Preliminary

Water Quality Management Plan

For:

Mountain Avenue Bees

3112 Lytle Creek Road

APN 0239-311-01, -02, -03

Prepared for:

Mountain Avenue Bees, Inc.

5981 Layton Steet

Alta Loma, CA 91737

Prepared by:

Land Engineering Consultants, Inc.

P.O. Box 541, 650 Avenue K

Calimesa, California 92320

(909) 795-8882

Preparation Date: 2/24/2022

Revision Date: 9/12/2022

Approval Date:_____

Project Owner's Certification

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

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

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Project Data			
Permit/Application Number(s):	PROJ-2022-00024	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0239-311-01, -02, -03

Owner's Signature			
Owner Name: Mountain Avenue Bees, Inc.			
Title	Ron Spears; Owner		
Company	Mountain Avenue Bees, Inc.		
Address	5981 Layton Street, Alta Loma CA 91737		
Email	candbees@yahoo.com		
Telephone #	(909) 754-2555		
Signature	Ron Spears	Date	2-24-22

Preparer's Certification

Project Data			
Permit/Application Number(s):	PROJ-2022-00024	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0239-311-01, -02, -03

"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: Steven H. Ritchey, P.E.		PE Stamp Below
Title	Principal	
Company	Land Engineering Consultants Inc.	
Address	P.O. Box 541 - 650 Avenue K Calimesa, California 92320	
Email	steve@lecincorporated.com	
Telephone #	(909) 795-8882	
Signature		
Date	*September 12, 2022*	

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Mountain Avenue Bees				
Project Owner Contact Name:	Ron Spears				
Mailing Address:	5981 Layton Street Alta Loma, CA 91737	E-mail Address:	candbees@yahoo.com	Tel:	(909) 754-2555
Permit/Application Number(s):	PROJ-2022-00024		Tract/Parcel Map Number(s):	APN 0239-311-01, -02, -03	
Additional Information/ Comments:					
Description of Project:	The existing site contains a large barren open area that contains a 2,200 sf house, a 5,863 sf metal storage building, and 21,808 sf of asphalt and concrete driveway and parking areas leading to the two structures. The storage building and a portion of the driveway are located within the proposed project area, while the house and remaining driveway area lies outside of the project area. The result is 18,184 sf of existing impervious surface within the proposed project area. This project proposes to demolish the storage building and utilize the existing house as a caretaker's quarters. This project includes a total development area of 188,585 sf of which 30,000 sf is proposed for two single-story Industrial Buildings, 84,265 sf is concrete parking and drive lane areas, 15,740 sf is landscape areas, and 96,048 sf is native areas. The result is a total of 114,265 sf of new impervious surface, which is an increase of 96,081 sf compared to the existing condition. The proposed site condition will be split into two drainage areas as described below: **Drainage Area 1:** Drainage Area 1 includes all of the site area that drains to the proposed infiltration basin. DA 1 has three major drainage paths which flow from two high points on the north side of the project area to the infiltration basin located east of the project area. The three drainage paths convey water on the surface through concrete swales within the drive lanes around the east and west project perimeter and through the center between the two buildings. The three drainage flows then confluence and exit the drive lanes into the infiltration basin through a catch basin with an 18" PVC. The infiltration basin has been sized to retain the design capture volume for DA 2. The site property contains a significant drainage feature to the north that accepts the flows the from the Grapevine Canyon. The project area is protected from this drainage feature by means of the existing topography (berm dike) that directs flow toward a culvert that allows the flows to pass under Lytle Creek Road. Additional drainage from the adjacent hillside also				

	drains through the project area, and in the proposed condition these offsite flows will be directed by earthen drainage swales around the project area. **<u>Drainage Area 2:</u>** Drainage Area 2 includes all of the site area that drains to the proposed infiltration trench located along the south side of the southerly driveway access. DA 2 has a single drainage path within the driveway that carries flows to the infiltration trench. Additionally, the barren area north of the driveway sheet flows toward driveway and into the infiltration trench.
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

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

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

2 Project Area (ft2):	225,333	**3** Number of Dwelling Units:	0	**4** SIC Code:	0279

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, Mountain Avenue Bees, Inc., is responsible for the implementation of all non-structural and structural BMPs. The developer/owner is also responsible for the scheduling of inspections, and maintenance and verification of maintenance. The owner is required to sign a statement declaring responsibility for all structural BMP maintenance until the time property is transferred. This transfer of property must have conditions requiring the recipient to assume responsibility for maintenance of any structural BMPs to be included in the sales or lease agreement for said property.

There will be no infrastructure transferred to any public agencies after project completion.

Mountain Avenue Bees, Inc.
Attn: Ron & Michele Spears
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Alta Loma, CA 91737
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(909) 754-2555

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 ☒	
Nutrients - Phosphorous	E ☒	N ☐	from Landscape Maintenance
Nutrients - Nitrogen	E ☒	N ☐	from Landscape Maintenance
Noxious Aquatic Plants	E ☐	N ☒	
Sediment	E ☒	N ☐	from Landscape Areas
Metals	E ☒	N ☐	Automotive wear
Oil and Grease	E ☒	N ☐	Automotive leakage
Trash/Debris	E ☒	N ☐	From wind, upstream flows, and litter
Pesticides / Herbicides	E ☒	N ☐	Landscaping
Organic Compounds	E ☒	N ☐	Landscaping
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

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

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

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

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

Section 3 Site and Watershed Description

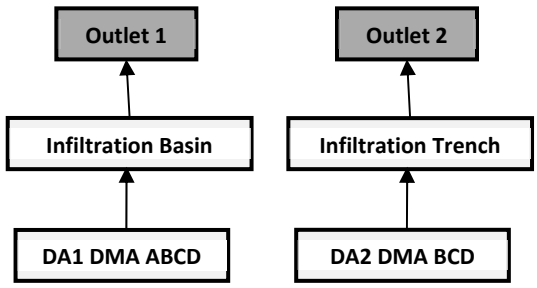
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at the approximate center of the site*	Latitude 34°11'51"N	Longitude 117°26'48"W	Thomas Bros Map page 544 GRID G2

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

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



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 Chambers to Outlet 1	The roof areas of both buildings drain onto the paved drive lanes and parking areas. The graded native areas drain toward the site's perimeter landscaping. The perimeter and parking lot landscape areas may pond +/- 2 inches and then spill over into the concrete drive lanes. The concrete drive lanes convey all of the onsite DA1 flows to the infiltration basin. The WQMP storm is retained for infiltration and excess detained flows exit the site via an overflow outlet structure so that it may continue in its historical drainage pattern.
DA2 Chambers to Outlet 2	The graded native areas drain toward the concrete drive lane and landscape strip. The landscape areas may pond +/- 2 inches and then spill over into the concrete drive lanes. The concrete drive lanes convey all of the onsite DA2 flows to the infiltration trench. The WQMP storm is retained for infiltration and excess detained flows exit the infiltration trench and continue in its historical drainage pattern.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA ABD			
1 DMA drainage area (ft^2)	151,092			
2 Existing site impervious area (ft^2)	9,886			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2 (AMC II)			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	449			
6 Longest flowpath slope (ft/ft)	0.0646			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	BARREN, COMMERCIAL			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	POOR			

SEE SITE PHOTOGRAPHS IN APPENDIX B

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA ABD			
1 DMA drainage area (ft^2)	74,241			
2 Existing site impervious area (ft^2)	8,298			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2 (AMC II)			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	361			
6 Longest flowpath slope (ft/ft)	0.0358			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	BARREN, COMMERCIAL			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	POOR			

Form 3-3 Watershed Description for Drainage Area 1 & 2

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See 'Drainage Facilities" link at this website*	Lytle Creek (mtn and vly), Warm Creek, Santa Ana River Reach 4, Reach 3 and Prado Basin.
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River Reach 3 - Pathogens
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana River Reach 4 – Indicator Bacteria Santa Ana River Reach 3 – Copper, lead, indicator bacteria Prado Basin - pH
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	San Bernardino Kangaroo Rat, Riversidian Alluvial Sage Scru
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Santa Ana River
Hydrologic Conditions of Concern	☒ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☐ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	The project owner will be provided educational materials. The materials will discuss water quality management issues relating to the project and property owner's individual and corporate responsibilities. The materials will contain appropriate information from private and government resources. These materials will include information on general good housekeeping practices that contribute to protection of Storm water quality, and BMPs that eliminate or reduce pollution. The materials will describe the use of chemicals that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharge to gutters, catch basins, and storm drains. These materials will be made available to the owner and are attached to the WQMP template as Appendix E. The owner will note the availability of stormwater information and educational materials available on the San Bernardino County Website http://www.sbcountystormwater.org/ It will be the responsibility of the property owner to educate the landlords, tenants and managers, who will then be responsible to educate their staff.
N2	Activity Restrictions	☒	☐	All activities that are in violation of San Bernardino County Ordinances and Codes are restricted. All activities are restricted for which there isn't an appropriate BMP provided for. When using pesticides, contact licensed pesticide application to do the application.
N3	Landscape Management BMPs	☒	☐	Maximize trees and other vegetation by planting additional vegetation, clustering tree areas, and planting of native and drought tolerant plants as specified on the landscape plan. Minimize the use of pesticides for landscape maintenance.
N4	BMP Maintenance	☒	☐	The owner will be responsible for all BMP maintenance. Refer to Form 5-1 of this document for site specific maintenance items, required inspection and maintenance activities, and the estimated frequency of inspection and maintenance.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Note expected
N6	Local Water Quality Ordinances	☒	☐	The Project must comply with any applicable local water quality ordinances through this WQMP. The local jurisdiction (San Bernardino County), under local water quality ordinances, has authority to ensure clean stormwater discharges from the site.
N7	Spill Contingency Plan	☒	☐	The owner will develop a site-specific spill contingency plan. At minimum like absorbent materials will be kept onsite for parking lot spills

Form 4.1-1 Non-Structural Source Control BMPs				
N8	Underground Storage Tank Compliance	☐	☒	No Underground Storage Tanks to be used on this site.

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	
N9	Hazardous Materials Disclosure Compliance	☐	☒	Hazardous materials not expected.
N10	Uniform Fire Code Implementation	☒	☐	This site will comply with Article 80 of the Uniform Fire Code. The owner will implement spill controls and ensure the separation of incompatible materials, to reduce the potential for a release of hazardous materials that could affect public health or the environment.
N11	Litter/Debris Control Program	☒	☐	Implement trash management procedures including litter patrol and emptying of trash receptacles by landscape maintenance personel. Dispose of sweepings, and sediment properly.
N12	Employee Training	☒	☐	The owner or tenant shall train employees within 6 months of hire and on an annual basis thereafter. Employees will be trained in “good housekeeping” practices and general BMP inspection and maintenance. Training materials for specific BMPs are provided within this report - see appendix E.
N13	Housekeeping of Loading Docks	☒	☐	The loading docks shall be maintained by the building operator on a regular basis. Spills shall be cleaned immediately. Docks shall be inspected for uneven surfaces or cracks and shall be repaired as necessary. The inlets and sump pumps shall be inspected for build-up and blockage, and cleaned as often as necessary.
N14	Catch Basin Inspection Program	☒	☐	Maintain catch basin and stormwater inlets on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, and restore the catch basins sediment trapping capacity. A catch basin is distinguished from a stormwater inlet by having at its base a sediment sump designed to catch and retain

				sediments below the overflow point. Catch basin inserts will be installed to catch trash and debris.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The building operator shall be responsible for scheduling street vacuum sweeping as often as necessary, based on field observation of sediment and waste accumulation. At minimum paved areas shall be swept annually, prior to the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a public agency project
N17	Comply with all other applicable NPDES permits	☐	☒	This site will require a SWPPP for a Construction General Permit that will be developed for final engineering submittal. The owner shall comply with all other applicable NPDES based on the future use of the facilities.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Provide storm drain system stenciling and signage. The stencil shall be blue on a white background with lettering 2-1/2" in height or a catch basin curb marker. Label wording shall be "No Dumping-Drain to River". Stenciled wording must be reviewed and approved by San Bernardino County.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No materials being stored outside.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash enclosure areas shall be walled to prevent off-site transport of trash. Trash will be roofed to prevent rainfall from entering containers. Trash enclosures shall be paved with an impervious surface. Dumpsters shall be lined to prevent leakage.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation methods will be utilized to minimize runoff of excess irrigation water across impervious surfaces and into the storm water conveyance system. Such measures shall include employing rain-triggered shutoff devices to eliminate or reduce irrigation during and immediately after precipitation, using mulches (such as wood chips) to minimize sediment in runoff and to maintain soil infiltration capacity, and coordinating design of the irrigation system and landscape to minimize overspray and runoff. Irrigation systems shall use flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or water supply lines. Water conservation devices such as programmable irrigation timers and soil moisture sensors shall be used.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	All landscaping next to impervious surfaces shall be finish-graded at a minimum of 1-2 inches below top of curb or sidewalk for increased retention/infiltration of stormwater and irrigation water, as shown by detail on WQMP Site Plan and Grading Plan.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Vegetate slopes with native or drought tolerant vegetation.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S7	Dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Dead end sump with pump is provided to convey drainage to paved parking lot surface swale for conveyance to infiltration chambers.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle washing proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No covered outdoor processing areas are proposed.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment washing proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping is proposed.
S14	Wash water control for food preparation areas	☐	☒	Food preparation is not proposed.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	Not proposed.

4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices

If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets

Minimize impervious areas: Yes ☐ No ☒

Explanation: Drive lanes, parking spaces, and sidewalk areas sized to provide minimum areas while still complying with County standards and providing sufficient truck movements. All impervious areas are being mitigated by proposed landscaping and infiltration basin.

Maximize natural infiltration capacity: Yes ☒ No ☐

Explanation: Landscaping and infiltration basin makes use of the natural infiltration capacity of the on-site soil and minimize unnecessary compaction of soils, where possible.

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

Explanation: Site drainage flows have been designed to convey water through the site to the historical discharge location. Flow paths have been designed along the site perimeters to propose only a minor increase to the time of concentration for the on-site flows.

Disconnect impervious areas: Yes ☒ No ☐

Explanation: This site design proposes to disconnect impervious areas throughout the site with landscaping, wherever feasible. Areas between sidewalks and buildings have been landscaped along the south and east perimeter.

Protect existing vegetation and sensitive areas: Yes ☐ No ☒

Explanation: There is minimal existing vegetation and no sensitive areas within the project area. Proposed landscaping to be planted as alternative.

Re-vegetate disturbed areas: Yes ☒ No ☐

Explanation: Although the apiaries provide an agricultural support exemption for the County landscape standards. The proposed landscape areas will be vegetated per county standards. The graded areas that are proposed to remain natural shall be re-seeded with a native mix and protected via erosion control BMPs until vegetation is established.

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

Explanation: The infiltration basin area will be staked off during construction to avoid any unnecessary compaction to the area.

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

Explanation: Pervious swales exist within the landscape areas around the perimeter of the site; however, in most cases flow will either be conveyed to underground pipes or concrete swales in the parking areas. All landscaped areas will be depressed in accordance with LID BMP principles. The basin forebay will provide sufficient pre-treatment for the drainage area.

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

Explanation: The landscaping areas will be staked off to minimize compaction during construction, this will be indicated by a construction note on the Precise Grading Plan.

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 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

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

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

1 Project area DA 1 (ft^2): 151,092	**2** Imperviousness after applying preventative site design practices (Imp%): 64.90%	**3** Runoff Coefficient (Rc): 0.448 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.930 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 1.377 *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): 15,247 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

1 Project area DA 1 (ft^2): 74,241	**2** Imperviousness after applying preventative site design practices (Imp%): 20.85%	**3** Runoff Coefficient (Rc): 0.175 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.930 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 1.377 *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): 2,927 *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** 39,050 *Form 4.2-3 Item 12*	**2** 10.45 *Form 4.2-4 Item 13*	**3** 6.99 *Form 4.2-5 Item 10*
Post-developed	**4** 51,069 *Form 4.2-3 Item 13*	**5** 9.40 *Form 4.2-4 Item 14*	**6** 7.80 *Form 4.2-5 Item 14*
Difference	**7** *12,019* *Item 4 – Item 1*	**8** *1.05* *Item 2 – Item 5*	**9** *0.81* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *30.8%* *Item 7 / Item 1*	**11** *10.0%* *Item 8 / Item 2*	**12** 11.6*%* *Item 9 / Item 3*

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

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** 19,374 *Form 4.2-3 Item 12*	**2** 10.60 *Form 4.2-4 Item 13*	**3** 3.43 *Form 4.2-5 Item 10*
Post-developed	**4** 19,943 *Form 4.2-3 Item 13*	**5** 10.50 *Form 4.2-4 Item 14*	**6** 3.90 *Form 4.2-5 Item 14*
Difference	**7** *569* *Item 4 – Item 1*	**8** *0.10* *Item 2 – Item 5*	**9** *3.032* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *2.9%* *Item 7 / Item 1*	**11** *0.9%* *Item 8 / Item 2*	**12** 13.7*%* *Item 9 / Item 3*

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

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type	BARREN							
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	151,092							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
Weighted Curve Number Determination for: Post-developed DA	DMA A/B	DMA C	DMA D	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	ROOFS/CONC	LANDSCAPE	NATURAL					
2b Hydrologic Soil Group (HSG)	A	A	A					
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	98,065	11,151	41,876					
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	98	32	78					

5 Pre-Developed area-weighted CN: 78	**7** Pre-developed soil storage capacity, S (in): 2.82 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.56 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 87.6	**8** Post-developed soil storage capacity, S (in): 1.42 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.28 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 5.45
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 39,050
*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): 51,069
*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): 9,466
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 2)

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	BARREN							
2a Hydrologic Soil Group (HSG)	A							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	74,241							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	78							
Weighted Curve Number Determination for: Post-developed DA	DMA B	DMA C	DMA D	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	CONC	LANDSCAPE	NATURAL					
2b Hydrologic Soil Group (HSG)	A	A	A					
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	15,480	4,589	54,172					
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	98	32	78					

5 Pre-Developed area-weighted CN: 78	**7** Pre-developed soil storage capacity, S (in): 2.82 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.56 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 79.3	**8** Post-developed soil storage capacity, S (in): 2.61 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.52 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 5.45
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 19,374
*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): 19,943
*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): 0
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

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

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

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA ABC	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*	449				741			
2 Change in elevation (ft)	29.0				30.0			
3 Slope (ft/ft), S_o *= Item 2 / Item 1*	0.0646				0.0405			
4 Land cover	UNDEV. POOR				COM.			
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*	10.45				9.40			
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*	0				0			
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*	10.45				9.40			
13 Pre-developed time of concentration (min): 10.45 *Minimum of Item 12 pre-developed DMA*								
14 Post-developed time of concentration (min): 9.40 *Minimum of Item 12 post-developed DMA*								
15 Additional time of concentration needed to meet HCOC requirement (min): 0.53 $T_{C\text{-}HCOC}$ *= (Item 13 * 0.95) – Item 14*								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 2)

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 ABC	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*	361				501			
2 Change in elevation (ft)	14.0				21.0			
3 Slope (ft/ft), *S_o = Item 2 / Item 1*	0.0388				0.0419			
4 Land cover	UNDEV. POOR				COM.			
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*	10.60				10.50			
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*	0				0			
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*	10.60				10.50			

13 Pre-developed time of concentration (min): 10.60 *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): 10.50 *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet HCOC requirement (min): 0 *$T_{C\text{-}HCOC}$ = (Item 13 * 0.95) – Item 14*

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

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA ABC	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*		2.654			2.828		
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)*		3.47			3.47		
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)*		1.000			0.571		
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*		0.415			0.578		
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)*		0.415			0.330		
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*		6.99			7.80		
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 ABC	*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: 6.99 *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): 6.99 *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: 7.80 *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): 7.80 *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0.42 *$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*		

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 2)

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 ABC	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*		2.631			2.646		
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)*		1.72			1.72		
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)*		1.000			0.784		
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*		0.415			0.478		
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)*		0.415			0.124		
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*		3.43			3.90		
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 ABC	*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: 3.43

*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): 3.43 *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A: 3.90

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): 3.90 *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0.28 *$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*

4.3 Project Conformance Analysis

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

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

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

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1 & 2)

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

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

If Yes, Provide basis: (attach)

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

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

4.3.1 Site Design Hydrologic Source Control BMP

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

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

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

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

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

4.3.2 Infiltration BMPs

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

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

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 15,247 *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*	DA1 DMA ABC 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*	10.0 IN/HR		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.81		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.56		
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*	4		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.7		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	6,075		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3 HRS		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	15,734		
15 Underground Retention Volume (ft^3) *This basin is a proprietary system and the volume was provided by the manufacturer.*	0	0	0
16 Total Retention Volume from LID Infiltration BMPs: 15,734 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 103% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 2,927 *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*	DA2 DMA ABC 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*	10.0 IN/HR		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.81		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.56		
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*	1		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	640		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	8		
12 Gravel porosity	0.4		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3 HRS		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	3,258		
15 Underground Retention Volume (ft^3) *This basin is a proprietary system and the volume was provided by the manufacturer.*	0	0	0

16 Total Retention Volume from LID Infiltration BMPs: 3,258 *(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.

4.3.3 Harvest and Use BMP

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

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

Form 4.3-4 Harvest and Use BMPs (DA 1 & 2)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16

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

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

10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☒ No ☐
If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1 & 2)

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

Form 4.3-6 Volume Based Biotreatment (DA 1 & 2) – Bioretention and Planter Boxes with Underdrains

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

Form 4.3-7 Volume Based Biotreatment (DA 1 & 2) – Constructed Wetlands and Extended Detention

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

Form 4.3-8 Flow Based Biotreatment (DA 1 & 2)

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

4.3.5 Conformance Summary

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

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

1 Total LID DCV for the Project DA-1 (ft^3): 15,247 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 15,734 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

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

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

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

1 Total LID DCV for the Project DA-1 (ft^3): 2,927 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 3,258 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for HCOC performance criteria (ft^3): 9,466 *(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): 15,734 *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 ** see below*
3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

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

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

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

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

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

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

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

Form 4.3-10 Hydromodification Control BMPs (DA 2)

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

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 3,258 *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 ** see below*

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

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

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

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

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

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

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

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

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

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
INFILTRATION BASIN	OWNER	BASIN TO BE INSPECTED 48 HOURS AFTER EVERY RAINFALL FOR STANDING WATER. STANDING WATER INDICATES MANTENANCE IS NEEDED. BASIN TO CLEARED OF SEDIMENT AND DEBRIS AS NECESSARY TO RESTORE DESIGN CAPACITY.	EVERY 6 MONTHS AND AFTER RAIN EVENTS
ACTIVITY RESTRICTIONS	OWNER	THE BUILDING OPERATERS, TENANTS, AND MANAGERS ARE TO REPORT ANY OBSERVED VIOLATIONS TO THE CITY CODE ENFORCEMENT OFFICERS.	IMMEDIATE, DAILY
LITTER/DEBRIS CONTROL PROGRAM	OWNER	MAINTENANCE SHALL CONSIST OF LITTER PATROL, EMPTYING OF TRASH RECEPTACLES, AND USING THE PROPER CONTAINERS FOR TRASH. CONTAINERS SHOULD BE CLEANED AT LEAST EVERY SIX MONTHS.	LITTER PATROL - DAILY CONTAINER CLEANING – 6 MONTHS
STORM DRAIN SIGNAGE	OWNER	INSPECT LEGIBILITY AND REPAIR, REPLACE, OR RESTORE AS NECESSARY	YEARLY
LANDSCAPE FINISH GRADE	OWNER	REMOVE/ADD SOIL TO MAINTAIN REQUIRED DEPTH OF 1”-2” BELOW FINISHED GRADE, RECYCLE/REUSE SOIL ON SITE.	YEARLY
PROTECT SLOPES AND SWALES	OWNER	CHANNELS (DRAINAGE SWALES) - INSPECT, CLEAN, REPAIR AND REPLACE ALL CHANNEL STABILIZATION AND VEGETATION. SLOPES - INSPECT, CLEAN, REPAIR AND REPLACE ALL SLOPE STABILIZATION AND VEGETATION AS NECESSARY	MONTHLY AND AFTER RAIN EVENTS

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities

LANDSCAPE PLANNING	OWNER	LANDSCAPES SHALL BE MAINTAINED TO ENSURE WATER EFFICIENCY AND HEALTHY APPEARANCE. A REGULAR MAINTENANCE SCHEDULE SHALL INCLUDE, BUT NOT BE LIMITED TO, CHECKING, ADJUSTING, AND REPAIRING THE IRRIGATION EQUIPMENT; RESETTING THE AUTOMATIC CONTROLLER; AERATING AND DETHATCHING TURF AREAS; REPLENISHING MULCH; FERTILIZING; PRUNING, WEEDING, REMOVING LITTER AND REPLACEMENT OF PLANTS AS REQUIRED. VERIFY FERTILIZER AND PESTICIDE USAGE REQUIREMENTS CONSISTENT WITH THE INSTRUCTIONS CONTAINED ON PRODUCT LABELS AND WITH THE REGULATIONS ADMINISTERED BY THE STATE DEPARTMENT OF PESTICIDE REGULATION COMPLY WITH PRODUCT LABELS AS NEW PRODUCTS ARE PURCHASED AND UPDATE NEW REGULATIONS BY THE STATE DEPARTMENT OF PESTICIDE REGULATION (HTTP://WWW.CDPR.CA.GOV/)	WEEKLY
CATCH BASIN INSERTS	OWNER	INSPECT REGULARLY FOR BLOCKAGE. SERVICE WILL RESTORE MAXIMUM FLOW CAPACITY. REPLACE STORMBROOM AND DISPOSE OF DEBRIS FROM SKIMMER TRAY DURING SERVICE.	QUARTERLY AND AFTER RAIN EVENTS
STORM DRAINS	OWNER	BLOCKAGES SHALL BE FOUND WHEN THE FLOW BACKS UP OR SLOWS DOWN. BLOCKAGES SHALL BE CLEARED AS SOON AS POSSIBLE.	QUARTERLY AND AFTER RAIN EVENTS
FOREBAY	OWNER	REQUIRES SEDIMENT REMOVAL AND INSPECTION FOR BLOCKAGE AND BUILD UP. FOREBAY MUST BE CLEANED REGULARLY TO RESTORE MAXIMUM CAPACITY.	QUARTERLY AND AFTER RAIN EVENTS
LOADING DOCK	OWNER	INSPECT CATCH BASINS AND INSERTS FOR BLOCKAGE AND BUILDUP. MONITOR POTENTIAL SPILLS DURING LOADING AND UNLOADING, AND CLEAN IMMEDIATELY. AVOID WASHING SPILLS INTO CATCH BASINS.	QUARTERLY AND AFTER RAIN EVENTS

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections
- The WQMP site plan and drainage plan are found in Appendix C

6.2 Electronic Data Submittal

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

6.3 Post Construction

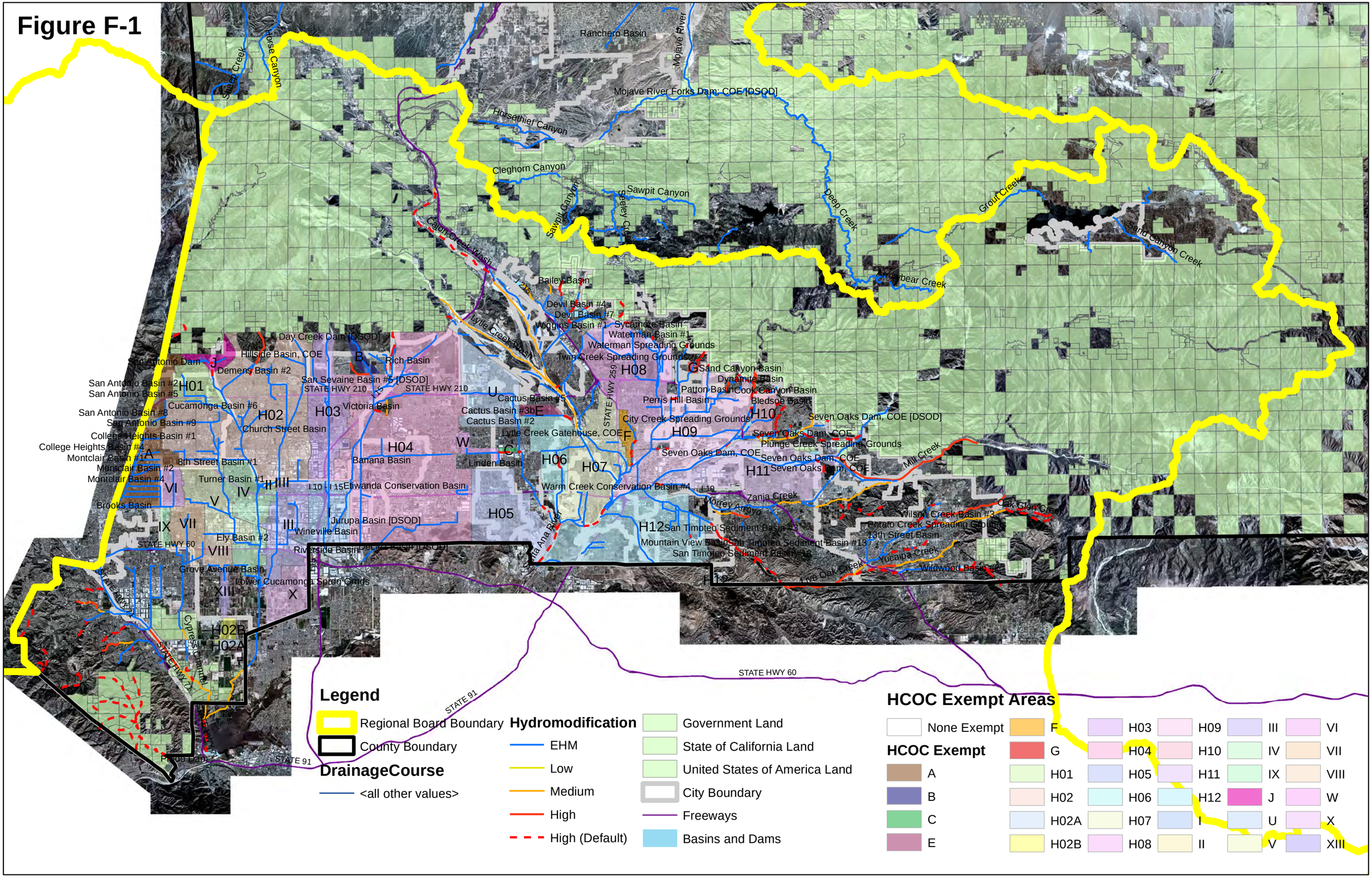
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

APPENDIX A

Figure F-1



Legend

- Regional Board Boundary
- County Boundary

DrainageCourse

- <all other values>

Hydromodification

- EHM
- Low
- Medium
- High
- High (Default)

- Government Land
- State of California Land
- United States of America Land
- City Boundary
- Freeways
- Basins and Dams

HCOC Exempt Areas

- None Exempt

HCOC Exempt

- A
- B
- C
- E
- F
- G
- H01
- H02
- H02A
- H02B
- H03
- H04
- H05
- H06
- H07
- H08
- H09
- H10
- H11
- H12
- I
- II
- III
- IV
- V
- VI
- VII
- VIII
- IX
- J
- U
- W
- X
- XIII

Hydromodification

A.1 Hydrologic Conditions of Concern (HCOC) Analysis

HCOC Exemption:

1. **Sump Condition:** All downstream conveyance channel to an adequate sump (for example, Prado Dam, Santa Ana River, or other Lake, Reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

2. **Pre = Post**: The runoff flow rate, volume and velocity for the post-development condition of the Priority Development Project do not exceed the pre-development (i.e, naturally occurring condition for the 2-year, 24-hour rainfall event utilizing latest San Bernardino County Hydrology Manual.

    a. Submit a substantiated hydrologic analysis to justify your request.

3. **Diversion to Storage Area**: The drainage areas that divert to water storage areas which are considered as control/release point and utilized for water conservation.

    a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (http://sbcounty.permitrack.com/wap) for reference.

4. **Less than One Acre**: The Priority Development Project disturbs less than one acre. The Co-permittee has the discretion to require a Project Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The project disturbs less than one acre and is not part of a common plan of development.

5. **Built Out Area**: The contributing watershed area to which the project discharges has a developed area percentage greater than 90 percent.

    a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (http://sbcounty.permitrack.com/wap) for reference.

Summary of HCOC Exempted Area

	HCOC Exemption reasoning				
	1	2	3	4	5
Area					
A			X		X
B			X		
C					X
E			X		
F					X
G			X		X
H01	X		X		
H02	X		X		
H02A	X		X		
H02B			X		
H03			X		
H04	X		X		
H05	X				
H06			X		
H07	X				
H08	X		X		
H09	X				
H10	X		X		
H11	X		X		
H12	X				
J			X		
U			X		
W			X		
I			X		
II			X		
III					X
IV			X		X
V			X*		
VI					X
VII					X
VIII			X		
IX					X
X			X		
XIII			X		

*Detention/Conservation Basin

APPENDIX B

NOAA Atlas 14, Volume 6, Version 2
Location name: Fontana, California, USA*
Latitude: 34.1978°, Longitude: -117.4467°
Elevation: 2200.14 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	**0.170** (0.142-0.207)	**0.222** (0.185-0.271)	**0.292** (0.241-0.356)	**0.348** (0.286-0.429)	**0.427** (0.339-0.543)	**0.488** (0.379-0.634)	**0.550** (0.417-0.734)	**0.616** (0.453-0.845)	**0.705** (0.497-1.01)	**0.776** (0.528-1.15)
10-min	**0.244** (0.203-0.297)	**0.319** (0.265-0.388)	**0.418** (0.346-0.510)	**0.499** (0.410-0.614)	**0.612** (0.485-0.779)	**0.699** (0.543-0.909)	**0.789** (0.597-1.05)	**0.882** (0.649-1.21)	**1.01** (0.713-1.45)	**1.11** (0.757-1.65)
15-min	**0.295** (0.245-0.359)	**0.386** (0.320-0.469)	**0.505** (0.418-0.616)	**0.604** (0.496-0.743)	**0.740** (0.587-0.942)	**0.845** (0.656-1.10)	**0.954** (0.722-1.27)	**1.07** (0.785-1.46)	**1.22** (0.862-1.75)	**1.35** (0.916-2.00)
30-min	**0.459** (0.382-0.558)	**0.600** (0.498-0.730)	**0.786** (0.651-0.959)	**0.940** (0.771-1.16)	**1.15** (0.913-1.47)	**1.32** (1.02-1.71)	**1.48** (1.12-1.98)	**1.66** (1.22-2.28)	**1.90** (1.34-2.72)	**2.09** (1.43-3.10)
60-min	**0.712** (0.592-0.865)	**0.930** (0.773-1.13)	**1.22** (1.01-1.49)	**1.46** (1.20-1.79)	**1.79** (1.42-2.27)	**2.04** (1.58-2.65)	**2.30** (1.74-3.07)	**2.58** (1.90-3.53)	**2.95** (2.08-4.22)	**3.25** (2.21-4.82)
2-hr	**1.09** (0.908-1.33)	**1.43** (1.18-1.73)	**1.87** (1.54-2.28)	**2.23** (1.83-2.74)	**2.73** (2.16-3.47)	**3.12** (2.42-4.05)	**3.52** (2.66-4.69)	**3.93** (2.89-5.40)	**4.50** (3.18-6.45)	**4.96** (3.37-7.35)
3-hr	**1.41** (1.17-1.71)	**1.84** (1.53-2.24)	**2.41** (1.99-2.94)	**2.88** (2.36-3.54)	**3.52** (2.79-4.48)	**4.02** (3.12-5.23)	**4.53** (3.43-6.04)	**5.07** (3.73-6.95)	**5.80** (4.09-8.31)	**6.38** (4.35-9.47)
6-hr	**2.13** (1.77-2.59)	**2.78** (2.31-3.39)	**3.64** (3.02-4.45)	**4.35** (3.57-5.35)	**5.32** (4.22-6.77)	**6.07** (4.71-7.89)	**6.84** (5.18-9.12)	**7.63** (5.62-10.5)	**8.73** (6.15-12.5)	**9.58** (6.53-14.2)
12-hr	**2.97** (2.47-3.61)	**3.88** (3.22-4.72)	**5.07** (4.20-6.19)	**6.04** (4.96-7.43)	**7.35** (5.84-9.36)	**8.36** (6.50-10.9)	**9.39** (7.11-12.5)	**10.4** (7.69-14.3)	**11.9** (8.38-17.0)	**13.0** (8.84-19.3)
24-hr	**4.14** (3.67-4.77)	**5.45** (4.82-6.28)	**7.15** (6.31-8.27)	**8.53** (7.47-9.95)	**10.4** (8.82-12.5)	**11.8** (9.83-14.6)	**13.3** (10.8-16.8)	**14.8** (11.7-19.2)	**16.8** (12.7-22.7)	**18.4** (13.5-25.7)
2-day	**5.22** (4.62-6.01)	**7.02** (6.21-8.10)	**9.46** (8.34-10.9)	**11.5** (10.1-13.4)	**14.4** (12.2-17.3)	**16.7** (13.8-20.5)	**19.0** (15.4-24.0)	**21.6** (17.0-27.9)	**25.1** (19.0-33.9)	**28.0** (20.5-39.1)
3-day	**5.72** (5.07-6.59)	**7.81** (6.91-9.01)	**10.7** (9.45-12.4)	**13.2** (11.6-15.4)	**16.8** (14.3-20.3)	**19.8** (16.4-24.4)	**23.0** (18.6-28.9)	**26.4** (20.8-34.2)	**31.4** (23.8-42.4)	**35.5** (26.0-49.6)
4-day	**6.13** (5.43-7.06)	**8.41** (7.44-9.70)	**11.6** (10.3-13.5)	**14.4** (12.6-16.8)	**18.6** (15.7-22.3)	**22.0** (18.2-27.0)	**25.6** (20.8-32.3)	**29.7** (23.4-38.4)	**35.6** (26.9-48.0)	**40.5** (29.6-56.5)
7-day	**7.00** (6.20-8.07)	**9.64** (8.52-11.1)	**13.4** (11.8-15.5)	**16.6** (14.5-19.4)	**21.4** (18.1-25.8)	**25.3** (21.0-31.2)	**29.6** (24.0-37.3)	**34.4** (27.1-44.5)	**41.3** (31.2-55.7)	**47.0** (34.4-65.6)
10-day	**7.64** (6.77-8.80)	**10.5** (9.31-12.1)	**14.6** (12.9-16.9)	**18.1** (15.9-21.2)	**23.4** (19.8-28.1)	**27.7** (23.0-34.1)	**32.4** (26.2-40.8)	**37.5** (29.6-48.6)	**45.1** (34.1-60.8)	**51.4** (37.6-71.7)
20-day	**9.15** (8.10-10.5)	**12.6** (11.2-14.6)	**17.5** (15.5-20.3)	**21.8** (19.1-25.5)	**28.2** (23.8-33.9)	**33.4** (27.7-41.1)	**39.1** (31.6-49.2)	**45.3** (35.7-58.7)	**54.5** (41.2-73.5)	**62.1** (45.4-86.7)
30-day	**10.5** (9.31-12.1)	**14.5** (12.9-16.8)	**20.2** (17.8-23.4)	**25.2** (22.0-29.3)	**32.5** (27.5-39.1)	**38.5** (31.9-47.3)	**45.1** (36.5-56.8)	**52.3** (41.2-67.7)	**62.8** (47.5-84.7)	**71.7** (52.4-100)
45-day	**12.2** (10.8-14.0)	**16.9** (14.9-19.4)	**23.5** (20.7-27.1)	**29.2** (25.6-34.1)	**37.7** (31.9-45.4)	**44.7** (37.1-55.0)	**52.3** (42.4-65.9)	**60.7** (47.8-78.5)	**72.9** (55.1-98.3)	**83.1** (60.7-116)
60-day	**14.2** (12.6-16.3)	**19.6** (17.3-22.6)	**27.3** (24.1-31.5)	**34.0** (29.7-39.6)	**43.7** (37.1-52.7)	**51.9** (43.0-63.8)	**60.6** (49.1-76.4)	**70.3** (55.4-91.0)	**84.4** (63.8-114)	**96.2** (70.3-134)

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

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

Please refer to NOAA Atlas 14 document for more information.

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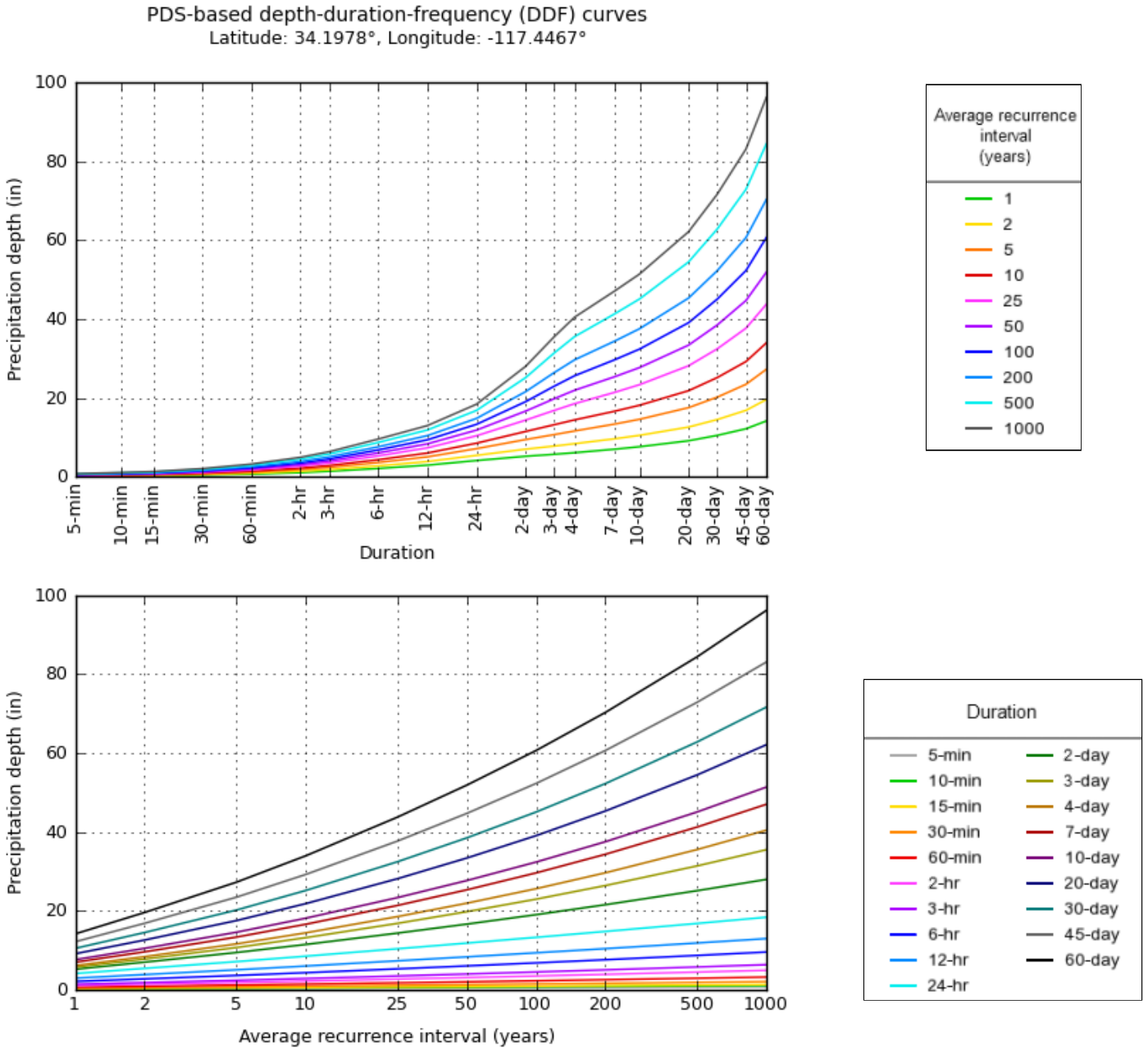
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Jan 10 16:34:32 2022

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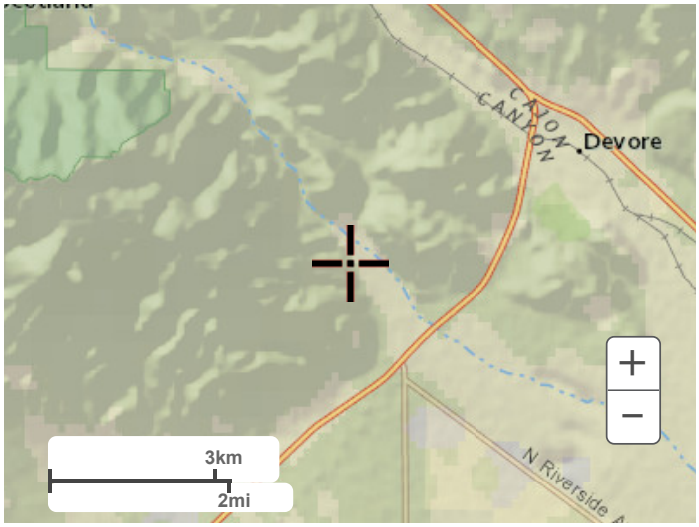
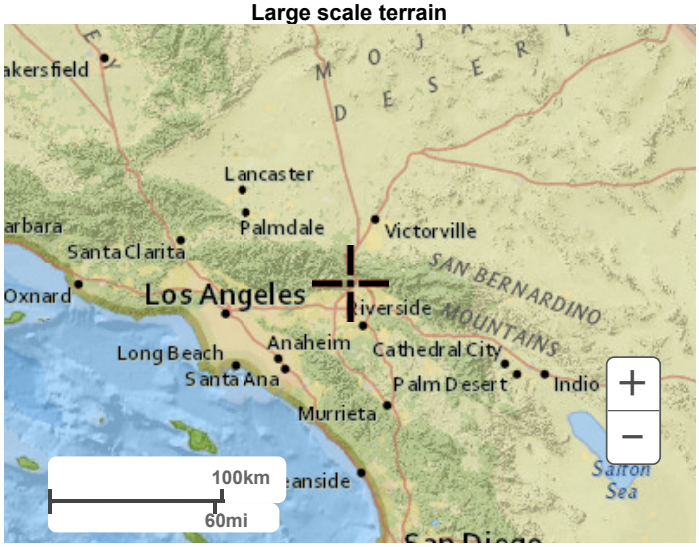
Maps & aerials

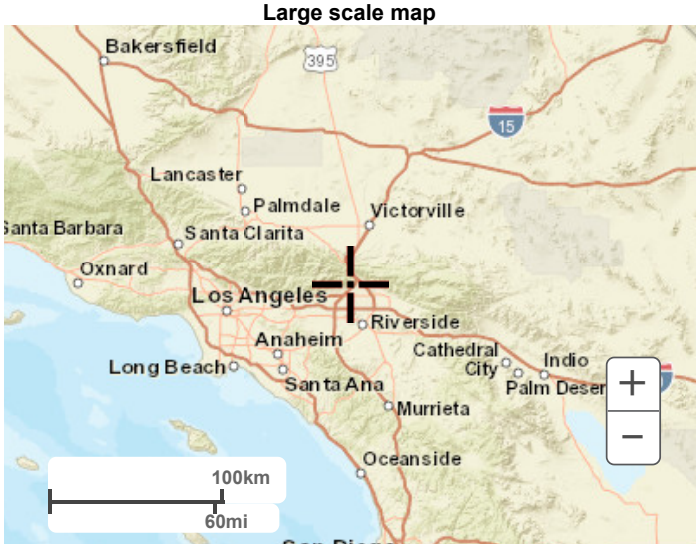
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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National Weather Service
National Water Center
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

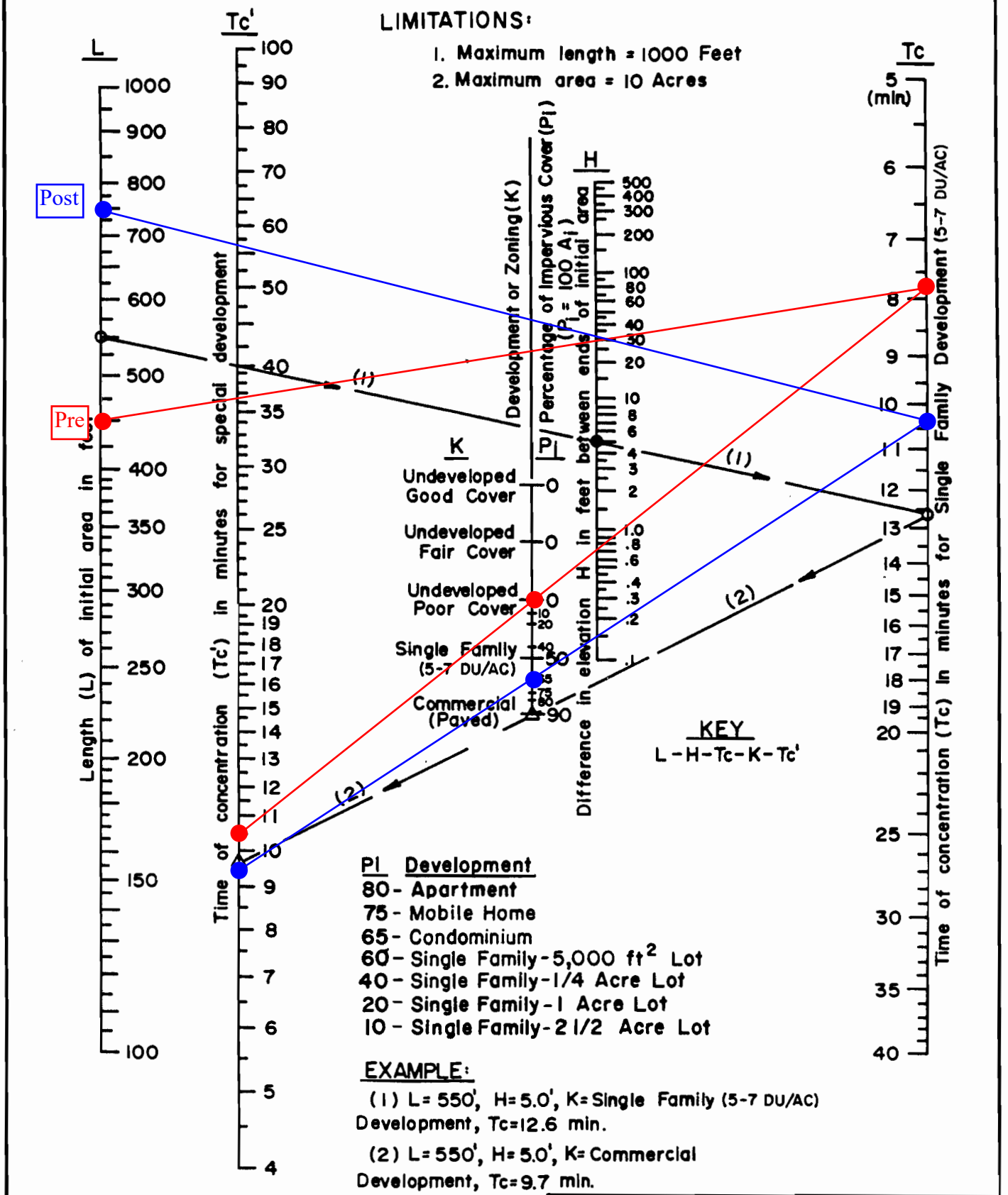
Disclaimer

Figure 1 - Google Earth Aerial View

Figure 2 - Southeast Entrance Looking Northwest

Figure 3 - Northeast Corner Looking Southwest

DRAINAGE AREA 1

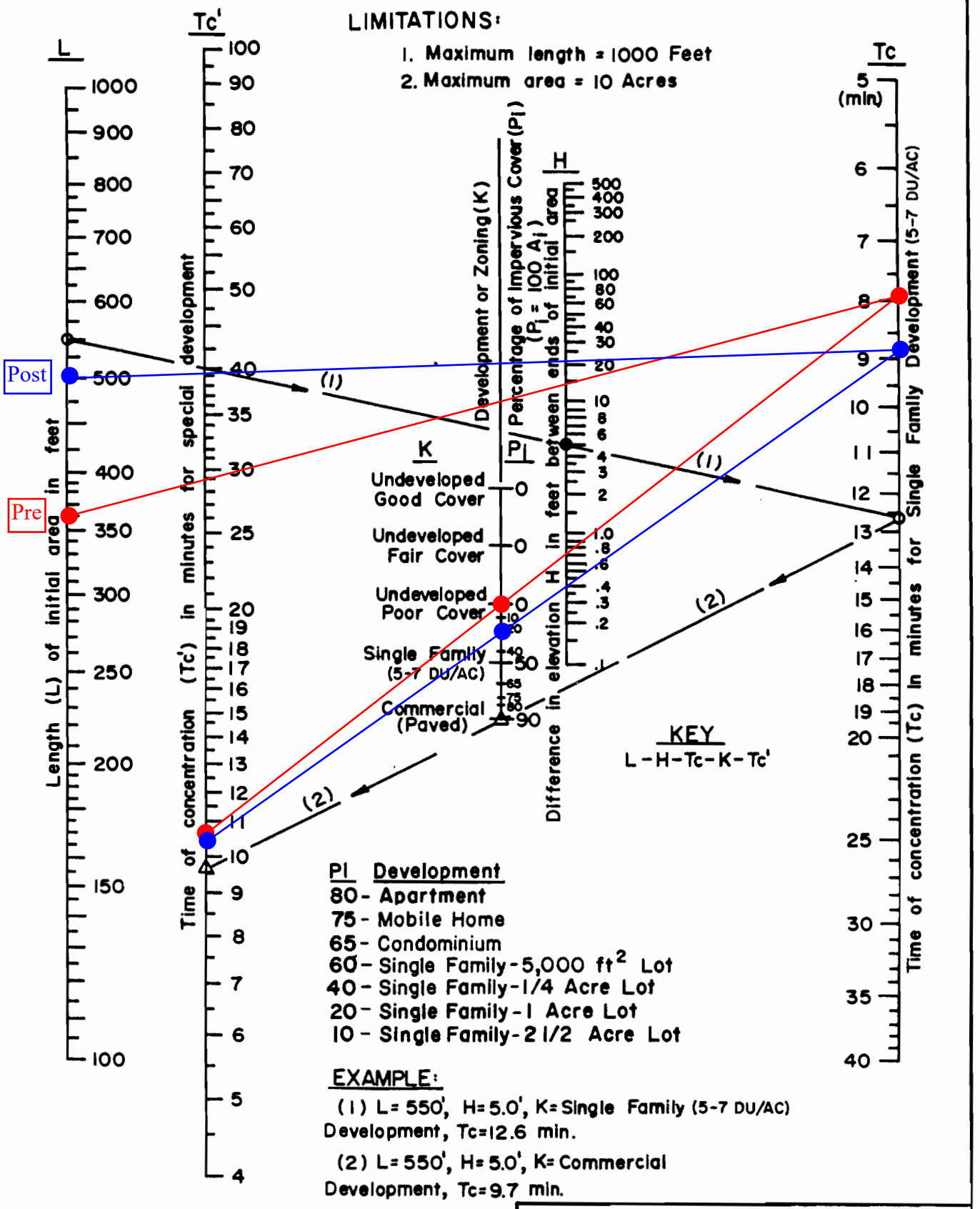


SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

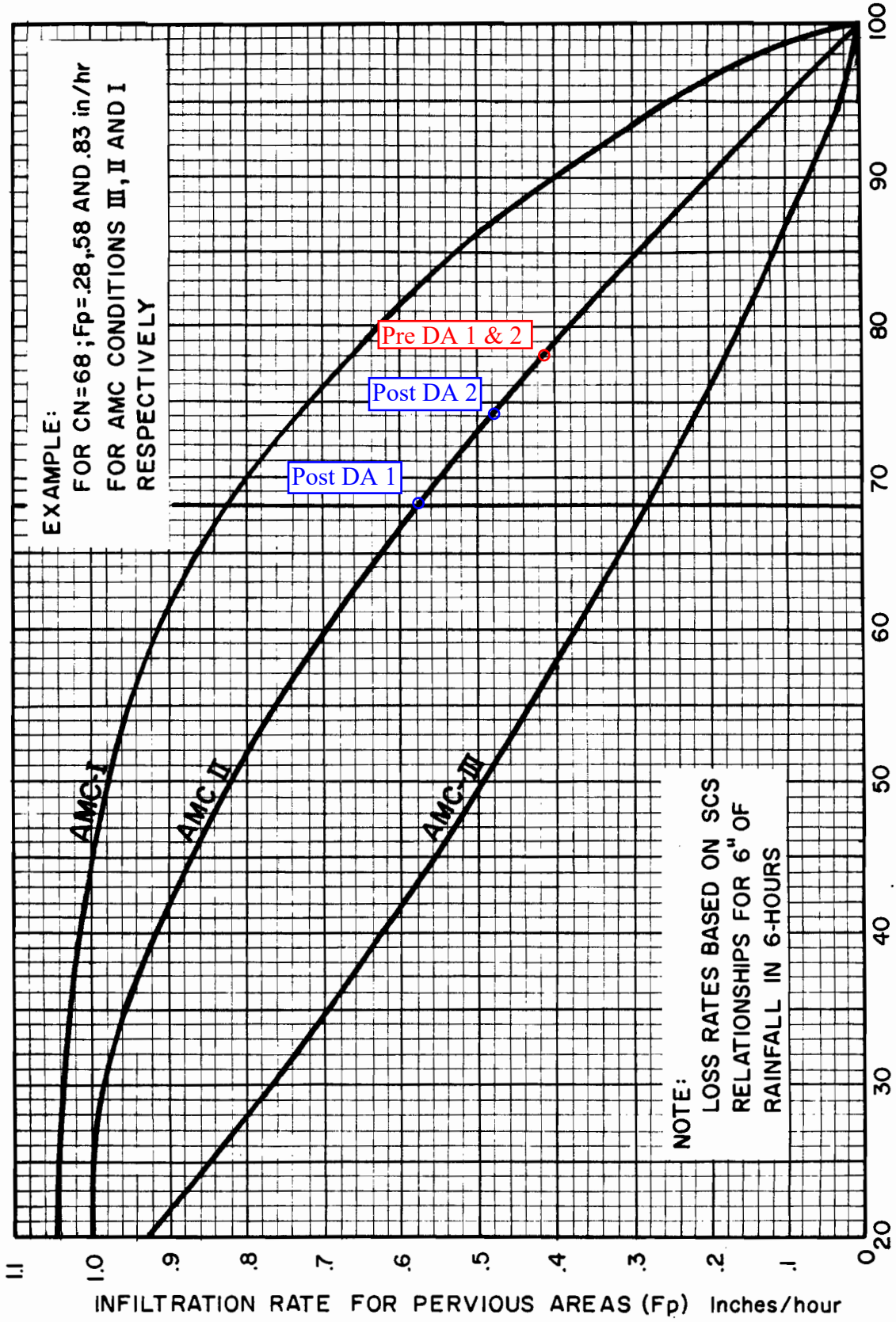
DRAINAGE AREA 2



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS SCS CURVE NUMBERS

Figure C-6

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Hydrology Studio v 3.0.0.26

09-16-2022

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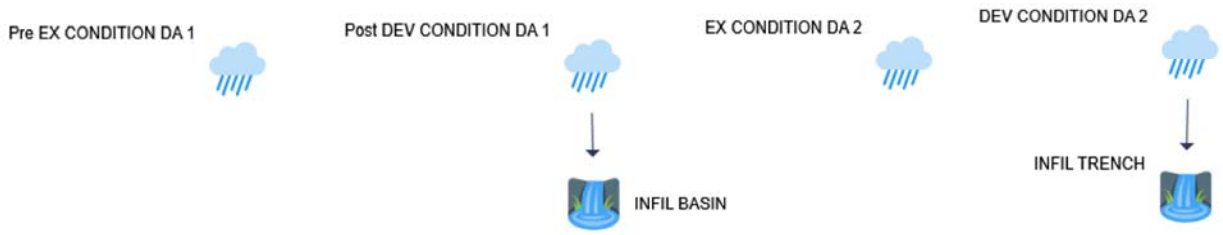
Basin Model

Hydrology Studio v 3.0.0.26

Project Name:

09-16-2022



Hydrograph by Return Period

Project Name:

09-16-2022

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	NRCS Runoff	Pre EX CONDITION DA 1		6.766			13.13			23.19
2	NRCS Runoff	Post DEV CONDITION DA 1		10.90			18.78			30.81
3	Pond Route	INFIL BASIN		0.290			4.898			20.33
4	NRCS Runoff	EX CONDITION DA 2		3.800			7.373			13.01
5	NRCS Runoff	DEV CONDITION DA 2		3.969			7.564			13.20
6	Pond Route	INFIL TRENCH		3.807			7.336			12.94

Hydrograph 2-yr Summary

Project Name:

09-16-2022

Hydrology Studio v 3.0.0.26

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	Pre EX CONDITION DA 1	6.766	10.03	38,043	----		
2	NRCS Runoff	Post DEV CONDITION DA 1	10.90	9.97	50,440	----		
3	Pond Route	INFIL BASIN	0.290	11.57	2,375	2	2188.14	16,848
4	NRCS Runoff	EX CONDITION DA 2	3.800	10.00	19,945	----		
5	NRCS Runoff	DEV CONDITION DA 2	3.969	10.00	20,705	----		
6	Pond Route	INFIL TRENCH	3.807	10.03	10,894	5	2180.20	3,357

Hydrograph Report

Project Name:

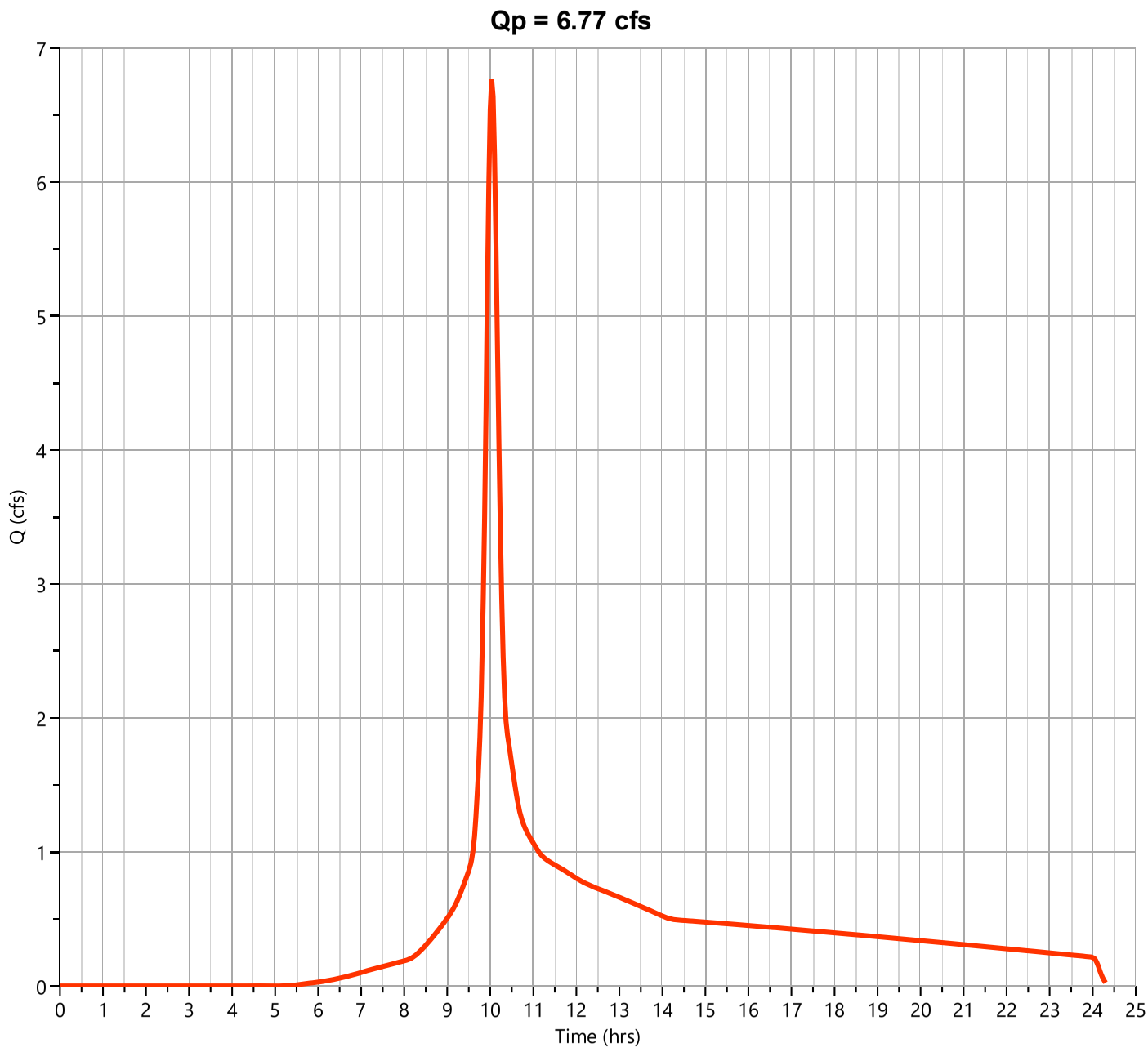
Hydrology Studio v 3.0.0.26

09-16-2022

Pre EX CONDITION DA 1

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 6.766 cfs
Storm Frequency	= 2-yr	Time to Peak	= 10.03 hrs
Time Interval	= 2 min	Runoff Volume	= 38,043 cuft
Drainage Area	= 3.47 ac	Curve Number	= 78
Tc Method	= User	Time of Conc. (Tc)	= 15.49 min
Total Rainfall	= 5.45 in	Design Storm	= Type I
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

09-16-2022

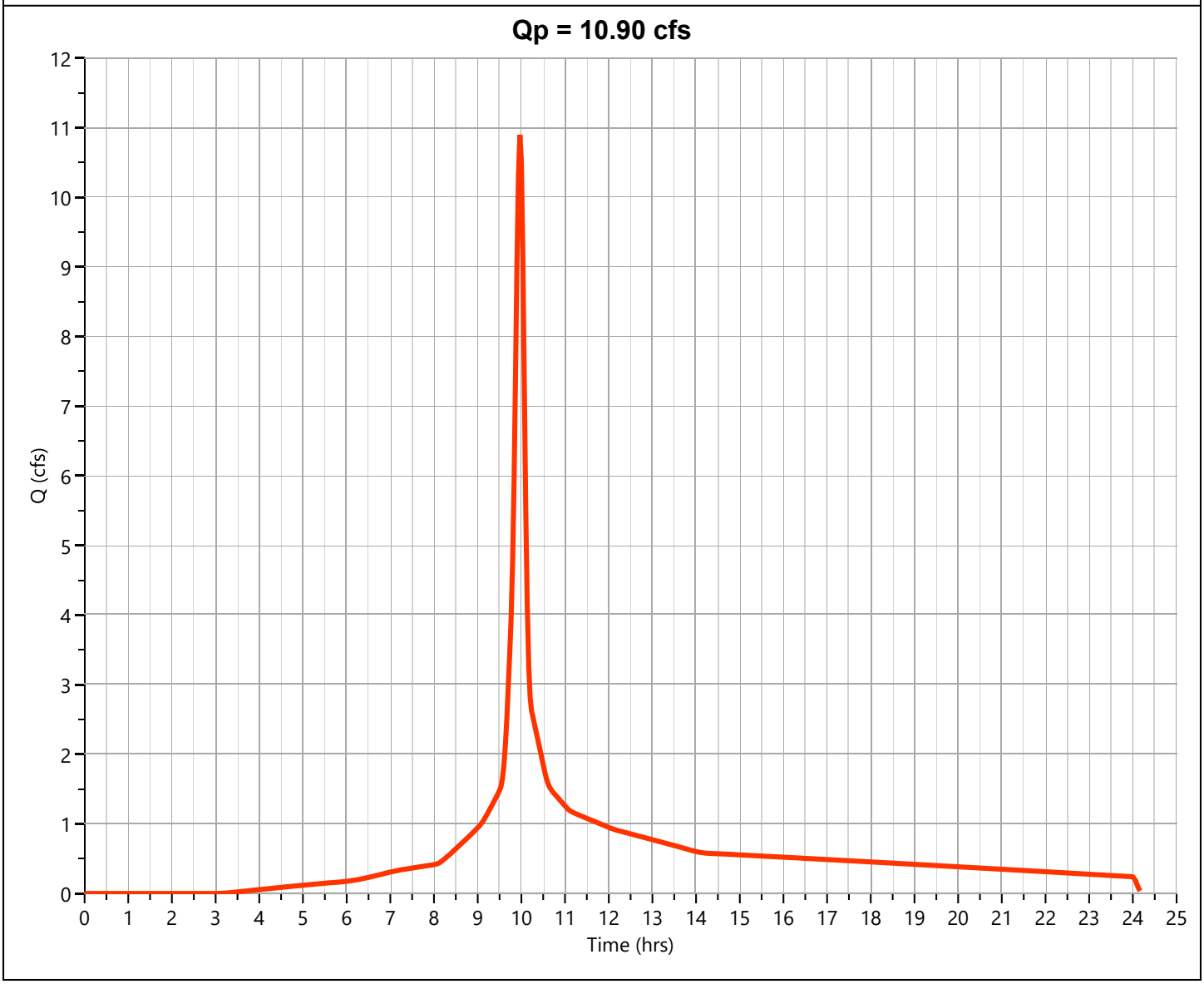
Post DEV CONDITION DA 1

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 10.90 cfs
Storm Frequency	= 2-yr	Time to Peak	= 9.97 hrs
Time Interval	= 2 min	Runoff Volume	= 50,440 cuft
Drainage Area	= 3.48 ac	Curve Number	= 87*
Tc Method	= User	Time of Conc. (Tc)	= 7.89 min
Total Rainfall	= 5.45 in	Design Storm	= Type I
Storm Duration	= 24 hrs	Shape Factor	= 484

*** Composite CN Worksheet**

AREA (ac)	CN	DESCRIPTION
2.25	98	CONC/BLDG
0.96	78	NATURAL
0.26	32	LANDSCAPE
3.48	**87**	Weighted CN Method Employed



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

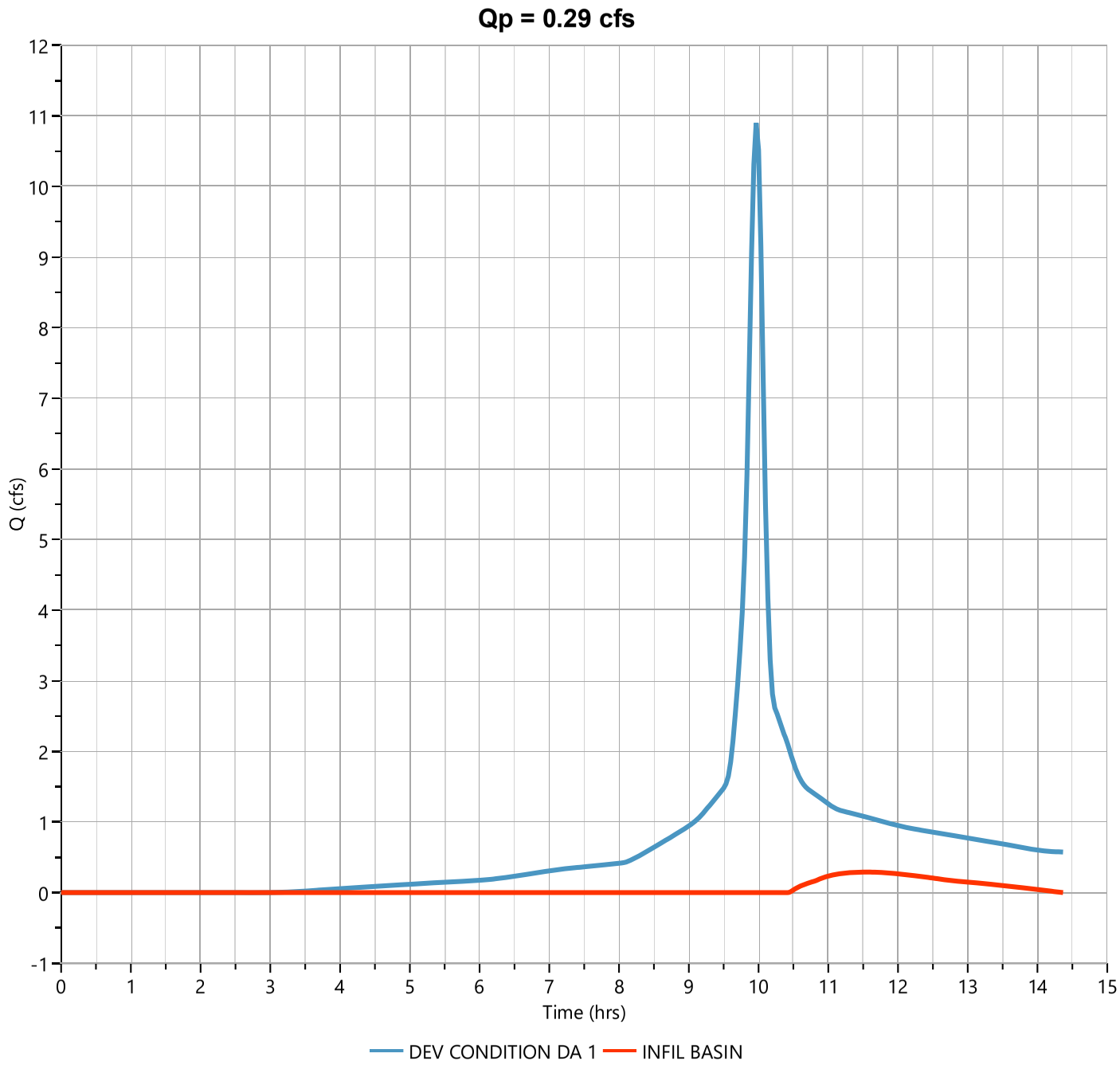
09-16-2022

INFIL BASIN

Hyd. No. 3

Hydrograph Type	= Pond Route	Peak Flow	= 0.290 cfs
Storm Frequency	= 2-yr	Time to Peak	= 11.57 hrs
Time Interval	= 2 min	Hydrograph Volume	= 2,375 cuft
Inflow Hydrograph	= 2 - DEV CONDITION DA 1	Max. Elevation	= 2188.14 ft
Pond Name	= BASIN	Max. Storage	= 16,848 cuft

Pond Routing by Storage Indication Method



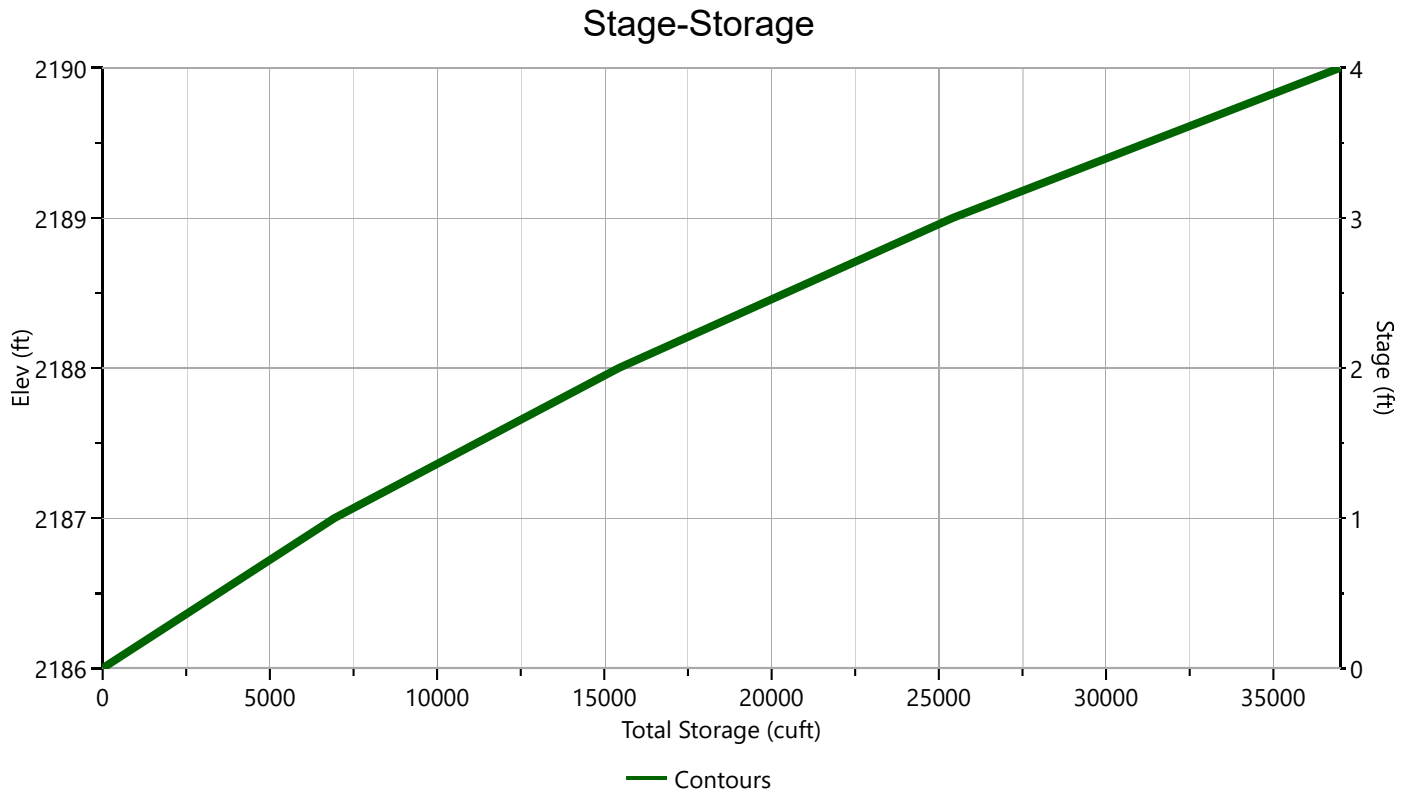
BASIN

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	2186.00
Voids (%)	100.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	2186.00	6,075	0.000	0.000
1.00	2187.00	7,795	6,935	6,935
2.00	2188.00	9,202	8,499	15,434
3.00	2189.00	10,765	9,984	25,417
4.00	2190.00	12,390	11,578	36,995



Pond Report

Project Name:

Hydrology Studio v 3.0.0.26

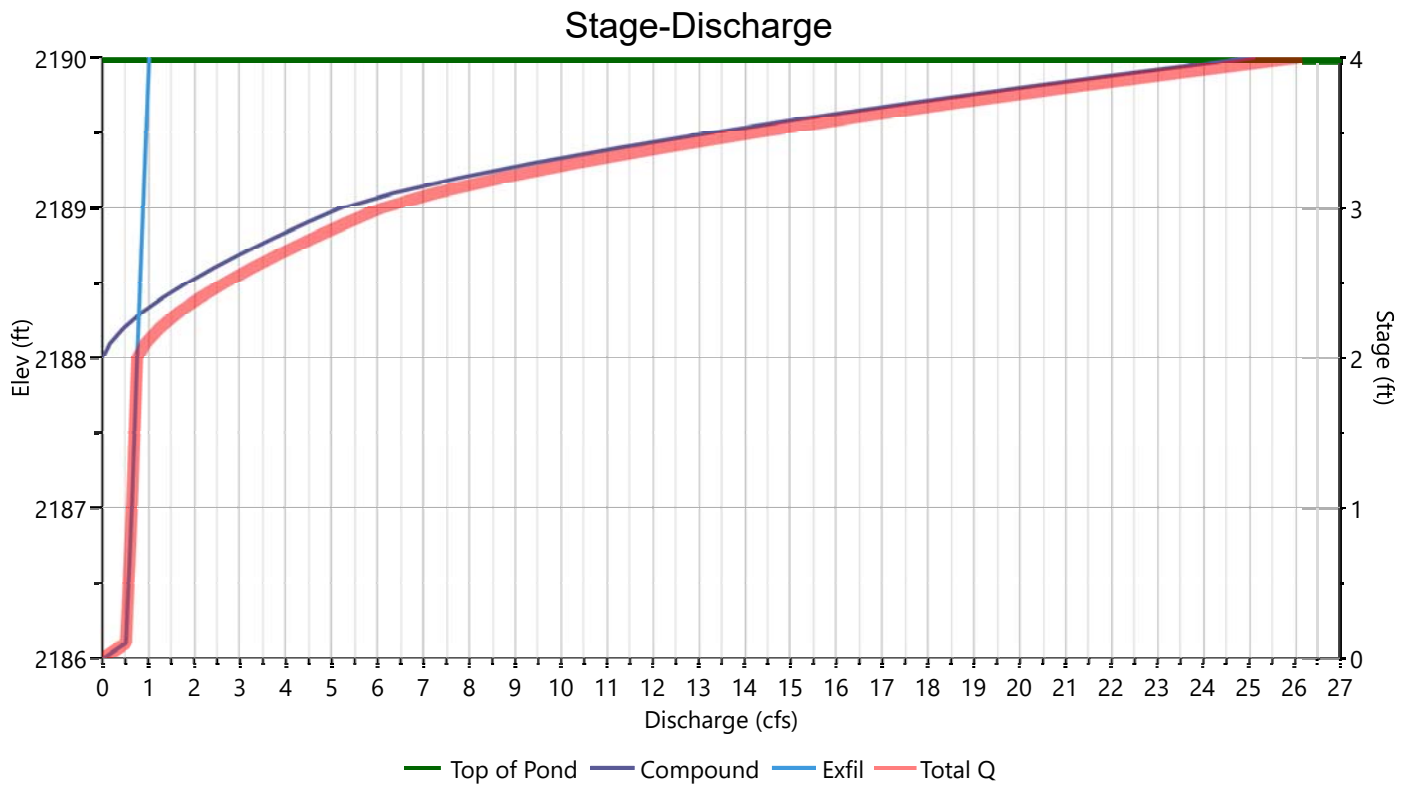
09-16-2022

BASIN

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type	Circular	Compound	Broad Crested	Broad Crested	Exfiltration, in/hr	3.56**
Crest Elevation, ft		2189 U 2188 L	2187.7			
Crest Length, ft		6 Total 2 L	1.5			
Angle, deg						
Weir Coefficient, Cw		2.6	3.3			

*Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.



BASIN

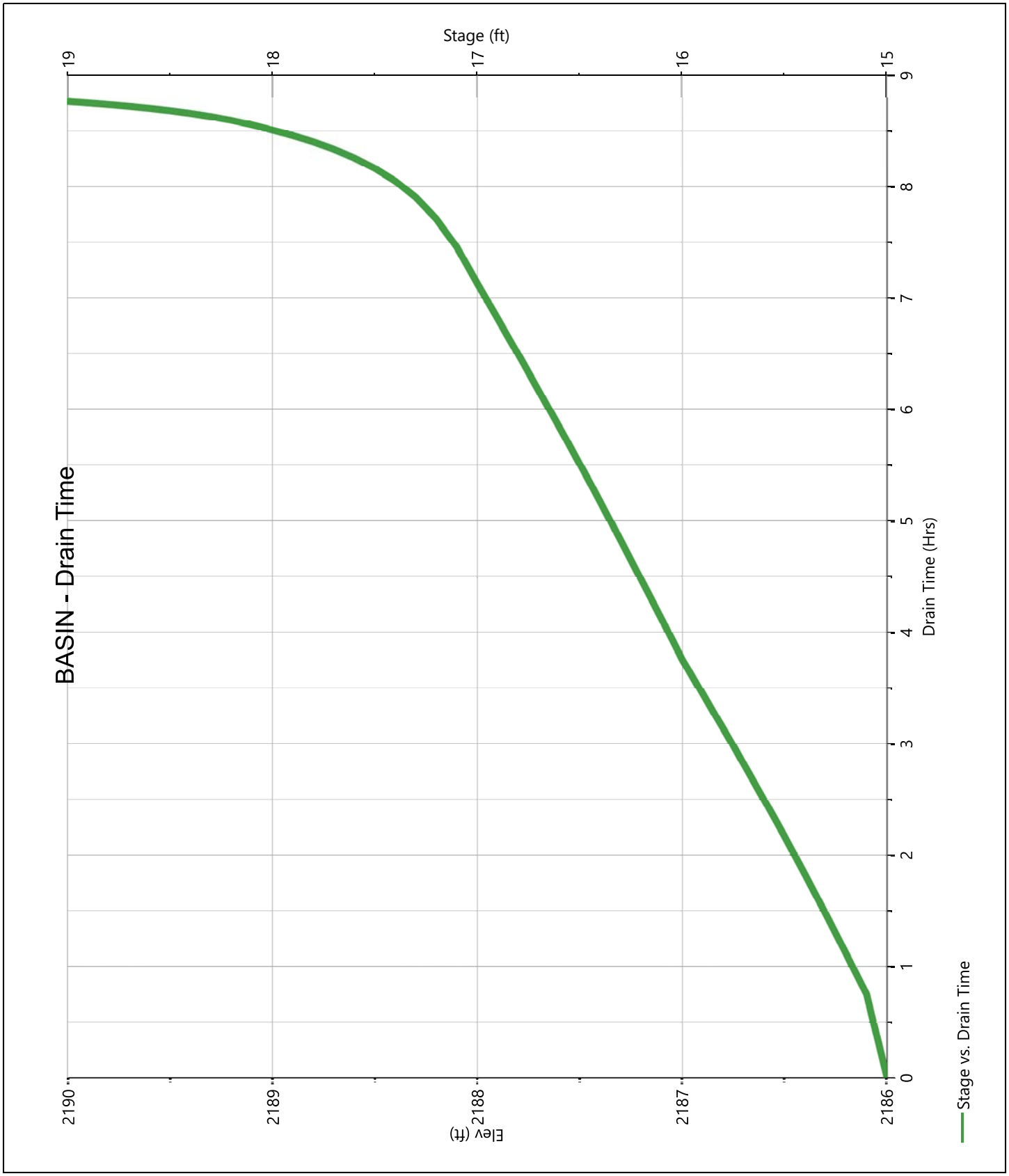
Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	2186.00	0.000						0.000	0.000			0.000		0.000
1.00	2187.00	6,935						0.000	0.000			0.642		0.642
2.00	2188.00	15,434						0.000	0.000			0.758		0.758
3.00	2189.00	25,417						5.200	0.000			0.887		6.087
4.00	2190.00	36,995						25.11	0.000			1.021		26.13

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

BASIN

Pond Drawdown



Hydrograph Report

Project Name:

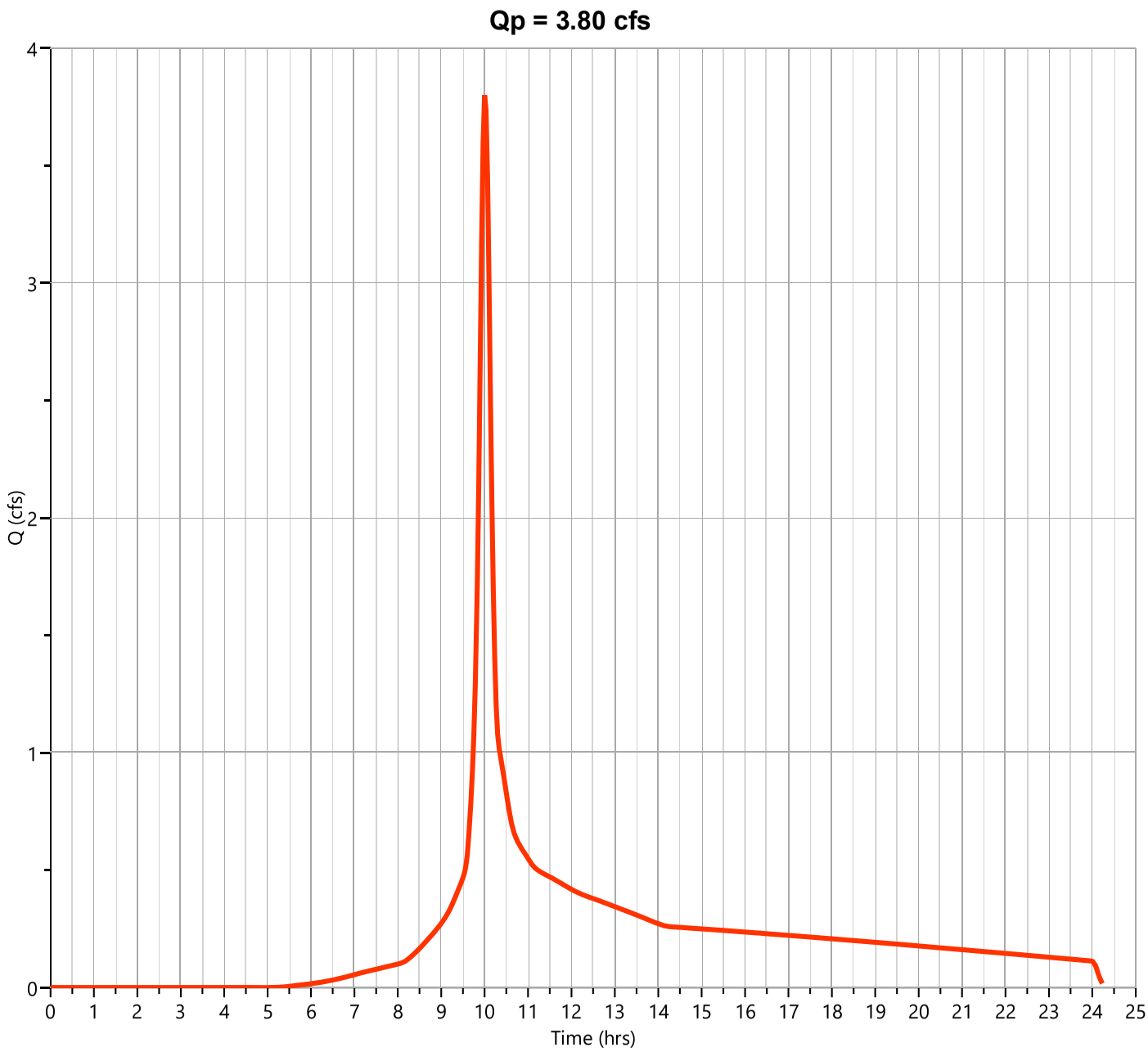
Hydrology Studio v 3.0.0.26

09-16-2022

EX CONDITION DA 2

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.800 cfs
Storm Frequency	= 2-yr	Time to Peak	= 10.00 hrs
Time Interval	= 2 min	Runoff Volume	= 19,945 cuft
Drainage Area	= 1.72 ac	Curve Number	= 78
Tc Method	= User	Time of Conc. (Tc)	= 12.42 min
Total Rainfall	= 5.45 in	Design Storm	= Type I
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.26

09-16-2022

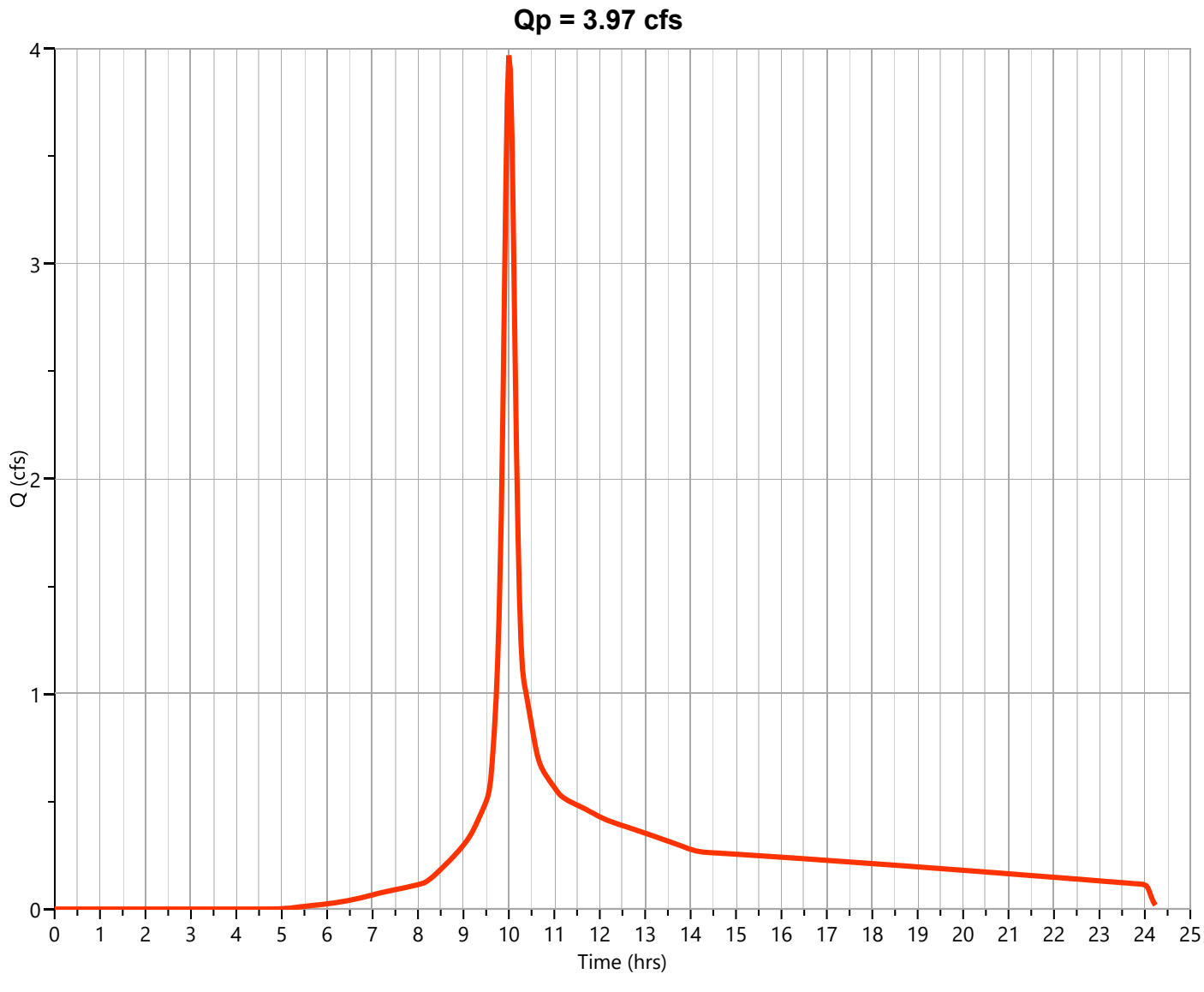
DEV CONDITION DA 2

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.969 cfs
Storm Frequency	= 2-yr	Time to Peak	= 10.00 hrs
Time Interval	= 2 min	Runoff Volume	= 20,705 cuft
Drainage Area	= 1.72 ac	Curve Number	= 79.24*
Tc Method	= User	Time of Conc. (Tc)	= 10.64 min
Total Rainfall	= 5.45 in	Design Storm	= Type I
Storm Duration	= 24 hrs	Shape Factor	= 484

*** Composite CN Worksheet**

AREA (ac)	CN	DESCRIPTION
0.36	98	CONC
0.11	32	LS
1.25	78	NATURAL
1.72	**79**	Weighted CN Method Employed

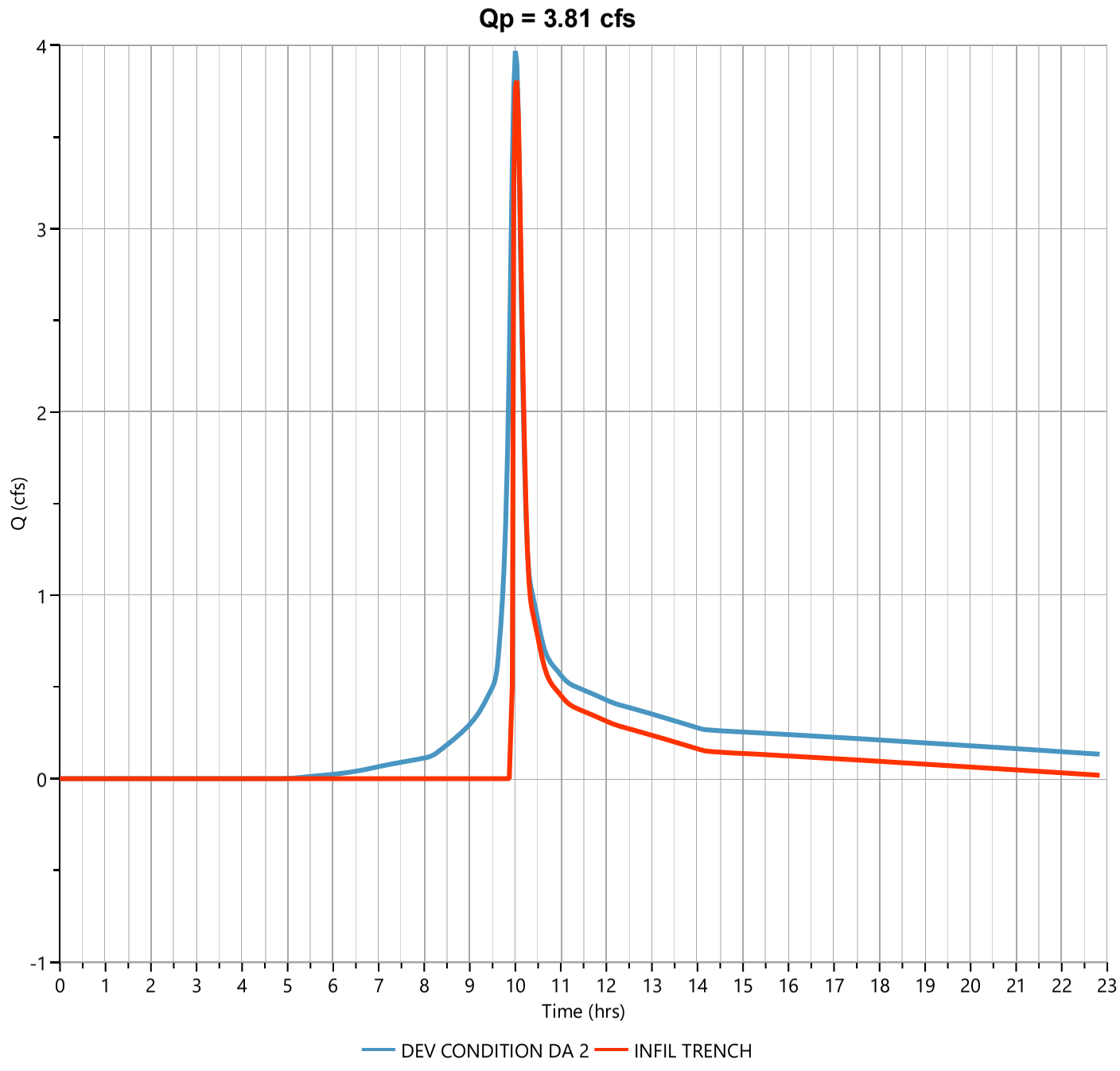


INFIL TRENCH

Hyd. No. 6

Hydrograph Type	= Pond Route	Peak Flow	= 3.807 cfs
Storm Frequency	= 2-yr	Time to Peak	= 10.03 hrs
Time Interval	= 2 min	Hydrograph Volume	= 10,894 cuft
Inflow Hydrograph	= 5 - DEV CONDITION DA 2	Max. Elevation	= 2180.20 ft
Pond Name	= TRENCH	Max. Storage	= 3,357 cuft

Pond Routing by Storage Indication Method



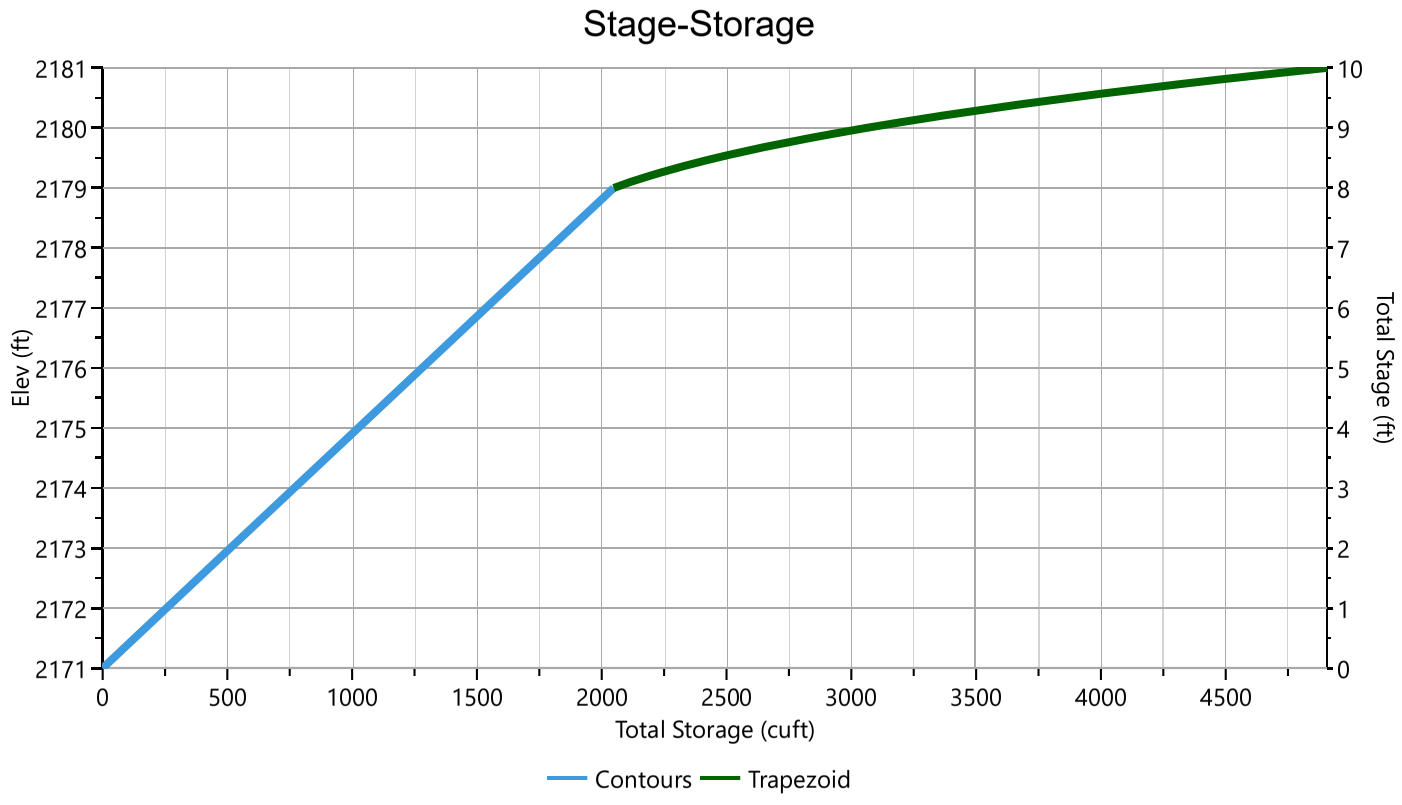
TRENCH

Stage-Storage

User Defined Contours	
Description	**Input**
Bottom Elevation, ft	2171.00
Voids (%)	40.00
Volume Calc	Ave End Area

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	2171.00	640	0.000	0.000
2.00	2173.00	640	512	512
4.00	2175.00	640	512	1,024
6.00	2177.00	640	512	1,536
8.00	2179.00	640	512	2,048



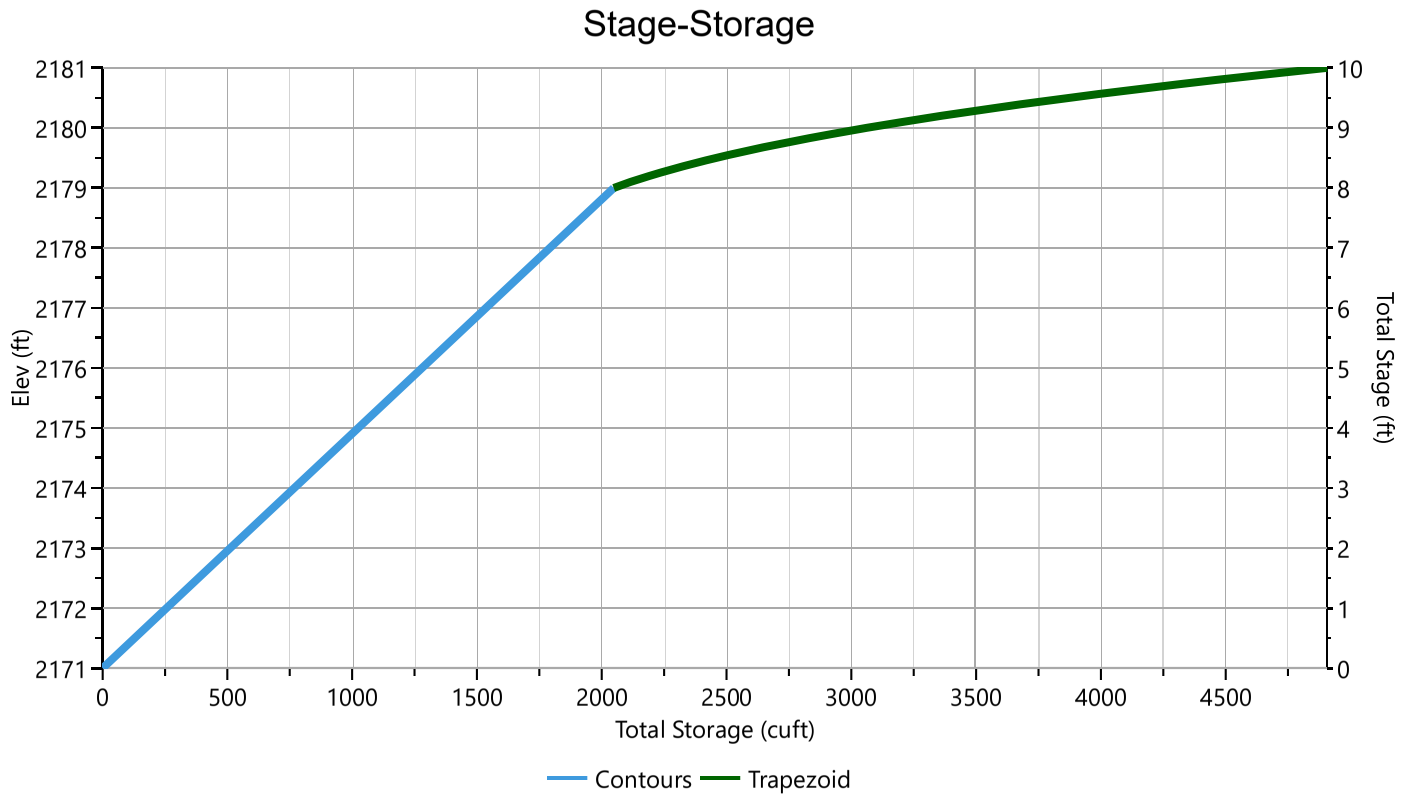
TRENCH

Stage-Storage

Trapezoid	
Description	**Input**
Bottom Elevation, ft	2179.00
Bottom Length, ft	80.00
Bottom Width, ft	8.00
Side Slope, H:1	4.00
Total Depth, ft	2.00
Voids (%)	100.00

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incr. Storage (cuft)	Total Storage (cuft)
0.00	2179.00	640	0.000	0.000
0.10	2179.10	711	67.5	67.5
0.20	2179.20	783	74.7	142
0.30	2179.30	857	82.0	224
0.40	2179.40	932	89.4	314
0.50	2179.50	1,008	97.0	411
0.60	2179.60	1,085	105	515
0.70	2179.70	1,164	112	628
0.80	2179.80	1,244	120	748
0.90	2179.90	1,325	128	877
1.00	2180.00	1,408	137	1,013
1.10	2180.10	1,492	145	1,158
1.20	2180.20	1,577	153	1,312
1.30	2180.30	1,663	162	1,474
1.40	2180.40	1,751	171	1,644
1.50	2180.50	1,840	180	1,824
1.60	2180.60	1,930	189	2,012
1.70	2180.70	2,022	198	2,210
1.80	2180.80	2,115	207	2,417
1.90	2180.90	2,209	216	2,633
2.00	2181.00	2,304	226	2,859

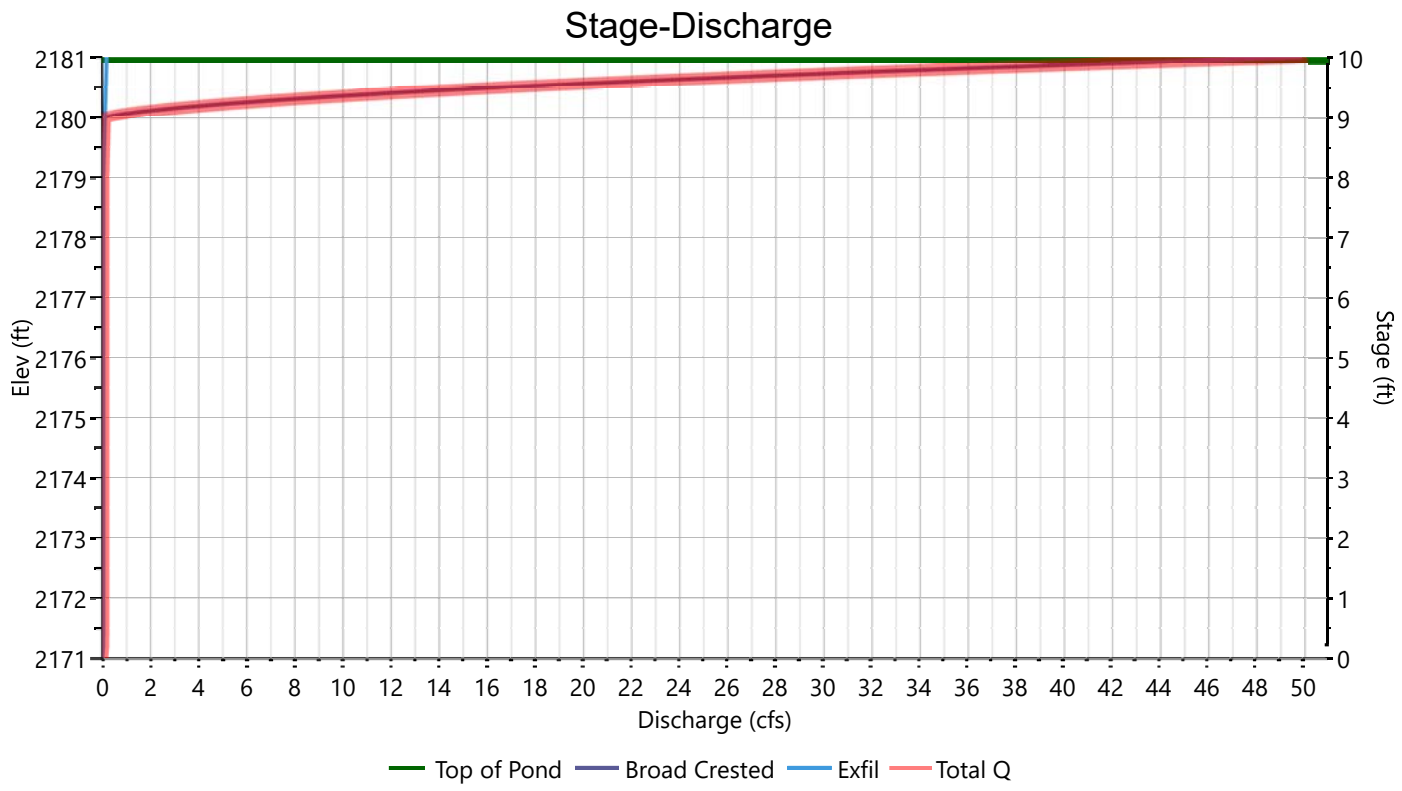


TRENCH

Stage-Discharge

Culvert / Orifices	Culvert	Orifices			Perforated Riser	
		1	2	3		
Rise, in					Hole Diameter, in	
Span, in					No. holes	
No. Barrels					Invert Elevation, ft	
Invert Elevation, ft					Height, ft	
Orifice Coefficient, Co					Orifice Coefficient, Co	
Length, ft						
Barrel Slope, %						
N-Value, n	0.000					
Weirs	**Riser***	**Weirs**			**Ancillary**	
		1	2	3		
Shape / Type		Broad Crested			Exfiltration, in/hr	3.56**
Crest Elevation, ft		2180				
Crest Length, ft		16				
Angle, deg		14 (4:1)				
Weir Coefficient, Cw		2.6				

**Routes through Culvert. **Exfiltration extracted from outflow hydrograph. Rate applied to contours.*



TRENCH

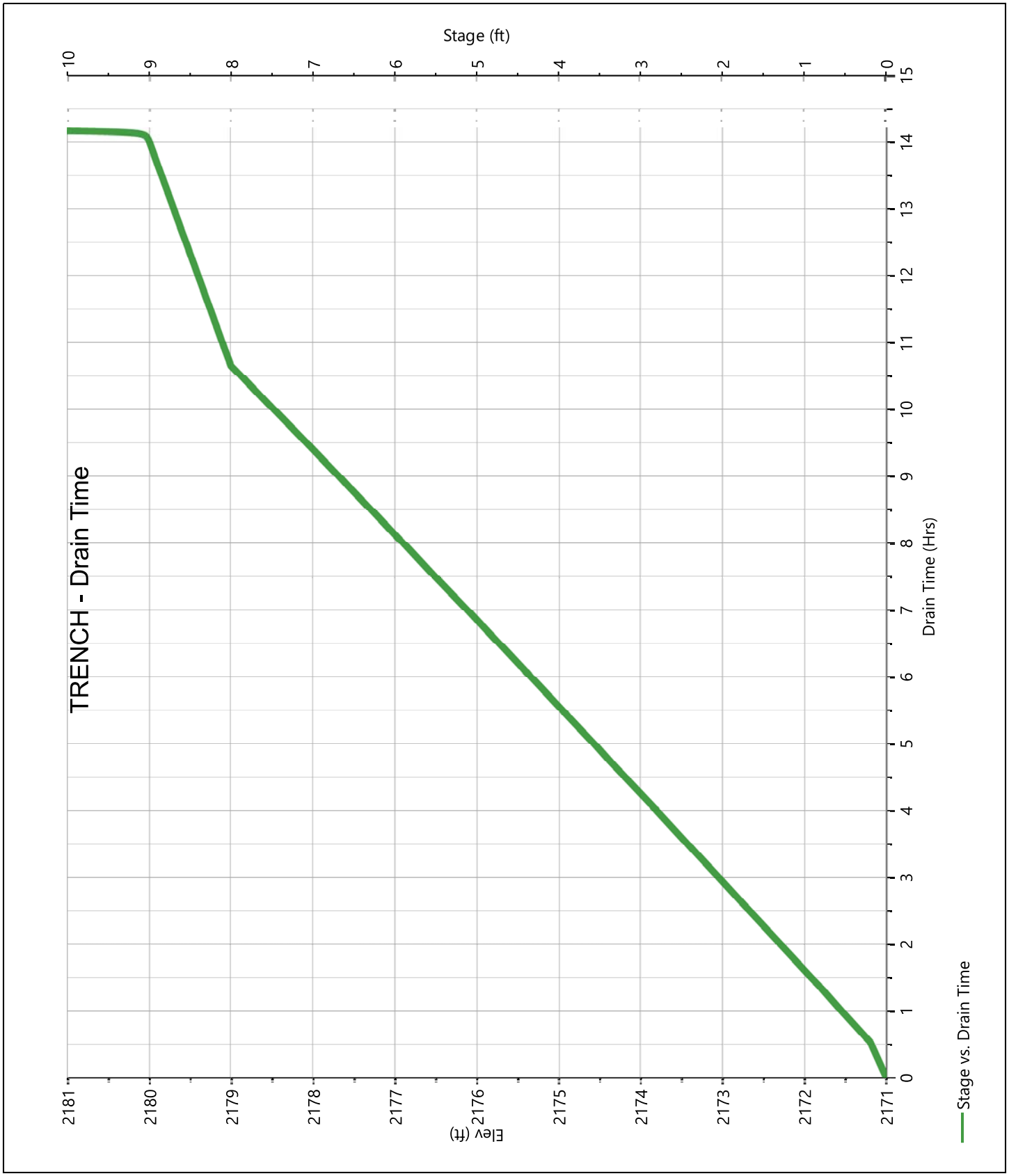
Stage-Storage-Discharge Summary

Stage (ft)	Elev. (ft)	Storage (cuft)	Culvert (cfs)	Orifices, cfs			Riser (cfs)	Weirs, cfs			Pf Riser (cfs)	Exfil (cfs)	User (cfs)	Total (cfs)
				1	2	3		1	2	3				
0.00	2171.00	0.000						0.000				0.000		0.000
2.00	2173.00	512						0.000				0.054		0.054
4.00	2175.00	1,024						0.000				0.055		0.055
6.00	2177.00	1,536						0.000				0.056		0.056
8.00	2179.00	2,048						0.000				0.057		0.057
8.10	2179.10	2,116						0.000				0.059		0.059
8.20	2179.20	2,190						0.000				0.065		0.065
8.30	2179.30	2,272						0.000				0.071		0.071
8.40	2179.40	2,362						0.000				0.077		0.077
8.50	2179.50	2,459						0.000				0.083		0.083
8.60	2179.60	2,563						0.000				0.089		0.089
8.70	2179.70	2,676						0.000				0.096		0.096
8.80	2179.80	2,796						0.000				0.103		0.103
8.90	2179.90	2,925						0.000				0.109		0.109
9.00	2180.00	3,061						0.000				0.116		0.116
9.10	2180.10	3,206						1.344				0.123		1.467
9.20	2180.20	3,360						3.868				0.130		3.998
9.30	2180.30	3,522						7.248				0.137		7.385
9.40	2180.40	3,692						11.36				0.144		11.51
9.50	2180.50	3,872						16.18				0.152		16.33
9.60	2180.60	4,060						21.66				0.159		21.82
9.70	2180.70	4,258						27.77				0.167		27.94
9.80	2180.80	4,465						34.53				0.174		34.71
9.90	2180.90	4,681						41.90				0.182		42.09
10.00	2181.00	4,907						49.92				0.190		50.11

Suffix key: ic = inlet control, oc = outlet control, s = submerged weir

TRENCH

Pond Drawdown



Design Storm Report

Custom Storm filename: TR32850.cds

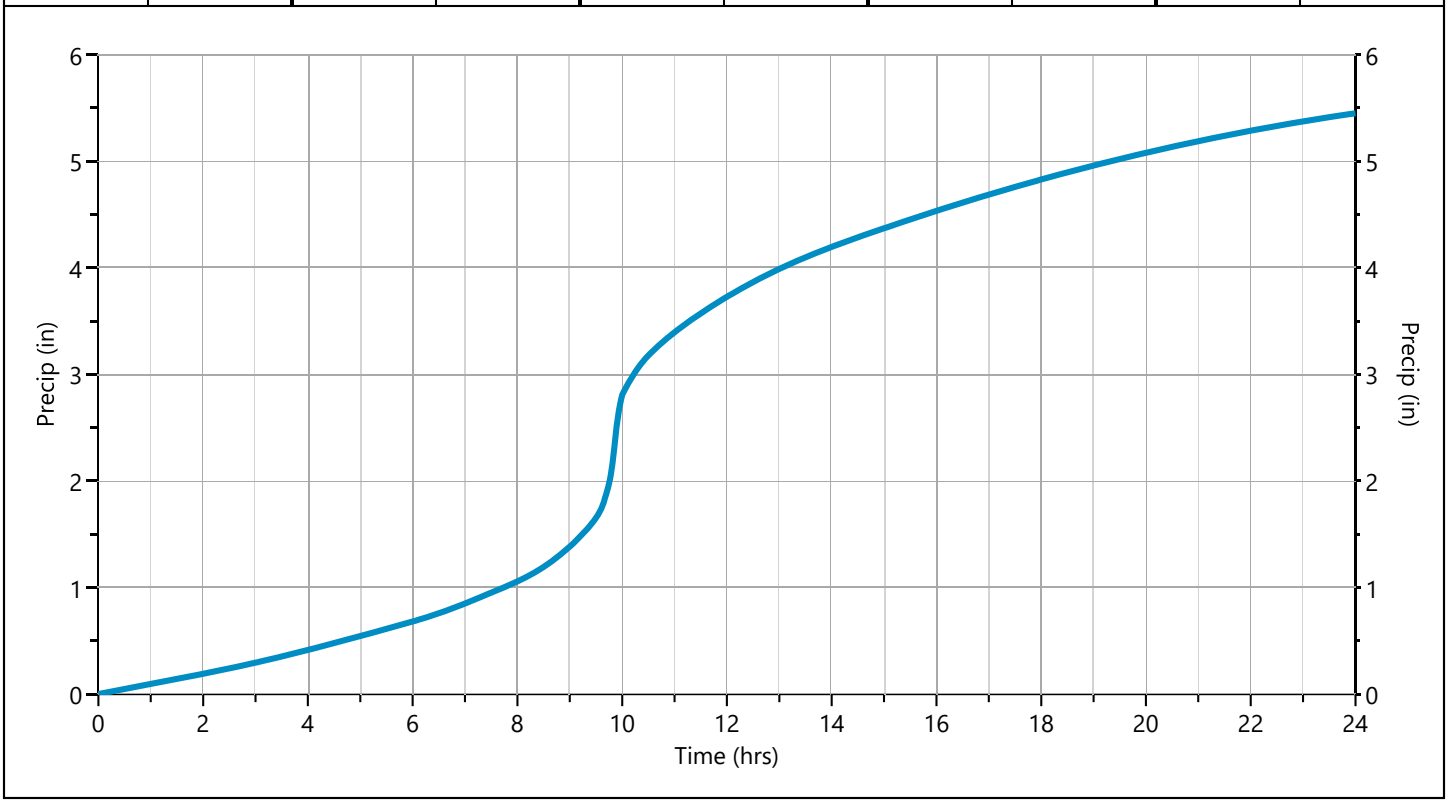
Hydrology Studio v 3.0.0.26

09-16-2022

Storm Distribution: NRCS/SCS - Type I, 24-hr

Storm Duration	Total Rainfall Volume (in)								
	1-yr	✔ 2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
24 hrs	0.00	5.45	0.00	0.00	8.53	0.00	0.00	13.30	

Incremental Rainfall Distribution, 2-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
8.87	0.013414	9.23	0.017358	9.60	0.035631	9.97	0.098613	10.33	0.022527
8.90	0.013647	9.27	0.017803	9.63	0.041425	10.00	0.057753	10.37	0.021437
8.93	0.013879	9.30	0.018249	9.67	0.047219	10.03	0.030672	10.40	0.020347
8.97	0.014112	9.33	0.018695	9.70	0.053013	10.07	0.031247	10.43	0.019257
9.00	0.014344	9.37	0.019140	9.73	0.058807	10.10	0.030157	10.47	0.018167
9.03	0.014685	9.40	0.019586	9.77	0.070967	10.13	0.029067	10.50	0.017077
9.07	0.015129	9.43	0.020032	9.80	0.103109	10.17	0.027977	10.53	0.016402
9.10	0.015575	9.47	0.020478	9.83	0.128850	10.20	0.026887	10.57	0.016132
9.13	0.016021	9.50	0.020923	**9.87**	**0.141271**	10.23	0.025797	10.60	0.015865
9.17	0.016466	9.53	0.024040	9.90	0.140372	10.27	0.024707	10.63	0.015599
9.20	0.016912	9.57	0.029837	9.93	0.126153	10.30	0.023617	10.67	0.015333



APPENDIX C

SCALE: 1"=30'
30 0 30 60

SAN BERNARDINO COUNTY, CALIFORNIA
PROPOSED INDUSTRIAL AGRICULTURAL SUPPORT SERVICE USE BUILDINGS
WQMP SITE PLAN
A.P.N. 0239-311-01, -02, -03

TRASH ENCLOSURE PER SB COUNTY 12'X17'-4" ENCLOSURE STANDARD

DMA D (G)

DMA C (E)

DMA B (F)

DA1
151,092 SF

DMA A (A B E)
CATCH BASIN W/ INSERT FILTER

4"DRN

CATCH BASIN W/ INSERT FILTER

"A" "B" "C" "D" "E"

APN 0239-311-02

APN 0239-311-01

APN 0239-311-03

LYTLE CREEK ROAD

VELOCITY REDUCING RIPRAP PAD

FOREBAY

WQMP BASIN
DCV = 15,247 CF
PROP. = 23,282 CF
BOT. ELEV. = 2186.0

OUTLET STRUCTURE

DA2
74,241 SF

LEACH LINES

EXPANSION LINES

WQMP TRENCH/
DCV = 2,927 CF
PROP. = 3,221 CF

TRAILER

RW

PL

GNV

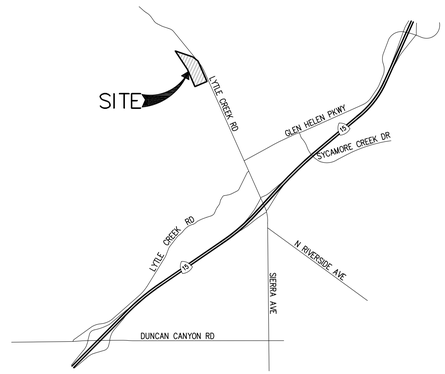
PP

FH

SOURCE CONTROL BMP'S:

- (A) NON-STORMWATER DISCHARGES (SC-10)
- (B) SPILL PREVENTION, CONTROL & CLEANUP (SC-11)
- (C) OUTDOOR LOADING/UNLOADING (SC-30)
- (D) WASTE HANDLING AND DISPOSAL (SC-34)
- (E) BUILDING AND GROUNDS MAINTENANCE (SC-41)
- (F) PARKING AREA MAINTENANCE (SC-43)
- (G) DRAINAGE SYSTEM MAINTENANCE (SC-44)

LEGEND		DA1	DA2
	BLDG. ROOF – DMA A	30,000 SF	0
	CONC. AREAS – DMA B	68,065 SF	15,480 SF
	LANDSCAPE – DMA C	11,151 SF	4,589 SF
	NATIVE – DMA D	41,876 SF	54,172 SF
	TOTAL	151,092 SF	74,241 SF
	PERCENT IMPERVIOUS	64.90%	20.85%
	DESIGN CAPTURE VOLUME	15,247 CF	2,927 CF



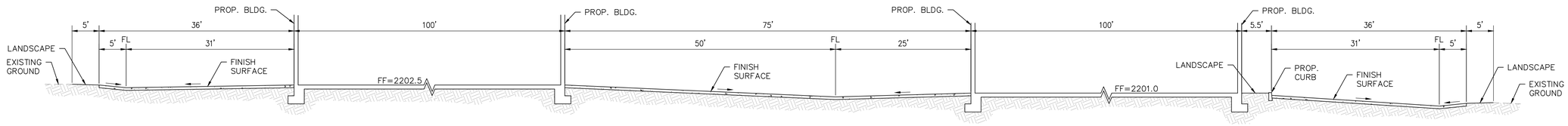
VICINITY MAP
N.T.S.

NOTE:
THERE ARE NO FEASIBILITY/SUITABILITY CONSTRAINTS ON THIS SITE.

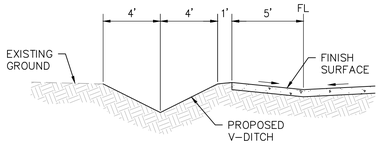
REGISTERED PROFESSIONAL ENGINEER
STEVEN H. RITCHEY
NO. 51129
Exp. 9-30-23
CIVIL
STATE OF CALIFORNIA

LEC
LAND ENGINEERING CONSULTANTS, INC.
P.O. BOX 541, 650 AVENUE K
CALIMESA, CALIFORNIA 92320
TEL: 909-795- 8882 FAX: 909-795-8818
STEVEN H. RITCHEY
R.C.E. 51129, EXP. 9/30/23

9/12/22
DATE

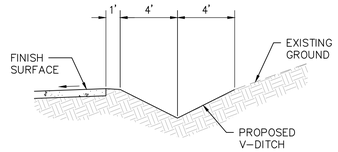


SECTION A–A
NO SCALE

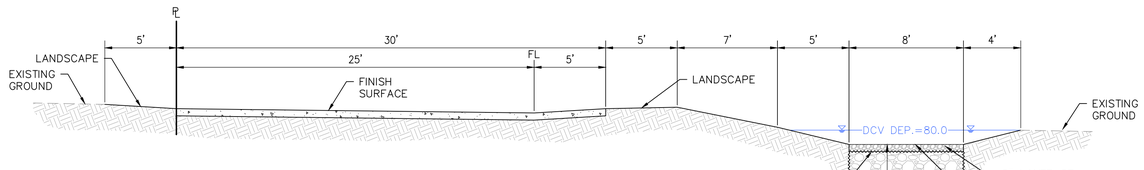


SECTION B–B
NO SCALE

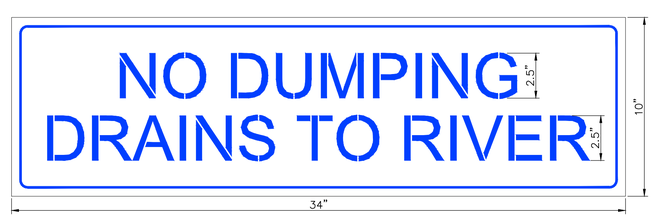
SECTION D–D
NO SCALE



SECTION C–C
NO SCALE



SECTION E–E
NO SCALE

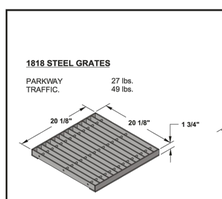


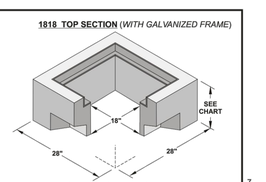
DETAIL – STORM DRAIN STENCIL
NO SCALE

1818 TOP SECTION (*WITH GALVANIZED FRAME*)

1818 STEEL GRATES

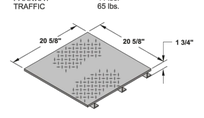
PARKWAY 27 lbs.
TRAFFIC. 49 lbs.





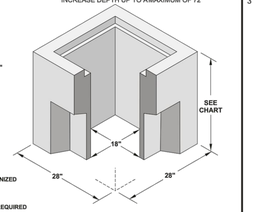
1818 STEEL COVER

PARKWAY 44 lbs.
TRAFFIC 65 lbs.



1818 LOWER SECTION (*NO FRAME*)

NOTE: USE 12", 18", 24" LOWERS TO INCREASE DEPTH UP TO A MAXIMUM OF 72"



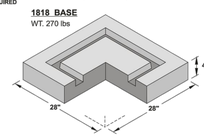
NOTES:
1. GRATES AND COVERS AVAILABLE PAINTED BLACK OR GALVANIZED
2. "ADA" GRATES AVAILABLE IN PARKWAY & TRAFFIC
3. "HEEL PROOF" GRATES AVAILABLE IN PARKWAY & TRAFFIC
4. A TOP SECTION WITH FRAME MUST BE USED IF BOLT DOWN REQUIRED

TOP SECTION	HT.	LBS	KNOCK-OUT
1818 T6	6"	215	NONE
1818 T12	12"	370	(4) 5" x 10"
1818 T18	18"	555	(4) 9" x 11"
1818 T24	24"	785	(4) 9" x 11"

EXTENSION SECTION	HT.	LBS	KNOCK-OUT
1818 E6	6"	215	NONE

LOWER SECTION	HT.	LBS	KNOCK-OUT
1818 L12	12"	370	(4) 9" x 11"
1818 L18	18"	555	(4) 9" x 11"
1818 L24	24"	785	(4) 9" x 11"

1818 BASE
WT. 270 lbs



18" x 18" CATCH BASIN

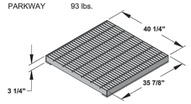
ORIG. ENGG. DATE	REV. ENGG. DATE
04-20-95	02-28-00

BROOKS PRODUCTS
1818 CB

7-03

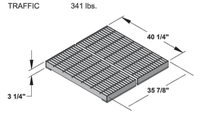
3636 STEEL GRATES - 1 Pc.

PARKWAY 93 lbs.



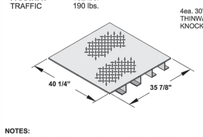
3636 STEEL GRATES - 2 Pc.

TRAFFIC 341 lbs.

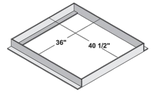


3636 STEEL COVER - 1 Pc.

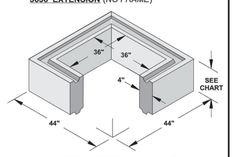
PARKWAY 152 lbs.
TRAFFIC 190 lbs.



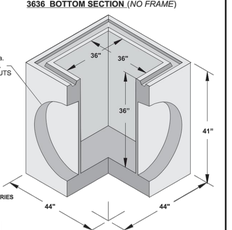
3636 FRAME ONLY



3636 EXTENSION (*NO FRAME*)



3636 BOTTOM SECTION (*NO FRAME*)



NOTES:
1. GRATES AND COVERS AVAILABLE PAINTED BLACK OR GALVANIZED
2. "ADA" OR "HEEL-PROOF" GRATES ARE NOT AVAILABLE FOR THIS SERIES
3. BOLT DOWN GRATES AND COVERS ARE AVAILABLE

EXTENSION SECTION	HT.	LBS	KNOCK-OUTS
3636 E6	6"	525	NONE
3636 E12	12"	1050	NONE

BOTTOM SECTION	HT.	LBS	KNOCK-OUTS
3636 B36	36"	2,230	(4) 30" DIA.

36" x 36" CATCH BASIN

ORIG. ENGG. DATE	REV. ENGG. DATE
11-23-99	02-14-20

JENSEN PRECAST EST. 1958
BROOKS 3636 CB

7-06

Oldcastle Infrastructure
A CRH COMPANY

STORM WATER

FLOGARD®
Catch Basin Insert Filter

Catch basin insert designed to capture sediment, gross solids, trash and petroleum hydrocarbons from low ("first flush") flows, even during the most extreme weather conditions

Example Types, Sizes and Capacities: Additional sizes, including regional and custom options are available.

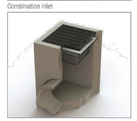
FloGard Combination Inlet
SPECIFIER CHART

MODEL NO.	STANDARD & SHALLOW DEPTH (Units in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH 33 Inches		MODEL NO.	SHALLOW DEPTH 10 Inches	
STANDARD DEPTH	INLET ID Inside Dimension (Units in Inch)	GRADE OD Outside Dimension (Units in Inch)	TOTAL BYPASS CAPACITY (In ft / sec)	SOLIDS STORAGE CAPACITY (In ft)	FILTERED FLOW (In ft / sec)	SHALLOW DEPTH	SOLIDS STORAGE CAPACITY (In ft)	FILTERED FLOW (In ft / sec)
FGP-1515FCO	16 X 33	18 X 36	7.0	2.5	1.7	FGP-1505FCOS	1.4	1.1
FGP-1530FCO	16 X 36	18 X 40	6.5	2.3	1.6	FGP-1530FCOS	1.3	.9
FGP-2034FCO	22 X 34	24 X 36	8.1	3.6	2.1	FGP-2034FCOS	2.1	1.4
FGP-2434FCO	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2434FCOS	1.95	1.13

FloGard Flat Grated Inlet
SPECIFIER CHART

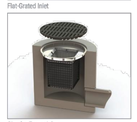
MODEL NO.	STANDARD & SHALLOW DEPTH (Units in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH 33 Inches		MODEL NO.	SHALLOW DEPTH 10 Inches	
STANDARD DEPTH	INLET ID Inside Dimension (Units in Inch)	GRADE OD Outside Dimension (Units in Inch)	TOTAL BYPASS CAPACITY (In ft / sec)	SOLIDS STORAGE CAPACITY (In ft)	FILTERED FLOW (In ft / sec)	SHALLOW DEPTH	SOLIDS STORAGE CAPACITY (In ft)	FILTERED FLOW (In ft / sec)
FGP-15F	12 X 15	12 X 14	3.5	0.9	0.4	FGP-10F6	.16	.05
FGP-18F	12 X 18	12 X 20	4.7	0.8	0.7	FGP-10F	.45	.2
FGP-1518F	16 X 18	18 X 20	4.7	1.8	0.7	FGP-1018F	.45	.2
FGP-1836F	16 X 36	18 X 40	6.5	3.3	1.6	FGP-1018F6	1.3	.9
FGP-2031F	20 X 30	22 X 34	6.1	2.2	1.5	FGP-2018	1.23	.85
FGP-2436F	24 X 36	24 X 37	6.1	2.2	1.5	FGP-2418	1.23	.85
FGP-3436F	34 X 36	34 X 40	8.0	3.4	2.0	FGP-3436F6	1.95	1.13
FGP-2448F	24 X 48	24 X 48	8.0	4.4	2.4	FGP-2448F6	3.3	1.35
FGP-2871N	28 X 28	30 X 30	6.3	2.2	1.8	FGP-2871N	1.03	.89
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F6	2.05	1.13
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F6	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.0	6.8	3.2	FGP-3648F6	3.3	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F6	5.45	2.5
FGP-1533F	16 X 34	18 X 36	6.0	2.3	1.6	FGP-1033F6	1.3	.9
FGP-2034F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2034F6	1.95	1.13


Combination Inlet

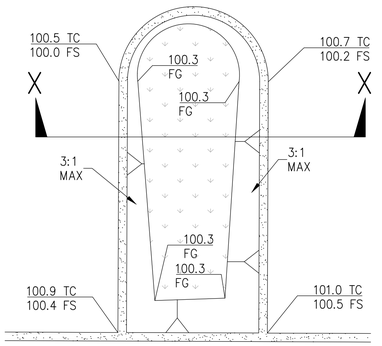

Flat-Grated Inlet

FloGard Circular Grated Inlet
SPECIFIER CHART

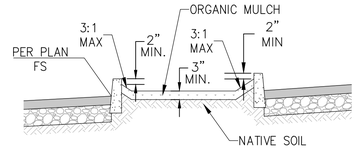
MODEL NUMBER	INLET ID (Inches)	GRADE OD (Inches)	SOLIDS STORAGE CAPACITY (Cu. FT.)	FILTERED FLOW (GSF)	TOTAL BYPASS CAPACITY (CFS)
FGP-8FF18F	13	18	0.3	0.4	3.8
FGP-8FF18F	18	20	0.8	0.7	4.7
FGP-8FF20F	20	23	0.8	0.7	4.7
FGP-8FF23F	21	23.5	0.8	0.7	4.7
FGP-8FF23F	22	24	0.8	0.7	4.7
FGP-8FF24F	24	26	0.8	0.7	4.7
FGP-8FF30F	30	33	2.3	1.6	6.1
FGP-8FF36F	36	39	3.6	2.0	6.1


Circular Frame Inlet

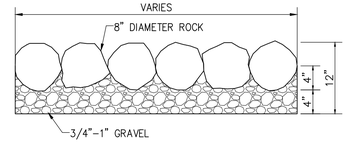
INLET FILTRATION



DETAIL–TYPICAL PLANTER GRADING
NO SCALE



TYPICAL PLANTER
SECTION X–X
NO SCALE



RIPRAP FLOWLINE DETAIL
NO SCALE

REGISTERED PROFESSIONAL ENGINEER
STEVEN H. RITCHEY
NO. 51129
Exp. 9-30-23
CIVIL
STATE OF CALIFORNIA

LEC
LAND ENGINEERING CONSULTANTS, INC.

P.O. BOX 541, 650 AVENUE K
CALIMESA, CALIFORNIA 92320
TEL: 909-795- 8882 FAX: 909-795-8818

STEVEN H. RITCHEY — DATE 9/12/22
R.C.E. 51129, EXP. 9/30/23

APPENDIX D

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	0.50
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	3	0.75
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.25
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.81
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					DA1: 10.0
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$					DA1: 3.56

Supporting Data

Two double ring infiltrometer tests were performed in order to establish infiltration rates at the location of the infiltration basin. The infiltration testing results can be found in appendix D of the WQMP report.

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

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

September 8, 2022

Land Engineering Consultants, Inc.
P.O. Box 541
Calimesa, California 92320

Project No. 13789.11

Attention: Mr. Ryan Ritchey

Subject: Response to County Review Comments, APN 0239-311-01-0000, Lytle Creek Area, San Bernardino County, California

Reference: Preliminary Geotechnical and Infiltration Feasibility Investigation, Proposed Commercial/Light Industrial Project, APN 0239-311-01-0000, Lytle Creek Area, San Bernardino County, California, Project No. 13789.1, dated February 23, 2022.

At your request, we have prepared this letter to clarify the standard used for our double ring infiltration testing as reported in the above referenced report.

Double ring infiltration testing was conducted in general accordance with ASTM D3385.

Should you have any questions regarding this letter, please do not hesitate to contact us as your convenience.

Respectfully submitted,
LOR Geotechnical Group, Inc.

John P. Leuer, GE 2030
President

AAT:JPL:ss

Distribution: Addressee via email ryan@lecincorporated.com

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

PRELIMINARY GEOTECHNICAL AND INFILTRATION FEASIBILITY INVESTIGATION
APN 0239-311-01-0000
LYTLE CREEK AREA
SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO. 13789.1
FEBRUARY 23, 2022

Prepared For:

Land Engineering Consultants, Inc.
P.O. Box 541
Calimesa, California 92320

Attention: Mr. Daniel J. Haskins

February 23, 2022

Land Engineering Consultants, Inc.
P.O. Box 541
Calimesa, California 92320

Project No. 13789.1

Attention: Mr. Daniel J. Haskins

Subject: Preliminary Geotechnical and Infiltration Feasibility Investigation, Proposed Commercial/Light Industrial Project, APN 0239-311-01-0000, Lytle Creek Area, San Bernardino County, California.

LOR Geotechnical Group, Inc., is pleased to present this report summarizing our geotechnical investigation for the above referenced project. This report was based upon a scope of services generally outlined in our Proposal Reference No. 5933, dated November 11, 2021, and other written and verbal communications with you.

In summary, it is our opinion that the site can be developed from a geotechnical perspective, provided the recommendations presented in the attached report are incorporated into design and construction. The following executive summary reviews some of the important elements of the project. However, this summary should not be solely relied upon.

It is our opinion that the existing fill/topsoil materials and upper portions of the native alluvial soils will not provide uniform and/or adequate support for the proposed improvements. Therefore, we recommend that a compacted fill mat be constructed beneath footings and slabs. All loose soils should be removed from structural areas and areas to receive structural fills. The data developed during this investigation indicates that removals on the order of 2 to 4 feet will be required within currently proposed development areas.

On-site soils were found to have good R-value quality, good infiltration characteristics, and to contain a negligible soluble sulfate content. Near completion and/or at the completion of site grading, foundation soils should be sampled and tested, as necessary to verify their R-value, expansion potential, and soluble sulfate content, as necessary.

LOR Geotechnical Group, Inc.

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INTRODUCTION

During December of 2021 and January and February of 2022, a Preliminary Geotechnical and Infiltration Feasibility Investigation was performed by LOR Geotechnical Group, Inc., for the proposed construction of two warehouse/light industrial buildings within APN 0239-311-01-0000, in the Lytle Creek area of San Bernardino County, California. The purpose of this investigation was to provide a technical evaluation of the geologic setting of the site and to provide geotechnical design recommendations for the proposed development. The scope of our services included:

- Review of available pertinent geotechnical literature, reports, maps, and agency information pertinent to the study area;
- Geologic field reconnaissance to verify the areal distribution of earth units and significance of surficial features as compiled from documents, literature, and reports reviewed;
- A subsurface field investigation to determine the physical soil conditions pertinent to the proposed development;
- Geophysical investigation by our subcontractor, Terra Geosciences, using seismic refraction lines to aid in the identification of possible subsurface faulting;
- Laboratory testing of selected soil samples obtained during the field investigation;
- Development of geotechnical recommendations for site grading and foundation design;
- Performance of two double ring infiltrometer tests within the proposed infiltration facility location; and
- Preparation of this report summarizing our findings, and providing conclusions and recommendations for site development.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1, within Appendix A.

To orient our investigation at the site, we were provided with a Site Plan prepared by you. This drawing shows the proposed improvements overlain on a topographic map of the existing conditions and a copy was utilized as a base for our Plat, Enclosure A-2, within Appendix A.

PROJECT CONSIDERATIONS

Information furnished to this firm indicates the proposed project will consist of the construction of two, approximately 15,000 square-foot, metal frame buildings, driveways and parking areas, and associated landscaping within the relatively flat, central portion of the subject 16-acre site. Light to moderate foundation loads are anticipated with the proposed structures. A small infiltration basin to serve the site will be built within the southeast portion.

Based upon our review of the current site topographic conditions, it is anticipated that, excluding removals and/or over-excavations, site grading will consist of minor cuts and fills of less than 5 feet to create the proposed planar building pads.

EXISTING SITE CONDITIONS

The subject site consists of an irregular shaped property comprising 16 acres of land located at 3112 Lytle Creek Road and along the west side of this road. The property largely consists of planar land that slopes gently to the south and east. In the northern and southwest portions, outside of the areas of proposed development area, moderate to steep hillsides are present.

The property currently contains a residence in the southwest corner and a warehouse building in the central-western portion. Water from a spring located to the west-northwest of the site provides water for these buildings while an onsite water well, located in the central-eastern portion, has periodically been used for supplying irrigation water for onsite agricultural purposes.

Contiguous property belonging to the owner of the subject site is present to the north and west with national forest lands beyond. Lytle Creek Road is present along much of the eastern side of the property and a residential property is located adjacent to the southern site boundary. Grapevine Canyon crosses from northwest to southeast across the northern half of the site, north of the area of proposed improvements.

AERIAL PHOTOGRAPH ANALYSIS

During our investigation we reviewed a series of aerial photographs on file at the San Bernardino County Flood Control and Transportation Department aerial photography collection. These photographs consisted of large scale regional photographs taken of the

site and surrounding area between 1938 and 1972. In addition, we reviewed historic aerial photographs available through Google Earth (2022) and Historic Aerials (2022).

The San Bernardino County Flood Control aerial photographs reviewed consisted of vertical aerial stereographic photograph pairs of varying scales. These photographs were viewed using stereoscopes with magnifications of 2X and 4X for three dimensional enhancement. Due to the relatively large photograph scales involved, the analysis and subsequent interpretation of detail from aerial photographs sometimes require a degree of subjective judgment. The degree of certainty on the interpretation of details depends upon such factors as the scale and the quality of the photograph. A complete list of the aerial photographs reviewed is presented within the References at the end of this report.

The aerial photographs were examined in detail to assess the local and regional geologic and geomorphic characteristics of the site and vicinity. During our review, we also noted major changes that occurred onsite throughout this time span. Prior to the early 1960's, the site remained in a largely natural condition with the exception of disturbances in the form of clearings and crude dirt roads related to the installation of overhead power lines and towers that appear to have been installed across the property in the early 1930's. In addition, disturbance to the land in the far northern portion of the site, north of Grapevine Canyon, has taken place since the 1860's and mainly during the late 1800's. The disturbances here consist of a hydraulically mined hillside (Texas Hill) and the associated outwash that consists of fill soils between this gold mine quarry and Grapevine Canyon. The onsite structures appear to have been built during the early 1960's and fruit trees and a garden area were located in the area between the residence and the water well during much of the late 1900's.

Flooding damage related to the flood event of 1938 is apparent in the earliest photographs. The northern part of the site adjacent to Grapevine Canyon and portions of Lytle Creek Road were eroded away as a result of this flooding. Some years later, the scars from the flooding related erosion were repaired and earthen levees were built along the south side of the main drainage course for Grapevine Canyon, north of the proposed improvement area.

Our examination of reviewed photographs, including both those available through the county and online, did not identify any evidence for faulting across the area of proposed structural improvements. However, evidence for faulting related to the Lytle Creek fault is apparent within the elevated hillside areas to the south, west, and

northwest of the site. Features related to faulting, including various photo-lineaments in the area, are identified on our Enclosure A-5, Photo-lineament Map, in Appendix A.

As seen in the aerial images, the development area of the site appears to be underlain by younger alluvial deposits that slope gently to the southeast overall. As illustrated on our Regional Geologic Maps (Enclosure A-3a and A-3b) and our Greater Site Area Geologic Map (Enclosure A-4), igneous and metamorphic bedrock materials form the base of the hillsides along the western and northern sides of the site and these are capped by elevated older alluvial deposits.

FIELD EXPLORATION PROGRAM

During December of 2021, seismic refraction traverse across the general area of proposed improvements was conducted by our subconsultant, Terra Geosciences, to assist in the evaluation of the possible presence of subsurface faulting related to the San Jacinto fault zone. As presented within Appendix D, the findings and conclusions of that investigation indicate that no faults traverse through the area of proposed development.

Physical subsurface field exploration program was conducted by this firm on January 25, 2022, and consisted of excavating 6 exploratory trenches using a JD 410C backhoe. The trenches were excavated to depths of approximately 5 to 15 feet beneath the existing ground surface. In addition, two double-ring infiltration tests were conducted within shallow test pits excavated within the area of the proposed infiltration basin. The approximate locations of our exploratory trenches and infiltration tests are presented on the attached Plat, Enclosure A-2 within Appendix A.

The subsurface conditions encountered in the exploratory trenches were logged by a geologist from this firm. In-place density tests were taken at select intervals in accordance with the ASTM D 1557, the Sand Cone test method. Bulk samples were obtained at select intervals and returned to our geotechnical laboratory in sealed containers for further testing and evaluation. A detailed description of the field exploration program and the trench logs are presented in Appendix B.

LABORATORY TESTING PROGRAM

Selected soil samples obtained during the field investigation were subjected to laboratory testing to evaluate their physical and engineering properties. Laboratory testing included moisture content, laboratory compaction characteristics, direct shear, sieve analysis, sand

equivalent, R-value, and soluble sulfate content. A detailed description of the laboratory testing program and the test results are presented in Appendix C.

GEOLOGIC CONDITIONS

Regional Geologic Setting

The site is located within the far eastern portion of the San Gabriel Mountains of the Transverse Ranges geomorphic province. These mountains are underlain by Precambrian to Miocene age igneous and metamorphic bedrock. From late Tertiary through Holocene time, the region has undergone substantial uplift, as evidenced by numerous landslides and elevated older alluvial deposits.

In the Lytle Creek area of the Transverse Ranges province, the San Andreas fault, as well as the San Jacinto fault, act as the boundary between the San Gabriel Mountains to the west and the San Bernardino Mountains to the east. East of the site, but on the northern side of the San Andreas fault and east of the Cajon Pass, are the San Bernardino Mountains portion of the Transverse Ranges province.

The San Gabriel Mountains are situated between the Sierra Madre/Cucamonga fault zone on the south and the San Andreas fault on the north. Portions of the San Jacinto fault become the San Gabriel fault to the west of the site and the Cucamonga fault crosses the mouth of Lytle Creek canyon before merging with the San Jacinto fault to the southeast of the property. Locally, the motions on these various faults has resulted in the San Gabriel Mountains moving to the northwest relative to the San Bernardino Mountains. While this motion is distributed along a very wide shear zone of various other major faults in the region, perhaps as much as one half of the total offset is thought to have occurred along the San Andreas fault.

The San Jacinto and San Andreas faults dominate the local area in terms of seismic potential and fault rupture hazard. While there are other faults in the local area that could cause significant ground shaking, none of these are of near equal significance due to their greater distances and/or lower magnitudes. The regional geology as mapped by the U.S.G.S. (Morton and Miller, 2001) and partial legend is shown on Enclosure A-3a, within Appendix A. In addition, a second Regional Geologic Map, prepared by Dibblee and Minch (2003) is presented as Enclosure A-3b within Appendix A. This map is provided mainly to show the location of an inferred fault that traverses the site as mapped by these authors.

Site Geologic Conditions

The site is underlain by a relatively thin layer of fill/topsoil and near surface soils that have been disturbed through past agricultural use and bioturbation. These are on the order of 1 to 3 feet thick and consist of loose to medium dense silty sand with gravel, cobbles, and boulders.

Beneath the topsoil materials, alluvial deposits ranging from silty sand with gravel in the near surface and poorly graded sands with locally abundant gravels and cobbles below. At depth, numerous cobble to boulder sized rocks were encountered. Rock materials within the alluvium consist mostly of subrounded intrusive igneous rocks.

Although not encountered during our subsurface investigation within the area of proposed improvements, other areas of the site include additional geologic units, including undocumented fill soils, active wash deposits, elevated older alluvial deposits, as well as intrusive and metamorphic bedrock. The general configuration of the geologic conditions across the overall 16-acre site are depicted on our General Site Area Geologic Map, Enclosure A-4.

Groundwater Hydrology

Groundwater was not encountered in our exploratory trenches as advanced to a maximum depth of approximately 15 feet below the existing ground surface. The onsite water well was measured to a depth of 295 feet without water or a bottom encountered. However, the property owner reports that the water table was at a depth of approximately 83 feet when the depth to water in this well was last checked, about 2 to 3 years ago.

According to information available from the California Department of Water Resources (DWR, 2022) and Watermaster Support Services, et al (2021), there are three wells for which they have records within close proximity of the site and each of these is located within the Lytle Creek wash to the northeast and southeast. For each of the last approximately 7 years, the depth to groundwater in these wells has averaged about 75 to 95 feet below the surface. Considering this and the above information, groundwater does not appear to be a factor that could impact site development.

Surface Runoff

Current surface runoff of precipitation waters across the site is generally as sheetflow to the south-southeast.

Mass Movement

The site lies on a relatively flat surface. Mass movement failures such as landslides, rockfalls, or debris flows within the site vicinity are not known to exist and no evidence of mass movement was observed on the site. The westerly of the two proposed buildings is to be located, at its closest point, approximately 40 feet from the toe of a natural hillside that rises approximately 150 feet to the west at fairly steep gradients. However, no evidence for mass movement features was noted during our site reconnaissance or review of aerial photographs and no landslides are shown to be present in this area on regional geologic maps that cover the site area.

Faulting

According to the Official Maps of Alquist-Priolo Earthquake Fault Zones of California (Hart and Bryant, 1997) portions of the subject site lie within a current State of California Earthquake Fault Zone. In addition, a fault mapped as a portion of the local Lytle Creek fault of the San Jacinto fault zone is mapped as projecting toward and terminating just southeast of the southern site boundary. The approximate site boundary is overlain on a copy of Figure 1 that accompanies California Division of Mines and Geology Fault Evaluation Report FER 240 (1994) that was used to develop the current Earthquake Fault Zone maps for this area and is presented as Enclosure A-6 in Appendix A.

Due to the presence of the above mentioned fault that projects toward the proposed development area of the site, we enlisted the geophysical services of Terra Geosciences to conduct a seismic refraction line traverse across the general area of proposed development and in an approximate perpendicular orientation to the projection of this mapped fault. As outlined within the report prepared by Terra Geosciences, in Appendix D, no evidence for the presence of subsurface faults was identified by this study.

During the course of this investigation, the proposed building locations shifted slightly and the current proposed location for the northwesterly of the two buildings now appears to be across the approximate northeast Earthquake Fault Zone boundary. However, the geophysical study conducted covers the area of the proposed building.

Our review of geologic literature pertinent to the site and review of aerial photographs identified one map (Dibblee and Minch, 2003; see Enclosure A-3b) that shows an inferred extension of the Lytle Creek fault as the San Jacinto fault projecting through the western portion of the relatively flat lying potions of the site, along the base of the hillside and through the large cut exposure that identifies Texas Hill in the northwest portion of the

property. However, no other authors show this inferred fault on any of their maps and the feature is not recognized by the State of California on the latest Earthquake Fault Zone maps. We did not find any evidence for this feature during our review of aerial imagery or during our site geologic mapping, including observation of the vertical exposures within older alluvial soils within which the hydraulic mining scars of Texas Hill were made and where this inferred fault is projected to extend across.

Reconnaissance mapping of the greater site area revealed that the strongest evidence for faulting is present to the northwest and southwest of the area of proposed development. Some of these features are identified on our Photo-lineament Map, Enclosure A-5, while direct observation of one, if not the strongest, fault related features may be observed within a road cut exposure located approximately 1,000 feet to the west-northwest of the area of proposed development (location noted on Enclosure A-5).

The closest known active earthquake fault with a documented location is the Lytle Creek fault of the San Jacinto fault zone located northwest and southwest of the area of development. Two other strands of the San Jacinto fault zone, each referred to as the San Bernardino Valley Sections, are located at distances of 1.6 kilometers (1 mile) and 3.5 kilometers (2.2 miles) to the northeast. In addition, other relatively close active faults include the Cucamonga fault located approximately 1.9 kilometers (1.2 miles) to the south and the San Andreas fault located approximately 5.9 kilometers (3.7 miles) to the northeast.

The San Jacinto fault zone is a sub-parallel branch of the San Andreas fault zone, extending from the northwestern San Bernardino area, southward into the El Centro region. It is believed that the San Jacinto fault zone has an average slip rate of about 12 mm/year and is capable of producing an earthquake magnitude on the order of 6.5 or greater.

The Cucamonga fault is considered to be part of the Sierra Madre fault system which marks the southern boundary of the San Gabriel Mountains. This is a north dipping thrust fault which is believed to be responsible for the uplift of the San Gabriel Mountains. It is believed that the Cucmonga fault is capable of producing an earthquake magnitude on the order of 7.0.

The San Andreas fault is considered to be the major tectonic feature of California, separating the Pacific plate and the North American plate. While estimates vary, the San Andreas fault is generally thought to have an average slip range on the order of 24 mm/yr and capable of generating large magnitude events on the order of 7.5 or greater.

Current standards of practice included a discussion of all potential earthquake sources within a 100 kilometer (62 mile) radius. However, while there are other large earthquake faults within a 100 kilometer (62 mile) radius of the site, none of these are considered as relevant to the site as the faults described above, due to their greater distance and smaller anticipated magnitudes.

Historical Seismicity

In order to obtain a general perspective of the historical seismicity of the site and surrounding region, a search was conducted for seismic events at and around the area within various radii. This search was conducted utilizing the historical seismic search website of the USGS. This website conducts a search of a user selected cataloged seismic events database, within a specified radius and selected magnitudes, and then plots the events onto a map. At the time of our search, the data base contained data from 1932 through February 18, 2022.

In our first search, the general seismicity of the region was analyzed by selecting an epicenter map listing all events of magnitude 4.0 and greater, recorded since 1932, within a 100 kilometer (62 mile) radius of the site, in accordance with guidelines of the California Division of Mines and Geology. This map illustrates the regional seismic history of moderate to large events. As depicted on Enclosure A-7, within Appendix A, the site lies within a relatively active region associated with the San Jacinto and San Andreas fault zones trending southeast to northwest.

In the second search, the micro seismicity of the area lying within a 10 kilometer (6.2 mile) radius of the site was examined by selecting an epicenter map listing events on the order of 2.0 and greater since 1978. The result of this search is a map that presents the seismic history around the area of the site with much greater detail, not permitted on the larger map. The reason for limiting the events to the last 40± years on the detail map is to enhance the accuracy of the map. Events recorded prior to the mid 1970s are generally considered to be less accurate due to advancements in technology. As depicted on this map, Enclosure A-8, the San Jacinto fault zone appears to be the source of numerous events.

In summary, the historical seismicity of the site entails numerous small to medium magnitude earthquake events occurring around the subject site, predominately associated with the presence of the San Jacinto and San Andreas faults. Any future developments at the subject site should anticipate that moderate to large seismic events could occur very near the site.

Secondary Seismic Hazards

Other secondary seismic hazards generally associated with severe ground shaking during an earthquake include liquefaction, seiches and tsunamis, earthquake induced flooding, landsliding and rockfalls, and seismic-induced settlement.

Liquefaction: The potential for liquefaction generally occurs during strong ground shaking within loose granular sediments where the depth to groundwater is usually less than 50 feet. As the site is underlain by relatively medium dense alluvial materials and the depth to groundwater is thought to be in excess of 50 feet, the possibility of liquefaction at the site is considered nil.

Seiches/Tsunamis: The potential for the site to be affected by a seiche or tsunami (earthquake generated wave) is considered nil due to absence of any large bodies of water near the site.

Flooding (Water Storage Facility Failure): There are no large water storage facilities located on or near the site which could possibly rupture during an earthquake and affect the site by flooding.

Seismically-Induced Landsliding: Due to the low relief of the site and lack of landsliding noted during this investigation of the ajacent hillside, the potential for landslides to occur at the site is considered nil.

Rockfalls: No large, exposed, loose or unrooted boulders are present above the site that could affect the integrity of the site.

Seismically-Induced Settlement: Settlement generally occurs within areas of loose, granular soils with relatively low density. Since the site is underlain by relatively medium dense alluvial materials, the potential for settlement is considered low. In addition, the earthwork operations recommended to be conducted during the development of the site will mitigate any near surface loose soil conditions.

SOILS AND SEISMIC DESIGN CRITERIA (California Building Code 2019)

Design requirements for structures can be found within Chapter 16 of the 2019 California Building Code (CBC) based on building type, use, and/or occupancy. The classification of use and occupancy of all proposed structures at the site, shall be the responsibility of the building official.

Site Classification

Chapter 20 of the ASCE 7-16 defines six possible site classes for earth materials that underlie any given site. Bedrock is assigned one of three of these six site classes and these are: A, B, or C. Soil is assigned as C, D, E, or F. Per ASCE 7-16, Site Class A and Site Class B shall be measured on-site or estimated by a geotechnical engineer, engineering geologist or seismologist for competent rock with moderate fracturing and weathering. Site Class A and Site Class B shall not be used if more than 10 feet of soil is between the rock surface and bottom of the spread footing or mat foundation. Site Class C can be used for very dense soil and soft rock with Ñ values greater than 50 blows per foot. Site Class D can be used for stiff soil with Ñ values ranging from 15 to 50 blows per foot. Site Class E is for soft clay soils with Ñ values less than 15 blows per foot. Our previous investigation, mapping by others, and our experience in the site region indicates that the materials beneath the site are considered Site Class D stiff soils.

CBC Earthquake Design Summary

Earthquake design criteria have been formulated in accordance with the 2019 CBC and ASCE 7-16 for the site based on the results of our investigation to determine the Site Class and an assumed Risk Category II. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region. In addition, the building official should confirm the Risk Category utilized in our design (Risk Category II). Our design values are presented in Appendix F.

INFILTRATION TESTING AND TEST RESULTS

A total of 2 double ring infiltration tests were conducted within the area of a proposed basin as illustrated on the enclosed Plat, Enclosure A-2, located in Appendix A. The testing was conducted at the approximate bottom elevations for the proposed system.

A 12-inch diameter steel casing (ring) was installed within the center of each test location, with a 24-inch diameter steel ring centered around it. Each ring was imbedded approximately 4 inches. These rings extended approximately 16 inches above the bottom of each test location. Each test location was tested immediately after the rings were installed by filling both the inside and outside rings and maintaining a water level to a depth of approximately 2 inches above the ground surface. Water was then metered into the test hole to maintain this water level within both rings. The volume of water used in a given time period was recorded at various time intervals to establish the infiltration rate of water within the inner ring.

The infiltration rate is measured as the drop in water level compared to the permeability of the bottom surface area soils in the bottom of the test hole. If a ring is not used, the water column in the test hole is allowed to seep into both the bottom and sidewalls of the hole, for which the drop in water level must be corrected and reduced for the volume of water seeping into the sidewall and for the diameter of the test hole. As described above, the tests described herein were conducted using a 12-inch diameter inner ring and 24-inch diameter outer ring.

The test holes were found to have the following measured clear water infiltration rates:

Infiltration Test No.	Depth (ft.)*	Clear Water Infiltration Rate** (inches/hour)
DRI-1	2	17.0
DRI-2	5	18.0
* below existing ground surface ** average of final 4 readings rounded to the nearest tenth		

The results of our double ring infiltrometer tests are attached as Enclosures E-1 and E-2, located in Appendix E.

CONCLUSIONS

General

This investigation provides a broad overview of the geotechnical and geologic factors which are expected to influence future site planning and development. On the basis of our field investigation and testing program, it is the opinion of LOR Geotechnical Group, Inc., that the proposed improvements to the site are feasible from a geotechnical standpoint,

provided the recommendations presented in this report are incorporated into design and implemented during grading and construction.

It should be noted that the subsurface conditions encountered in our exploratory trenches are indicative of the locations explored. The subsurface conditions may vary. If conditions are encountered during the construction of the project that differ significantly from those presented in this report, this firm should be notified immediately in order that we may assess the impact to the recommendations provided.

Foundation Support

Based upon our field investigation and laboratory test data, it is our opinion that the existing fill/topsoil materials and upper portions of the native alluvial soils will not, in their present condition, provide uniform and/or adequate support for the proposed structures. However, the alluvial soils at depths greater than approximately 2 to 4 feet are considered suitable for support of the proposed structures and/or structural fills.

To provide adequate support for the proposed structures, we recommend that a minimum 24-inch thick compacted fill mat be constructed beneath slabs on grade and footings and that this fill mat bear upon medium dense to dense alluvial materials. Conventional foundations, either individual spread footings and/or continuous wall footings, will provide adequate support for the anticipated downward and lateral loads when utilized in conjunction with the recommended compacted fil mat or when bearing uniformly upon medium dense to dense older alluvial soils.

Soil Expansiveness

As noted by our explorations and laboratory testing, the majority of the site surficial soils consist of silty sands and sands with gravel, cobbles, and local boulders. These materials are considered to have a very low expansion potential. Therefore, conventional design and construction should be applicable for the project.

Careful evaluation of on-site soils and any import fill for their expansion potential should be conducted during the grading operation.

Geologic Mitigations

No special geologic recommendation methods are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

Seismicity

Seismic ground rupture is generally considered most likely to occur along pre-existing active faults. Since no known faults are known to exist at, or project into the site, the probability of ground surface rupture occurring at the site is considered nil.

Due to the site's close proximity to the faults described above, it is reasonable to expect a strong ground motion seismic event to occur during the lifetime of the proposed development on the site. Large earthquakes could occur on other faults in the general area, but because of their lesser anticipated magnitude and/or greater distance, they are considered less significant than the faults described above from a ground motion standpoint.

The effects of ground shaking anticipated at the subject site should be mitigated by the seismic design requirements and procedures outlined in Chapter 16 of the California Building Code. However, it should be noted that the current building code requires the minimum design to allow a structure to remain standing after a seismic event, in order to allow for safe evacuation. A structure built to code may still sustain damage which might ultimately result in the demolishing of the structure (Larson and Slosson, 1992).

RECOMMENDATIONS

Geologic Recommendations

It is our recommendation that the bottom of all removal/over-excavation areas be observed by the project geologist in order to determine if any geologic features indicative of the possible presence of faulting are present and to provide any supplemental recommendations that could become warranted. No other special geologic recommendation methods are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer. An on-site, pre-job meeting with the owner, the developer, the contractor, and geotechnical engineer should occur prior to all grading related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the California Building Code, and/or applicable local ordinances.

All areas to be graded should be stripped of significant vegetation and other deleterious materials.

It is our recommendation that all existing fill/topsoil under any proposed flatwork and paved areas be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur. Any undocumented fills encountered during grading should be completely removed and cleaned of significant deleterious materials. These may then be reused as compacted fill.

Cavities created by removal of subsurface obstructions should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended in the following Engineered Compacted Fill section of this report.

Initial Site Preparation

All existing fill/topsoil and loose alluvial materials should be removed from structural areas and areas to receive structural fills. The data developed during this investigation indicates that for the majority of the site, removals on the order of 2 to 4 feet will be required to encounter competent alluvium. Competent alluvium is defined as damp, relatively dense materials with a minimum in-place relative compaction of 85 percent (ASTM D 1557). Removals should extend at a distance equal to the depth of the removals plus proposed fill and at least a minimum of 5 feet. The actual depths of removals should be determined during the grading operation by observation and in-place density testing. Locally, greater removals may be required.

Preparation of Fill Areas

After the removals of the loose, unsuitable portions of the alluvial materials as described above and prior to placing fill, the surfaces of all areas to receive fill should be scarified to a depth of at least 6 inches. The scarified soil should be brought to near optimum moisture content and compacted to a relative compaction of at least 90 percent (ASTM D 1557).

Preparation of Foundation Areas

All footings should rest upon a minimum of 24 inches of properly compacted fill material placed over competent alluvium. Based on the recommended removals discussed above, it is anticipated that this will be accomplished in most areas. However, in areas where the required fill thickness is not accomplished by the removal of any surficial fill and loose alluvial materials and site rough grading, the footing areas should be further subexcavated to a depth of at least 24 inches below the proposed footing base grade, with the subexcavation extending at least 5 feet beyond the footing lines. The bottom of this excavation should then be scarified to a depth of at least 12 inches, brought to near optimum moisture content, and compacted to at least 90 percent relative compaction (ASTM D 1557) prior to refilling the excavation to grade as properly compacted fill.

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 12 inches of compacted soil. The remedial grading recommended above is anticipated to accomplish the minimum 24 inches of compacted fill. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Engineered Compacted Fill

The on-site soils should provide adequate quality fill material, provided they are free from organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 6 inches should not be buried or placed in fills.

Import fill, if required, should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. Sources for import fill should be approved by the geotechnical engineer prior to their use.

Fill should be spread in maximum 8-inch uniform, loose lifts, with each lift brought to near optimum moisture content prior to, during and/or after placement, and compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Based upon the relative compaction of the near surface soils determined during this investigation and the relative compaction anticipated for compacted fill soil, we estimate a compaction shrinkage factor of approximately 10 to 15 percent. Therefore, 1.10 cubic yards to 1.15 cubic yards of in-place materials would be necessary to yield one cubic yard of properly compacted fill material. In addition, we would anticipate subsidence of approximately 0.1 feet. These values are for estimating purposes only, and are exclusive of losses due to stripping or the removal of subsurface obstructions. These values may vary due to differing conditions within the project boundaries and the limitations of this investigation. Shrinkage should be monitored during construction. If percentages vary, provisions should be made to revise final grades or adjust quantities of borrow or export.

Short-Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations 5 feet deep and greater should be sloped or shored. All excavations and shoring should conform to CAL-OSHA requirements.

Short-term excavations 5-feet deep and greater shall conform to Title 8 of the California Code of Regulations, Construction Safety Orders, Section 1504 and 1539 through 1547. Based on our exploratory trenches, it appears that Type C soil is the predominant type of soil on the project and all short-term excavations should be based on this type of soil. Deviation from the standard short-term slopes are permitted using Option 4, Design by a Registered Professional Engineer (Section 1541.1).

Short-term slope construction and maintenance are the responsibility of the contractor, and should be a consideration of his methods of operation and the actual soil conditions encountered.

Slope Construction

Preliminary data indicates that cut and fill slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Infiltration

Based upon our field investigation and infiltration test data, a clear water absorption rate of 10 inches per hour appears warranted for design. A factor of safety should be applied as indicated by the Design Handbook for Low Impact Development Best Management Practices (RCFCWCD, 2011). The design infiltration rate should be adjusted using a factor of safety 3.0.

To ensure continued infiltration capability of the infiltration area, a program to maintain the facility should be considered. This program should include periodic removal of accumulated materials, which can slow the infiltration considerably and decrease the water quality. Materials to be removed from the catch basin areas typically consist of litter, dead plant matter, and soil fines (silts and clays). Proper maintenance of the system is critical. A maintenance program should be prepared and properly executed. At a minimum, the program should be as outlined in the Design Handbook for Low Impact Development Best Management Practices (RCFCWCD, 2011).

The program should also incorporate the recommendations contained within this report and any other jurisdictional agency requirements.

- Systems should be set back at least 10 feet from foundations or as required by the design engineer.

- Any geotextile filter fabric utilized should consist of such that it prevents soil piping but has greater permeability than the existing soil.

- During site development, care should be taken to not disturb the area(s) proposed for infiltration as changes in the soil structure could occur resulting in a change of the soil infiltration characteristics.

Slope Protection

Since the native materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after completion. The use of succulent ground covers such as iceplant or sedum is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Foundation Design

If the site is prepared as recommended, the proposed structures may be safely founded on conventional foundation systems, either individual spread footings and/or continuous wall footings, bearing on a minimum of 24 inches of engineered compacted fill. All foundations should have a minimum width of 12 inches and should be established a minimum of 12 inches below lowest adjacent grade.

For the minimum width and depth, footings may be designed using a maximum net soil bearing pressure of 2,000 pounds per square foot (psf) for dead plus live loads incorporating a factor of safety of 3.0. Soil bearing pressure may be increased 300 psf for every foot of width and 900 psf for every foot of depth up to a maximum soil bearing pressure of 4,000 psf for dead plus live loads. The weight of the foundations and the backfill over the foundations may be neglected when computing dead loads. The values apply to the maximum edge pressure for foundations subjected to eccentric loads or overturning.

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, passive earth pressure may be considered to be developed at a rate of 490 pounds per square foot per foot of depth. Base friction may be computed at 0.42 times the normal load. Base friction and passive earth pressure may be combined without reduction.

Footings on very low expansive soils will not required any particular reinforcement from the geotechnical standpoint.

Settlement

Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Maximum settlement of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be on the order of 0.5 inch. Differential settlements between adjacent footings should be about one-half of the total settlement. Settlement of all foundations is expected to occur rapidly, primarily as a result of elastic compression of supporting soils as the loads are applied, and should be essentially completed shortly after initial application of the loads.

Building Area Slab-On-Grade

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 12 inches of compacted soil. The final pad surfaces should be rolled or track-walked to provide fairly smooth, dense surfaces upon which to place the concrete.

Since very low expansive soils are anticipated to underlying slab areas, no particular geotechnical and/or structural mitigation measures to control expansive soil problems will be required.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor barrier. This barrier may consist of an impermeable membrane. Two inches of sand over and two inches of sand below the membrane will reduce punctures and aid in obtaining a satisfactory concrete cure. The sand should be moistened just prior to placing of concrete.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

Exterior Flatwork

To provide adequate support, exterior flatwork improvements should rest on a minimum of 12 inches of soil compacted to at least 90 percent (ASTM D 1557).

Since very low expansive soils are anticipated to underlie flatwork areas, no particular geotechnical and/or structural mitigation measures to counteract expansive soil problems will be required.

Flatwork surface should be sloped a minimum of 1 percent away from buildings and slopes, to approved drainage structures.

Wall Pressures

The design of footings for retaining structures should be performed in accordance with the recommendations described earlier under Preparation of Foundation Areas and Foundation Design. For design of retaining wall footings, the resultant of the applied loads should act in the middle one-third of the footing, and the maximum edge pressure should not exceed the basic allowable value without increase.

For design of retaining walls unrestrained against movement at the top, we recommend an active pressure of 30 pounds per square foot (psf) per foot of depth be used. This assumes level backfill consisting of recompacted, non-square expansive, native soils placed against the structures and with the backcut slope extending upward from the base of the stem at 35 degrees from the vertical or flatter.

To avoid overstressing or excessive tilting during placement of backfill behind walls, heavy compaction equipment should not be allowed within the zone delineated by a 45 degree line extending from the base of the wall to the fill surface. The backfill directly behind the walls should be compacted using light equipment such as hand operated vibrating plates and rollers. No material larger than 3-inches in diameter should be placed in direct contact with the wall.

Wall pressures should be verified prior to construction, when the actual backfill materials and conditions have been determined. Recommended pressures are applicable only to level, non-expansive, properly drained backfill (with no additional surcharge loadings). If inclined backfills are proposed, this firm should be contacted to develop appropriate active earth pressure parameters. Toe bearing pressure for non-structural walls on soils, not prepared as described earlier under Preparation of Foundation Areas, should not exceed California Building Code values.

Sulfate Protection

The results of the soluble sulfate tests conducted on selected subgrade soils expected to be encountered at foundation levels are presented on Enclosure C.

Based on the test results it appears that there is a negligible sulfate exposure to concrete elements in contact with on site soils. The CBC, therefore, does not recommend special design criteria for concrete elements in conduct with such materials.

Preliminary Pavement Design

Testing and design for preliminary on-site pavement was conducted in accordance with the California Highway Design Manual. Based upon our preliminary sampling and testing, and upon Traffic Indices typical for such projects, it appears that the structural section tabulated below should provide satisfactory pavement for the subject pavement improvements:

AREA	T.I.*	DESIGN R-VALUE	PRELIMINARY SECTION
Car Parking Areas and Access Lanes (ADTT=1)	5.0	50	0.25' AC / 0.35' AB 4.0" PCC / 4.0" AB
Parking and Drive Areas (light vehicular traffic and occasional truck traffic) (ADTT=10)	6.0	50	0.25' AC / 0.35' AB 5.0" PCC / 4.0" AB
Entrance and Service Lanes (ADTT=25)	7.0	50	0.30' AC / 0.45' AB 5.5" PCC / 4.0" AB
AC - Asphalt Concrete AB - Class 2 Aggregate Base PCC-Portland Cement Concrete, MR = 550 psi *Actual Traffic Index should be determined by others			

The above structural section is predicated upon 90 percent relative compaction (ASTM D 1557) of all utility trench backfills and 95 percent relative compaction (ASTM D 1557) of the upper 12 inches of pavement subgrade soils and of any aggregate base utilized. In addition, the aggregate base should meet Caltrans specifications for Class 2 Aggregate Base.

In areas of the pavement which will receive high abrasion loads due to start-ups and stops, or where trucks will move on a tight turning radius, consideration should be given to installing concrete pads. Such pads should be designed utilizing a Traffic Index of 7.0 with a minimum of 5.5-inch thick concrete, with a 4-inch thick aggregate base. Concrete pads are also recommended in areas adjacent to trash storage areas where heavier loads will occur due to operation of trucks lifting trash dumpsters. The recommended 5.5-inch thick portland cement concrete (PCC) pavement section should have a minimum modulus of rupture (MR) of 550 pounds per square inch (psi).

It should be noted that all of the above pavement design was based upon the results of preliminary sampling and testing and should be verified by additional sampling and testing

during construction when the actual subgrade soils are exposed. Improvement of the R-value quality of the soils may be provided through mixing with granular soils observed on-site.

Construction Monitoring

Post investigative services are an important and necessary continuation of this investigation. Project plans and specifications should be reviewed by the project geotechnical consultant prior to construction to confirm that the intent of the recommendations presented herein have been incorporated into the design. Additional expansion index and soluble sulfate testing may be required after the site is rough graded.

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this investigation with the actual subsurface conditions exposed during construction. Items requiring observation and testing include, but are not necessarily limited to, the following:

1. Site preparation-stripping and removals.

2. Excavations, including approval of the bottom of excavation prior to filling.

3. Scarifying and recompacting prior to fill placement.

4. Subgrade preparation for pavements and slabs-on-grade.

5. Placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

6. Foundation excavations.

LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by Land Engineering Consultants, Inc., and their design consultants, for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. If conditions are encountered during the construction of the project which differ significantly from those presented in this report, this firm should be notified immediately in order that we may assess the impact to the recommendations provided. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc., provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report. Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control.

Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc. verifying the suitability of the conclusions and recommendations.

Land Engineering Consultants, Inc. Project No. 13789.1
February 23, 2021

CLOSURE

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please do not hesitate to contact us as your convenience.

Respectfully submitted,
LOR Geotechnical Group, Inc.

Robert M Markoff, CEG 2073
Engineering Geologist

John P. Leuer, GE 2030
President

RMM:JPL:ss

Distribution: Addressee (2) and via email dan@lecincorporated.com

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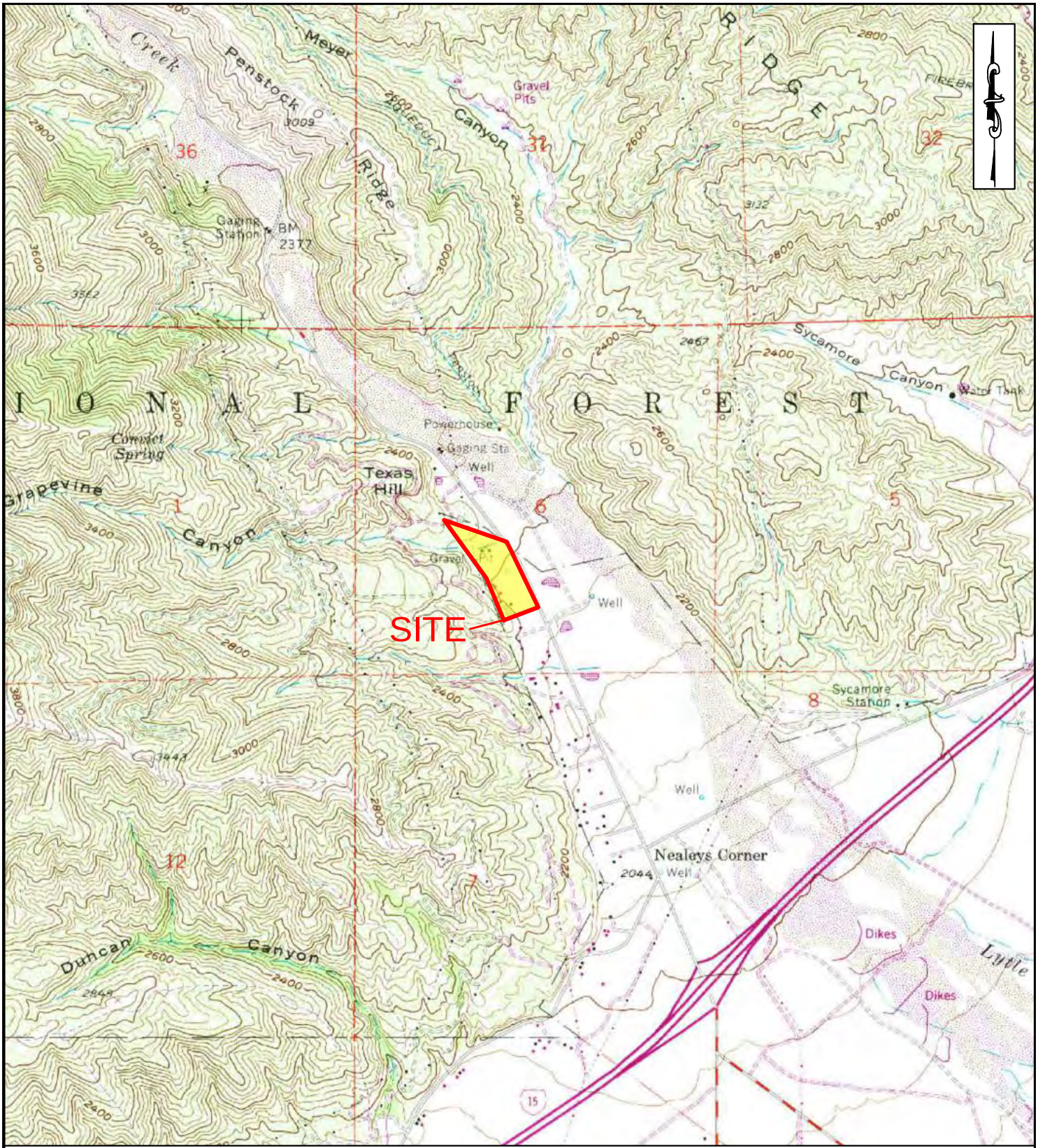
AERIAL PHOTOGRAPHS

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
DATE	**FLIGHT NO.**	**PHOTO NO(S).**	**SCALE 1"=**
1938	W-73	I-3-7, I-3-8, and I-3-9	1,200'
July 9, 1938	AXL 63	75 and 76	1,600'
November 10, 1955	F-34	7-25 and 7-26	1,200'
May 22, 1962	C-16	26 and 27	1,000'
January 1, 1966	C-144	1-22 through 1-25	500'
April 17, 1967	C-132	25, 26	1,000'
February, 1969	C-295	8 and 9	2,000'
January 24, 1972	C-182	1 through 4	1,000'

APPENDIX A

Index Map, Plat, Regional Geologic Maps, Greater Site Area Geologic Map, Photo-Lineament Map, Earthquake Fault Zone Map, and Historical Seismicity Maps



INDEX MAP

PROJECT:	APN 0239-311-01-0000, Lytle Creek, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	A-1
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022
		SCALE:	1" ≈ 2,000'

Legend

(Locations Approximate)

Map Symbols

- **T-6** - Exploratory Trench
- **DRI-2** - Double-Ring Infiltration Test

(Grapevine Creek)

(Lytle Creek Wash)

LYTLE CREEK ROAD

(Qya)

T-1 T-2 T-3 T-4 T-5 T-6

DRI-1 DRI-2

WQMP BASIN
DCV = 28,428 CF
= 26,500 CF
ELEV. = 2187.0

APN 0239-311-02
WELL PARCEL

TRUCK SHOP

STORAGE

EXTRACTION

UTILITY

HOT

OFFICE

TRUCK LANE

PE=2200.0
FF=2200.5

PE=2201.5
FF=2202.0

APPROX. LIMIT OF OVERHEAD POWER LINES

LEACH LINE
EXPANSION LINE

SEPTIC TANK

CENTERLINE OF 200' WIDE SCE TRANSMISSION LINE EASEMENT

EX. STRUCTURE TO BE DEMOLISHED

CENTERLINE OF SCE AND AT&T ACCESS EASEMENT

(Qya)

CONDITIONAL USE PERMIT - SITE PLAN

BEING ALL THAT PORTION OF

LAND ENGINEERING CONSULTANTS, INC. JANUARY, 2022

OWNERS/APPLICANT:
RON SPEARS, APPLICANT
MOUNTAIN AVENUE BEES, INC.
5981 LAYTON STREET
ALTA LOMA, CA 91737
PH: (XXX) XXX-XXXX

ENGINEER/MAP PREPARER:
LAND ENGINEERING CONSULTANTS, INC.
P.O. BOX 541, 630 AVENUE K
CALIMESA, CA. 92320
PH: (909) 795-8862
EMAIL: STEVE@LECINCORPORATED.COM

LOCAL AGENCIES SERVICING THIS AREA:

WATER:
WEST VALLEY WATER DISTRICT
855 W BASELINE ROAD
RIALTO, CA 92376
(909) 875-1804

GAS:
PROPANE

SEWER:
SEPTIC

POWER:
SOUTHERN CALIFORNIA EDISON
1351 E. FRANCIS ST
ONTARIO, CA. 91761
(714) 947-2998

TELEPHONE:
FRONTIER
3281 E. GUASTI RD. #700
ONTARIO, CA 91761
PH: (909) 312-4400

CABLE:
FRONTIER
3281 E. GUASTI RD. #700
ONTARIO, CA 91761
PH: (909) 312-4400

LEGAL DESCRIPTION:
REAL PROPERTY IN THE UNINCORPORATED AREA OF THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

SEE GRANT DEED PER DOC NO: 2020-277602 OF OFFICIAL RECORDS.

PROJECT SCOPE:
THIS PROJECT PROPOSES TO CONSTRUCT TWO APPROXIMATELY 15,000 SF CONCRETE TILT-UP BUILDINGS.

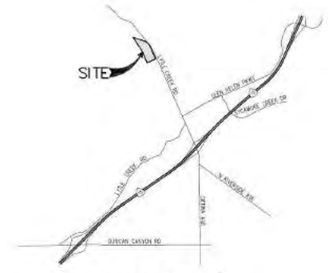
PARKING ANALYSIS:

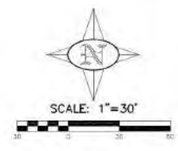
USE:	CHAPTER 83.11:	REQUIRED:	PROVIDED:
OFFICE:	1 SPACE PER 250 SF (1,307/250)	5 SPACES	5 SPACES
WAREHOUSE:	1 SPACE PER 1,000 SF (28,693/1,000)	29 SPACES	29 SPACES
LOADING:	1 SPACE PER 5,000 SF (30,000/5,000)	4 SPACES	2 SPACES
		38 SPACES TOTAL	36 SPACES TOTAL
DISABLED:	TOTAL SPACES BETWEEN 26-50	2 SPACES (1 VAN ACCESS)	2 SPACES

ELECTRIC VEHICLE:

LOT COVERAGE/FLOOR AREA RATIO ANALYSIS:

LANDSCAPING STANDARDS ANALYSIS:





NO.	DATE	REVISION

LEC LAND ENGINEERING CONSULTANTS, INC.
P.O. BOX 541, 630 AVENUE K
CALIMESA, CALIFORNIA 92320
TEL: 909-795-8862 FAX: 909-795-8816
STEVEN H. RITCHEY R.C.E. 51129, EXP. 9/30/23 DATE

PLAT

PROJECT NO.: 13789.1

ENCLOSURE: A-2

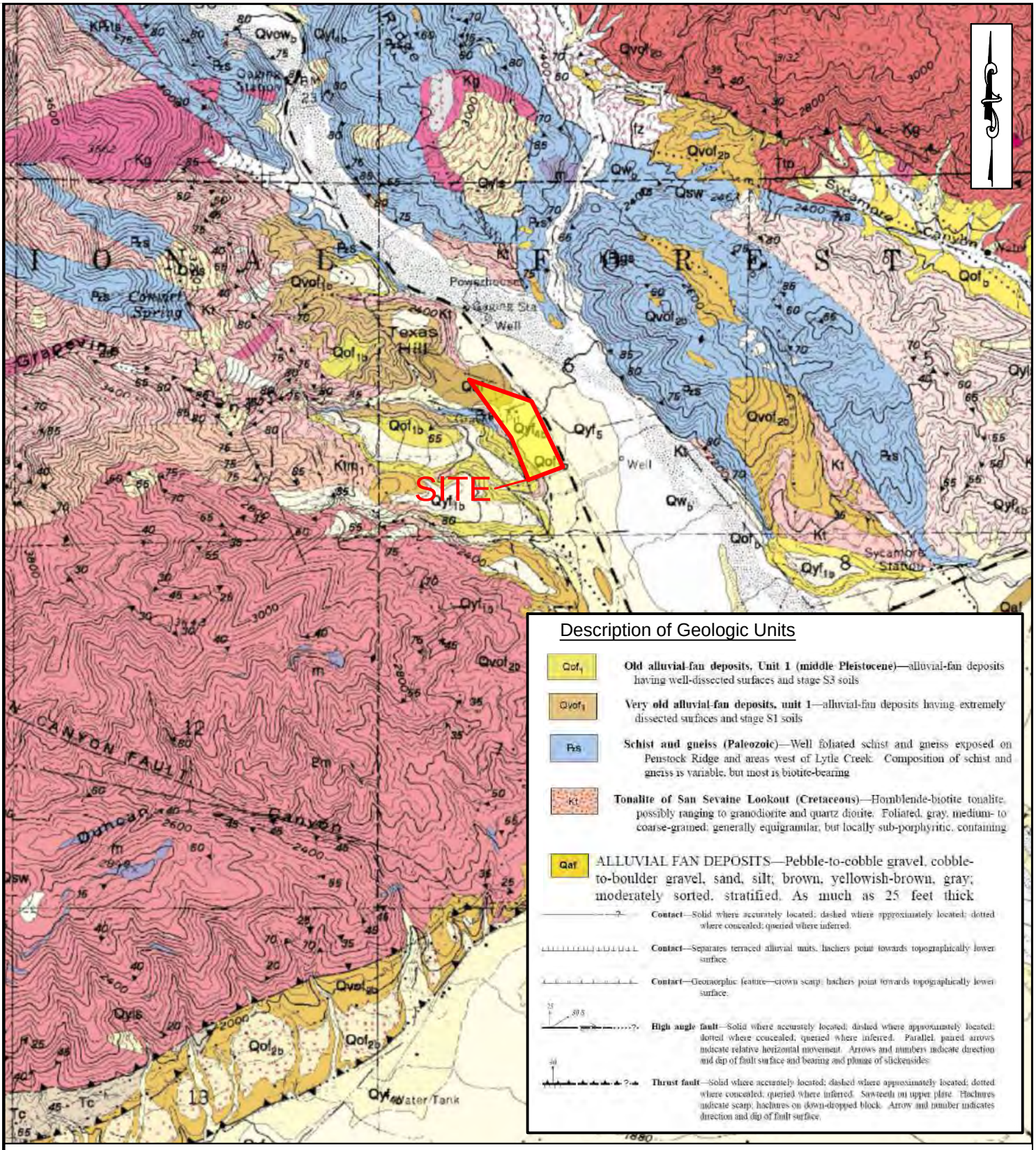
DATE: February 2022

SCALE: 1" ≈ 170'

PROJECT: APN 0239-311-01-0000, Lytle Creek, California

CLIENT: Land Engineering Consultants, Inc.

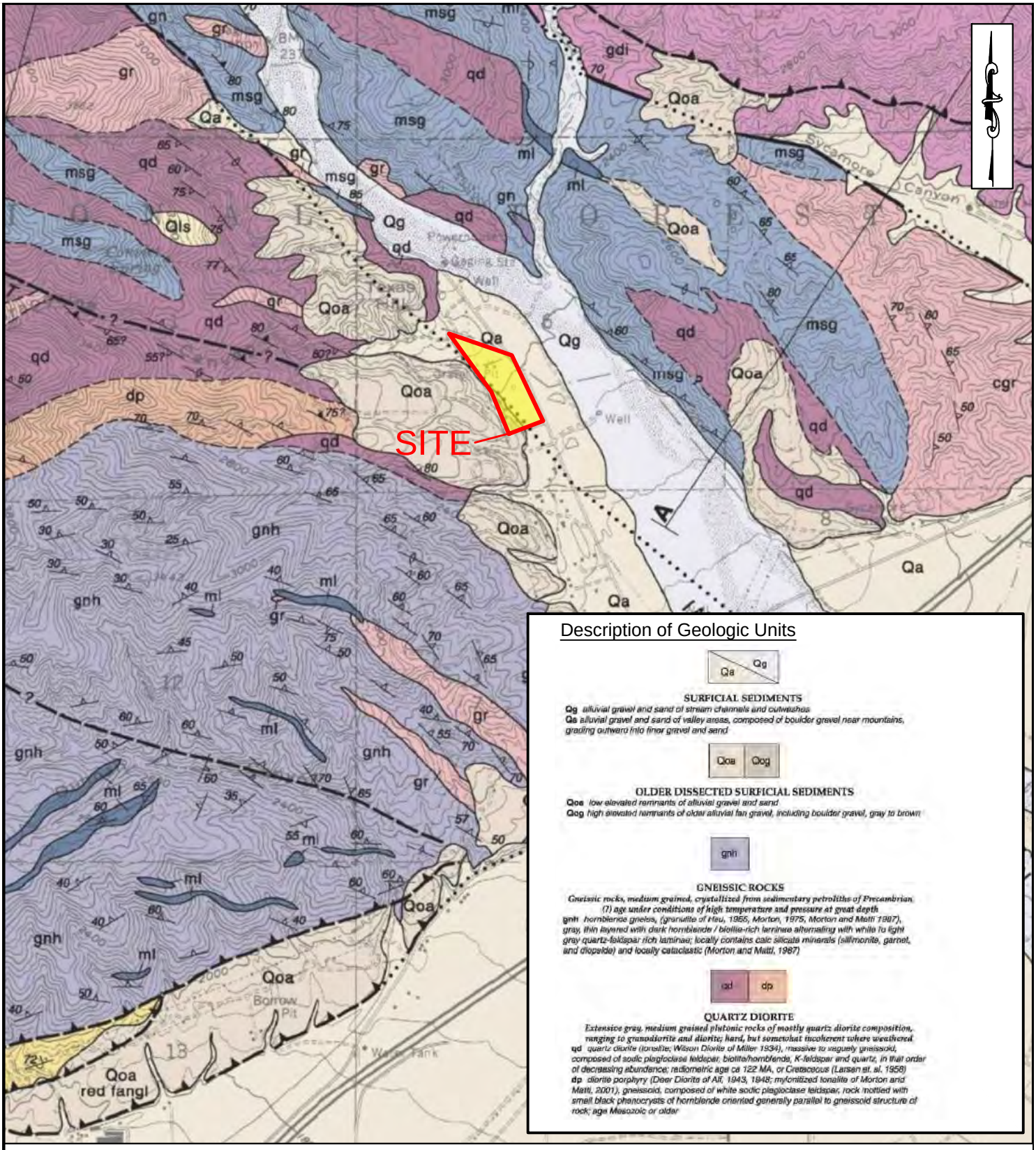
LOR GEOTECHNICAL GROUP, INC.



REGIONAL GEOLOGIC MAP

(Morton and Matti, 2001)

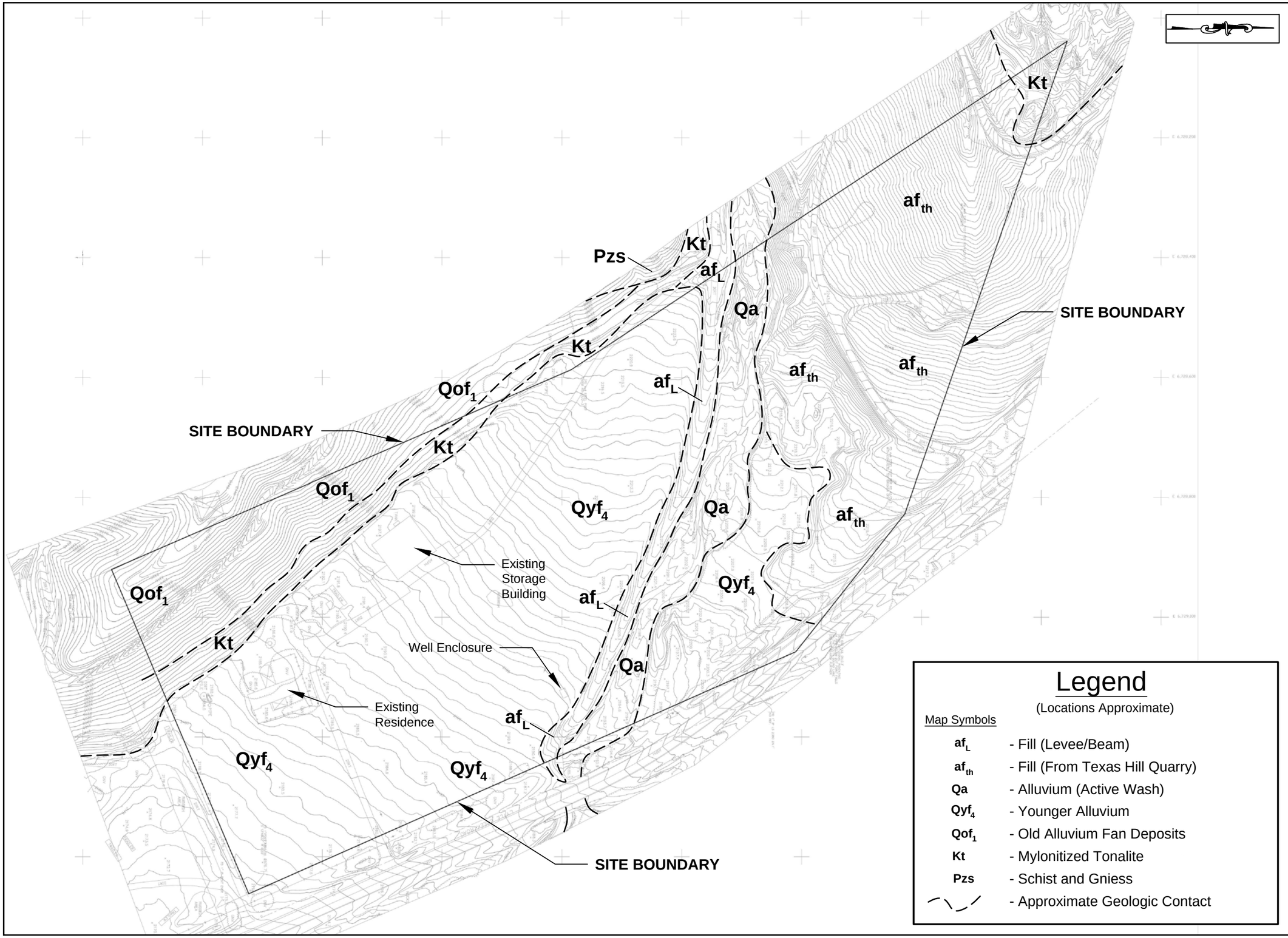
PROJECT:	APN 0239-311-01-0000, Lytle Creek, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	A-3a
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022
		SCALE:	1" ≈ 2,000'



REGIONAL GEOLOGIC MAP

(Dibblee and Minch, 2003)

PROJECT:	APN 0239-311-01-0000, Lytle Creek, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	A-3b
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022
		SCALE:	1" ≈ 2,000'



Legend

(Locations Approximate)

Map Symbols

af_L	- Fill (Levee/Beam)
af_{th}	- Fill (From Texas Hill Quarry)
Qa	- Alluvium (Active Wash)
Qyf_4	- Younger Alluvium
Qof_1	- Old Alluvium Fan Deposits
Kt	- Mylonitized Tonalite
Pzs	- Schist and Gniess
	- Approximate Geologic Contact

GREATER SITE AREA GEOLOGIC MAP

APN 0239-311-01-0000, Lytle Creek, California

Land Engineering Consultants, Inc.

PROJECT NO.:	13789.1
ENCLOSURE:	A-4
DATE:	February 2022
SCALE:	1" ≈ 150'

PROJECT:

CLIENT:

LOR GEOTECHNICAL GROUP, INC.

PHOTO-LINEAMENT MAP

PROJECT: APN 0239-311-01-0000, Lytle Creek, California

CLIENT: Land Engineering Consultants, Inc.

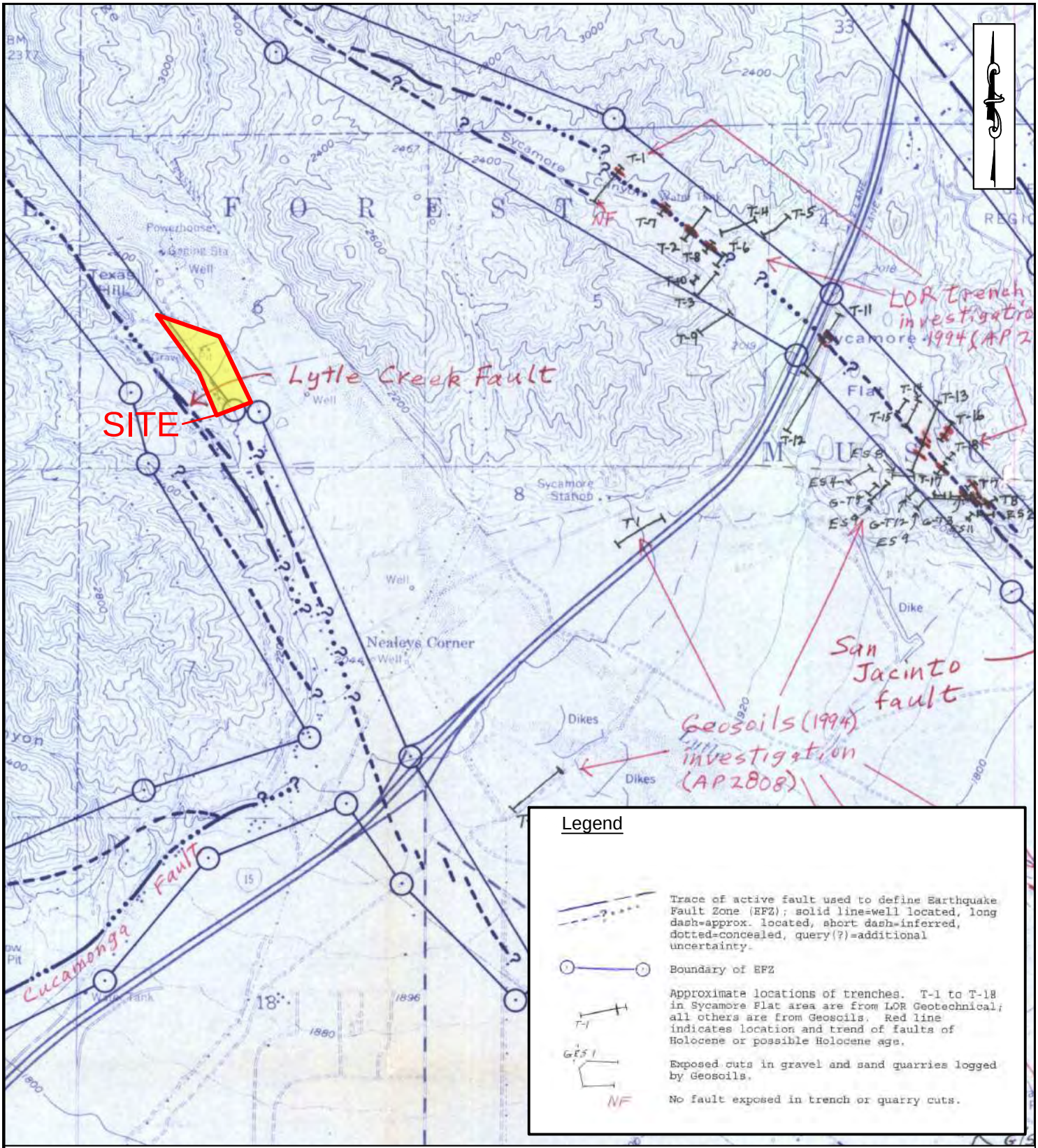
LOR GEOTECHNICAL GROUP, INC.

PROJECT NO.: 13789.1

ENCLOSURE: A-5

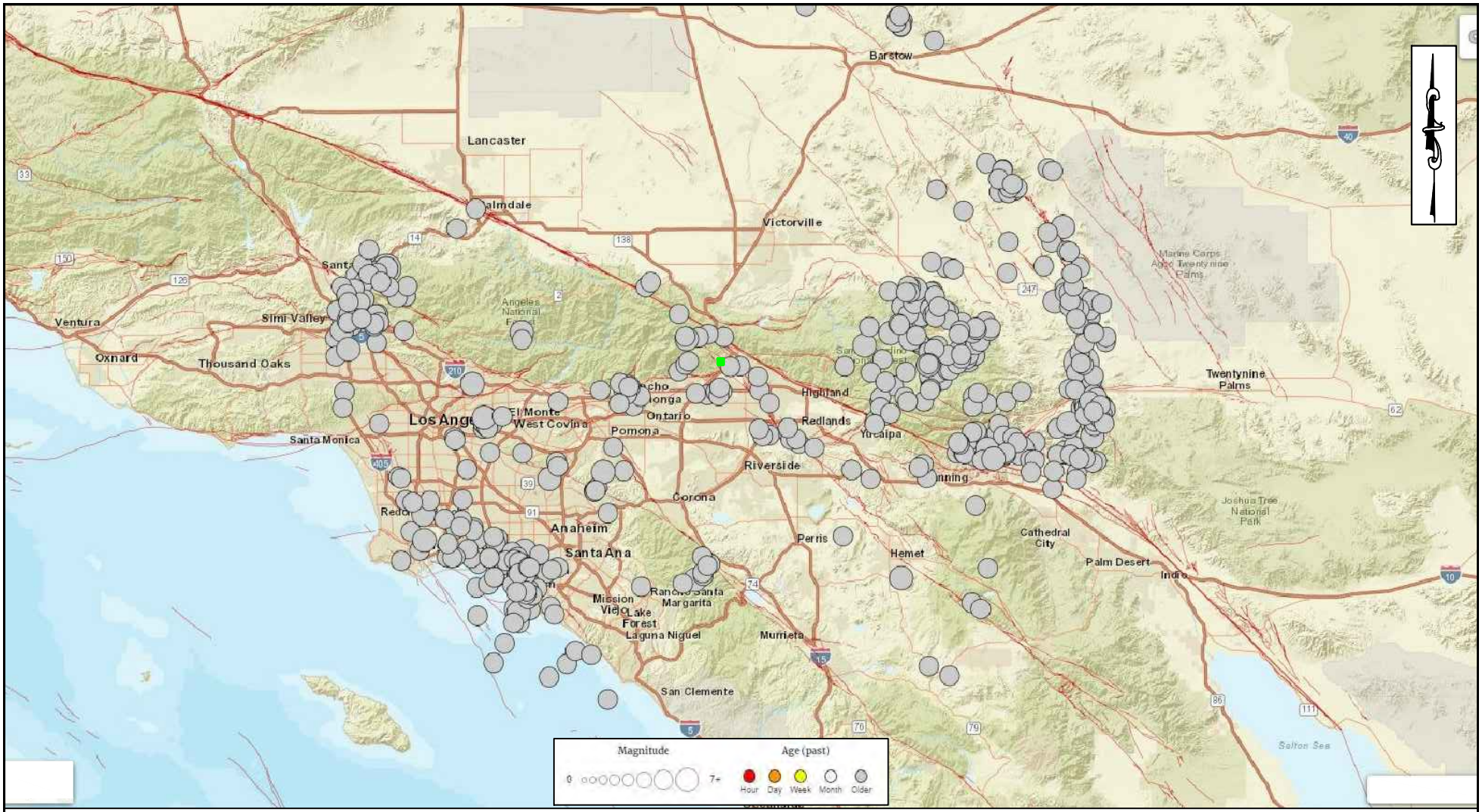
DATE: February 2022

SCALE: 1" ≈ 170'



EARTHQUAKE FAULT ZONE MAP

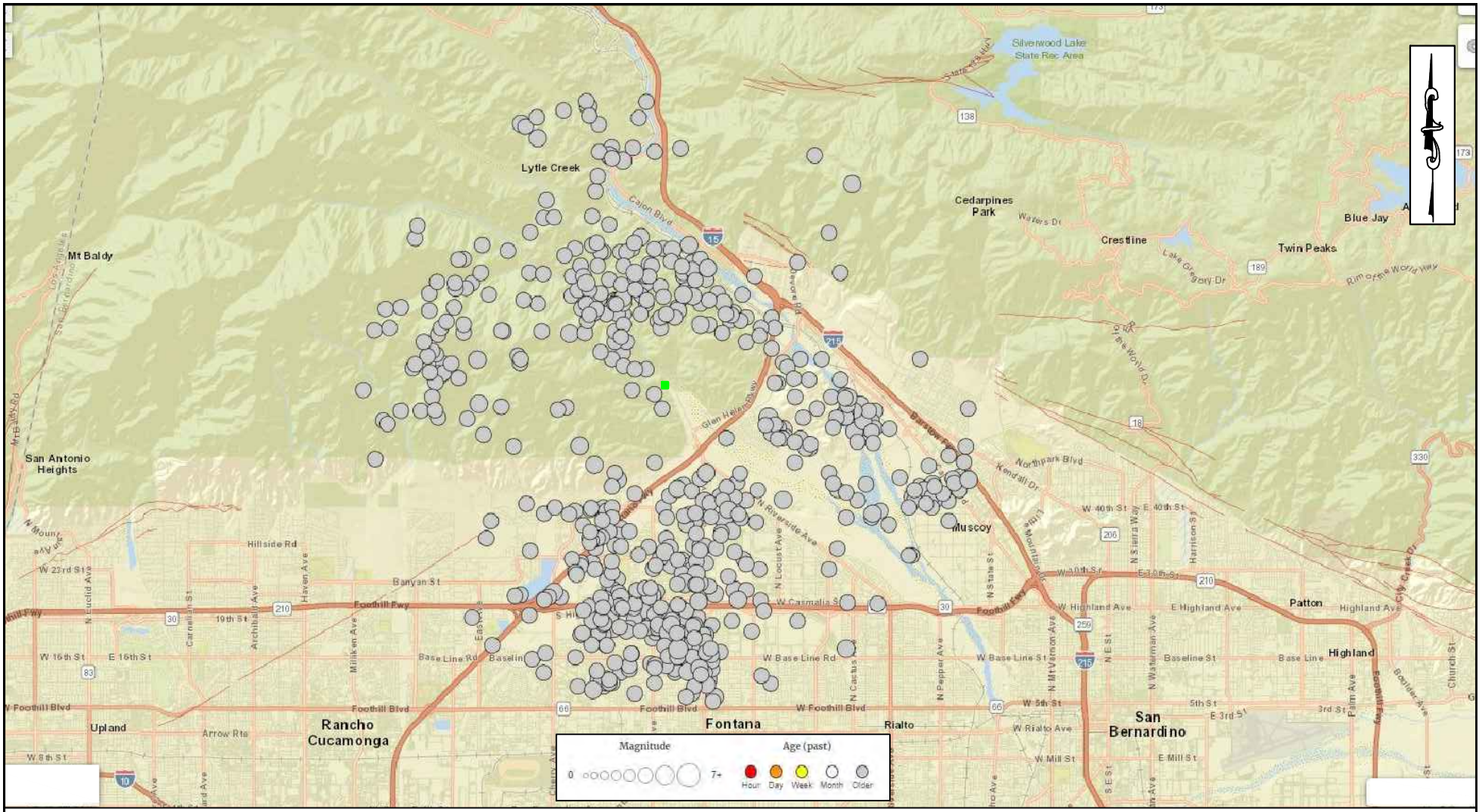
PROJECT:	APN 0239-311-01-0000, Lytle Creek, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	A-6
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022
		SCALE:	1" ≈ 2,000'



U.S. Geologic Survey (2021) real-time earthquake epicenter map. Plotted are 542 epicenters of instrument-recorded events from 01/01/32 to present (02/18/22) of local magnitude 4+ within a radius of ~62 miles (100 kilometers) of the site. Location accuracy varies. The site is indicated by the green square. The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These events are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 100km Radius

PROJECT:	APN 0239-311-01-0000, Lytle Creek, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	A-7
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022
		SCALE:	1" ≈ 40km



U.S. Geologic Survey (2021) real-time earthquake epicenter map. Plotted are 641 epicenters of instrument-recorded events from 01/01/78 to present (02/18/22) of local magnitude 2+ within a radius of ~9.2 miles (15 kilometers) of the site. Location accuracy varies. The site is indicated by the green square. The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These events are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 15km Radius

PROJECT:	APN 0239-311-01-0000, Lytle Creek, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	A-8
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022
		SCALE:	1" ≈ 10km

APPENDIX B

Field Investigation Program and Trench Logs

APPENDIX B
FIELD INVESTIGATION

Subsurface Exploration

Our subsurface exploration of the site consisted of excavating 6 exploratory trenches to depths of approximately 5 to 15 feet beneath the existing ground surface. The approximate locations of the trenches are shown on our Plat, Enclosure A-2, within Appendix A.

The trenching exploration was conducted using a rubber-tire backhoe equipped with a 36-inch bucket. The soils were continuously logged by our geologist who inspected the site, created detailed logs of the trenches, obtained disturbed, soil samples for evaluation and testing, and classified the soils by visual examination in accordance with the Unified Soil Classification System. In-place density tests were taken at select intervals in accordance with the ASTM D 1557, the Sand Cone Method. Bulk samples were obtained at select intervals and returned to our geotechnical laboratory in sealed containers for further testing and evaluation.

All samples obtained were taken to our geotechnical laboratory for storage and testing. Detailed logs of the trenches are presented on the enclosed Trench Logs, Enclosures B-1 and B-6. A Trench Log Legend is presented on Enclosure B-i. A Soil Classification Chart is presented as Enclosure B-ii.

CONSISTENCY OF SOIL

SANDS

SPT BLOWS	CONSISTENCY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Over 50	Very Dense

COHESIVE SOILS

SPT BLOWS	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very Stiff
30-60	Hard
Over 60	Very Hard

SAMPLE KEY

Symbol	Description
	INDICATES CALIFORNIA SPLIT SPOON SOIL SAMPLE INDICATES BULK SAMPLE INDICATES SAND CONE OR NUCLEAR DENSITY TEST INDICATES STANDARD PENETRATION TEST (SPT) SOIL SAMPLE

TYPES OF LABORATORY TESTS

1	Atterberg Limits
2	Consolidation
3	Direct Shear (undisturbed or remolded)
4	Expansion Index
5	Hydrometer
6	Organic Content
7	Proctor (4", 6", or Cal216)
8	R-value
9	Sand Equivalent
10	Sieve Analysis
11	Soluble Sulfate Content
12	Swell
13	Wash 200 Sieve

TRENCH LOG LEGEND

PROJECT:	APN 0239-311-01-0000, San Bernardino, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	B-i
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
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

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	
12"	3"	3/4"	No . 4	No. 10	No. 40	200	

(U.S. STANDARD SIEVE SIZE)

SOIL CLASSIFICATION CHART

PROJECT:	APN 0239-311-01-0000, San Bernardino, California	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ENCLOSURE:**	B-ii
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	February 2022

LOG OF TRENCH T-1

DEPTH IN FEET	LABORATORY TESTS		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0								SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND with GRAVEL, approximately 20% gravel to 3" diameter, 10% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 20% silty fines, brown, damp, loose, heavily bioturbated and contains occasional man-made items (wood, concrete).
	3, 7, 9 10, 11		82	3.0	117.8			SP	@ 1 foot, ALLUVIUM: GRAVELLY SAND, approximately 35% gravel to 3" diameter and occasional cobbles, 15% coarse grained sand, 25% medium grained sand, 20% fine grained sand, 5% silty fines, light brown, damp, crudely stratified, medium dense.
			86	4.7	122.3				
5									below 5± feet, decrease in percentage of cobbles and gravels, mostly clean, medium to coarse grained sand.
10									below 12± feet, includes occasional boulders to 2' diameter, increase in cobbles, occasional thin lenses of SILTY SAND.
15									END OF TRENCH @ 14' due to severe caving Fill to 1' Moderate caving @ 10', heavy below No groundwater No bedrock

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP INC.		**DATE EXCAVATED:**	January 25, 2022
		EQUIPMENT:	JD 410C
		BUCKET WD.: 36	**ENCLOSURE:** B-1

LOG OF TRENCH T-2

DEPTH IN FEET	LABORATORY TESTS		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0								SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND with GRAVEL, approximately 20% gravel to 3" diameter, 10% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 20% silty fines, brown, damp, loose, heavily bioturbated and contains occasional man-made items (wood, concrete).
								SP	@ 1 foot, ALLUVIUM: GRAVELLY SAND, approximately 10% cobbles, 25% gravel, 10% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 5% silty fines, light brown, damp, loose. Likely 1938 flood deposits as it overlies at 0.5±' thick darkened layer (2-2.5'), may be just fill.
			85	3.4	121.6				@ 2.5 feet, ALLUVIUM: GRAVELLY SAND, approximately 25% gravel with 5% cobbles, 15% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 5% silty fines, brown, moist, medium dense, moderately stratified.
5			87	3.8	124.5				below 4 feet, decrease in gravel and cobbles.
10									@ 12± feet, includes minor boulders to 1.5' diameter and local, dark, micaceous SILTY SAND lenses/layers.
15									END OF TRENCH @ 15' Fill to 2.5±' Moderate to heavy caving No groundwater No bedrock

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP INC.		**DATE EXCAVATED:**	January 25, 2022
		EQUIPMENT:	JD 410C
		BUCKET WD.: 36	**ENCLOSURE:** B-2

LOG OF TRENCH T-3

DEPTH IN FEET	LABORATORY TESTS		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	3, 7, 8, 9, 10, 11							SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND with GRAVEL, approximately 20% gravel to 3" diameter, 10% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 20% silty fines, brown, damp, loose, heavily bioturbated and contains occasional man-made items (wood, concrete).
	3, 7, 9 10, 11		82	6.2	112.6			SP	@ 2 feet, ALLUVIUM: GRAVELLY SAND, approximately 20% gravel to 3" diameter, 20% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 5% silty fines, brown, damp, medium dense, moderately well stratified, overall decrease in gravel with increase in depth.
			88	7.5	120.1				
5									below 6 feet, includes cobbles and small boulders (average 1.5' diameter with one to 3.5' maximum diameter), local SILTY SAND (yellowish-brown and/or dark brown) amongst boulders, very difficult digging.
10									END OF TRENCH @ 11' due to severe caving Fill to 2' Heavy caving No groundwater No bedrock
15									

TEST DATA

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP INC.		**DATE EXCAVATED:**	January 25, 2022
		EQUIPMENT:	JD 410C
		BUCKET WD.: 36	**ENCLOSURE:** B-3

LOG OF TRENCH T-4

DEPTH IN FEET	LABORATORY TESTS		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0								SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 15% gravel to 2" diameter, 10% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 20% silty fines, brown to dark brown, moist, loose to medium dense, includes occasional small roots (to 1/4" diameter), portions of unit appear to be recent flood deposits, sharp lower contact, upper 1.5± ' heavily bioturbated.
			84	5.0	114.8			SP	@ 2.5 feet, ALLUVIUM: GRAVELLY SAND, approximately 20% gravel, 15% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 5% silty fines, brown, damp, stratified, medium dense.
5			88	4.1	120.5				
									below 9± feet, includes occasional small boulders to (1.5' diameter) and cobbles, hard digging.
10									END OF TRENCH @ 11.5' due to severe caving Fill to 2.5' Heavy caving No groundwater No bedrock
15									

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP INC.		**DATE EXCAVATED:**	January 25, 2022
		EQUIPMENT:	JD 410C
		BUCKET WD.: 36	**ENCLOSURE:** B-4

LOG OF TRENCH T-5

DEPTH IN FEET	LABORATORY TESTS		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0								SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 15% gravel, 15% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 15% silty fines, brown, damp, loose, heavily bioturbated.
			84	2.8	115.4			SP	@ 2 feet, ALLUVIUM: GRAVELLY SAND, approximately 25% gravel with trace of cobbles, 10% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 5% silty fines.
			87	4.5	118.9				@ 4 to 4.5± feet, thin, moist, finer grained sand with silt layer.
5									below 8 feet, includes minor cobbles and boulders to 1.5' diameter.
10									@ 12 feet, increase in boulders, includes occasional thin, dark brown, fine to medium grained sand with silt layers/lenses, difficult digging.
15									END OF TRENCH @ 15' Fill to 2' Heavy caving No groundwater No bedrock

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP INC.		**DATE EXCAVATED:**	January 25, 2022
		EQUIPMENT:	JD 410C
		BUCKET WD.: 36	**ENCLOSURE:** B-5

LOG OF TRENCH T-6

DEPTH IN FEET	LABORATORY TESTS		ESTIMATED COMPACTION (%)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
			TEST DATA						
0								SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND with GRAVEL and man-made debris, approximately 15% gravel with occasional pieces of wood and pieces of concrete to 2' maximum diameter, 15% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 15% silty fines, brown, damp, loose.
			90	4.9	123.0			SP	@ 3± feet, ALLUVIUM: GRAVELLY SAND, approximately 25% gravel, 15% coarse grained sand, 30% medium grained sand, 25% fine grained sand, 5% silty fines, brown, damp, medium dense, crudely stratified.
5									END OF TRENCH @ 5' Fill to 3±' Minor caving No groundwater No bedrock

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants, Inc.	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP INC.		**DATE EXCAVATED:**	January 25, 2022
		EQUIPMENT:	JD 410C
		BUCKET WD.: 36	**ENCLOSURE:** B-6

APPENDIX C

Laboratory Testing Program and Test Results

APPENDIX C
LABORATORY TESTING

General

Selected soil samples obtained from our trenches were tested in our geotechnical laboratory to evaluate the physical properties of the soils affecting foundation design and construction procedures. The laboratory testing program performed in conjunction with our investigation included moisture content, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, and soluble sulfate content. Descriptions of the laboratory tests are presented in the following paragraphs:

Moisture Density Tests

The moisture content and dry density information provides an indirect measure of soil consistency for each stratum, and can also provide a correlation between soils on this site. The dry unit weight and field moisture content were determined and the results are shown on the Trench Logs, Enclosures B-1 through B-6, for convenient correlation with the soil profile.

Laboratory Compaction Characteristics

Selected soil samples were tested in the laboratory to determine compaction characteristics using the ASTM D 1557 compaction test method. The results are presented in the following table:

LABORATORY COMPACTION				
Trench Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Maximum Dry Density (pcf)**	**Optimum Moisture Content (percent)**
T-1	2-4	(SP) Gravelly Sand	143.0	5.0
T-3	0-2	(SM) Silty Sand ith Gravel	134.0	7.0
T-3	2-5	(SP) Gravelly Sand	137.0	8.0

Direct Shear Tests

Shear tests are performed with a direct shear machine in general accordance with ASTM D 3080 at a constant rate-of-strain (usually 0.04 inches/minute). The machine is designed to test a sample partially extruded from a sample ring in single shear. Samples are tested at varying normal loads in order to evaluate the shear strength parameters, angle of internal friction and cohesion. Samples are tested in a remolded condition (90 percent relative compaction per ASTM D 1557) and soaked, to represented the worse case conditions expected in the field.

The results of the shear tests are presented in the following table:

DIRECT SHEAR TESTS				
Trench Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Angle of Internal Friction (degrees)**	**Apparent Cohesion (psf)**
T-1	2-4	(SP) Gravelly Sand	42	0
T-3	0-2	(SM) Silty Sand with Gravel	40	100
T-3	2-5	(SP) Gravelly Sand	45	0

Sieve Analysis

A quantitative determination of the grain size distribution was performed for selected samples in accordance with the Caltrans Test Number 202 laboratory test procedure. The determination is performed by passing the soil through a series of sieves, and recording the weights of retained particles on each screen. The results of the sieve analyses are presented graphically on Enclosure C-1.

Sand Equivalent

The sand equivalent of selected soils were evaluated using the California Sand Equivalent Test Method, Caltrans Number 217. The results of the sand equivalent tests are presented in the following table:

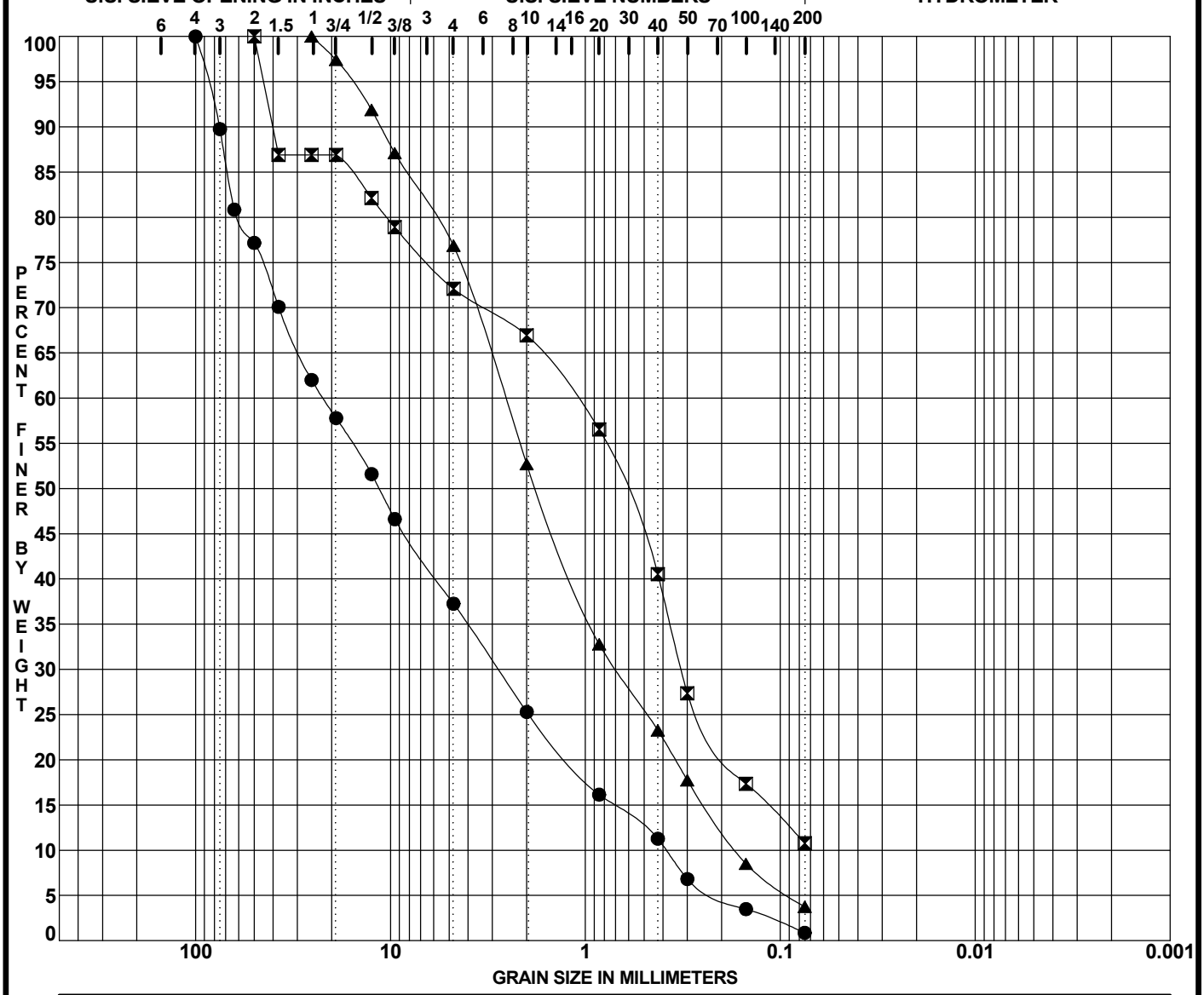
R-Value Test

Soil samples were obtained at the probable pavement subgrade level and sieve analysis and sand equivalent tests were conducted. Based on these indicator tests, a selected soil sample was tested to determine its R-value using the California R-Value Test Method, Caltrans Number 301. The result of the R-value test is presented on Enclosure C-1.

Soluble Sulfate Content Tests

The soluble sulfate content of selected subgrade soils were evaluated. The concentration of soluble sulfates in the soils was determined by measuring the optical density of a barium sulfate precipitate. The precipitate results from a reaction of barium chloride with water extractions from the soil samples. The measured optical density is correlated with readings on precipitates of known sulfate concentrations. The test results are presented on the following table:

SOLUBLE SULFATE CONTENT TESTS			
Trench Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Sulfate Content (percent by weight)**
T-1	2-4	(SP) Gravelly Sand	< 0.005
T-3	0-2	(SM) Silty Sand with Gravel	< 0.005
T-3	2-5	(SP) Gravelly Sand	< 0.005



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Soil Classification	SE	RV	PL	PI	Cc	Cu
●	T-1	@ 2-4'	(SP) Gravelly Sand	84	--			0.93	57.5
⊠	T-3	@ 0-2'	(SM) Silty Sand with Gravel	50	53			1.32	16.3
▲	T-3	@ 2-5'	(SP) Gravelly Sand	70	--			1.10	15.5

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	T-1	@ 2-4'	100.00	22.13	2.810	0.3849	52.5	36.4	0.9	
⊠	T-3	@ 0-2'	50.00	1.13	0.322		27.9	61.3	10.8	
▲	T-3	@ 2-5'	25.40	2.60	0.694	0.1679	23.1	73.1	3.7	

PROJECT:	APN 0239-311-01-0000	**PROJECT NO.:**	13789.1
CLIENT:	Land Engineering Consultants	**DATE:**	February 2022

GRADATION CURVES

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: C-1

APPENDIX D

Terra Geosciences Geophysical Investigation Report

TERRA GEOSCIENCES

GEOPHYSICAL SURVEY

PROPOSED COMMERCIAL / LIGHT INDUSTRIAL PROJECT

ASSESSOR'S PARCEL NO. 0239-311-01-0000

LYTLE CREEK, SAN BERNARDINO COUNTY, CALIFORNIA

Project No. 213747-1

December 17, 2021

Prepared for:

LOR Geotechnical Group, Inc.
6121 Quail Valley Court
Riverside, CA 92507

Consulting Engineering Geology & Geophysics

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LOR Geotechnical Group, Inc.
6121 Quail Valley Court
Riverside, CA 92507

Attention: Mr. Robb Markoff

Regarding: Geophysical Survey
Proposed Commercial / Light Industrial Project
Assessor's Parcel No. 0239-311-01-0000
Lytle Creek, San Bernardino County, California
LOR Project No. 13789.1

INTRODUCTION

In accordance with your request, we have completed a geophysical survey using the seismic refraction method across a portion of the subject site, as referenced above. We understand that since the San Jacinto Fault traverses within the vicinity of the site, non-invasive geophysical methods have been deemed appropriate to aid in evaluating the subsurface geological structure, with respect to any faulting potentials that may impact the proposed development. This report will describe in detail the seismic refraction methodology, field procedures used, data processing of the various seismic modeling programs utilized, and the results of this survey, along with the representative seismic models being presented within Appendices A and B for visual and reference purposes. As authorized by you, the following services were performed during this study:

- ***Review of available pertinent published and unpublished geologic and geophysical data in our files pertaining to the site, along with a field reconnaissance.***
- ***Conducting a geophysical survey, using the seismic refraction method, to aid in evaluating the deeper subsurface lithology and geologic structure present beneath the subject site. The field survey and the data analysis were performed by a licensed State of California Professional Geophysicist.***
- ***Preparation of representative seismic models for the seismic traverse displaying the subsurface geologic structure using various computer data analysis programs for both comparative and quality control purposes.***
- ***Preparation of this report, presenting the results of our interpretation of the geophysical data with respect to any possible anomalous structural features at depth.***

Accompanying Map, Illustrations, and Appendices

Plate 1 - Seismic Line Location Map
Plate 2 - Google™ Earth Imagery Map
Appendix A - Layer Velocity Model
Appendix B - Refraction Tomographic Model
Appendix C - References

PROJECT SUMMARY

As requested, we have performed a geophysical survey using the seismic refraction method across a selected portion of the subject property, as referenced above. The purpose of this geophysical study was to provide both a qualitative and quantified geophysical analysis of the subsurface geologic structure and lithologic composition, using the seismic refraction method, in order to discern and any anomalous geologic structures that may be related to faulting beneath the subject site where locally surveyed. Our study involved using various seismic refraction computer modeling programs for both quality control and comparative purposes, which allowed for an unbiased and more thorough analysis. Each of these modeling programs, as described in more detail further in this report, have both strengths and limitations and it was our intention to compare these models to form a more coherent representation of the interpreted subsurface geologic structure.

The location of our seismic traverse was accomplished by use of the Google™ Earth imagery (2021) and Terrain Navigator mapping software (Maptech, 2021), supplemented with GPS (Global Positioning System) coordinates. The traverse location of Seismic Line S-1 was selected in the field based on site topography, physical obstructions, and proposed development coverage. An attempt was made to keep a near-perpendicular orientation to the local fault trend.

From a geologic standpoint, the subject property (where locally surveyed) has been mapped by Morton and Matti (2001) to be surficially mantled by unconsolidated to moderately consolidated Holocene and late Pleistocene age alluvial fan deposits, being directly underlain by progressively older and more consolidated alluvial fan deposits. Based on extrapolation of their geological mapping, these alluvial fan deposits are in turn presumably underlain at depth by cretaceous age granitic rocks (mapped just beyond the beginning of our seismic traverse to the west) comprised of a medium- to coarse-grained hornblende-biotite tonalite.

SUMMARY OF SEISMIC REFRACTION SURVEY

Methodology

The seismic refraction method is well suited to identify whether there is a distinct velocity change at depth that could represent a possible subsurface structural differential. The seismic refraction method consists of measuring (at known points along the surface of the ground) the travel times of compressional waves generated by an impulsive energy source and can be used to estimate the layering, structure, and seismic acoustic velocities of subsurface horizons. Seismic waves travel down and through the soils and rocks, and when the wave encounters a contact between two earth materials having different velocities, some of the wave's energy travels along the contact at the velocity of the lower layer.

The fundamental assumption is that each successively deeper layer has a velocity greater than the layer immediately above it. As the wave travels along the contact, some of the wave's energy is refracted toward the surface where it is detected by a series of motion-sensitive transducers (geophones). The arrival time of the seismic wave at each of the geophone locations can be related to the relative seismic velocities of the subsurface layers in feet per second (fps), which can then be used to aid in interpreting both the depth and type of materials encountered.

Field Procedures

One seismic refraction line was performed (Seismic Line S-1) within the southern portion of the site as directed. This traverse was oriented in a North 59° East direction, being in a near-perpendicular orientation to the local trend of the San Jacinto Fault that traverses through the region. Although the traverse was not surveyed, the location, as presented on Plates 1 and 2, is considered to be fairly accurate, based on the Google™ Earth imagery (2021), physical structures, and GPS coordinates. The survey line consisted of overlapping two individual 230-foot spreads (each with 24, 14-hertz geophones), using 10-foot spacings, with six overlapped geophones in between each spread. This created a combined continuous survey profile of 430 feet in length. Seven shot points were utilized along each spread using forward, reverse, and intermediate locations in order to obtain high resolution survey data for velocity analysis and depth modeling purposes. To produce the necessary seismic wave energy, a 16-pound sledge-hammer was used as the energy source to detect both the direct and refracted waves. Each shot point used multiple hammer impacts to increase the signal to noise ratio, which provided clearer first “P”-Wave arrivals.

The seismic wave arrivals were digitally recorded in SEG-2 format on a Geometrics StrataVisor™ NZXP model signal enhancement refraction seismograph. The data was acquired using a sampling rate of 0.0625 milliseconds having a record length of 0.10 seconds with no acquisition filters to preserve the raw wave-forms. The data on the paper record and/or display screen were used to analyze the arrival time of the primary seismic “P”-Waves at each geophone station for quality control purposes in the field. Each geophone and seismic shot location were surveyed using a hand level and ruler for relative topographic correction, with “0” representing the lowest elevation point along the line.

Data Reduction

All of the recorded seismic data was subsequently transferred to our office computer for further processing, analyzing, and printing purposes, using the computer programs **SIPwin** (**S**eismic Refraction **I**nterpretation **P**rogram for **Win**dows) developed by Rimrock Geophysics, Inc. (2004); **Refractor** (Geogiga, 2001-2020); and **Rayfract™** (Intelligent Resources, Inc., 1996-2021). The associated subsurface profile models for each of these computer modeling programs are presented within Appendices A and B for visual and reference purposes.

- **SIPwin** is a ray-trace modeling program that evaluates the subsurface using layer assignments based on time-distance curves and is better suited for layered media, using the "Seismic Refraction Modeling by Computer" method (Scott, 1973). The first step in the modeling procedure is to compute layer velocities by least-squares techniques. Then the program uses the delay-time method to estimate depths to the top of layer-2. A forward modeling routine traces rays from the shot points to each geophone that received a first-arrival ray refracted along the top of layer-2. The travel time of each such ray is compared with the travel time recorded in the field by the seismic system. The program then adjusts the layer-2 depths so as to minimize discrepancies between the computed ray-trace travel times and the first arrival times picked from the seismic waveform record. The process of ray tracing and model adjustment is repeated a total of three times to improve the accuracy of depths to the top of layer-2.

- **Refractor** is seismic refraction software that also evaluates the subsurface using layer assignments utilizing interactive and interchangeable analytical methods that include the Delay-Time method, the Plus-Minus method, and the Generalized Reciprocal Method (GRM). They are described as follows: The Delay-Time method will measure the delay time depth to a refractor beneath each geophone rather than at shot points. Delay-time is the time spent by a wave to travel up or down through the layer (slant path) compared to the time the wave would spend if traveling along the projection of the slant path on the refractor. The Plus-Minus time analysis method includes a Plus time analysis for depth analysis and a Minus time analysis for velocity determination. The basis of the Plus-Minus time analysis method lies in the traveltime reciprocity, i.e., the traveltime of a seismic wave from source to receiver is equal to the traveltime in the opposite direction if source and receiver are interchanged. It can be used to calculate the depth and velocity variations of an undulating layer boundary for slope angles less than ~10°. The GRM method is a technique for delineating undulating refractors at any depth from in-line seismic refraction data consisting of forward and reverse travel-times and is capable of resolving dips of up to 20% and does not over-smooth or average the subsurface refracting layers. In addition, the technique provides an approach for recognizing and compensating for hidden layer conditions.

- **Rayfract™** is seismic refraction tomography software that models subsurface refraction, transmission, and diffraction of acoustic waves which generally indicates the relative structure and velocity distribution of the subsurface using first break energy propagation modeling. An initial 1D gradient model is created using the Delta-t-V method which gives a good initial fit between modeled and picked first breaks. This initial model is then refined automatically with a true 2D WET (Wavepath Eikonal Traveltime) tomographic inversion (Schuster and Quintus-Bosz, 1993). WET tomography models multiple signal propagation paths contributing to one first break, whereas conventional ray tracing tomography is limited to the modeling of just one ray per first break.

The combined use of these computer programs provided a more thorough analysis of the subsurface geologic and lithologic structure, and the seismic velocity characteristics, with respect to identifying any anomalous features that may be suggestive of subsurface faulting. Each computer program has a specific purpose based on the objective of the analysis. **Rayfract™** provided tomographic velocity and structural imaging that is very conducive to detecting strong lateral velocity characteristics, while **SIPwin** and **Refractor** are generally based on detecting layered media with some lateral velocity contrast being imaged.

All of the computer programs performed their analysis using exactly the same input data which includes first-arrival "P"-waves and survey line geometry. The resultant travel-time curve (Time-Distance Plot) that was developed from picking of the primary seismic "P"-wave data is presented below on Figure 1 for reference.

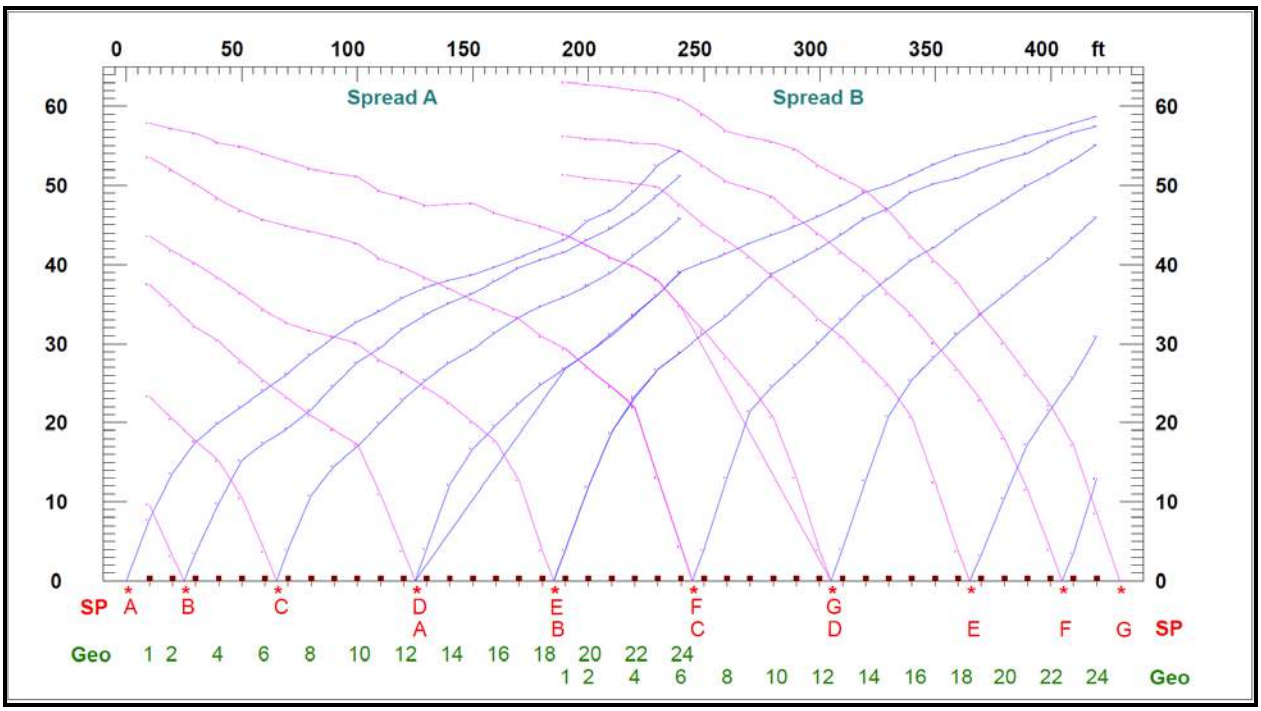


FIGURE 1- Time Distance Plot (S-1).

SUMMARY OF DATA ANALYSIS

As previously discussed, the primary purpose of the seismic refraction survey was to aid in evaluating any possible anomalous geologic structures and/or lithologic variabilities at depth such as offset stratigraphic units (i.e., lateral velocity contrasts) that may be suggestive of subsurface faulting. For this survey we used three different computer processing software programs in order to provide a more thorough analysis of the seismic data of which are described in more detail below, along with the seismic models being presented within Appendices A and B for visual and reference purposes.

- ***Layer Velocity Model:***

  The Layer Velocity Model is a more traditional approach to modeling the subsurface and was analyzed using the computer program **SIPwin** and **Refractor** of which a composite model was produced as presented in Appendix A. Based on the model derived from these programs, two distinct seismic velocity layers were encountered.

  The uppermost velocity layer V1 is comprised of loose and unconsolidated younger alluvial type materials that have an average weighted velocity of 1,296 fps, being up to 12± feet in thickness. Directly underlying the surficial materials is the V2 velocity layer that has an average weighted velocity of 3,952 fps, which most likely represents slightly-consolidated relatively older alluvial materials possibly of early Holocene to late Pleistocene age. It should be noted that this velocity range is also representative of weathered granitic bedrock materials also. The deeper V3 velocity layer underlying the subject property at depth, has an average weighted velocity of 7,641 fps, which appears to consist of crystalline granitic bedrock.

- ***Refraction Tomographic Model:***

  The **Rayfract™** tomographic model does not create discrete velocity layers or boundaries but rather produces a "smoothed" tomographic image that displays the velocity gradient within the limits of the seismic wave ray coverage that was sampled. The data appeared to be of good quality which was verified by the Root Mean Square Error (RMS) that is displayed on the tomographic model. The RMS error (misfit between picked and modeled first break times) is automatically calculated during the processing routine, with a value of less than 5.0% being preferred. The resultant model obtained value of 1.7%. Based on the tomographic model presented within Appendix B, generally consistent relatively planar velocity structural contours are depicted with the velocity gradient gradually increasing with depth.

SUMMARY OF FINDINGS AND CONCLUSIONS

The raw field data was considered to be of good quality with little amounts of ambient "noise" being introduced during our survey. Therefore, analysis of the data and picking of the primary "P"-wave arrivals was therefore performed with little difficulty. Based on the results of our comparative seismic analyses of the computer programs **SIPwin**, **Refractor**, and **Rayfract™**, the seismic refraction survey line models appear to generally coincide with one another, with some minor variances due to the methods that these programs process and integrate the input data.

Based on the layer velocity profiles, it appears that there is a generally thin mantle (up to 12± feet) of loose, unconsolidated younger alluvial materials overlying the site, with the underlying V2 velocity layer most likely consisting of progressively older and denser alluvial deposits. It is possible that this velocity layer could also represent weathered granitic bedrock but based on the subsurface geomorphic expression and the great

thickness along the eastern portion of the survey traverse, this layer is most likely older alluvial fan deposits. Additionally, it is also possible that since the average velocity of this layer is representative of both older alluvial deposits and weathered bedrock, there may be some combination of both units in the V2 layer that are not discernable. The lower deposit (V3), underlying the site at depth, is believed to consist of Cretaceous age crystalline granitic bedrock, such as exposed just to the west of the seismic traverse.

The refraction tomographic model revealed overall relatively planar structural velocity contouring with a minor inflection at a distance of around 175 to 200± feet (at a depth of around 25-40± feet), which is also depicted on the layer velocity model along the V2/V3 boundary contact at approximately the same distance/depth interval. This feature on both models appears to represent natural channel scouring and deposition along the bedrock contact at depth and is not suggestive of faulting, as deeper structural velocity contouring is not disrupted on the tomographic model.

In summary, based on the data obtained, there do not appear to be any observable anomalous conditions from a geophysical standpoint that would suggest that subsurface faulting is present within the limits of our survey traverse (i.e., lateral velocity contrasts and/or or other lithologic differentials).

CLOSURE

The field survey was performed by the undersigned on December 11, 2021 using "state of the art" geophysical equipment and techniques along the selected portion of the subject study area. The seismic data was evaluated using various seismic inversion computer programs, including using recently developed tomographic inversion techniques to provide a more thorough analysis and understanding of the subsurface structural conditions.

It is important to understand that the fundamental limitation for seismic refraction surveys is known as nonuniqueness, wherein a specific seismic refraction data set does not provide sufficient information to determine a single “true” earth model. Therefore, the interpretation of any seismic data set uses “best-fit” approximations along with the geologic models that appear to be most reasonable for the local area being surveyed. It should be noted that estimates of the layer velocity boundaries are generally considered to be within 10± percent of the total depth of the contact.

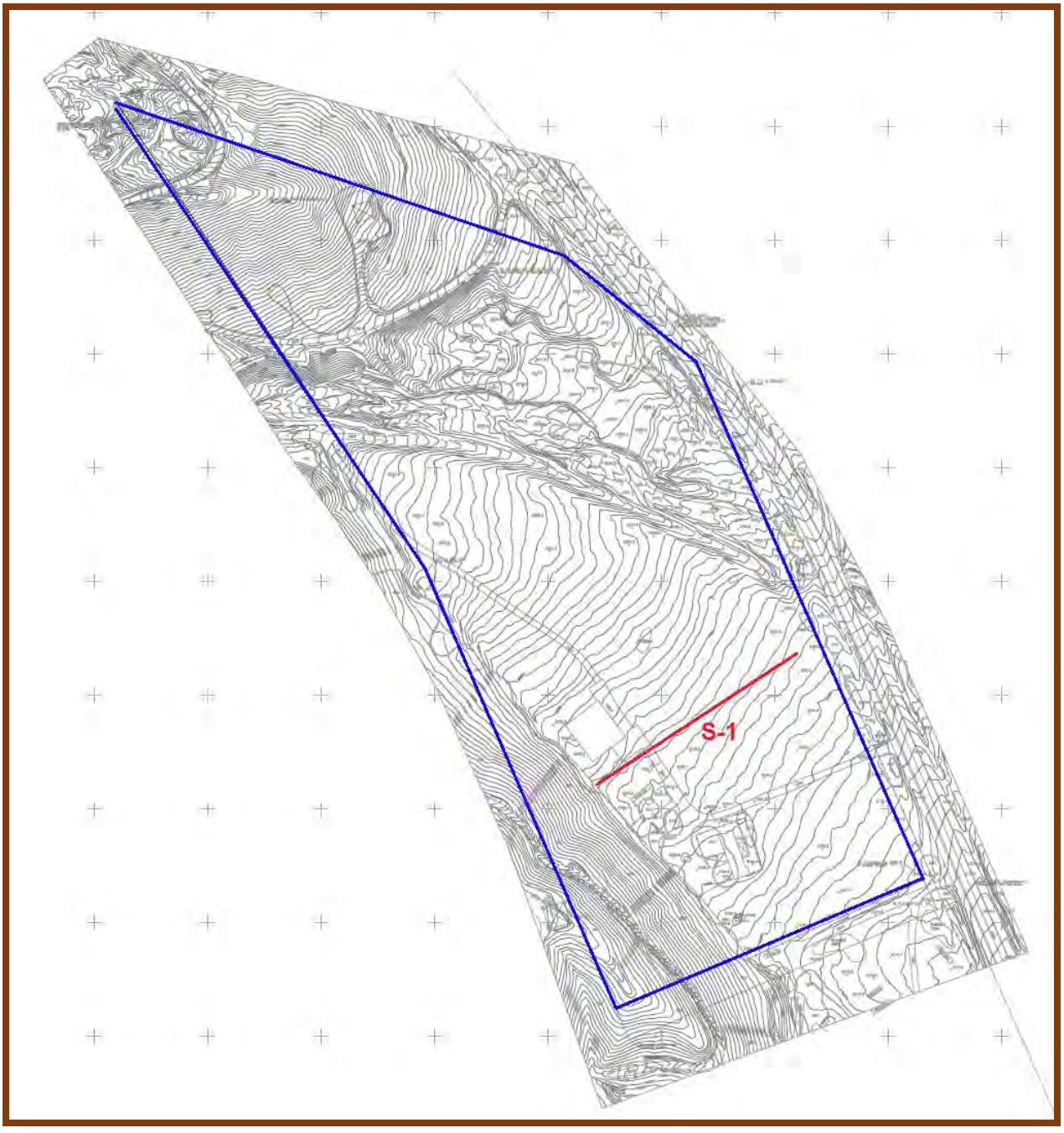
Client should also understand that when using the theoretical geophysical principles and techniques discussed in this report, sources of error are possible in both the data obtained and, in the interpretation and that the results of this survey may not represent actual subsurface conditions. These are all factors beyond ***Terra Geosciences*** control and no guarantees as to the results of this survey can be made. We make no warranty, either expressed or implied. If the client does not understand the limitations of this geophysical survey, additional input should be sought from the consultant.

This opportunity to be of service is sincerely appreciated. If you should have any questions regarding this report or do not understand the limitations of this study or the data that is presented, please do not hesitate to contact our office at your earliest convenience.

Respectfully submitted,
TERRA GEOSCIENCES

Donn C. Schwartzkopf
Professional Geophysicist
PGP 1002

SEISMIC LINE LOCATION MAP



Topographic base map prepared by TMR Associates, San Bernardino, CA, dated 11/18/21.

GOOGLE™ EARTH IMAGERY MAP

Base Map: Google™ Earth imagery (2021); Seismic Line S-1 indicated by red/yellow line; approximate site boundaries outlined in blue.

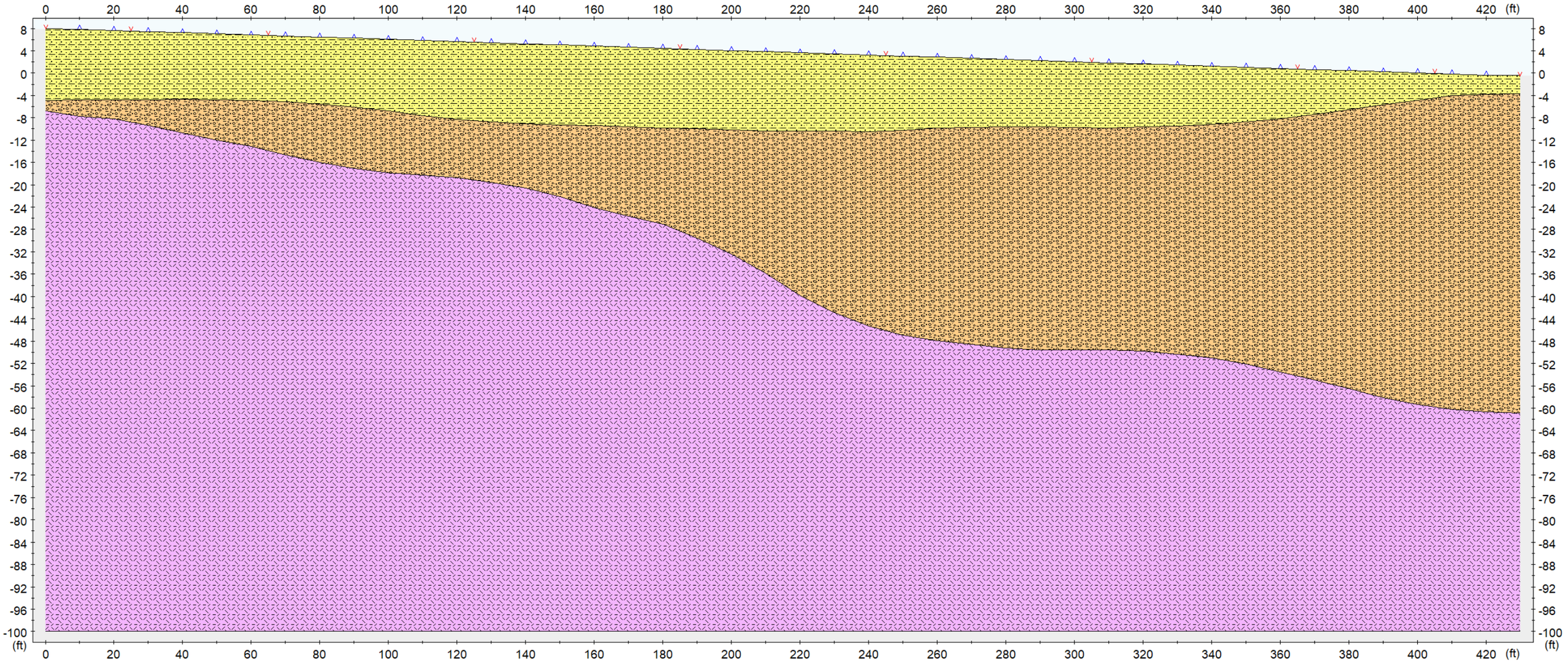
APPENDIX A

LAYER VELOCITY MODEL

SEISMIC LINE S-1

North 59° East >

LAYER VELOCITY MODEL



V SEISMIC SOURCE

Λ GEOPHONE RECEIVER

V1	V2	V3
1296	3952	7641

P-Wave Velocity (ft/sec)

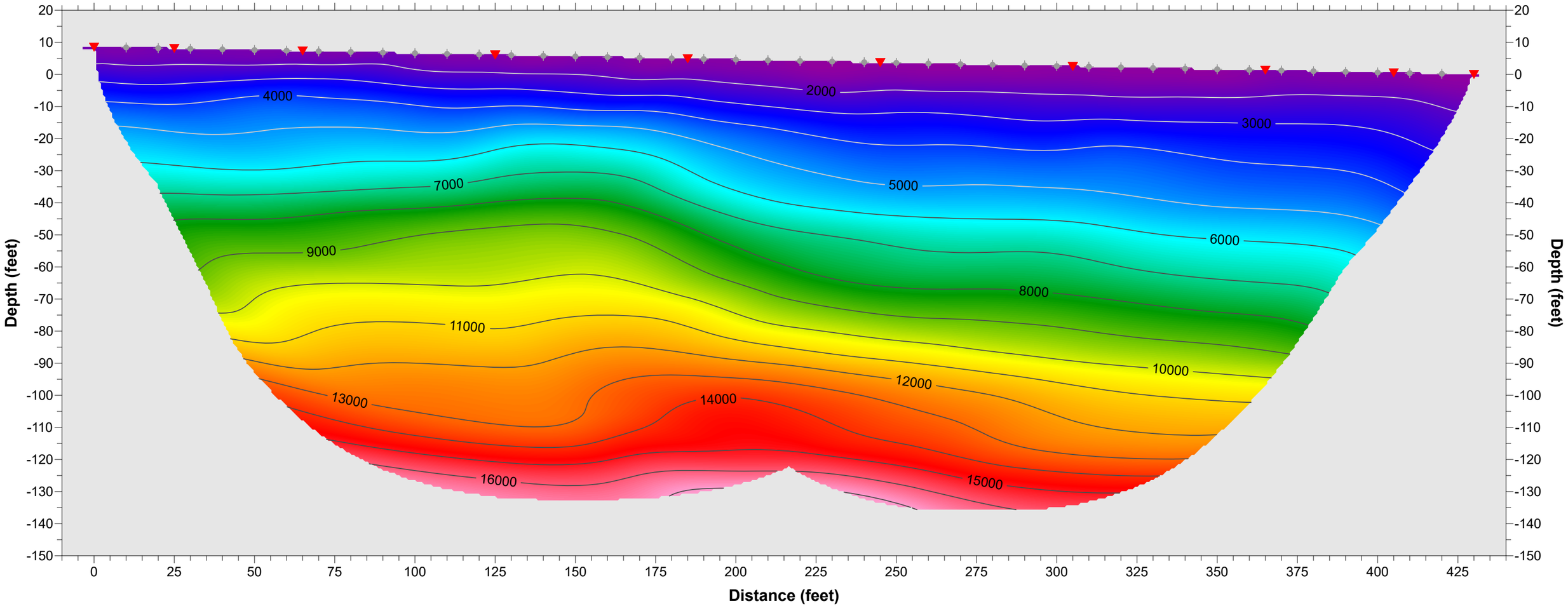
APPENDIX B

REFRACTION TOMOGRAPHIC MODEL

SEISMIC LINE S-1

North 59° East →

REFRACTION TOMOGRAPHIC MODEL



▼ Seismic Source

Geophone Receiver

1000 3000 5000 7000 9000 11000 13000 15000 17000

P-Wave Velocity (feet/second)

SCALE: 1:1 (Horizontal = Vertical)

RMS error 1.7%; Rayfract Version 4.02

APPENDIX C

REFERENCES

REFERENCES

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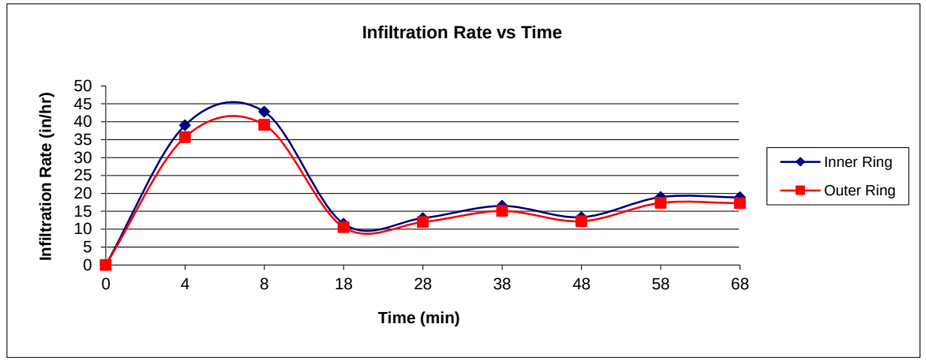
APPENDIX E

Infiltration Test Results

DOUBLE RING INFILTROMETER TEST DATA

Project:	APN 0239-311-01-0000	**Client:**	Land Engineering Consultants,
Project No.:	13789.1	**Test Date:**	January 25, 2022
Soil Classification:	(SP) Poorly graded sand w/ gravel	**Test Hole No.:**	DRI-1
Depth of Test Hole:	2.0 ft.	**Test Hole Diameter:**	12 in. inner, 24 in. annular
Liquid Used:	Tap Water	**Date Excavated:**	January 25, 2022
Area of Rings:	Inner = 0.785 ft^2 , Annular 2.36 ft^2	**pH:**	7.8
Tested By:	R.L.	**Depth of Water in Rings:**	3.0 in.
Liquid Level Maintained Using:	Vacuum Seal	**Ring Penetration:**	6.0 in.
Depth to Water Table:	> 50 ft.		

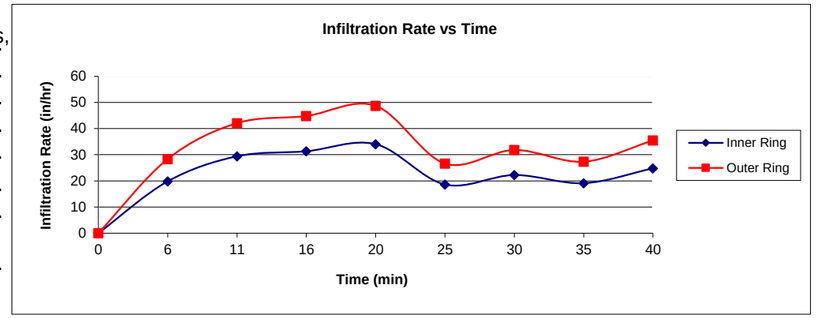


TEST PERIOD

TRIAL NO.	INNER				ANNULAR SPACE			WATER USED (lbs.)		WATER USED (gal)		INFILTRATION RATE (gal/sf.day)		INFILTRATION RATE (in/hr)		LIQUID TEMP (°F)	REMARKS
	TIME		TIME INTERVAL (minutes)	TOTAL ELASPED TIME (minutes)	TIME	TIME INTERVAL (minutes)	TOTAL ELASPED TIME (minutes)	inner	annular space	inner	annular space	inner	annular space	inner	annular space		
1	S	9:12	4	4	9:12	4	4	10.58	29.09	1.270	3.492	582.5	532.7	39.0	35.7	58	
	E	9:16			9:16											58	
2	S	9:16	4	8	9:16	4	8	11.60	31.90	1.393	3.830	638.6	584.2	42.8	39.1	58	
	E	9:20			9:20											58	
3	S	10:35	10	18	10:35	10	18	7.81	21.47	0.938	2.577	172.0	157.3	11.5	10.5	59	
	E	10:45			10:45											59	refilled both
4	S	10:45	10	28	10:45	10	28	8.87	24.40	1.065	2.929	195.3	178.7	13.1	12.0	59	
	E	10:55			10:55											59	
5	S	10:55	10	38	10:55	10	38	11.18	30.75	1.342	3.691	246.2	225.3	16.5	15.1	59	
	E	11:05			11:05											60	
6	S	11:07	10	48	11:07	10	48	9.04	24.86	1.085	2.984	199.1	182.1	13.3	12.2	60	
	E	11:17			11:17											60	refilled both
7	S	11:17	10	58	11:17	10	58	12.85	35.34	1.543	4.242	283.0	258.9	19.0	17.3	60	
	E	11:27			11:27											60	
8	S	11:27	10	68	11:27	10	68	12.79	35.17	1.535	4.222	281.7	257.6	18.9	17.3	60	
	E	11:37			11:37											60	

DOUBLE RING INFILTROMETER TEST DATA

Project:	APN 0239-311-01-0000	**Client:**	Land Engineering Consultants,
Project No.:	13789.1	**Test Date:**	January 25, 2022
Soil Classification:	(SP) Poorly graded sand w/ gravel	**Test Hole No.:**	DRI-2
Depth of Test Hole:	5.0 ft.	**Test Hole Diameter:**	12 in. inner, 24 in. annular
Liquid Used:	Tap Water	**Date Excavated:**	January 25, 2022
Area of Rings:	Inner = 0.785 ft^2 , Annular 2.36 ft^2	**pH:**	7.8
Tested By:	R.L.	**Depth of Water in Rings:**	3.0 in.
Liquid Level Maintained Using:	Vacuum Seal	**Ring Penetration:**	6.0 in.
Depth to Water Table:	> 50 ft.		



TEST PERIOD

TRIAL NO.	INNER				ANNULAR SPACE			WATER USED (lbs.)		WATER USED (gal)		INFILTRATION RATE (gal/sf.day)		INFILTRATION RATE (in/hr)		LIQUID TEMP (°F)	REMARKS
	TIME		TIME INTERVAL (minutes)	TOTAL ELASPED TIME (minutes)	TIME	TIME INTERVAL (minutes)	TOTAL ELASPED TIME (minutes)	inner	annular space	inner	annular space	inner	annular space	inner	annular space		
1	S	9:15	6	6	9:15	6	6	8.06	34.66	0.968	4.161	295.8	423.2	19.8	28.4	56	
	E	9:21			9:21											56	
2	S	9:21	5	11	9:21	5	11	9.97	42.87	1.197	5.146	439.1	628.1	29.4	42.1	56	
	E	9:26			9:26											56	
3	S	9:26	5	16	9:26	5	16	10.62	45.66	1.275	5.481	467.7	668.9	31.3	44.8	56	
	E	9:31			9:31											56	
4	S	9:31	4	20	9:31	4	20	9.23	39.69	1.108	4.765	508.1	726.9	34.0	48.7	57	
	E	9:35			9:35											57	
5	S	9:37	5	25	9:37	5	25	6.31	27.13	0.758	3.257	277.9	397.5	18.6	26.6	57	
	E	9:42			9:42											57	refilled both
6	S	9:42	5	30	9:42	5	30	7.54	32.42	0.905	3.892	332.1	475.0	22.2	31.8	57	
	E	9:47			9:47											57	
7	S	9:47	5	35	9:47	5	35	6.48	27.86	0.778	3.345	285.4	408.2	19.1	27.3	57	
	E	9:52			9:52											58	
8	S	9:52	5	40	9:52	5	40	8.40	36.12	1.008	4.336	370.0	529.2	24.8	35.5	58	
	E	9:57			9:57											58	
9	S	10:01	5	45	10:01	5	45	4.27	18.36	0.513	2.204	188.1	269.0	12.6	18.0	58	
	E	10:06			10:06											58	refilled both
10	S	10:06	5	50	10:06	5	50	6.59	28.34	0.791	3.402	290.2	415.2	19.4	27.8	58	
	E	10:11			10:11											58	
11	S	10:11	5	55	10:11	5	55	6.04	25.97	0.725	3.118	266.0	380.5	17.8	25.5	58	
	E	10:16			10:16											59	
12	S	10:16	5	60	10:16	5	60	6.53	28.08	0.784	3.371	287.6	411.4	19.3	27.6	58	
	E	10:21			10:21											59	
13	S	10:21	5	65	10:21	5	65	5.08	21.84	0.610	2.622	223.7	320.0	15.0	21.4	58	
	E	10:26			10:26											59	
14	S	10:26	5	70	10:26	5	70	7.38	31.73	0.886	3.809	325.0	464.9	21.8	31.1	58	
	E	10:31			10:31											59	

APPENDIX F

Seismic Design Spectra

Project: APN 0239-311-01-0000
Project Number: 13789.1
Client: Land Engineering Consultants, Inc.
Site Lat/Long: 34.1980/-117.4466
Controlling Seismic Source: San Jacinto

REFERENCE	NOTATION	VALUE
Site Class	C, D, D default, or E	D measured
Site Class D - Table 11.4-1	F_a	1.0
Site Class D - 21.3(ii)	F_v	2.5
$0.2*(S_{D1}/S_{DS})$	T_0	0.119
S_{D1}/S_{DS}	T_S	0.593
Fundamental Period (12.8.2)	T	Period
Seismic Design Maps or Fig 22-14	T_L	8
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	0.9917*
Equation 11.4-2 - F_V*S_1	S_{M1}	1.4875*

REFERENCE	NOTATION	VALUE
Fv (Table 11.4-2)[Used for General Spectrum]	F_v	1.7
Design Maps	S_s	2.508
Design Maps	S_1	0.875
Equation 11.4-1 - F_A*S_S	S_{MS}	2.508*
Equation 11.4-3 - $2/3*S_{MS}$	S_{DS}	1.672*
Design Maps	PGA	1.029
Table 11.8-1	F_{PGA}	1.1
Equation 11.8-1 - $F_{PGA}*PGA$	PGA_M	1.132*
Section 21.5.3	80% of PGA_M	0.906
Design Maps	C_{RS}	0.907
Design Maps	C_{R1}	0.882

RISK COEFFICIENT

Cr - At Perods <=0.2, Cr=C_{RS}	C_{RS}	0.907
Cr - At Periods >=1.0, Cr=C_{R1}	C_{R1}	0.882

Cr - At Periods between 0.2 and 1.0 use trendline formula to complete

Period	Cr
0.200	0.907
0.300	0.904
0.400	0.901
0.500	0.898
0.600	0.895
0.680	0.892
1.000	0.882

* **Code based design value**. See accompanying data for Site Specific Design values.

Mapped values from https://seismicmaps.org/

PROBABILISTIC SPECTRA[1]
2% in 50 year Exceedence

Project No: 13789.1

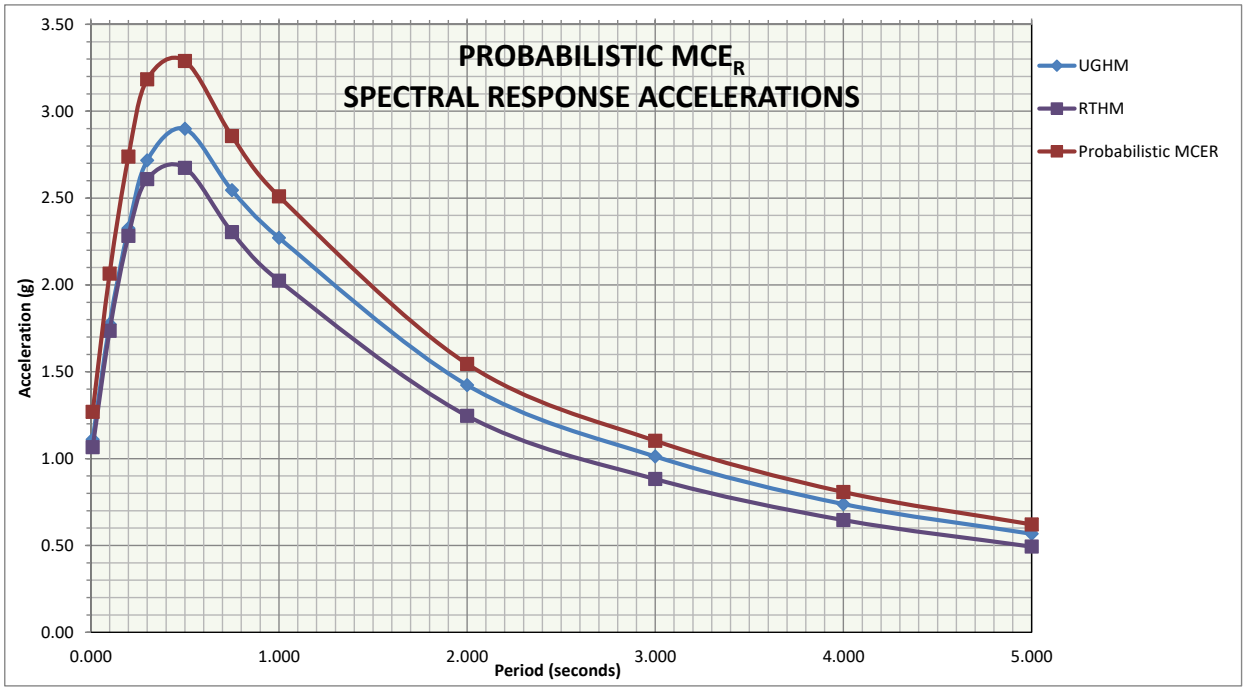
Period	UGHM	RTHM	Max Directional Scale Factor[2]	Probabilistic MCE
0.010	1.110	1.066	1.19	1.269
0.100	1.774	1.735	1.19	2.065
0.200	2.325	2.282	1.20	2.738
0.300	2.717	2.609	1.22	3.183
0.500	2.898	2.674	1.23	3.289
0.750	2.545	2.304	1.24	2.857
1.000	2.271	2.024	1.24	2.510
2.000	1.423	1.246	1.24	1.545
3.000	1.012	0.882	1.25	1.103
4.000	0.738	0.646	1.25	0.808
5.000	0.567	0.493	1.26	0.621

Probabilistic PGA: 1.110

Is Probabilistic $Sa_{(max)} < 1.2F_a$? NO

[1] Data Sources:
https://earthquake.usgs.gov/hazards/interactive/
https://earthquake.usgs.gov/designmaps/rtgm/

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



DETERMINISTIC SPECTRUM

Largest Amplitudes of Ground Motions Considering All Sources Calculated using Weighted Mean of Attenuation Equations[1]

Controlling Source: San Jacinto

Is Probabilistic $Sa_{(max)}$<1.2Fa? NO

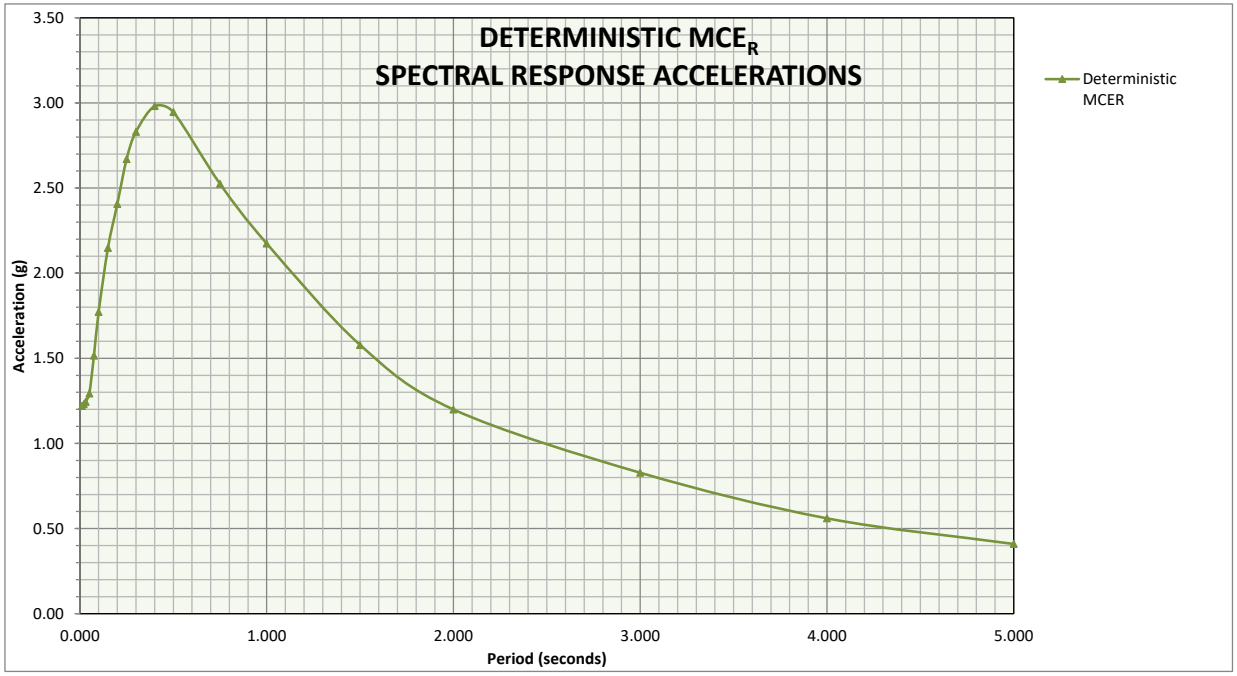
Period	Deterministic PSa Median + 1.σ for 5% Damping	Max Directional Scale Factor[2]	Deterministic MCE	Section 21.2.2 Scaling Factor Applied
0.010	1.025	1.19	1.220	1.220
0.020	1.034	1.19	1.231	1.231
0.030	1.046	1.19	1.244	1.244
0.050	1.087	1.19	1.293	1.293
0.075	1.274	1.19	1.516	1.516
0.100	1.490	1.19	1.773	1.773
0.150	1.791	1.20	2.149	2.149
0.200	2.006	1.20	2.407	2.407
0.250	2.207	1.21	2.671	2.671
0.300	2.320	1.22	2.831	2.831
0.400	2.424	1.23	2.981	2.981
0.500	2.395	1.23	2.946	2.946
0.750	2.036	1.24	2.525	2.525
1.000	1.753	1.24	2.174	2.174
1.500	1.273	1.24	1.578	1.578
2.000	0.967	1.24	1.199	1.199
3.000	0.662	1.25	0.828	0.828
4.000	0.448	1.25	0.560	0.560
5.000	0.325	1.26	0.409	0.409

Project No: 13789.1

Is Determinstic $Sa_{(max)}$<1.5*Fa?	NO
Section 21.2.2 Scaling Factor:	N/A
Deterministic PGA:	1.025
Is Deterministic PGA >=F_{PGA}*0.5?	YES

[1] NGAWest 2 GMPE worksheet and Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) - Time Dependent Model

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



SITE SPECIFIC SPECTRA

Period	Probabilistic MCE	Deterministic MCE	Site-Specific MCE	Design Response Spectrum (Sa)
0.010	1.269	1.220	1.220	0.814
0.100	2.065	1.773	1.773	1.212
0.200	2.738	2.407	2.407	1.604
0.300	3.183	2.831	2.831	1.887
0.500	3.289	2.946	2.946	1.964
0.750	2.857	2.525	2.525	1.683
1.000	2.510	2.174	2.174	1.450
2.000	1.545	1.199	1.199	0.800
3.000	1.103	0.828	0.828	0.552
4.000	0.808	0.560	0.560	0.373
5.000	0.621	0.409	0.409	0.273

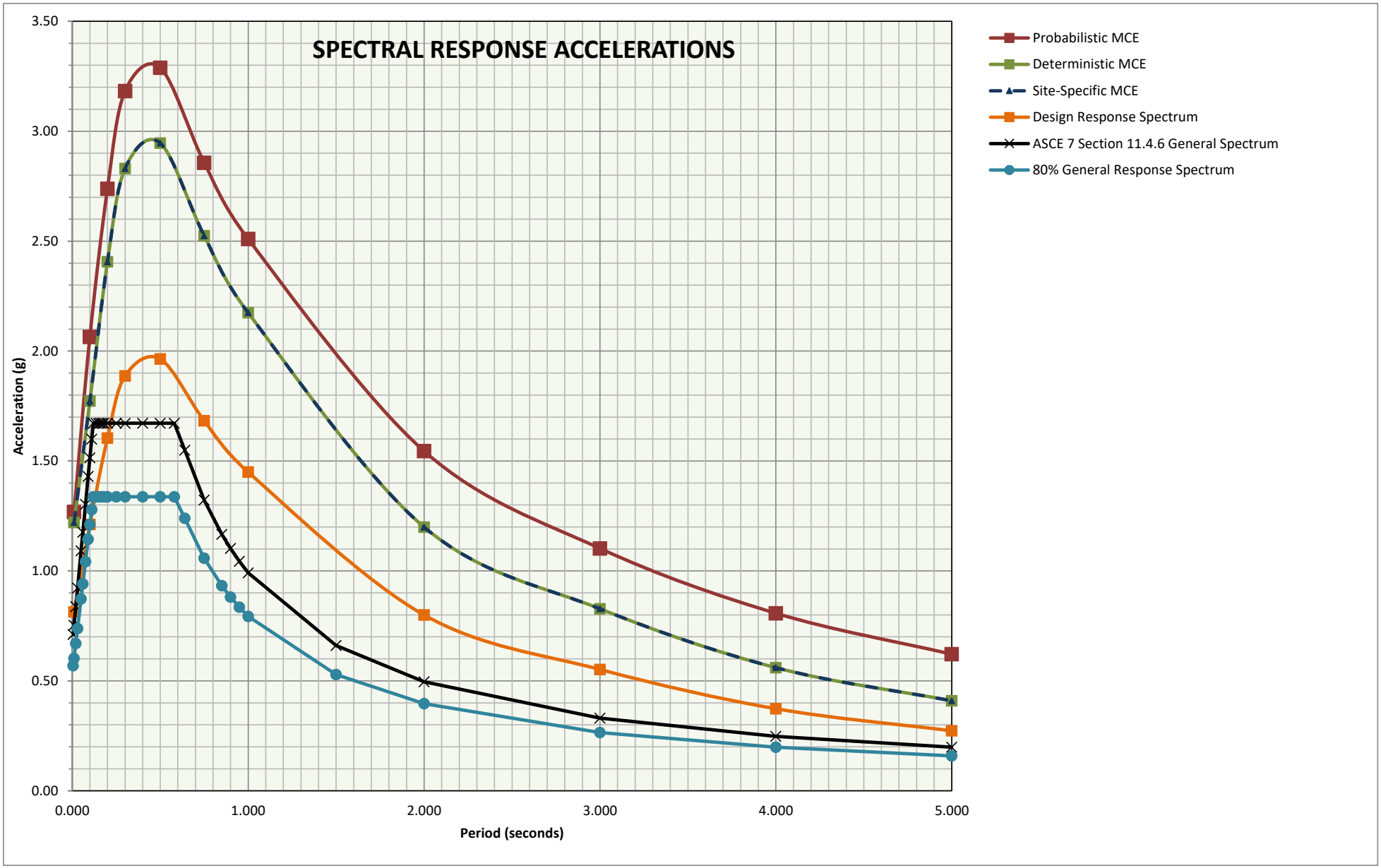
ASCE 7-16: Section 21.4
Site Specific

	Calculated Value	Design Value
SDS:	1.768	1.768
SD1:	1.655	1.655
SMS:	2.651	2.651
SM1:	2.483	2.483
Site Specific PGAm:	1.025	1.025
Site Class:	D measured	

Seismic Design Category - Short* E
Seismic Design Category - 1s* E
* Risk Categories I, II, or III

Period	ASCE 7 SECTION 11.4.6 General Spectrum	80% General Response Spectrum
0.005	0.711	0.569
0.010	0.753	0.603
0.020	0.838	0.670
0.030	0.923	0.738
0.050	1.092	0.873
0.060	1.176	0.941
0.075	1.303	1.042
0.090	1.430	1.144
0.100	1.515	1.212
0.110	1.599	1.279
0.120	1.672	1.338
0.136	1.672	1.338
0.150	1.672	1.338
0.160	1.672	1.338
0.170	1.672	1.338
0.180	1.672	1.338
0.200	1.672	1.338
0.250	1.672	1.338
0.300	1.672	1.338
0.400	1.672	1.338
0.500	1.672	1.338
0.580	1.672	1.338
0.640	1.549	1.240
0.750	1.322	1.058
0.850	1.167	0.933
0.900	1.102	0.881
0.950	1.044	0.835
1.000	0.992	0.793
1.500	0.661	0.529
2.000	0.496	0.397
3.000	0.331	0.264
4.000	0.248	0.198
5.000	0.198	0.159

Project No: 13789.1



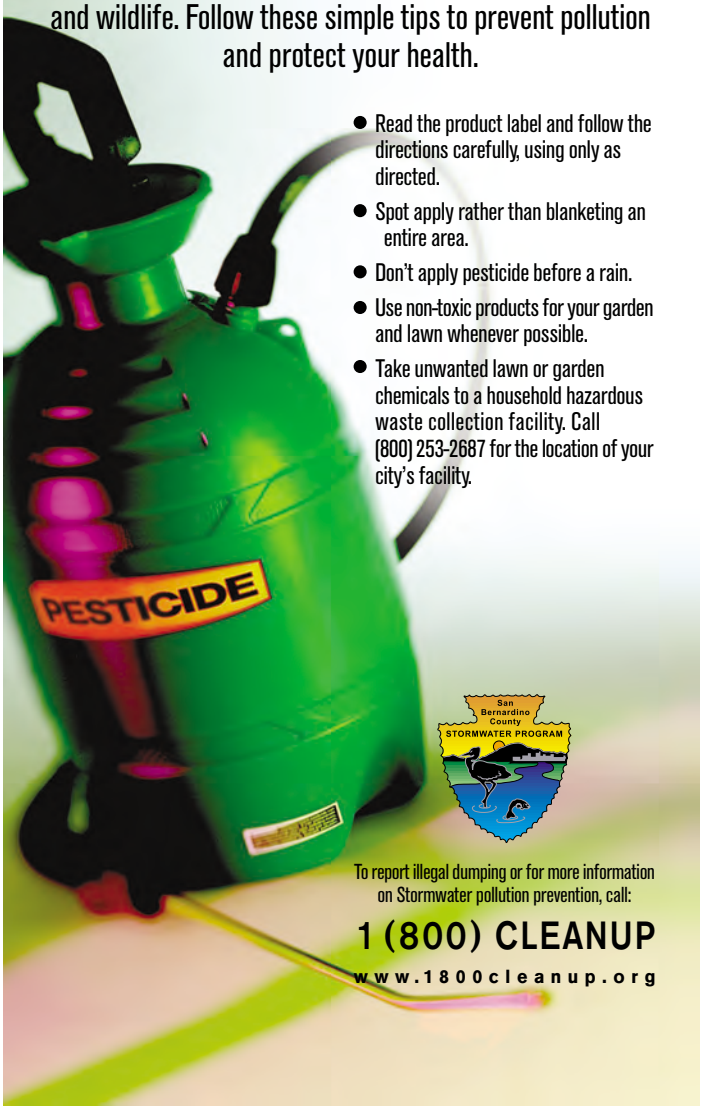
Project No: 13789.1

APPENDIX E

Pesticide Tips to Prevent Pollution

Water that runs off your lawn and garden can carry pesticide into the San Bernardino County storm drain system, and it does 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.

- Read the product label and follow the directions carefully, using only as directed.
- Spot apply rather than blanketing an entire area.
- Don't apply pesticide before a rain.
- Use non-toxic products for your garden and lawn whenever possible.
- Take unwanted lawn or garden chemicals to 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 Pesticidas.

El desagüe del jardín puede llevar pesticidas que acaben 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.

- Leer las etiquetas del producto y seguir las instrucciones cuidadosamente, usarlas tal como se indica.
- Apliqua solo parte por parte, no en areas grandes.
- No aplique los pesticidas antes de que llueva.
- Trata de usar productos no-toxicos para tu jardín cada vez que sea posible.
- Desechalos en unlugar de colección de desechos 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: Pesticide 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 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

Fertilizer Tips to Prevent Pollution

Water that runs off your lawn and garden can carry fertilizer into the San Bernardino County storm drain system, and it does 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.

- Read the product label and follow the directions carefully, using only as directed.
- Avoid applying near driveways or gutters.
- Never apply fertilizer before a rain.
- Store fertilizers and chemicals in a covered area and in sealed, waterproof containers.
- Take unwanted lawn or garden chemicals to a household hazardous waste collection facility. Call (800) 253-2687 for the location of your city's facility.
- Use non-toxic products for your garden and lawn whenever possible.

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 Fertilizantes.

El desagüe del jardín puede llevar fertilizantes que acaben 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.

- Leer las etiquetas del producto y seguir las instrucciones cuidadosamente, usarlas tal como se indica.
- Evita aplicarlos cerca de la cocheras o las alcantarillas.
- Nunca aplicar el fertilizante antes de llover.
- Guarda los fertilizantes y otros quimicos en un lugar cuvierto y en contenedores contra agua.
- Desechalos en unlugar de colección de desechos peligrosos. Llama al (800) 253-2687 para información de un centro cerca a ti.
- Trata de usar productos no-toxicos para tu jardín cada vez que sea posible.

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: Fertilizer bill insert **Actual size:** 3.625" x 8.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 8/29/03

Pick Up After Your Pooch to Curb Pollution.

Maybe you weren't aware, but dog waste left on the ground gets into storm drains, polluting rivers, lakes and beaches. The bacteria and risk of disease threatens the health of our kids and communities. Wherever you live in San Bernardino County, this pollution is a problem. The answer? Pick up after your dog, to help prevent pollution and protect our health. It's in your hands.

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

Recoge los desperdicios de tu mascota para prevenir la contaminación de la calle.

Quizás usted no lo sepa, pero el excremento de perro que se deja en el suelo va a las alcantarillas, contaminando nuestros ríos, lagos y playas. Las bacterias y el riesgo de enfermedades amenazan la salud de nuestros niños y comunidades. No importa donde usted resida, esta contaminación es un problema. ¿Cuál es la respuesta? Recoja los desechos de su perro, para ayudar a prevenir la contaminación y proteger nuestra salud.

San Bernardino County STORMWATER PROGRAM

To report illegal dumping or for more information on Stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

Spanish side

Item: Dog waste bill insert **Actual size:** 3.625" x 8.5" **Advertiser:** San Bernardino County Storm Water Program
Agency: Industrial Strength Advertising **Date:** 9/10/03

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

STORMWATER Pollution Prevention

Stormwater Management Practices for Carpet Cleaning Activities

Toxic chemicals and discharged waste water from carpet, drapery, furniture and window cleaning 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.

These guidelines apply even if the cleaning products are labeled "nontoxic" or "biodegradable". Although these products may be less harmful to the environment, they can still have harmful effects if they enter the storm drain untreated.

Dispose of Wastewater Properly

Wastewater from cleaning equipment must be discharged into a sink, toilet, or other drain connected to the sanitary sewer system within sanitary sewer discharge limits, hauled off and disposed of properly, or may be discharged to a pervious area, for example, a lawn area, as long as it does not overflow into the street, gutter, parking lot or storm drain. Wastewater should never be discharged into a street, gutter, parking lot or storm drain.

Filter Wastewater

Carpet cleaning wastewater should be filtered before discharging it to the sanitary sewer since fibers and other debris in the wastewater can clog pipes. The filtered material can be disposed of in the garbage, provided that the waste is not contaminated with hazardous pollutants.

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

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Commercial landscape maintenance:

Yard waste, sediments and toxic lawn and 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. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Recycle Yard Waste:** Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Let your customers know about grass cycling --the natural recycling of grass by leaving clippings on the lawn when mowing instead of using a grass catcher. Grass clippings will quickly decompose, returning valuable nutrients to the soil. You can get more information at www.ciwmb.ca.gov/Organics.
- **Use Fertilizers, Herbicides & Pesticides Safely:** Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural, non-toxic alternatives to traditional garden chemicals. If you must use chemical fertilizers, herbicides, or pesticides spot apply rather than blanketing entire areas, avoid applying near curbs and driveways and never apply before a rain.
- **Recycle Hazardous Waste:** Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility. 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.
- **Planting:** 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 should be covered with plastic sheeting to protect from rain, wind and runoff.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

COMMERCIAL TRASH ENCLOSURES

FOLLOW THESE **REQUIREMENTS** TO **KEEP OUR WATERWAYS CLEAN**

Trash enclosures, such as those found in commercial and apartment complexes, typically contain materials that are intended to find their way to a landfill or a recycling facility. **These materials are NOT meant to go into our local lakes and rivers.**

PROTECT WATER QUALITY BY FOLLOWING THESE SIMPLE STEPS

PUT TRASH INSIDE

Place trash inside the bin (preferably in sealed bags)

CLOSE THE LID

Prevent rain from entering the bin in order to avoid leakage of polluted water runoff

KEEP TOXICS OUT

- Paint
- Grease, fats and used oils
- Batteries, electronics and fluorescent lights

SOME ADDITIONAL GUIDELINES, INCLUDE

✓ **SWEEP FREQUENTLY**
Sweep trash enclosure areas frequently, instead of hosing them down, to prevent polluted water from flowing into the streets and storm drains.

✓ **FIX LEAKS**
Address trash bin leaks immediately by using dry clean up methods and report to your waste hauler to receive a replacement.

✓ **CONSTRUCT ROOF**
Construct a solid cover roof over the existing trash enclosure structure to prevent rainwater from coming into contact with trash and garbage. Check with your local City/County for Building Codes.

In San Bernardino County, stormwater pollution is caused by food waste, landscape waste, chemicals and other debris that are washed into storm drains and end up in our waterways - untreated! You can be part of the solution by maintaining a water-friendly trash enclosure.

THANK YOU FOR HELPING TO KEEP SAN BERNARDINO COUNTY CLEAN AND HEALTHY!

San Bernardino County STORMWATER PROGRAM

To report illegal dumping **(877-WASTE18)** or
to find a household hazardous waste facility (800-OILY CAT): **sbcountystormwater.org**
To dispose of hazardous waste call the San Bernardino County Fire Dept. - CUPA Program **(909) 386-8401**

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

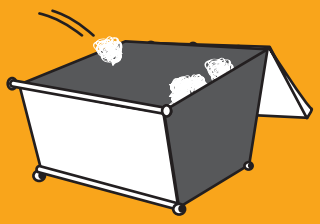
CONTENEDORES COMERCIALES PARA LA BASURA

SIGA ESTOS **PASOS** PARA MANTENER **LIMPIAS NUESTRAS VÍAS FLUVIALES**

Los contenedores de basura, tales como aquellos que se encuentran en las unidades comerciales y departamentos, generalmente contienen materiales que están destinados a los rellenos sanitarios o en algún establecimiento de reciclaje.
Estos materiales NO deben ser vertidos en nuestros lagos y ríos locales.

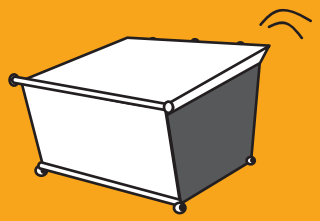
SIGA ESTOS PASOS PARA PROTEGER LA CALIDAD DEL AGUA

COLOQUE LA BASURA ADENTRO



Coloque la basura adentro del contenedor (preferentemente en bolsas selladas)

CIERRE LA TAPA



Evite que la lluvia ingrese al contenedor para evitar un escape de escorrentía contaminada

MANTENGA LOS PRODUCTOS TÓXICOS AFUERA

- Pintura
- Lubricante, grasas y aceites usados
- Baterías, componentes electrónicos y luces fluorescentes

ALGUNAS GUÍAS ADICIONALES, LAS CUALES INCLUYEN

✓ BARRER CON FRECUENCIA

Barra con frecuencia las áreas de los recintos para la basura, en lugar de lavarlas con una manguera, para evitar que el agua contaminada se vierta en las calles y los desagües de lluvia.

✓ REPARE LAS GOTERAS

Ocúpese inmediatamente de las goteras en los contenedores de basura. Use los métodos de limpieza en seco e infórmele a su recolector de basura para que reciba un reemplazo.

✓ CONSTRUYA UN TECHO

Construya un techo de cubierta sólida sobre la estructura actual del recinto para la basura a fin de evitar que el agua de lluvia entre en contacto con los desechos y la basura. Consulte a su Ciudad/Condado para conocer los Códigos de Construcción.

En el Condado de San Bernardino, los desechos de alimentos y jardines, los productos químicos y otros restos que se vierten en los desagües de aguas pluviales y que terminan en nuestras vías fluviales sin tratamiento alguno provocan la contaminación de estas aguas. Usted puede ser parte de la solución si mantiene un recinto para la basura que no contamine el agua.

¡MUCHAS GRACIAS POR AYUDAR A MANTENER LIMPIO Y SIN CONTAMINACIÓN AL CONDADO DE SAN BERNARDINO!

San Bernardino County STORMWATER PROGRAM

Para informar acerca del vertedero ilegal, llame a (877-WASTE18), o para encontrar un establecimiento donde arrojar los residuos peligrosos del hogar, llame a (800-OILY CAT): sbcountystormwater.org

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District" • Upland • Yucaipa

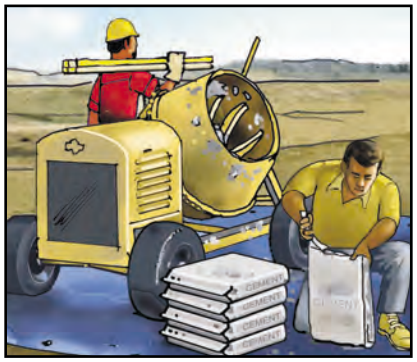
STORMWATER Pollution Prevention

FRESH CONCRETE & MORTAR APPLICATION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites 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 waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.

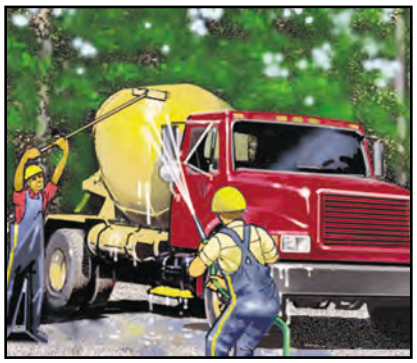
Storing Materials
Keep construction materials and debris away from the street, gutter and storm drains. Secure open bags of cement and cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

Ordering Materials & Recycling Waste
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. When breaking up paving, recycle the pieces at a crushing company. You can also recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. Call (909) 386-8401 for recycling and disposal information.



During Construction
Schedule excavation and grading during dry weather. Prevent mortar and cement from entering the street and storm drains by placing erosion controls. Setup small mixers on tarps or drop cloths, for easy cleanup of debris. Never bury waste material. Recycle or dispose of it as hazardous waste.

Cleaning Up
Wash concrete dust onto designated dirt areas, not down driveways or into the street or storm drains. Wash out concrete mixers and equipment in specified washout areas, where water can flow into a containment pond. Cement washwater can be recycled by pumping it back into cement mixers for reuse. Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

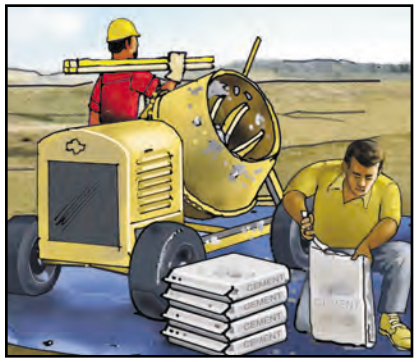
Prevención de Contaminación del Desagüe

APLICANDO CONCRETO FRESCO

Cemento, grava, asfalto y liquidos de auto, tierra y residuos peligrosos de lugares de concreto fresco 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.

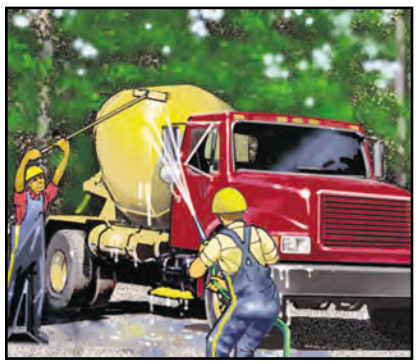
Almacenando Materiales
Manten materiales de construcción y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y herramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.

Ordenando Materiales & Reciclando
Reduce la cantidad al ordenar el material, solo ordena lo necesario. Usa materiales recicables cuando sea posible. Cuando estes rompiendo el pavimento, recicla los pedasos en la compañia demolidora. Se puede reciclar el aspfalto, concreto, madera y la vegetacion. Materiales no reciclados se deverian llevar a lugares de desechos peligrosos. llama al (909) 386-8401 para más información.



Durante Construcción
Planea las excavaciones durante clima seco. No dejes que el cemento o la cal lleguen hasta las calles o drenajes, evita esto con plantas temporales para detener el desagüe. Cubre las maquinas de mesclar con alguna garra para que se facilite la limpieza de residuos. Nunca entierres los desechos. Recicla todos los desechos peligrosos.

Limpiando
Lava la cal en un area designada, no la eches hacia la cochera o en la calle. Lava las mescladoras y las herramientas en un lugar especifico, donde el agua llegue a un contenedor. El agua de cemento se puede reciclar volviendola a usar en las mescladoras. Nunca dejes el agua de cemento que corra hacia las calles, alcantarillas o drenajes.



Para reportar actividadas ilegales u obtener
más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

STORMWATER Pollution Prevention

CONSTRUCTION

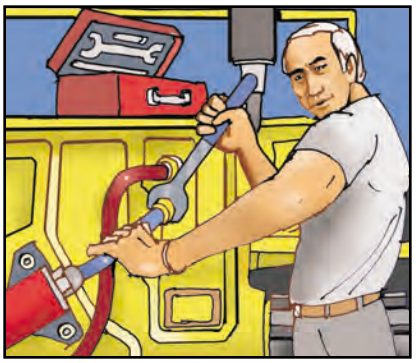
Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.

Store Materials Safely
Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

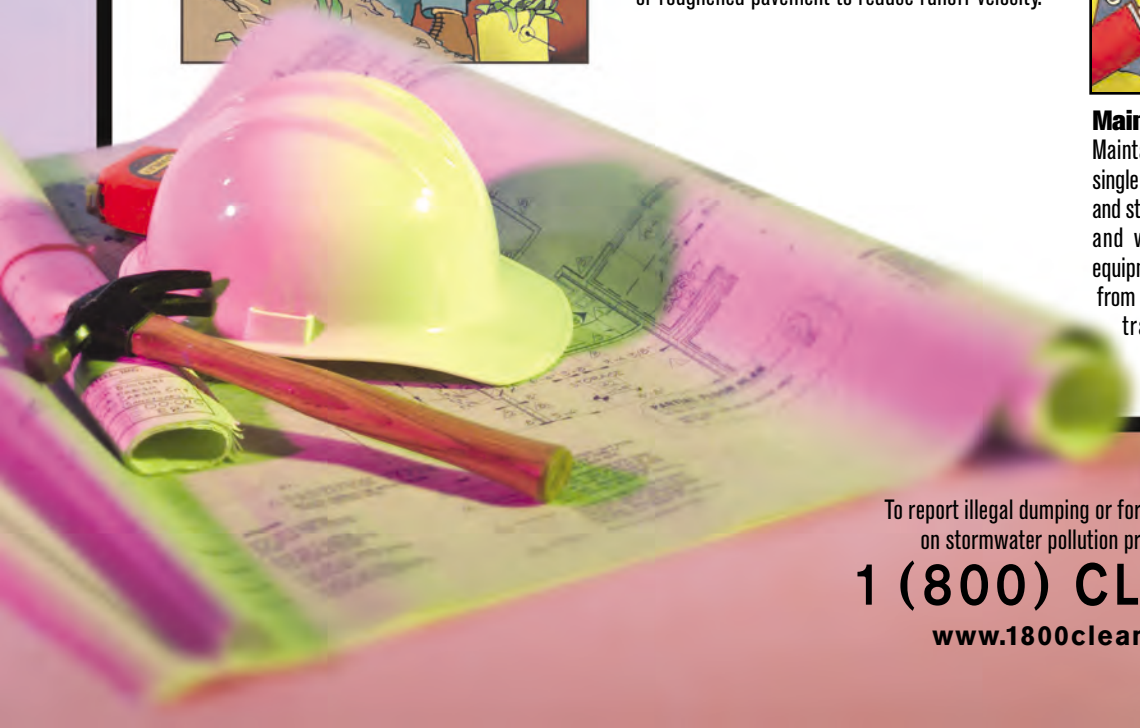
Ordering Materials & Recycling Waste
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.

Cleaning & Preventing Spills
Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.

Preventing Erosion
Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.



To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

CONSTRUCCIÓN

Cemento, sedimentos, liquidos de auto, polvos y residuos peligrosos acaban 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.

Almacenando Materiales Cuidadosamente

Manten materiales de construcción y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y herramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.

Ordenando Materiales & Reciclando Desechos

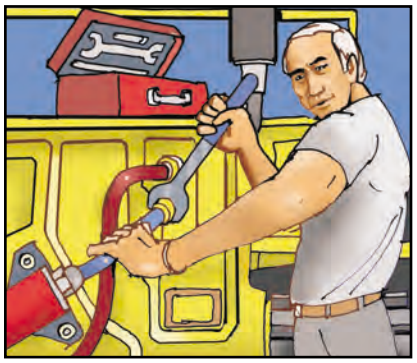
Reduce la cantidad al ordenar el material, solo ordena lo necesario. Usa materiales que se puedan reciclar cuando sea posible. Se puede reciclar el aspfalto, concreto, madera y la vegetacion. Materiales no reciclados se deven llevar a lugares de desechos peligrosos. Para mas información llama al (909) 386-8401.

Limpiando & Previniendo Derrames

Usa siempre un enbudo al vaciar liquidos. Barre los derrames en ves de lavarlos con la manguera. Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin. Para reportar derrames llama al 911.

Previniendo Erosiones

Evita las excavaciones durante lluvia. Planta vegetacion temporal en colinas donde aun no hay planes de construccion y planta vegetacion permanente al terminar las excavaciones. Construye algunos canales para el desagüe. Estos pueden ser creados con pasto y cemento para reducir la velocidad del desagüe.



Mantenimiento de Vehiculos & Herramientas

Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y preveen goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

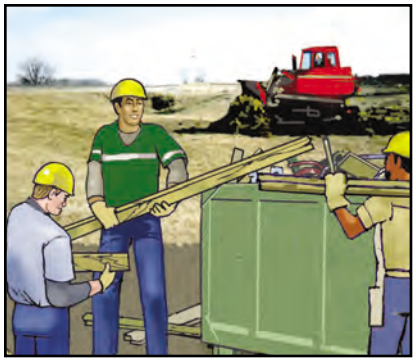
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

EXCAVATION AND GRADING

Sediment, cement wash, asphalt and vehicle fluids from soil excavation and grading 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 waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Recycling Waste

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.

Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutters and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks. Use gravel approaches where truck traffic is heavy to reduce soil compaction and limit the tracking of sediment into the street.

Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids. To report serious spills, call 911.

Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

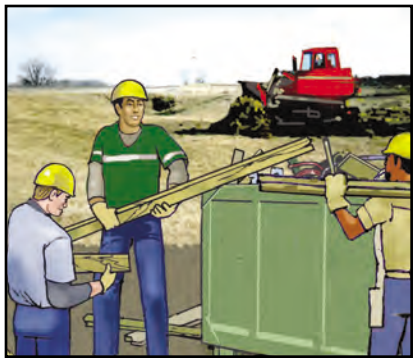
www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

EXCAVACIONES

Sedimento, cemento, asfalto y liquidos de auto, tierra y residuos peligrosos de lugares de construcción acaban 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.



Reciclando Desechos
Recicla el aspfalto, concreto, madera y la vegetacion cuando sea posible. Materiales no reciclados se deverian llevar a lugares de desechos peligrosos. Para màs informacion llama al (909) 386-8401.

Manteniendo Vehiculos & Herramientas
Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura. Usa grava donde mayormente se consentra el trafico de camiones para y reducir el sedimento en las calles.

Limpiando & Previniendo Derrames
Usa siempre un enbudo al vaciar liquidos. Barre los derrames en ves de lavarlos con la manguera. Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin. Preveen goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador. Para reportar derrames llama al 911.

Almacenando Materiales
Manten materiales de construccion y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y erramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.

Previniendo Erosiones
Evita las excavaciones durante lluvia. Planta vegetacion temporal en colinas donde aun no hay planes de construcción y planta vegetacion permanente al terminar las excavaciones. Construye algunos canales para el desagüe. Estos pueden ser creados con pasto y cemento para reducir la velocidad del desagüe.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

ROADWORK AND PAVING

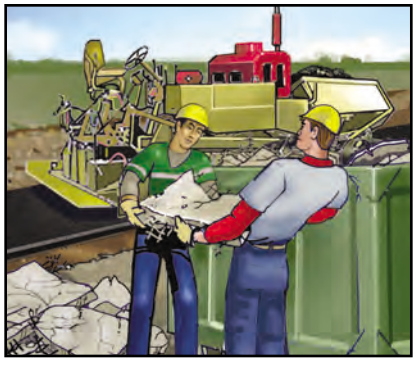
Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.

Preventing Erosion
Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

During Construction
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.

Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal
Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.



Cleaning & Preventing Spills
Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

TRABAJO DE CARRETERAS & PAVIMENTO

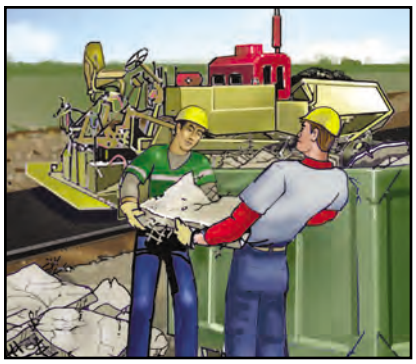
Asfalto, mezcla y materiales de excavaciones del pavimento acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Previniendo Erosiones
Planea las excavaciones trabajo de jardineria durante el clima seco. Desarrolla e implementa planes de embancamientos de control de sedimento y excavaciones. Cubre montones de tierra, grava y otros materiales con un plastico para protejerlos de la llvia, aire y desagüe.

Durante Construcción
Cubre los lavados y da mantenimiento a los hoyos al aplicar selladura o mezcla. Revisa las areas de excavaciones, y evita pasarte de agua para preveenir polvadura. Nunca laves los materiales llenos de concreto en la calle, drenajes o en el desagüe.

Mantenimiento de Vehiculos & Herramientas
Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y evita goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Removiendo Asfalto & Concreto
Bloquea alrededor de los drenajes cuando estes usando las maquinas de sierra, tambien recicla todo el pavimento roto en la compañia demolidora. Para más información llama al (909) 386-8401.



Limpiando & Previniendo Derrames
Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin Barre los derrames en ves de lavarlos con la manguera. Previene los derrames de las maquinas usando enbudos o colocanto garras para absorver cualquier liquido. Para reportar derrames llama al 911.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al :

1 (800) CLEANUP

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

CESQG PROGRAM

Conditionally Exempt Small Quantity Generator

WHAT IS A CESQG?

Businesses that generate 27 gallons or 220 lbs. of hazardous waste, or 2.2 lbs. of extremely hazardous waste per month are called "Conditionally Exempt Small Quantity Generators," or CESQGs. San Bernardino County Household Hazardous Program provides waste management services to CESQG businesses. The most common CESQGs in San Bernardino County are painters, print shops, auto shops, builders, agricultural operators and property managers, but there are many others. When you call, be ready to describe the types and amounts of waste your business generates in a typical month. If you generate hazardous waste on a regular basis, you must:

- Register with San Bernardino County Fire Department (909) 386-8401 as a hazardous waste generator.
- To obtain an EPA ID# and application form from the State visit www.dtsc.ca.gov.
- Manage hazardous waste in accordance with all applicable local, state and federal laws and regulations.

HOW DO I GET SERVICE?

To arrange an appointment for the CESQG Program, call 1-800-OILY CAT or 909-382-5401. Be ready to describe the type and amount of hazardous waste your business is ready to dispose of, and the types and size(s) of containers that the waste is in.

Waste Type and Cost

There is a small handling fee involved in the collection of hazardous waste from your business. Disposal costs depend on the type of waste.

Aerosols	$1.29/lb.
Automobile motor oil	$.73/gal.
Anti-freeze	$1.57/gal.
Contaminated oil	$4.48/gal.
Car batteries	$.62/ea.
Corrosive liquids, solids	$2.80/lb.
Flammable solids, liquids	$1.57/lb.
Latex Paint	$.73/lb.
Mercury	$10.08/lb.
NiCad/Alkaline Batteries	$2.13/lb.
Oil Base Paints	$1.00/lb.
Oil Filters	$.56/ea.
Oxidizers	$9.63/lb.
PCB Ballasts	$5.94/lb.
Pesticides (most)	$2.91/lb.
Photofixer, developer	$4.31/gal.
Television & Monitors	$11.20/ea.
Additional Handling	$138.00/hr.

Rates subject to change without notice

WE CANNOT ACCEPT

- Radioactives
- Water reactives
- Explosives
- Compressed gas cylinders
- Medical or biohazardous waste
- Asbestos
- Remediation wastes

HAZARDOUS WASTE

WHY IS THE FIRE DEPARTMENT COLLECTING HAZARDOUS WASTE?

Small Quantity Generators often have difficulty disposing of small quantities of hazardous waste. Hazardous waste companies usually have a minimum amount of waste that they will pick up, or charge a minimum fee for service. Typically, the minimum fee exceeds the cost of disposal for the hazardous waste. This leaves the small quantity generator in a difficult situation. Some respond by storing hazardous waste until it becomes economical for the hazardous waste transporter to pick it up, putting the business out of compliance by exceeding regulatory accumulation time limits. Other businesses simply store their hazardous wastes indefinitely, creating an unsafe work environment and exceeding accumulation time limits. Yet other businesses attempt to illegally dispose of their waste at household hazardous waste collection facilities. These facilities are not legally permitted to accept commercial wastes, nor are prepared to provide legal documentation for commercial hazardous waste disposal. In answer to the problems identified above, the San Bernardino County Fire Department Household Hazardous Program instituted the Conditionally Exempt Small Quantity Generator Program.

PAYMENT FOR SERVICES

The CESQG Program will prepare an invoice for your business at the time of service. You can pay at the time of service with cash or a check, or you can mail your payment to the Fire Department within 30 days. Please note that we do not accept credit card payments. The preferred method of payment is to handle payment at time of service. Additional charges may apply for accounts not paid within 30 days.

ARE THERE ANY OTHER WAYS THAT I CAN SAVE MONEY ON HAZARDOUS WASTE DISPOSAL?

Yes! First, start by reducing the amount of waste that you produce by changing processes or process chemicals, at your business. Next, examine if there is a way that you can recycle your waste back into your processes. Network with similar businesses or trade associations for waste minimization and pollution prevention solutions.

WHAT IF YOUR BUSINESS DOES NOT QUALIFY?

Call the San Bernardino County Fire Department Field Services Division for assistance with hazardous waste management at 909-386-8401. If you reduce the amount of waste you generate each month to 27 gallons or less, you may qualify in the future.

WHAT HAPPENS TO YOUR HAZARDOUS WASTE?

Hazardous waste collected by the CESQG Program is transported to a state permitted processing facility in San Bernardino. The waste is further processed at this point and packaged for off-site recycling (oil filters, oil, latex paint, antifreeze, and batteries) or destructive incineration (pesticides, corrosives, flammables, oil based paint).

San Bernardino County Fire Department
CESQG Program
2824 East "W" Street
San Bernardino, CA 92415-0799
Phone: 909-382-5401
Fax: 909-382-5413
www.sbcfire.org/hazmat/hhw.asp
Email: jschwab@sbcfire.org

WHEN WORKING OUTDOORS USE THE 3Cs

CUANDO TRABAJE AL AIRE LIBRE UTILICE LAS 3Cs

CONTROL | CONTROL

Locate the nearest storm drain and ensure nothing can enter or be discharged into it.
Ubique el desagüe de aguas pluviales más cercano y asegúrese de que nada pueda ingresar a éste ni descargarse en él.

CONTAIN | CONTENER

Isolate your area to prevent material from potentially flowing or being blown away.
Aísle su área para evitar que el material pueda discurrirse o ser llevado por el viento.

CAPTURE | CAPTURAR

Sweep up debris and place it in the trash. Clean up spills with an absorbent material (e.g. kitty litter) or vacuum with a Wet-Vac and dispose of properly.
Recoja los restos y colóquelos en la basura. Limpie los derrames con un material absorbente (como la arena para gatos) o aspírelos con una Wet-Vac (aspiradora de humedad) y deséchelos correctamente.

COMMERCIAL LANDSCAPE

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

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

RECYCLE YARD WASTE

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

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

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY

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

USE WATER WISELY

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

HOMEOWNERS

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

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

For more information on proper disposal call,

(909) 382-5401 or 1-800-OILY CAT.

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

In the event of a spill or discharge to a storm drain or waterway, contact San Bernadino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

sbcountystormwater.org

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernadino • San Bernadino County • San Bernadino County Flood Control District • Upland • Yucaipa

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. Fountain water containing chlorine and copperbased algaecides is toxic to aquatic life. Proper inspection, cleaning, and repair of pedestrian areas and HOA owned surfaces and structures can reduce pollutant runoff from these areas. Maintaining these areas may involve one or more of the following activities:

1. **Surface Cleaning**
2. **Graffiti Cleaning**
3. **Sidewalk Repair**
4. **Controlling Litter**
5. **Fountain Maintenance**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for sidewalk, plaza, and fountain maintenance and cleaning include:

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).
- Once per year, educate HOA staff and tenants on pollution prevention measures.

MODEL PROCEDURES:

1. Surface Cleaning

Discharges of wash water to the storm water drainage system from cleaning or hosing of impervious surfaces is prohibited.
Sidewalks, Plazas

✓ Use dry methods (e.g. sweeping, backpack blowers, vacuuming) whenever practical to clean sidewalks and plazas rather than hosing, pressure washing, or steam cleaning. DO NOT sweep or blow material into curb; use devices that contain the materials.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

Parking Areas, Driveways, Drive-thru

✓ Parking facilities should be swept/vacuumed on a regular basis. Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

✓ Sweep all parking lots at least once before the onset of the wet season.

✓ Use absorbents to pick up oil; then dry sweep.

✓ Appropriately dispose of spilled materials and absorbents.

OPTIONAL:

- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc.

Building Surfaces, Decks, etc., without loose paint

✓ Use high-pressure water, no soap.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

Unpainted Building Surfaces, Wood Decks, etc.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

✓ Use biodegradable cleaning agents to remove deposits.

✓ Make sure pH is between 6.5 and 8.5 THEN discharge to landscaping (if cold water without a cleaning agent) otherwise dispose of properly.

2. Graffiti Cleaning

Graffiti Removal

✓ Avoid graffiti abatement activities during rain events.

✓ When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal in the Roads, Streets, and Highway Operation and Maintenance procedure sheet.

✓ Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

✓ Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.

OPTIONAL:

• Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

3. Sidewalk Repair

Surface Removal and Repair

✓ Schedule surface removal activities for dry weather if possible.

✓ Avoid creating excess dust when breaking asphalt or concrete.

✓ Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up material.

✓ Designate an area for clean up and proper disposal of excess materials.

✓ Remove and recycle as much of the broken pavement as possible.

✓ When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains shovel or vacuum the slurry, remove from site and dispose of properly.

✓ Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so or contain and dispose of properly.

Concrete Installation and Repair

✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.

✓ Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other storm water conveyance structures. (See Concrete Waste Management BMP WM – 8)

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

- ✓ Store dry and wet concrete materials under cover, protected from rainfall and runoff and away from drainage areas. After job is complete remove temporary stockpiles (asphalt materials, sand, etc.) and other materials as soon as possible.
- ✓ Return leftover materials to the transit mixer. Dispose of small amounts of excess concrete, grout, and mortar in the trash.
- ✓ When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.
- ✓ Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.
- ✓ Protect applications of fresh concrete from rainfall and runoff until the material has hardened.

4. Litter Control

- ✓ Enforce anti-litter laws.
- ✓ Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- ✓ Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.

OPTIONAL:

- Post "No Littering" signs.

5. Fountain Maintenance

- ✓ Do not use copper-based algaecides. Control algae with chlorine or other alternatives, such as sodium bromide.
- ✓ Allow chlorine to dissipate for a few days and then recycle/reuse water by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present (concentration must be less than 0.1 ppm).
- ✓ Contact local agency for approval to drain into sewer or storm drain.
- ✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.

GATEWAY
On Call. On Time. On Target.

Good Housekeeping Practices for Commercial Dumpsters

Why is Dumpster Management Important?

Dumpsters that are not properly maintained not only draw flies and vermin but also can become a source of non-point source pollution. To keep rain from washing pollutants into local streams, several dumpster usage practices and good housekeeping practices are recommended for commercial, industrial, and municipal facilities.

What are the Dumpster Usage Practices?

Appropriate dumpster usage includes:

- Make sure the dumpster area remains clean and free of debris.
- Keep all dumpsters and other containers securely closed.
- Keep dumpster enclosure locked to keep out illegal dumping and large animals from entering.
- Locate dumpsters and other trash receptacles away from storm drain inlets and streams.
- If food waste or other moist waste is placed in the dumpster, consider covering the dumpster and placing a berm around it, and draining the dumpster area to the sanitary sewer.
- Pick up litter before washing dumpster areas and avoid washing grit and grime into the storm drainage system.
- Don't use soap or bleach when washing your dumpster area, unless it drains to the sanitary sewer.
- Clean up any spills with absorbent materials and dispose of the absorbent materials properly.

What are the Dumpster Good Housekeeping Practices?

Good housekeeping practices are aimed at reducing waste in the first place.

- Reduce waste: Look for ways to reduce waste before it is disposed.
- Identify whether or not the waste is hazardous and avoid hazardous products when you can.
- Reuse or recycle material when ever possible.
- Look to find vendors who recycle various liquid wastes.
- Compost plant wastes.
- Make sure leasing company maintains and cleans dumpsters regularly.
- Return leaking or damaged dumpsters for repair immediately.

What should be kept out of a Dumpster?

The following waste should be kept out of dumpsters:

- Hazardous material: oil based paints, stains, solvent, pesticides, asbestos, and medical waste
- Large bulky items: couches, chairs, and mattresses
- Liquid waste: grease, oil.
- Plant waste from landscaping.
- Construction, remodeling or demolition materials: roofing material, and shingles
- Automobile repair material: tires, used motor oil and filters, automobile batteries, and lead acid batteries
- Freon from household appliances.

Street, Curb & Gutter Maintenance

For More Information:

Stormwater Division

Utilities Department

303-655-2121

stormwater@brightonco.gov

Possible Pollutants

- Fine-grained sediment
- Organics
- Oil
- Saw-cut slurry
- Trash

Good Housekeeping

- Dumpster/Waste Management
- Employee/Contractor Training
- Proper cleanup and disposal procedures
- Dry cleaning methods

Related Procedures

- Spill Prevention and Response
- Street Sweeping
- Street Sweeper Cleaning and Waste

SOP - 13

Description

Street, curb & gutter activities include concrete/asphalt installation, maintenance, repair & replacement; bridge maintenance; and painting/striping.

When performing these activities, pollutants such as sediments, oil and slurry, may be exposed to stormwater. Rainwater will pick up these pollutants and discharge them directly on our local pond or river affecting the environment.

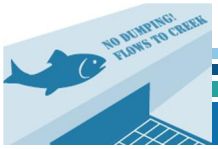
The goal of this written Standard Operation Procedure (SOP) is to provide guidance for municipal employees to help prevent stormwater pollution.

If services are contracted, this SOP should be provided to the Contractor. The contract should also specify that the Contractor is responsible for compliance with all applicable municipal, state and federal laws.

Procedures

General

- Protect adjacent storm drain inlets with curb socks, rock berms, inlet protection, or drain covers/mats prior to any maintenance activity.
- When saw cutting ensure that no slurry enters the storm drain, let the slurry dry, sweep it up, and properly dispose of the sweepings.
- Do not perform concrete or asphalt patch work during wet conditions whenever possible.
- Store materials in containers under cover when not in use and away from any storm drain inlet.
- Monitor equipment for leaks and use drip pans as necessary. Leaking containers should be properly discarded and replaced
- Sweep or vacuum the road once maintenance activities are completed.



Concrete Maintenance

- Minimize the drift of chemical cure on windy days by using the curing compound sparingly and applying it close to the concrete surface.
- Ensure there is a concrete truck washout area available or require the contractor to wash out at the batch plant.
- Whenever possible, recycle concrete rubble; otherwise, dispose of it as solid waste.

Asphalt Maintenance

- Sweep to minimize sand & gravel from new asphalt from getting into storm drains, streets, and creeks.
- Do not allow asphaltic concrete grindings, pieces, or chunks used in embankments or shoulder backing to enter any storm drain or watercourses. Apply temporary perimeter controls. Install silt fence until the structure is stabilized or permanent controls are in place.
- Whenever possible, recycle broken asphalt. If not possible, then dispose of as solid waste.
- Drainage inlet structures shall be covered with inlet protection during application of seal coat, tack coat, slurry seal, and/or fog seal.

Painting & Striping

- If possible, schedule painting and striping projects during dry weather.
- Use thermoplastic or epoxy markings in place of paint whenever feasible.
- The pre-heater for thermoplastic striping and the melting tanks used during pavement marking must be filled carefully to prevent splashing or spilling of materials. Leave 6" at the top of pre-heater and the melting tanks to allow room for material to move and splash when vehicles are deadheaded.

Bridge Maintenance

- Do not transfer or load any materials directly over waterways.
- Secure lids and caps on all containers when on bridges.
- Suspend drop cloths or nets below any bridgework where wastes, scraps, or drips might be spilled into a waterway/

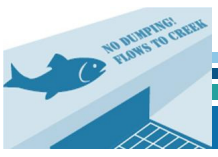
Employee Training

- Train applicable employees on this SOP, including information on how to avoid and report spills. Conduct refresher training periodically.

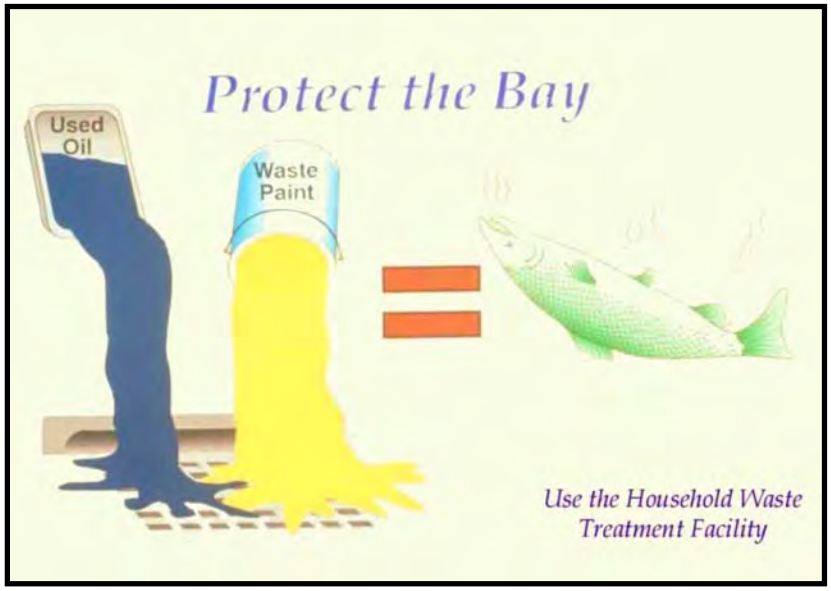
Records

The following records could be used to document activities performed:

- Records of employee training with sign-in sheet.



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.

CASQA California Stormwater Quality Association

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:

- 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/

Outdoor Loading/Unloading SC-30

Photo Credit: Geoff Brosseau

Objectives

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

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Targeted Constituents

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

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

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

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Suggested Protocols

Loading and Unloading – General Guidelines

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm the loading/unloading area to a drain that is connected to a deadend.

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Have an emergency spill cleanup plan readily available.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Other Considerations (Limitations and Regulations)

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

Requirements

Costs

Costs should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.

- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:

  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.

  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

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/

Waste Handling & Disposal SC-34

Photo Credit: Geoff Brosseau

Objectives

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

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Targeted Constituents

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

Approach

Pollution Prevention

- Accomplish reduction in the amount of waste generated using the following source controls:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

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Suggested Protocols

General

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

Run-on/Runoff Prevention

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropyleneor hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Inspection

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.

- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training

- Train staff in pollution prevention measures and proper disposal methods.
- Train employees and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

Other Considerations (Limitations and Regulations)

Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Requirements

Costs

Capital and O&M costs for these programs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance

- None except for maintaining equipment for material tracking program.

Supplemental Information

Further Detail of the BMP

Land Treatment System

Minimize runoff of polluted stormwater from land application by:

- Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, and there is a closed drainage system

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water
- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site
- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)
- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins
- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples

The port of Long Beach has a state-of-the-art database for identifying potential pollutant sources, documenting facility management practices, and tracking pollutants.

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

Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety. Harvard University. 2002.

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

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

The Storm Water 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

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

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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
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