pre-Sat
	Final	1:25 PM		7.31				
P2	Initial	1:26 PM	25.0	6.36	0.90	1.29	2.97	
	Final	1:51 PM		7.26				
1	Initial	1:52 PM	10.0	6.39	0.43	1.50	3.11	Infiltration Testing
	Final	2:02 PM		6.82				
2	Initial	2:03 PM	10.0	6.35	0.42	1.54	2.95	
	Final	2:13 PM		6.77				
3	Initial	2:14 PM	10.0	6.39	0.43	1.50	3.11	
	Final	2:24 PM		6.82				
4	Initial	2:25 PM	10.0	6.37	0.42	1.52	2.99	
	Final	2:35 PM		6.79				
5	Initial	2:36 PM	10.0	6.39	0.42	1.50	3.02	
	Final	2:46 PM		6.81				
6	Initial	2:47 PM	10.0	6.38	0.42	1.51	3.01	
	Final	2:57 PM		6.80				

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval H above GS= 0
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	San Bernardino County, CA
Project Number	18G112-3
Engineer	Scott McCann

Test Hole Radius	4	(in)
Test Depth	14.8	(ft)

Infiltration Test Hole	I-5

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)	
P1	Initial	12:00 PM	25.0	12.80	0.77	1.62	2.07	Pre-Sat
	Final	12:25 PM		13.57				
P2	Initial	12:26 PM	25.0	12.89	0.69	1.57	1.91	
	Final	12:51 PM		13.58				
1	Initial	12:52 PM	10.0	12.91	0.42	1.68	2.73	Infiltration Testing
	Final	1:02 PM		13.33				
2	Initial	1:03 PM	10.0	13.05	0.36	1.57	2.49	
	Final	1:13 PM		13.41				
3	Initial	1:14 PM	10.0	13.07	0.35	1.56	2.44	
	Final	1:24 PM		13.42				
4	Initial	1:25 PM	10.0	13.08	0.34	1.55	2.38	
	Final	1:35 PM		13.42				
5	Initial	1:36 PM	10.0	13.07	0.34	1.56	2.36	
	Final	1:46 PM		13.41				
6	Initial	1:47 PM	10.0	13.07	0.34	1.56	2.36	
	Final	1:57 PM		13.41				

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval H above GS= 0
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	San Bernardino County, CA
Project Number	18G112-3
Engineer	Scott McCann

Test Hole Radius	4	(in)
Test Depth	12.2	(ft)

Infiltration Test Hole	I-6

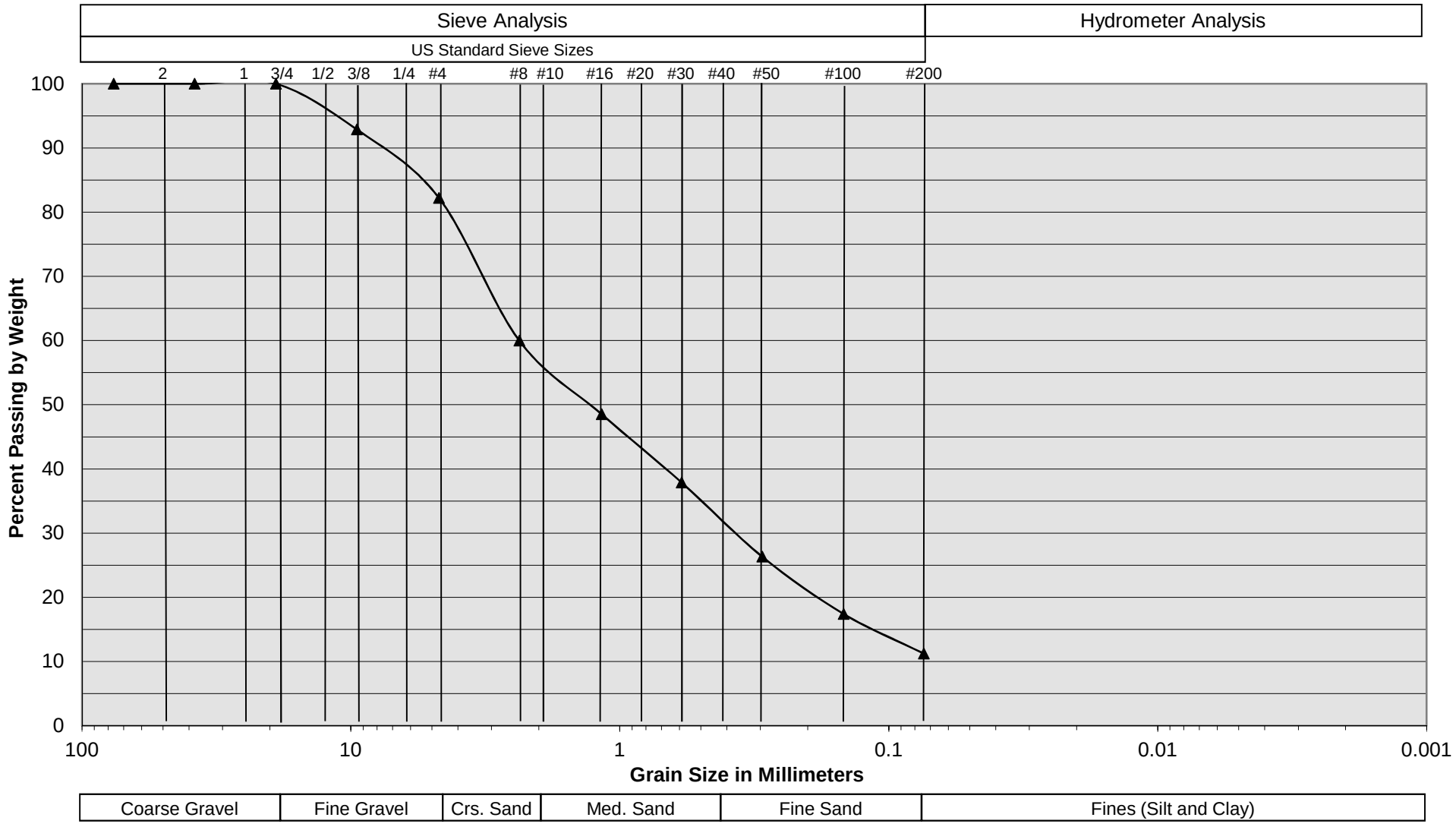
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:00 AM	30.0	10.35	0.29	1.71	0.62
	Final	9:30 AM		10.64			
2	Initial	9:30 AM	30.0	10.41	0.27	1.66	0.59
	Final	10:00 AM		10.68			
3	Initial	10:00 AM	30.0	10.38	0.26	1.69	0.56
	Final	10:30 AM		10.64			
4	Initial	10:30 AM	30.0	10.44	0.26	1.63	0.58
	Final	11:00 AM		10.70			
5	Initial	11:00 AM	30.0	10.45	0.25	1.63	0.56
	Final	11:30 AM		10.70			
6	Initial	11:30 AM	30.0	10.44	0.25	1.64	0.56
	Final	12:00 PM		10.69			
7	Initial	12:00 PM	30.0	10.49	0.25	1.59	0.57
	Final	12:30 PM		10.74			
8	Initial	12:30 PM	30.0	10.48	0.24	1.60	0.54
	Final	1:00 PM		10.72			
9	Initial	1:00 PM	30.0	10.50	0.24	1.58	0.55
	Final	1:30 PM		10.74			
10	Initial	1:30 PM	30.0	10.50	0.24	1.58	0.55
	Final	2:00 PM		10.74			
11	Initial	2:00 PM	30.0	10.49	0.24	1.59	0.55
	Final	2:30 PM		10.73			
12	Initial	2:30 PM	30.0	10.50	0.24	1.58	0.55
	Final	3:00 PM		10.74			

Per County Standards, Infiltration Rate calculated as follows:

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

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval H above GS= 0.0
H_{avg} = Average Head Height over the time interval

Grain Size Distribution



Sample Description	I-1 @ 10.5 to 12 feet
Soil Classification	Gray Brown Gravelly fine to coarse Sand, little Silt

Proposed Warehouse
San Bernardino County, CA
Project No. 18G112-3
PLATE C-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

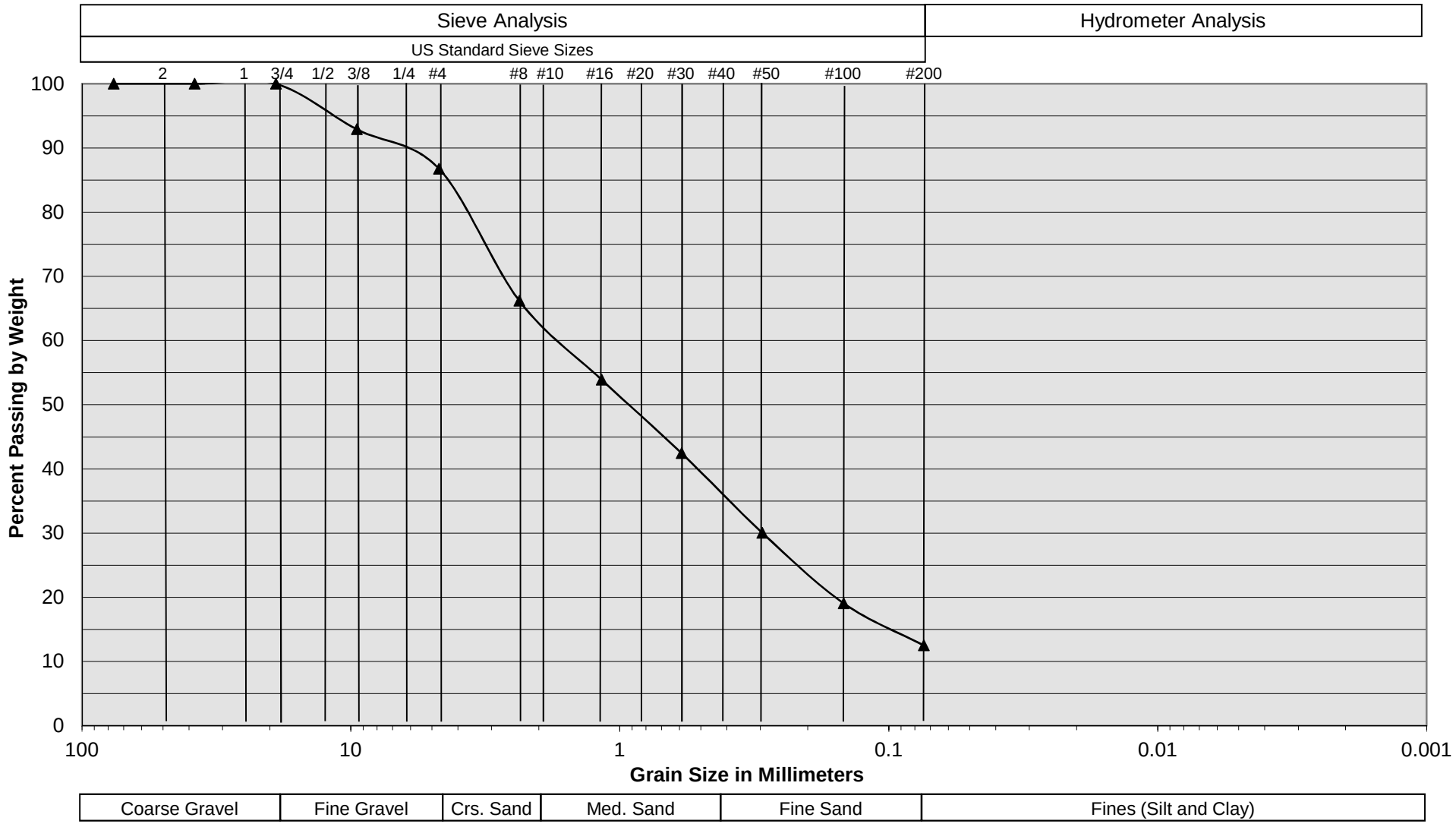


Sample Description	I-2 @ 3.5 to 4 feet
Soil Classification	Dark Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel

Proposed Warehouse
San Bernardino County, CA
Project No. 18G112-3
PLATE C-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-3 @ 5.5 to 7 feet
Soil Classification	Light Gray Brown Gravelly fine to coarse Sand, little Silt

Proposed Warehouse
San Bernardino County, CA
Project No. 18G112-3
PLATE C-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-4 @ 6.5 to 8 feet
Soil Classification	Gray Brown Gravelly fine to coarse Sand, little Silt

Proposed Warehouse
San Bernardino County, CA
Project No. 18G112-3
PLATE C-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

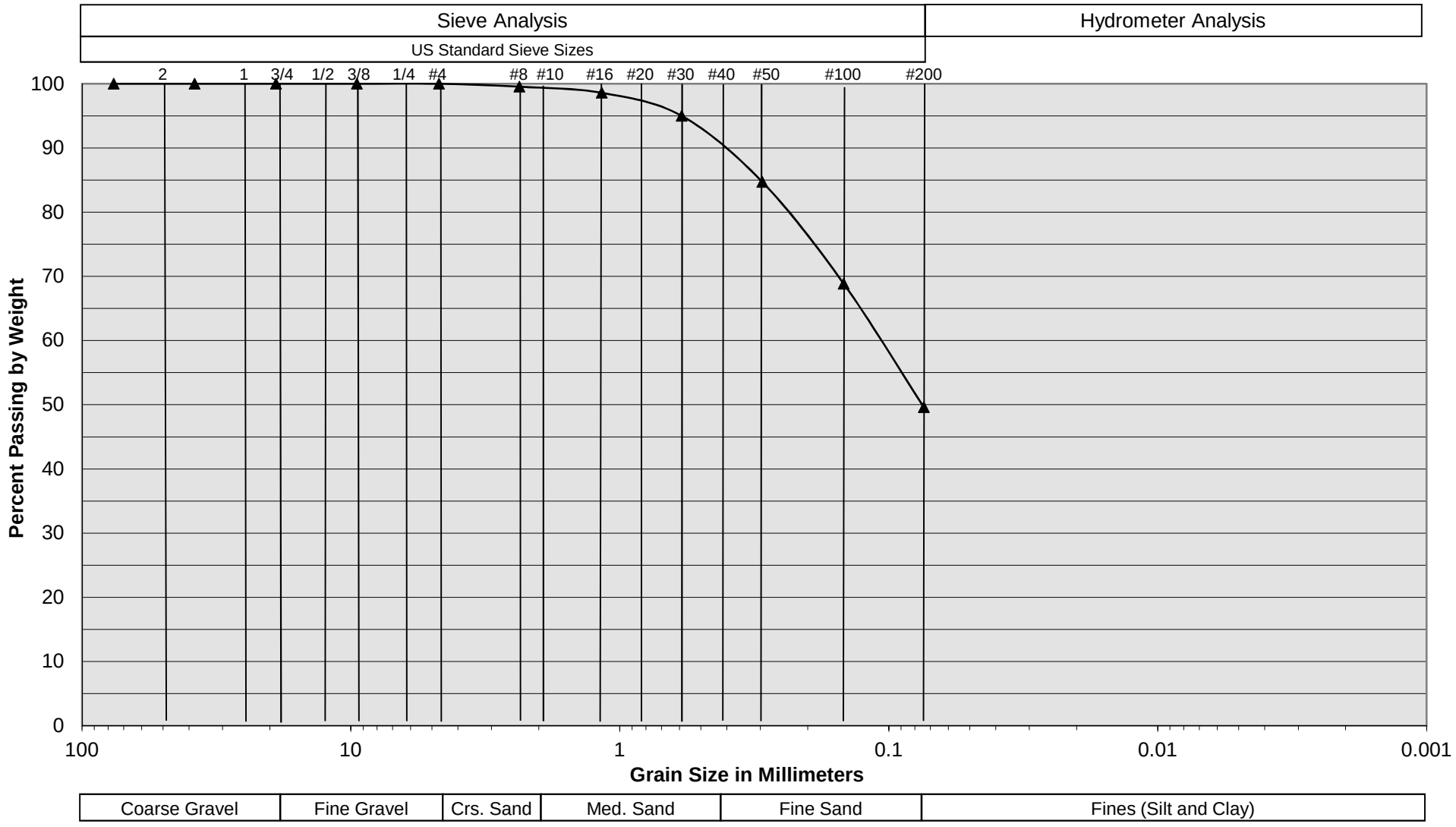


Sample Description	I-5 @ 13.5 to 15 feet
Soil Classification	Gray Brown Gravelly fine to coarse Sand, little Silt

Proposed Warehouse
San Bernardino County, CA
Project No. 18G112-3
PLATE C-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-6 @ 10.5 to 12 feet
Soil Classification	Dark Gray to Black Silty fine Sand to fine Sandy Silt, little medium Sand

Proposed Warehouse
San Bernardino County, CA
Project No. 18G112-3
PLATE C-6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

January 7, 2019

Lake Creek Industrial
17551 Norwood Street
Tustin, California 92780

Attention: Mr. Michael Johnson
Principal

Project No.: **18G218-4**

Subject: **Results of Additional Infiltration Testing**
Proposed Alder Logistics Center
10336 Alder Avenue
San Bernardino County, California

References: 1) Updated Geotechnical Investigation, Proposed Alder Logistics Center, 10336 Alder Avenue, San Bernardino County, California, prepared for Lake Creek Industrial by Southern California Geotechnical, Inc. (SCG), SCG Project No. 18G218-1, dated November 15, 2018.

2) Updated Results of Infiltration Testing, Proposed Alder Logistics Center, 10336 Alder Avenue, San Bernardino County, California, prepared for Lake Creek Industrial by SCG, SCG Project No. 18G218-2, dated November 15, 2018.

Dear Mr. Johnson:

In accordance with your request, we have conducted additional infiltration testing at the subject site. The additional infiltration testing was required for the design of the proposed infiltration systems located in the southeastern area of the site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Change Order 18G218-CO, dated December 5, 2018. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The site is located on the west side of Alder Avenue, 600± feet north of Slover Avenue, at the address of 10336 Alder Avenue in an unincorporated area within San Bernardino County, California. The site is bounded to the north by a Southern Pacific Railroad easement, to the west by a railroad yard, to the south by a steel facility, and to the east by Alder Avenue. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 of this report.

The subject site consists of an assemblage of five parcels, which total 8.50± acres. The site is currently developed as the Gene Belk Fruit Packers and Briners facility. This facility includes a metal-frame building located in the northeastern corner of the site. This building is approximately 10,000 square feet and is of metal-frame construction with sheet-metal siding, presumably supported on a shallow foundation system with a concrete slab-on-grade floor. This building is currently being utilized for produce processing. The existing facility also includes numerous smaller buildings, structures, and brine tanks throughout the site as well as a single-family residence of wood-frame construction presumably supported on a shallow foundation system with a concrete slab-on-grade floor. The ground surface cover generally consists of heavily weathered asphaltic concrete pavements with isolated areas of exposed soil and aggregate base, and Portland cement concrete pavements surrounding the brine tanks.

The current owner of the property previously provided the approximate locations of existing underground improvements. The existing underground improvements include, but are not limited to, a 10,000-gallon rain storage tank located in the southern region of the site, and two (2) septic systems in the western and eastern regions. The underground improvements presumably extend to a depth of 12± feet below the existing site grades. In addition, each septic system includes a 40±-foot deep, 4±-foot diameter seepage pit.

Topographic information was obtained from a conceptual grading plan prepared by SB&O, Inc., the project civil engineer. Based on our review of this plan, the existing site topography generally slopes downward to the south-southeast at a gradient of 1 to 2 percent. The elevation at the subject site ranges from 1100± feet mean sea level (msl) at the northwest corner of the site to 1088± feet msl in the southeast corner of the site. There is approximately 12 feet of elevation differential across on subject site.

Proposed Development

The site plan provided to our office by the client indicates that the new development will consist of a 172,780± ft^2 commercial/industrial building located in the north-central region of the site. The new building will include a 2,000± ft^2 mezzanine. The new building will be constructed with dock-high doors along the southern building wall. The building is expected to be surrounded by asphaltic concrete pavements in the parking and drive lane areas, Portland cement concrete pavements in the loading dock areas, and concrete flatwork and landscaped planters located throughout the site.

We understand that the proposed development will include on-site infiltration to dispose of storm water. Based on conversations with representatives of SB&O, Inc., and the conceptual precise grading plan provided, the new storm water infiltration systems will consist of an infiltration/detention basin and a below-grade chamber system located in the southeastern area of the subject site. The proposed infiltration systems will extend to depths ranging from 8 to 10± feet below the existing site grades.

Previous Studies

SCG previously performed a geotechnical investigation at the subject site, which is referenced above. As part of this investigation, six (6) borings were advanced to depths of 5 to 20± feet below the existing site grades. Asphaltic concrete pavements were encountered at the ground

surface at most of the boring locations. The pavements consisted of 2± inches of asphaltic concrete with no underlying layer of aggregate base. However, one (1) of the borings was drilled in an area covered with 6± inches of aggregate base at the ground surface. Artificial fill soils were encountered below the pavements and/or aggregate base at all of the boring locations. The fill soils extend to depths of 1½ to 4½± feet below the existing site grades. The fill soils generally consisted of loose to medium dense silty fine sands and medium to coarse sands, with varying fine to coarse gravel content and occasional cobbles. Native alluvial soils were encountered below the fill soils at all of the boring locations, extending to at least the maximum depth explored of 20± feet below the existing site grades. The alluvial soils generally consisted of medium dense to very dense silty fine to medium sands, gravelly fine to coarse sands, fine to coarse sandy gravel, and fine sandy silts, with occasional cobbles. Free water was not encountered during the drilling of any of the borings.

SCG also previously performed infiltration testing at the subject site. The results of the previous infiltration testing were presented in the infiltration report referenced above. The subsurface exploration performed for the previous infiltration study consisted of six (6) infiltration test borings, advanced to depths of 4 to 15± feet below the existing site grades. Asphaltic concrete pavements were encountered at the ground surface at Infiltration Boring Nos. I-1, I-2, I-4, and I-6, which consisted of 2 to 5± inches of asphaltic concrete, underlain by 2 to 4± inches of aggregate base. Artificial fill soils were encountered beneath the pavements and at the ground surface at the remaining infiltration boring locations, extending to depths of 2 to 4± feet, and to a depth of 12± feet at Boring No. I-6. Boring Nos. I-2 and I-6 were both terminated within the artificial fill soils, at depths of 4 and 12± feet below existing site grades. The fill soils generally consisted of loose to very dense silty fine sands and fine sandy silts with varying medium to coarse sands and fine to coarse gravel content. Native alluvial soils were encountered beneath the fill soils at all of the boring locations, except Boring Nos. I-2 and I-6, extending to the maximum depth explored of 15± feet below the existing site grades. The alluvial soils generally consisted of medium dense to very dense silty fine sands, fine to coarse sands, and gravelly fine to coarse sands with varying silt and gravel content.

The infiltration rates at the test locations ranged from 0.6 to 4.2 inches per hour. Based on the infiltration results at varying depths within the areas of the proposed infiltration systems, SCG recommended infiltration rates ranging from 1 to 4 inches per hour be used for the design of the proposed infiltration basin and below-grade chamber system. The approximate locations of the six (6) borings and six (6) infiltration borings from the previous studies are indicated on the Infiltration Test Location Plan, included as Plate 2 of this report.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the additional infiltration testing consisted of two (2) backhoe excavated trenches, extending to depths of 10± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-7 and I-8) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Asphaltic concrete pavements were encountered at the ground surface at both of the infiltration trench locations. The pavements consist of 3 to 4± inches of asphaltic concrete underlain by 3± inches of aggregate base at Infiltration Trench No. I-8. Artificial fill soils were encountered beneath the asphaltic concrete pavements or aggregate base at both of the trench locations, extending to depths of 2½ to 4± feet below the existing site grades. The fill soils generally consist of medium dense fine sands and silty fine sands with varying medium to coarse sands and fine to coarse gravel. The fill soils possess a disturbed, mottled appearance and trace asphaltic concrete fragments at Trench No. I-8, resulting in their classification as artificial fill.

Native alluvium was encountered beneath the artificial fill soils at both of the infiltration trench locations. The alluvial soils generally consist of medium dense to dense fine sandy silts, silty fine sands, fine to coarse sands, and gravelly fine to coarse sands with occasional cobbles, extending to the maximum depth explored of 10± feet. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are included with this report.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration systems that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at both of the trench locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4 inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at each infiltration test location, the volumetric measurements were made at increments of 2 minutes. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Test Elevation (msl)	Soil Description	Infiltration Rate (inches/hour)
I-7	10	1081	Fine to coarse Sand, little fine Gravel, little Silt	12.1
I-8	10	1079.5	Silty fine to coarse Sand, little fine Gravel	8.5

Laboratory Testing

In-situ Moisture Content

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

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test trench has been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of the grainsize analysis are presented on Plates C-1 and C-2 of this report.

Design Recommendations

Two (2) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations are 8.5 to 12.1 inches per hour. These infiltration rates are higher than previously tested mainly due to a more accurate test method and that the soils at the bottom of the tests were located within native alluvium.

Based on the infiltration test results from Infiltration Test No. I-7, we recommend a design infiltration rate of 12.1 inches per hour be used for the proposed below-grade chamber system, if the bottom of the chamber system extends into the native sandy soils approximately 10± feet below existing site grades. Based on the infiltration test results from Infiltration Test No. I-8, we recommend a design infiltration rate of 8.5 inches per hour be used for the proposed infiltration/detention basin, if the bottom of the basin extends into the native sandy soils approximately 10± feet below existing site grades.

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. It should be confirmed that the soils at the base of the proposed infiltration systems

correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rates reported herein.

The design of the proposed storm water infiltration system should be performed by the project civil engineer, in accordance with the County of San Bernardino guidelines. However, it is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above are based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rates are based on infiltration testing at two (2) discrete locations and the overall infiltration rates of the storm water infiltration systems could vary considerably.

Infiltration versus Permeability

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

Location of Infiltration Systems

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

General Comments

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

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

Closure

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

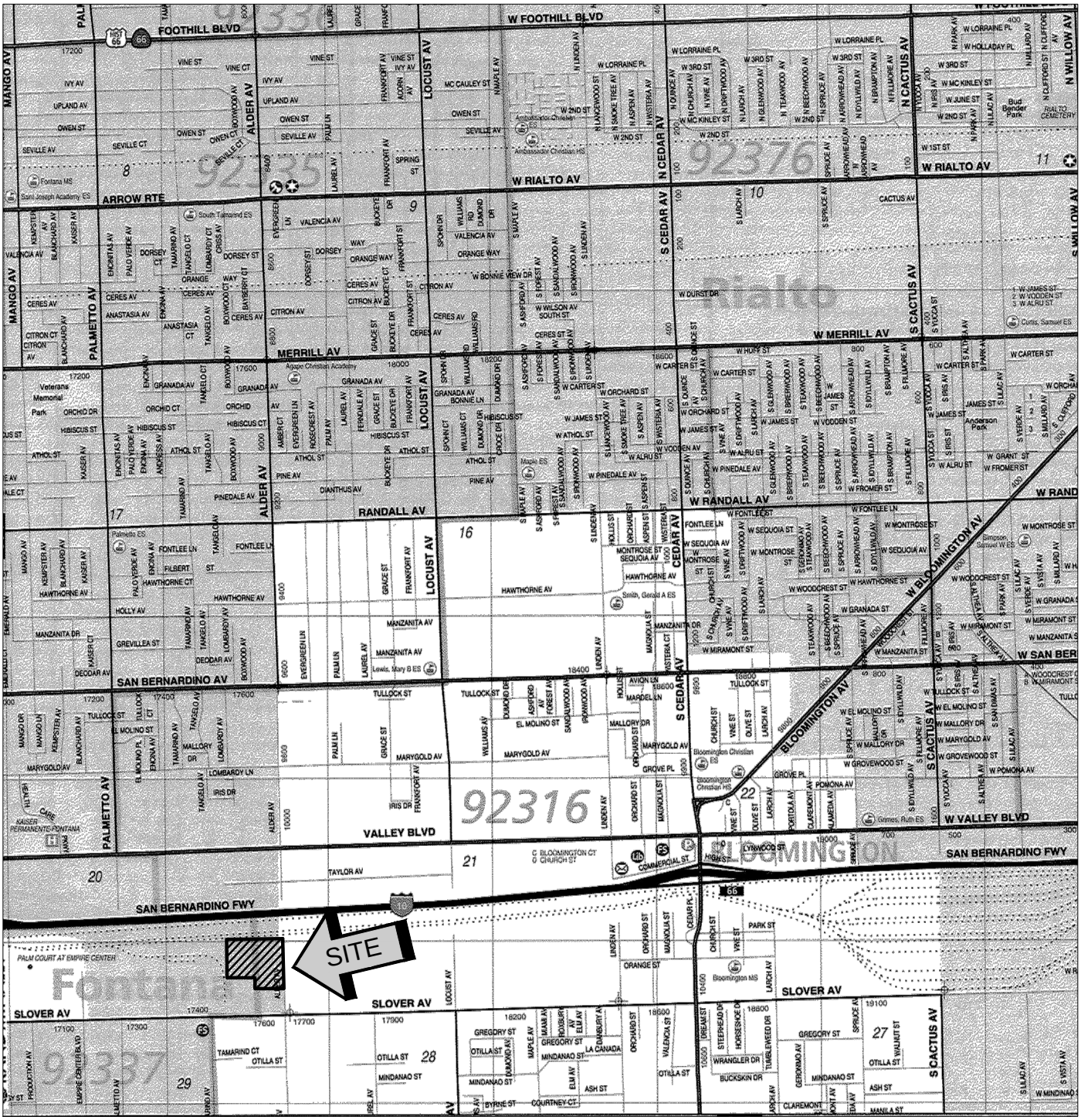
Scott McCann
Staff Scientist



Gregory K. Mitchell, GE 2364
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Trench Logs (2 pages)
Infiltration Test Results Spreadsheets (2 pages)
Grain Size Distribution Graphs (2 pages)



SOURCE: SAN BERNARDINO COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP

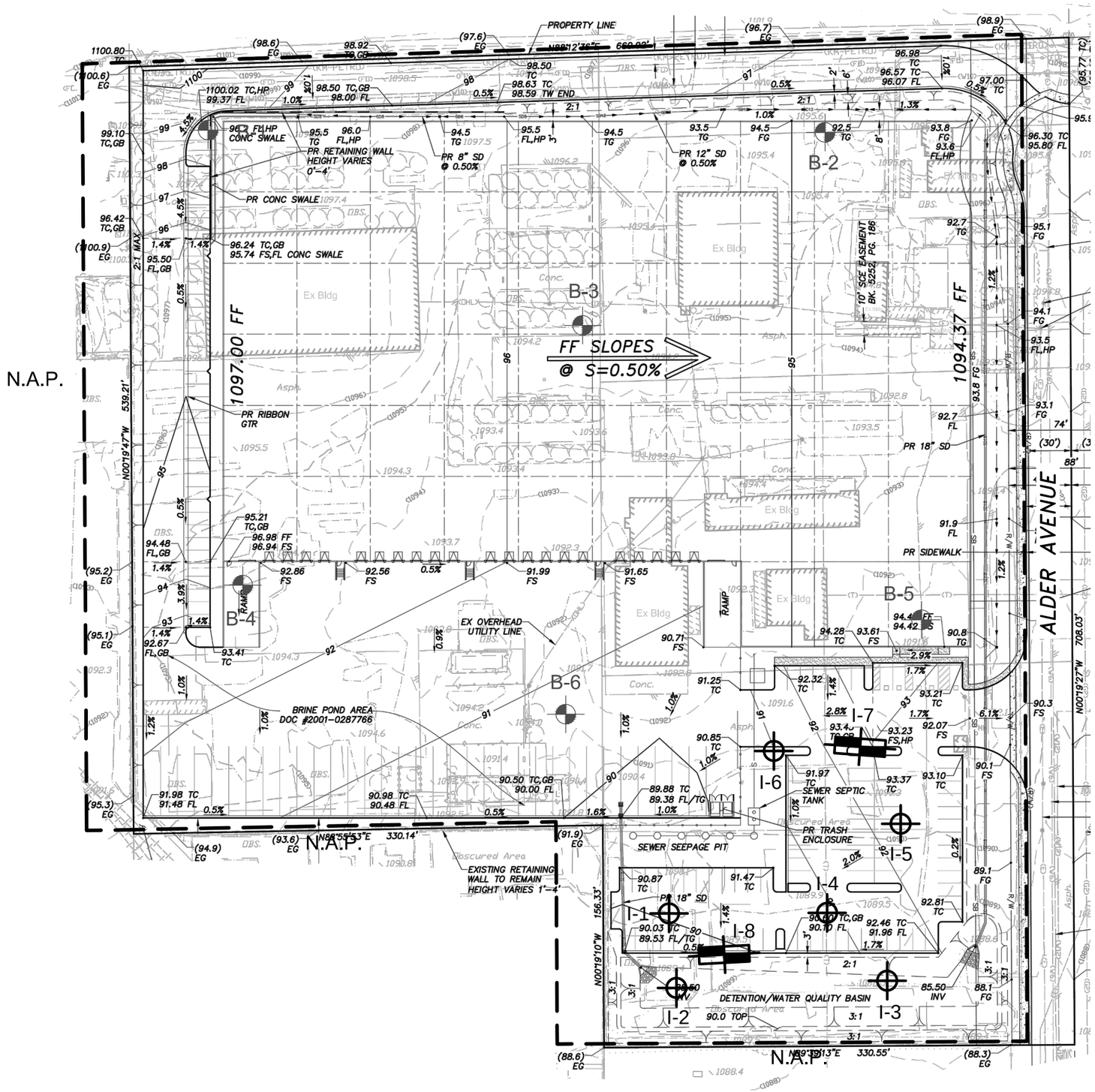
PROPOSED ALDER LOGISTICS CENTER

SAN BERNARDINO COUNTY, CALIFORNIA

SCALE: 1" = 2400'	
DRAWN: SAM CHKD: GKM	
SCG PROJECT 18G218-4	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



N.A.P.

NORTH
SoCalGeo

GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE INFILTRATION TEST LOCATION FROM PREVIOUS STUDY (SCG PROJECT NO. 18G218-2)
- APPROXIMATE BORING LOCATION FROM PREVIOUS STUDY (SCG PROJECT NO. 18G218-1)

NOTE: SITE PLAN PREPARED BY SB&O, INC.

INFILTRATION TEST LOCATION PLAN
PROPOSED ALDER LOGISTICS CENTER
SAN BERNARDINO COUNTY, CALIFORNIA

SCALE: 1" = 80'
DRAWN: SAM
CHKD: GKM
SCG PROJECT 18G218-4
PLATE 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-7

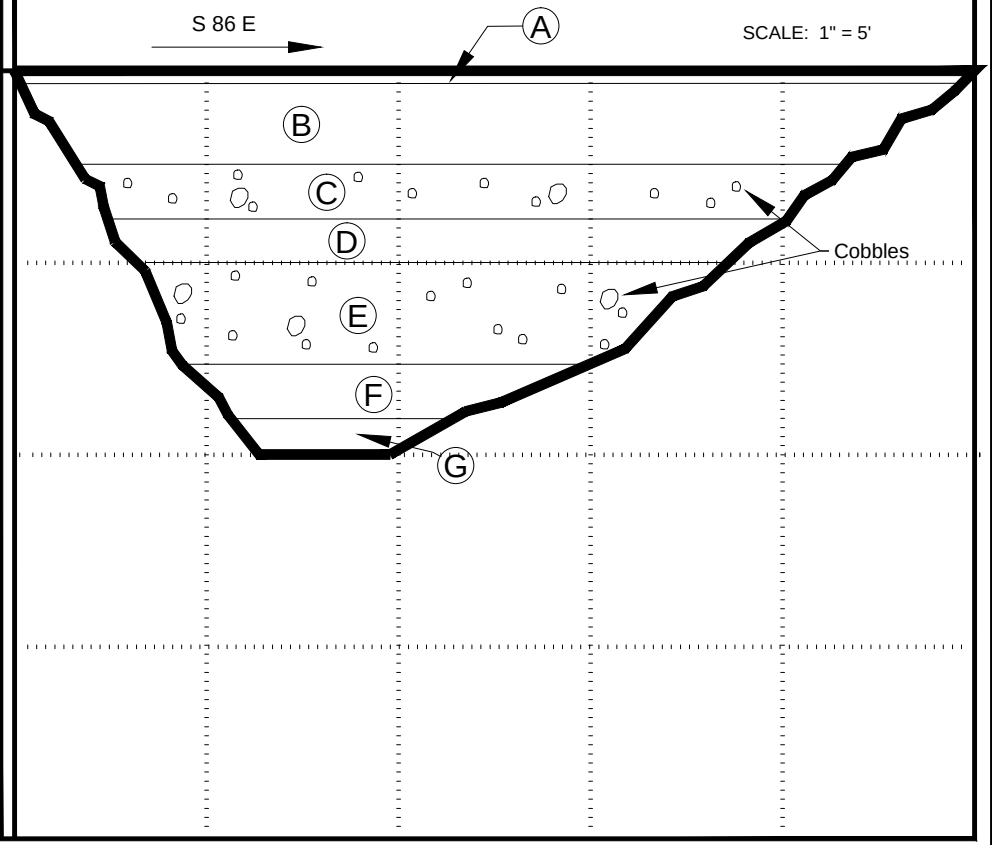
JOB NO.: 18G218-4
PROJECT: Proposed Alder Logistics Center
LOCATION: San Bernardino County, CA
DATE: 12-11-2018

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: S 86 E
TOP OF TRENCH ELEVATION: 1091 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
	b		5	A: ASPHALTIC CONCRETE (AC) : 3 inches thick B: FILL: Brown Silty fine Sand, little medium Sand, trace coarse Sand, trace fine to coarse Gravel, medium dense - damp
	b		5	C: ALLUVIUM: Gray Brown Gravelly fine to coarse Sand, trace Silt, occasional Cobbles, dense - dry to damp D: ALLUVIUM: Brown fine Sand, little medium Sand, trace coarse Sand, trace fine Gravel, trace Silt, medium dense - damp
5				E: ALLUVIUM: Light Gray Gravelly fine to coarse Sand, occasional Cobbles, dense - dry to damp
	b		7	F: ALLUVIUM: Brown Silty fine to medium Sand, little coarse Sand, little fine Gravel, trace coarse Gravel, medium dense - damp
10	b		6	G: ALLUVIUM: Gray Brown fine to coarse Sand, little fine Gravel, little Silt, medium dense to dense - damp
				Trench Terminated @ 10 feet Bottom of Trench Elevation: 1081 feet msl
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH NO. I-8

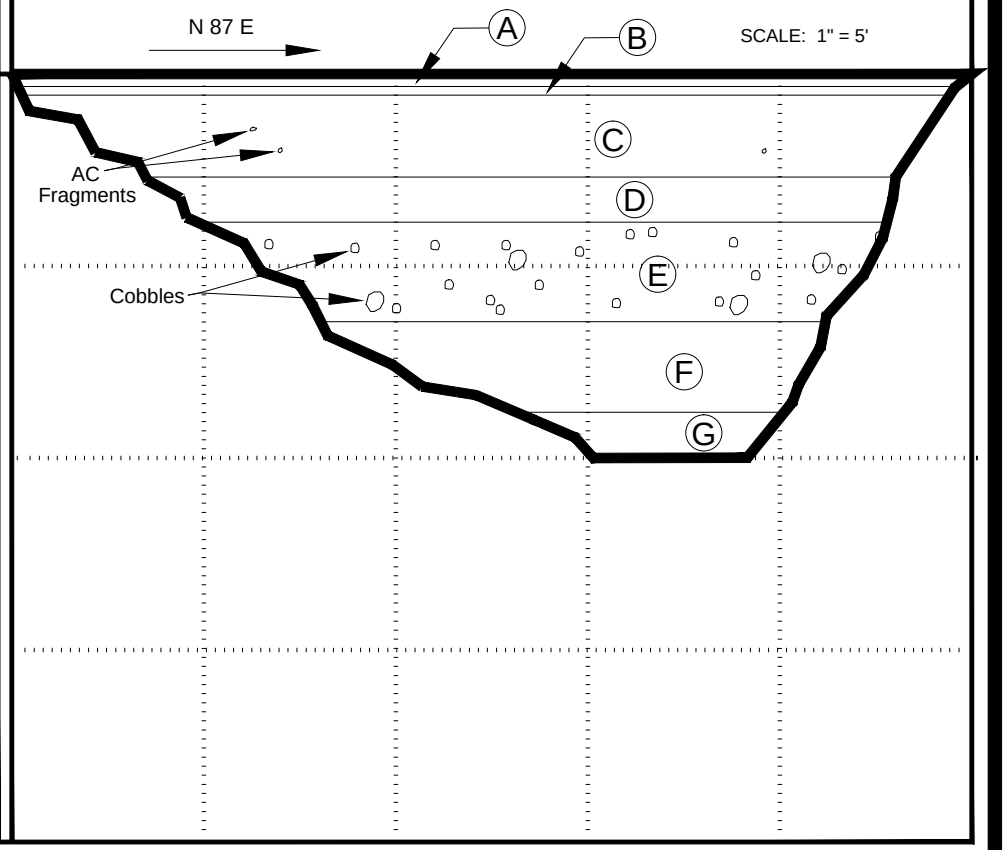
JOB NO.: 18G218-4
PROJECT: Proposed Alder Logistics Center
LOCATION: San Bernardino County, CA
DATE: 12-11-2018

EQUIPMENT USED: Backhoe
LOGGED BY: Scott McCann
ORIENTATION: N 87 E
TOP OF TRENCH ELEVATION: 1089.5 feet msl

WATER DEPTH: Dry
SEEPAGE DEPTH: Dry
READINGS TAKEN: At Completion

DEPTH	SAMPLE	DRY DENSITY (PCF)	MOISTURE (%)	EARTH MATERIALS DESCRIPTION
	b		6	A: ASPHALTIC CONCRETE (AC) : 3 to 4 inches thick B: AGGREGATE BASE (AB) : 3 inches thick C: FILL: Brown Silty fine Sand, little medium to coarse Sand, trace fine Gravel, trace Asphaltic concrete fragments, medium dense - damp
	b		8	D: FILL: Light Gray fine Sand, little medium Sand, trace coarse Sand, little Silt, trace fine Gravel, medium dense - damp to moist E: ALLUVIUM: Light Gray Brown Gravelly fine to coarse Sand, trace Silt, occasional Cobbles, little Iron oxide staining, dense - damp
5				
	b		20	F: ALLUVIUM: Gray fine Sandy Silt, trace medium to coarse Sand, little Iron oxide staining, medium dense - very moist
	b		9	G: ALLUVIUM: Brown Silty fine to coarse Sand, little fine Gravel, trace Iron oxide staining, medium dense - damp to moist
10				Trench Terminated @ 10 feet Bottom of Trench Elevation: 1079.5 feet msl
15				

GRAPHIC REPRESENTATION



KEY TO SAMPLE TYPES:
B - BULK SAMPLE (DISTURBED)
R - RING SAMPLE 2-1/2" DIAMETER (RELATIVELY UNDISTURBED)

TRENCH LOG

PLATE B-2

INFILTRATION CALCULATIONS

Project Name	Proposed Alder Logistics Center
Project Location	San Bernardino County, CA
Project Number	18G218-4
Engineer	Scott McCann

Infiltration Test No: I-7

Constants

	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	11:00 AM	2	100	850	200	3000	34.95	41.12	13.76	16.19
	Final	11:02 AM	**2**	950		3200					
2	Initial	11:03 AM	2	950	800	3300	2850	32.89	39.06	12.95	15.38
	Final	11:05 AM	**5**	1750		6150					
3	Initial	11:06 AM	2	50	750	300	2800	30.84	38.38	12.14	15.11
	Final	11:08 AM	**8**	800		3100					
4	Initial	11:09 AM	2	850	750	3300	2800	30.84	38.38	12.14	15.11
	Final	11:11 AM	**11**	1600		6100					
5	Initial	11:12 AM	2	0	800	200	2700	32.89	37.00	12.95	14.57
	Final	11:14 AM	**14**	800		2900					
6	Initial	11:15 AM	2	800	775	3050	2600	31.87	35.63	12.55	14.03
	Final	11:17 AM	**17**	1575		5650					
7	Initial	11:18 AM	2	1600	775	5850	2650	31.87	36.32	12.55	14.30
	Final	11:20 AM	**20**	2375		8500					
8	Initial	11:21 AM	2	200	750	800	2600	30.84	35.63	12.14	14.03
	Final	11:23 AM	**23**	950		3400					

INFILTRATION CALCULATIONS

Project Name	Proposed Alder Logistics Center
Project Location	San Bernardino County, CA
Project Number	18G218-4
Engineer	Scott McCann

Infiltration Test No: I-8

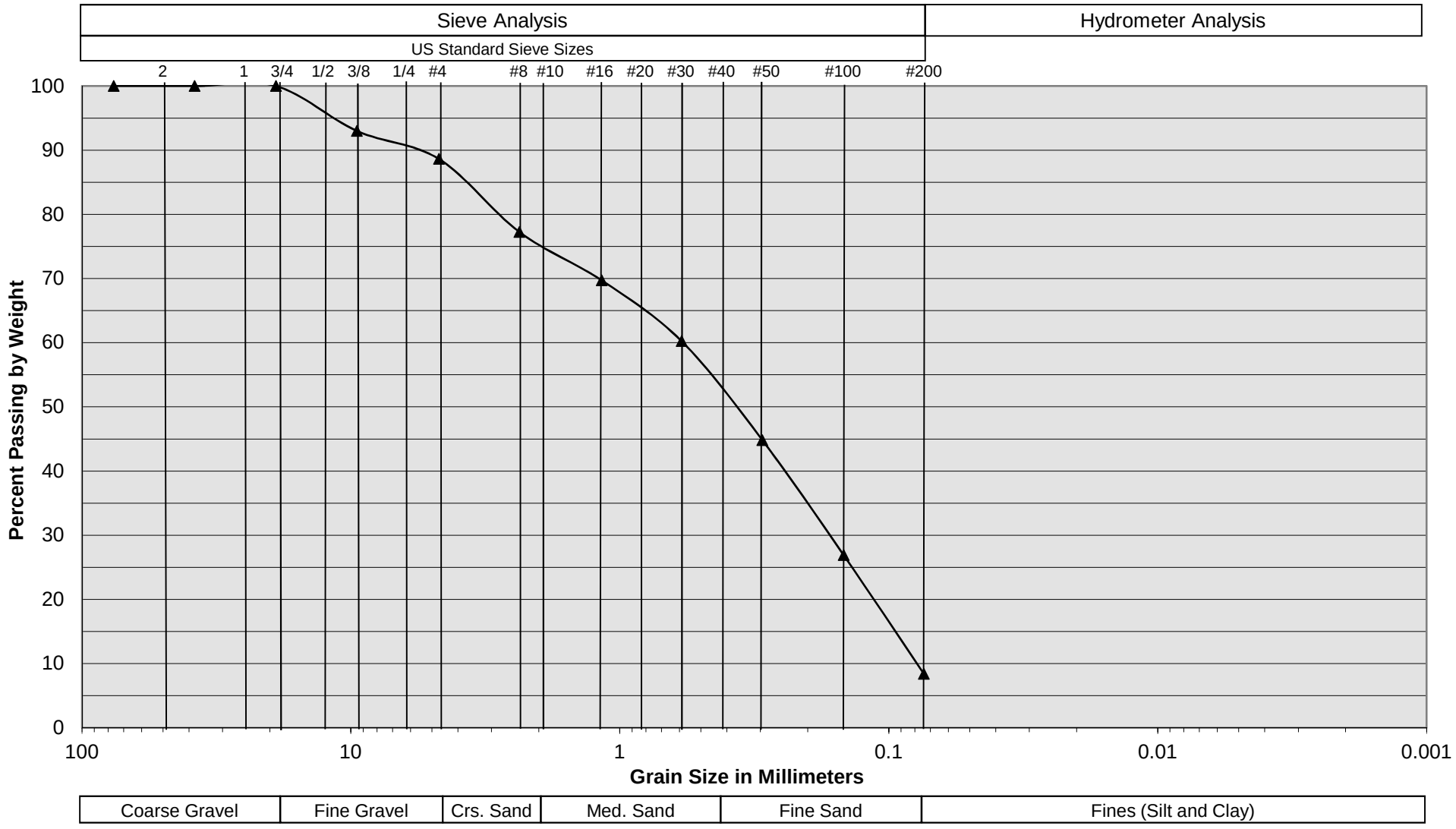
Constants

	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	8:45 AM	2	50	775	650	2850	31.87	39.06	12.55	15.38
	Final	8:47 AM	**2**	825		3500					
2	Initial	8:48 AM	2	300	775	400	2800	31.87	38.38	12.55	15.11
	Final	8:50 AM	**5**	1075		3200					
3	Initial	8:51 AM	2	1100	700	3300	2750	28.78	37.69	11.33	14.84
	Final	8:53 AM	**8**	1800		6050					
4	Initial	8:54 AM	2	200	650	700	2600	26.73	35.63	10.52	14.03
	Final	8:56 AM	**11**	850		3300					
5	Initial	8:57 AM	2	875	600	3350	2600	24.67	35.63	9.71	14.03
	Final	8:59 AM	**14**	1475		5950					
6	Initial	9:00 AM	2	1600	550	6000	2550	22.61	34.95	8.90	13.76
	Final	9:02 AM	**17**	2150		8550					
7	Initial	9:03 AM	2	350	550	950	2500	22.61	34.26	8.90	13.49
	Final	9:05 AM	**20**	900		3450					
8	Initial	9:06 AM	2	1000	525	3550	2550	21.59	34.95	8.50	13.76
	Final	9:08 AM	**23**	1525		6100					

Grain Size Distribution



Sample Description	I-7 @ 10 feet
Soil Classification	Gray Brown fine to coarse Sand, little fine Gravel, little Silt

Proposed Alder Logistics Center
San Bernardino County, CA
Project No. 18G218-4
PLATE C-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-8 @ 10 feet
Soil Classification	Brown Silty fine to coarse Sand, little fine Gravel

Proposed Alder Logistics Center
San Bernardino County, CA
Project No. 18G218-4
PLATE C-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

VII.4. Considerations for Infiltration Rate Factor of Safety

Given the known potential for infiltration BMPs to fail over time, an appropriate factor of safety applied to infiltration testing results must be mandatory. The infiltration rate will decline between maintenance cycles as the BMP surface becomes occluded and particulates accumulate in the infiltrative layer. Monitoring of actual facility performance has shown that the full-scale infiltration rate is far lower than the rate measured by small-scale testing. It is important that adequate conservatism is incorporated in the selection of design infiltration rates. The design infiltration rate discussed here is the infiltration rate of the underlying soil, below the elevation to which soil amendments would not be provided.

The factor of safety that should be applied to measured infiltration rates is a function of:

- Suitability of underlying soils for infiltration
- The infiltration system design.

These factors are discussed in the following sections.

The *measured infiltration rate* calculated for the purpose of infiltration infeasibility screening (**TGD Section 2.4.2.4**) shall be based on a factor of safety of 2.0 applied to the rates obtained from the infiltration test results. No adjustments from this value are permitted. The factor of safety used to compute the *design infiltration rate* shall not be less than 2.0, but may be higher at the discretion of the design engineer and acceptance of the plan reviewer, per the considerations described in the following sections.

It is recognized that there are competing objectives in the selection of a factor of safety. There is an initial economic incentive to select a lower factor of safety to yield smaller BMP designs. A low factor of safety also allows a broader range of systems to be considered "feasible" in marginal conditions. However, there are both economic and environmental incentives for the use of an appropriate factor of safety to prevent premature failure and substandard performance. The use of an artificially low factor of safety to demonstrate feasibility in the design process is shortsighted in that it does not consider the long term feasibility of the system.

The best way to balance these competing factors is through a commitment to thorough site investigation, use of effective pretreatment controls, good construction practices, the commitment to restore the infiltration rates of soils that are damaged by prior uses or construction practices, and the commitment to effective maintenance practices. However, these commitments do not mitigate the need to apply a factor of safety to account for uncertainty and long term deterioration that cannot be technically mitigated. Therefore, a factor of safety of no less than 2.0 shall be used to compute the design infiltration rate.

VII.4.1. Site Suitability Considerations

Suitability assessment related considerations include (**Table VII.3**):

- Soil assessment methods – the site assessment extent (e.g., number of borings, test pits, etc.) and the measurement method used to estimate the short-term infiltration rate.
- Predominant soil texture/percent fines – soil texture and the percent of fines can greatly influence the potential for clogging.
- Site soil variability – site with spatially heterogeneous soils (vertically or horizontally) as determined from site investigations are more difficult to estimate average properties for resulting in a higher level of uncertainty associated with initial estimates.
- Depth to seasonal high groundwater/impervious layer – groundwater mounding may become an issue during excessively wet conditions where shallow aquifers or shallow clay lenses are present.

Table VII.3: Suitability Assessment Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern	Medium Concern	Low Concern
Assessment methods (see explanation below)	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates	Direct measurement of ≥ 20 percent of infiltration area with localized infiltration measurement methods (e.g., infiltrometer)	Direct measurement of ≥ 50 percent of infiltration area with localized infiltration measurement methods or Use of extensive test pit infiltration measurement methods
Texture Class	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site soil variability	Highly variable soils indicated from site assessment or limited soil borings collected during site assessment	Soil borings/test pits indicate moderately homogeneous soils	Multiple soil borings/test pits indicate relatively homogeneous soils
Depth to groundwater/ impervious layer	<5 ft below facility bottom	5-10 ft below facility bottom	>10 below facility bottom

Localized infiltration testing refers to methods such as the double ring infiltrometer test (ASTM D3385-88) which measure infiltration rates over an area less than 10 sq-ft, may include lateral

flow, and do not attempt to account for heterogeneity of soil. The amount of area each test represents should be estimated depending on the observed heterogeneity of the soil.

Extensive infiltration testing refers to methods that include excavating a significant portion of the proposed infiltration area, filling the excavation with water, and monitoring drawdown. The excavation should be to the depth of the proposed infiltration surface and ideally be at least 50 to 100 square feet.

In all cases, testing should be conducted in the area of the proposed BMP where, based on review of available geotechnical data, soils appear least likely to support infiltration.

VII.4.2. Design Related Considerations

Design related considerations include (**Table VII.4**):

- Size of area tributary to facility – all things being equal, risk factors related to infiltration facilities increase with an increase in the tributary area served. Therefore facilities serving larger tributary areas should use more restrictive adjustment factors.
- Level of pretreatment/expected influent sediment loads – credit should be given for good pretreatment by allowing less restrictive factors to account for the reduced probability of clogging from high sediment loading. Also, facilities designed to capture runoff from relatively clean surfaces such as rooftops are likely to see low sediment loads and therefore should be allowed to apply less restrictive safety factors.
- Redundancy – facilities that consist of multiple subsystems operating in parallel such that parts of the system remains functional when other parts fail and/or bypass should be rewarded for the built-in redundancy with less restrictive correction and safety factors. For example, if bypass flows would be at least partially treated in another BMP, the risk of discharging untreated runoff in the event of clogging the primary facility is reduced. A bioretention facility that overflows to a landscaped area is another example.
- Compaction during construction – proper construction oversight is needed during construction to ensure that the bottoms of infiltration facility are not overly compacted. Facilities that do not commit to proper construction practices and oversight should have to use more restrictive correction and safety factors.

Table VII.4: Design Related Considerations for Infiltration Facility Safety Factors

Consideration	High Concern	Medium Concern	Low Concern
Tributary area size	Greater than 10 acres.	Greater than 2 acres but less than 10 acres.	2 acres or less.
Level of pretreatment/ expected influent sediment loads	Pretreatment from gross solids removal devices only, such as hydrodynamic separators, racks and screens AND tributary area includes landscaped areas, steep slopes, high traffic areas, or any other areas expected to produce high sediment, trash, or debris loads.	Good pretreatment with BMPs that mitigate coarse sediments such as vegetated swales AND influent sediment loads from the tributary area are expected to be relatively low (e.g., low traffic, mild slopes, disconnected impervious areas, etc.).	Excellent pretreatment with BMPs that mitigate fine sediments such as bioretention or media filtration OR sedimentation or facility only treats runoff from relatively clean surfaces, such as rooftops.
Redundancy of treatment	No redundancy in BMP treatment train.	Medium redundancy, other BMPs available in treatment train to maintain at least 50% of function of facility in event of failure.	High redundancy, multiple components capable of operating independently and in parallel, maintaining at least 90% of facility functionality in event of failure.
Compaction during construction	Construction of facility on a compacted site or elevated probability of unintended/ indirect compaction.	Medium probability of unintended/ indirect compaction.	Heavy equipment actively prohibited from infiltration areas during construction and low probability of unintended/ indirect compaction.

VII.4.3. Determining Factor of Safety

A factor of safety shall be used. To assist in selecting the appropriate design infiltration rate, the measured short term infiltration rate should be adjusted using a weighted average of several safety factors using the worksheet shown in **Worksheet H** below. The design infiltration rate would be determined as follows:

1. For each consideration shown in **Table VII.3** and **Table VII.4** above, determine whether the consideration is a high, medium, or low concern.
2. For all high concerns, assign a factor value of 3, for medium concerns, assign a factor value of 2, and for low concerns assign a factor value of 1.
3. Multiply each of the factors by the corresponding weight to get a product.
4. Sum the products within each factor category to obtain a safety factor for each.
5. Multiply the two safety factors together to get the final combined safety factor. If the combined safety factor is less than 2, then 2 shall be used as the safety factor.
6. Divide the measured short term infiltration rate by the combined safety factor to obtain the adjusted design infiltration rate for use in sizing the infiltration facility.

The design infiltration rate shall be used to size BMPs and to evaluate their expected long term performance. This rate shall not be less than 2, but may be higher at the discretion of the design engineer.

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	0.50
		Predominant soil texture	0.25	1.0	0.25
		Site soil variability	0.25	2.0	0.50
		Depth to groundwater / impervious layer	0.25	1.0	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.50
B	Design	Tributary area size	0.25	2.0	0.50
		Level of pretreatment/ expected sediment loads	0.25	2.0	0.50
		Redundancy	0.25	2.0	0.50
		Compaction during construction	0.25	2.0	0.50
		Design Safety Factor, $S_B = \Sigma p$			2.00
Combined Safety Factor, $S_{Total} = S_A \times S_B$					3.0
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					4.0 inches / hour
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					1.33 inches / hour

Supporting Data

Briefly describe infiltration test and provide reference to test forms:
Two sets of infiltration testing were done per attached SCG reports.

Per top of page 6 of first report (dated 11/15/2018), the GE recommends the measured rate at I-2 be taken as 4 inches per hour if the infiltration surface bottom is extended into the native underlying gravelly sands identified at I-2 at elevation 81.5. This would involve removal of unwanted artificial fill materials from the basin bottom and backfill with native alluvium (gravelly sands) found deeper down. This replacement location is shown in Section A-A on the WQMP Site Map. Assuming this is done as the soils report suggests, and allows, and is known to be allowed per past experiences with the County of San Bernardino, then we accept the soils engineer-recommended rate of 4 inches per hour at I-2. I-3 is also in the basin footprint and is also taken as simply 4 inches per hour (though 4.2 was measured). Thus the 4 inches per hour for I-2 and I-3 is entered in the above table as the measured rate. Note that I-2 and I-6 were the only two relatively low rates among the first testing set and they were the only two done in artificial fill, per the soils report.

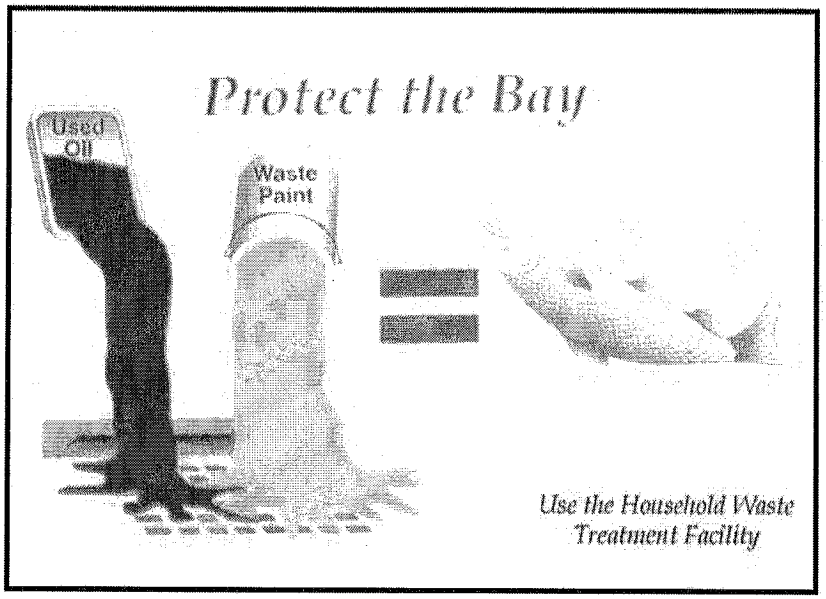
The second set of testing was done as we had anticipated need for more infiltration area (and it may still be needed in final design as key field/design survey data is needed and may have a significant impact on infiltration area (and related detention volume and discharge-to-street elevation). For this preliminary submittal of this WQMP, only the first set of infiltration numbers are employed. However, it is worth noting that the second infiltration report notes that the numbers were higher due to a "a more accurate method" of testing, i.e., double ring method versus the bore hole method used in the first infiltration report. It it likely the measured rate is greater than 4 inches per hour with this in mind.

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

Attachment E

BMP Educational Materials

Non-Stormwater Discharges SC-10



Art Credit: Margie Winter

Objectives

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

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

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Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate 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 or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- 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

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

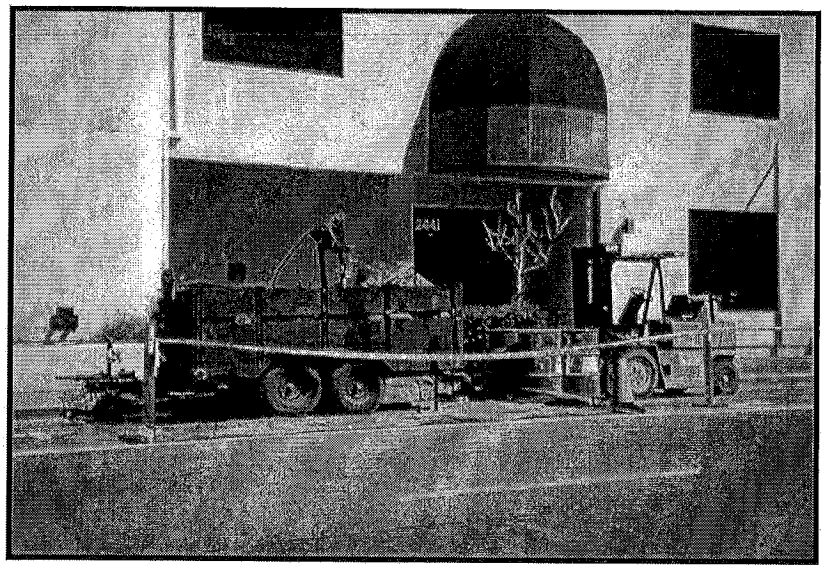


Photo Credit: Geoff Brosseau

Objectives

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

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

CASQA California Stormwater Quality Association

- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- If consistent illegal dumping is observed at the facility:
  - Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

- Routine maintenance:
  - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
  - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
  - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:

  - 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

Training

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off' of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

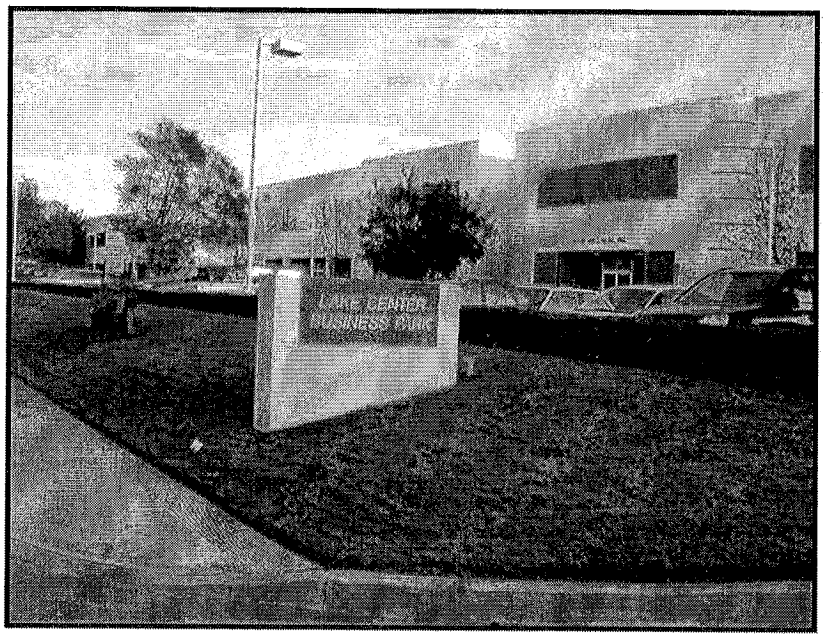
Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Building & Grounds Maintenance SC-41



Objectives

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

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

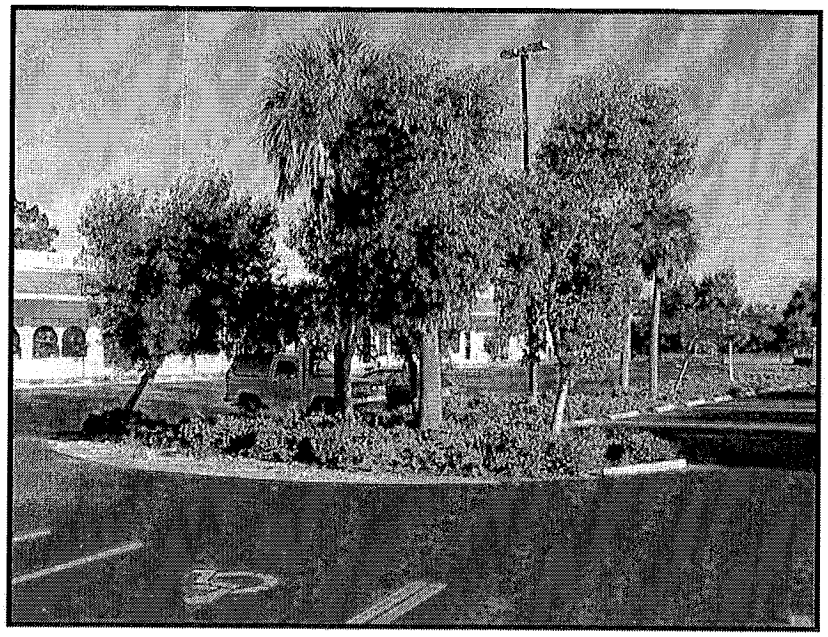
Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43



Objectives

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

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- 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 usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

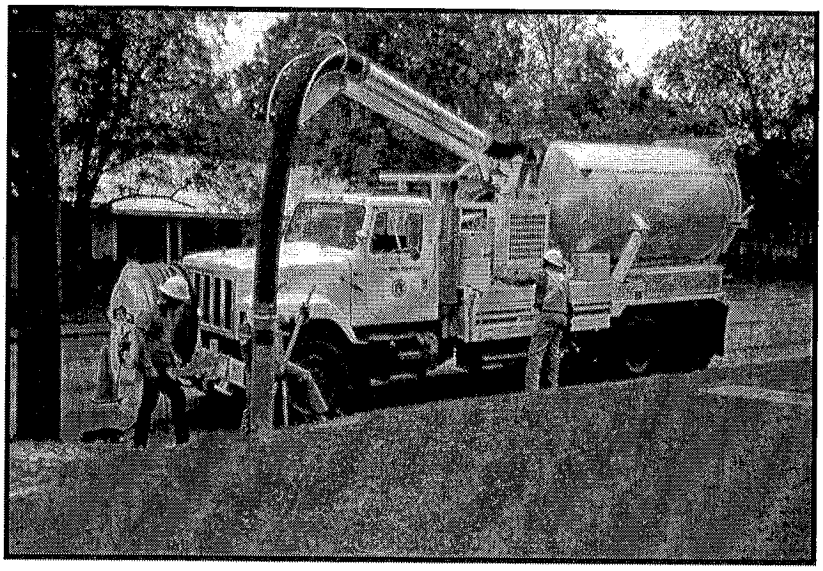
Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Drainage System Maintenance SC-44



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with 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 SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures 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.
- 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 if necessary 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. Do not dewater near a storm drain or stream.

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 and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and 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

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
  - 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 upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate 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

- Inspect and clean up hot spots and other storm drainage areas regularly 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.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up 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 prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
  - Purchase and installation of signs.
  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
  - Purchase of landfill space to dispose of illegally-dumped items and material.

- 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.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. 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, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect 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 recollect 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% for organics and 55-65% 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 sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

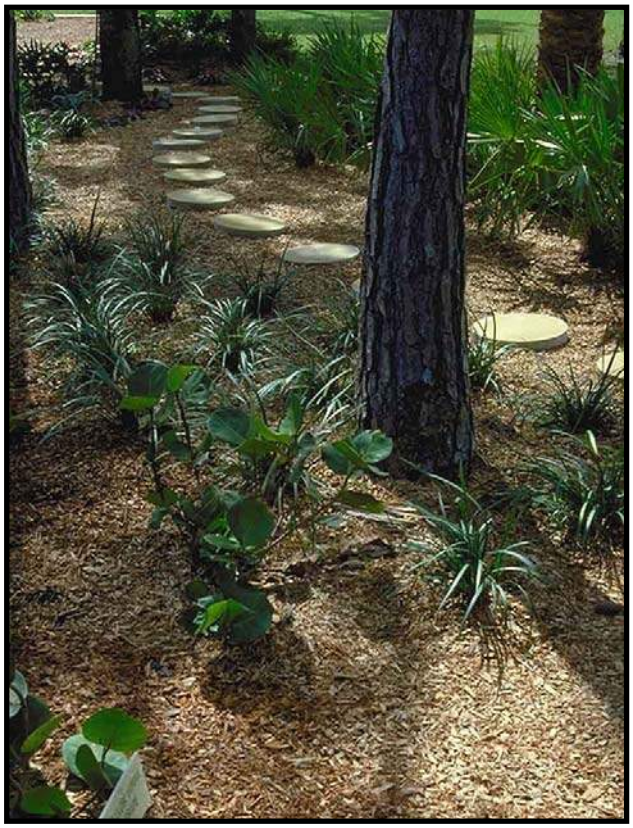
Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

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.

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).

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- 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

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Outdoor Material Storage Areas SD-34



Design Objectives

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

Description

Proper design of outdoor storage areas for materials reduces opportunity for toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to enter the stormwater conveyance system. Materials may be in the form of raw products, by-products, finished products, and waste products. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity.

Approach

Outdoor storage areas require a drainage approach different from the typical infiltration/detention strategy. In outdoor storage areas, infiltration is discouraged. Containment is encouraged. Preventative measures include enclosures, secondary containment structures and impervious surfaces.

Suitable Applications

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

Design Considerations

Some materials are more of a concern than others. Toxic and hazardous materials must be prevented from coming in contact with stormwater. Non-toxic or non-hazardous materials do not have to be prevented from stormwater contact. However, these materials may have toxic effects on receiving waters if allowed to be discharged with stormwater in significant quantities. Accumulated material on an impervious surface could result in significant impact on the rivers or streams that receive the runoff.

Material may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Stormwater contamination may be prevented by eliminating the possibility of stormwater contact with the material storage areas either through diversion, cover, or capture of the stormwater. Control measures may also include minimizing the storage area. Design

requirements for material storage areas are governed by Building and Fire Codes, and by current City or County ordinances and zoning requirements. Control measures are site specific, and must meet local agency requirements.

Designing New Installations

Where proposed project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, the following structural or treatment BMPS should be considered:

- Materials with the potential to contaminate stormwater should be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the stormwater conveyance system, or (2) protected by secondary containment structures such as berms, dikes, or curbs.
- The storage area should be paved and sufficiently impervious to contain leaks and spills.
- The storage area should slope towards a dead-end sump to contain spills and direct runoff from downspouts/roofs should be directed away from storage areas.
- The storage area should have a roof or awning that extends beyond the storage area to minimize collection of stormwater within the secondary containment area. A manufactured storage shed may be used for small containers.

Note that the location(s) of installations of where these preventative measures will be employed must be included on the map or plans identifying BMPs.

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 permits.

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.

Infiltration Basin TC-11



Maintenance Concerns, Objectives, and Goals

- Vector Control
- Clogged soil or outlet structures
- Vegetation/Landscape Maintenance
- Groundwater contamination
- Accumulation of metals
- Aesthetics

General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

Targeted Constituents

✓	Sediment	■
✓	Nutrients	■
✓	Trash	■
✓	Metals	■
✓	Bacteria	■
✓	Oil and Grease	■
✓	Organics	■

Legend ***(Removal Effectiveness)***

- ● Low
- ■ High
- ▲ Medium

Inspection/Maintenance Considerations

Infiltration basins perform better in well-drained permeable soils. Infiltration basins in areas of low permeability can clog within a couple years, and require more frequent inspections and maintenance. The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system.

Scarification or other disturbance should only be performed when there are actual signs of clogging or significant loss of infiltrative capacity, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor. This BMP may require groundwater monitoring. Basins cannot be put into operation until the upstream tributary area is stabilized.

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TC-11 Infiltration Basin

Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Inspection Activities	Suggested Frequency
■ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. ■ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary.	Post construction
■ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition	Semi-annual and after extreme events
Maintenance Activities	**Suggested Frequency**
■ Factors responsible for clogging should be repaired immediately. ■ Weed once monthly during the first two growing seasons.	Post construction
■ Stabilize eroded banks. ■ Repair undercut and eroded areas at inflow and outflow structures. ■ Maintain access to the basin for regular maintenance activities. ■ Mow as appropriate for vegetative cover species. ■ Monitor health of vegetation and replace as necessary. ■ Control mosquitoes as necessary. ■ Remove litter and debris from infiltration basin area as required.	Standard maintenance (as needed)
■ Mow and remove grass clippings, litter, and debris. ■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. ■ Replant eroded or barren spots to prevent erosion and accumulation of sediment.	Semi-annual
■ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. ■ Seed or sod to restore ground cover. ■ Disc or otherwise aerate bottom. ■ Dethatch basin bottom.	3-5 year maintenance

Additional Information

In most cases, sediment from an infiltration basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children. Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

Light equipment, which will not compact the underlying soil, should be used to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This also prevents smearing of the basin floor.

References

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: ftp://dnr metrokc.gov/wlr/dss/spcm/SPCM.HTM

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

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Draft #1

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SAN BERNARDINO STORMWATER EDUCATION PROGRAM

FACT SHEET

Protecting our valuable environmental resources is an important issue in Southern California. One of the top concerns in our area is Stormwater pollution. San Bernardino County is committed to protecting our lakes, rivers and oceans. To this end, some 16 cities in San Bernardino County have united to sponsor the San Bernardino Stormwater Education Program. The goal of this important campaign is to increase awareness among County residents about the issue, and encourage behavioral changes that will reduce the amount of pollutants flowing through the storm drain system into Los Angeles County waterways.

The following provides some important facts relating to Stormwater safety and education. One undeniable fact is: No matter where you live in Southern California, the beach starts literally at your front door."

GETTING TO THE HEART OF THE ISSUE

Q: What is stormwater?
A: Stormwater is rainwater that enters the storm drain system and empties into lakes, rivers, streams or the ocean.

Q: Is stormwater pollution a major problem?
A: Yes. Approximately 100 million gallons of contaminated water and debris drain through the storm drain system each dry day. On rainy days, the daily flow can increase to 10 billion gallons.

Q: What's the biggest misconception about the stormwater system?
A: A major misconception among residents is that the stormwater system is the same as the sewage system.

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A: (cont'd): Most individuals confuse the two systems, but they are two completely separate systems. The sewer or waste water system travels to treatment plants, and is put through an extensive and thorough filtration process before being released into the ocean.

The stormwater system, however, was created to quickly route rainwater off the streets during a heavy storm. It does not receive any filtration, and everything that is in the street goes directly into the storm drains, and ultimately becomes urban run-off and ends up in our local waterways and beaches.

Q: What is urban run-off?
A: Urban run-off is the stormwater pollution from the rain, irrigation, garden hoses or other activities that picks up pollutants (cigarette butts, trash, automotive fluids, used oil, paint, fertilizers and pesticides, lawn and garden clippings and pet waste) from streets, parking lots, driveways and yards and carries them through the storm drain system and straight to our waterways, lakes and the ocean.

Q: What types of pollutants are found in the storm drain system?
A: The list is long, and it includes: litter, fast food wrappers, motor oil, cigarette butts, paint, fertilizers, pesticides, Styrofoam cups, paper, golf balls, dirty diapers, animal feces and other trash.

THE EDUCATION PROGRAM

Stormwater pollution is an issue that effects everyone. And, it is up to both individual and businesses to take responsibility and change their habits to help clean up the local waters. The most effective method for creating change is through education.

Q: What is the San Bernardino County Stormwater Education program?
A: San Bernardino County's Stormwater Public Education Program is a multi-faceted campaign incorporating community outreach, corporate partnership programs and targeted advertising in print and broadcast media. The educational program focuses on the key stormwater issues and pollutants,

Q: Which local cities and municipalities participate in the program?
A: The cities that are participating in San Bernardino County's Stormwater Education program are: **Big Bear Lake, Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Upland and Yucaipa.**

Q: Has this program been effective?
A: The educational program has been well received. It not only supported by residents, but major corporations such as LOWE'S, HOME DEPOT and PETCO are active participants and sponsors.

Q: What are the results?
A: Recently, the San Bernardino County Stormwater Program released findings from its strategic stormwater research study, "The 2002 San Bernardino County Stormwater Program Study". Some key findings included:

- Residents are concerned about Water and Storm Drain Pollution. In fact, 58 percent of those surveyed stated that pollution of local beaches is a serious problem. And, 44 percent said that pollution of local storm drains is a serious problem.

- Nearly one in four say pollution of local waterways is worsening. Twenty-two percent said that the water in local rivers and lakes in the area is more polluted than it was a few years ago.

- Residents want to learn more. According to the survey, more than 1 in 4 people are very interested in learning how to reduce pollution.

- Sixty-two percent said they would definitely change their behavior if they learned they were polluting waterways.

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WHAT CAN BE DONE

Q: How can residents report violations/violators?
A: To report illegal dumping, call 1-800-CLEANUP.

Q: Where can residents find valuable information and tips on how to protect our local waters?
A: Residents can visit area hardware, home and pet stores that are participating in the program to obtain free material and tips for protecting the stormwater system. In addition, billboards, ads and informative radio spots provide prevention tips and information about this issue. Resident can also access this information online by visiting: www.co.san-bernardino.ca.us/flood/npdes.

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Press Contact: Lori Miller
(818) 769-8429

THE RAINY SEASON – WHAT IT MEANS FOR STORMWATER SAFETY

San Bernardino County, February 28, 2005 – While Southern California enjoys a sunny climate most of the year, during the winter months residents brace for the "rainy season." During this wet season, the area can experience days of heavy rainfall and high intensity storms, which not only cloud our normally dry landscape, but produce flooding and mudslides in the mountains and traffic congestion, pollution and urban run-off in the flatlands. This winter, the problem has been compounded by the devastating fires that scorched the mountains and hillsides last year.

So, where does all of this water end up? Millions of gallons of the water and "urban run-off" flow directly into the storm drain system, the vast underground network of pipes and tunnels servicing San Bernardino county. The water flowing through the storm drain system, unlike our sewage system, is not treated and eventually ends up in our oceans, bays and lakes – carrying pollutants and debris with it. On a yearly average, over 40 tons of trash and debris washes up on our beaches, pollutes our waterways, endangers marine life, and ultimately our own healthy lifestyles.

San Bernardino County has established an outreach program, the San Bernardino County Stormwater Public Education Program that targets area residents and businesses with an important message: the debris and trash in our streets and neighborhoods ultimately pollutes our waterways, as well as the nearby lakes, oceans and rivers.

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The multi-faceted awareness campaign incorporates community outreach, corporate partnership programs and targeted advertising in print and broadcast media. The educational program focuses on the key stormwater issues and pollutants, including garbage, litter, tossing cigarette butts in the street, dog waste and the improper use of pesticides and fertilizers.

Some 16 cities in the Inland Empire have united to sponsor the San Bernardino County Stormwater Education Program. The participating cities in San Bernardino County's Stormwater Education program are: **Big Bear Lake, Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Upland and Yucaipa.**

<u>What can be done to reduce the Amount of Debris and Pollution flowing Through the Storm Drain System and into our Waterways during the Rainy Season?</u>

Area Businesses must do their share! The County has produced educational fact sheets, tips cards and POP displays with advice on how to prevent pollution and protect our environmental resources. The material are available free of charge to businesses in the area.

Residents can also pitch in by:

- Picking up litter and yard clippings around their homes.
- Disposing of, or recycling debris via County and City-issued containers.
- Using pesticides and fertilizers properly, and ensuring that household hazardous materials are covered or stored indoors, and that they are never dumped into the storm drains.
- Cleaning up pet waste and flush it down the toilet or disposing of it in your City-issued trash container.

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In addition, San Bernardino County maintains a comprehensive web site with advice, tips and background to help both businesses and residents change their daily behavior when it comes to protecting our natural resources. The web page also features links to other, helpful online resources.

The community outreach program incorporates a proactive in-school component. San Bernardino County offers “free” one-hour classroom presentations for elementary schools. As part of an interactive presentation, students and teachers participate in hands-on and fun sessions on: the water cycle, watersheds, stormwater and stormwater pollutions and ways to prevent stormwater pollution.

Residents, businesses and educators are encouraged to access the county’s helpful material online, by logging onto: www.sbcounty.gov/stormwater.

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PROJECT PROFILE

By Lori E. Miller

San Bernardino County Stormwater Public Education Program Scores an A With Residents and Businesses

San Bernardino County, located approximately 60 mi. from Los Angeles, CA, has a population of more than 1 million people and is home to some of southern California's most prosperous industries and corporations. The county offers residents and visitors a host of popular natural resources and attractions, including Big Bear, Lake Arrowhead, Joshua Tree National Park, Lake Gregory, Death Valley National Park, and San Bernardino National Forest.

Although the county is part of the state's "Inland Empire," residents regularly take advantage of nearby beaches, rivers, and lakes. Protecting local valuable environmental resources is an important issue in southern California, and one of the top concerns in the area is stormwater pollution. San Bernardino County is extremely committed to protecting its own waterways as well as the lakes, oceans, and rivers in neighboring communities. To help protect the environment, the county developed an educational program to directly address stormwater pollution.

To this end, 16 cities, the county, and the flood control district in San Bernardino County united to sponsor the educational program. The participating cities are Big Bear Lake, Chino, Chino Hills, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto, San Bernardino, Upland, and Yucaipa.



"Our primary goal with the campaign is to increase awareness among residents about the stormwater issue and the impact that residents have on water quality," says Naresh Varma, chief of the Environmental Management Division in the county's Department of Public Works.

Nancy DeCourcey, senior environmental control technician for the City of Fontana and chair of the Public Education Subcommittee adds, "We also want to encourage behavioral changes among individuals as they go about their daily routines—changes that will ultimately reduce the amount of pollutants flowing through the storm drain system into local waterways."

The campaign, called The San Bernardino County Stormwater Public Education Program, began in 1994, and today it is one of the county's most successful community programs. It has helped change attitudes and perceptions among county residents about the impact of urban runoff, and it has stimulated measured behavioral changes among individuals and businesses. These changes are accumulating to help reduce the pollutants that end up in the storm drain system—and that ultimately pollute local rivers, lakes, and beaches.



The program uses a multifaceted campaign, incorporating community outreach, corporate partnership programs, and targeted advertising into print and broadcast media. The educational program focuses on key stormwater issues and pollutants, including reducing litter, getting residents to pick up their dog waste, and reducing the runoff from the use of pesticides and fertilizers.

County Research Study

The campaign has been well received by local residents. The county recently conducted an in-depth sur-

vey to measure the impact of the program's messages and educational tips. The San Bernardino County Stormwater Program released findings from its strategic stormwater research study of county residents and their knowledge and opinions regarding this environmental issue.

Some key findings from "2002 San Bernardino County Stormwater Program Study" revealed the following:

- Residents are concerned about water and storm drain pollution. In fact, 58% of those surveyed stated that pollution of local beaches is a serious problem, and 44% said pollution of local storm drains is a serious problem.
- One factor that might help explain high levels of concern about the water pollution issues is that so many of San Bernardino County residents visit beaches and local lakes. While 69% indicated they visited a beach in the last year or two, 40% said they regularly engage in ocean activities, such as surfing, swimming, and fishing.
- Residents want to learn more. According to the survey, more than 25% of people are very interested in learning how to reduce pollution.
- Sixty-two percent said they would definitely change their behavior if they learned they were polluting waterways.
- Those who recall seeing information and advertising about storm drain pollution were more concerned about pollution. Nearly half (48%) of the adult residents in the county say they have seen, read, or heard something in the past year about the storm drain system and the pollution of local waters. This number has doubled since the last survey in 1997, when the number was 23%.



Residents, Businesses Take Action

The county realized that for the program to be successful, it must be comprehensive, encompassing grassroots educational tools, community outreach, and partnerships with local businesses and the corporate community. Stormwater pollution affects everyone, and both individuals and local businesses are taking responsibility and changing their habits to help clean up the local waters.

Major companies in San Bernardino literally have stepped up to the plate. Such companies as Lowe's, Home Depot, Ace Hardware, PETCO, and other home and garden stores are active participants in promoting this program.

Ken Lambert, manager of the San Bernardino branch of Ace Hardware, notes, "It is a valuable program, and as a business in the community, we want to do what we can to improve our environment."

The county has created in-store point-of-purchase displays and easy-to-read, helpful tip cards that are now distributed at more than 120 area stores. The stores and their employees enthusiastically distribute the tip cards to customers and encourage them to read the material and follow the valuable advice. The cards cover a variety of topics that address stormwater pollution prevention, including "Paint Tips to Prevent Pollution," "Pesticide Tips to Prevent Pollution," "Fertilizer Tips to Prevent Pollution," and "Curbing Pollution by Picking Up After Your Pooch." The cards are available in both English and Spanish.

The program annually distributes more than 50,000 tip cards at the stores and trains almost 1,000 employees so they also can provide customers with important information about pollution prevention.



Advertising Campaign Garners International Award

Another key component of the San Bernardino County Stormwater Public Education Program is an innovative advertising campaign featuring outdoor billboards, print ads, and radio spots. The ads, similar to the tip cards, focus on key stormwater issues and offer tips on preventing pollution.

San Bernardino County's print advertising campaign, "Street Stories," was so successful that it was recognized with a Certificate of Merit for Outstanding Creativity at the 2002 International Mobius Advertising Awards in the category of Environmental Issues & Concerns.

What's Next?

The county continues to expand the program and promote the need for proactive prevention of stormwater pollution. San Bernardino County also offers fact sheets, tips, and school presentations via its Web site. Residents, businesses, and educators are encouraged to access the county's helpful material on-line at www.sbcounty.gov/stormwater.

San Bernardino County's education program scores an A for its originality and relevance and for directly speaking to those who matter most when it comes to stormwater safety—the residents who live, work, and play in the community.

Guest author ***Lori E. Miller*** *lives in the San Bernardino, CA, area.*

FOR IMMEDIATE RELEASE

Press Contact: Lori E. Miller
LMPR
(818) 769-8429

SCHOOL MAY BE OUT FOR THE SUMMER –

BUT SAN BERNARDINO COUNTY IS LAUNCHING ITS ANNUAL STORMWATER PUBLIC EDUCATION PROGRAM

SAN BERNARDINO COUNTY, (Date) – The San Bernardino County Stormwater Public Education Program officially kicks off this month in more than 16 cities throughout the Inland Empire. The goal of this important environmental program is to increase awareness among County residents about the impact of urban runoff, and to stimulate behavioral changes to reduce the pollutants that end up in the storm drain system – and ultimately pollute local rivers, lakes and beaches.

San Bernardino County's Stormwater Public Education Program is a multi-faceted campaign incorporating community outreach, corporate partnership programs and targeted advertising in print and broadcast media. The educational program focuses on the key stormwater issues and pollutants, including garbage, litter, tossing cigarette butts in the street, dog waste and the improper use of pesticides and fertilizers.

County Commissions Major Research Study

Recently, the San Bernardino County Stormwater Program released findings from its strategic stormwater research study of county residents, and their knowledge and opinions regarding this environmental issue.

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Some key findings from the study, entitled, “2002 San Bernardino County Stormwater Program Study,” revealed:

- Residents are concerned about Water and Storm Drain Pollution. In fact, 58 percent of those surveyed stated that pollution of local beaches is a serious problem. And, 44 percent said that pollution of local storm drains is a serious problem.
- Nearly one in four say pollution of local waterways is worsening. Twenty-two percent said that the water in local rivers and lakes in the area is more polluted than it was a few years ago.
- Residents want to learn more. According to the survey, more than 1 in 4 people are very interested in learning how to reduce pollution.
- Sixty-two percent said they would definitely change their behavior if they learned they were polluting waterways.

The study also found that the County’s educational program has been effective. The study showed that those who recall seeing information and advertising about storm drain pollution were more concerned about pollution. Nearly half (48 percent) of the adult residents in the county say they have seen, read or heard something in the past year about the storm drain system and the pollution of local waters.

As summer swings into high gear, so does the San Bernardino County Stormwater Public Education Program. Residents will soon see billboards and ads, as well as hear informative radio spots about this issue. Also, if residents want to learn more about stormwater pollution prevention, they can call 1-800-CLEANUP or visit: www.co.san-bernardino.ca.us/flood/npdes.

# # #

Paint Tips to Prevent Pollution

Washing a paint brush or dumping rinse water in the gutter allows toxic chemicals to flow into the San Bernardino County storm drain system, and they do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.

- Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or "cleans with water."
- Don't clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink and oil-based paints with thinner.
- Recycle leftover paint at a household hazardous waste collection facility. Call (800) 253-2687 for the location of your city's facility.



San Bernardino County STORMWATER PROGRAM

To report illegal dumping or for more information on Stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

English side

Consejos de Prevención Para la Contaminación de Pintura.

Lavar las brochas de pintura o arrojar agua sucia en el desagüe acaba por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

- Usa pinturas de agua cuando sea posible. Son menos toxicas que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or "cleans with water".
- Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner.
- Recicla la pintura que sobra en un lugar de colección de materiales peligrosos. Llama al (800) 253-2687 para información de un centro cerca a ti.



San Bernardino County STORMWATER PROGRAM

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

Spanish side

Item: Paint bill insert **Actual size:** 3.625" x 8.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 8/29/03

Paint Tips to Prevent Pollution

Washing a paint brush or dumping rinse water in the gutter allows toxic chemicals to flow into the San Bernardino County storm drain system, and they do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health:



- Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or "cleans with water."
- Don't clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink and oil-based paints with thinner.
- Recycle leftover paint at a household hazardous waste collection facility. Call (800) 253-2687.

To report illegal dumping or for more information on Stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

English side

Consejos de Prevención Para la Contaminación de Pintura.

Lavar las brochas de pintura o arrojar agua sucia en el desagüe acaba por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica:



- Usa pinturas de agua cuando sea posible. Son menos toxicas que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or "cleans with water".
- Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner.
- Recicla la pintura que sobra en un lugar de colección de materiales peligrosos. Llama al (800) 253-2687.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

Spanish side

Item: Paint tip card **Actual size:** 4.125" x 5.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 9/10/03

PRESORTED
STANDARD
U.S. POSTAGE
PAID
SACRAMENTO, CA
PERMIT# 000

San Bernardino County Stormwater Program
825 East Third Street · Room 127
San Bernardino, CA 94215-0835

STORMWATER Pollution Prevention

LANDSCAPE MAINTENANCE



STORMWATER Pollution Prevention

Stormwater Management Practices for Commercial Landscape Maintenance

Yard waste, sediments, and toxic lawn/garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Following these best management practices will prevent pollution, comply with regulations and protect public health.

Recycle Yard Waste

Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Try grasscycling - the natural recycling of grass by leaving clippings on the lawn when mowing. Grass clippings will quickly decompose, returning valuable nutrients to the soil. Further information can be obtained at www.ciwmb.ca.gov/Organics.

Use Fertilizers, Herbicides and Pesticides Safely

Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use of natural, non-toxic alternatives to the traditional fertilizers, herbicides and pesticides is highly recommended. If you must use chemical fertilizers, herbicides, or pesticides:



- Spot apply pesticides and herbicides, rather than blanketing entire areas.
- Avoid applying near curbs and driveways, and never apply before a rain.
- Apply fertilizers as needed, when plants can best use it, and when the potential for it being carried away by runoff is low.

Recycle Hazardous Waste

Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility, which accepts these types of materials. For information on proper disposal call, (909) 386-8401.

Use Water Wisely

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

Prevent Erosion

Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways.

- Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff.
- Avoid excavation or grading during wet weather.

Store Materials Safely

Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials must be covered with plastic sheeting to protect from rain, wind and runoff.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

or visit our websites:

www.co.san-bernardino.ca.us/flood/npdes

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Attachment F

O&M Information, CC&Rs, and Maintenance Agreement (in Final WQMP)

RECORDING REQUESTED BY:
County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:
County of San Bernardino
Department of Public Works
825 E. Third Street, Room 117
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

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

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

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

OWNER NAME: _____

PROPERTY ADDRESS: _____

_____

APN: _____

THIS AGREEMENT is made and entered into in

_____ ,California, this _____ day of

_____ , by and between

_____ , hereinafter

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

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

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

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

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

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

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

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

1. Owner shall comply with the WQMP

2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

3. Owner hereby provides the County's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the County Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The County shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the County may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay County for all costs incurred by County in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of County invoice.

4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the County, the Owner shall provide the County with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the County , the County is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the County Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay County within thirty (30) calendar days of County invoice.

6. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

7. The County agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the County in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a County invoice and prior to the County's issuance of such certificate. Where the County cannot issue an estoppel certificate, Owner shall pay the County within thirty (30) calendar days of receipt of a County invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the County and the Owner.

9. County and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to County under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the County if said cure reasonably requires more than the subject time, the County may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the County may recover any damages to which the County may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the County, including interest as herein above set forth, subject to foreclosure in event of default in payment.

12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the County harmless and pay all costs incurred by the County in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of

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

15. Time is of the essence in the performance of this Agreement.

16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the County) and hold harmless the County and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the County on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the County's "active" as well as "passive" negligence but does not apply to the County's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the County under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO COUNTY :

Director of Public Works

825 E. Third Street, Room 117

San Bernardino, CA 92415-0835

IF TO OWNER:

_____

_____

_____

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

OWNER:

Signature: _____

Name: _____

Title: _____

Date: _____

FOR: Maintenance Agreement, dated _____, for the project known as _____ _____ (APN)_____, As described in the WQMP dated _____.

OWNER:

Signature: _____

Name: _____

Title: _____

Date: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

GERRY NEWCOMBE, Director of Public Works

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/illustration)