Appendix J Preliminary Water Quality Management Plan

Appendices

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Preliminary Water Quality Management Plan

For:

Chaffey College Fontana Campus

APN: 0255-101-34-0000

Prepared for:

Chaffey Community College District

5885 Haven Ave

Rancho Cucamonga, CA, 91737

(909) 652 – 6000

Prepared by:

LPA

5301 California Ave, Suite #100

Irvine, CA 92617

(949) 261-1001

January 6, 2023

Preliminary for Entitlements Complete Date: ______________________

Construction WQMP Complete Date: ______________________

Final WQMP Approved Date: ______________________

MCN No.___________________ **WQMP No. __________________**

Project Owner's Certification

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

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

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0255-101-34

Owner's Signature			
Owner Name:			
Title			
Company			
Address			
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0255-101-34

"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:		PE Stamp Below
Title	Director of Civil Engineering	
Company	LPA	
Address	5301 California Ave, Suite 100, Irvine, CA	
Email	kshinkai@lpadesignstudios.com	
Telephone #	(949) 261-1001	
Signature		
Date		

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Forms

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">Chaffey College Fontana Campus</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4"></td></tr>
<tr><td>Mailing Address:</td><td></td><td>E-mail Address:</td><td></td><td>Telephone:</td><td></td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td></td><td>Tract/Parcel Map Number(s):</td><td colspan="2"></td></tr>
<tr><td colspan="2">Additional Information/ Comments:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">The Chaffey College Fontana Campus is located at 11070 Sierra Avenue in Fontana. This project is a new Fontana campus for the Chaffey Community College District. The existing site area is vacant land.

The project’s disturbed area is 624,485 s.f. (14.3 acres). The campus will be built in 2 phases, however this preliminary WQMP encompasses the full built out condition. Phase 1 includes the parking lot, sidewalks, utility infrastructure, trash enclosure, landscaped areas, welcome center/library, an instructional building, automotive technology building, and an O&M building. Phase 2 includes an instructional building, student and community center, and CTE building. See Section 6.1 for a phased site plan.

The existing site ranges in elevation from 1158’ at the north east end of Sierra Avenue to 1147’ at the south west corner of the site. The existing site consists of 2 drainage areas. Storm water runoff is conveyed through surface flow.

Approximately half of the site drains to an existing detention basin to the south. The property to the south is currently proposing to reduce the size of the existing basin and build an affordable housing project. This involves re routing an existing 108” RCP SD line in Sierra Avenue. The other half drains to the neighboring property to the west. The western property was previously undeveloped and is currently in construction of an industrial building. The project also built a retaining wall along the western property line. See Section 6.4 for Existing Topography Exhibit provided by Value Engineering for reference.

Storm water runoff from the project site will be treated to the best extent practical before release into the Public storm drain system. The geotechnical report and percolation testing provided by Leighton Consulting, Inc recommend infiltration at depths between 15-25 feet on the western portion of the site. Per discussions with the geotechnical engineer, drywells are a recommended Best Management Practice (BMP) to reach the infiltrating soil layers. Storm water tributary to the northern, western, and southern portions of the site will receive treatment via drywells located along the western drive aisle. A bioretention planter with underdrains is also a proposed BMP for the frontage along Sierra Avenue. Stormwater tributary to the eastern portion of the site will be routed for treatment in a bioretention planter. The implementation of drywells and a bioretention planter was discussed with the city of Fontana and deemed acceptable.</td></tr>
</table>

	Stormwater in excess of stormwater treatment requirements for a 100-year storm will be stored in an underground detention facility and released to the proposed 108” city of Fontana storm drain along the southern property edge. Per discussions with the city of Fontana, Chaffey College is permitted to connect to the City of Fontana storm drain line. See Section 6.1 for Post-Development Preliminary WQMP Exhibit and Section 6.4 for the Geotechnical Report.
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	N/A

Section 2 Project Description

2.1 Project Information

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

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

<table>
<tr><th colspan="6">Form 2.1-1 Description of Proposed Project</th></tr>
<tr><td colspan="6">1 Development Category (Select all that apply):</td></tr>
<tr><td>☐ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site</td><td colspan="2">☒ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site</td><td colspan="2">☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539</td><td>☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more</td></tr>
<tr><td>☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more</td><td colspan="2">☐ Developments of 2,500 ft² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.</td><td colspan="2">☒ Parking lots of 5,000 ft² or more exposed to storm water</td><td>☐Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day</td></tr>
<tr><td colspan="6">☐ Non-Priority / Non-Category Project May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</td></tr>
<tr><td>2 Project Area (ft2):</td><td>610,711</td><td>3 Number of Dwelling Units:</td><td>N/A</td><td>4 SIC Code:</td><td>8221</td></tr>
<tr><td colspan="6">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.</td></tr>
<tr><td colspan="6">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)</td></tr>
</table>

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:
Maintenance of the provided WQMP facilities will be the sole responsibility of the property owner. This comprises of BMP maintenance, catch basin inspection, storm drain maintenance, etc. The owner shall be held responsible until the property is sold or ownership is transferred.

2.3 Property Ownership/Management

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 ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☐	N ☒	The proposed development does not include an area where water will be stagnant and promote the growth of aquatic plants.
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Property Ownership/Management

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 %:			
Description of Water Quality Credit Eligibility	The proposed project does not utilize any water quality credits.		

Section 3 Site and Watershed Description

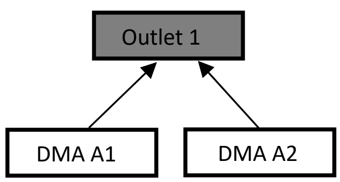
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34° 3'10.29"N	Longitude 117°26'12.54"W	Thomas Bros Map page

[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
DMA A1 to Outlet 1	Proposed site runoff will sheet flow and be guided by gutters into drain inlet. Stormwater is then routed via underground pipe to underground detention chamber.
DMA A2 to Outlet 1	Proposed site runoff will be directed to underground detention basin with underdrains for treatment. Stormwater is then routed via underground pipe to underground detention chamber.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area A and B

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A1	DMA A2		
1 DMA drainage area (ft^2)	511,175	112,910		
2 Existing site impervious area (ft^2)	0	0		
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2	2		
4 Hydrologic soil group *See Section 6.4 for Soil Type Map*	A	A		
5 Longest flowpath length (ft)	250'	500'		
6 Longest flowpath slope (ft/ft)	0.8%	1.0%		
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Commercial	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	Poor		

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Declez Channel (See Section 6.4 for Receiving Waters Map)
Applicable TMDLs *Refer to Local Implementation Plan*	None
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*	None
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	None
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	None
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	☒	☐	General information shall be provided to tenants on maintenance practice that involves the protection of stormwater. This includes the tenant being familiarized with the WQMP documents and educational material in Section 6.4.2.
N2	Activity Restrictions	☒	☐	Tenants or occupants shall not be allowed to discharge chemicals, chemical residues, wastewater or other prohibited discharges listed in the City of Fontana stormwater ordinance.
N3	Landscape Management BMPs	☒	☐	Maintenance shall be conducted to ensure the irrigation system is functioning efficiently and repaired as needed. Adjust the irrigation heads and system run times to prevent overwatering, overspray, or run-off from landscaped areas. Mowing and trimming waste shall be properly disposed of and fertilizer and pesticides shall be used in limited amounts.
N4	BMP Maintenance	☒	☐	The owner shall inspect BMP's for standing water within 48 hours after of storm events. BMP maintenance shall be performed per Form 5-1.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste associated with proposed project.
N6	Local Water Quality Ordinances	☒	☐	Property Owner shall ensure tenants comply with the City of Fontana Storm Water Ordinance through the operation and maintenance of BMP's.
N7	Spill Contingency Plan	☒	☐	The Property Owner shall develop a spill contingency plan which mandates stockpiling of cleanup materials, notification of responsible agencies, disposal of cleanup materials, and documentation.
N8	Underground Storage Tank Compliance	☐	☒	The proposed project does not include underground storage of materials.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous waste associated with proposed 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	
N10	Uniform Fire Code Implementation	☒	☐	The project will be developed and operated in accordance with Article 80 of the Uniform Fire Code.
N11	Litter/Debris Control Program	☒	☐	Property owner shall implement a trash management and litter control procedure, aimed at reducing pollution of stormwater. They may contract with their landscape maintenance firm to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles, and noting trash disposal violations by tenants.
N12	Employee Training	☒	☐	The property owner shall develop an education program to train future employees in good housekeeping practices for the protection of stormwater. Recommended educational materials are included in Section 6.4.
N13	Housekeeping of Loading Docks	☐	☒	No loading docks proposed.
N14	Catch Basin Inspection Program	☒	☐	The on-site catch basins shall be inspected monthly during the rainy season and before/after each storm to ensure proper operation.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The paved areas shall be swept and cleaned monthly.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No gasoline outlet proposed.
N17	Comply with all other applicable NPDES permits	☒	☐	The developer shall comply with the California Statewide General Construction Storm Water Permit.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, If not applicable, state reason
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Storm drain stencils are highly visible source control messages placed directly adjacent to inlets. Stencils shall include prohibitive language such as "NO DUMPING – DRAINS TO OCEAN" and graphical icons to discourage illegal dumping. Owner shall maintain legibility of stencils and signs.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☒	☐	Hazardous material storage areas were designed to properly store hazardous materials in an enclosure that prevents contact to storm water.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash enclosures were designed to not allow run-on from adjoining areas and are walled to prevent off-site transport of trash. There is also a solid roof to prevent direct precipitation.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Owner shall utilize rain shutoff valves to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be 1-2 inches below top of curb, sidewalk, or pavement.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	All slopes shall be hard lined, rip-rapped or vegetated to provide erosion protection and prevent sediment transport.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No dock areas proposed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No covered outdoor processing areas proposed.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, If not applicable, state reason
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping proposed.
S14	Wash water control for food preparation areas	☐	☒	No food preparation areas proposed.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No car washing 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: Proposed design assumed 80% imperviousness. Where applicable planting and trees have been added throughout the site.
Maximize natural infiltration capacity: Yes☒ No☐ Explanation: Design proposes buildings to be in areas outside of high infiltration rates.
Preserve existing drainage patterns and time of concentration: Yes☒ No☐ Explanation: The post developed condition will have relatively the same drainage pattern and depression points compared to the pre developed condition.
Disconnect impervious areas: Yes☒ No☐ Explanation: Several buildings roof drains allow runoff to be directed to permeable areas.
Protect existing vegetation and sensitive areas: Yes☐ No☒ Explanation: Not applicable, there are no known sensitive areas.
Re-vegetate disturbed areas: Yes☒ No☐ Explanation: Any impervious area will be stabilized with landscaping cover.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes☒ No☐ Explanation: Landscaping areas will be staked off after rough grading has been completed to prevent excess compaction.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes☐ No☒ Explanation: No vegetative swales proposed.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes☐ No☐ Explanation: Landscaping areas will be staked off after rough grading has been completed to prevent excess compaction.

4.2 Project Performance Criteria

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA A1)		
1 Project area DA 1 (ft^2): **511,575 SF**	2 Imperviousness after applying preventative site design practices (Imp%): 80%	3 Runoff Coefficient (Rc): 0.60 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.525 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.78 *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): 39,164 *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 A1)

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

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

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

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

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

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

Form 4.2-3, 4.2-4, 4.2-5 is not applicable and has not been included in this preliminary WQMP due to no potential cause or contribution to an HCOC. See Section 6.4 for HCOC exempt area map.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA A2)

1 Project area DA 1 (ft^2): **112,910 SF**	**2** Imperviousness after applying preventative site design practices (Imp%): 80%	**3** Runoff Coefficient (Rc): 0.60 *$R_c = 0.858(Imp\%)^{3}-0.78(Imp\%)^{2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.525 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.78 *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): 8,644 *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 A2)

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

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

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

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

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

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

Form 4.2-3, 4.2-4, 4.2-5 is not applicable and has not been included in this preliminary WQMP due to no potential cause or contribution to an HCOC. See Section 6.4 for HCOC exempt area map.

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).

Form 4.3-1 Infiltration BMP Feasibility (DA A1 and DA A2)

Feasibility Criterion – Complete evaluation for each DA on the Project Site
[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes☐ No☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes☐ No☒ (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than eight feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.
If Yes, Provide basis: (attach)
[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes☐ No☒
If Yes, Provide basis: (attach)
[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes☐ No☒
If Yes, Provide basis: (attach)
[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes☐ No☒
If Yes, Provide basis: (attach)
[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes☐ No☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
[7] Any answer from Item 1 through Item 3 is "Yes": Yes☐ No☒ *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.* [8] Any answer from Item 4 through Item 6 is "Yes": Yes☐ No☒ *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.* [9] All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.*

4.3.1 Site Design Hydrologic Source Control BMP

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

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA A1 and DA A2)

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

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA A1)

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 (ft²)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft³/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft³) $V_{retention}$ *= Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft³): $V_{retention}$ *=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 (ft²)			
24 Runoff volume retention from street trees (ft³) $V_{retention}$ *= Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft³): $V_{retention}$ *= 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 (ft³) $V_{retention}$ *= Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): $V_{retention}$ *=Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: *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.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA A1)			
1 Remaining LID DCV not met by site design HSC BMP (ft^3): 39,164 CF — *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DMA A1 Underground Chamber	DMA A1 Drywells (2)	
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	30 in/hr	30 in/hr	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	5	5	
4 Design percolation rate (in/hr) Pdesign = Item 2 / Item 3	6 in/hr	6 in/hr	
5 Drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48 hours	48 hours	
6 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*	14,000 SF	12.57 SF	
7 Depth of reservoir, *d* (ft)	6.75’	14’	
8 Porosity of aggregate, if none then 1.0	0.4	0.4	
9 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3 hours	3 hours	
14 Retention Volume (ft^3) *$V_{retention}$ = ((Item 4/12)*Item 6*Item 9) + (Item 6*Item 7*Item 8)*	49,000 CF	90 CF (2)	
16 Total Retention Volume from LID Infiltration BMPs: 49,180 *(Sum of Items in row 14)*			
17 Fraction of DCV achieved with infiltration BMP: 100%+ *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 A1 and DA A2)			
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): N/A *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			
9 Total Retention Volume (ft^3) from Harvest and Use BMP *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes☐ No☐ *If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.*			

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA A2)		
1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 8,664 CF	List pollutants of concern *Copy from Form 2.3-1.* Pathogens, Nutrients, Sediment, Metals, Oil and Grease, Trash/Debris, Pesticides/Herbicides, Organic Compounds	
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* ☒Bioretention with underdrain ☐Planter box with underdrain ☐Constructed wetlands ☐Wet extended detention ☐Dry extended detention	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume* ☐Vegetated swale ☐Vegetated filter strip ☐Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 10,230 CF *Form 4.3- 6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): 0 *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): N/A *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 Volume Based Biotreatment (DA A2) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DMA A2 Bioretention Basin with Underdrain		
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	Pathogens, Nutrients, Sediment, Metals, Oil and Grease, Trash/Debris, Pesticides/Herbicides, Organic Compounds		
2 Amended soil infiltration rate *Typical ~ 5.0*	5.0		
3 Amended soil infiltration safety factor *Typical ~ 2.0*	2.0		
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	2.5		
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	48 hours		
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.5’		
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	0.5’		
8 Amended soil surface area (ft^2)	5,180 SF		
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1.5’		
10 Amended soil porosity, *n*	0.3		
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	1’		
12 Gravel porosity, *n*	0.4		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3 hours		
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))]*	10,230 CF		
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 10,230 SF *Sum of Item 14 for all volume-based BMPs included in this form*			

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

Form 4.3-8 Flow Based Biotreatment (DA 1)			
Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*	N/A		
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 $2^{\wedge 1.67}$ * Item $3^{\wedge 0.5}$)*			
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 $2^{\wedge 2}$)*			
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 A1)
1 Total LID DCV for the Project DA-1 (ft^3): 39,164 CF *Copy Item 7 in Form 4.2-1*
2 On-site retention with site design hydrologic source control LID BMP (ft^3): N/A *Copy Item 30 in Form 4.3-2*
3 On-site retention with LID infiltration BMP (ft^3): 49,180 CF *Copy Item 16 in Form 4.3-3*
4 On-site retention with LID harvest and use BMP (ft^3): N/A *Copy Item 9 in Form 4.3-4*
5 On-site biotreatment with volume based biotreatment BMP (ft^3): N/A CF *Copy Item 3 in Form 4.3-5*
6 Flow capacity provided by flow based biotreatment BMP (cfs): N/A CF *Copy Item 6 in Form 4.3-5*
7 LID BMP performance criteria are achieved if answer to any of the following is “Yes”: - Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes☒ No☐ *If yes, sum of Items 2, 3, and 4 is greater than Item 1* - Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes☐ No☒ *If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized* - On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes☐ No☒ *If yes, Form 4.3-1 Items 7 and 8 were both checked yes*
8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: - Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐ *Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%* - An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐ *Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed*

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA A2)

1 Total LID DCV for the Project DA-1 (ft^3): 8,644 CF *Copy Item 7 in Form 4.2-1*

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

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

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

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 10,230 CF *Copy Item 3 in Form 4.3-5*

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA A1 and DA A2)	
1 Volume reduction needed for HCOC performance criteria (ft³): N/A *(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 (ft³): *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft³): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): *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)

The preliminary design of the project was able to fully retain and infiltrate the DCV through onsite BMP’s, an alternative compliance plan to address the remainder of the LID DCV was not necessary.

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) per form 5-1. See section 6.3 for Operations and Maintenance Plan.

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

BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Underground Chambers	Property Owner	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris, and sediment as determined by inspections. See manufacturer recommendations for additional maintenance activities in Section 6.3.	Annually and within 48 hours following a significant storm event to verify there is no standing water in the chambers.
Drywells	Property Owner	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris, and sediment as determined by inspections. See manufacturer recommendations for additional maintenance activities in Section 6.3.	Annually and within 48 hours following a significant storm event to verify there is no standing water in the chamber.
Bioretention Basin with Underdrain	Property Owner	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris, and sediment as determined by inspections. See manufacturer recommendations for additional maintenance activities in Section 6.3.	Annually before the storm season (October) and 48 hours following a significant storm event to verify there is no standing water in the chambers.
Onsite Storm Drain Catch Bains and Piping	Property Owner	Onsite catch basins shall be inspected quarterly for debris buildup and evidence of illegal dumping and shall be cleaned whenever debris/sediment accumulates.	Quarterly
Landscape Maintenance	Property Owner	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains.	Weekly/Monthly
Litter Control	Property Owner	Property Owner shall implement a trash management and litter control procedure aimed at reducing pollution of stormwater. They may contract with their landscape maintenance firm to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptables, and noting trash disposal violations by tenants.	Daily
Parking Lot Sweeping and Litter Control	Property Owner	Streets and parking lots are required to be swept.	Monthly/Prior to rainy season (October)
Anti-Dumping Stenciling and Signage	Property Owner	Visible inspection and replacement of damaged or illegible stenciling and signage over onsite catch basins.	Annually

Irrigation System	Property Owner	Check and repair the irrigation system. Verify there are no leaks or runoff from landscaped areas. Adjust irrigation heads and system run times as necessary.	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

- Vicinity Map and Project Phasing Diagram
- Pre and Post Development Hydrology Exhibit
- LID BMP Details
- Post Development WQMP Exhibit

6.2 Electronic Data Submittal

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

6.3 Post Construction

- Operation and Maintenance Plan

6.4 Other Supporting Documentation

- Existing Topography Exhibit
- HCOC Exempt Area Map
- Receiving Waters Map
- Soil Type Map
- Preliminary Plan Sheets for Reference
- Geotechnical Report

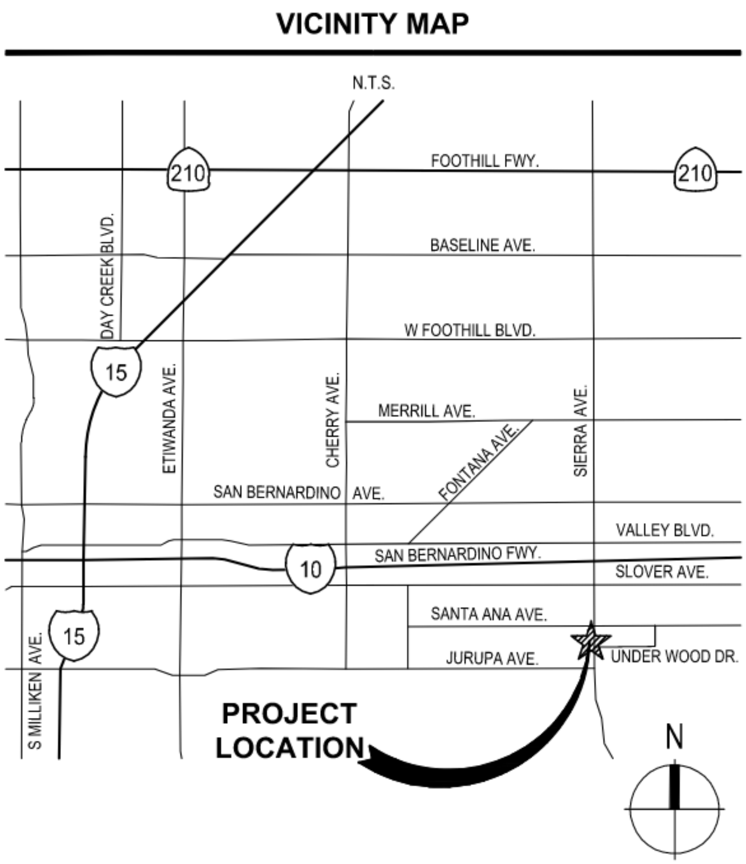
SECTION 6.1

Vicinity Map and Project Phasing Diagram

Pre and Post Development Hydrology Exhibit

LID BMP Details

Post Development WQMP Exhibit


VICINITY MAP
N.T.S.
FOOTHILL FWY.
210
BASELINE AVE.
W FOOTHILL BLVD.
DAY CREEK BLVD.
15
ETIWANDA AVE.
CHERRY AVE.
MERRILL AVE.
FONTANA AVE.
SIERRA AVE.
SAN BERNARDINO AVE.
VALLEY BLVD.
SAN BERNARDINO FWY.
10
SLOVER AVE.
SANTA ANA AVE.
JURUPA AVE.
UNDER WOOD DR.
S MILLIKEN AVE.
PROJECT LOCATION
N

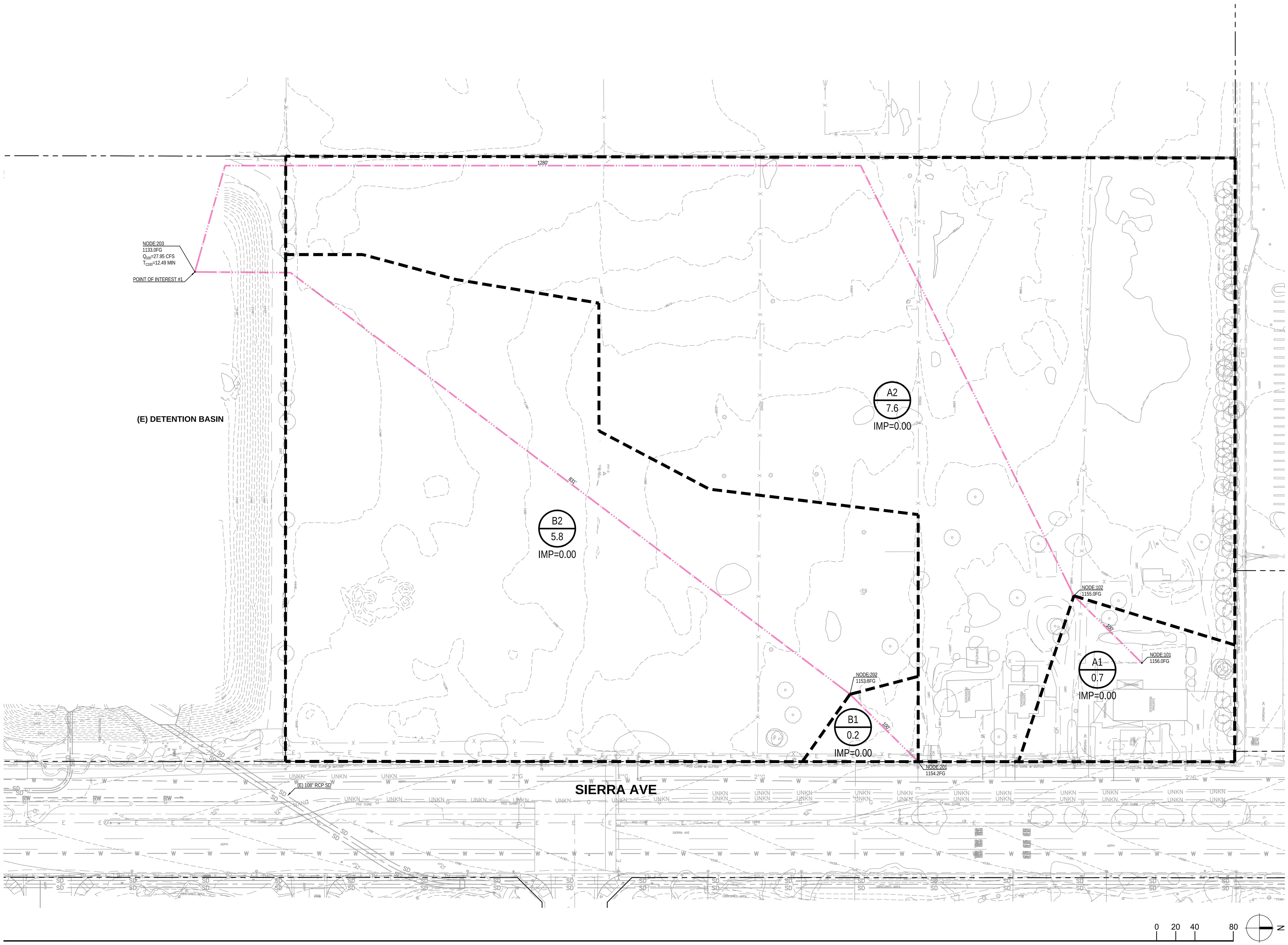

Equipment Rental
Prestige Animal Hospital - South Fontana
Juniper Ave
Sierra Ave.
White Oak Ln
Under Wood Dr
Walgreens
Drug store
Quick Quack Car Wa
Bank of America Financial Center
Kraft Ln
Mendoza Paving
Starbucks
Jack in the Box
Fast Food · $
Jurupa Ave
Just Doors
Windcrest Dr
CHAFFEY COLLEGE FONTANA CAMPUS

CAMPUS VISION PLAN

- **A** **Welcome Center/Library** Phase 1
- **B** **Instructional Building I** Phase 1
- **C** **Automotive Technology Building** Phase 1
- **D** **CTE Building** Phase 2
- **E** **Operations and Maintenance Building** Phase 1
- **F** **Instructional Building II** Phase 2
- **G** **Student and Community Center** Phase 2

LEGEND

SURFACE FLOW	
LIMIT OF WORK/DELINEATION BETWEEN DRAINAGE AREAS	
NAME	DRAINAGE SUBAREA
X.XX	AREA (ACRES)
IMP=0.XX	IMPERVIOUS RATIO



LPA

ARCHITECTURE ENGINEERING INTERIORS
LANDSCAPE ARCHITECTURE PLANNING

949-261-1001 Office
949-260-1190 Fax
LPADesignStudios.com

5301 California Avenue,
Suite 100
Irvine, California 92617

CHAFFEY COLLEGE FONTANA CAMPUS

110?0 SIERRA AVENUE
FONTANA CA

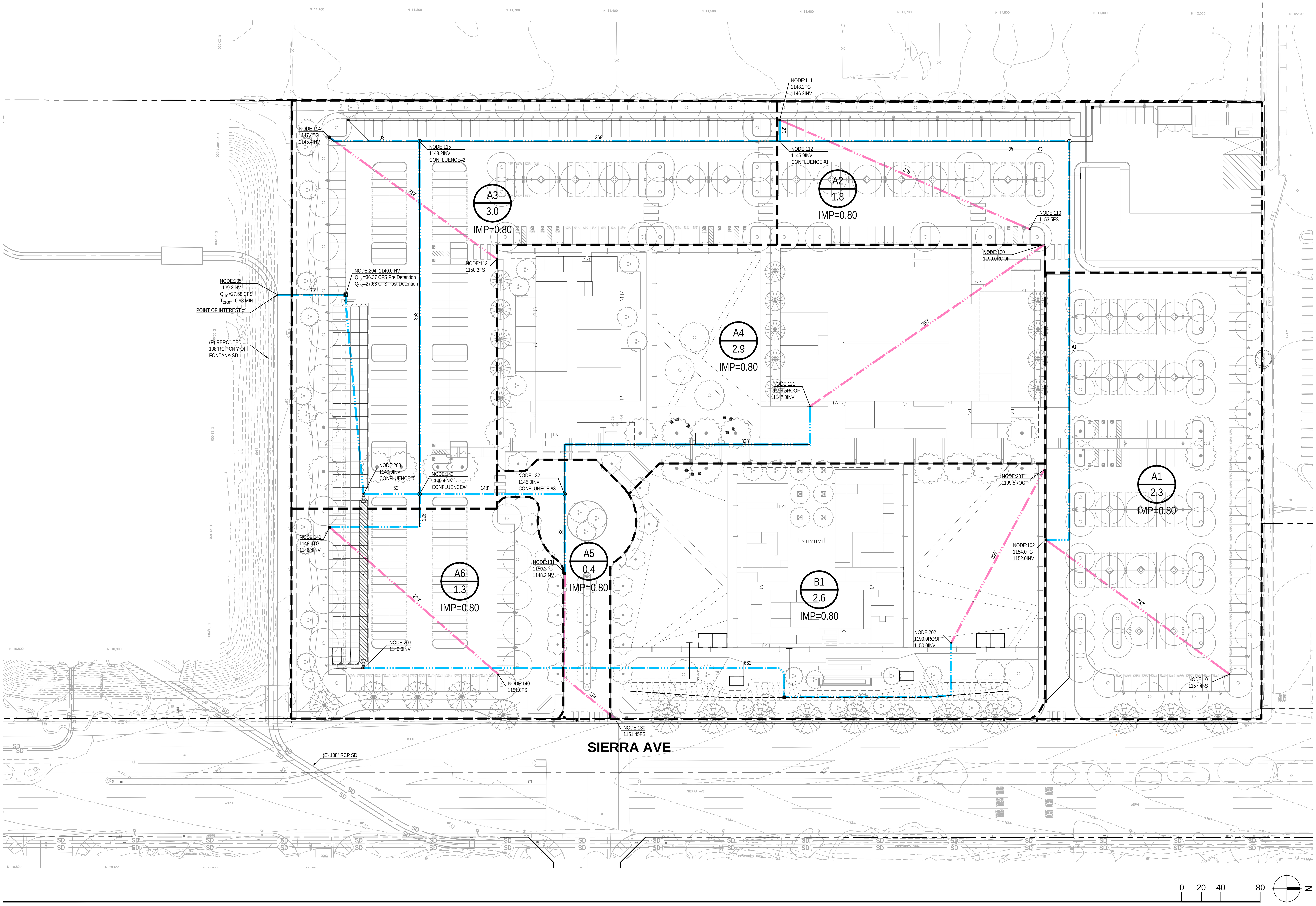
CHAFFEY COLLEGE

	0 1 01
	MM.DD.YY
	S
	1" = 40'

EXISTING HYDROLOGY EXHIBIT

LEGEND

(pink dash-dot line)	SURFACE FLOW
(blue dash-dot line)	PIPE FLOW
(black dashed line)	LIMIT OF WORK/DELINEATION BETWEEN DRAINAGE AREAS
NAME / X.XX / IMP=0.XX	DRAINAGE SUBAREA / AREA (ACRES) / IMPERVIOUS RATIO



J-45

LPA

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CHAFFEY COLLEGE FONTANA CAMPUS

11070 SIERRA AVENUE
FONTANA, CA 92337

Developed for
CHAFFEY COLLEGE

Date	Revision

Date	Submittal

Job Number	30671.01
Date Published	01/05/2023
Checked By	K.S.
Scale	1" = 40'

PROPOSED HYDROLOGY EXHIBIT

LEGEND

(pattern)	PERVIOUS LANDSCAPE AREA
(pattern)	BIORETENTION WITH UNDERDRAINS
(pattern)	PROPOSED BUILDING
(arrow)	SURFACE FLOW DIRECTION
(line)	STORM DRAIN FLOW DIRECTION
NAME	DRAINAGE SUBAREA
X.XX	AREA (ACRES)
IMP=0.XX	IMPERVIOUS RATIO

STRUCTURAL BMPs

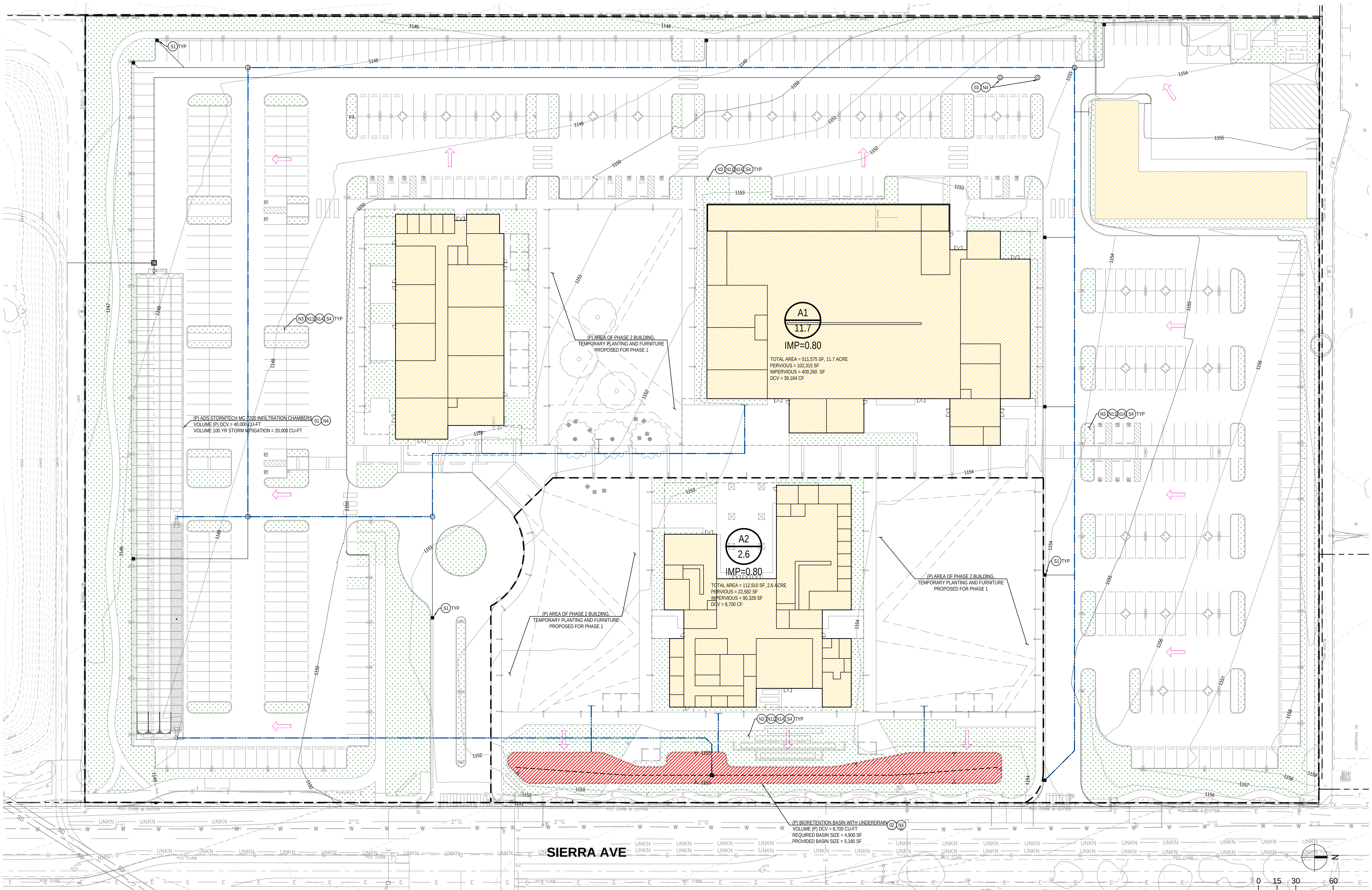
- 01 ADS STORMTECH MC-7200 INFILTRATION CHAMBERS TRIBUTARY AREA = 14,000 SF
- 02 UNDERGROUND DETENTION BASIN WITH UNDERDRAINS TRIBUTARY AREA = 5,180 SF
- 02 MAXWELL DRYWELLS TRIBUTARY AREA = 12.57 SF

NON-STRUCTURAL SOURCE CONTROL BMPs

- N3 COMMON AREA LANDSCAPE MANAGEMENT
- N4 BMP MAINTENANCE
- N11 COMMON AREA LITTER CONTROL
- N14 COMMON AREA CATCH BASIN INSPECTION

STRUCTURAL SOURCE CONTROL BMPs

- S1 STORM DRAIN STENCILING
- S4 EFFICIENT IRRIGATION



PRELIMINARY WQMP EXHIBIT

1" = 30'

01

PRO ECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PRO ECT NO	

ADS
Ad d Dr S I

ADS SiteAssist
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

CHAFFEY COLLEGE FONTANA CAMPUS

FONTANA CA USA

MC-7200 STORMTECH CHAMBER SPECIFICATIONS

1 CHAMBERS SHALL BE STORMTECH MC- 200

2 CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS

CHAMBERS SHALL MEET THE RE UIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE PP CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 0 101

4 CHAMBER ROWS SHALL PROVIDE CONTINUOUS UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION

THE STRUCTURAL DESIGN OF THE CHAMBERS THE STRUCTURAL BAC FILL AND THE INSTALLATION RE UIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12 12 ARE MET FOR 1 LONG-DURATION DEAD LOADS AND 2 SHORT-DURATION LIVE LOADS BASED ON THE AASHTO DESIGN TRUC WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES

CHAMBERS SHALL BE DESIGNED TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2 8 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" LOAD CONFIGURATIONS SHALL INCLUDE 1 INSTANTANEOUS 1 MIN AASHTO DESIGN TRUC LIVE LOAD ON MINIMUM COVER 2 MA IMUM PERMANENT -YR COVER LOAD AND ALLOWABLE COVER WITH PAR ED 1-WEE AASHTO DESIGN TRUC

RE UIREMENTS FOR HANDLING AND INSTALLATION
- TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING CHAMBERS SHALL HAVE INTEGRAL INTERLOC ING STAC ING LUGS
- TO ENSURE A SECURE OINT DURING INSTALLATION AND BAC FILL THE HEIGHT OF THE CHAMBER OINT SHALL NOT BE LESS THAN
- TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR E UAL TO 4 0 LBS FT THE ASC IS DEFINED IN SECTION 2 8 OF ASTM F2418 AND TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES ABOVE F 2 C CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS

8 ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED UPON RE UEST BY THE SITE DESIGN ENGINEER OR OWNER THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PRO ECT SITE AS FOLLOWS
- THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER
- THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR E UAL TO 1 FOR DEAD LOAD AND 1 FOR LIVE LOAD THE MINIMUM RE UIRED BY ASTM F2 8 AND BY SECTIONS AND 12 12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE
- THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN E CEPT THAT IT SHALL BE THE -YEAR MODULUS USED FOR DESIGN

CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 001 CERTIFIED MANUFACTURING FACILITY

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-7200 CHAMBER SYSTEM

1 STORMTECH MC- 200 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS

2 STORMTECH MC- 200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC- 200 CONSTRUCTION GUIDE"

CHAMBERS ARE NOT TO BE BAC FILLED WITH A DO ER OR E CAVATOR SITUATED OVER THE CHAMBERS STORMTECH RECOMMENDS BAC FILL METHODS
- STONESHOOTER LOCATED OFF THE CHAMBER BED
- BAC FILL AS ROWS ARE BUILT USING AN E CAVATOR ON THE FOUNDATION STONE OR SUBGRADE
- BAC FILL FROM OUTSIDE THE E CAVATION USING A LONG BOOM HOE OR E CAVATOR

4 THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS

OINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE

MAINTAIN MINIMUM - " 2 0 SPACING BETWEEN THE CHAMBER ROWS

INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" 00 INTO CHAMBER END CAPS

8 EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN CRUSHED ANGULAR STONE MEETING THE AASHTO M4 DESIGNATION OF OR 4

STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 12" 00 BETWEEN AD ACENT CHAMBER ROWS

10 STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING

11 THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER

12 ADS RECOMMENDS THE USE OF "FLE STORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF

NOTES FOR CONSTRUCTION EQUIPMENT

1 STORMTECH MC- 200 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC- 200 CONSTRUCTION GUIDE"

2 THE USE OF E UIPMENT OVER MC- 200 CHAMBERS IS LIMITED
- NO E UIPMENT IS ALLOWED ON BARE CHAMBERS
- NO RUBBER TIRED LOADER DUMP TRUC OR E CAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC- 00 MC- 200 CONSTRUCTION GUIDE"
- WEIGHT LIMITS FOR CONSTRUCTION E UIPMENT CAN BE FOUND IN THE "STORMTECH MC- 200 CONSTRUCTION GUIDE"

FULL " 00 OF STABILI ED COVER MATERIALS OVER THE CHAMBERS IS RE UIRED FOR DUMP TRUC TRAVEL OR DUMPING

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

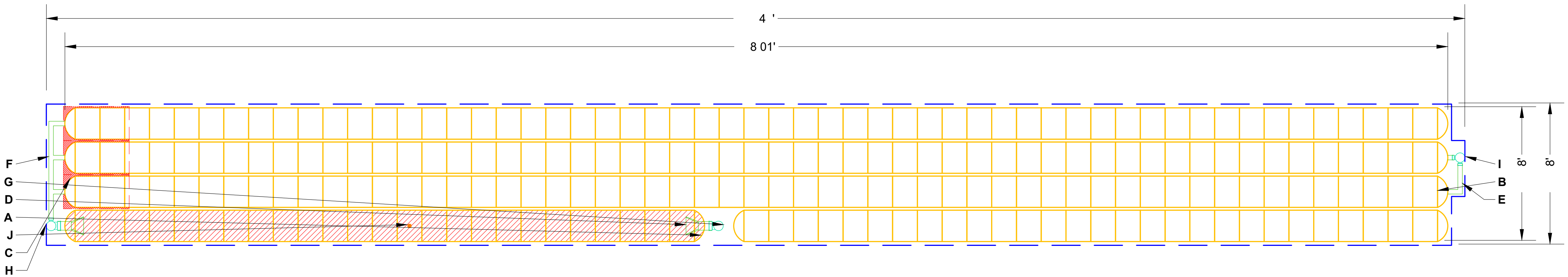
CONTACT STORMTECH AT 1-888-8 2-2 4 WITH ANY UESTIONS ON INSTALLATION RE UIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION E UIPMENT

PROPOSED LAYOUT	
218	STORMTECH MC- 200 CHAMBERS
10	STORMTECH MC- 200 END CAPS
12	STONE ABOVE
	STONE BELOW
40	STONE VOID
1	INSTALLED SYSTEM VOLUME CF PERIMETER STONE INCLUDED COVER STONE INCLUDED BASE STONE INCLUDED
1410	SYSTEM AREA SF
8 0 1	SYSTEM PERIMETER

CONCEPTUAL ELEVATIONS	
MA IMUM ALLOWABLE GRADE TOP OF PAVEMENT UNPAVED	12
MINIMUM ALLOWABLE GRADE UNPAVED WITH TRAFFIC	8 2
MINIMUM ALLOWABLE GRADE UNPAVED NO TRAFFIC	
MINIMUM ALLOWABLE GRADE TOP OF RIGID CONCRETE PAVEMENT	
MINIMUM ALLOWABLE GRADE BASE OF FLE IBLE PAVEMENT	
TOP OF STONE	
TOP OF MC- 200 CHAMBER	
12" 12" TOP MANIFOLD INVERT	2
24" ISOLATOR ROW PLUS INVERT	0 4
24" ISOLATOR ROW PLUS INVERT	0 4
12" 12" BOTTOM MANIFOLD INVERT	0 88
12" BOTTOM CONNECTION INVERT	0 88
BOTTOM OF MC- 200 CHAMBER	0
BOTTOM OF STONE	0 00

INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PARTIAL CUT END CAP PART MC 200IEPP24B TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2 2 "	
PREFABRICATED END CAP	B	12" BOTTOM PARTIAL CUT END CAP PART MC 200IEPP12B TYP OF ALL 12" BOTTOM CONNECTIONS	1 "	
PREFABRICATED END CAP	C	12" TOP PARTIAL CUT END CAP PART MC 200IEPP12T TYP OF ALL 12" TOP CONNECTIONS	"	
FLAMP	D	INSTALL FLAMP ON 24" ACCESS PIPE PART MC 20024RAMP TYP 2 PLACES		
MANIFOLD	E	12" 12" BOTTOM MANIFOLD ADS N-12	1 "	
MANIFOLD	F	12" 12" TOP MANIFOLD ADS N-12	"	
NYLOPLAST INLET W ISO PLUS ROW	G	0" DIAMETER 24 00" SUMP MIN		CFS IN
NYLOPLAST INLET W ISO PLUS ROW	H	0" DIAMETER 24 00" SUMP MIN		4 CFS IN
NYLOPLAST OUTLET	I	0" DIAMETER DESIGN BY ENGINEER		4 0 CFS OUT
INSPECTION PORT		4" SEE DETAIL		



ISOLATOR ROW PLUS
SEE DETAIL

PLACE MINIMUM 1 0' OF ADSPLUS1 WOVEN GEOTE TILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

MANIFOLD SI E TO BE DETERMINED BY SITE DESIGN ENGINEER SEE TECH NOTE 2 FOR MANIFOLD SI ING GUIDANCE

DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD

THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY AD UST GRADING TO ENSURE THE CHAMBER COVER RE UIREMENTS ARE MET

THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED

NOT FOR CONSTRUCTION: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT THE RE UIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE

CHAFFEY COLLEGE FONTANA CAMPUS
FONTANA CA USA

DRAWN T
CHEC ED N A
DATE
PRO ECT

DATE | DRW | CH | DESCRIPTION

StormTech
C r S
888-8 2-2 4 | WWW STORMTECH.COM

ADS
4 40 TRUEMAN BLVD
HILLIARD OH 4 02
1-800- - 4

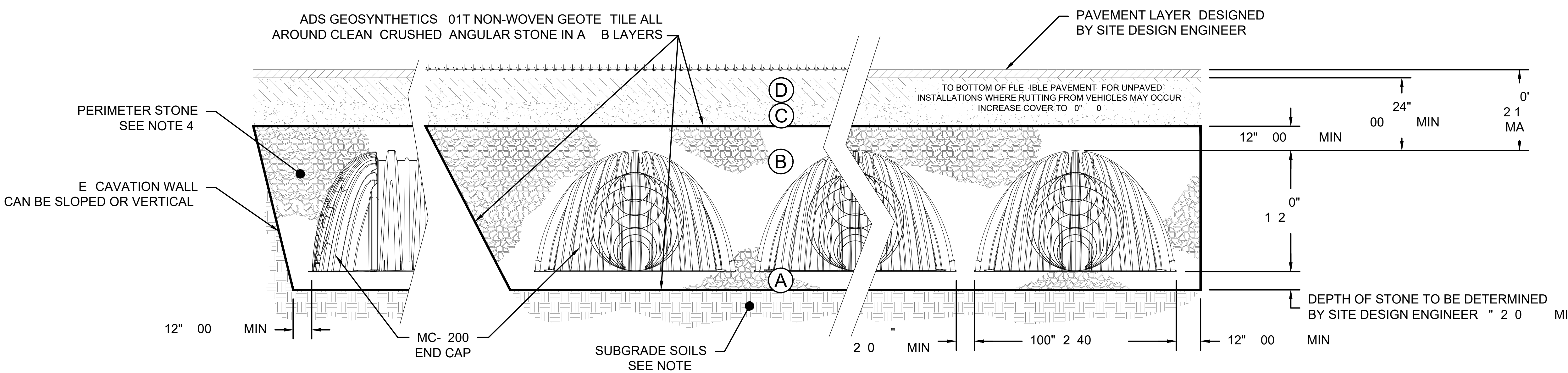
0
0
0

SHEET
2 OF

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION DENSITY RE UIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLE IBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL ROC MATERIALS NATIVE SOILS OR PER ENGINEER'S PLANS CHEC PLANS FOR PAVEMENT SUBGRADE RE UIREMENTS	N A	PREPARE PER SITE DESIGN ENGINEER'S PLANS PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION RE UIREMENTS
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE 'B' LAYER TO 24" 00 ABOVE THE TOP OF THE CHAMBER NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER	GRANULAR WELL-GRADED SOIL AGGREGATE MI TURES FINES OR PROCESSED AGGREGATE MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER	AASHTO M14 [1] A-1 A-2-4 A- OR AASHTO M4 [1] 4 4 8 8 8 8 10	BEGIN COMPACTIONS AFTER 24" 00 OF MATERIAL OVER THE CHAMBERS IS REACHED COMPACT ADDITIONAL LAYERS IN 12" 00 MA LIFTS TO A MIN PROCTOR DENSITY FOR WELL GRADED MATERIAL AND RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE 'A' LAYER TO THE 'C' LAYER ABOVE	CLEAN CRUSHED ANGULAR STONE	AASHTO M4 [1] 4	NO COMPACTION RE UIRED
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT BOTTOM OF THE CHAMBER	CLEAN CRUSHED ANGULAR STONE	AASHTO M4 [1] 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE [2]

PLEASE NOTE
1 THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY THE STONE MUST ALSO BE CLEAN CRUSHED ANGULAR FOR E AMPLE A SPECIFICATION FOR 4 STONE WOULD STATE "CLEAN CRUSHED ANGULAR NO 4 AASHTO M4 STONE"
2 STORMTECH COMPACTION RE UIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN " 2 0 MA LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR
WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION FOR STANDARD DESIGN LOAD CONDITIONS A FLAT SURFACE MAY BE ACHIEVED BY RA ING OR DRAGGING WITHOUT COMPACTION E UIPMENT FOR SPECIAL LOAD DESIGNS CONTACT STORMTECH FOR COMPACTION RE UIREMENTS
4 ONCE LAYER 'C' IS PLACED ANY SOIL MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL RE UIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION



NOTES:

1 CHAMBERS SHALL MEET THE RE UIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE PP CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 0 101
2 MC- 200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2 8 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE ALLOWABLE BEARING CAPACITY OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF E PECTED SOIL MOISTURE CONDITIONS
4 PERIMETER STONE MUST BE E TENDED HORI ONTALLY TO THE E CAVATION WALL FOR BOTH VERTICAL AND SLOPED E CAVATION WALLS
RE UIREMENTS FOR HANDLING AND INSTALLATION
- TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING CHAMBERS SHALL HAVE INTEGRAL INTERLOC ING STAC ING LUGS
- TO ENSURE A SECURE OINT DURING INSTALLATION AND BAC FILL THE HEIGHT OF THE CHAMBER OINT SHALL NOT BE LESS THAN
- TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR E UAL TO 4 0 LBS FT THE ASC IS DEFINED IN SECTION 2 8 OF ASTM F2418 AND TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES ABOVE F 2 C CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS

CHAFFEY COLLEGE FONTANA CAMPUS
FONTANA CA USA

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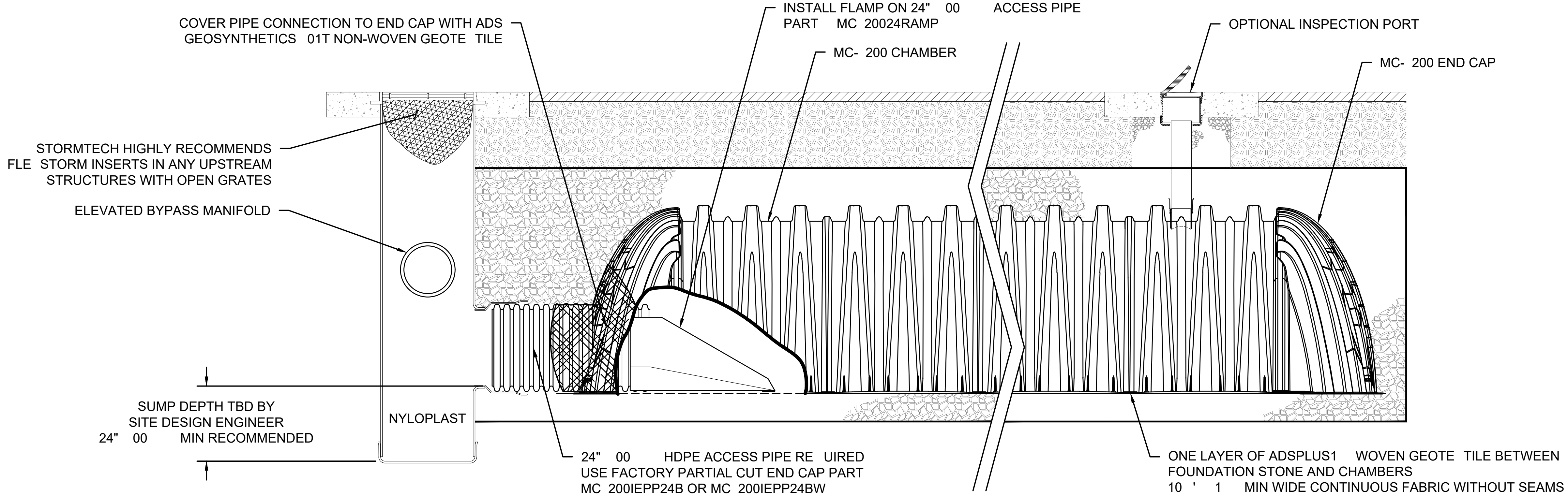


MC-7200 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1 INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A INSPECTION PORTS IF PRESENT
  - A 1 REMOVE OPEN LID ON NYLOPLAST INLINE DRAIN
  - A 2 REMOVE AND CLEAN FLE STORM FILTER IF INSTALLED
  - A USING A FLASHLIGHT AND STADIA ROD MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A 4 LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS OPTIONAL
  - A IF SEDIMENT IS AT OR ABOVE " 80 PROCEED TO STEP 2 IF NOT PROCEED TO STEP
- B ALL ISOLATOR PLUS ROWS
  - B 1 REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B 2 USING A FLASHLIGHT INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B IF SEDIMENT IS AT OR ABOVE " 80 PROCEED TO STEP 2 IF NOT PROCEED TO STEP

STEP 2 CLEAN OUT ISOLATOR ROW PLUS USING THE ETVAC PROCESS
- A A FI ED CULVERT CLEANING NO LE WITH REAR FACING SPREAD OF 4 " 1 1 OR MORE IS PREFERRED
- B APPLY MULTIPLE PASSES OF ETVAC UNTIL BAC FLUSH WATER IS CLEAN
- C VACUUM STRUCTURE SUMP AS RE UIRED

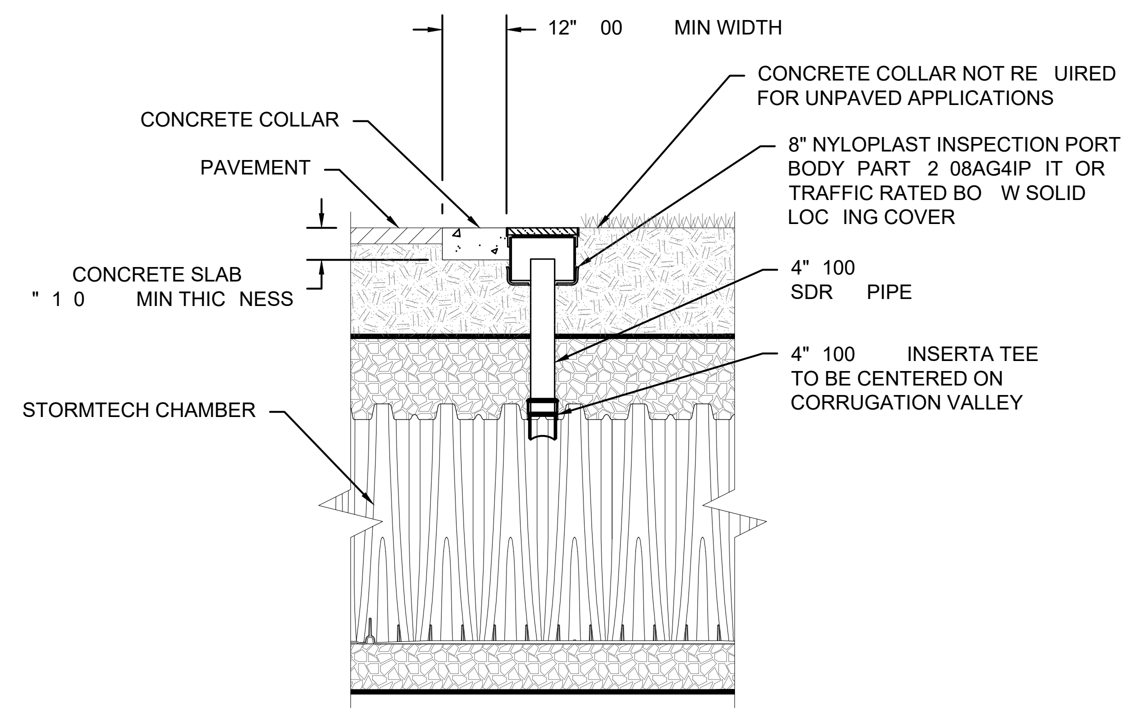
STEP REPLACE ALL COVERS GRATES FILTERS AND LIDS RECORD OBSERVATIONS AND ACTIONS

STEP 4 INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM

NOTES

1 INSPECT EVERY MONTHS DURING THE FIRST YEAR OF OPERATION AD UST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS

2 CONDUCT ETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY



NOTE
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY

4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)

NTS

CHAFFEY COLLEGE FONTANA CAMPUS
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MC-7200 TECHNICAL SPECIFICATION

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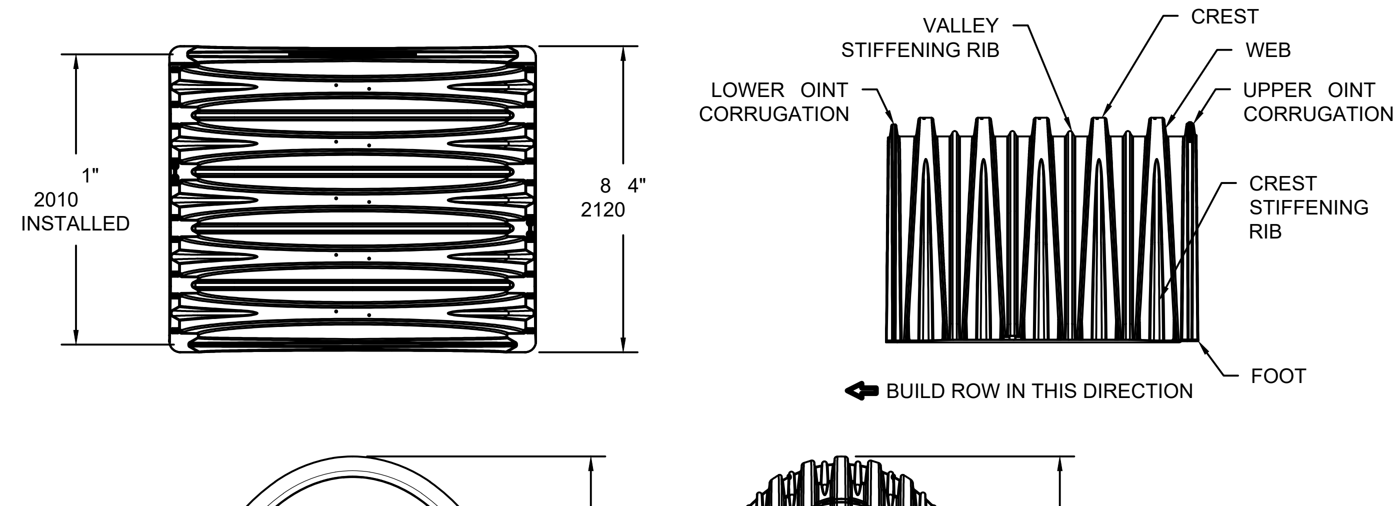
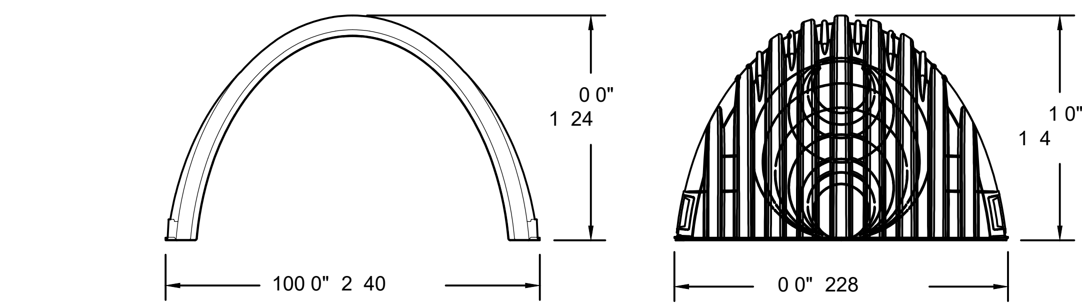
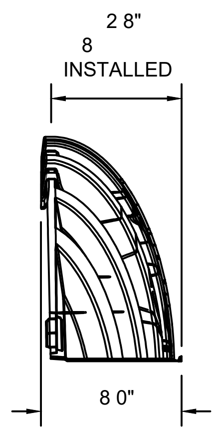






NOMINAL CHAMBER SPECIFICATIONS

SI E W H INSTALLED LENGTH	100 0"	0 0"	1"	2 40	1 24	2010
CHAMBER STORAGE	1	CUBIC FEET		4 8		
MINIMUM INSTALLED STORAGE	2	CUBIC FEET				
WEIGHT NOMINAL	20			2		

NOMINAL END CAP SPECIFICATIONS

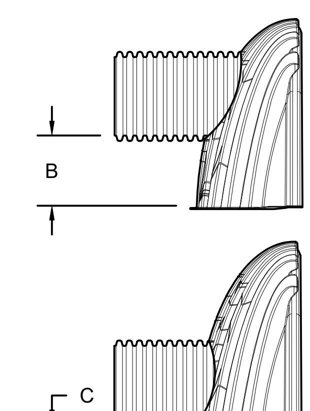
SI E W H INSTALLED LENGTH	0 0"	1 0"	2 8"	228	1 4	8
END CAP STORAGE		CUBIC FEET		1 12		
MINIMUM INSTALLED STORAGE	11	CUBIC FEET		2		
WEIGHT NOMINAL	0			40 8		

ASSUMES 12" 0 STONE ABOVE " 22 STONE FOUNDATION AND BETWEEN CHAMBERS
12" 0 STONE PERIMETER IN FRONT OF END CAPS AND 40 STONE POROSITY

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC 200IEPP0 T	" 1 0	42 4" 1081	---
MC 200IEPP0 B		---	0 8 " 22
MC 200IEPP08T	8" 200	40 0" 102	---
MC 200IEPP08B		---	1 01" 2
MC 200IEPP10T	10" 2 0	8 "	---
MC 200IEPP10B		---	1 " 4
MC 200IEPP12T	12" 00	" 0	---
MC 200IEPP12B		---	1 "
MC 200IEPP1 T	1 "	2 2" 8 1	---
MC 200IEPP1 B		---	1 0" 4
MC 200IEPP18T	18" 4 0	2 " 4	---
MC 200IEPP18TW			
MC 200IEPP18B		---	1 " 0
MC 200IEPP18BW			
MC 200IEPP24T	24" 00	2 0 " 8	---
MC 200IEPP24TW			
MC 200IEPP24B		---	2 2 "
MC 200IEPP24BW			
MC 200IEPP 0BW	0" 0	---	2 "
MC 200IEPP BW	" 00	---	2 " 8
MC 200IEPP42BW	42" 10 0	---	" 0

NOTE ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON RE UEST INVENTORIED MANIFOLDS INCLUDE 12-24" 00- 00 SI E ON SI E AND 1 -48" -1200 ECCENTRIC MANIFOLDS CUSTOM INVERT LOCATIONS ON THE MC- 200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SI ES GREATER THAN 10" 2 0 THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SI E

MC-SERIES END CAP INSERTION DETAIL

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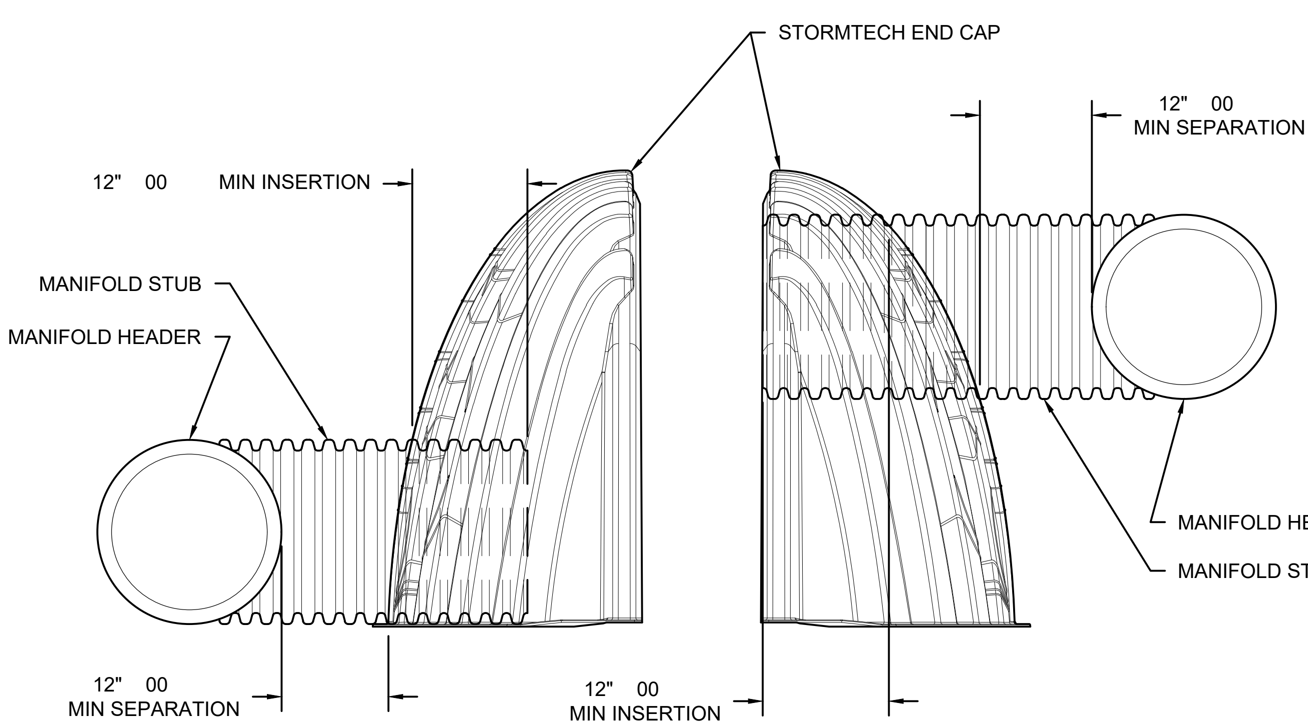

NOTE MANIFOLD STUB MUST BE LAID HORI ONTAL FOR A PROPER FIT IN END CAP OPENING

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NYLOPLAST DRAIN BASIN

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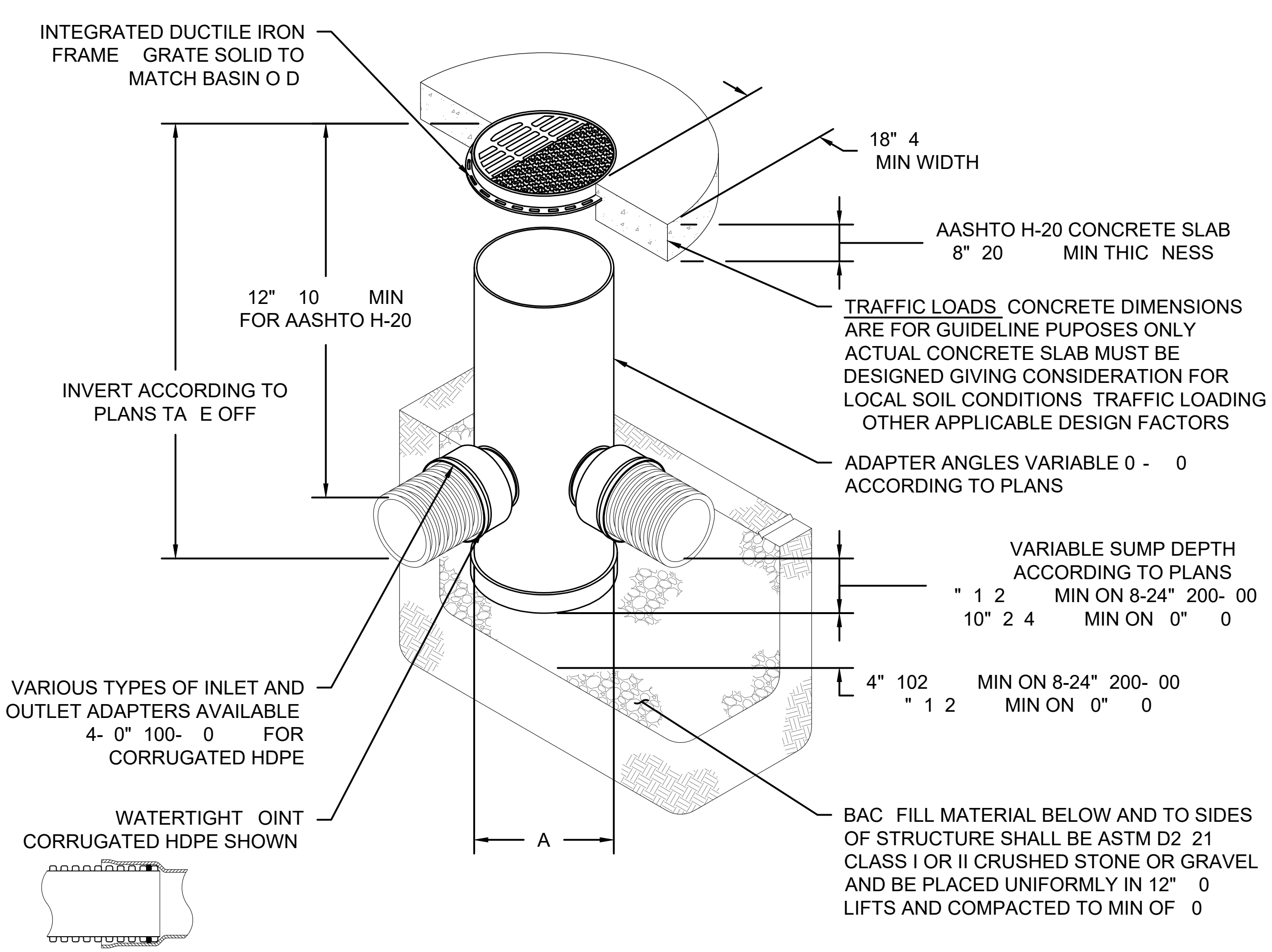

NOTES

1 8- 0" 200- 0 GRATES SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A GRADE 0- 0-0
2 12- 0" 00- 0 FRAMES SHALL BE DUCTILE IRON PER ASTM A GRADE 0- 0-0
DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4 DRAINAGE CONNECTION STUB OINT TIGHTNESS SHALL CONFORM TO ASTM D 212 FOR CORRUGATED HDPE ADS HANCOR DUAL WALL SDR PVC
FOR COMPLETE DESIGN AND PRODUCT INFORMATION **WWW.NYLOPLAST-US.COM**
TO ORDER CALL **800-821-6710**

A	PART	GRATE SOLID COVER OPTIONS		
8" 200	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" 2 0	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" 00	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
1 "	281 AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" 4 0	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" 00	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
0" 0	28 0AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

CHAFFEY COLLEGE FONTANA CAMPUS
FONTANA CA USA

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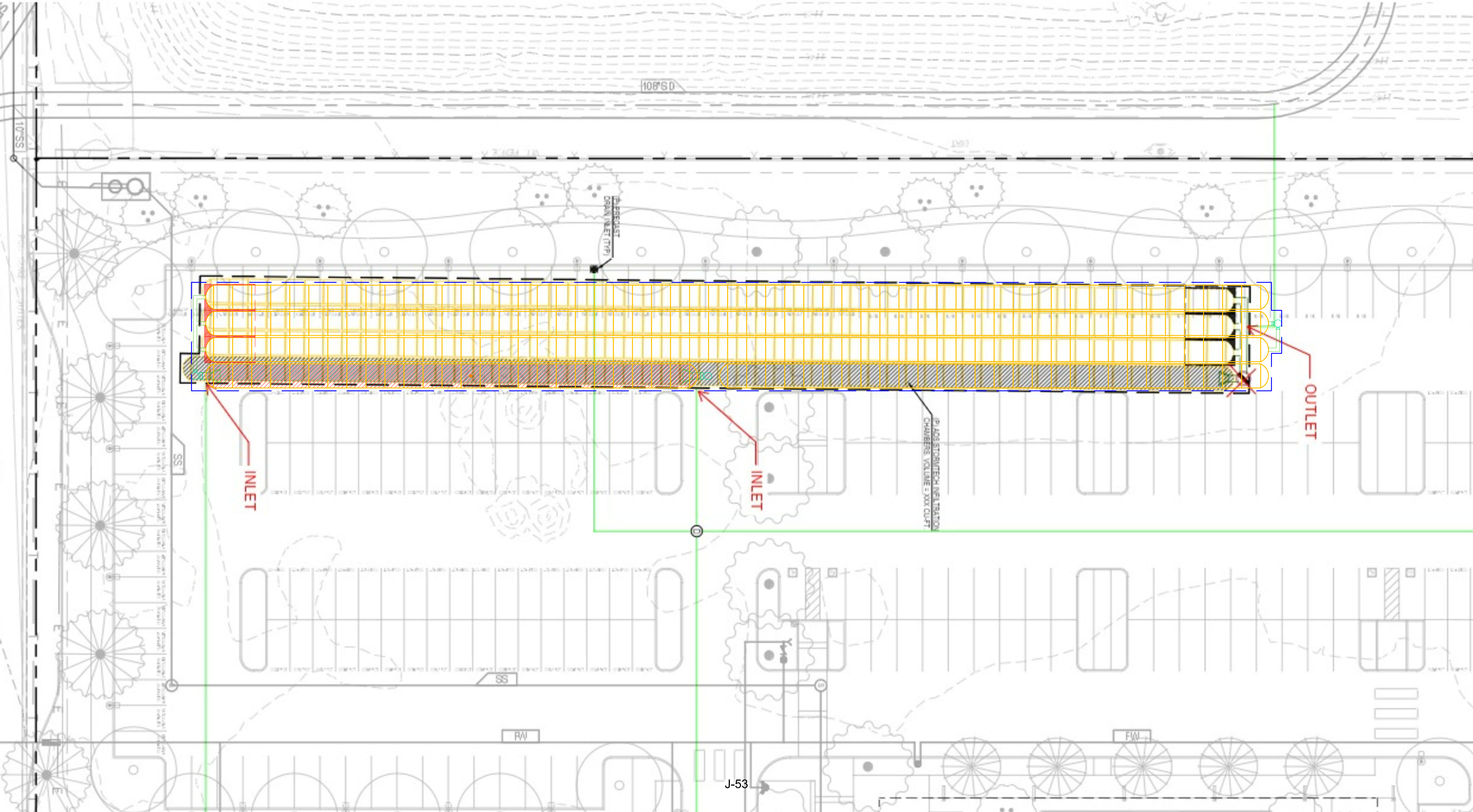


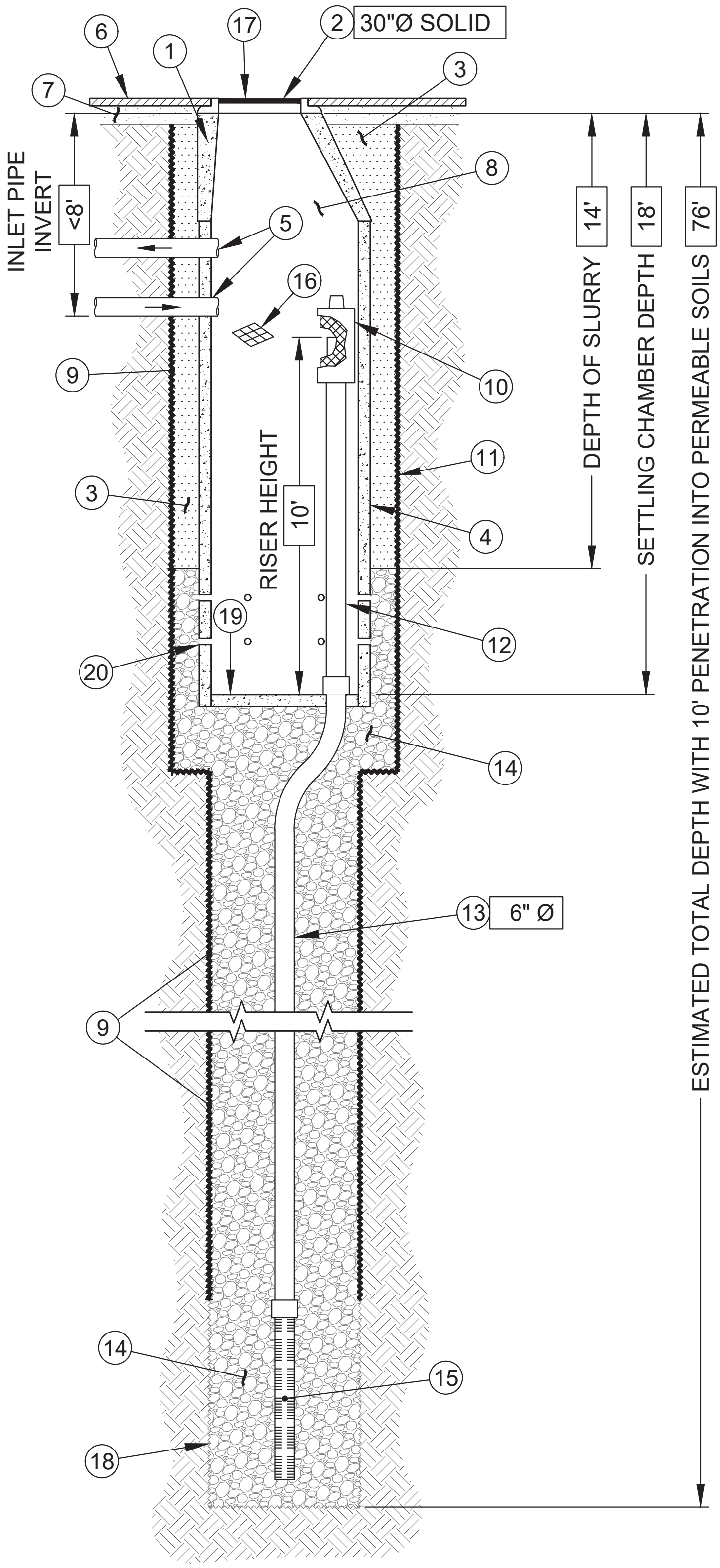
108"SD
10"SS
(P) PRECAST DRAIN INLET (TYP)
(P) ADS STORMTECH INFILTRATION CHAMBERS VOLUME = XXX CU-FT
INLET
INLET
OUTLET
SS
SS
FW
FW
J-53

The MaxWell® IV

DRAINAGE SYSTEM DETAILS AND SPECIFICATIONS

Chaffey College Extension - A1

Fontana,CA



ITEM NUMBERS

1. **MANHOLE CONE** - MODIFIED FLAT BOTTOM.
2. **BOLTED RING & GRATE/COVER** - DIAMETER & TYPE AS SHOWN. CLEAN CAST IRON WITH WORDING **"STORM WATER ONLY"** IN RAISED LETTERS. **BOLTED IN 2 LOCATIONS** AND SECURED TO CONE WITH MORTAR. RIM ELEVATION ±0.02' OF PLANS.
3. **STABILIZED BACKFILL** - TWO-SACK SLURRY MIX.
4. **PRE-CAST LINER -** 4000 PSI CONCRETE 48" ID. X 54" OD. **CENTER IN HOLE** AND ALIGN SECTIONS **TO MAXIMIZE BEARING SURFACE.**
5. **INLET PIPE/OUTLET PIPE (BY OTHERS).** SEE SEPARATE PLAN FOR INVERT ELEVATIONS.
6. **GRADED BASIN OR PAVING** (BY OTHERS).
7. **COMPACTED BASE MATERIAL**, IF REQUIRED (BY OTHERS).
8. **FREEBOARD DEPTH VARIES** WITH INLET PIPE ELEVATION. INCREASE SETTLING CHAMBER DEPTH AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE RISER PIPE.
9. **NON-WOVEN GEOTEXTILE SLEEVE** - MIRAFI 140 NL. MIN. 6 FT Ø. HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
10. **PUREFLO® DEBRIS SHIELD** - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL 0.265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. **FUSION BONDED EPOXY COATED**.
11. **MIN. 6' Ø DRILLED SHAFT.**
12. **RISER PIPE** - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
13. **DRAINAGE PIPE** - ADS HIGHWAY GRADE OR SCH. 40 PVC WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS. DIAMETER AS NOTED.
14. **ROCK** - WASHED, SIZED BETWEEN 3/8" AND 1-1/2".
15. **FLOFAST® DRAINAGE SCREEN** - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. OVERALL LENGTH VARIES, UP TO 120" WITH TRI-B COUPLER.
16. **ABSORBENT** - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, 2 PER CHAMBER.
17. **FABRIC SEAL** - U.V. RESISTANT GEOTEXTILE - **TO BE REMOVED BY CUSTOMER** AT PROJECT COMPLETION. GRATED ONLY.
18. **MIN 4' Ø DRILLED SHAFT.**
19. **BASE SEAL** - CONCRETE SLURRY.
20. **6 PERFORATIONS MINIMUM PER FOOT, 2 ROWS MINIMUM.**

AZ Lic. ROC070465 A, ROC047067 B-4, ADWR 363
CA Lic. 886759, C-42, C-57, HAZ.
Also licensed in the following states: MT, NM, NV, OR, TX, UT, and WA.

U.S. Patent No. 4,923,330 - TM Trademark 1974, 1990, 2004

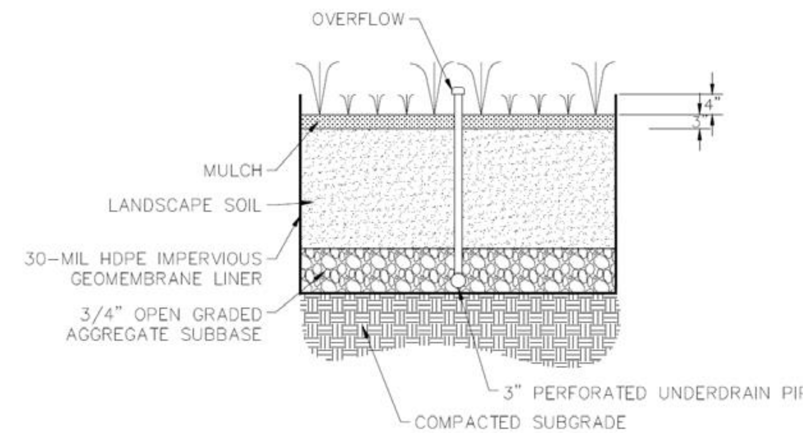
DETAIL : IV-4-SS-CA	REVISED BY: RJA	
DRAWN ON: 05-14-19	REVISED DATE: 12-15-22	SCALE: N.T.S

Manufactured and Installed by

TORRENT® RESOURCES
An evolution of McGuckin Drilling
www.torrentresources.com
CALIFORNIA 909-829-0740
ARIZONA 602-268-0785

Bioretention/Planter Box

Bioretention/planter boxes are shallow, vegetated depressions underlain by an engineered soil media. Bioretention/planter boxes can be used when infiltration is determined to be infeasible by including an underdrain or used without an underdrain to promote infiltration. When an underdrain is included, flows are captured and discharged once they have been treated through the media matrix. Bioretention/planter boxes with underdrains provide excellent treatment of metals, nutrients, and particulates. Bioretention/planter boxes without underdrains remove 100% of the pollutant load, as infiltration is a volume reduction which results in complete pollutant removal.



Note: Bioretention/planter boxes with underdrain perforated pipes should have minimum diameter of 6 inches, minimum lateral spacing of 5 feet, and minimum slope of 0.5%. Historic high groundwater mark, bedrock, tree, and well/tank/spring horizontal setbacks identified for other infiltration BMPs apply if an underdrain is not proposed.

Design Criteria and Constraints

Design Parameter	Design Criteria
Drainage area	1-10 acres
Design drawdown time	48 hours (without underdrain)
Maximum ponding depth	18 inches (6 inches minimum)
Maximum ponding area side slope	3:1 (vertical allowed if perpendicular to walkways/parking stalls)
Depth of mulch layer above bioretention	2-3 inches
Minimum depth of engineered soil media	18 inches
Minimum depth gravel layer	12 inches
Location setbacks	Not allowed in front landscape setback > 50 feet away from slopes steeper than 15% > 8 feet from building foundations > 10 feet from property line (*recommended* per Zoning and Development Code) but will vary case by case

Material Specifications

Design Parameter	Design Criteria
Planter box structure	Stone, concrete, brick, and other stable materials
Vegetation for bioretention/planter box	Native grasses, shrubs, and small trees
Engineered soil mix	85% mineral component (sandy loam with the following specifications: 70-80% sand, 15-20% silt, 5-10% clay) and 15% organic component

Operation

1. Post-construction: regularly water during the first three months as vegetation establishes roots, and check the swale drains within the design drawdown time
2. Curb cuts: curb cuts or inlets should be placed approximately every 10 feet around the perimeter of the bioretention/planter box to allow runoff into the box and must include erosion control (curb cut must be at least 1 foot wide and include local depression)
3. Overflow system: an overflow route is needed to redirect excessive flows to a downstream conveyance system in case of clogging or a large storm event
4. Observation wells: observation wells must be provided every 50 feet to serve as cleanouts if underdrains are used
5. Slope: invert slope effects storage volume; no slope ensures storage volume is calculated properly

Maintenance

Maintenance Activities	Suggested Frequency
Remove trash and debris	Ongoing standard maintenance as needed
Replace surface mulch layers	Maintain required depth of 2-3 inches
Check for ponding	48 hours after a significant rainfall event
Inspect/clean inlets and outlets	Annually before the storm season (October)

SECTION 6.2

SECTION 6.3

Operations and Maintenance Plan

Operations and Maintenance (O&M) Log

Preliminary Water Quality Management Plan

for

Chaffey College Fontana Campus

11070 Sierra Avenue

Fontana, CA 92337

APN: 0255-101-34-0000

Operations and Maintenance Plan

Inspection and maintenance records shall be kept for a minimum of five years and be made available for inspection by the City staff.

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Inspection / Maintenance Activities Required	Person or Entity with Operation & Maintenance Responsibility
Non-Structural Source Control BMPs			
N1. Education for Property Owners, Tenants and Occupants	Upon Tenant Occupancy	Educational materials shall be provided to all employees.	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600
N2. Activity Restriction	Monthly	The owner shall develop activity restrictions to minimize the threat of hazardous waste or contamination into the storm drainage system. Car washing is not allowed on-site at any time.	
N3. Common Area Landscape Management	Weekly	Maintenance of the landscape areas is to be performed consistent with County Water Conservation Resolution or city equivalent. Fertilizer and pesticide use shall be limited and consistent with Management Guidelines for Fertilizers (DAMP Section 5.5). Fertilizer shall be incorporated directly into soil around the plant, where possible, to minimize potential surface runoff.	
N4. BMP Maintenance	Weekly	Maintenance of BMPs implemented at the project site shall be performed at the frequency prescribed in this WQMP.	
N7. Spill Contingency Plan	Weekly	Stockpiling of cleanup materials shall be inspected and disposal of cleanup materials shall be handled properly.	
N11. Common Area Litter Control	Daily	Litter patrol, violations investigation, reporting and other litter control activities shall be performed in conjunction with maintenance activities.	
N12. Employee Training	Yearly for all employees and within 6 months of hire date for new employees.	Education programs shall be implemented as they apply to future employees and training of current employees.	

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Inspection / Maintenance Activities Required	Person or Entity with Operation & Maintenance Responsibility
N14. Common Area Catch Basin Inspection	Minimum of once a year prior to rainy season	Litter and debris removal, illicit discharge violations investigation and reporting and shall be performed in conjunction with maintenance activities.	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600
N15. Street Sweeping Private Streets and Parking Lots	Monthly	The parking lots are required to be swept prior to the rainy season or as required by the governing jurisdiction.	
Structural Source Control BMPs			
S1. Provide Storm Drain System Stenciling and Signage	Yearly	All proposed inlets shall be marked with the appropriate "No Dumping. Drains to Ocean." stencil. The stencils must be repainted when they becomes illegible, but at a minimum once every five years.	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600
S2. Design Outdoor Hazardous Material Storage Areas to Reduce Pollutant Introduction	Weekly	Storage area shall be places on a paved area and in an enclosure that prevents contact with storm water. The storage area must have a roof to minimize direct precipitation.	
S3. Design and Construct Trash and Waste Storage Areas to Reduce Pollutant Introduction	Weekly	Trash receptacles shall be placed on a paved area. Sweep trash area at least once per week. Maintain area clean of trash and debris.	

BMP Name and BMP Implementation, Maintenance, and Inspection Procedures	Implementation, Maintenance, and Inspection Frequency and Schedule	Inspection / Maintenance Activities Required	Person or Entity with Operation & Maintenance Responsibility
S4. Use Efficient Irrigation Systems & Landscape Design	Monthly	Verify that landscape design continues to function properly by correctly adjusting to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, and day or night time temperatures	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600
Low Impact Development (LID) and Treatment Control BMPs			
StormTech Underground Chambers	Annually and 48 hours following a significant storm event	• Initially the isolator row should be inspected every 6 months for the first year of operation. For the subsequent years the inspection should be adjusted based on previous observation. • Check the inspection ports for sediment. If sediment exceeds 3″, a clean-out should be performed. • Clean out isolator row using the JetVac process as necessary. • Inspect and clean catch basins and manholes upstream of the StormTech System. • For more details see attached Isolator Row Plus O&M Manual	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600

Torrent Resources Drywells	Annually and 48 hours following a significant storm event	• Drywells should be cleaned via truck mounted hydro-vactor when there is at least 2′ of sediment, trash, and debris. • Inlet grates and covers are removed for the hydro-vactor process. At that time check for any obstructions or accumulated debris in inlets and connecting pipes. Also replace floating absorbent pillows and change the filter fabric at the bottom of chamber. • For more details see attached Drywell O&M Manual	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600
Bioretention Basin with Underdrain	Annually and 48 hours following a significant storm event	• Remove trash and debris • Replace surface mulch layers to maintain required depth of 2-3 inches • Check for ponding 48 hours after a significant rainfall event • Inspect and clean inlets and outlets annually before the storm season (October) • For more details see attached page from the City of Fontana WQMP Handbook	Company: Chaffey Community College District Contact: TBD Title: TBD Address: 5885 Haven Ave, Rancho Cucamonga, CA 91737 Phone: (909) 652-600

Today's Date: ______________________________

Name of Person Performing Activity (Printed): ______________________________

Signature: ______________________________

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

BMP Implementation Tracking Table

BMP	Activity	Activity Completion Dates or Frequency
Source Control BMPs (Structural and Nonstructural)		
Low Impact Development and Treatment Control BMPs		

Isolator® Row Plus

O&M Manual

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

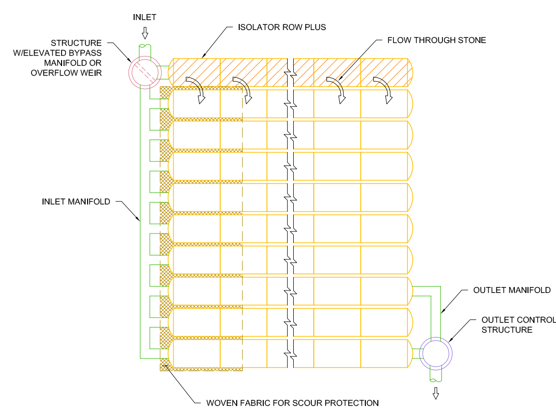
The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

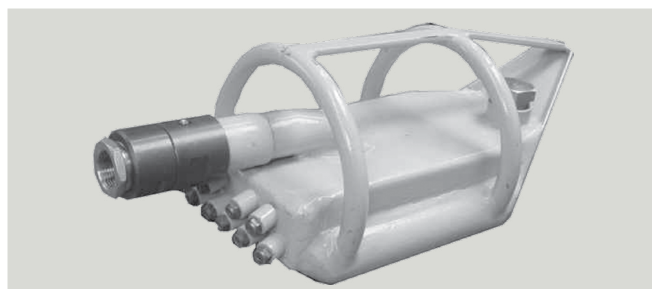
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

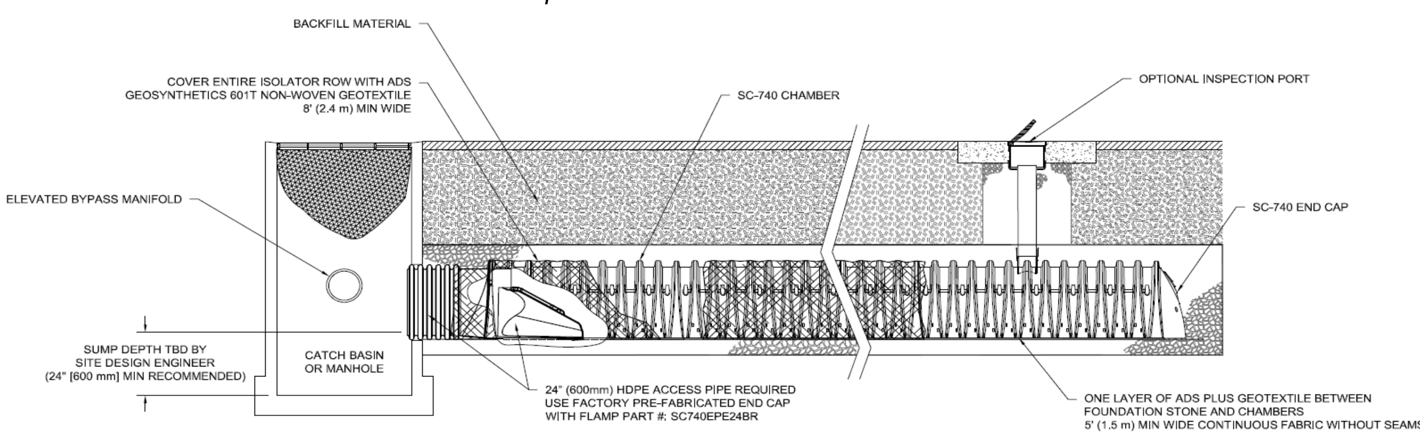
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

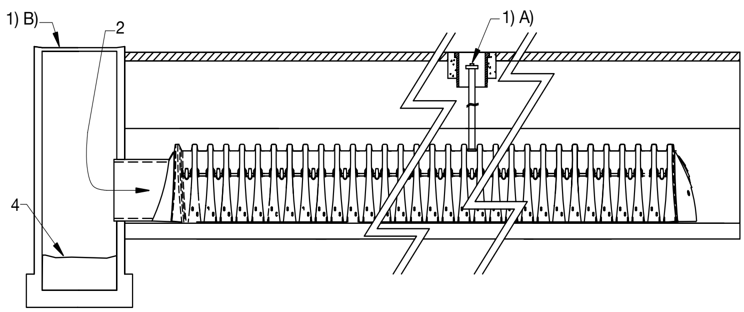
Inspect Isolator Row Plus for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Row Plus
  - i. Remove cover from manhole at upstream end of Isolator Row Plus
  - ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
    If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3
Replace all caps, lids and covers, record observations and actions.

Step 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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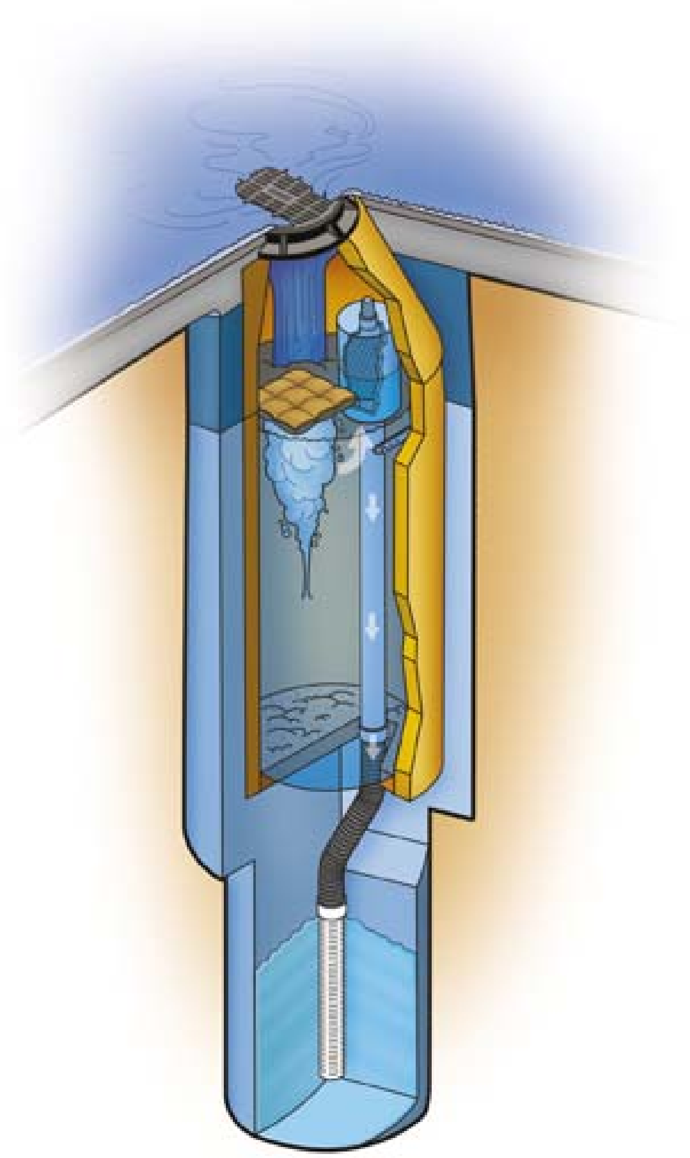
OPERATION AND MAINTENANCE MANUAL

The ***MaxWell® IV*** Drainage System



Torrent Resources Incorporated

The watermark for drainage solutions.®

Table of Contents

Company Overview

Torrent Resources Incorporated…an Employee-Owned Company.

First licensed as a drainage contractor, Torrent Resources has evolved into a full-service; drainage solutions partner to address ever-growing customer needs in California, Arizona, New Mexico, Nevada and Texas. The company is headquartered in Phoenix, with an additional office in Fontana, California.

Since 1972, Torrent Resources has set the standard in design and construction of water drainage systems for the mitigation of excess surface water. In 1974, the company revolutionized the industry with its exclusive, patented ***MaxWell***® systems – products unmatched in efficiency and reliability by any other type of stormwater disposal application. To date, more than 80,000 MaxWell drywells have been installed throughout the western United States.

General Purpose

With a greater awareness of the need to address the quality of urban stormwater runoff, on-site drainage systems used for the stormwater elimination have come under closer scrutiny. One such system is the drywell which has been used previously throughout the United States to dispose of retained or surplus surface water. The early versions of this structure were not much more than holes in the ground filled with rocks. This meant that maintenance on these primitive types was impossible, and inundation from silt-loading quickly led to clogging and failure of the drywells.

Fortunately, the introduction of the MaxWell concept provided a solution to this problem by incorporating a deep settling basin to trap out the suspended solids for easy removal during routine cleaning. To that end, all MaxWell drainage systems are designed to remove not only sediment and debris, but also floating hydrocarbons and organic compounds prior to recharging the treated stormwater back into the sub-grade. The water is then further polished by the soil envelope as it passes through the vadose zone to eventually replenish the resource.

The MaxWell is a treatment and infiltration BMP, which recharges cleaned stormwater back into the ground to recharge the aquifer beneath. In most cases, the system will be utilized in one of two applications: mitigation of the entire amount of retained water from a rainfall event of some historic frequency and duration, in which case the product would be considered volume-based; or, removal of only first flush constituents from an incremental portion of a larger rainfall event. In the latter, the system would be considered a flow-based BMP.

The system itself is <u>not intended to provide storage volume</u>, but instead is designed to gradually dispose of accumulated stormwater to ensure maximum pre-treatment efficiency. Therefore, in both applications described above, a means of storing the required capture volume should be provided separately. This can be done in shallow surface basins or planter areas with the drywells incorporated into the low spots, or by interconnecting the drainage systems to underground tanks or vaults. This allows the minimum number of drainage systems to be used to percolate the water into the sub soils, using the total allowable draw-down timeframe. More systems could be used in lieu of storage to increase processing rates, but this is generally not as cost-effective as providing a means or retaining the required volume.

MaxWell® IV Description

Initial treatment is provided in the deep sump of the MaxWell IV, which provides 1,000 gallons of volume to capture sediment and trash. Depending upon the permeability of the soils, the pilot-hole excavations for the drywells may be up to 120 feet deep.

The typical MaxWell IV processes incoming stormwater for the removal of suspended solids and floating hydrocarbons (gasoline and diesel). These chambers are constructed of 4000 PSI pre-cast concrete liner segments that are 48-inches I.D., 54-inches O.D. with a 3-inch wall thickness. In constructing the chambers, these sections are carefully aligned, centered, and stacked in the borehole to maximize bearing surfaces.

Next, a corrugated HDPE drainage pipe with a slotted Schedule 40 PVC drainage screen attached to the lower end is inserted into the pilot-hole excavation. This component is then capped and suspended slightly off the bottom of the borehole. Clean, washed aggregate sized between 3/8" to 1 ½" to best complement site soil conditions is utilized for the backfill material surrounding the drainage pipe in the lower excavation of the main well. The pre-cast concrete chambers are then erected in the 72-inch diameter reamed portions of the upper excavation.

An overflow pipe constructed of Schedule 40 PVC is installed in the main chamber, and is mated to the drainage pipe with a coupling under the chamber bottom. This vertical pipe is supported by a fusion-bonded epoxy-coated galvanized steel bracket attached to the liner wall. Our ***PureFlo***® Debris Shield equipped with an internal screen is then fitted onto the top of the overflow inlet. This cylindrical shield is approximately 24-inches in length, and is fabricated from rolled 16-gauge galvanized steel. The component is coated with fusion-bonded epoxy, and fitted with an anti-siphon vent. In operation, the shield forces water to be drawn into the system from several inches beneath the surface, effectively isolating and containing floating trash, paper, debris and pavement oils within the chambers. The internal screen effectively filters out suspended material, and the vent prevents floating debris from being sucked into the overflow pipe as the water level inside the chamber subsides.

The chamber is equipped with a hydrophobic floating absorbent pillows, which will remove a wide range of hydrocarbons and organic liquids. The sponges are 100% water repellant, and literally "wick" floating petrochemical compounds from the surface of the water. Each pillow has a removal capacity of at least 128 ounces to accommodate effective, long-term treatment.

At the surface of the ground, the inlet structure will be equipped with a 24" or 30" diameter cast-iron grate and ring assembly capable of handling H-20 loads. See Appendix 1-A for MaxWell detail.

Installation

Once the locations of any utilities have been identified, the exact locations of the drywell on the jobsite is laid out and identified by an onsite survey team. When installed with standard inverts, the layout requires a center stake for the chamber, with a 10' offset.

The installation begins with the excavation of a 48" pilot-hole boring down to the bottom of the proposed gravel pack. The upper part of this excavation, where the chamber will sit, must then be enlarged to 72" in order to provide sufficient space to stack the liner segments and place the aggregate backfill in the annular space around the outside of the chamber.

It is vital to the function of the finished drainage system that a 10' minimum penetration into permeable soil is achieved. As the drilling progresses and each load of cuttings is discharged, the composition of the drainage soils is assessed for suitable permeability. Optimum permeability is found in soils comprised of clean sand, gravel, and small cobbles, with an absence of silt, clay or excessive fines. However, other materials may possess acceptable transmissibility, such as clean sand or decomposed granite.

When the drilling is completed, the drilling crew will leave the site protected by covering the open holes with steel plates, and constructing a berm around the immediate well site. Barricades and flagging are additionally utilized to protect the drilled shafts after the excavation is complete. A construction crew will then arrive within a day or two to finish the installation process.

The actual construction sequence begins with pulling the plates back far enough to allow the placement of a setting platform over the first open boring. The first component lowered into the excavation is the slotted drainage screen, connected to the lower end of the drainage pipe. The material used for the drainage pipe is heavy-duty ADS Highway Grade corrugated polyethylene. This HDPE drainage pipe is lowered into position, and held slightly off the bottom of the pilot-hole. The pipe is then capped and suspended by a chain, which has been secured to the setting platform above the excavation.

As the fabrication progresses, the protective steel plates are pulled completely away so that there is access for the backfill operation. A skip loader is utilized to place the gravelpack into the entire length of the 48-inch pilot hole around the suspended drainage pipe. Next, the lower perforated section of 48-inch precast liner for the main well is lowered into place within the enlarged 6-foot diameter excavation. Additional liner segments are carefully aligned and stacked in the enlarged portion of the shaft to create the settling chamber of the system. The last section to be placed at grade is a modified manhole cone. The opening in the manhole cone is covered to prevent the accidental introduction of gravel as the upper excavation is backfilled with this same washed, graded aggregate.

In order to prevent subsidence and lock all of the components in place, a 1-sack slurry mixture is used to backfill the upper 5' of annular space and around the cone. This material effectively encapsulates the components and exceeds the compaction of native soil. With the chamber completed, the interior components are installed. The overflow pipe is lowered into position in the main well chamber as assembly progresses.

After securing the grate to the cast-iron ring, a layer of ultraviolet-resistant geotextile fabric is applied over the grate. This UV-resistant fabric layer is banded to the grated inlet, and is intended to prevent incidental introduction of trash or debris before the well goes into service. This fabric will be removed by the General Contractor after final landscaping and paving are completed. Premature fabric removal could result in system damage and may void some, or all warranty conditions.

The metal grates and covers used are embossed with “Torrent Resources”, the MaxWell trade name, and the words “Storm Water Only” as a general reminder to the public as to the intended usage of the structure.

The final step in the installation process is the application of a mortar mix to affix the ring and grate assemblies securely to the manhole cone. This completes the construction sequence.

MaxWell Operation

Influent stormwater enters the system either through the grate at the ground surface or through a piped inlet. Upon entering the drywell chamber, stormwater will accumulate, giving silt and other heavy particles a chance to settle. A vented, screened, and shielded inlet ensures containment of floating debris within the chamber and elimination of petroleum constituents through the floating absorbent pillows. The system is drained as water rises under the PureFlo™ Debris Shield, and spills into the top of the overflow pipe. The drainage assembly returns the cleaned water to the surrounding soil through the FloFast™ Drainage Screen.

All MaxWell IV Systems are equipped with bolted, theft-deterrent cast iron grates as standard security features. Special inset castings are available for use in landscaped applications, which are resistant to loosening from accidental impact. Machined mating surfaces, and “Storm Water Only” wording are standard on these components.

Maintenance

The responsible party, such as a Property Management Company or Homeowners Association, is typically responsible for maintaining the drywell(s).

New systems should receive a thorough visual examination following the first several significant rainfall events. This assessment will assure that there is no standing water, and that runoff or nuisance water flows are being eliminated within the allowable 48 hour draw-down timeframe. Beyond that, the drainage structures should be inspected once a year and within 48 hours of a significant storm event to ensure that there is no standing water in the chambers.

Standing water problems are usually caused by inadequate performance of the existing drainage systems on the property. Reasons are varied but may be due to system aging, reduced soil permeability, pavement settlement, ineffective site maintenance, property expansions and additions, or change in property usage.

If a drywell is draining slowly or leaves water standing over the grate for longer than regulations allow, debris may simply be blocking the inlet. The maintenance guidelines begin with the performance of an annual inspection, which should include assessing the need for cleaning and inspecting the functional and structural continuity of the system. At the same time, surface aspects of the drainage way are evaluated for evidence of staining or standing water.

A typical cleaning is carried out using a truck-mounted hydro-vactor (see below) when accumulated trash, debris, and sediment occupy 15% or more of the original settling chamber capacity. The hydro-vactor utilizes streams of air and high-pressure water to dislodge built-up material, which is then removed via vacuum hose and disposed of off-site.

Inlet grates and covers are removed for this operation and all filters and screens are cleaned during this procedure. At the same time, any obstructions or accumulated debris in remote inlets and connecting pipes is removed by jet-rodding. The cleaning operation also involves replacement of the floating absorbent pillows and changing out the filter fabric at the bottom of the chambers where applicable.

After the initial cleaning, most systems generally will not require subsequent cleaning for 3-5 years. When afforded regularly scheduled maintenance, our records indicate that our MaxWell Drywells will provide decades of efficient, reliable service.

A written log shall be kept of all inspections and maintenance actions performed on the drywell systems.

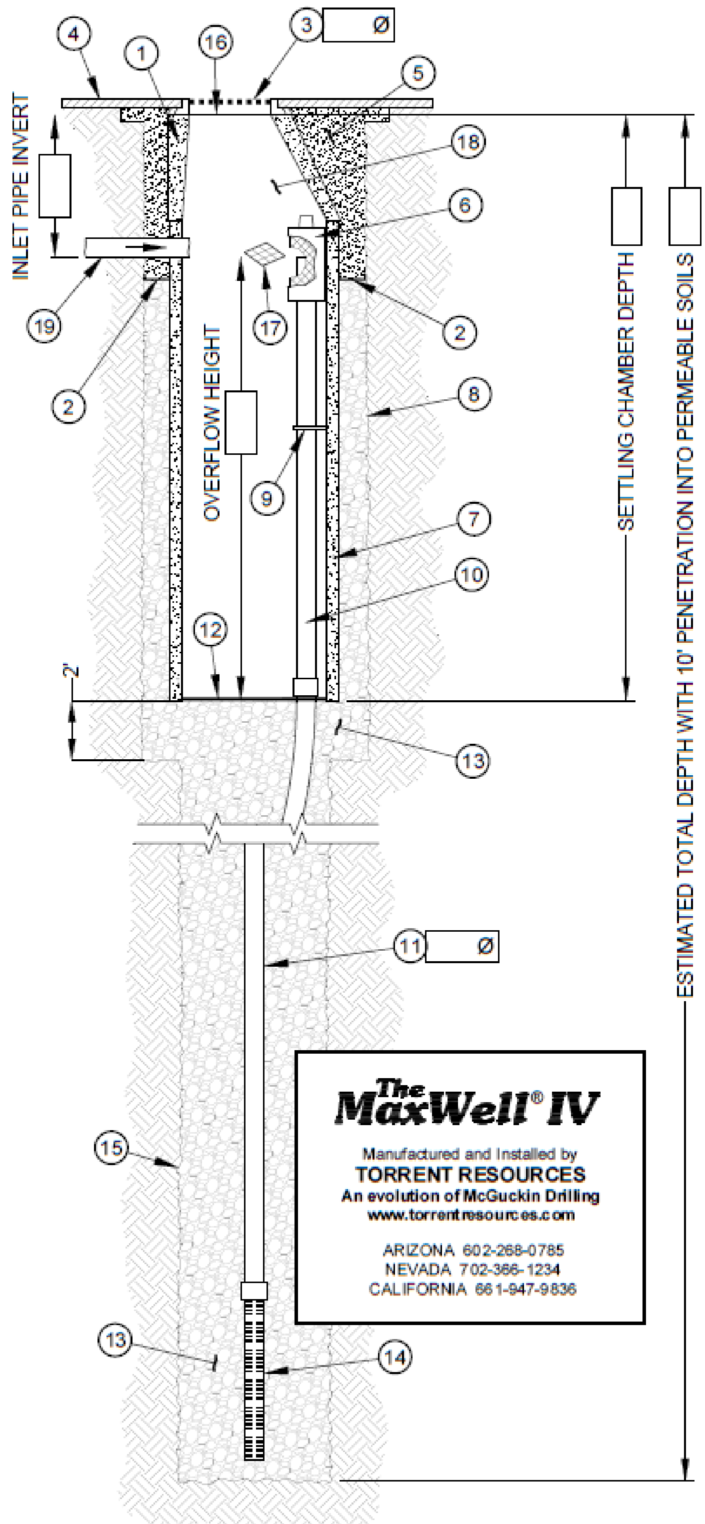
Typical Hydrovactor Truck used for Drywell Maintenance

APPENDIX
1-A

The MaxWell® IV Drainage System Detail And Specifications

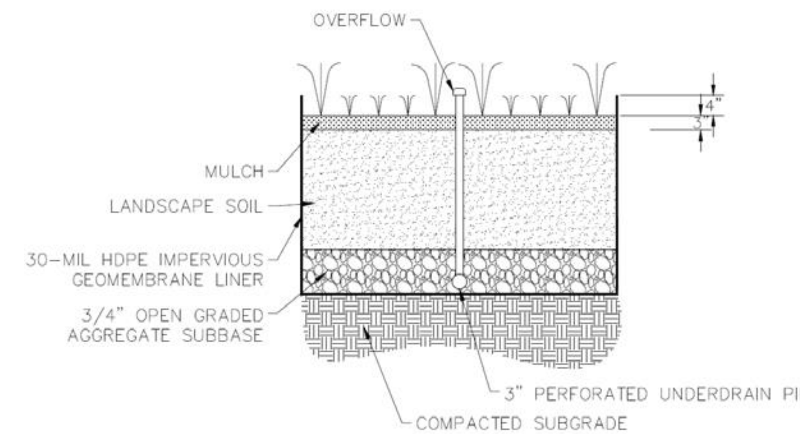
NOTES

1. **MANHOLE CONE** - MODIFIED FLAT BOTTOM.
2. **MOISTURE MEMBRANE** - 6 MIL. PLASTIC. APPLIES ONLY WHEN NATIVE MATERIAL IS USED FOR BACKFILL. PLACE MEMBRANE SECURELY AGAINST ECCENTRIC CONE AND HOLE SIDEWALL.
3. **BOLTED RING & GRATE** - DIAMETER AS SHOWN. CLEAN CAST IRON WITH WORDING **"STORM WATER ONLY"** IN RAISED LETTERS. **BOLTED IN 2 LOCATIONS** AND SECURED TO CONE WITH MORTAR. RIM ELEVATION ±0.02' OF PLANS.
4. **GRADED BASIN OR PAVING** (BY OTHERS).
5. **STABILIZED BACKFILL** - 1 SACK SLURRY.
6. **PUREFLO® DEBRIS SHIELD** - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL .265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. **FUSION BONDED EPOXY COATED.**
7. **PRE-CAST LINER** - 4000 PSI CONCRETE 48" ID. X 54" OD. **CENTER IN HOLE** AND ALIGN SECTIONS TO **MAXIMIZE BEARING SURFACE**.
8. **MIN. 6' Ø DRILLED SHAFT**.
9. **SUPPORT BRACKET** - FORMED 12 GA. STEEL. **FUSION BONDED EPOXY COATED**.
10. **OVERFLOW PIPE** - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
11. **DRAINAGE PIPE** - ADS HIGHWAY GRADE WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS TO PREVENT BUCKLING OR BREAKAGE. DIAMETER AS NOTED.
12. **BASE SEAL** - GEOTEXTILE OR CONCRETE SLURRY.
13. **ROCK** - WASHED, SIZED BETWEEN 3/8" AND 1-1/2" TO **BEST COMPLEMENT SOIL CONDITIONS**.
14. **FLOFAST® DRAINAGE SCREEN** - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. 120" OVERALL LENGTH WITH TRI-B COUPLER.
15. **MIN. 4' Ø SHAFT** - DRILLED TO **MAINTAIN PERMEABILITY** OF DRAINAGE SOILS.
16. **FABRIC SEAL** - U.V. RESISTANT GEOTEXTILE - **TO BE REMOVED BY CUSTOMER** AT PROJECT COMPLETION.
17. **ABSORBENT** - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY.
18. **FREEBOARD DEPTH** VARIES WITH INLET PIPE ELEVATION. INCREASE SETTLING CHAMBER DEPTH AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE OVERFLOW PIPE INLET.
19. **INLET PIPE** (BY OTHERS).



Bioretention/Planter Box

Bioretention/planter boxes are shallow, vegetated depressions underlain by an engineered soil media. Bioretention/planter boxes can be used when infiltration is determined to be infeasible by including an underdrain or used without an underdrain to promote infiltration. When an underdrain is included, flows are captured and discharged once they have been treated through the media matrix. Bioretention/planter boxes with underdrains provide excellent treatment of metals, nutrients, and particulates. Bioretention/planter boxes without underdrains remove 100% of the pollutant load, as infiltration is a volume reduction which results in complete pollutant removal.



Note: Bioretention/planter boxes with underdrain perforated pipes should have minimum diameter of 6 inches, minimum lateral spacing of 5 feet, and minimum slope of 0.5%. Historic high groundwater mark, bedrock, tree, and well/tank/spring horizontal setbacks identified for other infiltration BMPs apply if an underdrain is not proposed.

Design Criteria and Constraints

Design Parameter	Design Criteria
Drainage area	1-10 acres
Design drawdown time	48 hours (without underdrain)
Maximum ponding depth	18 inches (6 inches minimum)
Maximum ponding area side slope	3:1 (vertical allowed if perpendicular to walkways/parking stalls)
Depth of mulch layer above bioretention	2-3 inches
Minimum depth of engineered soil media	18 inches
Minimum depth gravel layer	12 inches
Location setbacks	Not allowed in front landscape setback > 50 feet away from slopes steeper than 15% > 8 feet from building foundations > 10 feet from property line (*recommended* per Zoning and Development Code) but will vary case by case

Material Specifications

Design Parameter	Design Criteria
Planter box structure	Stone, concrete, brick, and other stable materials
Vegetation for bioretention/planter box	Native grasses, shrubs, and small trees
Engineered soil mix	85% mineral component (sandy loam with the following specifications: 70-80% sand, 15-20% silt, 5-10% clay) and 15% organic component

Operation

1. Post-construction: regularly water during the first three months as vegetation establishes roots, and check the swale drains within the design drawdown time
2. Curb cuts: curb cuts or inlets should be placed approximately every 10 feet around the perimeter of the bioretention/planter box to allow runoff into the box and must include erosion control (curb cut must be at least 1 foot wide and include local depression)
3. Overflow system: an overflow route is needed to redirect excessive flows to a downstream conveyance system in case of clogging or a large storm event
4. Observation wells: observation wells must be provided every 50 feet to serve as cleanouts if underdrains are used
5. Slope: invert slope effects storage volume; no slope ensures storage volume is calculated properly

Maintenance

Maintenance Activities	Suggested Frequency
Remove trash and debris	Ongoing standard maintenance as needed
Replace surface mulch layers	Maintain required depth of 2-3 inches
Check for ponding	48 hours after a significant rainfall event
Inspect/clean inlets and outlets	Annually before the storm season (October)

SECTION 6.4

Existing Topography Exhibit

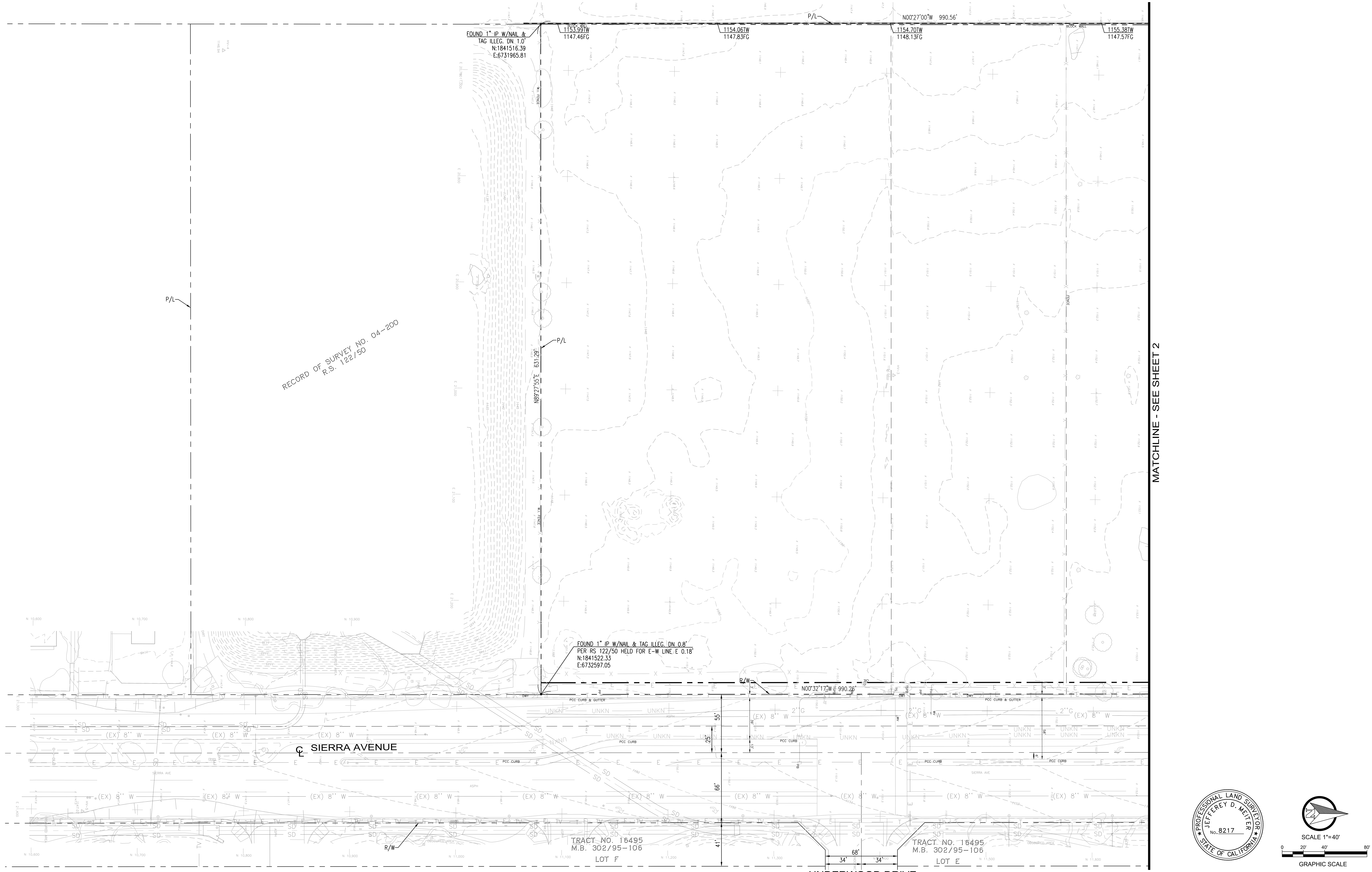
HCOC Exempt Area Map

Receiving Waters Map

Soil Type Map

Preliminary Plan Sheets for Reference

Geotechnical Report



BENCHMARK
CITY BM # 296 NAVD29

EL= 1137.71

BASIS OF BEARING
THE BASIS OF BEARINGS FOR THIS SURVEY CORS
EAST LINE PMB 217/44-45 (PTS 11 & 27) BEARING
N 0-32-17 W

VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

CHAFFEY FONTANA TOPO
OCTOBER 2022

SHEET 1 OF 2

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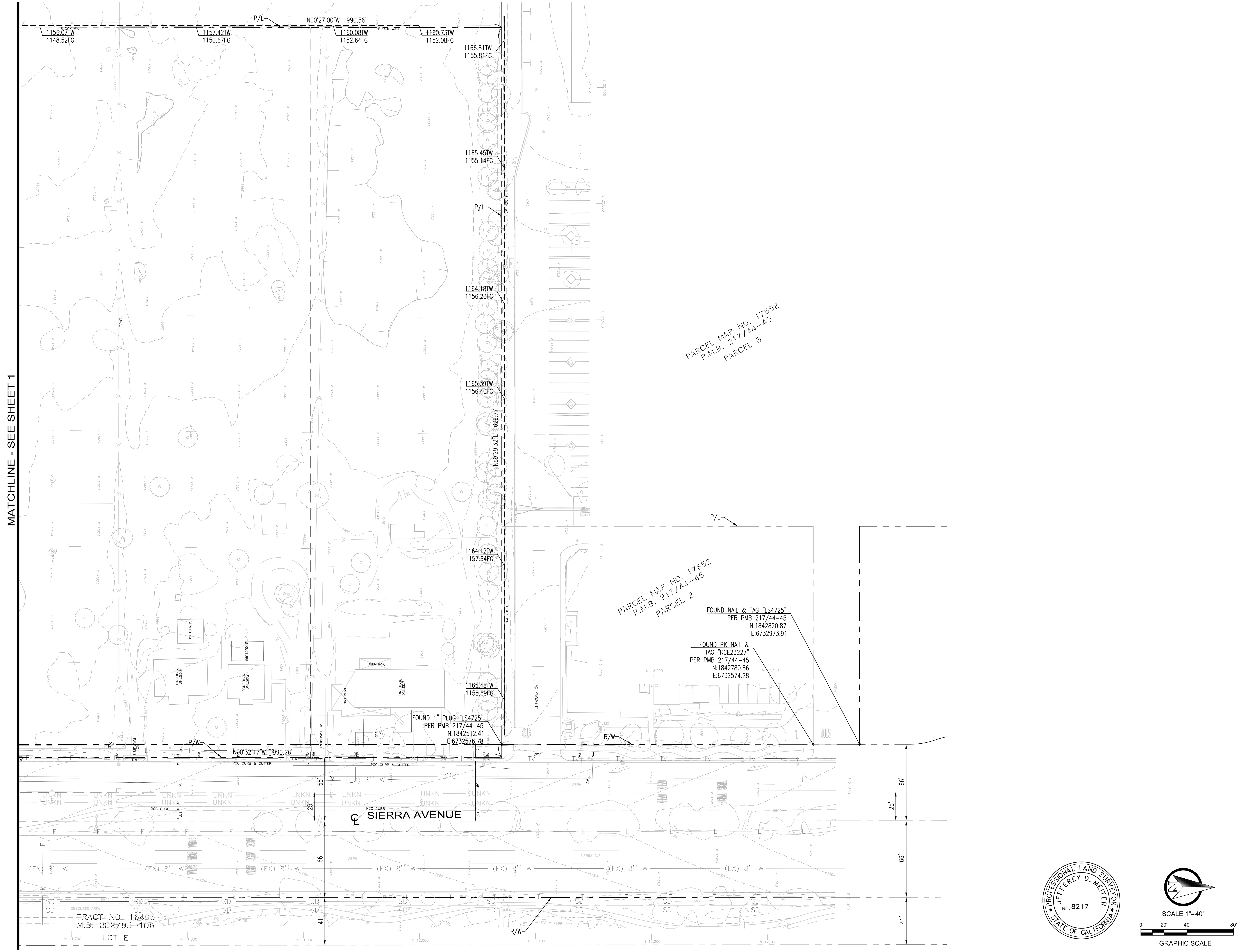

BENCHMARK	BASIS OF BEARING		
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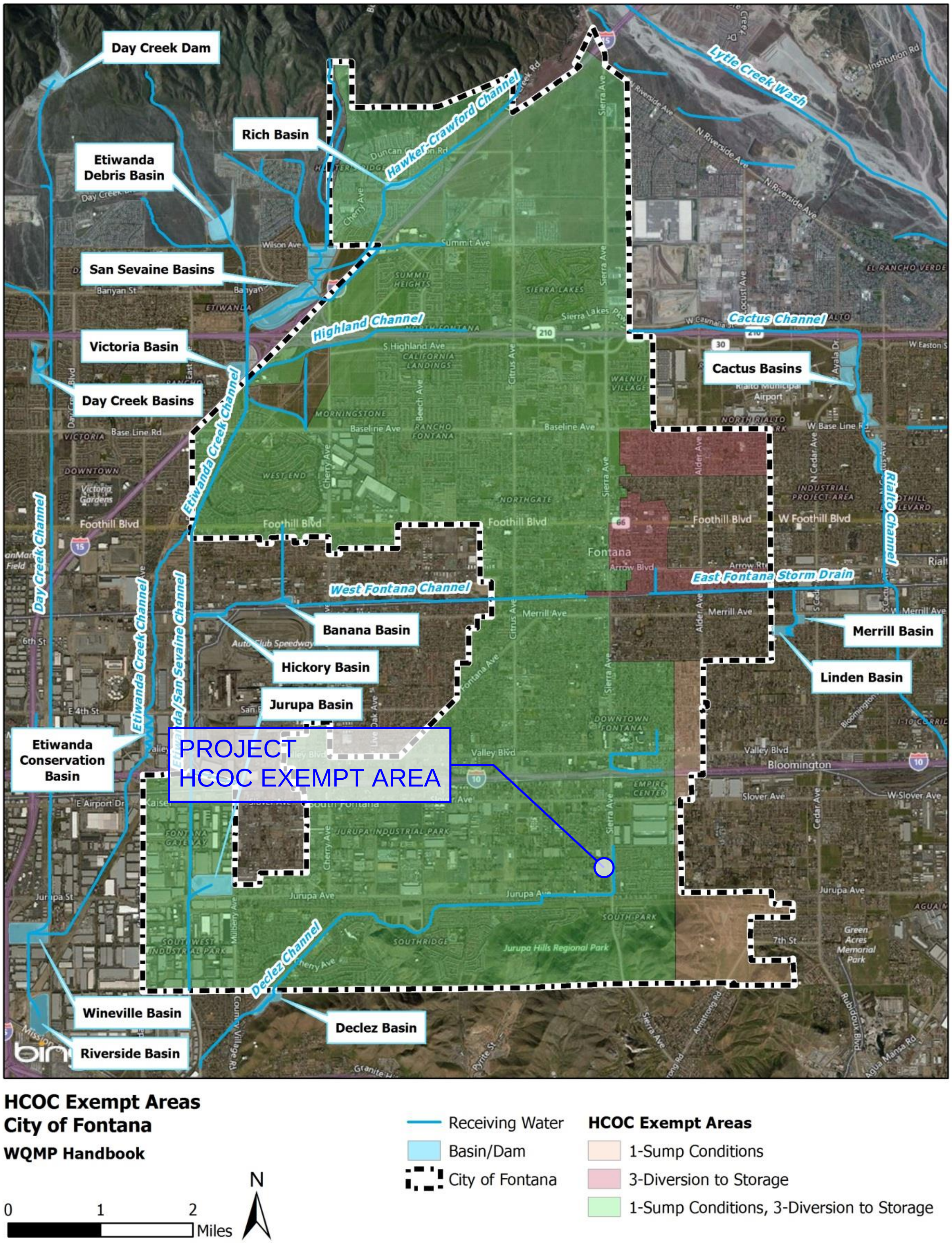


Figure 2-2 HCOC Exempt Areas

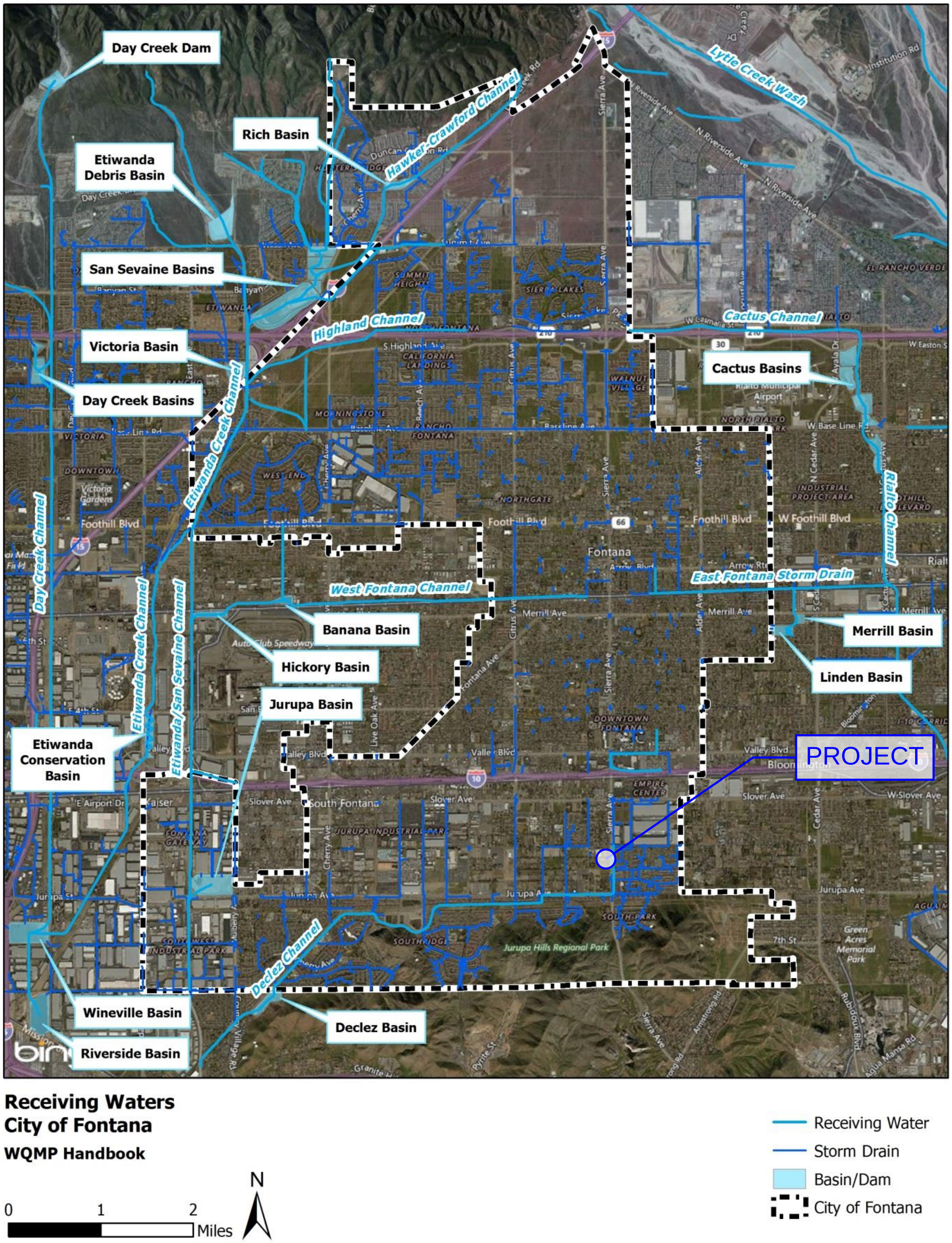


Figure 2-3 Receiving Waters

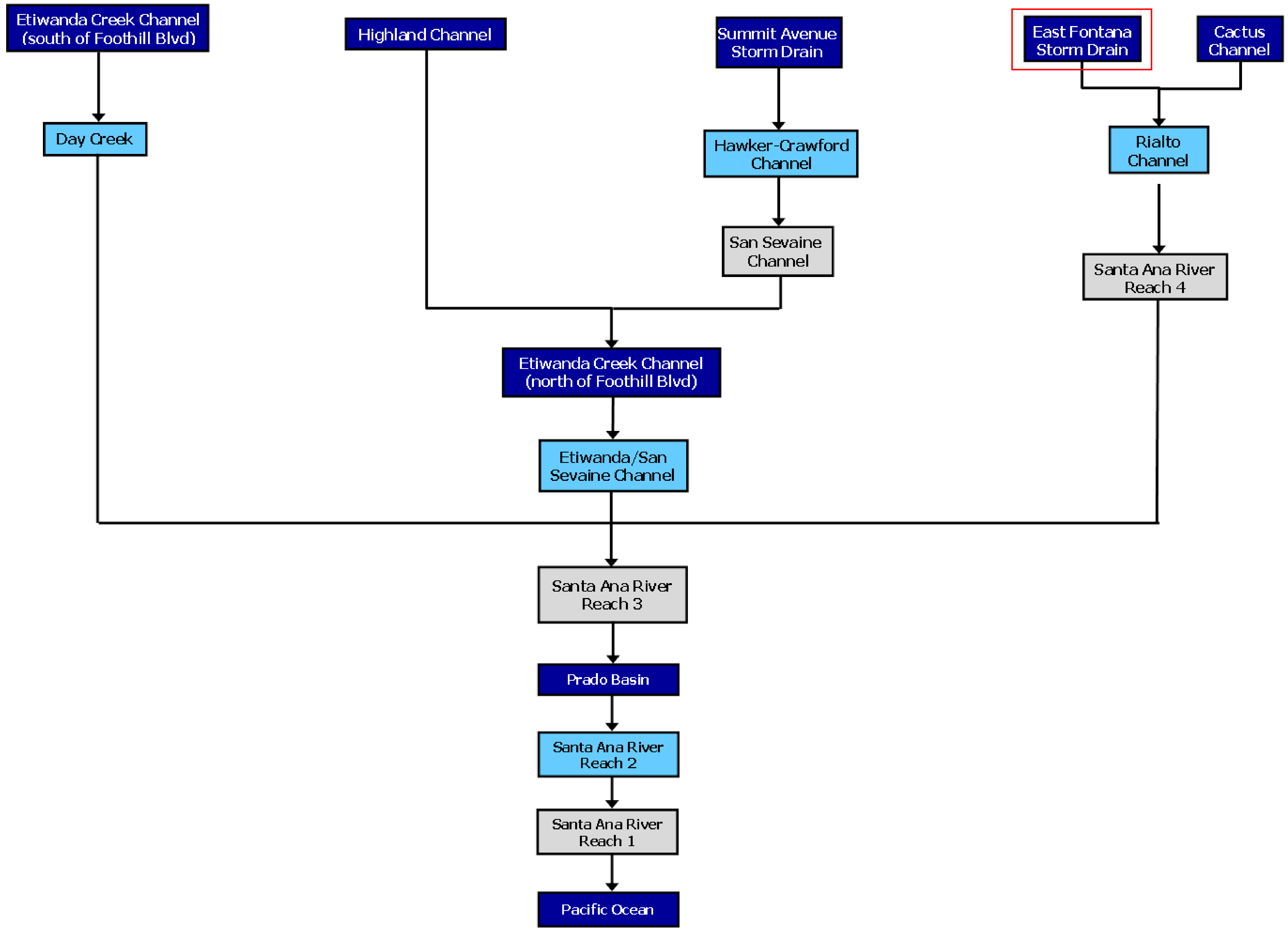


Figure 2-4 Receiving Waters Flow Chart

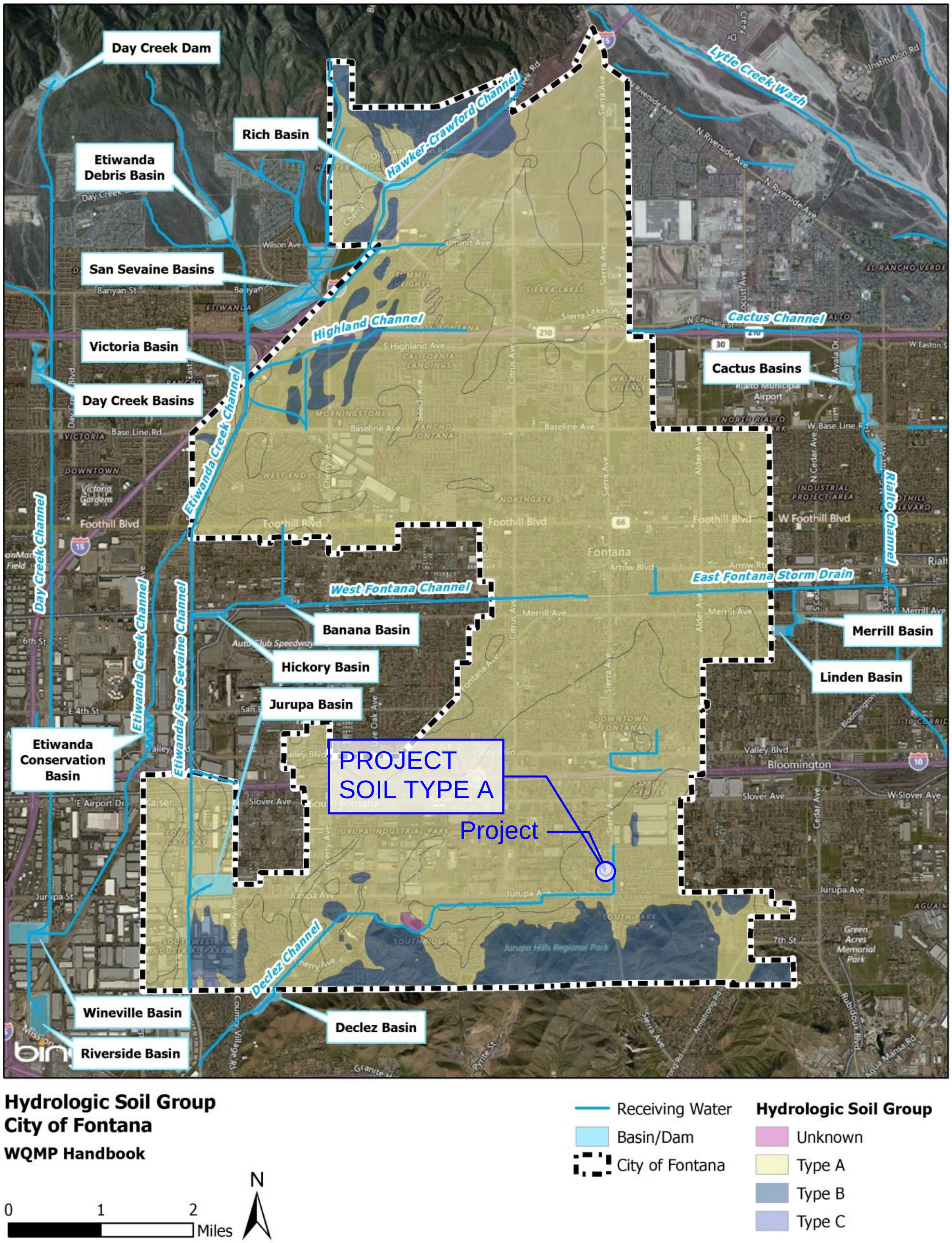
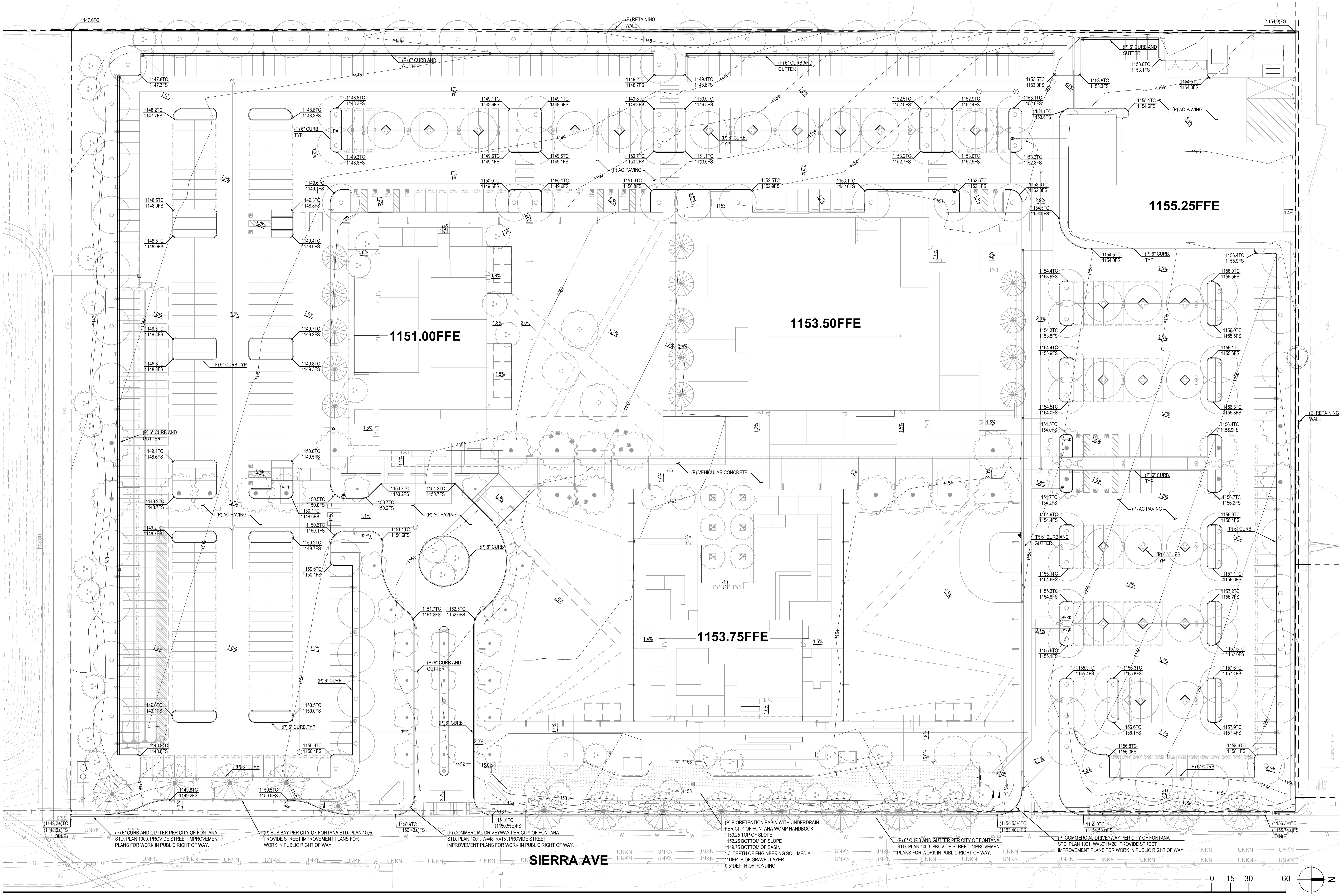


Figure 2-1 Hydrologic Soil Group

FOR REFERENCE



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Developed for
CHAFFEY COLLEGE

Submittal	Date	Revision	Date

Job Number	30671.01
Date Published	01/05/2023
Checked By	K.S.
Scale	1" = 30'

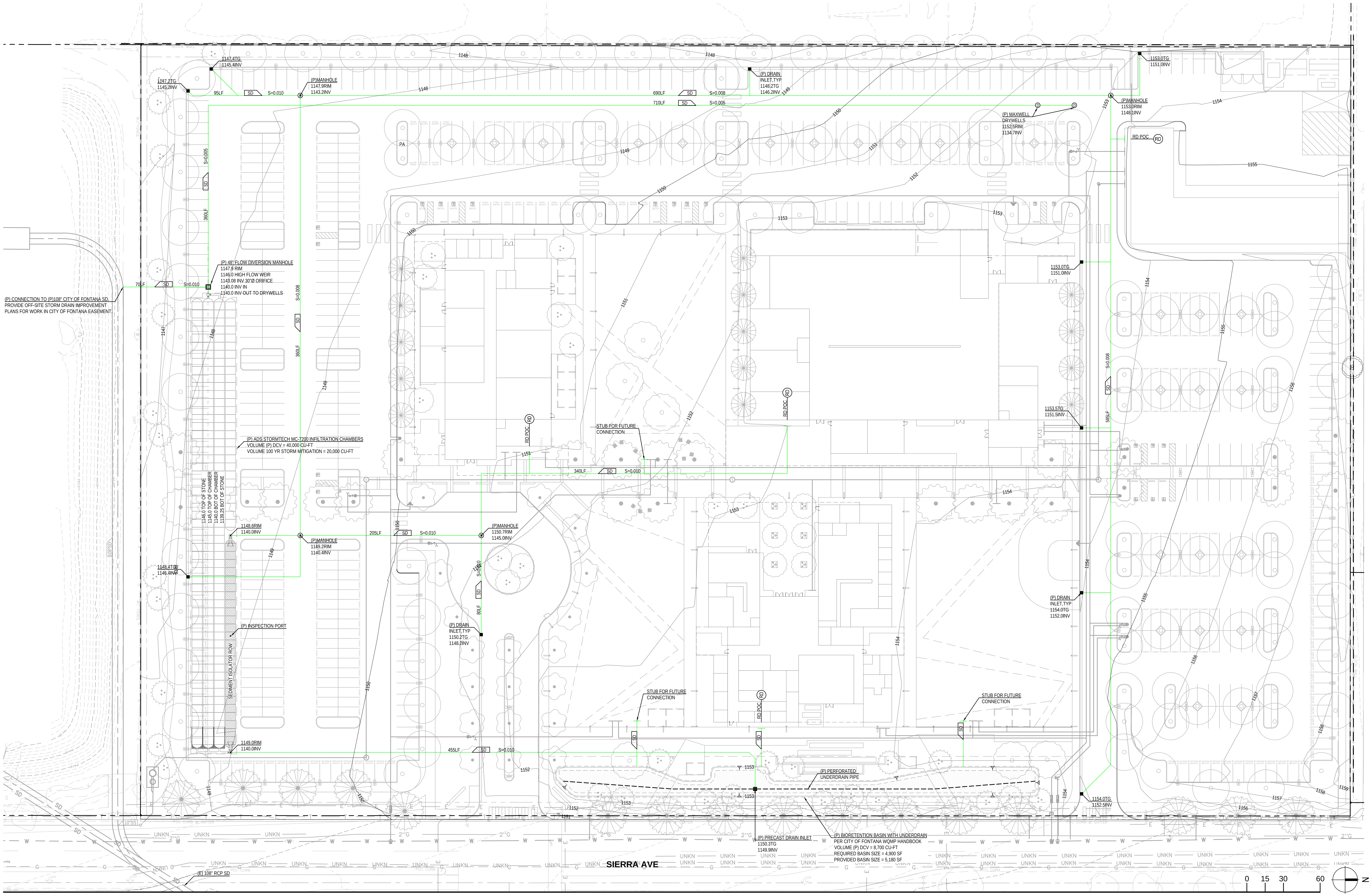
PRELIMINARY GRADING PLAN

C2.01

FOR REFERENCE

LEGEND

PROPOSED STORM DRAIN LINE



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Date Published	01/05/2023
Checked By	K.S.
Scale	1" = 30'

PRELIMINARY STORM DRAIN PLAN

C3.01

GEOTECHNICAL INVESTIGATION
PROPOSED NEW CHAFFEY COLLEGE FONTANA CAMPUS
11070 SIERRA AVENUE, CITY OF FONTANA, CALIFORNIA

Prepared For **CHAFFEY COMMUNITY COLLEGE DISTRICT**
5885 HAVEN AVENUE
RANCHO CUCAMONGA, CA 91737

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Project No. 12691.011

October 14, 2022

October 14, 2022

Project No. 12691.011

Chaffey Community College District
5885 Haven Avenue
Rancho Cucamonga, California 91737

Attention: Mr. Jim Rogers
Senior Construction Manager

Subject: Geotechnical Investigation
Proposed New Chaffey College Fontana Campus
11070 Sierra Avenue
City of Fontana, California

In accordance with your request and authorization, Leighton Consulting, Inc. (Leighton) has conducted a geotechnical investigation for the proposed new Chaffey College Fontana Campus to be located at 11070 Sierra Avenue in the City of Fontana, County of San Bernardino, California. The purpose of our study has been to evaluate the geologic and geotechnical conditions, including potential geologic hazards, and to provide geotechnical recommendations for design and construction of the proposed new college campus.

The proposed new college campus project includes the construction of four (4) new buildings and associated parking, drives and flatwork within the approximately 14.3-acre site.

This report presents our findings and conclusions regarding this project. Based upon our geotechnical investigation, the proposed improvements are feasible from a geotechnical viewpoint, provided our recommendations are incorporated into the design and construction of the project. The most significant geotechnical issues are shallow potentially compressible soils underlying the site and the potential for strong seismic shaking. These and other geotechnical issues are discussed in this report.

We appreciate the opportunity to be of service to the Chaffey Community College District. If you have any questions, or if we can be of further service, please call us at your convenience at (909) 484-2205.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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Distribution: (1) Addressee (PDF via email)

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1.0 INTRODUCTION

1.1 Site Location and Description

The proposed new Chaffey College Fontana Campus is to be located at 11070 Sierra Avenue in the City of Fontana, County of San Bernardino, California (see Figure 1, *Site Location Map*). The proposed campus is bounded to the east by Sierra Avenue, to the north by commercial developments, to the west by an industrial warehouse development currently undergoing construction, and to the south by a water retention basin. The project site is approximately 14.3 acres. The site is relatively flat with a gentle gradient from the northeastern corner at approximate elevation El. 1,057 feet above mean sea level (msl) to the southwest corner at approximate El. 1,047 feet msl. Elevation data of existing topography was obtained from a site plan provided to us by the project architect, LPA Design Studios (LPA). An existing slope offsite and adjacent to the southern boundary of the project descends approximately 15 vertical feet into a water retention basin at an approximate 3H:1V slope.

Based on a review of historical aerial imagery and topographic maps, the site of the proposed campus was previously utilized for agricultural purposes (row crops) prior to the 1950's. After that, portions of the site appear to have been developed with residential properties along Sierra Avenue.

1.2 Proposed Improvements

Based on review of the Preliminary Site Exhibit provided to us by LPA on September 7, 2022, we understand the project consists of the construction of four (4) new buildings within the approximately 14.3-acre site. Three (3) additional buildings are planned for future construction phases, which are not included in this study. The proposed development will also include large parking areas that wraps around the north, west, and south sides of the campus, vehicular drop-off routes, a campus quad, and a pedestrian walkway connecting the north and south parking lots. Associated flatwork, landscaping, and utility installation are also planned. The proposed building locations are shown on Figure 2, *Geotechnical Map*.

Grading plans were not available at the time of this study, however, based on the gently sloping topography of the site, we anticipate the majority of grading to consist of minor cuts and fills (less than 5 feet) to achieve design grades for the proposed improvements. This is a public school project under the jurisdiction of the Division of the State Architect (DSA), to be designed and constructed in accordance with the 2019 California Building Code (CBC).

1.3 Previous Study

Geocon West, Inc. (Geocon) previously conducted a geotechnical feasibility investigation for this project when a design was not available (Geocon, 2020). The purpose of Geocon's 2020 investigation was to evaluate subsurface soil and geologic conditions and to provide conclusions and geotechnical recommendations for design and construction. Geocon's investigation consisted of eight hollow-stem auger borings to depths between 10½ to 20½ feet below the ground surface (bgs). Undocumented, artificial fill was encountered in the borings to a maximum depth of two feet and was overlain by Quaternary age alluvial deposits, which consisted of interbedded fine-grained and coarse-grained material. No groundwater was encountered in their borings to a maximum depth of 20 ½ feet. Geocon (2020) concluded that the geotechnical conditions they encountered during their investigation would not preclude the construction of the proposed development provided that the recommendations presented in their report were followed and implemented during design and construction.

1.4 Purpose of Investigation

The purpose of our study has been to evaluate geologic and geotechnical conditions, including potential geologic hazards, within the area of the proposed improvements; to explore subsurface conditions; and to provide recommendations for design and construction of the proposed new college campus.

1.5 Scope

The scope of our geotechnical investigation has included the following tasks:

- **Geologic Hazards Review**: We reviewed pertinent, readily available geologic literature covering the site. Our review included published geologic maps and reports available from our library as well as historical aerial photographs covering the site. Documents reviewed are listed in the attached *References*.
- **Pre-field Investigation Activities**: Leighton contacted Dig Alert (811) a minimum 48 hours prior to drilling and coordinated with school representatives to locate and mark existing underground utilities prior to subsurface exploration.

- **Field Exploration**: Our field exploration included nineteen (19) hollow-stem auger borings (LB-1 through LB-15 and LI-1 through LI-4), logging earth materials encountered, and collecting soil samples. From September 7, 2022 to September 12, 2022, we advanced these borings at representative locations to depths ranging from approximately 21½ to 51½ feet bgs (see Figure 2, *Geotechnical Map*).

  Encountered earth materials were logged by our technical staff and described in accordance with the Unified Soil Classification System (USCS). Representative bulk soil samples were collected from the borings at shallow depths. Relatively undisturbed soil samples were obtained at select interval depths within these borings using a Modified California ring-lined sampler. A 2-inch outside diameter, unlined Standard Penetration Test (SPT) split-spoon sampler was also used for collecting soil samples. These sampling methods generally followed respective ASTM D3550 and ASTM D1586 procedures. Sampling resistance blow counts were obtained by dropping a 140-pound automatic hammer through a 30-inch free fall onto a sampling rod anvil. The number of blows was recorded for each 6 inches of penetration per ASTM D1586. The logs of our geotechnical borings are presented in Appendix A. The approximate boring locations are shown on the accompanying Figure 2, *Geotechnical Map*.

  Infiltration tests were conducted within four of our borings (LI-1, LI-2A, LI-3, and LI-4). These tests were conducted in locations specified by LPA as shown on Figure 2, *Geotechnical Map*, to evaluate general infiltration rates of subsurface soils at the depths and locations tested. The infiltration tests were conducted in general accordance with the Technical Guidance Document for Water Quality Management Plans (County of San Bernardino, 2013). Testing was conducted to depths reaching approximately 22 to 30 feet bgs to estimate infiltration characteristics of tested soils.

  Borings were backfilled with soil cuttings up to existing surfaces to approximately match the surrounding ground surface. Logs of the drilled borings are provided in Appendix A, *Geotechnical Exploration Logs*.

- **Laboratory Tests**: Laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field investigation. Our geotechnical laboratory testing program was directed toward a quantitative and qualitative evaluation of physical and mechanical properties of sampled soils at this site, and to aid in evaluating soil classification.

Tests were performed at our in-house geotechnical laboratory. Tests performed include:

- In situ moisture and dry density
- Maximum dry density and optimum moisture content
- Grain Size Analyses
- Atterberg Limits
- Expansion Potential
- Direct Shear
- R-value
- Collapse/Swell Potential
- Soil corrosivity screening of resistivity, sulfate content, chloride content and pH

Results of the in-situ moisture and density tests are provided in the boring logs presented in Appendix A, *Geotechnical Exploration Logs*. The results of remaining tests are provided in Appendix B, *Geotechnical Laboratory Test Results*.

- **Engineering Analysis**: Data obtained from background review and field exploration was evaluated and analyzed to provide the geotechnical conclusions and recommendations presented in Section 3.0 of this report.

- **Report Preparation**: Results of our geologic hazards review and geotechnical investigation have been summarized in this report, presenting our findings, conclusions and recommendations for the project.

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Hazards Review

We have reviewed pertinent, readily available geologic and geotechnical literature covering the site. Our review included regional geologic maps, reports, and data available from our library and online. Documents reviewed are listed in the *References* at the end of this report. Potential geologic hazards are discussed in the following sections. Our review has considered California Geological Survey's Note 48, *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*. A copy of the Note 48 checklist is included in Appendix E of this report and has been annotated indicating the applicable sections of this report that address each checklist item.

2.2 Regional Geologic Setting

The site lies within the central portion of the San Bernardino Valley, within the Peninsular Ranges Geomorphic Province. Prominent mountain ranges surround this valley, including the San Gabriel Mountains on the northwest, San Bernardino Mountains on the north and east, the San Jacinto Mountains to the east, and the Temescal and Santa Ana Mountain ranges to the south.

Uplift of the San Bernardino Mountain ranges are the result of the interaction between the North American and Pacific tectonic plates. Several active or potentially active faults have been mapped in the region and are believed to accommodate compressional and lateral crustal displacement from tectonics associated with the San Andreas transform system, which defines the location of the interaction between the North American and Pacific plates. The San Andreas transform includes the San Andreas fault zone as well as other components of the system such as the San Jacinto, Elsinore, and Cucamonga fault zones. The closest active fault from the project site is a trace related to the San Bernardino Valley section of the San Jacinto fault zone, which is located approximately 7.1 miles to the northeast. Active tectonics associated with the San Andreas transform system has also resulted in the uplift of the mountains surrounding the San Bernardino Valley.

Sediment eroded from the mountains surrounding the San Bernardino Valley has been transported and deposited onto alluvial plain below. This site region is situated on this alluvial plain and is underlain by Holocene to late Pleistocene young alluvial fan deposits, which have been regionally mapped to consist of silt, sand, gravel, cobble, and boulder deposits issued from a confined valley or canyon (Bedrossian et al., 2012).

The surficial geologic units mapped in the vicinity of the site are shown on Figure 3, *Regional Geology Map*.

2.3 Subsurface Soil Conditions

Based upon our subsurface exploration, the site is underlain by a shallow mantle of undocumented artificial fill (Afu) overlying young alluvial fan deposits (Qyf). Undocumented artificial fill was encountered in our soil borings to depths ranging from approximately 1 to 5 feet below the ground surface (bgs). As encountered, undocumented artificial fill appears to have been derived from the native soil onsite. These fill soils generally consisted of silty sand and sand with silt. No documentation of prior fill placement and compaction was provided for our review.

The native alluvial soils underlying undocumented artificial fill as encountered within our geotechnical borings generally consisted of silty sand and sandy silt, with minor amounts of clay and gravel in the upper 50 feet. Layers of coarse sand with silt were encountered at variable depths, however an approximate 5-foot thick sand layer was generally encountered at depths of 15 to 25 feet below grade.

Based on field sampling blow counts, the native soils are generally loose to medium dense for granular soils, and stiff to very stiff for cohesive soils in the upper 20 feet. Soils below 20 feet generally become denser with depth. The soils within the upper 10 feet was typically characterized as slightly moist. Dry densities from relatively undisturbed samples ranged from 101 to 123 pounds per cubic foot (pcf), with moisture content from 1 to 6 percent by weight.

More detailed descriptions of the subsurface conditions are presented on the boring logs. Cross-section representations of the materials encountered during Leighton's exploration are shown in Figures 4a and 4b – Geotechnical Cross-Sections A-A' and B-B'; cross-section locations are shown on Figure 2 - *Geotechnical Map*.

2.3.1 Compressibility and Collapse

Soil compressibility refers to a soil's potential for settlement when subjected to increased loads as from a new structure or fill surcharge. Based on our investigation, the near surface materials encountered are typically medium dense to stiff at shallow depths and are considered slightly compressible. Remedial removals and recompaction of this soil as recommended later in this report will reduce the potential for adverse differential settlement of the proposed improvements.

Collapse potential (moisture sensitivity, sometimes referred to as 'hydrocollapse') refers to the potential settlement of a soil under existing stresses upon being wetted. Laboratory testing was performed by Leighton on two samples collected at a depth of approximately 7.5 feet bgs. Test results indicated the onsite soils are anticipated to have low to moderate collapse potential, resulting in less than ½ inch of settlement over 40 feet laterally. Based on our overexcavation recommendations, collapse potential is not a significant concern at this site.

2.3.2 Expansive Soil

Expansive soils contain significant amounts of clay particles that swell considerably when wetted and shrink when dried. Foundations constructed on these soils are subjected to large uplifting forces caused by the swelling. Without proper measures taken, cracking of building foundations and slabs-on-grade could result.

Expansive index tests were conducted on relatively shallow soils (Geocon, 2020 and Leighton, current study). These tests resulted in an Expansion Index of 0. Based on these laboratory test results, near-surface onsite soils are anticipated to exhibit a "very low" expansion potential.

2.3.3 Sulfate Content

Water-soluble sulfates in soil can react adversely with concrete. However, concrete in contact with soil containing sulfate concentrations of less than 0.1 percent by weight is considered to have negligible sulfate exposure based on the American Concrete Institute (ACI) provisions, adopted by the 2019 CBC (CBC, 2019 and ACI, 2014).

A representative near-surface soil sample was tested during this investigation for soluble sulfate content. The results of this test indicated a sulfate content of less than 0.1 percent by weight, indicating negligible sulfate exposure (Exposure Class S0). As such, the soils exposed at pad grade are not expected to pose a significant potential for sulfate reaction with concrete.

2.3.4 Resistivity, Chloride and pH

Soil corrosivity to ferrous metals can be estimated by the soil's electrical resistivity, chloride content and pH. In general, soil having a minimum resistivity between 1,000 and 2,000 ohm-cm is considered corrosive, and soil having a minimum resistivity less than 1,000 ohm-cm is considered severely corrosive. Soil with a chloride content of 500 parts-per-million (ppm) or more is considered corrosive to ferrous metals.

As a screening for potentially corrosive soil, a soil sample was tested during this investigation to determine minimum resistivity, chloride content, and pH. These tests indicated a minimum resistivity of 7,360 ohm-cm, a chloride content of 180 ppm, and a pH of 6.8. Based on these results, the onsite soil is considered "mildly corrosive" to ferrous metals.

2.4 Groundwater

Groundwater was not encountered in any of our borings excavated onsite to a maximum depth of 51½ feet below the existing ground surface. The site lies within the Chino Groundwater Basin. To research groundwater levels at this site, we reviewed groundwater level data measured from Well No. CHINO-1002239 located approximately 1.3 miles northwest of site (CDWR, 2022a). Data from this well ranged in date from 1992 through 2022 and indicated groundwater no shallower than 322 feet below the surface. Data taken from an unnamed well located approximately 0.5 mile west of the site from 1912 through 2008 indicated groundwater no shallower than 225 feet below the surface. Fife and Morton (1976) estimated the generalized depth to groundwater onsite in 1960 was between 200 and 500 feet bgs.

Based on the above, shallow groundwater levels (≤50 feet bgs) do not exist currently, nor have they existed historically based on review of available data.

2.5 Faulting and Seismicity

In general, the primary seismic hazards for this region include surface rupture along active faults and strong ground shaking.

2.5.1 Surface Faulting

One of the primary seismic hazards for this region is surface fault rupture. Our assessment of the possible presence of active faulting through the proposed improvement project site included a review of available literature, maps, and aerial photographs.

The site is not within a State or County designated Earthquake Fault Zone (Bryant and Hart, 2007, San Bernardino County, 2007). Additionally, published geologic mapping has not indicated any faults transecting or trending towards the site. No mapped faults or Earthquake Fault Zones transect or project through the project site.

The closest known potentially active fault is the buried "Fontana Seismic Trend" whose inferred trace is located approximately 2.9 miles northwest of the site. The closest active faults to the site is related to San Bernardino section of the San Jacinto fault zone located approximately 7.1 miles northeast of the site and a section related to the Cucamonga fault zone located approximately 8.2 miles north of the site. Figure 5, *Regional Faults and Historical Seismicity Map*, shows known significant potentially active and active faults in the area.

Based on our understanding of the current geologic framework, the potential for future surface rupture of active faults onsite is considered low.

2.5.2 Seismic Design Parameters

The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along several major active or potentially active faults in southern California. The project should be designed in accordance with applicable current building codes and standards utilizing appropriate seismic design parameters intended to reduce seismic risk as defined by California Geological Survey (CGS) Chapter 2 of Special Publication 117A (CGS, 2008). The following are seismic design parameters for new structures based on the 2019 California Building Code (CBC). The map-based seismic parameters presented were obtained from United States Geological Survey in accordance with American Society of Civil Engineers (ASCE) Publication ASCE 7-16 and the 2019 CBC, Chapter 16A.

Two geophysical survey lines utilizing Multi-channel Analysis of Surface Wave (MASW) methodology yielded a weighted average shear wave to a depth of 100 feet of 1246 ft/s (low Site Class C) and 1165 ft/s (high Site Class D). In addition, we performed an analysis with field Standard Penetration Blowcounts (SPT) from the geotechnical borings that extended to a maximum depth of 51.5 feet, which yielding a weighted average N-Value of 43 (with blowcount assumptions for soils below 50 feet) and classifies as Site Class D. Based on our evaluation of subsurface data and results of a geophysical shear-wave survey, we have selected Site Class D in accordance with ASCE 7-16 Section 20.3. A summary of Site Class evaluation is included in Appendix C.

Table 1 - 2019 CBC Seismic Design Parameters

2019 CBC Parameters (CBC or ASCE 7-16 reference)	Value 2019 CBC
Site Latitude and Longitude: 34.053, -117.436	
Site Class Definition (1613A.2.2, ASCE 7-16 Ch 20)	D
Mapped Spectral Response Acceleration at 0.2s Period (1613A.2.1), S_s	1.595 g
Mapped Spectral Response Acceleration at 1s Period (1613A.2.1), S_1	0.600 g
Short Period Site Coefficient at 0.2s Period (T1613A.2.3(1)), F_a	*1.000*
Long Period Site Coefficient at 1s Period (T1613A.2.3(2)), F_v	*1.700**
Adjusted Spectral Response Acceleration at 0.2s Period (1613A.2.3), S_{MS}	1.595 g
Adjusted Spectral Response Acceleration at 1s Period (1613A.2.3), S_{M1}	1.020* g
Design Spectral Response Acceleration at 0.2s Period (1613A.2.4), S_{DS}	1.063 g
Design Spectral Response Acceleration at 1s Period (1613A.2.4), S_{D1}	0.680* g
Seismic response coefficient, C_S	Special eqn*
Mapped MCE_G peak ground acceleration (11.8.3.2, Fig 22-9 to 13), *PGA*	0.648 g
Site Coefficient for Mapped MCE_G *PGA* (11.8.3.2), F_{PGA}	1.1
Peak Ground Acceleration, mod w/ site effects (1803A.5.12; 11.8.3.2), PGA_M	0.713 g

*Per Table 11.4-2 of Supplement 1 of ASCE 7-16, this value of Fv may only be used to calculate Ts [that note is not included in Table 1613A.2.3(2)]; note that S_{D1} and S_{M1} are functions of Fv. In addition, per Exception 2 of 11.4.8 of ASCE 7-16, special equations for Cs are required. This is in lieu of a site-specific ground motion hazard analysis per ASCE 7-16 Chapter 21.2. These parameters are valid only after California Geologic Survey (CGS) acceptance. Until reviewed and accepted by CGS, these parameters may be subject to change. Changes may be required as part of the CGS review process.

Based on 2019 CBC Table 1613A.2.3(2) footnote c., F_v should be determined in accordance with Section 11.4.8 of ASCE 7-16, since the mapped spectral response acceleration at 1 second is greater than 0.2g for Site Class D; in accordance with Section 11.4.8 of ASCE 7-16, a site-specific seismic analysis is required. However, the values provided in the table above may be utilized if design is performed in accordance with Exception (2) in Section 11.4.8 of ASCE 7-16, with special requirements for the seismic response coefficient (C_s), and F_v is only used for calculation of T_S. This exception does not apply (and the values in the table above would not be applicable) for structures with seismic isolation or seismic damping systems. The project structural engineer should review the seismic parameters. A site-specific seismic ground motion analysis can be performed upon request.

Based on ASCE 7-16 Equation 11.8-1, the F_{PGA} is 1.1, the PGA is 0.648g, and the PGA_M is 0.713g. As an added check, PGA and hazard deaggregation were also estimated using the United States Geological Survey's (USGS) 2008 Interactive Deaggregations utility. The results of this analysis indicate that the predominant modal earthquake has a PGA of 0.83g with a magnitude of approximately 8.1 (M_W) at a distance on the order of 11.5 kilometers for the Maximum Considered Earthquake (2% probability of exceedance in 50 years); 2/3 of this value is 0.55g. Deaggregation results are included in Appendix C.

Until reviewed and accepted by the California Geologic Survey (CGS), these parameters are subject to change. Changes may be required as part of the CGS review process.

2.5.3 Historical Seismicity

Figure 5, *Regional Faults and Historical Seismicity Map*, depicts locations recorded historical regional seismic events (those that have been recorded since the mid-1700s) with respect to the site. Based on this map, it appears that the site has been exposed to relatively significant seismic events; however, this site does not appear to have experienced more severe seismicity than compared to much of southern California in general. We are unaware of documentation that indicates that past earthquake damage in the site vicinity has been significantly worse than for the majority of southern California. In addition, we are unaware of damage in the site vicinity as the result of liquefaction, lateral spreading, or other related phenomena.

2.6 Secondary Seismic Hazards

In general, secondary seismic hazards for sites in the region could include soil liquefaction, earthquake-induced settlement, lateral displacement, surface manifestations of liquefaction, lateral spreading, landsliding, seiches and tsunamis. These potential secondary seismic hazards are discussed below.

2.6.1 Liquefaction and Lateral Spreading

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below structural foundations.

The project site has not been evaluated by the State for liquefaction hazards. The County has mapped the site to be outside a zone of Generalized Liquefaction Susceptibility (see Figure 7, *Seismic Hazards Map)*. Available data has indicated that groundwater levels are relatively deep in the region historically (see Section 2.4, Groundwater). Based on these findings, the potential for liquefaction onsite (including effects of liquefaction including lateral spreading) is considered very low.

2.6.2 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). During a strong seismic event, seismically induced settlement can occur within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. Settlement caused by ground shaking is often nonuniformly distributed, which can result in differential settlement.

We have performed analyses to estimate the potential for seismically induced settlement using the method of Tokimatsu and Seed, and based on Martin and Lew (1999), considering the maximum considered earthquake (MCE) peak ground acceleration (PGA_M). Design/historic high groundwater levels deeper than 100 feet below ground surface were used in the analysis. Based on our analysis, a potential for approximately 1.1 inches of seismic settlement is estimated at the site based on existing site conditions. Results of our seismic settlement analysis is presented in Appendix D.

If the potential differential settlement is estimated as half of the total seismic settlement over a horizontal distance of 30 feet, this would result in a maximum 0.6 inch differential settlement in 30 feet, or angular distortion of 0.0017L. This would be within the differential settlement threshold of 0.003L for "multistory structures with concrete or masonry wall systems" and of 0.006L for "other multistory structures" of Risk Category III, as listed in Table 12.13-3 of ASCE 7-16. "Other" buildings are those not constructed with concrete or masonry wall systems (i.e. wood- or steel-framed). The structural engineer should determine Structure Type and Risk Category and evaluate whether the differential settlement estimates described above are tolerable. A copy of ASCE 7-16 Table 12.13-3 is provided as follows for reference.

Table 12.13-3 Differential Settlement Threshold

Structure Type	Risk Category		
	I or II	III	IV
Single-story structures with concrete or masonry wall systems	0.0075L	0.005L	0.002L
Other single-story structures	0.015L	0.010L	0.002L
Multistory structures with concrete or masonry wall systems	0.005L	0.003L	0.002L
Other multistory structures	0.010L	0.006L	0.002L

2.6.3 Seiches and Tsunamis

Seiches are waves generated in enclosed bodies of water in response to passing seismic waves. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the inland location of the site and its distance from contained bodies of water, seiches and tsunamis are not a hazard to the site.

2.6.4 Slope Stability and Landslides

The site has not been evaluated by the State of California for seismic landslide hazards. No landslides have been mapped onsite or adjacent to the site in the State of California's Landslide Inventory.

No significant slopes are present or planned near the planned improvements. As such, slope stability evaluation (including development of static and dynamic strength parameters, pseudostatic slope stability coefficients, dynamic site conditions evaluation, and slope stability mitigation) is not warranted for this project.

2.6.5 Flooding and Dam Breach Inundation Potential

The site is not located within a 100-year flood zone or 500-year flood zone on the Federal Emergency Management Agency (FEMA) Flood Map for the site (see Figure 8, *Flood Hazard Zone Map*). Additionally, San Bernardino County has mapped the site outside of any flood zones (San Bernardino County, 2022). The adjacent, offsite basin located directly south of the site is mapped as a 100-year flood zone with 1 percent annual chance flood hazard.

Earthquake-induced flooding can result from the failure of dams or other water-retaining structures resulting from earthquakes. California Department of Water Resources' Division of Safety of Dams (CDWR, 2022b) has mapped the site to be outside of any mapped zone of dam breach inundation (see Figure 8, *Dam Breach Inundation Map*). Likewise, the site is not in a dam inundation zone as mapped by San Bernardino County. Therefore, the risk of earthquake-induced flooding at the site is considered to be less than significant.

2.6.6 Other Potential Hazards Listed on CGS Note 48

The following naturally occurring hazards are not believed to exist at the site nor in the region: methane gas, hydrogen-sulfide gas, tar seeps, volcanic eruption, radon-22 gas, and naturally occurring asbestos in geologic formations associated with serpentine.

Subsidence refers to ground settlement due to withdrawal of liquid from the underlying earth materials (such as water or oil). According to the USGS Areas of Land Subsidence in California, the site is not mapped within an area of potential subsidence. Based on the lack of shallow groundwater, the site does not pose a potential for significant subsidence due to groundwater extraction.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 General Conclusions

Based on this investigation, construction of the proposed improvements is feasible from a geotechnical standpoint. No severe geological or geotechnical issues were identified that would preclude construction of the proposed improvements. The most significant geotechnical issues at the site are those related to the potential for strong seismic shaking and the presence of surficial compressible soils. Good planning and design of the project can limit the impact of these constraints. Remedial recommendations for these and other geotechnical issues are provided in the following sections.

3.2 Earthwork and Grading

Grading should be performed in accordance with the General Earthwork and Grading Specifications presented in Appendix D, unless specifically amended below or by future recommendations based on final development plans.

3.2.1 Site Preparation

Prior to construction, the areas of the proposed improvements should be cleared of vegetation, asphalt pavement, and debris, which should be disposed of offsite. Any underground obstructions onsite should be removed. Resulting cavities should be properly backfilled and compacted. In addition, any uncontrolled fill should be removed and replaced as compacted fill. Efforts should be made to locate any existing utility lines. Those lines should be removed or rerouted if they interfere with the proposed construction, and the resulting cavities should be properly backfilled and compacted as recommended in Sections 3.2.3 and 3.9.

3.2.2 Overexcavation and Recompaction

To reduce the potential for adverse total and differential settlement of the proposed structures, the underlying subgrade soil should be prepared in such a manner that a uniform response to the applied loads is achieved. All undocumented artificial fill should be completely removed. Our borings indicated that undocumented artificial fill onsite was 1 to 5 feet thick, however, undocumented artificial fill may be found to be locally deeper during grading.

In addition to the complete removals of undocumented artificial fill, for the proposed new buildings, we recommend that the onsite soils be overexcavated a minimum depth of 5 feet below the existing ground surface or 3 feet below the bottom of the proposed footings, whichever is deeper. Where possible, the removal bottom should extend horizontally beyond the proposed structure a minimum of 5 feet from the outside edges of the footings, or a distance equal to the depth of overexcavation below the footings, whichever is farther. During overexcavation, the soil conditions should be observed by Leighton to further evaluate these recommendations based on actual field conditions encountered. If additional poor soils are encountered, additional overexcavation should be conducted.

A firm removal bottom should be established across the building footprint to provide uniform foundation support for the proposed building. Leighton should observe and test the removal bottom prior to placing fill. Deeper overexcavation and recompaction may be recommended locally until a firm removal bottom is achieved.

Areas outside of the proposed structures planned for asphalt or concrete pavement (such as parking areas or fire lanes), flatwork (such as sidewalks), site walls and low retaining walls (walls retaining less than 4 feet, taller walls should be overexcavated per the recommendations for buildings above), and areas to receive fill should be overexcavated to a minimum depth of 18 inches below existing grade or 12 inches below proposed subgrade (including footing subgrade), whichever is deeper.

After completion of the overexcavation, and prior to fill placement, the exposed surfaces should be scarified to a minimum depth of 6 inches, moisture conditioned to at least 2 percent above optimum moisture content, and recompacted to a minimum 90 percent relative compaction, relative to the ASTM D1557 laboratory maximum density.

3.2.3 Fill Placement

The onsite soil is suitable for use as compacted structural fill, provided it is free of debris and oversized material (greater than 8 inches in largest dimension). Any soil to be placed as fill, whether onsite or imported material, should be accepted by Leighton Consulting.

All fill soil should be placed in thin, loose lifts, moisture-conditioned, if necessary, to a minimum of 2 percentage points above optimum, and compacted to a minimum 90 percent relative compaction as determined by ASTM Test Method D1557. The upper 6 inches of subgrade soils in vehicle pavement areas should be compacted to a minimum 95 relative compaction, and aggregate base for pavement should be compacted to a minimum of 95 percent relative compaction.

3.2.4 Import Fill Soil

If import soil is to be placed as fill, it should be geotechnically accepted by Leighton. Preferably at least three (3) working days prior to proposed import to the site, the contractor should provide Leighton pertinent information of the proposed import soil, such as location of the soil, whether stockpiled or native in place, and pertinent geotechnical reports if available. We recommend that a Leighton representative visit the proposed import site to observe the soil conditions and obtain representative soil samples. Potential issues may include soil that is more expansive than onsite soil, soil that is too wet, soil that is too rocky or too dissimilar to onsite soils, oversize material, organics, debris, etc.

The owner should require proper documentation that soils imported to the project site are suitable for use at the school site from an environmental standpoint. The import soils should be evaluated and/or tested, as appropriate, for environmental suitability based on the Information Advisory - Clean Imported Fill (Department of Toxic Substances Control, October 2001 or more current edition). The documentation indicating the soils are suitable for use should be provided to the project construction manager prior to intended import to the site. Leighton can provide these services to the District, but the contractor must give Leighton adequate time to properly evaluate the material prior to import--a minimum of 3 working days (laboratory rush charges would apply), but preferably 5 working days or more. The contractor should provide Leighton pertinent information, such as the amount and location of the soil, whether stockpiled or native in place, soil owner contact information, and pertinent environmental reports, if available.

3.2.5 Shrinkage and Subsidence

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Field and laboratory data used in our calculations included laboratory-measured maximum dry densities for soil types encountered at the subject site and the measured in-place densities of soils encountered. We preliminarily estimate the following earth volume changes will occur during grading. These are rough estimates:

Shrinkage (Approximate)	15 ± 3 percent
Subsidence (Approximate)	0.15 foot

These estimates do not account for any removal of oversize material. The level of fill compaction, variations in the dry density of the existing soils and other factors influence the amount of volume change.

It should be noted that subsidence, as referred to above, is settlement of in-place earth materials due to heavy equipment processing. It does not refer to potential settlement due to placement of additional loads from new fill (i.e., rising of grades).

These shrinkage values are general guide values. Actual values will vary, due to the varying soil conditions and varying construction techniques. It is not possible to estimate exact values. Therefore, as with any grading project, some earthwork volume adjustments should be anticipated during grading.

3.2.6 Oversized Materials and Rippability

No oversize materials were encountered during our field exploration and it is not anticipated that oversized material (particles greater than 8 inches), requiring special handling for disposal, will be encountered during construction. If material greater than 8 inches in size is uncovered in the upper 5 feet, material should not be incorporated into compacted fill unless oversize material is broken or crushed to an acceptable size.

Based on the conditions observed at the surface and within our borings, onsite soils are expected to be rippable with conventional earthmoving equipment in good working order.

3.3 Foundations

Shallow foundations may be used to support the loads of the proposed buildings and associated structures. Overexcavation and recompaction of footing subgrade soils should be performed as detailed in Section 3.2.2.

3.3.1 Minimum Embedment and Width

Based on our investigation, footings for the proposed structure should have a minimum embedment of 18 inches, with a minimum width of 24 and 15 inches for isolated and continuous footings, respectively.

3.3.2 Allowable Bearing

An allowable bearing pressure of 2,000 pounds-per-square-foot (psf) may be used, based on the minimum embedment depth and width above. This allowable bearing value may be increased by 300 psf per foot increase in depth or width to a maximum allowable bearing pressure of 4,500 psf. These allowable bearing pressures are for total dead load and sustained live loads. Footing reinforcement should be designed by the structural engineer.

3.3.3 Lateral Load Resistance

Soil resistance available to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using an allowable coefficient of friction of 0.35. The passive resistance may be computed using an allowable (factor of safety of 1.5 applied) equivalent fluid pressure of 270 pounds per cubic foot (pcf), assuming there is constant contact between the footing and undisturbed soil. Friction and passive pressure may be combined without reduction, provided the footings can move laterally sufficiently to develop passive pressure (approximately ¼ inch); otherwise, friction alone should be assumed.

3.3.4 Increase in Bearing and Friction – Short Duration Loads

For the case of short term loading (seismic and wind loading), an increase of 1/3 would apply to the bearing pressure and friction values. The ultimate bearing pressure is assumed to be roughly three times the allowable bearing pressure. However, this ultimate pressure only considers structural failure/collapse (life safety) and not structural damage or significant cosmetic damage. Excessive settlement is anticipated to occur before the ultimate bearing pressure is attained.

3.3.5 Settlement Estimates

The recommended overexcavation, relative compaction and allowable bearing pressure are based on a total allowable, post construction settlement of 1 inch. Differential settlement due to static loading is estimated at approximately 1/2 inch over a horizontal distance of 30 feet between or along similarly loaded footings. Since settlement is a function of footing sustained load, size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists.

Seismic differential settlement is estimated to be a maximum of approximately 0.6 inch over 30 feet for the design-level earthquake, or angular distortion of 0.0017L. The structural engineer should determine Structure Type and Risk Category and evaluate whether the differential settlement estimates described above are tolerable. If they are not, alternate mitigation recommendations would be required.

3.4 Recommendations for Slabs-On-Grade

Concrete slabs-on-grade should be designed by the structural engineer in accordance with the current CBC for a soil with a “very low” expansion potential. Observation and possibly testing to confirm the expansion potential of the near surface soil should be conducted during site grading.

The following minimum slab recommendations should be used. More stringent requirements may be required by agencies, the structural engineer, the architect, or the CBC. Slabs-on-grade should have the following minimum recommended components:

Subgrade Moisture Conditioning: The subgrade soil should be moisture conditioned to at least 2 percentage points above optimum moisture content to a minimum depth of 12 inches prior to placing steel or concrete.

Concrete Thickness and Structural Design: Thickness of slabs-on-grade should be designed by the structural engineer, but should be at least 4 inches thick (this is referring to the actual minimum thickness, not the nominal thickness). Reinforcing steel should be designed by the structural engineer, but as a minimum (for conventionally reinforced slabs) should be No. 4 rebar placed at 18 inches on center, each direction, mid-depth in the slab.

Provided that the slab subgrade soils are compacted to a minimum of 95 percent relative compaction at 1 to 2 percentage points above optimum (as measured by ASTM D 1557), an average subgrade spring constant (modulus of subgrade reaction, k) of 175 pci (with linear deflections up to ¾ inch and a non-linear response for larger deflections) may be assumed for analysis of loading on slabs-on-grade. This value should not be used for estimation of actual settlements, but is intended to estimate shears, moments, and local distortions. An alternate check may be used by assuming an allowable bearing pressure of 1,100 psf (though the modulus of subgrade reaction method is the preferred method). If soils are allowed to dry out prior to placing concrete, the upper 9 inches should be scarified, moisture conditioned to 1 to 2 percentage points above optimum moisture content, and recompacted to a minimum of 95 percent relative compaction (based on ASTM D1557) prior to placing steel or concrete.

Minor cracking of the concrete as it cures, due to drying and shrinkage is normal and should be expected. However, cracking is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, aggregate that is not sufficiently clean, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. Low slump concrete can reduce the potential for shrinkage cracking. Additionally, reinforcement in slabs and foundations can generally reduce the potential for shrinkage cracking. The structural engineer should consider these and other pertinent concrete design and construction considerations in slab design and specifications.

3.4.1 Slab Underlayment for Moisture Vapor Retarding

Because moisture vapor from the underlying soils will be transmitted through slabs-on-grade without preventive measures, slab underlayment for moisture vapor retarding should be designed by qualified professionals (such as the structural engineer and/or architect) where control of moisture vapor transmission through slabs is considered important to this project (such as where moisture-sensitive floor coverings or equipment are planned). Slab underlayment typically includes a moisture vapor retarder membrane (such as 15-mil thick or greater) and provisions for protection of the vapor retarder during construction. The structural engineer and/or architect should specify pertinent slab and concrete design parameters, such as whether a sand blotter layer should be placed over the vapor retarder.

Moisture retarders can reduce, but not eliminate moisture vapor rise from the underlying soils up through the slab. Moisture retarders should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Institute, ASTM International, and California Building Code requirements and guidelines.

Leighton does not practice in the field of moisture vapor transmission evaluation/mitigation, since this does not fall under the geotechnical discipline. Therefore, we recommend that a qualified person, such as the flooring subcontractor, structural engineer, and/or architect, be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. That person (or persons) should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structures as deemed appropriate. In addition, the recommendations in this report and our services in general are not intended to address mold prevention, since we, along with geotechnical consultants in general, do not practice in the area of mold prevention. If specific recommendations are desired, a professional mold prevention consultant should be contacted.

3.5 Pole Foundations (Deep Foundations)

The following recommendations are applicable for light poles and shade structures/canopies. If large light structure, such as Musco light poles, are planned, then Leighton should review the proposed lighting system and provide supplemental recommendations if required. Similarly, if large shade structures are planned, then Leighton should review the proposed structure systems.

For enhanced sliding and overturning resistance, light poles are often founded on drilled cast-in-place reinforced concrete piers. Therefore, we present geotechnical design parameters for drilled cast-in-place concrete piers to support new light poles.

Lateral bearing resistance for proposed light pole pile foundations may be based on allowable lateral earth pressure of Class of Material 4 on Table 1806A.2 of the 2019 CBC, which can be doubled in accordance with 1806A.3.4, ignoring the upper 18 inches of soil in non-paved areas. This lateral bearing value assumes that the pole can tolerate at least a 0.5-inch deflection at the ground surface due to short term loading. Lateral bearing resistance should be computed in accordance with Section 1807A.3.2.1 (unconstrained laterally) of the 2019 CBC. These recommendations assume that the foundations will be embedded against firm intact soil.

As an alternative, the following parameters may be used in lateral loading analysis of concrete caisson piles: effective unit weight of 120 pcf, friction angle of 32 degrees, and soil-modulus parameter (*k value*) of 40 pci. These parameters are intended for analyses such as with the Ensoft LPILE program, which solves a beam on elastic foundation problem using independent nonlinear lateral springs, commonly referred to as p-y curves, to model the relationship between soil resistance and pile deflection. The soil material can be modeled as "Sand (Reese)". Additional parameters to be considered by the structural engineer for lateral pile analysis include head fixity, allowable deflection, and section bending stiffness assuming concrete cracking.

For axial design, we recommend an allowable resistance in compression for these foundations consisting of 200 psf for allowable skin friction, ignoring the bottom one diameter, and an allowable end bearing of 2,500 psf (assuming a cleaned-out bottom). We recommend that the piles be at least 4 pile diameters long. These values are for isolated single piles.

3.6 Seismic Design Parameters

Seismic parameters presented in this report should be considered during preliminary project design. In order to reduce the effects of ground shaking produced by regional seismic events, seismic design should be performed in accordance with the 2019 CBC. The 2019 seismic design parameters are presented in Section 2.5.2 of this report should be considered for the seismic analysis of the subject site.

3.7 Lateral Earth Pressures

We recommend that retaining walls be backfilled with "very low" expansive soil and constructed with a backdrain in accordance with the recommendations provided on Figure 10 - Retaining Wall Backfill and Subdrain Detail. Using expansive soil as retaining wall backfill will result in higher lateral earth pressures exerted on the wall and are, therefore, not recommended. Based on these recommendations, the following parameters may be used for the design of conventional retaining walls.

Table 2 – Retaining Wall Design Parameters

Static Equivalent Fluid Pressure (pcf)	
Condition	Level Backfill
Active	35
At-Rest	55
Passive (allowable)	270 (Maximum 3,000 psf)

The above values do not contain an appreciable factor of safety (except for the passive pressure), so the structural engineer should apply the applicable factors of safety and/or load factors during design.

Cantilever walls that are designed to yield at least 0.001H, where H is equal to the wall height, may be designed using the active condition. Rigid walls and walls braced at the top should be designed using the at-rest condition.

Passive pressure is used to compute soil resistance to lateral structural movement. In addition, for sliding resistance, a frictional resistance coefficient of 0.35 may be used at the concrete and soil interface. The lateral passive resistance should be taken into account only if it is ensured that the soil providing passive resistance, embedded against the foundation elements, will remain intact with time. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall should be considered in the design. A third of uniform vertical surcharge-loads should be applied at the surface as a horizontal pressure on cantilever (active) retaining walls, while half of uniform vertical surcharge-loads should be applied as a horizontal pressure on braced (at-rest) retaining walls. To account for automobile parking surcharge, we suggest that a uniform horizontal pressure of 100 psf (for restrained walls) or 70 psf (for cantilever walls) be added for design, where autos are parked within a horizontal distance behind the retaining wall less than the height of the retaining wall stem.

For walls with a retained height over 6 feet, or where otherwise required by Code or deemed appropriate by the structural engineer, we recommend that the wall designs be checked seismically using an additive seismic Equivalent Fluid Pressure (EFP) of 22 pcf for a cantilever (unrestrained) wall with level backfill and 35 pcf for a basement wall (restrained) with level backfill, which is added to the active EFP. Such walls that are to be designed in the static case assuming the at-rest condition should be checked seismically using this additive seismic EFP added to the active condition (i.e., the additive seismic EFP is not added to the at-rest EFP). The additive seismic EFP should be applied with a standard EFP pressure distribution (i.e., it is not an inverted triangle). The point of application of the dynamic load increment is at 1/3H, where H is the retained height.

Conventional retaining wall footings should have a minimum width of 24 inches and a minimum embedment of 12 inches below the lowest adjacent grade. An allowable bearing pressure of 2,000 psf may be used for retaining wall footing design, based on the minimum footing width and depth. This bearing value may be increased by 300 psf per foot increase in width or depth to a maximum allowable bearing pressure of 3,500 psf.

3.8 Pavement Design

Based on the design procedures outlined in the current Caltrans Highway Design Manual, and using laboratory test results of a recovered near surface soil sample R-value of 50, flexible pavement sections may consist of the following for the traffic index indicated. Final pavement design should be based on the Traffic Index determined by the project civil engineer and R-value testing provided near the end of grading.

Table 3 – Flexible Pavement Design

Traffic Index	Asphaltic Concrete (AC) Thickness (Inches)	Class 2 Aggregate Base Thickness (inches)
5 or less (auto access)	3.0	4.0
7 (bus/truck access and fire lanes)	4.0	4.5
5.5 (City “Local” Street)*	4.0*	4.0
6.5 (City “Collector” Street)*	4.5*	4.0

* Per City of Fontana Pavement Standards. Leighton should be informed if offsite improvements along Sierra Avenue are planned for additional recommendations.

If asphalt pavement is to be constructed prior to construction, the full pavement thickness should be placed to support heavy construction traffic.

In areas where rigid concrete pavement is planned with auto access, we recommend 5 inches of Portland Cement Concrete (PCC) over prepared subgrade soil. For truck/bus access, we recommend a minimum of 6.5 inches of PCC over prepared subgrade soil. The PCC should have a 28-day compressive strength of 4,000 psi. Reinforcement should be specified by the structural engineer.

The PCC pavement sections should be provided with crack-control joints spaced no more than 10 feet on center each way for 5-inch-thick concrete, and no more than 13 feet on center each way for 6.5-inch-thick concrete. If sawcuts are used, they should have a minimum depth of ¼ of the slab thickness and made within 24 hours of concrete placement. We recommend that sections be as nearly square as possible.

PCC sidewalks should be at least 4 inches thick over prepared subgrade soil, with construction joints no more than 8 feet on center each way, with sections as nearly square as possible. Use of reinforcing will help reduce severity of cracking. For concrete ADA stalls and ADA cross-walks, we recommend that a minimum 5 inches of concrete over prepared subgrade soil.

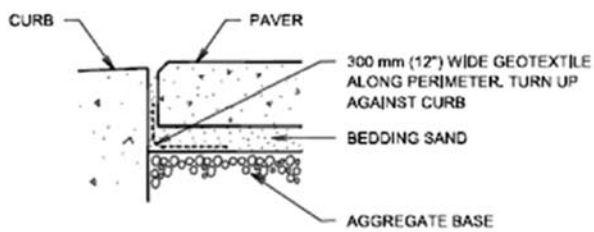
All pavement construction should be performed in accordance with the Standard Specifications for Public Works Construction. Field observations and periodic testing, as needed during placement of the base course materials, should be undertaken to ensure that the requirements of the standard specifications are fulfilled. Prior to placement of aggregate base, the subgrade soil should be processed to a minimum depth of 6 inches, moisture-conditioned, as necessary, and recompacted to a minimum of 95 percent relative compaction. Aggregate base should be moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction.

3.9 Paver Recommendations

Based on the design procedures outlined in ASCE 58-16, interlocking concrete paver pavement sections for a Traffic Index of 6.5 or less (auto access, parking) should consist of a minimum of 3-1/8-inch-thick concrete pavers over bedding sand, over a minimum of 6 inches of aggregate base. Bedding sand should be 1-inch thick (nominal) and should conform to recommendations in Interlocking Concrete Pavement Institute (ICPI) Tech Spec 17 and ASCE 58-16, or manufacturer recommendations if more stringent. The aggregate base should consist of crushed aggregate base or crushed miscellaneous base (CMB) per Greenbook specifications. If CMB is used, it is preferred that it be derived from asphalt grindings.

Paver areas should be confined laterally by a curb and gutter on the sides, or by a concrete edge band where the pavers transition to asphalt pavement. The concrete edge band should be a minimum depth of paver section thickness (10 inches) and a minimum 8 inches wide with crack control joints at 8 feet on center. The 28-day design compressive strength of the concrete should be a minimum of 3,000 pounds per square inch. Pavers should be placed with a herringbone pattern, with a sailor or soldier course along the edges.

ASCE 58-16 recommends that a 12-inch-wide strip of non-woven geotextile filter fabric be placed along the perimeter, turned up against the curb, in order to prevent bedding sand from migrating into cracks that may develop in the concrete and into crack control joints, which migration could cause settlement of the pavers; see following the detail from ASCE 58-16:



DETAIL 'A'

Likewise, if pavers are placed over a concrete subslab or treated base (CTB or ATB), ASCE 58-16 recommends that non-woven geotextile filter fabric be placed over the concrete or treated base prior to placement of bedding sand to prevent the bedding sand from migrating into cracks that may develop. Where such materials area used, 2-inch-diameter drain holes filled with clean angular aggregate are recommended at the lowest elevations, along with bedding sand drainage into catch basins, in accordance with ASCE 58-16 guidelines.

We have assumed that the proposed paver sections are not for infiltration or water collection purposes; if paver sections will be used for infiltration or water collection, then additional recommendations would need to be provided for paver reservoir aggregate layers.

All pavement construction should be performed in accordance with the Standard Specifications for Public Works Construction (Greenbook) for in-tract streets. Field inspection and periodic testing, as needed during placement of the base course materials, should be undertaken to ensure that the requirements of the standard specifications are fulfilled. Prior to placement of aggregate base, the subgrade soil should be processed to a minimum depth of 6 inches, moisture-conditioned, as necessary, and recompacted to a minimum of 95 percent relative compaction. Aggregate base should be moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction.

3.10 Infiltration Recommendations

Infiltration Rate:

As part of our subsurface investigation we conducted infiltration testing at various locations on the site as requested by the project architect, including the northwest, southwest and southeast corners, and along the middle of the eastern property line. Testing was conducted at depths ranging from 15 to 30 feet within soils containing varying amounts of fine and coarse-grained material. Based on our exploratory borings at the site, we targeted the coarse-grained sand layer that was generally encountered at a depth of 15 to 25 feet with varying thicknesses and would yield higher infiltration rates compared to the rest of the encountered materials that contained higher percentage of fines (silt and clay).

A well permeameter test is useful for field measurements of soil infiltration rates, and is suited for testing when the design depth of the basin or chamber is deeper than current existing grades. The test consists of excavating a boring to the depth of the test. A layer of clean sand is placed in the boring bottom to support temporary perforated well casing pipe. In addition, sand is poured around the outside of the well casing within the test zone to prevent the boring from caving/collapsing or eroding when water is added. The volume percolated during timed intervals is converted into an incremental infiltration rate, in inches per hour. The test was conducted based on the USBR 7300-89 test method.

Our infiltration test yielded a small-scale, clean-water unfactored infiltration rates of 1.0 to 30 in/hr. These are raw values, before applying an appropriate factor of safety or correction factor. Results of the infiltration testing are provided in the attachments, and are summarized in the table below.

Table 4 – Infiltration Tests

Test Boring	Test Zone Below Grade (ft)	Material	% Fines	Raw Infiltration Rate (in/hr)
LI-1	21 – 30	SP-SM	15	10
LI-2A	12 – 22	SM-ML	55	1.0
LI-3	17 – 25	SM	35	6
LI-4	21 – 25	SP	5	30

Soils within the upper 50 feet are primarily interbedded with silty sands and sandy silts with varying degrees of fine-grained material. A relatively continuous sand layer was encountered at depths of 15 to 25 feet, with an approximate thickness of 5 feet. Infiltration tests at LI-1 (southwest corner) and LI-4 (northeast corner) yielded the highest infiltration rates.

Infiltration Recommendations

Based on our testing, infiltration appears to be feasible but dependent upon location and depth of infiltration due to the variances in soil composition encountered at the site.

We anticipate that the finer-grained soil within the upper 15 feet bgs and silts below approximately 35 feet will not infiltrate well. Additionally, only thin layers of sand were encountered in borings LI-2 (southeast corner) and LI-3 (central eastern portion), which yielded lower rates. For underlying alluvial soils that are granular with a low fines content (generally encountered at a depth of 15 to 25 feet), we recommend an unfactored (small-scale) infiltration rate of 10 inches per hour. We recommend that a correction factor/safety factor be applied to the infiltration rate in conformance with San Bernardino County guidelines, since monitoring of actual facility performance has shown that actual infiltration rates are lower than measured in small-scale tests. Infiltration basins are subject to siltation, which can result in reduced infiltration rates. This small-scale infiltration rate should be divided by a design factor of at least 2 for buried chambers and at least 3 for open basins; although the design/safety factor may be higher based on project-specific aspects. It should be noted that during periods of prolonged precipitation, underlying soils tend to become saturated to greater depths/extent. Therefore, infiltration rates tend to decrease with prolonged rainfall.

We recommend that infiltration systems be located towards the western portion of the site. Infiltration be achieved with buried chambers extending to approximately 20 to 25 feet bgs in order to target the encountered granular sand layer. If shallow basins or swales are planned, we recommend that deeper soils be reached by installing infiltration borings or trenches, as described below.

Some design considerations are presented in the following paragraphs:

- **Infiltration Trenches**: The infiltration trenches should be a minimum of 18 inches wide, and extend to a minimum 20 to 25 feet bgs into the clean granular sands. However, to increase the surface area of the sand backfill interface and to reduce the time between siltation maintenance intervals, the top 9 inches of the trenches should be widened to a minimum of 4 feet; further widening of the trench tops may be considered, which would be anticipated to result in an increase in the amount of time between required siltation maintenance procedures. Trench backfill should consist of clean washed concrete sand, conforming to ASTM C33 Fine Aggregate, but with a special criterion that the fines content (passing the No. 200 sieve) be a maximum of 2 percent (measured prior to placement). ASTM C33 No. 9 stone would also be an acceptable filter media, with a special criteria that it contain a minimum of 5 percent passing the No. 16 sieve and no more than 2 percent passing the No. 200 sieve. Other materials of sand or sand/gravel mixtures may also be acceptable, with these criteria. If gravel is used as the backfill material for the trenches, Mirafi 140N filter fabric should be placed on the sides of the trench (prior to placing gravel) and also covering the gravel backfill; an upper layer of washed concrete sand should be placed over the filter fabric. Proposed filter media material should be observed and tested by Leighton prior to shipment to the site.

  The infiltration trench backfill is intended to act as a filter, where much of the silt in the basin water would be trapped at the surface of the sand. As silt develops on the surface, it would act to filter out even more silt, but which would also slow down infiltration. During the life of the project, as the top of the sand silts over or if it gets disturbed, or when infiltration rates become excessively slow, siltation maintenance should be conducted. Siltation maintenance consists of removing (scalping off of) the upper crust of silt deposits until clean, undisturbed sand is exposed. During removal of the upper crust, the removed upper sand should be replenished.

- **Adjacent Structure Impact**: As infiltrating water can seep within soil strata partially horizontally, it is important to consider impact that infiltration facilities can play on nearby subterranean structures, such as basement walls or open excavations, whether onsite or offsite, and whether existing or planned. Any such nearby features should be identified and evaluated as to whether infiltrating water can impact these facilities. Infiltration facilities should not be constructed adjacent to or under buildings. Setbacks should be discussed with Leighton during the planning process, but a building setback of at least 15 feet horizontally is initially suggested.

- **Infiltration Basins Type and Geometry**: Further testing may be required depending on final design of infiltration facilities. Infiltration rates are anticipated to vary based on location and depth. Infiltration concepts should be discussed with Leighton as infiltration plans are being developed. We should review all infiltration plans, including locations and depths of proposed facilities. Further testing may be required depending on infiltration facilities design details, particularly considering type, depth and location.

- **Siltation and Soil Changes**: These infiltration rates are for a clean, un-silted infiltration surface in native, sandy alluvial soil. These values may be reduced over time as silting of the basin or chamber occurs. Furthermore, if the basin or chamber bottom is allowed to be compacted by heavy equipment, this value is expected to be reduced. Infiltration of water through soil is highly dependent on such factors as grain size distribution of soil particles, gradation (uniform versus well graded), particle shape, fines content and density. Small changes in soil conditions, including density, can cause large differences in observed infiltration rates. Infiltration is not suitable in compacted fill. For open basins and swales, vegetation within the basin bottoms and sides is expected to help reduce erosion and help maintain infiltration rates.

- **De-silting Weir/Facilities**: Periodic flow of water carrying sediments into the basin or chamber, plus deposition of fine wind-blown sediments and sediments from erosion of basin side walls, will eventually cause the basin bottom or chamber to accumulate a layer of silt, which has the potential to significantly reducing the overall infiltration rate of the basin or chamber. Therefore, we recommend that significant amounts of silt/sediment not be allowed to flow into the facility within stormwater, especially during construction of the project and prior to achieving a mature landscape onsite. We recommend that an easily maintained, robust silt/sediment removal system be installed to pretreat storm water before it enters the infiltration facility. Infiltration facilities should be constructed with spillways or other appropriate means that would prevent overfilling that could damage the facility or adjacent improvements.

- **Drainage/Infiltration Time Cycle**: In general, the rate of infiltration reduces as the head of water in the infiltration facility reduces, and it also reduces with prolonged periods of infiltration. As such, water typically infiltrates much faster near the beginning of and/or immediately after storm events than at times well after a storm when the water level in the facility has receded, since the infiltration rate is then slower due to both lower head and longer overall duration of infiltration. In open basins with compacted or silty bottoms, this could be problematic, in that even if the basin had already infiltrated significant amounts of storm water, the lower several inches or feet of water could remain in the basin for an extended period of time, creating prolonged open-water safety concern (such as potential for mosquitos and waterborne diseases, algae odor, etc.). In a buried/cover infiltration chamber, these conditions would be of less concern.

- **Maintenance**: Infiltration facilities should be routinely monitored, especially before and during the rainy season, and corrective measures should be implemented if and as needed. Things to check for include removal of trash or dumping, proper infiltration, absence of accumulated silt, and that de-silting filters/features are clean and functioning. Pretreatment desilting features should be cleaned and maintained as recommended by the manufacturer or designer. Even with measures to prevent silt from flowing into the infiltration facility, accumulated silt may need to be removed.

3.11 Cement Type and Corrosion Protection

Based on the results of laboratory testing, concrete structures in contact with the onsite soil will have negligible exposure to water-soluble sulfates in the soil. Therefore, common Type II cement may be used for concrete construction. Concrete should be designed in accordance with ACI 318-14, Section 4.2 (ACI, 2014), adopted by the 2019 CBC (Section 1904A.2).

Based on our laboratory testing, the onsite soil is considered mildly corrosive to ferrous metals. Corrosion information presented in this report should be provided to your underground utility contractors.

3.12 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations and other excavations should be performed in accordance with project plans, specifications and all OSHA requirements, and the current edition of the California Construction Safety Orders, latest edition.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structures.

Cantilever shoring should be designed based on the active fluid pressure presented in the retaining wall section. If excavations are braced at the top and at specific design intervals, the active pressure may then be approximated by a rectangular soil pressure distribution with the pressure per foot of width equal to 22H, where H (feet) is equal to the depth of the excavation being shored.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA, standards to evaluate soil conditions. Close coordination between the competent person and Leighton Consulting should be maintained to facilitate construction while providing safe excavations.

3.13 Soil Modulus for Pipe Design and Thrust Block Design

Modulus of Soil Reaction (E') represents the stiffness of embedment soil on the sides of buried pipe and is used to estimate deflection of the pipe due to dead and live loads over the pipe. Based on the soil type encountered in the boring and blowcounts during sampling, an E' value of 700 psi may be used for analysis.

Lateral loads on thrust blocks and other appurtenant structures are generally resisted by passive soil pressure and friction, in combination. As such, an allowable passive pressure based on an equivalent fluid pressure of 270 pounds-per-cubic-foot (pcf), not to exceed 2,500 pounds per square foot (psf) can be used if the pipe is embedded into compacted fill (minimum 2 feet embedment). This equivalent fluid pressure may be doubled for isolated thrust blocks.

3.14 Trench Backfill

Utility-type trenches onsite can be backfilled with onsite material, provided it is free of debris, significant organic material and oversized material (greater than 3 inches for trench backfill within 3 feet of a pipe, and 6 inches for trench backfill above). Prior to backfilling the trench, pipes should be bedded and shaded in a granular material that has a sand equivalent of 30 or greater and will allow water to sufficiently permeate. We recommend that open-graded crushed rock or similar material not be used as bedding or shading material unless special provisions are implemented to limit the migration of surrounding soil into the open-graded rock. If gravel or open-graded rock is approved and used as bedding or shading, it should be wrapped in Mirafi 140N filter fabric, or equivalent. The bedding material should extend 12 inches above the top of the pipe. The bedding/shading sand should be densified in-place by mechanical means or jetting. Bedding sand should be placed in accordance with the Standard Specifications for Public Works Construction (Greenbook). Overlying native soil fill should be placed in loose layers, moisture conditioned, as necessary, and mechanically compacted using a minimum standard of 90 percent relative compaction based on ASTM D1557. The thickness of layers should be based on the compaction equipment used in accordance with the Standard Specifications for Public Works Construction (Greenbook).

3.15 Drainage and Site Conditions

Positive surface drainage should be provided to direct surface water away from structures and towards suitable collective drainage facilities. Surface drainage should be provided to prevent ponding of water adjacent to the structures. In general, the area around the buildings should slope away from the buildings. Care should be taken to avoid heavy irrigation, and under-irrigation should also be avoided.

3.16 Limitations and Additional Geotechnical Services

The geotechnical recommendations presented in this report are based on subsurface conditions as interpreted from limited subsurface explorations and limited laboratory testing. Our geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. However, additional geotechnical study and analysis may be required based on final development plans. Leighton Consulting should review the site and grading plans when available and comment further on the geotechnical aspects of the project. Geotechnical observation and testing should be conducted during excavation and all phases of grading operations. Our conclusions and preliminary recommendations should be reviewed and verified by Leighton Consulting during construction and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions, and recommendations presented in this report are based on the assumption that Leighton Consulting will provide geotechnical observation and testing during construction. Please refer to the GBA "Important Information about Your Geotechnical Engineering Report" presented at the end of this report.

Environmental services were not included as part of this study. This report was prepared for the sole use of Chaffey Community College District for application to the design of the proposed project in accordance with generally accepted geotechnical engineering practices at this time in California.

Geotechnical observation and testing should be provided:

- After completion of site demo/clearing.
- During overexcavation of compressible soil.
- During compaction of all fill materials.
- After excavation of all footings and prior to placement of concrete.
- During utility trench backfilling and compaction.
- During pavement subgrade and base preparation.

- When any unusual conditions are encountered.

Until reviewed and accepted by California Geological Survey (CGS), this report may be subject to change. Changes may be required as part of the CGS review process. Leighton assumes no risk or liability for consequential damages that may arise due to design work progressing before this report is reviewed and accepted by CGS.

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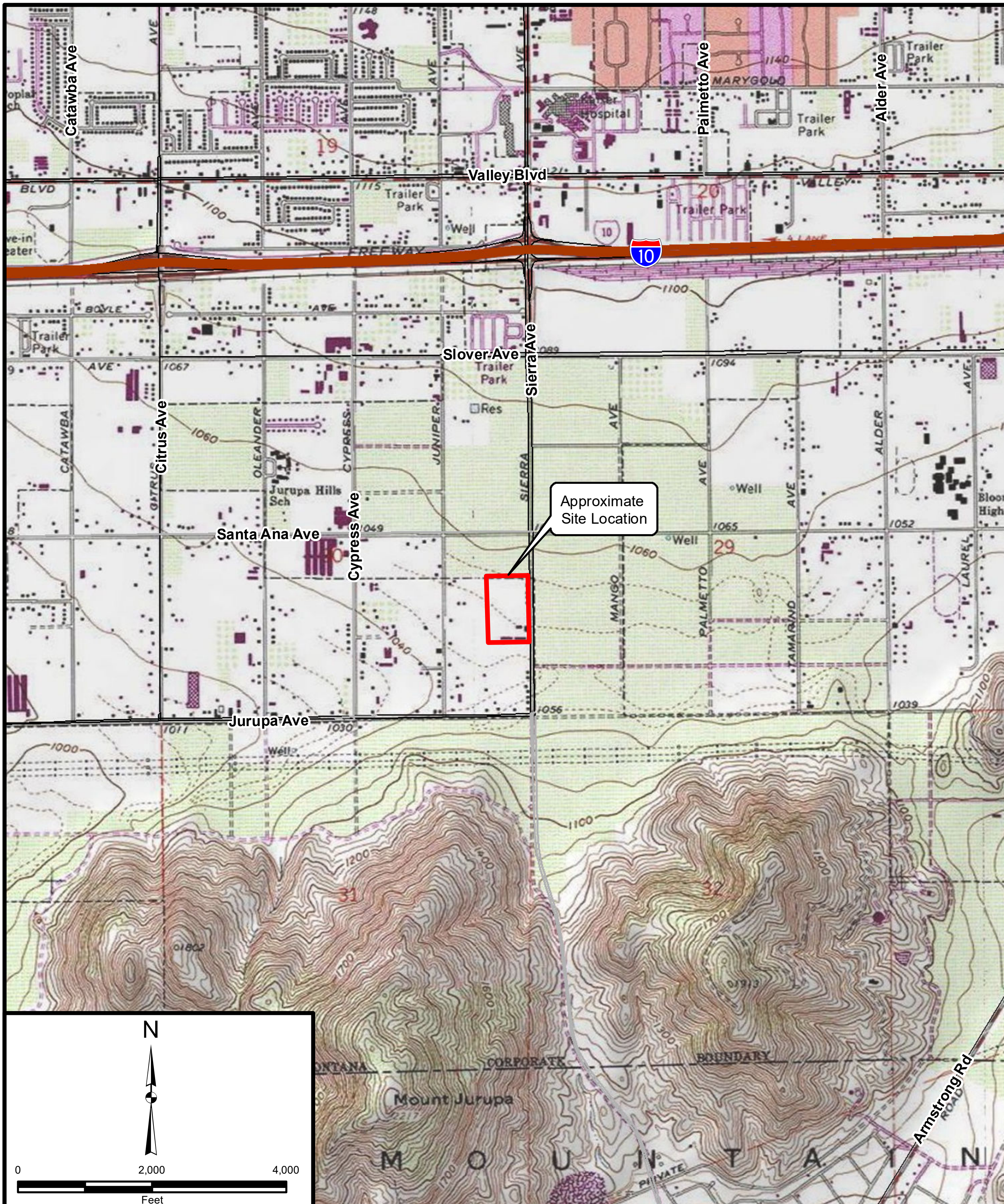


Project: 12691.011	Eng/Geol: JDH/SGO
Scale: 1 " = 2,000 '	Date: October 2022

Reference: Copyright:© 2013 National Geographic Society, i-cubed

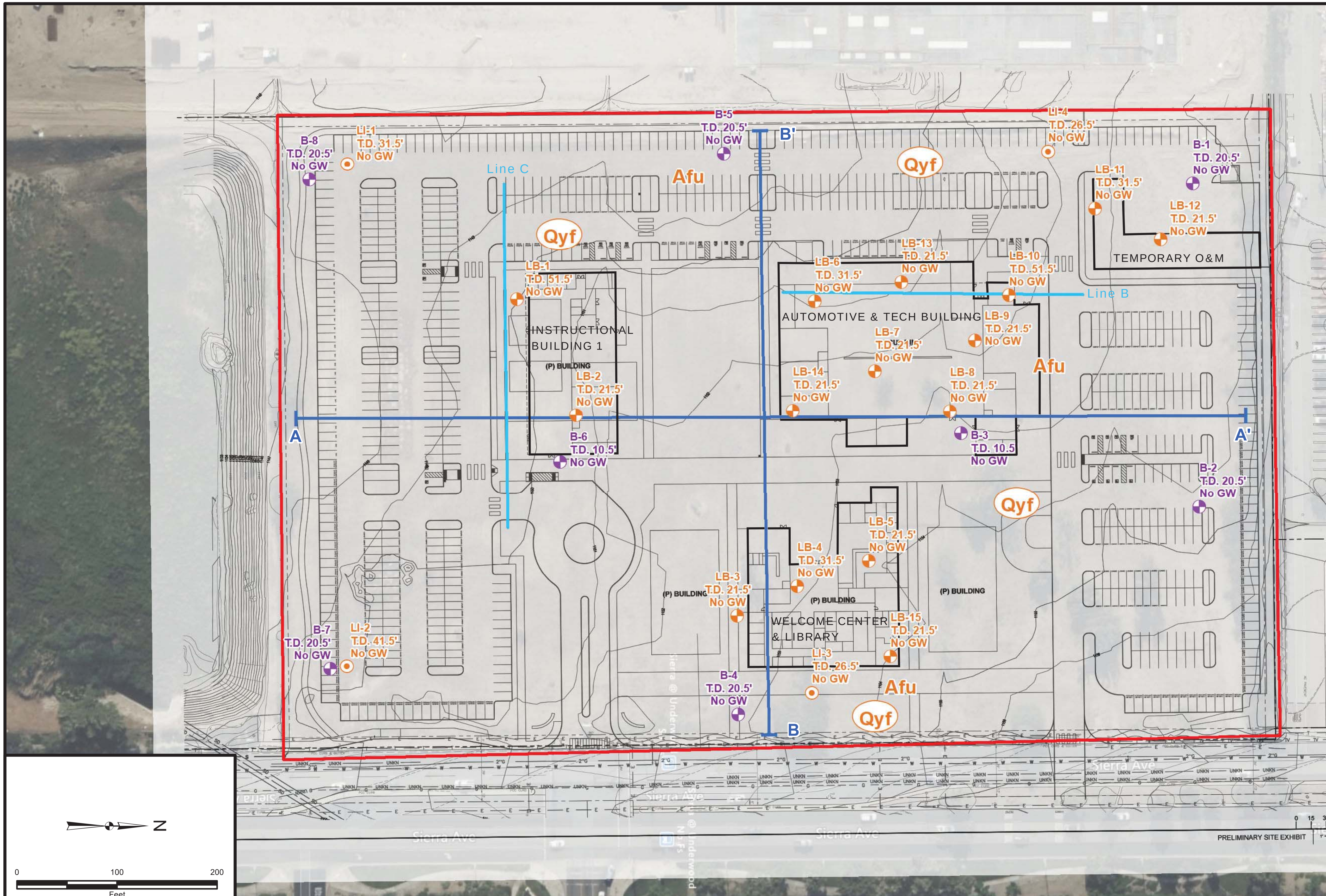
SITE LOCATION MAP

Chaffey College Fontana Campus
11070 Sierra Avenue
City of Fontana, California

FIGURE 1

Leighton

Map Saved as J:\Drafting\12691\011\Maps\12691.011_F01_SLM_2022-10-05.mxd on 10/6/2022 7:17:43 AM Author: KVM (kmanchikanti)



Legend

LB-15	Geotechnical Boring, Leighton, 2022
B-8	Geotechnical Boring, Geocon, 2020
LI-4	Infiltration Boring, Leighton 2022
	Geophysical Line
A A'	Cross-Section Line
	Approximate Site Boundary
Afu	Undocumented Fill
Qyf	Quaternary Alluvial Fan Deposits, circled where buried

Project: 12691.011	Eng/Geol: JDH/SGO
Scale: 1 " = 100 '	Date: October 2022

Reference: © 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) Distribution Airbus DS © 2022 TomTom, Rexford Industrial Realty, Conceptual Sie Plan

GEOTECHNICAL MAP

Chaffey College Fontana Campus

11070 Sierra Avenue, City of Fontana, California

FIGURE 2

Leighton

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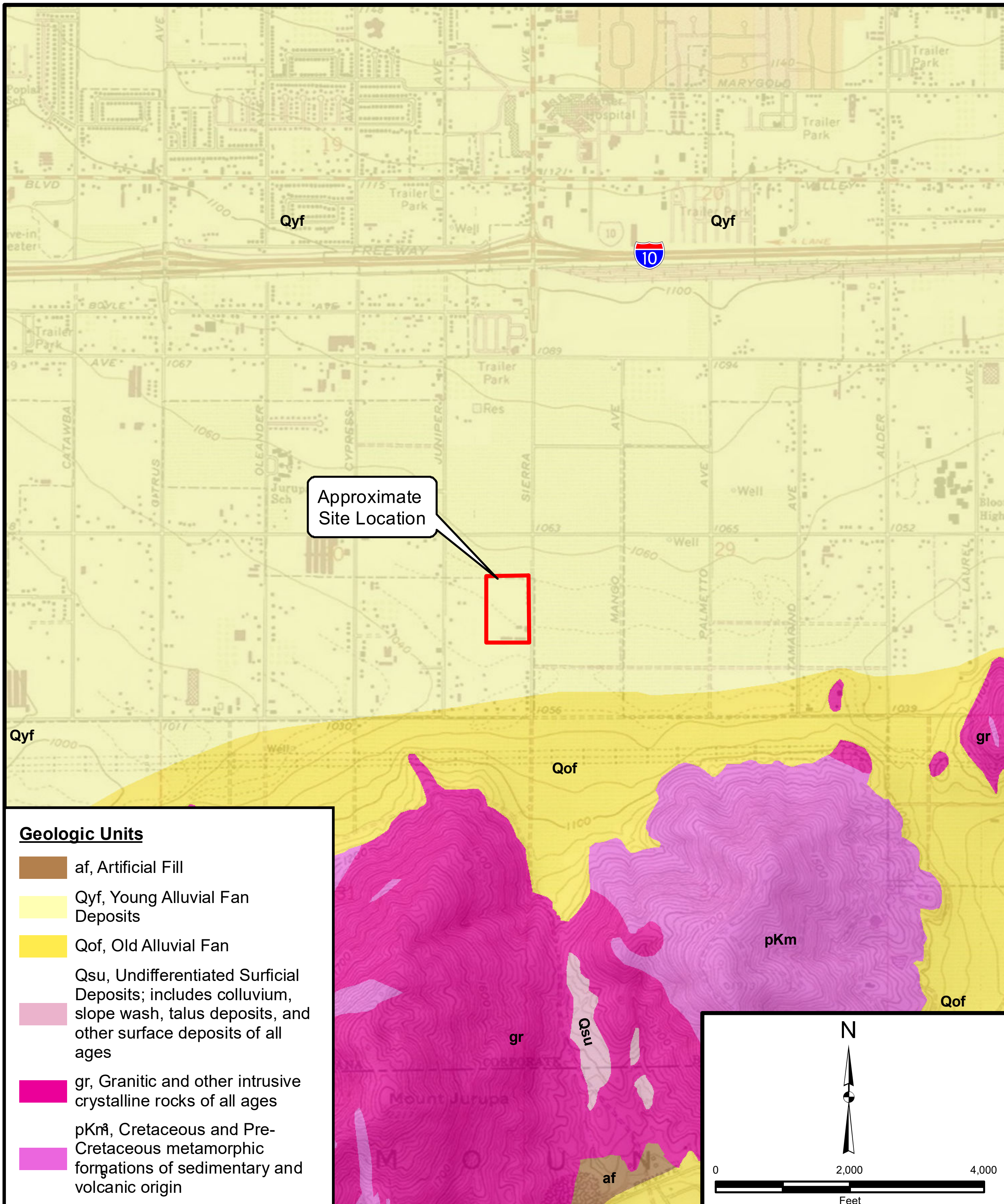


Project: 13600.001	Eng/Geol: JDH/SGO	
Scale: 1 " = 2,000 '	Date: October 2022	

Reference: Preliminary Geologic Map of Southern California in GIS Format by CGS, 2010a

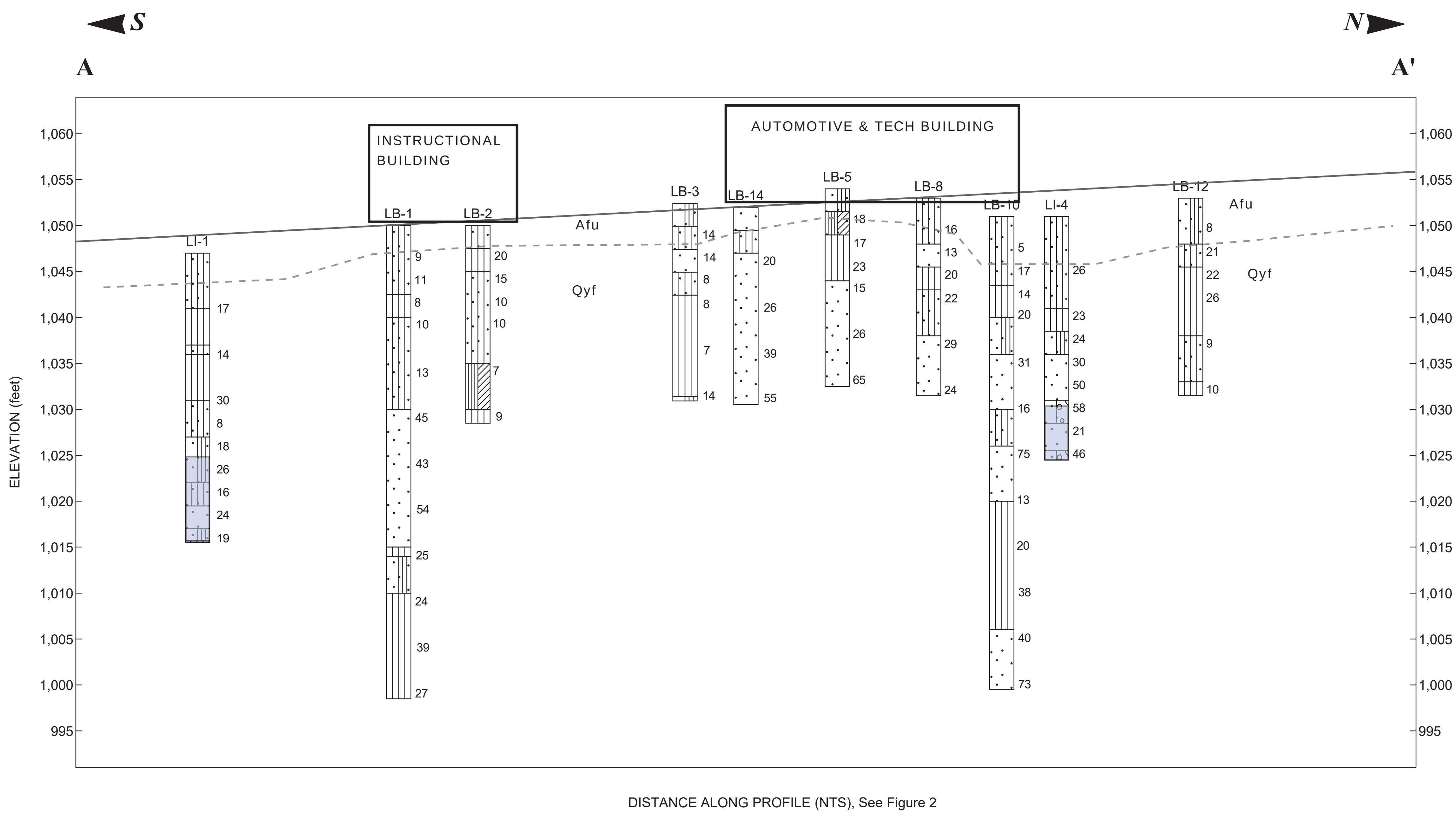
REGIONAL GEOLOGY MAP

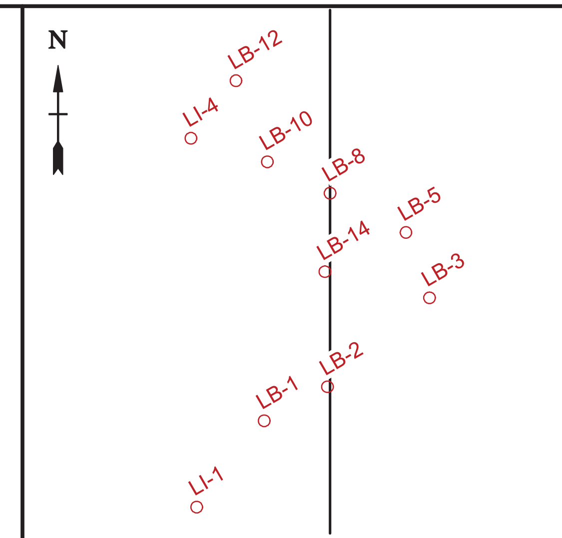
Chaffey College Fontana Campus
11070 Sierra Avenue
City of Fontana, California

FIGURE 4

Leighton

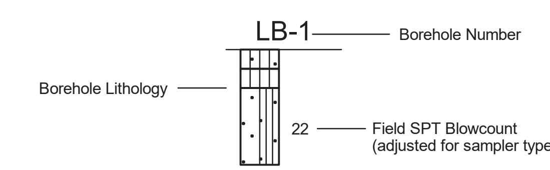
Map Saved as J:\Drafting\12691\011\Maps\12691.011_F04_RGM_2022-10-05.mxd on 10/12/2022 3:41:28 PM Author: KVM (kmanchikanti)





Site Map Not To Scale, See Figure 2

Explanation:



Infiltration Test Zone

Approximate Existing Grade

Approximate Geologic Contact

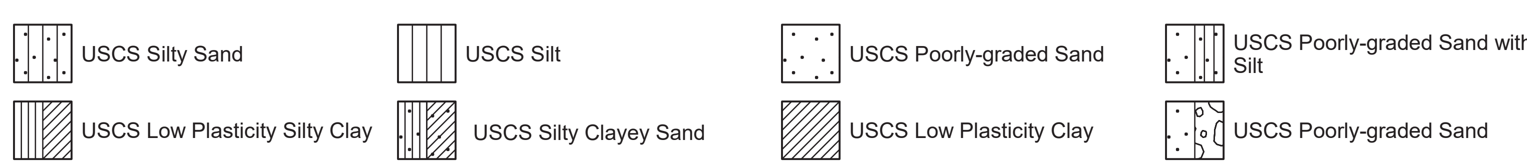
Approximate Proposed Building Location

Afu Undocumented Artificial Fill

Qyf Young Alluvial Fan Deposits

1. Select Borings Excluded due to Profile Overlap

Lithology Graphics



Leighton Consulting, Inc.

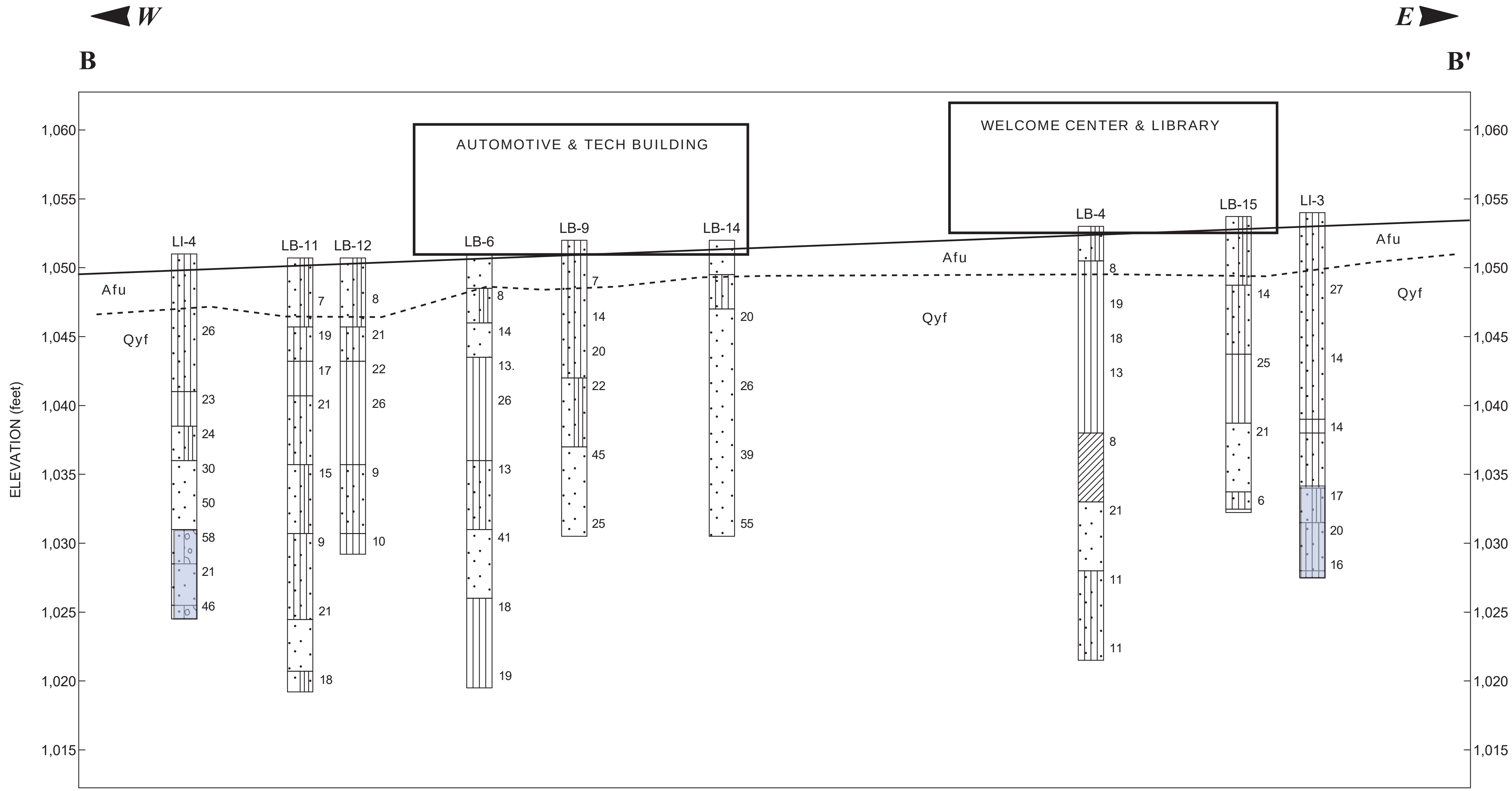
Geotechnical Cross Section A-A'

Leighton

Proposed Chaffey College Fontana Campus

JOB NUMBER	FIGURE NUMBER
12691.011	Figure 4a

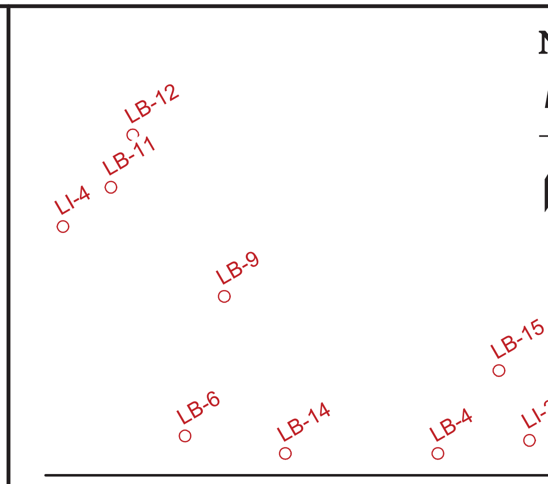
FNC AB NWNL01 - B SIZE 12691.011 CHAFFEY FONTANA BORING LOGS FENCE OUTPUT- COPY.GPJ ROCKLOG2012.GDT 10/10/22



DR T8NCE 8I ONG I 7OFI E (NTS), See Figure 2

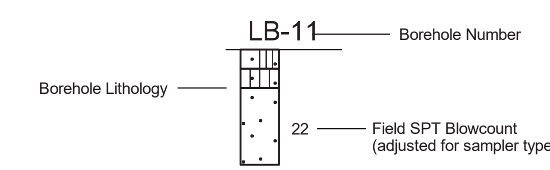
Lithology Graphics

- USCS Poorly-graded Sand with Silt
- USCS Silty Sand
- USCS Silt
- USCS Poorly-graded Sand
- USCS Low Plasticity Clay
- USCS Poorly-graded Sand



Site Map Not To Scale, See Figure 2

Explanation:



- Infiltration Test Zone
- Approximate Existing Grade
- Approximate Geologic Contact
- Approximate Proposed Building Location
- Afu — Undocumented Artificial Fill
- Qyf — Young Alluvial Fan Deposits

1. Select Borings Excluded due to Profile Overlap

Leighton Consulting, Inc.

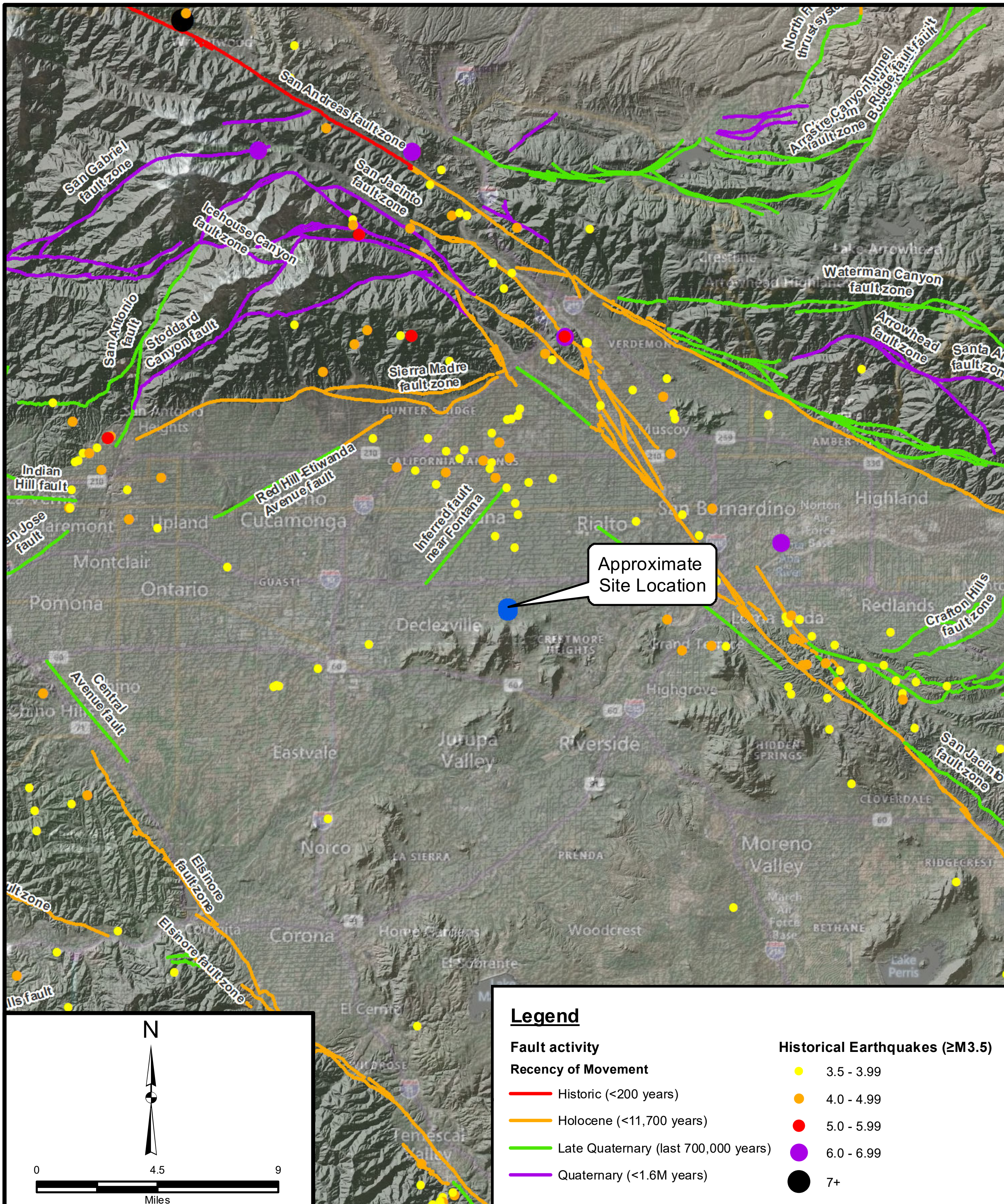
Geotechnical Cross Section B-B'

Leighton

Proposed Chaffey College Fontana Campus

JOB NUMBER	FIGURE NUMBER
12691.011	Figure 4b

FNC AB NWNL01 - B SIZE 12691.011 CHAFFEY FONTANA BORING LOGS E-W FENCE OUTPUT- COPY.GPJ ROCKLOG2012.GDT 10/11/22



Legend

Fault activity

Recency of Movement

- Historic (<200 years)
- Holocene (<11,700 years)
- Late Quaternary (last 700,000 years)
- Quaternary (<1.6M years)

Historical Earthquakes (≥M3.5)

- 3.5 - 3.99
- 4.0 - 4.99
- 5.0 - 5.99
- 6.0 - 6.99
- 7+

Project: 13600.001	Eng/Geol: JDH/SGO
Scale: 1 " = 5 miles	Date: October 2022

Basemap Reference: © 2022 Microsoft Corporation
Earthstar Geographics SIO © 2022 TomTom
Seismicity Data Reference: maps.conservation.ca.gov

REGIONAL FAULTS AND HISTORICAL SEISMICITY MAP

Chaffey College Fontana Campus
11070 Sierra Avenue
City of Fontana, California

FIGURE 5

Leighton

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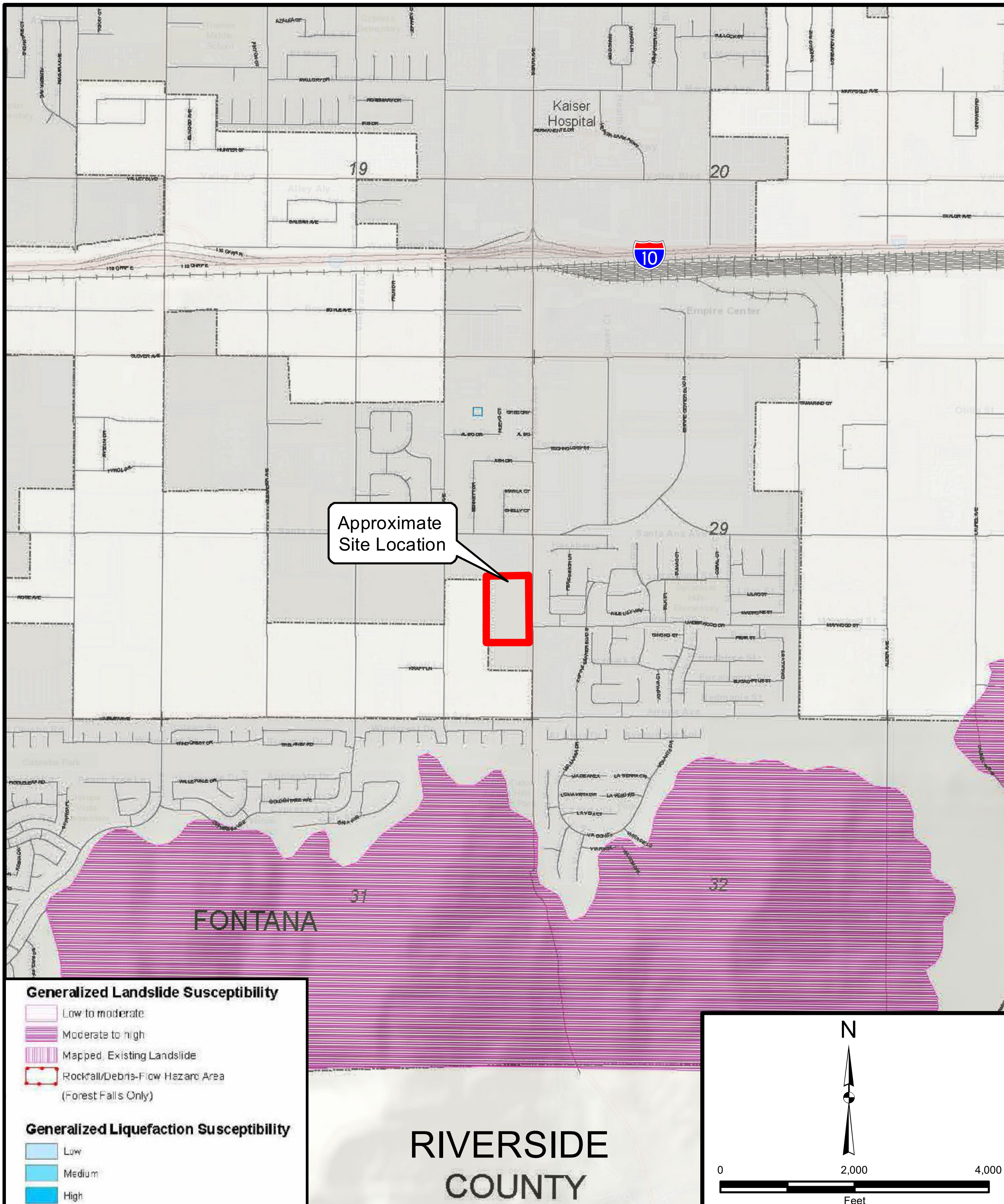

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Scale: 1 " = 2,000 '	Date: October 2022

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community, SB County Geologic Hazards

SEISMIC HAZARDS MAP

Chaffey College Fontana Campus
11070 Sierra Avenue, City of Fontana, California

FIGURE 6

Leighton

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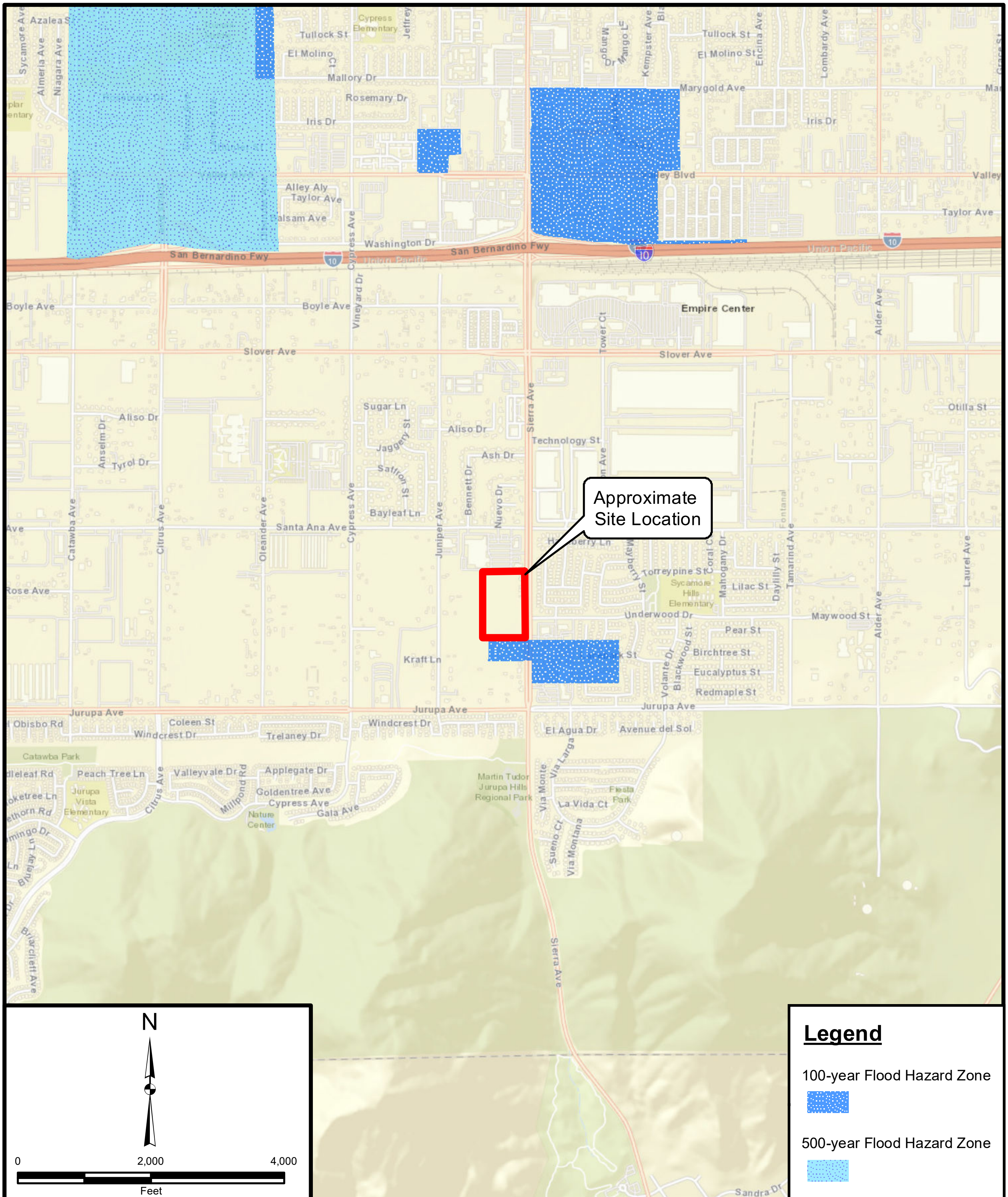

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Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
FEMA (http://www.fema.gov/index.shtml), DWR (http://www.dwr.ca.gov)

FLOOD HAZARD ZONE MAP

Chaffey College Fontana Campus
11070 Sierra Avenue, City of Fontana, California

FIGURE 7

Leighton

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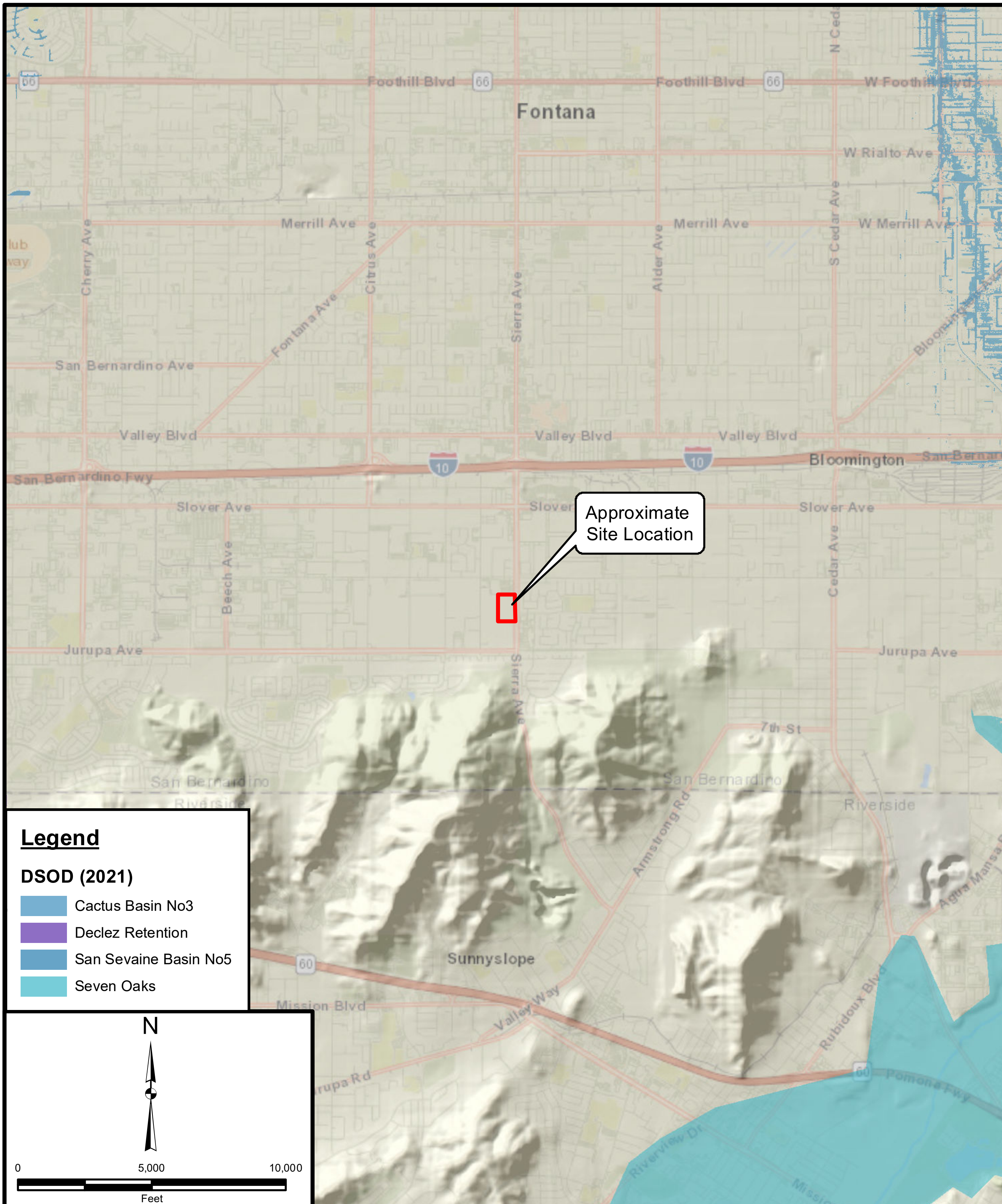

Project: 12691.011	Eng/Geol: JDH/SGO
Scale: 1 " = 5,000 '	Date: October 2022

Basemap Reference: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China
Reference: Office of Emergency Services (2007),
Dept of Safety of Dams (2021)
National Inventory of Dams, Army Corps of Engrs (2021)

DAM BREACH INUNDATION MAP

Chaffey College Fontana Campus
11070 Sierra Avenue, City of Fontana, California

FIGURE 8

Leighton

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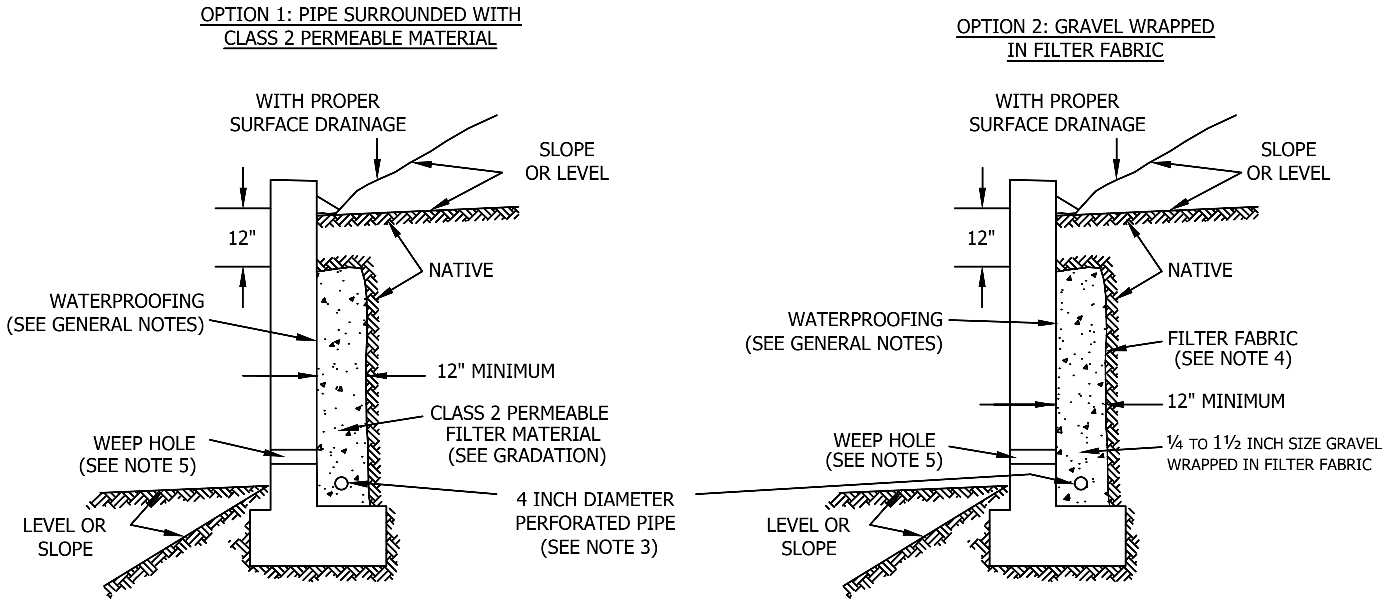
SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

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Figure 9

APPENDIX A

GEOTECHNICAL EXPLORATION LOGS

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(APPENDIX A)

GEOTECHNICAL BORING LOGS

The field investigation consisted of a surface reconnaissance and a subsurface exploration program. Encountered soils were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D2488). The logs of this subsurface exploration are included as part of this appendix.

The borings were drilled with a truck-mounted hollow-stem drill rig. Relatively undisturbed soil samples were obtained at selected intervals within the borings using a modified California Ring Sampler. A bulk sample of representative soil types were also obtained from the borings. These samples were transported to our geotechnical laboratory for evaluation and appropriate testing. Borings were backfilled with the excavated earth materials after logging and sampling was completed.

The attached subsurface exploration logs and related information depict subsurface conditions only at the location indicated and at the particular date designated on the log. Subsurface conditions at other locations may differ from conditions occurring at this location. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

GEOTECHNICAL BORING LOG LB-1

Project No.	12691.011	**Date Drilled**	9-7-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1050'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
1050	0						SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM): brown, dry, fine to medium SAND, 25% fines (field)	
			R-1	3 5 10				**Quaternary Young Alluvial Fan Deposits (Qyf)** @2.5': Silty SAND (SM): brown, loose, dry, fine to medium SAND, 20% fines (field)	
1045	5		R-2	5 8 10				@5': Silty SAND (SM): medium dense, brown, dry, fine to medium SAND, 40% fines (field)	
			R-3	4 6 8			ML	@7.5': Sandy SILT (ML): stiff, brown, slightly moist, fine to medium SAND, 80% low plasticity fines (field)	
1040	10		R-4	5 7 9			SM	@10': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 24% fines (lab)	-200
1035	15		S-1	4 6 7				@15': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 20% fines (field)	
1030	20		S-2	8 20 25			SP	@20': Poorly graded SAND with gravel (SP): dense, gray, slightly moist, medium to coarse SAND, 15% GRAVEL (field)	
1025	25		S-3	14 25 18				@25': Poorly graded SAND with gravel (SP): dense, grayish brown, slightly moist, medium-coarse SAND, 5% GRAVEL (field), 7% fines (lab)	-200
1020	30								

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-1

Project No.	12691.011	**Date Drilled**	9-7-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1050'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
1020	30			S-4	9 30 24				@30': Poorly graded SAND with gravel (SP): very dense, gray, slightly moist, medium to coarse SAND, 15% GRAVEL (field), white sandstone spotted	
1015	35			S-5A	11 12			ML	@35': SILT (ML): very stiff, brown, slightly moist, 90% low plasticity fines (field)	
				S-5B	13			SP-SM	@36': Poorly graded SAND with SILT (SP-SM): medium dense, brown, slightly moist, fine SAND, 10% fines (field)	
1010	40			S-6	8 12 12			ML	@40': Sandy SILT (ML): very stiff, brown, slightly moist, 60% non-plastic fines (lab)	-200, AL
1005	45			S-7	16 22 17				@45': Sandy SILT (ML): hard, brown, slightly moist, 75% low plasticity fines (field)	
1000	50			S-8	8 11 16				@50': Sandy SILT (ML): very stiff, brown, slightly moist, 70% low plasticity fines (field)	
									Total Depth: 51.5' bgs **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
995	55									
990	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-2

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1050'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
1050	0			B-1				SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM): brown, slightly moist, fine to medium SAND, 25% fines (field)	RV
				R-1	10 15 19			ML	**Quaternary Young Alluvial Fan Deposits (Qyf)** @2.5': Sandy SILT (ML): very stiff, brown, slightly moist, fine SAND, 65% low plasticity fines (field)	
1045	5			R-2	7 11 14			SM	@5': Silty SAND (SM): medium dense, brown, slightly moist, fine to coarse SAND, 20% fines (field)	
				R-3	7 8 9				@7.5': Silty SAND (SM): medium dense, brown, slightly moist, fine SAND, 40% fines (field)	
1040	10			R-4	7 7 9				@10': Silty SAND (SM): medium dense, brown, slightly moist, fine SAND, 25% fines (field)	
1035	15			S-1	3 3 4			CL-ML	@15': Sandy Silty CLAY (CL-ML): firm, brown, moist, 59% low plasticity fines (lab)	-200, AL
1030	20			S-2	3 4 5			ML	@20': SILT (ML): stiff, grayish, moist, 75% low plasticity fines (field)	
									Total Depth: 21.5' bgs **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
1025	25									
1020	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

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GEOTECHNICAL BORING LOG LB-3

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1055'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
1055	0							SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, slightly moist, fine to coarse SAND, 10% fines (field)	
				R-1	7 11 13			SM	@2.5': SILTY SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 35% fines (field)	
1050	5			R-2	7 12 12			SP	**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Poorly graded SAND with gravel (SP): medium dense, gray, slightly moist, fine to coarse SAND, 40% GRAVEL (field)	
				R-3	5 6 7			SM	@7.5': Silty SAND (SM): loose, reddish brown, slightly moist, fine SAND, 45% fines (field)	CO
1045	10			R-4	5 6 8			ML	@10': Sandy SILT (ML): stiff, brown, slightly moist, fine SAND, 55% low plasticity fines (field)	
1040	15			S-1	4 3 4				@15': SILT (ML): firm, brown, slightly moist, 95% low plasticity fines (field)	
1035	20			S-2A	3 7				@20': SILT (ML): stiff, brown, slightly moist, fine SAND, 95% low plasticity fines (field)	
				S-2B	7			SP-SM	@21': Poorly graded SAND with silt (SP-SM): medium dense, gray, slightly moist, fine SAND, 10% fines (field)	
									Total Depth: 21.5' bgs **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
1030	25									
1025	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-4

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1053'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0			B-1				SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, slightly moist, fine to coarse SAND, 10% fines (field)	
1050				R-1	6 9 4			ML	@2.5': Sandy SILT (ML): stiff, tan, dry, fine SAND, 60% low plasticity fines (field)	
	5			R-2	9 15 17				**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Sandy SILT (ML): very stiff, tan, dry, fine SAND, 55% low plasticity fines (field)	
1045				R-3	9 15 15				@7.5': Sandy SILT (ML): very stiff, tan, dry, fine SAND, 60% low pasticity fines (field)	
	10			R-4	7 10 11				@10': Sandy SILT (ML): stiff, tan, dry, fine SAND, 60% low plasticity fines (field)	
1040										
	15			S-1	3 4 4			CL	@15': Lean CLAY with sand (CL): firm, tan, slightly moist, 84% low plasticity fines (lab)	-200, AL
1035										
	20			S-2	6 10 11			SP	@20': Poorly graded SAND (SP): medium dense, gray, slightly moist, fine SAND, 5% fines (field)	
1030										
	25			S-3	5 5 6			SM	@25': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 49% fines (lab)	-200
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-4

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1053'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	**SOIL DESCRIPTION** *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	30			S-4	4 5 6				@30': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 40% fines (field)	
1020									**Total Depth: 31.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
	35									
1015										
	40									
1010										
	45									
1005										
	50									
1000										
	55									
995										
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-5

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1054'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, dry, fine to coarse SAND, 10% fines (field)	
				R-1	12 14 16			SC-SM	**Quaternary Young Alluvial Fan Deposits (Qyf)** @2.5': Silty Clayey SAND (SC-SM): medium dense, tan, slightly moist, 49% low plasticity fines (lab)	-200, AL
1050	5			R-2	9 14 15			ML	@5': Sandy SILT (ML): very stiff, tan, slightly moist, 60% low plasticity fines (field)	
				R-3	9 17 21				@7.5': Sandy SILT (ML): very stiff, tan, slightly moist, 60% low plasticity fines (field)	
1045	10			R-4	6 11 14			SP	@10': Poorly graded SAND with gravel (SP): medium dense, grayish brown, slightly moist, medium to coarse SAND, 25% GRAVEL (field)	
1040	15			S-1	8 9 17				@15': Poorly graded SAND with gravel and silt (SP): medium dense, gray, medium to coarse SAND, 15% GRAVEL (field), low plasticity, 5% low plasticity fines (lab)	-200
1035	20			S-2	17 36 29				@20': Poorly graded SAND with gravel (SP): very dense, gray, medium to coarse SAND, 20% GRAVEL (field)	
1030	25								**Total Depth: 21.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cutting to surface**	
1025	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-6

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SP	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND (SP): brown, dry, fine to coarse SAND, 5% fines (field)	
1050										
				R-1	5 9 14			SP-SM	**Quaternary Young Alluvial Fan Deposits (Qyf)** @2.5': Poorly graded SAND with silt and gravel (SP-SM): medium dense, brown, slightly moist, fine to coarse SAND, 10% fines (field), 15% GRAVEL (field)	
	5			R-2	8 10 14			SP	@5': Poorly graded SAND (SP): medium dense, gray, slightly moist, fine to coarse SAND, 5% fines (field), trace GRAVEL	
1045										
				R-3	7 11 11			ML	@7.5': Sandy SILT (ML): stiff, tan, slightly moist, fine SAND, 60% low plasticity fines (field)	
	10			R-4	17 20 23				@10': NO RECOVERY, Sandy SILT (ML): very stiff, 60% fines (field), rock found in sampler	
1040										
	15			S-1	6 7 6			SM	@15': Silty SAND (SM): medium dense, brown, slightly moist, fine SAND, 30% fines (field)	
1035										
	20			S-2	6 17 24			SP	@20': Poorly graded SAND with gravel (SP): dense, gray, slightly moist, medium to coarse SAND, 20% GRAVEL (field)	
1030										
	25			S-3	6 8 10			ML	@25': Sandy SILT (ML): very stiff, tan, slightly moist, fine SAND, 70% low plasticity fines (field)	
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-6

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
1020	30			S-4	7 10 9				@30': Sandy SILT (ML): very stiff, tan, slightly moist, fine SAND, 75% low plasticity fines (field)	
									Total Depth: 31.5' bgs **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
1015	35									
1010	40									
1005	45									
1000	50									
995	55									
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

Leighton

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GEOTECHNICAL BORING LOG LB-7

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1052'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1				SP	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with gravel (SP): brown, dry, fine to coarse SAND, 15% GRAVEL (field)	
1050				R-1	4 7 10				**Quaternary Young Alluvial Fan Deposits (Qyf)** @2.5': Poorly graded SAND (SP): medium dense, brown, slightly moist, fine to medium SAND, 5% fines (field)	
	5			R-2	5 7 12				@5': Poorly graded SAND with gravel (SP): medium dense, brown, slightly moist, medium to coarse SAND, 15% GRAVEL (field)	
1045				R-3	14 11 11			ML	@7.5': Sandy SILT (ML): stiff, tan, slightly moist, fine SAND, 70% low plasticity fines (field)	
	10			R-4	12 20 22				@10': NO RECOVERY	
1040										
	15			S-1	6 11 13			SP	@15': Poorly graded SAND (SP): medium dense, gray, slightly moist, medium to coarse SAND, 5% fines (field)	
1035										
	20			S-2	29 23 14				@20': Poorly graded SAND with gravel (SP): dense, gray, slightly moist, medium to coarse SAND, 30% GRAVEL (field)	
1030									**Total Depth: 21.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
	25									
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-8

Project No.	12691.011	**Date Drilled**	9-7-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1053'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1				SM	**<u>Artificial fill, undocumented (Afu)</u>** @Surface: Silty SAND (SM): brown, dry, fine to medium SAND, 22% fines (lab)	CR, DS, EI MD, SA
1050				R-1	6 9 16				**<u>Quaternary Young Alluvial Fan Deposits (Qyf)</u>** @2.5': Silty SAND (SM): medium dense, brown, dry, fine to medium SAND, 40% fines (field)	
	5			R-2	7 9 13			SP	@5': Poorly graded sand with gravel (SP): medium dense, brown, slightly moist, medium to coarse SAND, 20% GRAVEL (field)	
1045				R-3	8 14 20			ML	@7.5': Sandy SILT (ML): very stiff, brown, slightly moist, 80% low plasticity fines (field)	
	10			R-4	11 17 20			SM	@10': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 25% fines (field)	
1040										
	15			S-1	8 12 17			SP	@15': Poorly graded SAND (SP): medium dense, gray, slightly moist, medium to coarse SAND, 5% fines (field)	
1035										
	20			S-2	9 11 13				@20': Poorly graded SAND (SP): medium dense, gray, slightly moist, fine to medium SAND, 5% fines (field)	
1030									**Total Depth: 21.5' bgs** **No groundwater encountered during drilling** **Boring backfilled wtih soil cuttings to surface**	
	25									
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

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GEOTECHNICAL BORING LOG LB-9

Project No.	12691.011	**Date Drilled**	9-7-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1052'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM): brown, dry, fine to medium SAND, 40% fines (field)	
1050				R-1	4 5 6				@2.5': Silty SAND (SM): loose, brown, dry, fine to medium SAND, 40% fines (field)	
	5			R-2	8 9 15				**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM): medium dense, brown, dry, fine SAND, 45% fines (field)	
1045				R-3	8 14 20				@7.5': Silty SAND (SM): medium dense, brown, dry, fine SAND, 45% fines (field)	CO
	10			R-4	10 15 21			SP-SM	@10': Poorly graded SAND with silt (SP-SM): medium dense, grayish brown, slightly moist, fine to medium SAND, 10% fines (field)	
1040										
	15			R-5	12 30 45			SP	@15': Poorly graded SAND (SP): dense, gray, slightly moist, medium to coarse SAND, 5% fines (field)	
1035										
	20			S-1	8 11 14				@20': Poorly graded SAND (SP): medium dense, gray, slightly moist, medium to coarse SAND, 5% fines (field)	
1030									**Total Depth: 21.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
	25									
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-10

Project No.	12691.011	**Date Drilled**	9-7-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM): brown, dry, fine to medium SAND, 40% fines (field)	
1050										
				R-1	4 4 5				@2.5': Silty SAND (SM): loose, brown, slightly moist, fine to medium SAND, 40% fines (field)	
	5			R-2	7 13 16				**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM): medium dense, brown, slightly moist, fine SAND, 45% fines (field)	
1045										
				R-3	8 11 13			ML	@7.5': Sandy SILT (ML): very stiff, brown, slightly moist, fine SAND, 70% low plasticity fines (field)	
	10			R-4	8 15 18				@10': Sandy SILT (ML): very stiff, brown, slightly moist, fine SAND, 70% low plasticity fines (field)	
1040								SP-SM	@11': Poorly graded SAND with silt (SP-SM): dense, brown, slightly moist, fine to coarse SAND, 10% fines (field)	
	15			S-1	9 15 16			SP	@15': Poorly graded SAND (SP): dense, brown, slightly moist, fine to coarse SAND, 5% fines (field)	
1035										
	20			S-2	6 8 8					-200
1030								SM	@21': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 20% fines (lab)	
	25			S-3	26 37 38			SP	@25': Poorly graded SAND (SP): very dense, grayish brown, slightly moist, medium to coarse SAND, 5% fines (field) - sandstone present	
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-10

Project No.	12691.011	**Date Drilled**	9-7-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
1020	30			S-4	5 6 7			ML	@31': Sandy SILT (ML): stiff, brown, slightly moist, 54% low plasticity fines (lab)	-200, AL
1015	35			S-5	5 7 13				@35': Sandy SILT (ML): very stiff, brown, slightly moist, 80% low plasticity fines (field)	
1010	40			S-6	9 16 22				@40': Sandy SILT (ML): hard, dark brown, slightly moist, 80% non-plastic fines (field)	
1005	45			S-7	13 20 20			SP	@45': Poorly graded SAND (SP): dense, grayish brown, slightly moist, 5% fines (field)	
1000	50			S-8	12 28 45				@50': Poorly graded SAND (SP): very dense, grayish brown, slightly moist, 5% fines (field)	
995	55								**Total Depth: 51.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-11

Project No.	12691.011	**Date Drilled**	9-9-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1053'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0						SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, slightly moist, fine to medium SAND, 10% fines (field)	
1050			R-1	4 6 6				@2.5: Poorly graded SAND with silt (SP-SM): loose, brown, slightly moist, fine to medium SAND, 10% fines (field)	
	5		R-2	10 15 17			SM	**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 20% fines (field)	
1045			R-3	10 14 15			ML	@75.': SILT with sand (ML): very stiff, tan, slightly moist, fine SAND, 80% low plasticity fines (field)	
	10		R-4	16 17 18			SM	@10': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 45% fines (field)	
1040									
	15		S-1	4 7 8			SP-SM	@15': Poorly graded SAND with silt (SP-SM): medium dense, brown, slightly moist, fine to medium SAND, 10% fines (field)	
1035									
	20		S-2	3 4 5			SM	@20': Silty SAND (SM): loose, brown, slightly moist, fine to medium SAND, 34% fines (lab)	-200
1030									
	25		S-3	6 7 14				@25': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 30% fines (field)	
							SP	@26.25: Poorly graded SAND with gravel (SP): medium dense, brown, slightly moist, medium to coarse SAND, 15% GRAVEL (field)	
1025									
	30								

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-11

Project No.	12691.011	**Date Drilled**	9-9-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1053'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	**SOIL DESCRIPTION** *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	30			S-4	4 8 10			SP-SM	@30': Poorly graded SAND with silt (SP-SM): medium dense, brown, slightly moist, fine to coarse SAND, 10% fines (field)	
1020									**Total Depth: 31.5' bgs** **No groundwater encountered during drilling** **Bdoring backfilled with soil cuttings to surface**	
	35									
1015										
	40									
1010										
	45									
1005										
	50									
1000										
	55									
995										
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-12

Project No.	12691.011	**Date Drilled**	9-9-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1053'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, slightly moist, fine to coarse SAND, 10% fines (field)	
1050				R-1	3 5 7				@2.5': Poorly graded SAND with silt (SP-SM): loose, brown, slightly moist, fine to coarse SAND, 10% fines (field)	
	5			R-2	7 17 18			SM	**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM): medium dense, light brown, slightly moist, fine to medium SAND, 30% fines (field)	
1045				R-3	12 17 19			ML	@7.5': SILT with sand (ML): very stiff, tan, slightly moist, 90% low plasticity fines (field)	
	10			R-4	7 20 24				@10': SILT with sand (ML): very stiff, tan, slightly moist, 90% low plasticity fines (field)	
1040										
	15			S-1	4 4 5			SM	@15': Silty SAND (SM): loose, tan, slightly moist, low plasticity, 49% fines (lab)	-200
1035										
	20			S-2	5 5 5			ML	@20': Sandy SILT (ML): stiff, tan, slightly moist, fine SAND, 70% low plasticity fines (field)	
1030									**Total Depth: 21.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
	25									
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-13

Project No.	12691.011	**Date Drilled**	9-9-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
1050	0							SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, dry, fine to coarse SAND, 10% fines (field)	
								SM	@2.5': Silty SAND (SM): brown, slightly moist, fine SAND, 25% fines (field)	
1045	5			S-1	5 9 11			ML	**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Sandy SILT (ML): very stiff, tan, slightly moist, fine SAND, 60% low plasticity fines (field)	
1040	10			S-2	6 7 8				@10': Sandy SILT (ML): stiff, tan, slightly moist, fine SAND, 70% low plasticity fines (field)	
								SP	@11.25': Poorly graded SAND (SP): medium dense, gray, slightly moist, fine to coarse SAND, 5% fines (field)	
1035	15			S-3	5 8 9			SP-SM	@15': Poorly graded SAND with silt and gravel (SP-SM); medium dense, gray, slightly moist, fine to coarse SAND, 15% GRAVEL (field), 10% fines (field)	
1030	20			S-4	8 8 10				@20': Poorly graded SAND with silt and gravel (SP-SM); medium dense, gray, slightly moist, fine to coarse SAND, 15% GRAVEL (field), 10% fines (field)	
								SM	@21': Silty SAND (SM): medium dense, brown, slightly moist, fine to medium SAND, 20% fines (field)	
									Total Depth: 21.5' bgs **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
1025	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-14

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1052'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0							SP	<u>**Artificial fill, undocumented (Afu)**</u> @Surface: Poorly graded SAND with gravel (SP): brown, dry, fine to coarse SAND, 15% GRAVEL (field)	
1050								SM	@2.5': Silty SAND (SM): brown, slightly moist, fine SAND, 20% fines (field)	
	5			S-1	6 9 11			SP	<u>**Quaternary Young Alluvial Fan Deposits (Qyf)**</u> @5': Poorly graded SAND (SP): medium dense, brown, slightly moist, fine to coarse SAND, 5% fines (field), trace GRAVEL	
1045										
	10			S-2	5 9 17				@10': Poorly greaded SAND (SP): medium dense, brown, slightly moist, fine to medium sand, 5% fines (field) - Gray sandstone @ tip of sampler	
1040										
	15			S-3	14 19 20				@15': Poorly graded SAND (SP): dense, gray, medium to coarse SAND, trace GRAVEL, 5% fines (field)	
1035										
	20			S-4	11 26 29				@20': Poorly graded SAND with gravel (SP), very dense, gray, medium to coarse SAND, 25% GRAVEL (field)	
1030									**Total Depth: 21.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
	25									
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-15

Project No.	12691.011	**Date Drilled**	9-8-22
Project	Chaffey Fontana	**Logged By**	AA
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1055'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	AA

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
1055	0							SP-SM	**Artificial fill, undocumented (Afu)** @Surface: Poorly graded SAND with silt (SP-SM): brown, dry, fine to coarse SAND, 10% fines (field)	
1050	5			S-1	6 7 7			SM	**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM): medium dense, tan, slightly moist, fine to medium SAND, 35% fines (field)	
1045	10			S-2	6 12 13			ML	@10': SILT with sand (ML): very stiff, tan, slightly moist, fine SAND, 80% low plasticity fines (field) - Grey sandstone @ tip of sampler	
1040	15			S-3	7 9 12			SP	@15': Poorly graded SAND (SP): medium dense, gray, slightly moist, medium to coarse sand, 5% fines (field), trace GRAVEL	
1035	20			S-4	2 2 4			SM	@20': Silty SAND (SM): loose, brown, slightly moist, fine SAND, 30% fines (field)	
								SP	@21.25': Poorly graded SAND (SP): loose, brown, slightly moist, 5% fines (field)	
									Total Depth:21.5' bgs **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
1030	25									
1025	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LI-1

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1047'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM): light olive brown, slightly moist, predominately fine SAND, trace to few medium to coarse SAND, 25% fines (field), slightly micaceous	
1045									**Quaternary Young Alluvial Fan Deposits (Qyf)**	
	5			S-1	7 8 9			ML	@6': Sandy SILT (ML), very stiff, olive brown, slightly moist, very fine SAND, trace medium SAND, low plasticity	
1040										
	10			S-2	6 7 7			SM ML	@10': Silty SAND (SM): medium dense, light brown, slightly moist, fine SAND; grading to Sandy SILT (ML), stiff, olive brown, moist, very fine SAND, trace medium SAND, 60% low plasticity fines (field)	
1035										
	15			S-3	12 14 16			SM	@ ~2 -inch gravel bed over Silty SAND (SM), medium dense, olive brown, slightly moist, predominately fine SAND, few medium to coarse SAND, trace fine gravel, 20% fines (lab)	-200
1030				S-4	4 4 4				@17.5': Silty SAND (SM), loose, olive brown, moist, very fine SAND, trace medium SAND, very low plasticity, 30% fines (field)	
	20			S-5	8 8 10			SP-SM	@20': Poorly graded SAND with silt (SP-SM), medium dense, olive brown, moist, very fine SAND, trace medium SAND, 10-15% fines (field)	
1025				S-6	11 12 14				@22.5': Poorly graded SAND with silt (SP-SM), medium dense, olive brown, moist, very fine SAND, trace medium SAND, 10% fines (field)	
	25			S-7	8 8 8			SM	@25': Silty SAND (SM), medium dense, olive brown, moist, predominately fine SAND, trace medium SAND, 23% fines (lab)	SA
1020				S-8	10 14 10			SP-SM	@27.5': SAND with gravel (SP), medium dense, grayish brown, slightly moist, mostly fine SAND, little medium to coarse SAND, 10% fine GRAVEL (field), 5% fines (field)	
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LI-1

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1047'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			S-9	7 9 10			SP-SM	@30': Poorly graded SAND with silt (SP-SM), to Silty SAND (SM), medium dense, olive brown, moist, mostly fine SAND, 10-15% fines (field)	
1015								CL	@31.3': Lean CLAY (CL), gray, slightly moist, medium plasticity, some fine SAND, iron oxidation staining	
									Total Depth: 31.5' bgs **No groundwater encountered during drilling** **Temporary percolation well installed, screeded from 20-30' bgs** **Upon completion of infiltration testing, boring backfilled with soil cuttings to surface**	
	35									
1010										
	40									
1005										
	45									
1000										
	50									
995										
	55									
990										
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LI-2

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM), light olive brown, slightly moist, very fine SAND, trace medium to coarse SAND	
1050										
									Quaternary Young Alluvial Fan Deposits (Qyf)	
	5			S-1	6 9 11			SP-SM	@6': Poorly graded SAND with silt (SP-SM), medium dense, tan, slightly moist, predominately fine SAND, few medium to coarse SAND, trace fines subangular GRAVEL	
1045										
	10			S-2	4 4 5			SM-ML	@10': Sandy SILT to Silty SAND (SM-ML), loose to stiff, olive brown, moist, very fine SAND, trace medium SAND, slightly micaceous, 50% fines (field)	
1040								SM	@11': Silty SAND with clay (SM), reddish brown, fine SAND, low plasticity, 35% fines (field)	
	15			S-3	4 5 6			ML	@15': Sandy SILT with clay (ML), stiff, orange brown, moist, very fine SAND, trace medium SAND, low plasticity, 51% fines (lab)	-200
1035								SM	@16': Silty SAND (SM), medium dense, olive brown, moist, very fine to fine SAND, trace medium SAND, 20% fines (field)	
				S-4	7 8 7			SP	@17.5': Poorly graded SAND (SP), medium dense, tan, slightly moist, mostly fine SAND, some medium to coarse sand, 5% fines (field)	
								SM	@18.5': Silty SAND (SM), medium dense, tan to light brown, very fine SAND, slightly micaceous, 40% fines (field)	
	20			S-5	4 5 5				@20': Silty SAND (SM), loose, reddish brown, moist, very fine SAND, trace medium SAND, slightly micaceous, 30% fines (field)	-200
1030								ML	@21': Sandy SILT (ML), stiff, grayish brown, very fien SAND, low plasticity, 63% fines (lab)	
				S-6	3 3 4				@22.5': Sandy SILT (ML), medium stiff, olive brown, moist, very fine SAND, trace medium SAND, iron oxidation	
	25			S-7	3 5 6			CL	@25': Sandy Lean CLAY (CL), stiff, olive brown, moist, very fine to fine SAND, low plasticity, some iron oxidation staining	
1025								ML	@26': Sandy SILT (ML), stiff, light olive brown, very fine SAND, slightly micaceous	
				S-8	4 7 9				@27': Sandy SILT (ML), very stiff, olive brown and tan, moist, very fine SAND, low to no plasticity, 60-70% fines (field)	
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

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GEOTECHNICAL BORING LOG LI-2

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
1020	30			S-9	9 10 11			CL	@30': Silty Lean CLAY (CL), brown, moist, low plsticity, very stiff, iron oxidation staining, few fine SAND	AL
								ML	@31': Sandy SILT with clay (ML), very stiff, light olive brown, very fine SAND, low plasticity, few CLAY, slightly micaceous, 70% fines (field)	
				S-10	10 10 12			CL	@32.5': Silty Sandy CLAY (CL), very stiff, mottled reddish brown and grayish brown, moist, fine SAND, trace medium SAND, low to medium plasticity, iron oxidation staining	
1015	35			S-11	14 14 16				@35': Silty CLAY (CL), very stiff, gray, moist, low to medium plasticity, laminated, iron oxidation staining	
				S-12	8 9 12			ML	@38': Clayey SILT (ML), very stiff, grayish brown, some very fine SAND, low plasticity, slightly laminated, iron oxidation staining	
1010	40			S-13	6 17 17			CL	@40': Silty Sandy CLAY (CL), hard, gray brown, moist, very fine SAND, low plasticity, micaceous, iron oxidation staining, 55-65% fines (field)	
1005	45								**Total Depth: 41.5' bgs** **No groundwater encountered during drilling** **Boring backfilled with soil cuttings to surface**	
1000	50									
995	55									
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LI-2A

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								**Step-over 5' South of LI-2** **<u>Artificial fill, undocumented (Afu)</u>**	
1050										
									<u>Quaternary Young Alluvial Fan Deposits (Qyf)</u>	
	5									
1045										
	10									
1040										
	15									
1035										
	20			S-1	6 5 6			SM-ML	@20': Sandy SILT (ML), stiff, mottled gray brown and reddish brown, moist, very fine SAND, iron oxidation staining, 70% fines (field); grades to Silty SAND (SM), reddish brown, moist, very fine to fine SAND, slightly micaceous, 30% fines (field)	
1030										
	25								**Total Depth: 22' bgs** **No groundwater encountered during drilling** **Temporary percolation well installed, screeded from 12-22' bgs** **Upon completion of infiltration testing, boring backfilled with soil cuttings to surface**	
1025										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LI-3

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1054'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1				SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM), light olive brown, slightly moist, very fine to fine SAND, trace medium to coarse SAND, 25% fines (field)	
1050	5			S-1	8 12 15				**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM), medium dense, light olive brown to tan, slightly moist, very fine to fine SAND, trace to few medium to coarse SAND, trace fine subrounded gravel, 25% fines (field)	
1045	10			S-2	5 6 8				@10': Silty SAND (SM), medium dense, olive brown, slightly moist, very fine to fine SAND, trace medium to coarse SAND, 46% fines (lab), slightly micaceous	-200
1040	15			S-3	6 7 7			ML SM	@15': Sandy SILT (ML), stiff, tannish brown, moist, very fine SAND, trace medium SAND, low plasticity, 65% fines (field), slightly micaceous, calcium carbonate stringers @16': Silty SAND (SM), olive brown, moist, very fine SAND, 40% fines (field)	
1035	20			S-4	8 8 9				@20': Silty SAND (SM), medium dense, grayish brown, slightly moist, mostly fine SAND, few medium to coarse SAND, 14% fines (lab), slightly micaceous	-200
				S-5	8 9 11				@22.5': Silty SAND (SM), medium dense, light brown, slightly moist, very fine SAND, trace medium to coarse SAND, 40% fines (field), slightly micaceous	
1030	25			S-6	7 7 9			ML	@25': Silty SAND (SM), medium dense, light olive brown, slightly moist, very fine to fine SAND, trace medium to coarse SAND, slightly micaceous, 30% fines (field) @26': Sandy SILT (ML), very stiff, light olive brown, slightly moist, 60% fines (field), very fine SAND, slightly micaceous	
1025	30								**Total Depth: 26.5' bgs** **No groundwater encountered during drilling** **Temporary percolation well installed, screened from 15-25' bgs, backfilled with soil cuttings.**	

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LI-4

Project No.	12691.011	**Date Drilled**	9-12-22
Project	Chaffey Fontana	**Logged By**	BTM
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	1051'
Location	See Figure 2 - *Geotechnical Map*	**Sampled By**	BTM

Elevation Feet	Depth Feet	Graphic Log (N S)	PID (PPM)	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
1050	0			B-1				SM	**Artificial fill, undocumented (Afu)** @Surface: Silty SAND (SM), light olive brown, slightly moist, very fine to fine SAND, trace medium to coarse SAND, 25% fines (field)	
1045	5			S-1	7 13 13				**Quaternary Young Alluvial Fan Deposits (Qyf)** @5': Silty SAND (SM), medium dense, light brown, slightly moist, mostly fine SAND, few medium to coarse SAND, 15% fines (field); grading finer toward bottom to 30% fines (field)	
1040	10			S-2	8 11 12			ML	@10': SILT with sand (ML), very stiff, tan, slightly moist, some very fine SAND, 85% fines (field), slightly micaceous	
				S-3	5 9 15			SP-SM	@12.5': SAND with silt (SP-SM), medium dense, grayish brown, slightly moist, predominately fine SAND, few medium to coarse SAND, trace fine GRAVEL, 5% fines (field)	
1035	15			S-4	7 12 18			SP	@15: Poorly graded SAND (SP), medium dense, grayish brown, slightly moist, predominately fine SAND, some medium to coarse SAND, trace fine GRAVEL, < 5% fines (field)	
				S-5	19 26 24				@17.5': NO RECOVERY	
1030	20			S-6	15 23 35			SP-GP	@20': Poorly graded SAND with gravel (SP-GP), very dense, grayish brown, fine to coarse SAND, some fine subangular GRAVEL, 7% fines (lab)	SA
				S-7	5 9 12			SP	@22.5': Poorly graded SAND (SP), medium dense, brown, moist, fine SAND, 5% fines (field)	
1025	25			S-8	8 29 17			SP-GP	@25.5': Poorly graded SAND with gravel (SP-GP), dense, grayish brown, moist, mostly fine SAND, some medium to coarse SAND, few fine GRAVEL, 3 -inch bed of Silty CLAY @ 26'	
	30								**Total Depth: 26.5' bgs** **No groundwater encountered during drilling** **Temporary percolation well installed, screened from 15-25' bgs, boring backfilled with soil cuttings**	

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

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APPENDIX A

INFILTRATION TEST LOGS

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Results of Well Permeameter, from USBR 7300-89 Method

Project: 12691.001
Exploration #/Location: *LI-1*
Depth Boring drilled, bgs (ft): 30
Tested by: BTM
USCS Soil Type in test zone: SP
Weather (start to finish): Cloudy
Water Source/pH: H2O
Measured boring diameter: 8 in. — 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 30 ft, set 2" well pipe through augers, bottom 10' slotted pipe with sand backfill in test zone

Initial estimated Depth to Water Surface (in.): 296
Average depth of water in well, "h" (in.): 65
approx. h/r: 16.3
Tu (Fig. 8) (ft): 75.3
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	30.1 ft	0. in.	361
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing	20. ft	0. in.	

Depth of well bottom below top of casing (in): 361

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID: N/A

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/13/2022	Start time: 11:20	Gallons		ft	in.																	
9/13/22	11:20	828.82		26.99					0	323.9	37.3											
9/13/22	11:25	866.45		26.1				5	5	313.2	48.0	10.68	43	8693	-234	8459	1692	101503	1122	0.9	13.91	83.37
9/13/22	11:30	871.25		25.71				5	10	308.5	52.7	4.68	50	1109	-103	1006	201	12075	1315	0.9	1.47	8.46
9/13/22	11:35	876.26		25.71				5	15	308.5	52.7	0	53	1157	0	1157	231	13888	1374	0.9	1.72	9.32
9/13/22	11:40	881.3		25.75				5	20	309.0	52.2	-0.48	52	1164	11	1175	235	14097	1368	0.9	1.78	9.50
9/13/22	11:45	886.45		25.76				5	25	309.1	52.1	-0.12	52	1190	3	1192	238	14307	1361	0.9	1.81	9.69
9/13/22	11:50	891.58		25.78				5	30	309.4	51.8	-0.24	52	1185	5	1190	238	14283	1356	0.9	1.82	9.71
9/13/22	11:55	896.69		25.79				5	35	309.5	51.7	-0.12	52	1180	3	1183	237	14196	1352	0.9	1.81	9.68
9/13/22	12:00	901.8		25.81				5	40	309.7	51.5	-0.24	52	1180	5	1186	237	14228	1347	0.9	1.83	9.74
9/13/22	12:05	906.86		25.82				5	45	309.8	51.4	-0.12	51	1169	3	1171	234	14058	1343	0.9	1.82	9.65
9/13/22	12:10	911.93		25.84				5	50	310.1	51.1	-0.24	51	1171	5	1176	235	14117	1338	0.9	1.84	9.73
9/13/22	12:15	917.03		25.86				5	55	310.3	50.9	-0.24	51	1178	5	1183	237	14200	1332	0.9	1.86	9.83
9/13/22	12:20	922.13		25.87				5	60	310.4	50.8	-0.12	51	1178	3	1181	236	14169	1328	0.9	1.87	9.84
9/13/22	12:25	927.25		25.89				5	65	310.7	50.5	-0.24	51	1183	5	1188	238	14256	1323	0.9	1.89	9.93
9/13/22	12:30	932.36		25.92				5	70	311.0	50.2	-0.36	50	1180	8	1188	238	14260	1315	0.9	1.92	9.99
9/13/22	12:40	942.62		25.93				10	80	311.2	50.0	-0.12	50	2370	3	2373	237	14236	1309	0.9	1.92	10.02
9/13/22	12:45	947.76		25.95				5	85	311.4	49.8	-0.24	50	1187	5	1193	239	14311	1305	0.9	1.94	10.11
9/13/22	12:50	952.89		25.98				5	90	311.8	49.4	-0.36	50	1185	8	1193	239	14315	1297	0.9	1.97	10.17
9/13/22	13:00	963.16		26.03				10	100	312.4	48.8	-0.6	49	2372	13	2386	239	14313	1285	0.9	2.01	10.27
9/13/22	13:05	968.29		26.04				5	105	312.5	48.7	-0.12	49	1185	3	1188	238	14252	1276	0.9	2.00	10.29
9/13/22	13:10	973.43		26.05				5	110	312.6	48.6	-0.12	49	1187	3	1190	238	14280	1273	0.9	2.02	10.34
9/13/22	13:15	978.56		26.07				5	115	312.8	48.4	-0.24	48	1185	5	1190	238	14283	1269	0.9	2.03	10.38
9/13/22	13:20	983.61		26.04			increase flow	5	120	312.5	48.7	0.36	49	1167	-8	1159	232	13904	1270	0.9	1.95	10.09
9/13/22	13:25	997.2		22.3				5	125	267.6	93.6	44.88	71	3139	-983	2156	431	25873	1839	0.9	1.14	12.97
9/13/22	13:30	1012.99		22.28				5	130	267.4	93.8	0.24	94	3647	-5	3642	728	43707	2406	0.9	2.10	16.75
9/13/22	13:35	1027		21.96				5	135	263.5	97.7	3.84	96	3236	-84	3152	630	37826	2457	0.9	1.69	14.19
9/13/22	13:40	1042.9		21.77				5	140	261.2	100.0	2.28	99	3673	-50	3623	725	43475	2534	0.9	1.88	15.82
9/13/22	13:45	1055.38		21.67				5	145	260.0	101.2	1.2	101	2883	-26	2857	571	34279	2578	0.9	1.45	12.26
9/13/22	13:50	1069.26		21.56				5	150	258.7	102.5	1.32	102	3206	-29	3177	635	38128	2609	0.9	1.58	13.47
9/13/22	13:55	1083.8		21.51				5	155	258.1	103.1	0.6	103	3359	-13	3346	669	40147	2633	0.9	1.65	14.05
9/13/22	14:00	1098		21.43				5	160	257.2	104.0	0.96	104	3280	-21	3259	652	39110	2653	0.9	1.58	13.59
9/13/22	14:05	1112.23		21.36				5	165	256.3	104.9	0.84	104	3287	-18	3269	654	39225	2676	0.9	1.57	13.51
9/13/22	14:10	1126.58		21.32				5	170	255.8	105.4	0.48	105	3315	-11	3304	661	39652	2692	0.9	1.57	13.58
																			Minimum Rate:			8.46
														Raw Rate for design, prior to application of adjustment factors:								**10.00**

Results of Falling Head Infiltration Test

Project: 12691.001

Exploration #/Location: LI-2A
Depth Boring drilled, bgs (ft): 22
Tested by: BTM
USCS Soil Type in test zone: SP
Weather (start to finish): Cloudy
Water Source/pH: H2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 22 ft, set 2" well pipe through augers, bottom 10' slotted pipe with sand backfill in test zone

Initial estimated Depth to Water Surface (in.): 191
Average depth of water in well, "h" (in.): 75
approx. h/r: 18.8
Tu (Fig. 8) (ft): 84.1
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	22.2 ft	0. in.	266
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing	10. ft	0. in.	

Depth of well bottom below top of casing (in): 266

Use of Barrels: No
Use of Flow Meter: No
Test Type: Falling Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID: N/A

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/13/2022	Start time: 14:50	Gallons																				
9/13/22	14:50			15.05					0	180.6	85.8											
9/13/22	14:55			16.04				5	5	192.5	73.9	-11.88	80	0	260	260	52	3123	2057	0.9	0.23	1.40
9/13/22	15:00			17.33				5	10	208.0	58.4	-15.48	66	0	339	339	68	4070	1714	0.9	0.45	2.19
9/13/22	15:16			17.68				16	26	212.2	54.2	-4.2	56	0	92	92	6	345	1466	0.9	0.04	0.22
9/13/22							Refill															
9/13/22	15:43			12					53	144.0	122.4											
9/13/22	15:45			13.32				2	55	159.8	106.6	-15.84	114	0	347	347	174	10411	2927	0.9	0.41	3.28
9/13/22	15:47			14.18				2	57	170.2	96.2	-10.32	101	0	226	226	113	6783	2599	0.9	0.32	2.41
9/13/22	15:49			14.72				2	59	176.6	89.8	-6.48	93	0	142	142	71	4259	2388	0.9	0.22	1.64
9/13/22	15:51			15.32				2	61	183.8	82.6	-7.2	86	0	158	158	79	4732	2216	0.9	0.29	1.97
9/13/22	15:53			15.67				2	63	188.0	78.4	-4.2	80	0	92	92	46	2760	2072	0.9	0.18	1.23
9/13/22	15:55			16.31				2	65	195.7	70.7	-7.68	75	0	168	168	84	5048	1923	0.9	0.40	2.42
9/13/22	15:57			16.65				2	67	199.8	66.6	-4.08	69	0	89	89	45	2682	1775	0.9	0.23	1.39
9/13/22	15:59			17.29				2	69	207.5	58.9	-7.68	63	0	168	168	84	5048	1628	0.9	0.54	2.86
9/13/22	16:01			17.64				2	71	211.7	54.7	-4.2	57	0	92	92	46	2760	1478	0.9	0.33	1.72
9/13/22	16:03			17.95				2	73	215.4	51.0	-3.72	53	0	81	81	41	2445	1379	0.9	0.32	1.63
9/13/22	16:05			18.23				2	75	218.8	47.6	-3.36	49	0	74	74	37	2208	1290	0.9	0.33	1.58
9/13/22							Refill															
9/13/22	16:08			12					78	144.0	122.4											
9/13/22	16:10			13.54				2	80	162.5	103.9	-18.48	113	0	405	405	202	12146	2894	0.9	0.51	3.87
9/13/22	16:12			14.17				2	82	170.0	96.4	-7.56	100	0	166	166	83	4969	2567	0.9	0.23	1.78
9/13/22	16:14			14.72				2	84	176.6	89.8	-6.6	93	0	145	145	72	4338	2389	0.9	0.23	1.67
9/13/22	16:18			15.66				4	88	187.9	78.5	-11.28	84	0	247	247	62	3707	2164	0.9	0.25	1.58
9/13/22	16:20			16.07				2	90	192.8	73.6	-4.92	76	0	108	108	54	3234	1961	0.9	0.24	1.52
9/13/22	16:22			16.48				2	92	197.8	68.6	-4.92	71	0	108	108	54	3234	1837	0.9	0.26	1.62
9/13/22	16:24			17.25				2	94	207.0	59.4	-9.24	64	0	202	202	101	6073	1659	0.9	0.64	3.37
9/13/22	16:26			17.63				2	96	211.6	54.8	-4.56	57	0	100	100	50	2997	1486	0.9	0.35	1.86
9/13/22	16:28			17.94				2	98	215.3	51.1	-3.72	53	0	81	81	41	2445	1382	0.9	0.32	1.63
9/13/22	16:30			18.18				2	100	218.2	48.2	-2.88	50	0	63	63	32	1893	1299	0.9	0.27	1.34
9/13/22																						
9/13/22																						
9/13/22																						
9/13/22																						
																			Minimum Rate:			1.23
														Raw Rate for design, prior to application of adjustment factors:								**1.00**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project: 12691.001
Exploration #/Location: LI-3
Depth Boring drilled, bgs (ft): 25
Tested by: JAT
USCS Soil Type in test zone: SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 25 ft, set 2" well pipe through augers, bottom 10' slotted pipe with sand backfill in test zone

Initial estimated Depth to Water Surface (in.): 231
Average depth of water in well, "h" (in.): 69
approx. h/r: 17.2
Tu (Fig. 8) (ft): 80.7
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	25. ft	0. in.	300
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing	10. ft	0. in.	

Depth of well bottom below top of casing (in): 300

Use of Barrels: No
Use of Flow Meter: No
Test Type: Constant Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID: N/A

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/14/2022	Start time: 8:30	Gallons																				
9/14/22	8:56	1193.02		20.56					26	246.7	53.3											
9/14/22	9:06	1195.10		20.62				10	36	247.4	52.6	-0.72	53	480	16	496	50	2978	1380	0.9	0.37	1.99
9/14/22	9:11	1198.21		20.63				5	41	247.6	52.4	-0.12	53	718	3	721	144	8652	1370	0.9	1.08	5.82
9/14/22	9:16	1201.78		20.6				5	46	247.2	52.8	0.36	53	825	-8	817	163	9801	1373	0.9	1.21	6.58
9/14/22	9:21	1204.11		20.61				5	51	247.3	52.7	-0.12	53	538	3	541	108	6490	1376	0.9	0.81	4.35
9/14/22	9:26	1207.15		20.61				5	56	247.3	52.7	0	53	702	0	702	140	8427	1374	0.9	1.04	5.65
9/14/22	9:31	1210.30		20.6				5	61	247.2	52.8	0.12	53	728	-3	725	145	8700	1376	0.9	1.07	5.83
9/14/22	9:36	1213.50		20.58				5	66	247.0	53.0	0.24	53	739	-5	734	147	8807	1380	0.9	1.08	5.88
9/14/22	9:41	1216.40		20.58				5	71	247.0	53.0	0	53	670	0	670	134	8039	1383	0.9	0.99	5.36
9/14/22	9:46	1219.21		20.6				5	76	247.2	52.8	-0.24	53	649	5	654	131	7852	1380	0.9	0.97	5.24
9/14/22	9:51	1222.11		20.57				5	81	246.8	53.2	0.36	53	670	-8	662	132	7944	1382	0.9	0.97	5.30
9/14/22	9:56	1225.75		20.55				5	86	246.6	53.4	0.24	53	841	-5	836	167	10027	1389	0.9	1.22	6.65
9/14/22	10:01	1228.09		20.55				5	91	246.6	53.4	0	53	541	0	541	108	6486	1392	0.9	0.79	4.29
9/14/22	10:06	1230.87		20.54				5	96	246.5	53.5	0.12	53	642	-3	640	128	7675	1394	0.9	0.93	5.08
9/14/22	10:11	1234.02		20.55				5	101	246.6	53.4	-0.12	53	728	3	730	146	8763	1394	0.9	1.06	5.80
9/14/22	10:16	1237.05		20.55				5	106	246.6	53.4	0	53	700	0	700	140	8399	1392	0.9	1.02	5.56
9/14/22	10:21	1240.20		20.54				5	111	246.5	53.5	0.12	53	728	-3	725	145	8700	1394	0.9	1.05	5.75
9/14/22	10:26	1243.00		20.53				5	116	246.4	53.6	0.12	54	647	-3	644	129	7730	1397	0.9	0.93	5.10
9/14/22	10:31	1246.44		20.54				5	121	246.5	53.5	-0.12	54	795	3	797	159	9567	1397	0.9	1.16	6.31
9/14/22							increase flow															
9/14/22	10:48	1297.1		17.25					138	207.0	93.0											
9/14/22	10:50	1300.39		17.25				2	140	207.0	93.0	0	93	760	0	760	380	22800	2388	0.9	1.11	8.80
9/14/22	10:52	1305.22		17.25				2	142	207.0	93.0	0	93	1116	0	1116	558	33472	2388	0.9	1.64	12.92
9/14/22	10:54	1309.88		17.25				2	144	207.0	93.0	0	93	1076	0	1076	538	32294	2388	0.9	1.58	12.47
9/14/22	10:56	1313.46		17.23				2	146	206.8	93.2	0.24	93	827	-5	822	411	24652	2391	0.9	1.20	9.51
9/14/22	10:58	1317.89		17.22				2	148	206.6	93.4	0.12	93	1023	-3	1021	510	30621	2395	0.9	1.49	11.79
9/14/22	11:00	1322.45		17.25				2	150	207.0	93.0	-0.36	93	1053	8	1061	531	31837	2392	0.9	1.56	12.27
9/14/22	11:05	1332.5		17.35				5	155	208.2	91.8	-1.2	92	2322	26	2348	470	28174	2373	0.9	1.41	10.95
9/14/22	11:10	1341.9		17.35				5	160	208.2	91.8	0	92	2171	0	2171	434	26057	2357	0.9	1.30	10.19
9/14/22	11:15	1351.46		17.36				5	165	208.3	91.7	-0.12	92	2208	3	2211	442	26532	2356	0.9	1.33	10.38
9/14/22	11:20	1361.62		17.35				5	170	208.2	91.8	0.12	92	2347	-3	2344	469	28132	2356	0.9	1.41	11.01
9/14/22	11:25	1371.39		17.35				5	175	208.2	91.8	0	92	2257	0	2257	451	27082	2357	0.9	1.35	10.59
9/14/22	11:30	1381.21		17.36				5	180	208.3	91.7	-0.12	92	2268	3	2271	454	27253	2356	0.9	1.36	10.66
																					Minimum Rate:	4.29
														Raw Rate for design, prior to application of adjustment factors:								**6.00**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project: 12691.001
Exploration #/Location: *LI-4*
Depth Boring drilled, bgs (ft): 25
Tested by: BTM
USCS Soil Type in test zone: SP
Weather (start to finish): Cloudy
Water Source/pH: H2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 25 ft, set 2" well pipe through augers, bottom 10' slotted pipe with sand backfill in test zone

Initial estimated Depth to Water Surface (in.): 256
Average depth of water in well, "h" (in.): 42
approx. h/r: 10.5
Tu (Fig. 8) (ft): 78.7
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

Use of Barrels: **No**
Use of Flow Meter: **Yes**
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	25. ft	0. in.	300
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	2. in.	2
Depth to top of sand from top of casing	15. ft	0. in.	

Depth of well bottom below top of casing (in): 302

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID: N/A

Field Data | **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:	Gallons		ft	in.																	
9/13/2022	8:40																					
9/13/22	8:40	525.6		21.7					0	258.4	41.6											
9/13/22	8:45	538.1		21.82				5	5	259.8	40.2	-1.44	41	2888	32	2919	584	35029	1078	0.9	6.73	29.96
9/13/22	8:50	551		21.82				5	10	259.8	40.2	0	40	2980	0	2980	596	35759	1060	0.9	6.82	31.11
9/13/22	8:55	564.17		21.81				5	15	259.7	40.3	0.12	40	3042	-3	3040	608	36476	1061	0.9	6.92	31.69
9/13/22	9:00	578.55		21.8				5	20	259.6	40.4	0.12	40	3322	-3	3319	664	39830	1064	0.9	7.52	34.51
9/13/22	9:05	591.81		21.78				5	25	259.4	40.6	0.24	41	3063	-5	3058	612	36694	1069	0.9	6.86	31.65
9/13/22	9:10	605.69		21.74				5	30	258.9	41.1	0.48	41	3206	-11	3196	639	38349	1078	0.9	7.03	32.80
9/13/22	9:15	619.23		21.74				5	35	258.9	41.1	0	41	3128	0	3128	626	37533	1084	0.9	6.90	31.93
9/13/22	9:20	632.8		21.71				5	40	258.5	41.5	0.36	41	3135	-8	3127	625	37521	1088	0.9	6.79	31.78
9/13/22	9:25	646.35		21.71				5	45	258.5	41.5	0	41	3130	0	3130	626	37561	1093	0.9	6.81	31.69
9/13/22	9:40	687		21.64				15	60	257.7	42.3	0.84	42	9390	-18	9372	625	37487	1103	0.9	6.56	31.32
9/13/22	9:45	700.52		21.64				5	65	257.7	42.3	0	42	3123	0	3123	625	37477	1114	0.9	6.58	31.02
9/13/22	9:50	713.93		21.62				5	70	257.4	42.6	0.24	42	3098	-5	3092	618	37109	1117	0.9	6.45	30.63
9/13/22	9:55	727.4		21.6				5	75	257.2	42.8	0.24	43	3112	-5	3106	621	37276	1123	0.9	6.43	30.60
9/13/22	10:00	740.8		21.59				5	80	257.1	42.9	0.12	43	3095	-3	3093	619	37113	1127	0.9	6.37	30.35
9/13/22	10:05	754.23		21.58				5	85	257.0	43.0	0.12	43	3102	-3	3100	620	37196	1130	0.9	6.36	30.33
9/13/22	10:10	767.65		21.56				5	90	256.7	43.3	0.24	43	3100	-5	3095	619	37137	1135	0.9	6.29	30.16
9/13/22	10:15	781.07		21.55				5	95	256.6	43.4	0.12	43	3100	-3	3097	619	37169	1140	0.9	6.27	30.07
9/13/22	10:20	794.8		21.55				5	100	256.6	43.4	0	43	3172	0	3172	634	38060	1141	0.9	6.43	30.75
9/13/22	10:25	807.94		21.53				5	105	256.4	43.6	0.24	44	3035	-5	3030	606	36361	1144	0.9	6.08	29.30
9/13/22	10:30	821.41		21.51				5	110	256.1	43.9	0.24	44	3112	-5	3106	621	37276	1150	0.9	6.18	29.88
9/13/22	10:35	834.85		21.5				5	115	256.0	44.0	0.12	44	3105	-3	3102	620	37224	1155	0.9	6.15	29.72
9/13/22	10:40	848.27		21.48				5	120	255.8	44.2	0.24	44	3100	-5	3095	619	37137	1159	0.9	6.08	29.54
																			Minimum Rate:			29.30
														Raw Rate for design, prior to application of adjustment factors:								**30.00**

APPENDIX A

GEOTECHNICAL EXPLORATION LOGS

(GEOCON WEST, INC.)

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The site was explored on January 23, 2020, by excavating eight 8-inch diameter borings to depths between 10½ and 20½ feet below the existing ground surface using a truck-mounted hollow-stem auger drilling machine. Representative and relatively undisturbed samples were obtained by driving a 3-inch, O. D., California Modified Sampler into the “undisturbed” soil mass with blows from a 140-pound auto-hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch by 2³/₈-inch diameter brass sampler rings to facilitate soil removal and testing. Bulk samples were also obtained.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). The logs of the borings are presented on Figures A1 through A8. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the logs were revised based on subsequent laboratory testing. The location of the borings are shown on Figure 2.

PROJECT NO. T2749-99-10A

BORING 1

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**ARTIFICIAL FILL** Silty Sand, loose, slightly moist, light brown, fine- to medium-grained, trace fine gravel.			
2	B1@2'			SM	**ALLUVIUM** Silty Sand, loose, slightly moist to moist, loose, yellowish brown, fine-grained.	12	110.8	4.6
4								
	B1@5'				- medium dense, dry to slightly moist, light brown	38	115.2	2.2
6				ML	Sandy Silt, stiff, slightly moist, light brown.			
	B1@7'					28	107.5	5.3
8								
10	B1@10'				- hard	53	107.5	5.3
12								
				SM	Silty Sand, dense, slightly moist, brown, fine-grained, some medium- to coarse-grained.			
14								
	B1@15'					73	122.1	1.8
16								
18				ML	Silt with Sand, hard, slightly moist, light brown.			
20	B1@20'					60	103.8	4.5

Total depth of boring: 20.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

T2746-99-10A BORING LOGS.GPJ

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

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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

GEOCON

BORING 2

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ARTIFICIAL FILL** Silty Sand, loose, slightly moist, brown, fine-grained, trace fine gravel.			
2	B2@2'			SM	**ALLUVIUM** Silty Sand, medium dense, slightly moist, light brown to brown, fine-grained, trace coarse-grained.	37	105.0	10.8
4								
	B2@5'				- some medium- and coarse-grained	29	115.7	2.4
6					Sandy Silt, hard, dry to slightly moist, light brown, fine-grained.			
	B2@7'			ML		46	112.9	3.5
8								
					Silt with Sand, firm, dry to slightly moist, light brown.			
10	B2@10'					28	105.4	3.7
12				ML				
14								
	B2@15'				- hard, slightly moist	46	105.2	5.4
16								
18				SM	Silty Sand, medium dense, slightly moist, grayish brown, fine-grained, some medium-grained.			
20	B2@20'					24	123.5	2.2

Total depth of boring: 20.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

T2746-99-10A BORING LOGS.GPJ

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

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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

GEOCON

BORING 3

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ARTIFICIAL FILL** Silty Sand, loose, slightly moist, brown, fine- to medium-grained.			
2	B3@2'			SM	**ALLUVIUM** Silty Sand, loose, slightly moist to moist, brown, trace fine gravel and fine-grained sand.	12	105.6	10.9
4	B3@5'				- medium dense, dry to slighlty moist, light brown, fine-grained, some fine gravel	40	127.0	2.1
6	B3@7'			ML	Sandy Silt, hard, dry to slightly moist, light brown, trace fine gravel.	44	119.9	3.0
8								
10	B3@10'			ML	Silt, hard, dry to slightly moist, light brown, trace fine-grained sand.	78	115.5	3.5

Total depth of boring: 10.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

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

T2746-99-10A BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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

GEOCON

BORING 4

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			**ARTIFICIAL FILL** Silty Sand, loose, slightly moist, light brown, fine- to medium-grained.			
2	B4@2'	SM	**ALLUVIUM** Silty Sand, medium dense, slightly moist, brown, fine-grained.	27	110.6	16.4
5	B4@5'		- dry, light grayish brown, some coarse-grained	31	115.4	1.2
7	B4@7'		- trace medium- to coarse-grained	28	115.2	2.9
9		ML	Sandy Silt, firm, slightly moist, brown, fine-grained, trace medium-grained sand.			
10	B4@10'			21	112.4	5.3
13		ML	Silt with Sand, stiff, slighlty moist, brown, trace fine-grained.			
15	B4@15'			40	111.0	6.7
18		SP-SM	Sand with Silt, dense, dry, grayish brown, fine-grained, some medium-grained.			
20	B4@20'			54	116.0	1.2

Total depth of boring: 20.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

T2746-99-10A BORING LOGS.GPJ

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

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

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

GEOCON

BORING 5

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**ARTIFICIAL FILL** Silty Sand, loose, slightly moist to moist, brown, fine-grained sand.			
2	B5@2'			SM	**ALLUVIUM** Silty Sand, medium dense, slightly moist, brown, fine-grained sand.	19	119.4	7.4
4								
	B5@5'			ML	Sandy Silt, hard, dry, light brown, trace fine-grained. - dry light brown, trace fine gravel	67	116.5	2.4
6								
	B5@7'			SP-SM	Silt with Sand, hard, dry, light brown, trace fine-grained.	62	110.9	3.3
8								
10	B5@10'			SM	Silty Sand, medium dense, dry, grayish brown, fine- to medium-grained, trace coarse-grained and fine gravel.	47	117.3	1.1
12								
14								
16	B5@15'				- light brown, fine-grained, no medium- or coarse-grained, no fine gravel	38	199.9	2.3
18				SP	Sand, poorly graded, very dense, dry, brown, medium-grained, trace fine gravel.			
20	B5@20'					90		

Total depth of boring: 20.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

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

T2746-99-10A BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

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

GEOCON

PROJECT NO. T2749-99-10A

BORING 6

ELEV. (MSL.) **--** DATE COMPLETED **1/23/2020**

EQUIPMENT **HOLLOW STEM AUGER** BY: **JJK**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ARTIFICIAL FILL** Silty Sand, loose, slightly moist to moist, brown, fine-grained.			
2	B6@2'				**ALLUVIUM** Silty Sand, medium dense, slightly moist, brown, fine-grained, trace medium- to coarse-grained.	20	113.4	10.4
4								
	B6@5'				- dry to slightly moist	38	124.0	5.3
6				SM				
	B6@7'				- loose, trace medium-grained, no coarse-grained	18	115.8	2.4
8								
10	B6@10'				- medium dense, no medium-grained	27	113.7	3.9

Total depth of boring: 10.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

T2746-99-10A BORING LOGS.GPJ

Figure A6,
Log of Boring 6, Page 1 of 1

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

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

GEOCON

BORING 7

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	BULK 0-5'				**ARTIFICIAL FILL** Silty Sand, loose, moist, brown, fine- to medium-grained, trace fine gravel.			
2	B7@2'				**ALLUVIUM** Silty Sand, medium dense, moist, brown, fine-grained, trace medium-grained.	24	114.3	6.8
4								
	B7@5'			SM	- loose, no medium-grained sand, decrease in silt	17	112.9	5.5
6								
	B7@7'				- no recovery, large 4" rock in bottom of sampler	37	120.6	4.0
8					Silt with Sand, stiff, slightly moist to moist, brown, trace fine-grained.			
10	B7@10'			ML		25	112.6	8.5
12					Sandy Silt, stiff, slightly moist to moist, brown, fine-grained.			
14								
	B7@15'					27	109.5	10.7
16				ML				
18								
20	B7@20'				- firm, trace medium-grained	20	113.8	7.6

Total depth of boring: 20.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

T2746-99-10A BORING LOGS.GPJ

Figure A7,
Log of Boring 7, Page 1 of 1

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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

GEOCON

BORING 8

ELEV. (MSL.) -- DATE COMPLETED 1/23/2020

EQUIPMENT HOLLOW STEM AUGER BY: JJK

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT*)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ARTIFICIAL FILL** Silty Sand, loose, slightly moist, brown, fine-grained.			
2	B8@2'			SM	**ALLUVIUM** Silty Sand, loose, slightly moist to moist, light brown, fine-grained, trace coarse-grained.	16	101.9	9.9
4	B8@5'			ML	Silt with Sand, firm, slightly moist, olive brown, trace fine-grained, trace plasticity.	16	112.7	13.2
	B8@7'				- stiff	36	105.7	10.7
8	B8@10'			ML	Sandy Silt, stiff, slightly moist, light brown, fine-grained.	26	110.6	4.1
14	B8@15'			SM	Silty Sand, dense, dry to slightly moist, grayish brown, fine-grained, some fine gravel.	57	123.7	1.1
20	B8@20'				- medium dense, fine-grained, no gravel	45	104.9	2.6

Total depth of boring: 20.5 feet
Fill to 2 feet.
No groundwater encountered.
Backfilled with soil cuttings and tamped.

*Penetration resistance for 140-pound hammer falling 30 inches by auto-hammer.

T2746-99-10A BORING LOGS.GPJ

Figure A8,
Log of Boring 8, Page 1 of 1

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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

GEOCON

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

Leighton

MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Leighton

Project Name:	Chaffey Fontana Campus	Tested By:	J. Gonzalez	Date:	09/20/22
Project No.:	12691.011	Checked By:	A. Santos	Date:	09/21/22
Boring No.:	LB-8	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Olive brown silty sand (SM)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

			Scalp Fraction (%)		
Preparation Method:	X	Moist	#3/4		Rammer Weight (lb.) = 10.0
		Dry			Height of Drop (in.) = 18.0
Compaction Method	X	Mechanical Ram	#3/8		
		Manual Ram	#4	7.0	Mold Volume (ft³) 0.03330

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3603	3692	3742	3711		
Weight of Mold (g)	1826	1826	1826	1826		
Net Weight of Soil (g)	1777	1866	1916	1885		
Wet Weight of Soil + Cont. (g)	483.6	499.5	467.3	516.1		
Dry Weight of Soil + Cont. (g)	457.7	463.5	425.4	460.7		
Weight of Container (g)	40.9	38.7	38.0	37.9		
Moisture Content (%)	6.21	8.47	10.82	13.10		
Wet Density (pcf)	117.6	123.5	126.8	124.8		
Dry Density (pcf)	110.8	113.9	114.5	110.3		

Maximum Dry Density (pcf)	**114.6**	**Optimum Moisture Content (%)**	**10.0**
Corrected Dry Density (pcf)	**117.2**	**Corrected Moisture Content (%)**	**9.4**

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

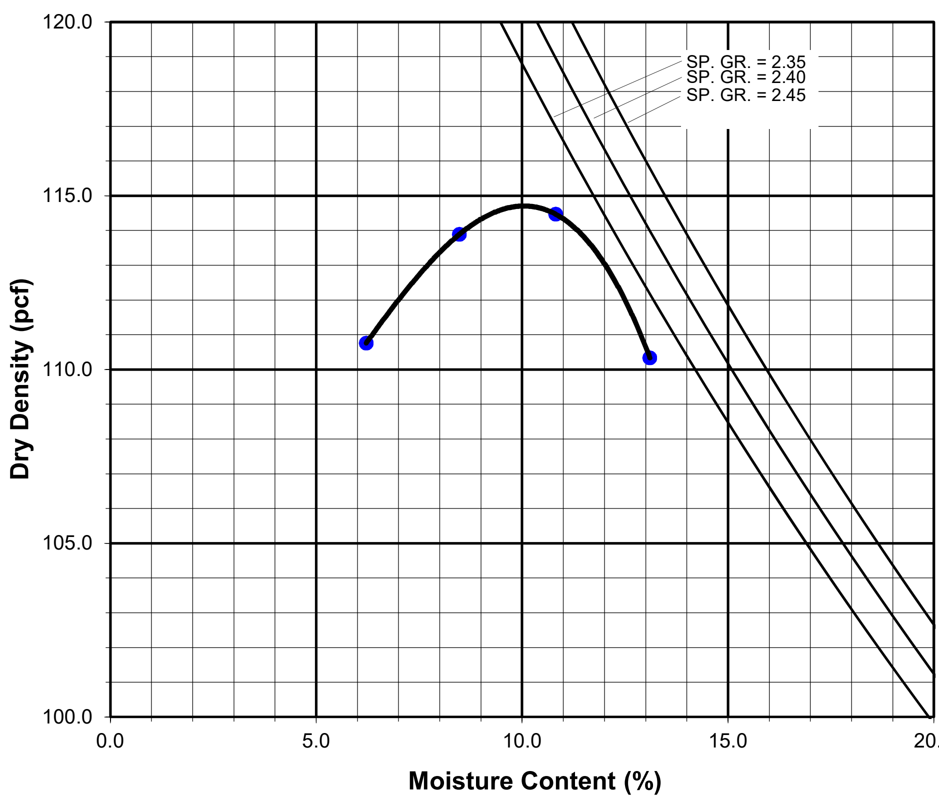
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



Boring No.	LB-1	LB-1	LB-1	LB-2	LB-4	LB-4	LB-5	LB-5
Sample No.	R-4	S-3	S-6	S-1	S-1	S-3	R-1	S-1
Depth (ft.)	10.0	25.0	40.0	15	15	25	25	15
Sample Type	Ring	SPT	SPT	SPT	SPT	SPT	Ring	SPT
Soil Identification	Olive silty sand (SM)	Olive poorly-graded sand with silt and gravel (SP-SM)g	Pale olive sandy silt s(ML)	Olive sandy silty clay s(CL-ML)	Olive lean clay with sand (CL)s	Olive silty sand (SM)	Olive brown silty clayey sand (SC-SM)	Olive poorly-graded sand with silt and gravel (SP-SM)g
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample Dry Weight Determination								
Weight of Sample + Container (g)	584.15	828.70	670.70	758.50	637.40	776.50	594.30	473.00
Weight of Container (g)	110.00	236.70	248.00	234.40	219.30	138.10	109.40	144.50
Weight of Dry Sample (g)	474.15	592.00	422.70	524.10	418.10	638.40	484.90	328.50
Container No.:								
After Wash								
Method (A or B)	A	A	A	A	A	A	A	A
Dry Weight of Sample + Cont. (g)	470.80	790.30	415.30	447.00	285.30	463.40	356.00	455.40
Weight of Container (g)	110.00	236.70	248.00	234.40	219.30	138.10	109.40	144.50
Dry Weight of Sample (g)	360.80	553.60	167.30	212.60	66.00	325.30	246.60	310.90
% Passing No. 200 Sieve	**23.9**	**6.5**	**60.4**	**59.4**	**84.2**	**49.0**	**49.1**	**5.4**
% Retained No. 200 Sieve	76.1	93.5	39.6	40.6	15.8	51.0	50.9	94.6

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Chaffey Fontana Campus
Project No.: 12691.011
Tested By: A. Santos Date: 09/20/22

Boring No.	LB-10	LB-10	LB-11	LB-12	LI-1	LI-2	LI-2	LI-3
Sample No.	S-2	S-4	S-2	S-1	S-3	S-3	S-5	S-2
Depth (ft.)	20.0	30.0	20.0	15	15	15	20	10
Sample Type	SPT	SPT	SPT	SPT	SPT	SPT	SPT	SPT
Soil Identification	Olive silty sand (SM)	Olive sandy silt s(ML)	Olive silty sand (SM)	Olive silty sand (SM)	Olive silty sand (SM)	Olive sandy silt s(ML)	Olive sandy silt s(ML)	Pale olive silty sand (SM)
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample Dry Weight Determination								
Weight of Sample + Container (g)	389.90	399.30	696.60	708.70	585.80	667.90	547.93	703.00
Weight of Container (g)	140.40	137.40	248.60	132.80	74.60	77.30	76.60	245.50
Weight of Dry Sample (g)	249.50	261.90	448.00	575.90	511.20	590.60	471.33	457.50
Container No.:								
After Wash								
Method (A or B)	A	A	A	A	A	A	A	A
Dry Weight of Sample + Cont. (g)	340.80	257.40	546.50	426.70	474.90	364.50	249.70	491.00
Weight of Container (g)	140.40	137.40	248.60	132.80	74.60	77.30	76.60	245.50
Dry Weight of Sample (g)	200.40	120.00	297.90	293.90	400.30	287.20	173.10	245.50
% Passing No. 200 Sieve	**19.7**	**54.2**	**33.5**	**49.0**	**21.7**	**51.4**	**63.3**	**46.3**
% Retained No. 200 Sieve	80.3	45.8	66.5	51.0	78.3	48.6	36.7	53.7

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Chaffey Fontana Campus
Project No.: 12691.011
Tested By: A. Santos Date: 09/20/22

Boring No.	LI-3								
Sample No.	S-4								
Depth (ft.)	20								
Sample Type	SPT								
Soil Identification	Olive silty sand (SM)								
Moisture Correction									
Wet Weight of Soil + Container (g)	0.00								
Dry Weight of Soil + Container (g)	0.00								
Weight of Container (g)	1.00								
Moisture Content (%)	0.00								
Sample Dry Weight Determination									
Weight of Sample + Container (g)	657.20								
Weight of Container (g)	126.20								
Weight of Dry Sample (g)	531.00								
Container No.:									
After Wash									
Method (A or B)	A								
Dry Weight of Sample + Cont. (g)	582.70								
Weight of Container (g)	126.20								
Dry Weight of Sample (g)	456.50								
% Passing No. 200 Sieve	**14.0**								
% Retained No. 200 Sieve	86.0								

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Chaffey Fontana Campus
Project No.: 12691.011
Tested By: A. Santos Date: 09/20/22

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D6913

Project Name: Chaffey Fontana Campus
Project No.: 12691.011
Boring No.: LB-8
Sample No.: B-1
Soil Identification: Olive brown silty sand (SM)

Tested By: J. Domingo Date: 09/21/22
Checked By: A. Santos Date: 10/02/22
Depth (feet): 0-5

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	CP-4	191	Wt. of Air-Dry Soil + Cont.(g)	0.0	0.0
Wt. Air-Dried Soil + Cont.(g)	2466.0	667.3	Wt. of Dry Soil + Cont. (g)	0.0	0.0
Wt. of Container (g)	222.0	159.6	Wt. of Container No.______(g)	1.0	1.0
Dry Wt. of Soil (g)	2244.0	507.7	Moisture Content (%)	0.0	0.0

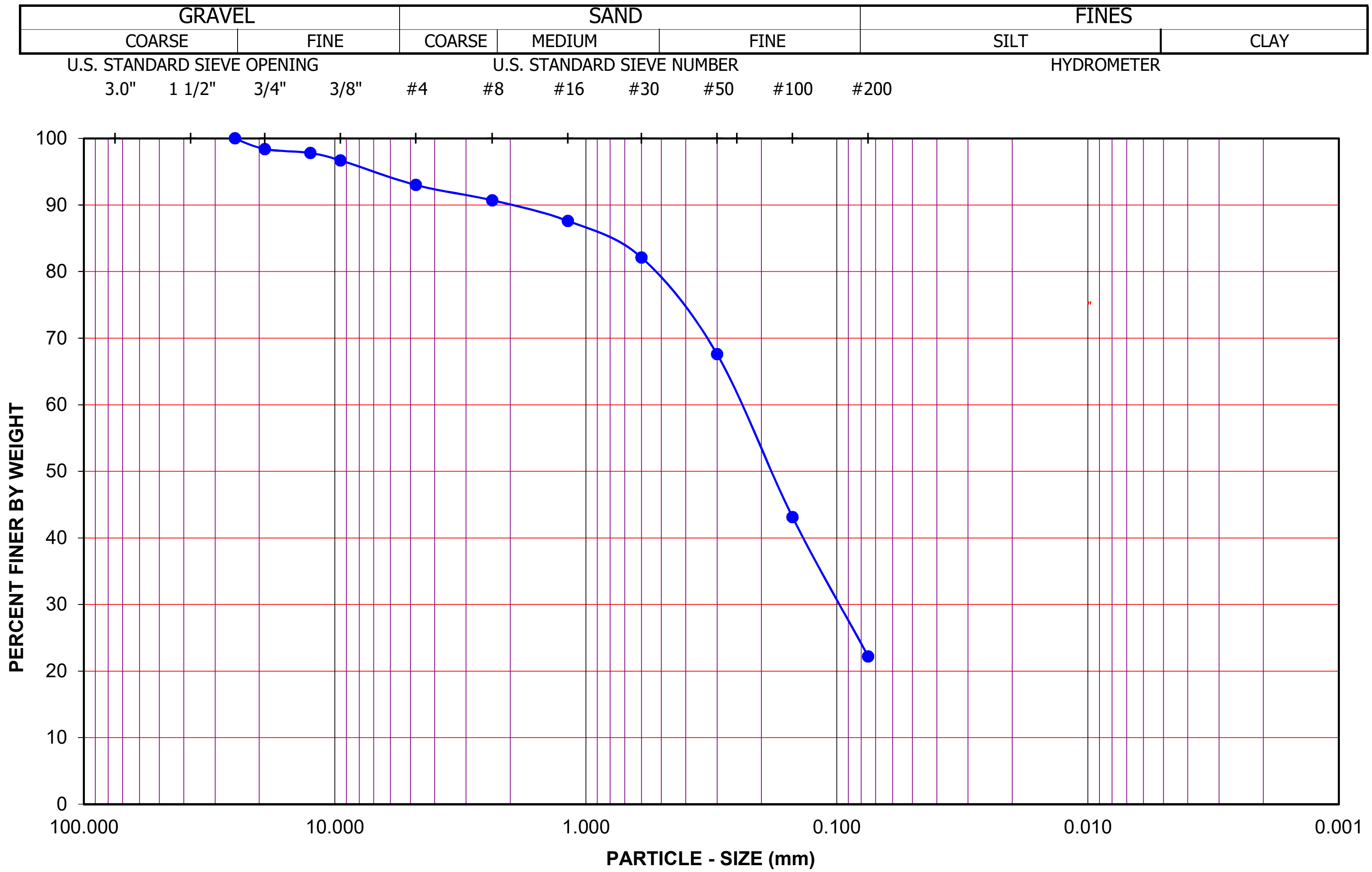
Passing #4 Material After Wet Sieve		
	Container No.	191
	Wt. of Dry Soil + Container (g)	561.1
	Wt. of Container (g)	159.6
	Dry Wt. of Soil Retained on # 200 Sieve (g)	401.5

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
3"	75.0			
1 1/2"	37.5			
1"	25.0	0.0		100.0
3/4"	19.0	36.2		98.4
1/2"	12.5	48.9		97.8
3/8"	9.5	73.5		96.7
#4	4.75	156.3		93.0
#8	2.36		12.6	90.7
#16	1.18		29.6	87.6
#30	0.600		59.3	82.1
#50	0.300		138.9	67.6
#100	0.150		272.4	43.1
#200	0.075		386.6	22.2
PAN				

GRAVEL: **7 %**
SAND: **71 %**
FINES: **22 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 =
Cc = $(D30)^2/(D60*D10)$ =

Remarks:



Project Name: Chaffey Fontana Campus

Project No.: 12691.011

Boring No.: LB-8 Sample No.: B-1

Depth (feet): 0-5 Soil Type : SM

Soil Identification: Olive brown silty sand (SM)

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 7 : 71 : 22

Oct-22

Sieve LB-8, B-1 @ 0-5

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D 6913

Project Name: Chaffey Fontana Campus
Project No.: 12691.011
Boring No.: LI-1
Sample No.: S-7
Soil Identification: Olive silty sand (SM)

Tested By: A. Santos Date: 09/20/22
Checked By: J. Ward Date: 10/02/22
Depth (feet): 25.0

		Moisture Content of Total Air - Dry Soil	
Container No.:	YK	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	783.1	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	251.1	Wt. of Container No.______ (g)	1.0
Dry Wt. of Soil (g)	532.0	Moisture Content (%)	0.0

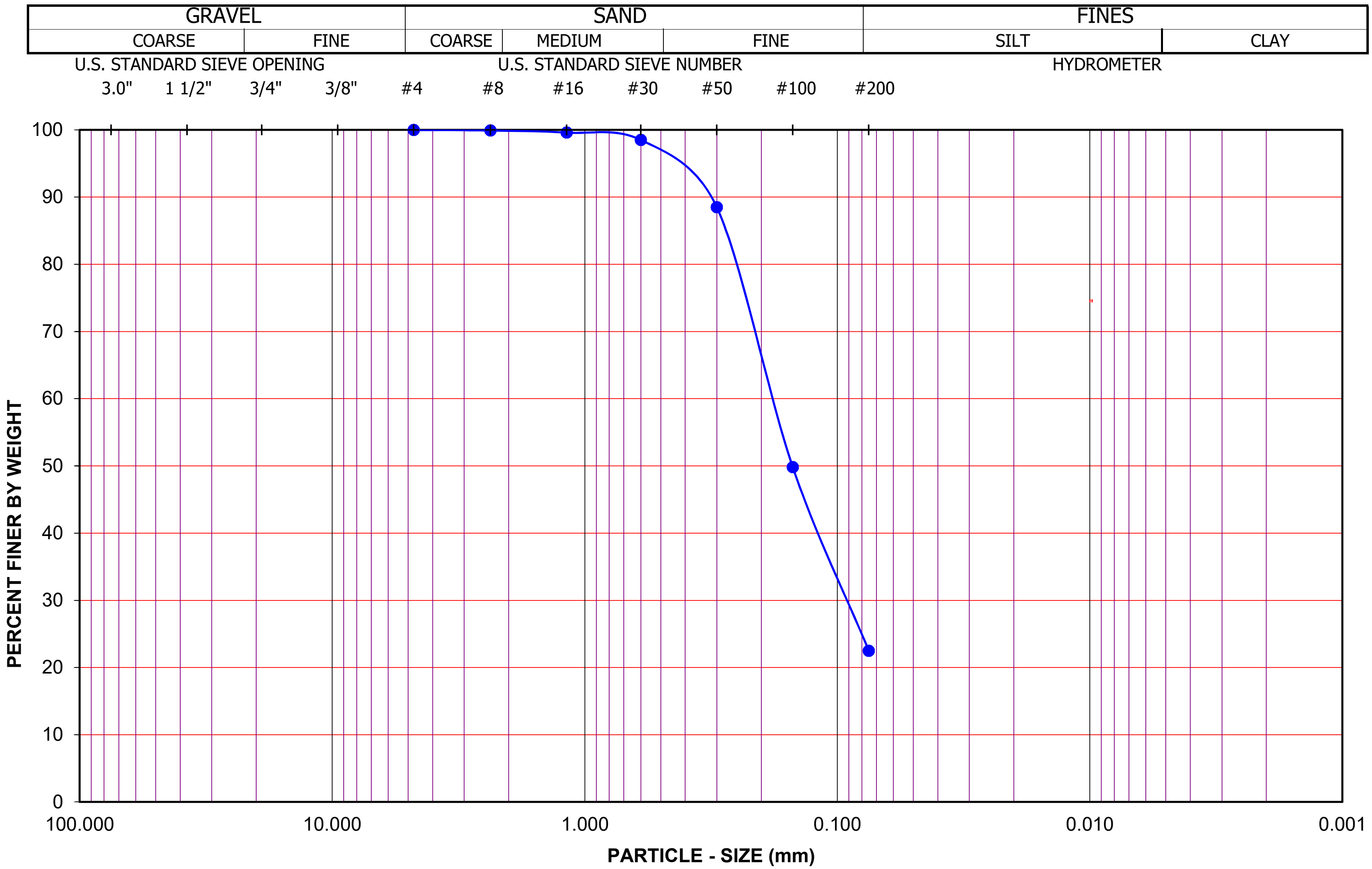
After Wet Sieve	Container No.	YK
	Wt. of Dry Soil + Container (g)	679.5
	Wt. of Container (g)	251.1
	Dry Wt. of Soil Retained on # 200 Sieve (g)	428.4

U. S. Sieve Size		Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
(in.)	(mm.)		
1 1/2"	37.5		
1"	25.0		
3/4"	19.0		
1/2"	12.5		
3/8"	9.5		
#4	4.75	0.0	100.0
#8	2.36	0.3	99.9
#16	1.18	1.9	99.6
#30	0.600	8.2	98.5
#50	0.300	61.1	88.5
#100	0.150	266.8	49.8
#200	0.075	412.3	22.5
PAN			

GRAVEL: **0 %**
SAND: **77 %**
FINES: **23 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = ______
Cc = $(D30)^2/(D60*D10)$ = ______

Remarks: ______



Project Name: Chaffey Fontana Campus

Project No.: 12691.011

Boring No.: LI-1

Sample No.: S-7

Depth (feet): 25.0

Soil Type : SM

Soil Identification: Olive silty sand (SM)

GR:SA:FI : (%) 0 : 77 : 23

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

Oct-22

Sieve LI-1, S-7 @ 25

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D 6913

Project Name: Chaffey Fontana Campus
Tested By: A. Santos Date: 09/20/22
Project No.: 12691.011
Checked By: J. Ward Date: 10/02/22
Boring No.: LI-4
Depth (feet): 20.0
Sample No.: S-6
Soil Identification: Olive poorly-graded sand with sand and gravel (SP-SM)g

		Moisture Content of Total Air - Dry Soil	
Container No.:	KG	Wt. of Air-Dry Soil + Cont. (g)	0.0
Wt. of Air-Dried Soil + Cont.(g)	530.7	Wt. of Dry Soil + Cont. (g)	0.0
Wt. of Container (g)	140.3	Wt. of Container No.______ (g)	1.0
Dry Wt. of Soil (g)	390.4	Moisture Content (%)	0.0

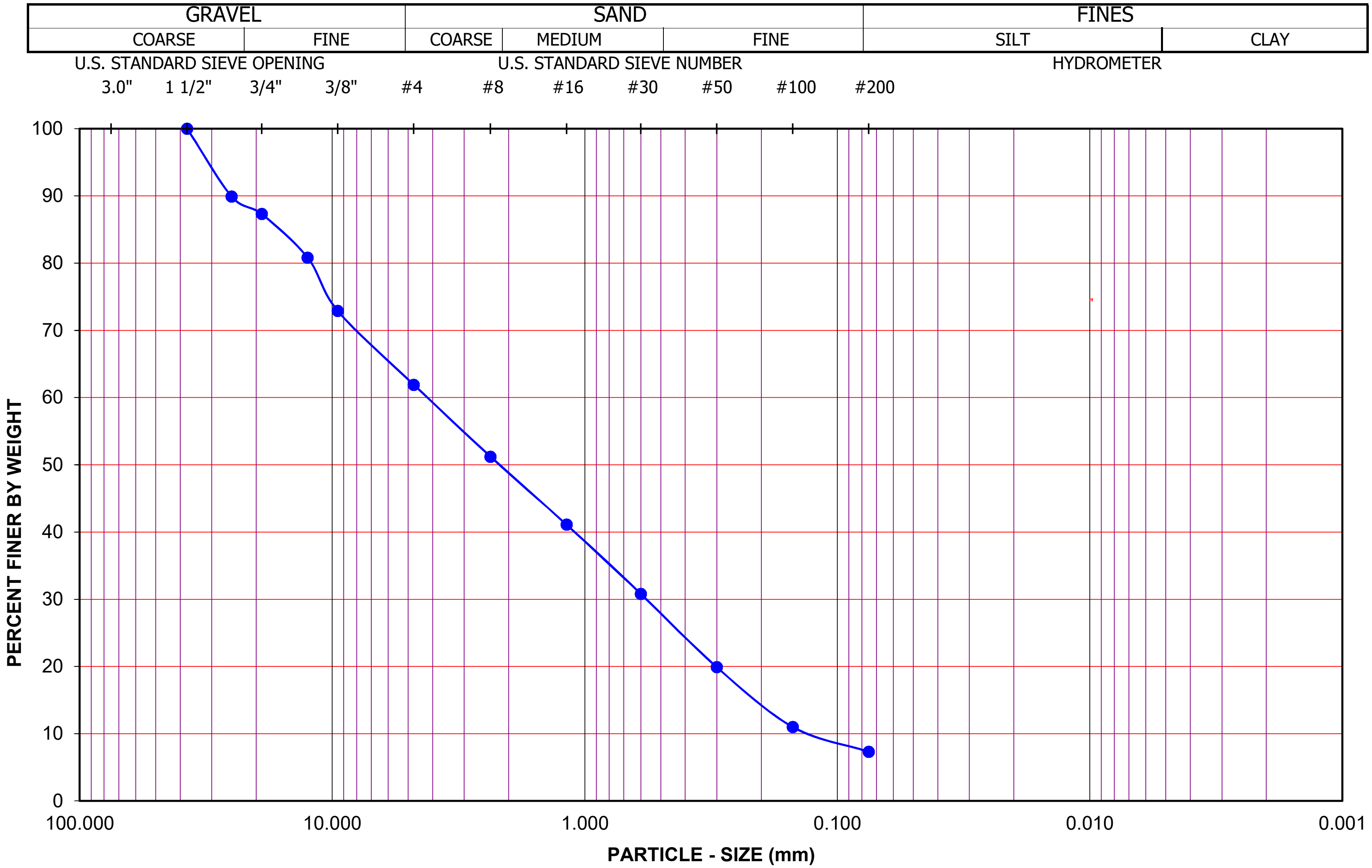
After Wet Sieve	Container No.	KG
	Wt. of Dry Soil + Container (g)	505.6
	Wt. of Container (g)	140.3
	Dry Wt. of Soil Retained on # 200 Sieve (g)	365.3

U. S. Sieve Size (in.)	(mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
1 1/2"	37.5	0.0	100.0
1"	25.0	39.3	89.9
3/4"	19.0	49.5	87.3
1/2"	12.5	75.0	80.8
3/8"	9.5	105.7	72.9
#4	4.75	148.9	61.9
#8	2.36	190.6	51.2
#16	1.18	230.1	41.1
#30	0.600	270.2	30.8
#50	0.300	312.6	19.9
#100	0.150	347.5	11.0
#200	0.075	362.0	7.3
PAN			

GRAVEL: **38 %**
SAND: **55 %**
FINES: **7 %**
GROUP SYMBOL: **SM**

Cu = D60/D10 = 28.00
Cc = $(D30)^2/(D60*D10)$ = 0.57

Remarks:



Project Name: Chaffey Fontana Campus

Project No.: 12691.011

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 6913

Boring No.: LI-4 Sample No.: S-6

Depth (feet): 20.0 Soil Type : SM

Soil Identification: Olive poorly-graded sand with sand and gravel (SP-SM)g

GR:SA:FI : (%) 38 : 55 : 7

Oct-22

Sieve LI-4, S-6 @ 20

ATTERBERG LIMITS
ASTM D 4318

Project Name:	Chaffey Fontana Campus	Tested By:	A. Santos	Date:	09/23/22
Project No. :	12691.011	Input By:	A. Santos	Date:	10/02/22
Boring No.:	LB-1	Checked By:	J. Ward		
Sample No.:	S-6	Depth (ft.)	40.0		
Soil Identification:	Pale olive sandy silt s(ML)				

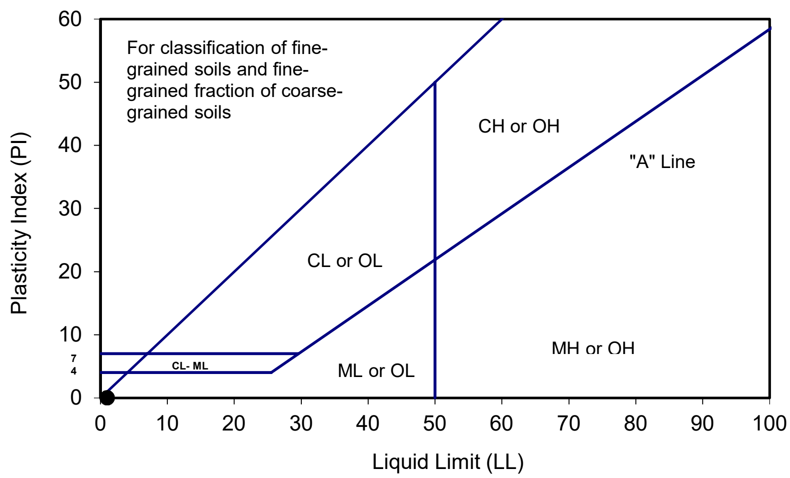
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			3			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		19.44	**Cannot get more than 6 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		15.18	**NonPlastic**		
Wt. of Container (g)			1.10			
Moisture Content (%) [Wn]			30.26			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

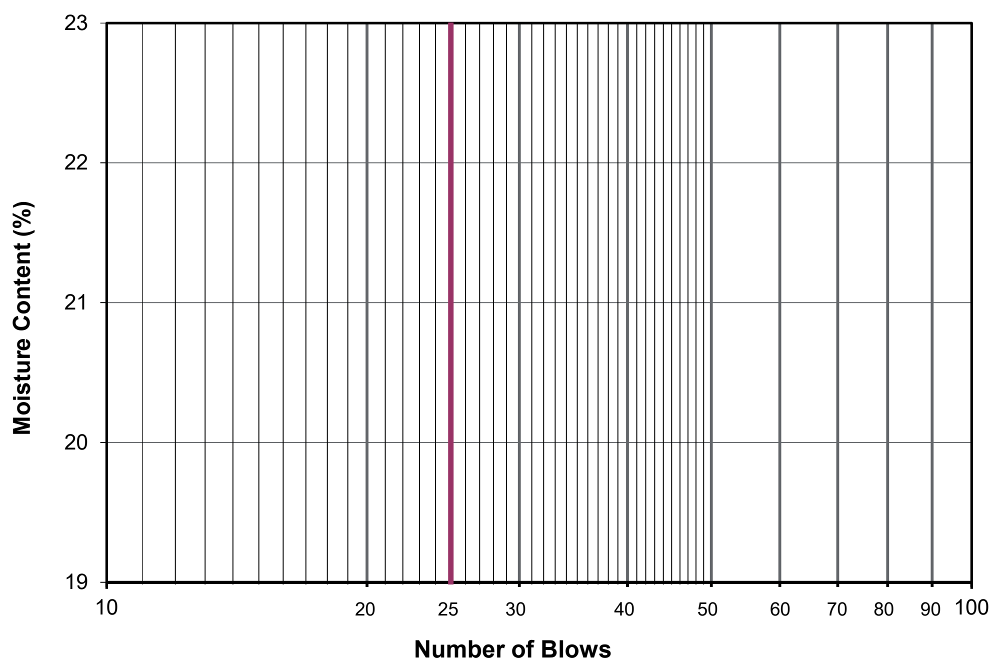
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



PROCEDURES USED

- [ ] Wet Preparation Multipoint - Wet
- [x] Dry Preparation Multipoint - Dry
- [x] Procedure A Multipoint Test
- [ ] Procedure B One-point Test



Leighton

ATTERBERG LIMITS
ASTM D 4318

Project Name:	Chaffey Fontana Campus	Tested By:	A. Santos	Date:	09/30/22
Project No. :	12691.011	Input By:	A. Santos	Date:	10/02/22
Boring No.:	LB-2	Checked By:	J. Ward		
Sample No.:	S-1	Depth (ft.)	15.0		
Soil Identification:	Olive sandy silty clay s(CL-ML)				

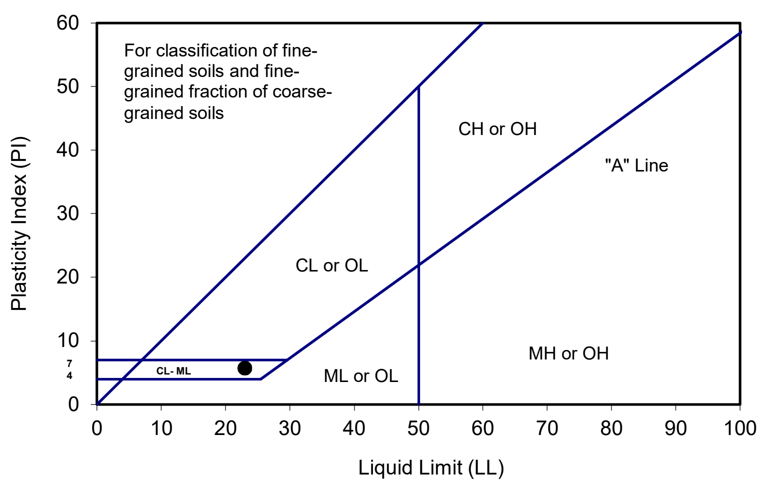
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	23	15	
Wet Wt. of Soil + Cont. (g)	9.38	9.69	20.27	20.17	20.28	
Dry Wt. of Soil + Cont. (g)	8.21	8.35	16.72	16.59	16.60	
Wt. of Container (g)	1.06	1.01	1.08	1.09	1.05	
Moisture Content (%) [Wn]	16.36	18.26	22.70	23.10	23.67	

Liquid Limit	**23**
Plastic Limit	**17**
Plasticity Index	**6**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) 2.19

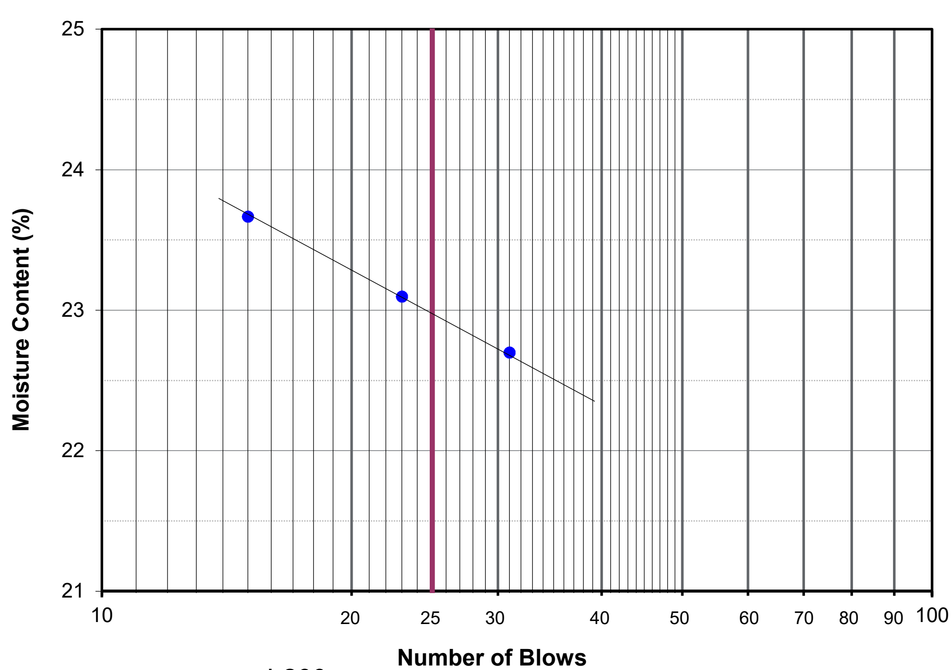
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

	Wet Preparation Multipoint - Wet
X	Dry Preparation Multipoint - Dry
X	Procedure A Multipoint Test
	Procedure B One-point Test



ATTERBERG LIMITS
ASTM D 4318

Project Name:	Chaffey Fontana Campus	Tested By:	A. Santos	Date:	09/30/22
Project No. :	12691.011	Input By:	A. Santos	Date:	10/02/22
Boring No.:	LB-4	Checked By:	J. Ward		
Sample No.:	S-1	Depth (ft.)	15.0		
Soil Identification:	Olive lean clay with sand (CL)s				

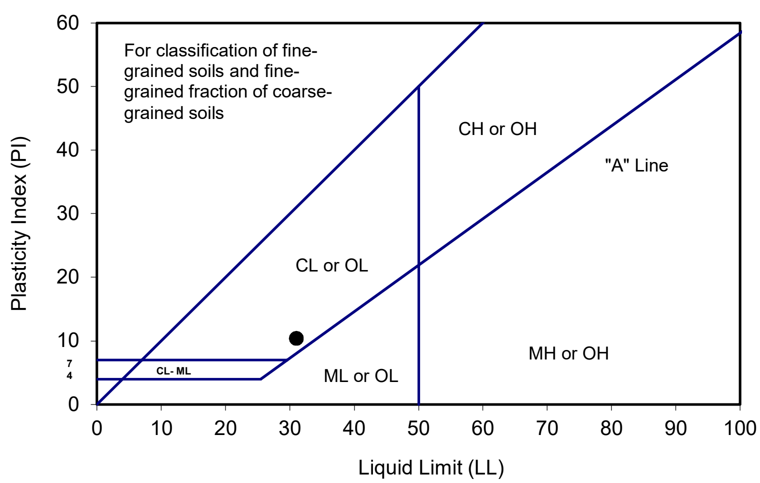
TEST NO.	PLASTIC LIMIT 1	PLASTIC LIMIT 2	LIQUID LIMIT 1	LIQUID LIMIT 2	LIQUID LIMIT 3	LIQUID LIMIT 4
Number of Blows [N]			35	26	16	
Wet Wt. of Soil + Cont. (g)	9.94	9.61	19.24	18.31	21.25	
Dry Wt. of Soil + Cont. (g)	8.42	8.15	15.03	14.23	16.30	
Wt. of Container (g)	1.09	1.04	1.01	1.00	1.02	
Moisture Content (%) [Wn]	20.74	20.53	30.03	30.84	32.40	

Liquid Limit	**31**
Plastic Limit	**21**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) | 8.03

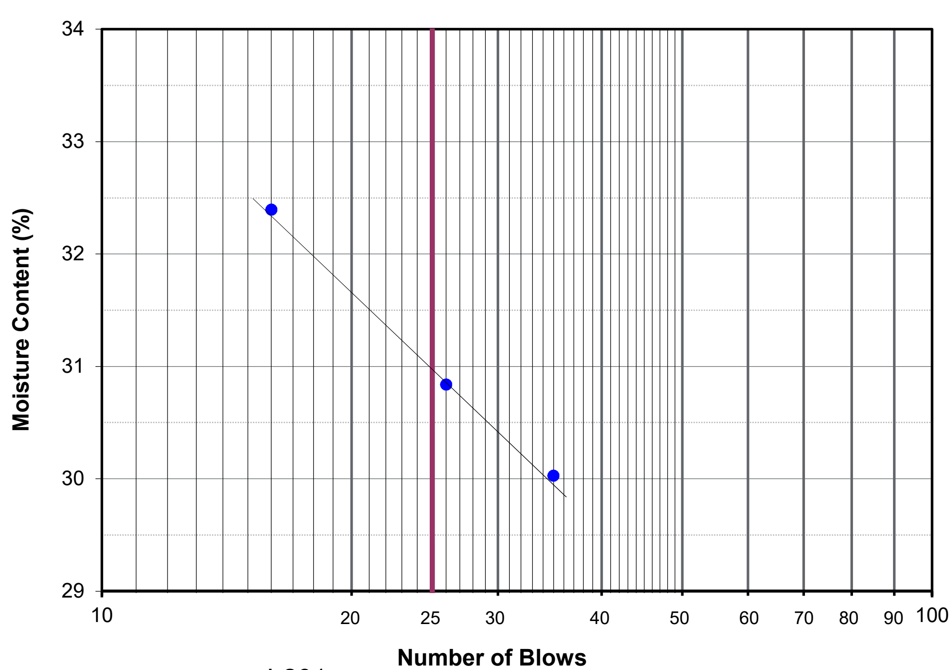
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



ATTERBERG LIMITS
ASTM D 4318

Project Name:	Chaffey Fontana Campus	Tested By:	J. Domingo	Date:	09/23/22
Project No. :	12691.011	Input By:	A. Santos	Date:	10/02/22
Boring No.:	LB-5	Checked By:	A. Santos		
Sample No.:	R-1	Depth (ft.)	2.5		
Soil Identification:	Olive brown silty clayey sand (SC-SM)				

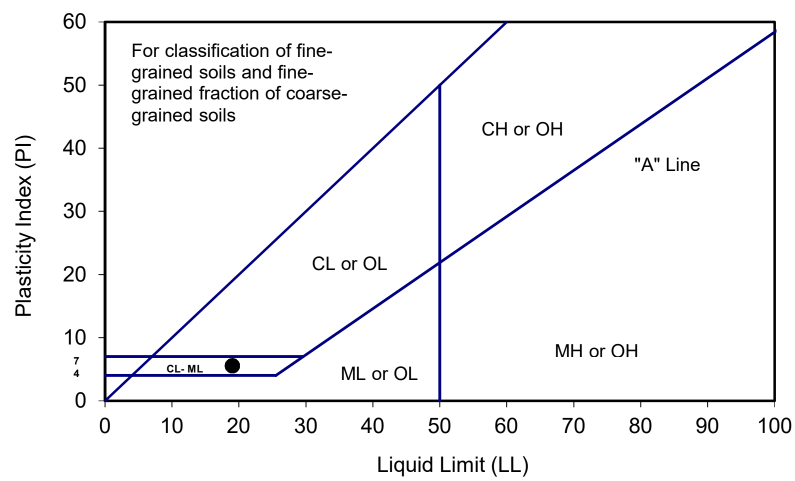
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	29	18	
Wet Wt. of Soil + Cont. (g)	9.88	9.78	22.88	22.24	22.38	
Dry Wt. of Soil + Cont. (g)	8.83	8.75	19.50	18.93	19.01	
Wt. of Container (g)	1.06	1.06	1.00	1.03	1.18	
Moisture Content (%) [Wn]	13.51	13.39	18.27	18.49	18.90	

Liquid Limit	**19**
Plastic Limit	**13**
Plasticity Index	**6**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) | -0.73

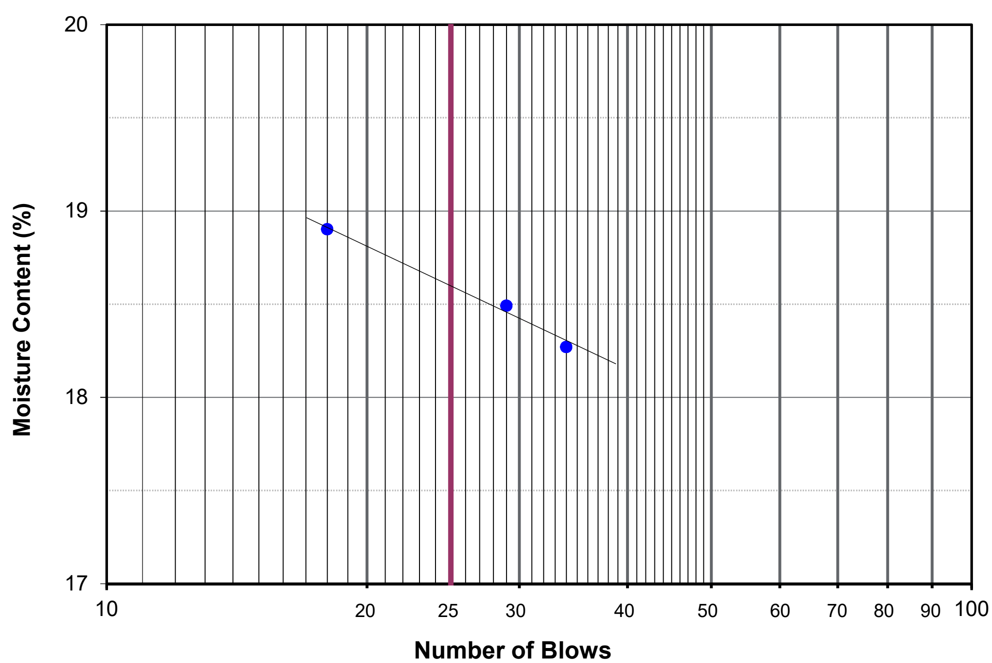
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



PROCEDURES USED

- [ ] Wet Preparation Multipoint - Wet
- [X] Dry Preparation Multipoint - Dry
- [X] Procedure A Multipoint Test
- [ ] Procedure B One-point Test



Leighton

ATTERBERG LIMITS
ASTM D 4318

Project Name:	Chaffey Fontana Campus	Tested By:	A. Santos	Date:	09/23/22
Project No. :	12691.011	Input By:	A. Santos	Date:	10/02/22
Boring No.:	LB-10	Checked By:	J. Ward		
Sample No.:	S-4	Depth (ft.)	31.0		
Soil Identification:	Olive sandy silt s(ML)				

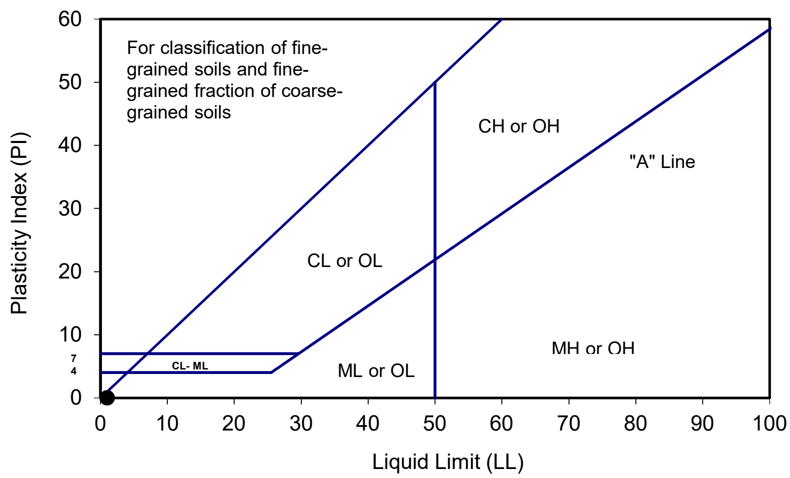
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			6			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		20.12	**Cannot get more than 6 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		16.50	**NonPlastic**		
Wt. of Container (g)			1.11			
Moisture Content (%) [Wn]			23.52			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

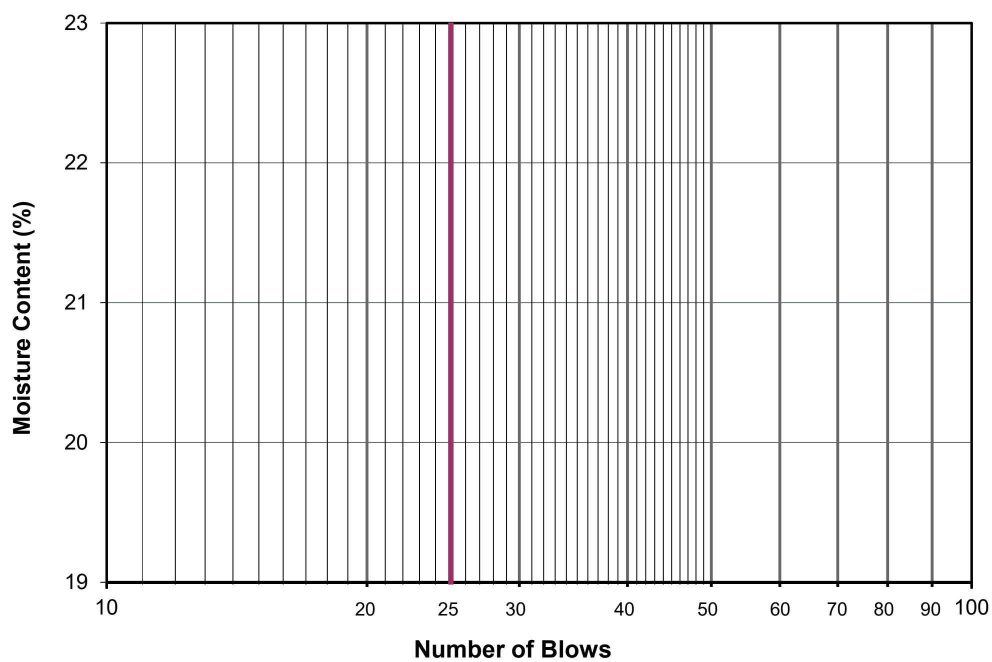
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



PROCEDURES USED

- [ ] Wet Preparation
  Multipoint - Wet
- [X] Dry Preparation
  Multipoint - Dry
- [X] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



ATTERBERG LIMITS
ASTM D 4318

Project Name:	Chaffey Fontana Campus	Tested By:	A. Santos	Date:	09/30/22
Project No. :	12691.011	Input By:	A. Santos	Date:	10/02/22
Boring No.:	LI-2	Checked By:	J. Ward		
Sample No.:	S-9	Depth (ft.)	30.0		
Soil Identification:	Olive lean clay (CL)				

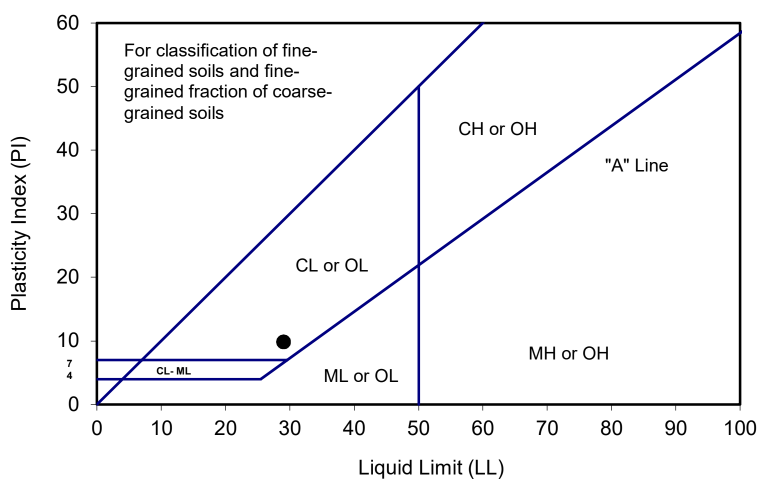
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	26	20	
Wet Wt. of Soil + Cont. (g)	10.75	10.10	21.45	21.74	19.63	
Dry Wt. of Soil + Cont. (g)	9.19	8.65	17.01	17.05	15.30	
Wt. of Container (g)	1.09	1.05	1.05	1.01	1.07	
Moisture Content (%) [Wn]	19.26	19.08	27.82	29.24	30.43	

Liquid Limit	**29**
Plastic Limit	**19**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 6.57

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.121}$



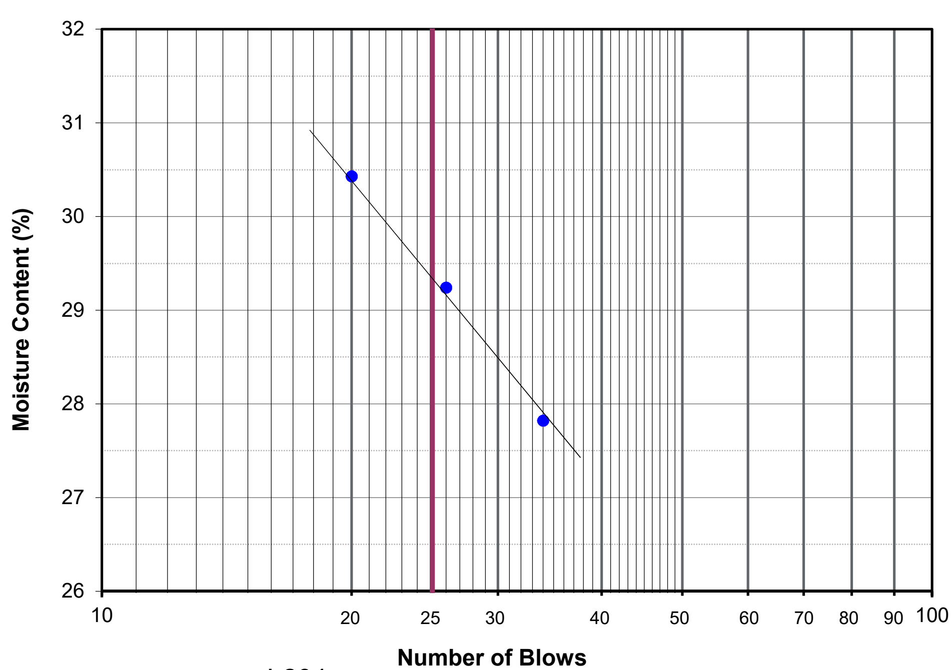
PROCEDURES USED

☐ Wet Preparation
Multipoint - Wet

☒ Dry Preparation
Multipoint - Dry

☒ Procedure A
Multipoint Test

☐ Procedure B
One-point Test



EXPANSION INDEX of SOILS
ASTM D 4829

Leighton

Project Name:	Chaffey Fontana Campus	Tested By: G. Berdy	Date: 09/21/22
Project No.:	12691.011	Checked By: A. Santos	Date: 10/02/22
Boring No.:	LB-8	Depth (ft.): 0-5	
Sample No.:	B-1		
Soil Identification:	Olive brown silty sand (SM)		

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0000
Wt. Comp. Soil + Mold (g)	596.40	428.30
Wt. of Mold (g)	190.00	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	819.60	618.30
Dry Wt. of Soil + Cont. (g)	751.90	562.84
Wt. of Container (g)	0.00	190.00
Moisture Content (%)	9.00	14.88
Wet Density (pcf)	122.6	129.2
Dry Density (pcf)	112.5	112.5
Void Ratio	0.499	0.499
Total Porosity	0.333	0.333
Pore Volume (cc)	68.9	68.9
Degree of Saturation (%) [S_{meas}]	**48.7**	80.5

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
09/21/22	12:00	1.0	0	0.5440
09/21/22	12:10	1.0	10	0.5440
Add Distilled Water to the Specimen				
09/21/22	13:16	1.0	66	0.5435
09/22/22	5:38	1.0	1048	0.5440
09/22/22	7:26	1.0	1156	0.5440

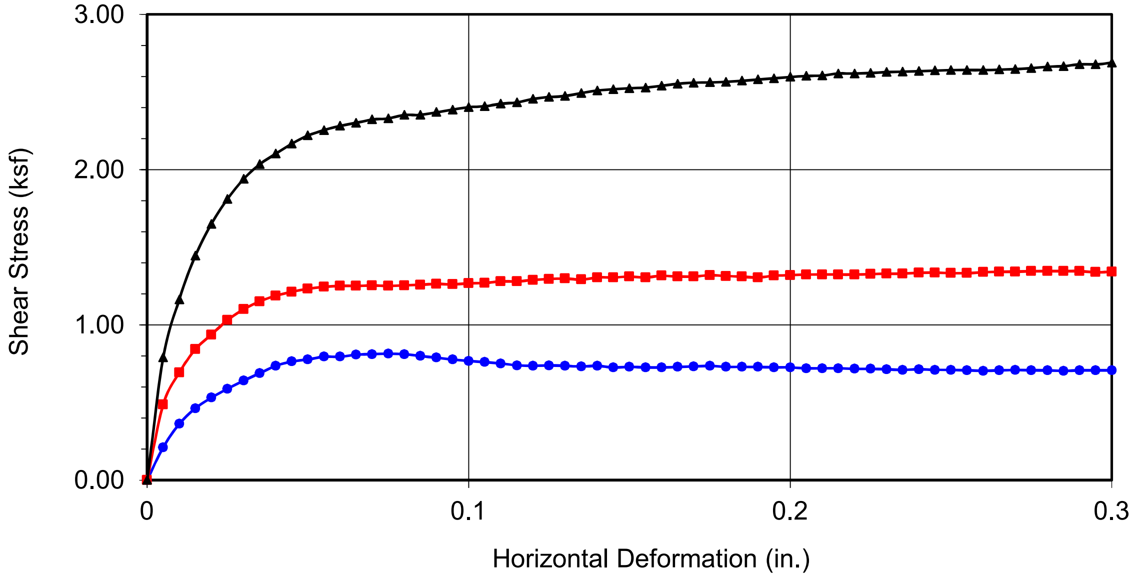
Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**0**

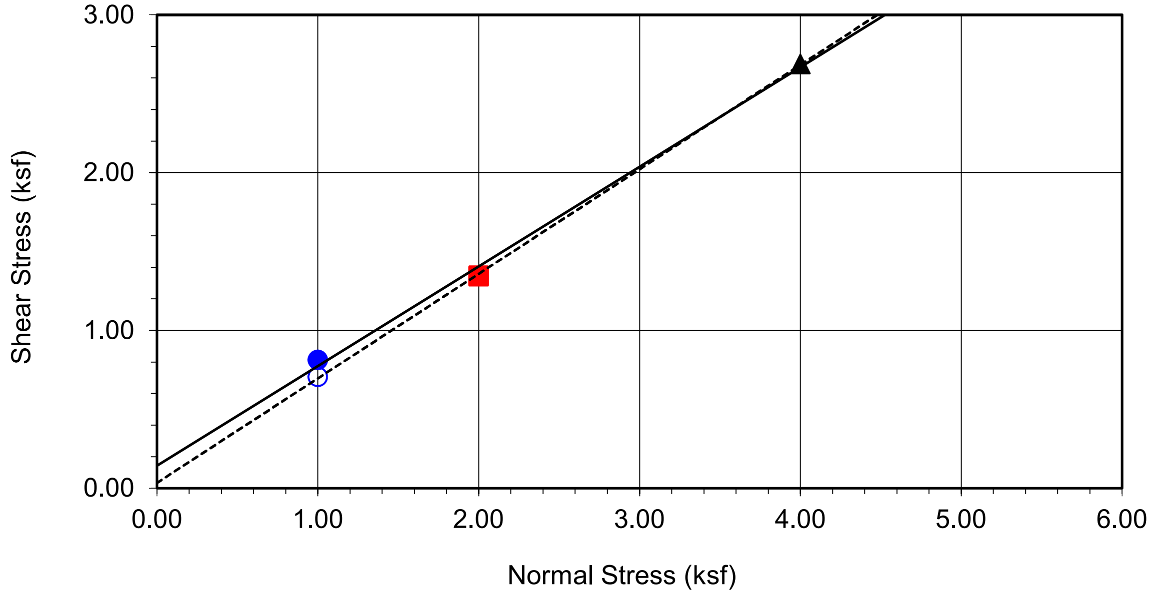
DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	Chaffey Fontana Campus	Tested By:	G. Bathala	Date:	09/26/22
Project No.:	12691.011	Checked By:	A. Santos	Date:	10/02/22
Boring No.:	LB-8	Sample Type:	90% Remold		
Sample No.:	B-1	Depth (ft.):	0-5		
Soil Identification:	Olive brown silty sand (SM)				

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	182.84	182.58	182.70
Weight of Ring(gm):	45.65	45.46	45.45
Before Shearing			
Weight of Wet Sample+Cont.(gm):	139.00	139.00	139.00
Weight of Dry Sample+Cont.(gm):	130.09	130.09	130.09
Weight of Container(gm):	39.81	39.81	39.81
Vertical Rdg.(in): Initial	0.2593	0.2582	0.0000
Vertical Rdg.(in): Final	0.2673	0.2710	-0.0185
After Shearing			
Weight of Wet Sample+Cont.(gm):	196.94	218.60	209.55
Weight of Dry Sample+Cont.(gm):	176.86	197.92	188.80
Weight of Container(gm):	56.64	77.77	66.52
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-8**
Sample No.	**B-1**
Depth (ft)	**0-5**
Sample Type:	90% Remold
Soil Identification:	Olive brown silty sand (SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	143	32
Ultimate	34	34

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.814	■ 1.346	▲ 2.688
Shear Stress @ End of Test (ksf)	○ 0.707	□ 1.342	△ 2.688
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.87	9.87	9.87
Dry Density (pcf)	103.8	103.8	103.9
Saturation (%)	42.8	42.7	42.8
Soil Height Before Shearing (in.)	0.9920	0.9872	0.9815
Final Moisture Content (%)	16.7	17.2	17.0

Leighton

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 12691.011

Chaffey Fontana Campus

09-22

DS LB-8, B-1 @ 0-5

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS
ASTM D 4546

Project Name:	Chaffey Fontana Campus	Tested By:	G. Bathala	Date:	09/23/22
Project No.:	12691.011	Checked By:	A. Santos	Date:	10/02/22
Boring No.:	LB-3	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.)	7.5		
Sample Description:	Light olive brown silt with sand (ML)s				

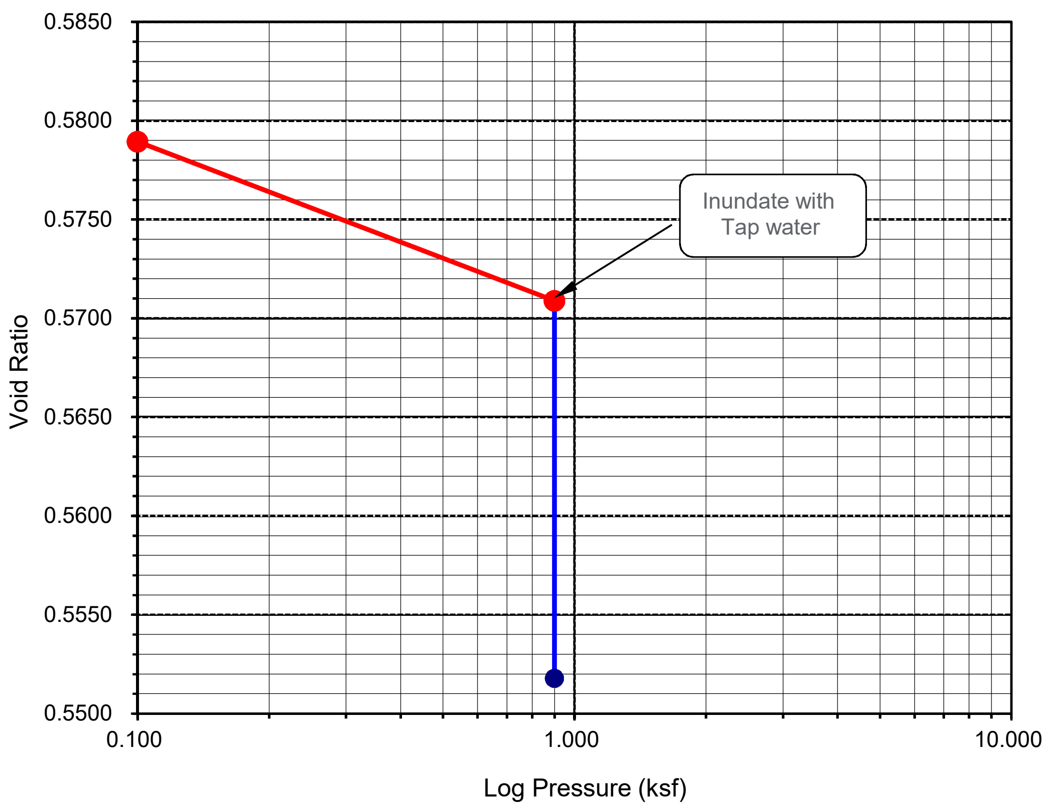
Initial Dry Density (pcf):	106.8
Initial Moisture (%):	4.24
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0900
Diameter(in):	2.415

Final Dry Density (pcf):	109.1
Final Moisture (%) :	18.0
Initial Void ratio:	0.5789
Specific Gravity(assumed):	2.70
Initial Saturation (%)	19.8

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.0900	1.0000	0.00	0.00	0.5789	0.00
0.900	0.0971	0.9929	0.20	-0.71	0.5709	-0.51
H_2O	0.1092	0.9808	0.20	-1.92	0.5518	-1.72

Percent Swell (+) / Settlement (-) After Inundation = -1.22

Void Ratio - Log Pressure Curve



ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS
ASTM D 4546

Leighton

Project Name:	Chaffey Fontana Campus	Tested By:	G. Bathala	Date:	09/23/22
Project No.:	12691.011	Checked By:	A. Santos	Date:	10/02/22
Boring No.:	LB-9	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.)	7.5		
Sample Description:	Olive silt with sand (ML)s				

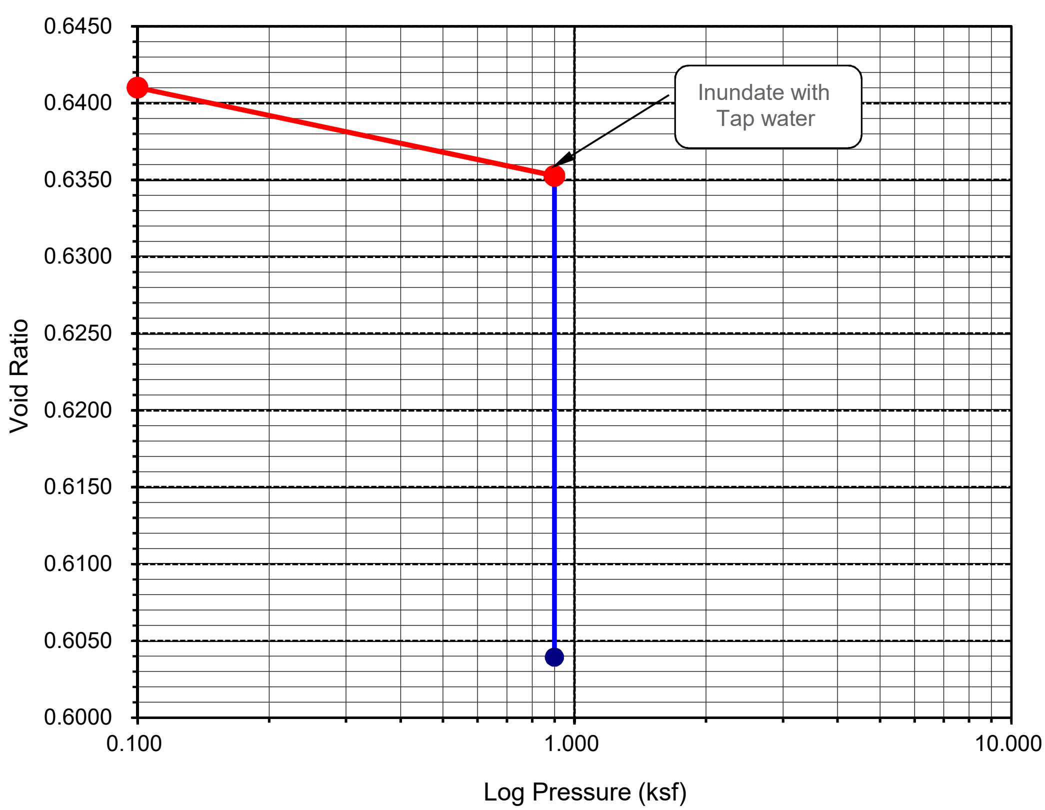
Initial Dry Density (pcf):	102.7
Initial Moisture (%):	3.36
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0927
Diameter(in):	2.415

Final Dry Density (pcf):	105.5
Final Moisture (%) :	18.9
Initial Void ratio:	0.6412
Specific Gravity(assumed):	2.70
Initial Saturation (%)	14.1

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.0928	0.9999	0.00	-0.01	0.6410	-0.01
0.900	0.0983	0.9944	0.20	-0.56	0.6353	-0.36
H2O	0.1174	0.9753	0.20	-2.47	0.6039	-2.27

Percent Swell (+) / Settlement (-) After Inundation = -1.92

Void Ratio - Log Pressure Curve



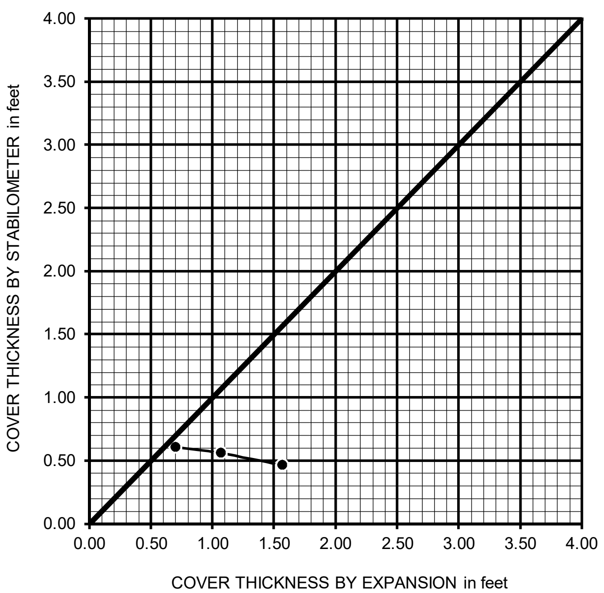
R-VALUE TEST RESULTS
DOT CA Test 301

PROJECT NAME:	Chaffey Fontana Campus	PROJECT NUMBER:	12691.011
BORING NUMBER:	LB-2	DEPTH (FT.):	0-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	O. Figueroa
SAMPLE DESCRIPTION:	Dark brown sandy silt s(ML)	DATE COMPLETED:	9/30/2022

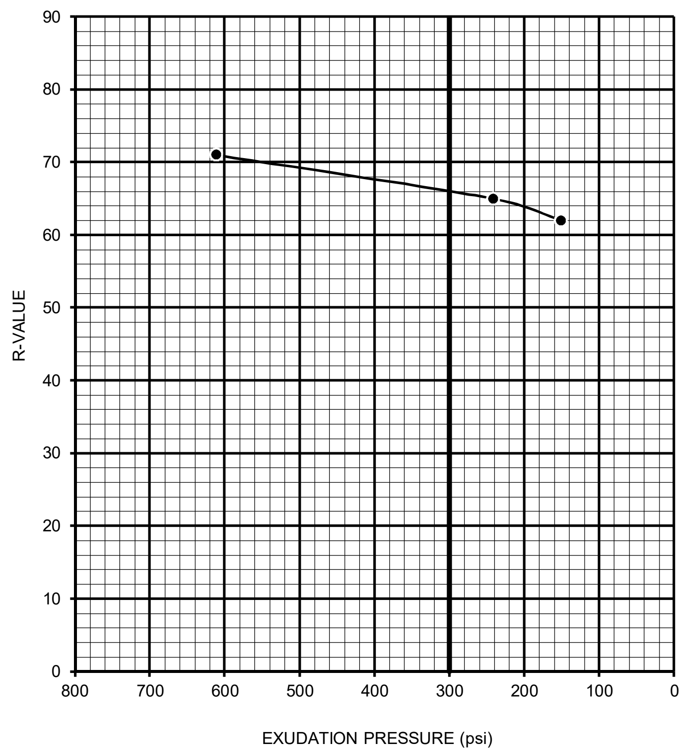
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	10.2	11.1	11.9
HEIGHT OF SAMPLE, Inches	2.47	2.47	2.54
DRY DENSITY, pcf	120.6	120.6	119.9
COMPACTOR PRESSURE, psi	325	275	180
EXUDATION PRESSURE, psi	611	241	150
EXPANSION, Inches x 10exp-4	47	32	21
STABILITY Ph 2,000 lbs (160 psi)	27	31	34
TURNS DISPLACEMENT	5.11	5.52	5.70
R-VALUE UNCORRECTED	71	65	62
R-VALUE CORRECTED	71	65	62

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.46	0.56	0.61
EXPANSION PRESSURE THICKNESS, ft.	1.57	1.07	0.70

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	59
R-VALUE BY EXUDATION:	66
EQUILIBRIUM R-VALUE:	59

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name:	Chaffey Fontana Campus	Tested By :	G. Berdy	Date: 09/21/22
Project No. :	12691.011	Checked By:	A. Santos	Date: 10/02/22

Boring No.	LB-8			
Sample No.	B-1			
Sample Depth (ft)	0-5			
Soil Identification:	Olive brown SM			
Wet Weight of Soil + Container (g)	0.00			
Dry Weight of Soil + Container (g)	0.00			
Weight of Container (g)	1.00			
Moisture Content (%)	0.00			
Weight of Soaked Soil (g)	100.34			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	7			
Crucible No.	5			
Furnace Temperature (°C)	860			
Time In / Time Out	7:10/7:55			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	18.5057			
Wt. of Crucible (g)	18.5037			
Wt. of Residue (g) (A)	0.0020			
PPM of Sulfate (A) x 41150	82.30			
PPM of Sulfate, Dry Weight Basis	**82**			

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15			
ml of AgNO3 Soln. Used in Titration (C)	1.1			
PPM of Chloride (C -0.2) * 100 * 30 / B	180			
PPM of Chloride, Dry Wt. Basis	**180**			

pH TEST, DOT California Test 643

pH Value	**6.80**			
Temperature °C	20.4			

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	Chaffey Fontana Campus	Tested By :	J. Domingo Date: 09/29/22
Project No. :	12691.011	Checked By:	A. Santos Date: 10/02/22
Boring No.:	LB-8	Depth (ft.) :	0-5
Sample No. :	B-1		

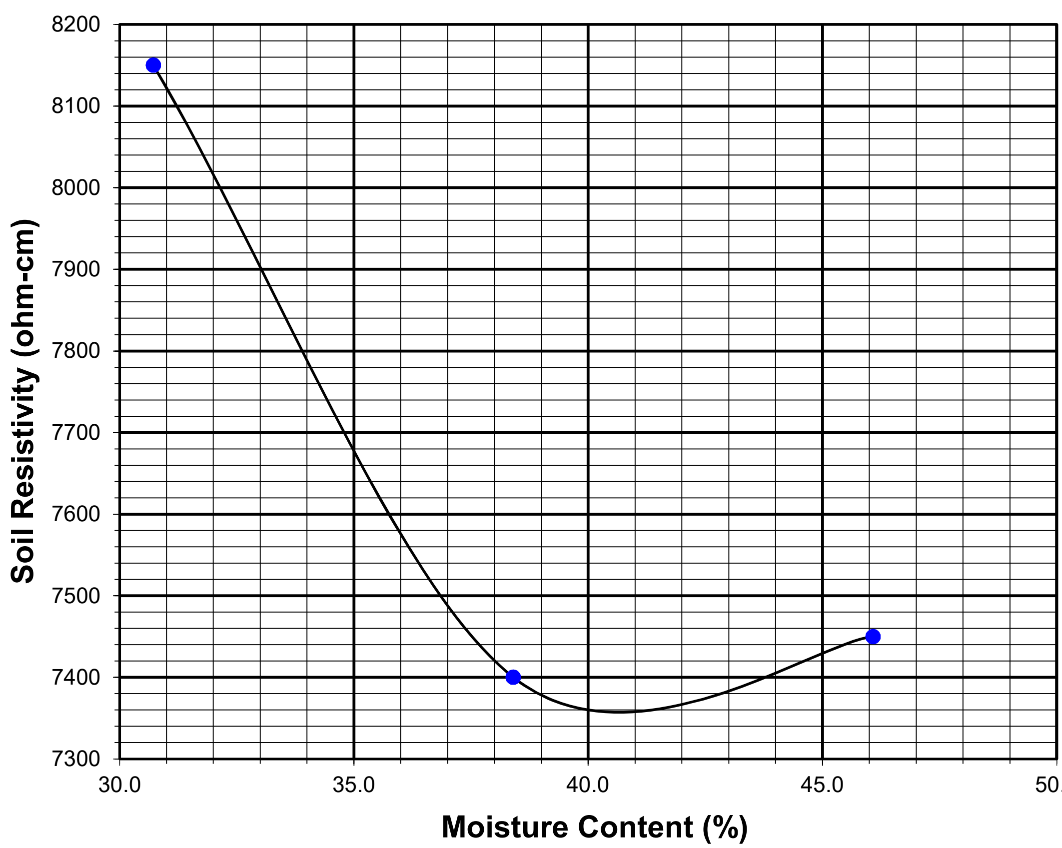
Soil Identification:* Olive brown SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	40	30.72	8150	8150
2	50	38.40	7400	7400
3	60	46.08	7450	7450
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.20
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
7360	**40.5**	**82**	**180**	**6.80**	**20.4**



APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

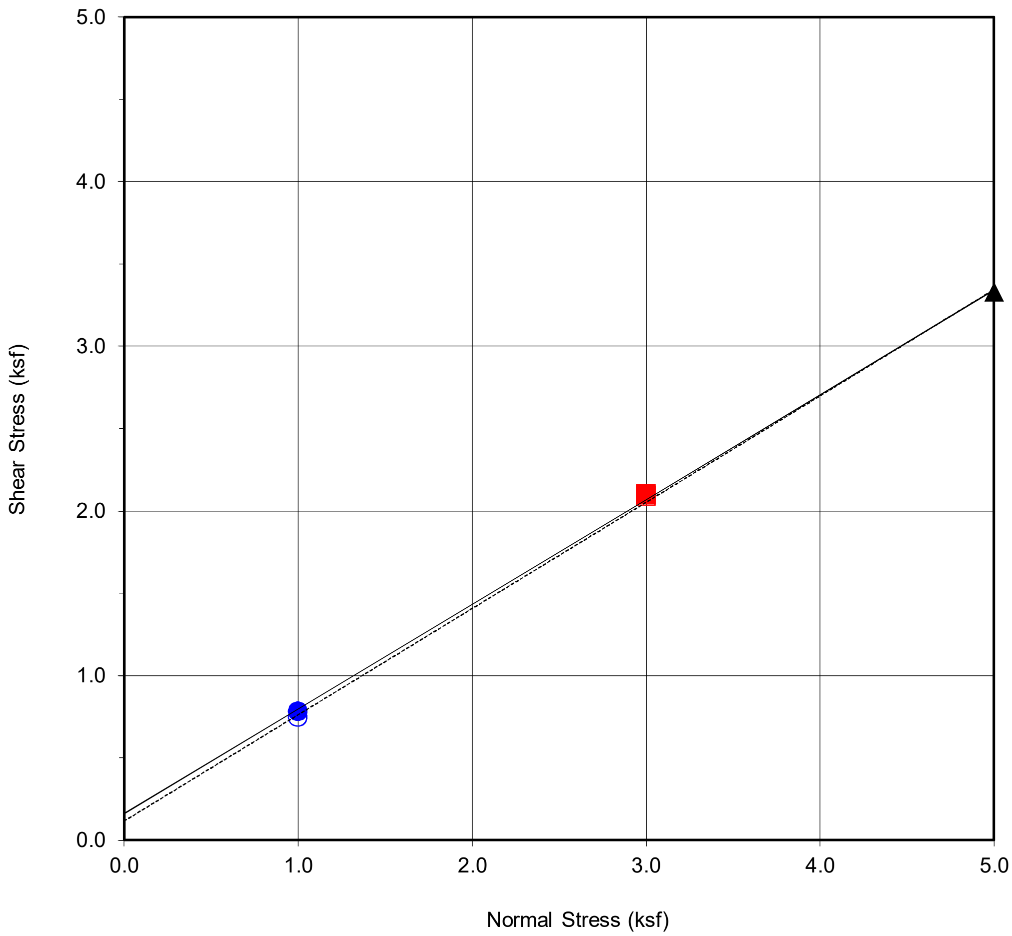
(GEOCON WEST, INC.)

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the International ASTM, or other suggested procedures. Selected samples were tested for direct shear strength, compaction, consolidation characteristics, expansive index, corrosivity, grain-size distribution, in-place dry density and moisture content. The results of the laboratory tests are summarized in Figures B1 through B23. The in-place dry density and moisture content of the samples tested are presented on the boring logs, Appendix A.



Boring No.	**B1**
Sample No.	**B1@0-5'**
Depth (ft)	**0-5'**
Sample Type:	Ring

Soil Identification:		
Light Brown Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ (^{o})
Peak	160	32.5
Ultimate	116	32.9

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.78	■ 2.10	▲ 3.33
Shear Stress @ End of Test (ksf)	○ 0.75	□ 2.09	△ 3.33
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	9.4	9.4	9.5
Initial Dry Density (pcf)	106.0	106.0	106.0
Initial Degree of Saturation (%)	43.2	43.1	43.3
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	22.7	21.8	22.9

GEOCON

DIRECT SHEAR TEST RESULTS

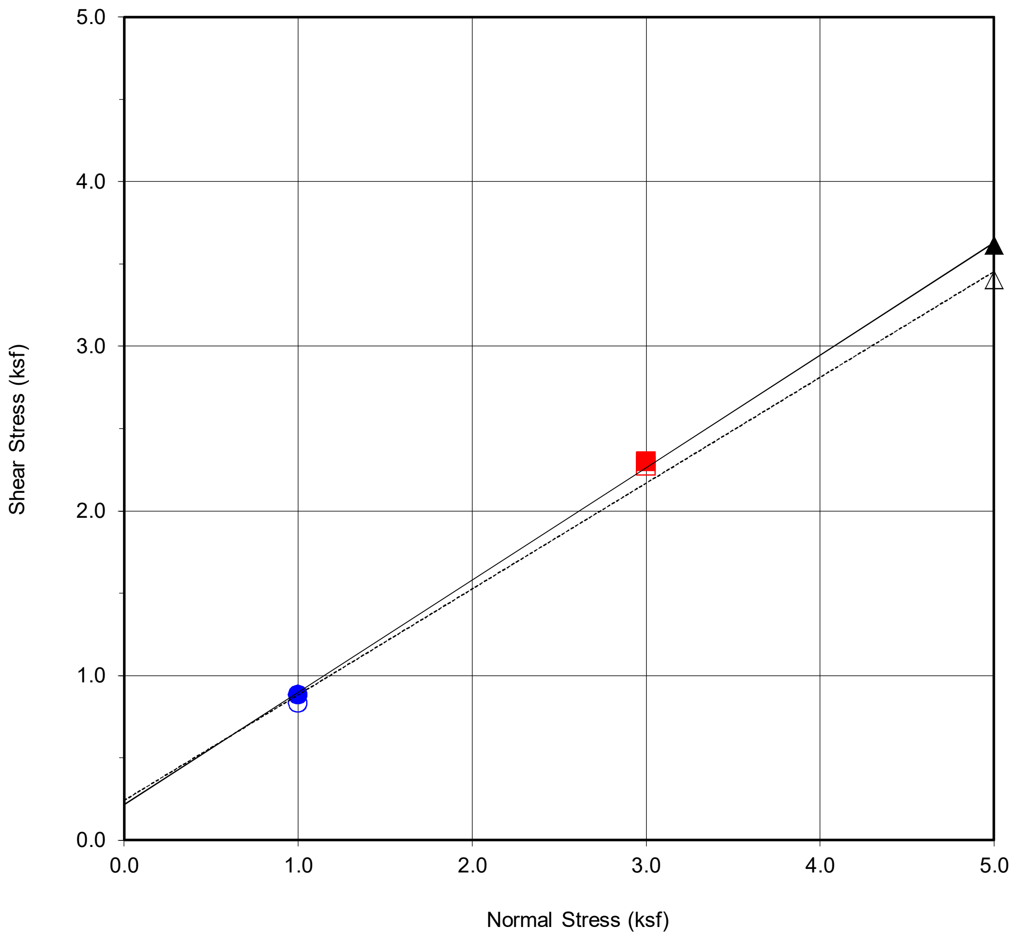
Consolidated Drained ASTM D-3080

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B1



Boring No.	B2
Sample No.	B2@2'
Depth (ft)	2
Sample Type:	Ring

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.88	■ 2.30	▲ 3.61
Shear Stress @ End of Test (ksf)	○ 0.83	□ 2.27	△ 3.40
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	9.6	10.1	10.8
Initial Dry Density (pcf)	101.0	106.5	107.3
Initial Degree of Saturation (%)	38.8	46.8	51.2
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	18.6	16.5	15.5

Soil Identification:

Light Brown Silty Sand (SM)

Strength Parameters

	C (psf)	ϕ (^{o})
Peak	216	34.3
Ultimate	241	32.7

GEOCON

DIRECT SHEAR TEST RESULTS

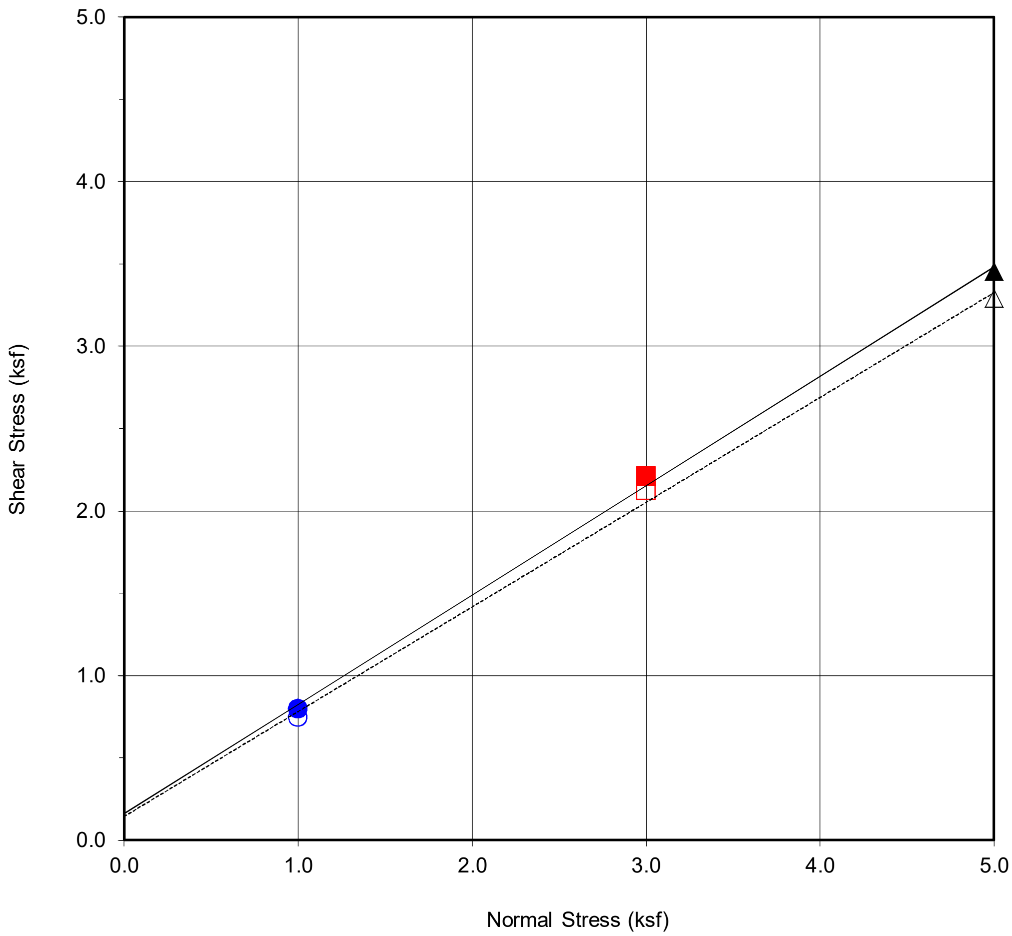
Consolidated Drained ASTM D-3080

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B2



Boring No.	**B3**
Sample No.	**B3@2'**
Depth (ft)	**2**
Sample Type:	Ring

Soil Identification:		
Brown Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ (^{o})
Peak	160	33.6
Ultimate	143	32.5

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.80	■ 2.21	▲ 3.45
Shear Stress @ End of Test (ksf)	○ 0.75	□ 2.12	△ 3.29
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	9.7	11.7	10.9
Initial Dry Density (pcf)	101.5	103.4	107.4
Initial Degree of Saturation (%)	39.7	50.3	51.9
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	16.6	15.3	15.2

GEOCON

DIRECT SHEAR TEST RESULTS

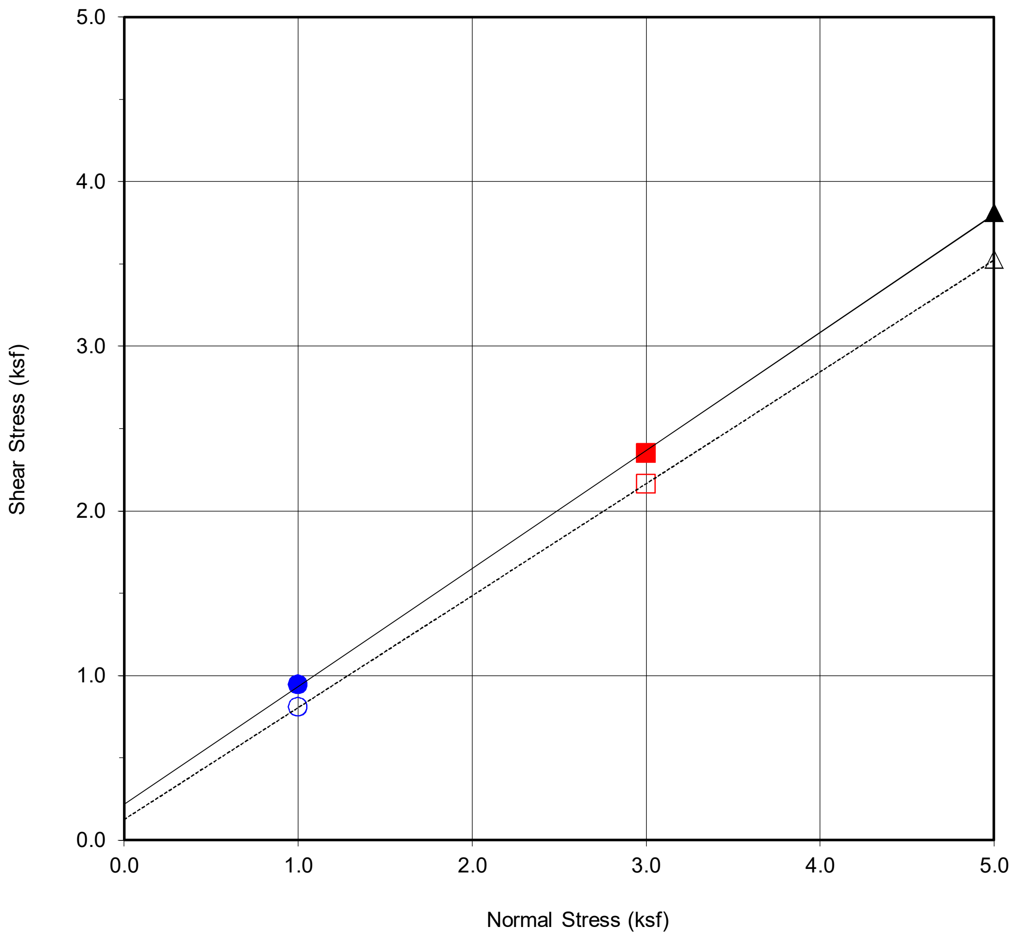
Consolidated Drained ASTM D-3080

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B3



Boring No.	**B4**
Sample No.	**B4@2'**
Depth (ft)	**2**
Sample Type:	Ring

Soil Identification:		
Brown Sandy Silt (ML)		
Strength Parameters		
	C (psf)	ϕ (^{o})
Peak	217	35.6
Ultimate	125	34.2

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.94	■ 2.35	▲ 3.81
Shear Stress @ End of Test (ksf)	○ 0.81	□ 2.16	△ 3.53
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	14.0	12.5	16.4
Initial Dry Density (pcf)	111.7	110.7	111.4
Initial Degree of Saturation (%)	74.4	64.4	86.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	16.4	15.4	14.8

GEOCON

DIRECT SHEAR TEST RESULTS

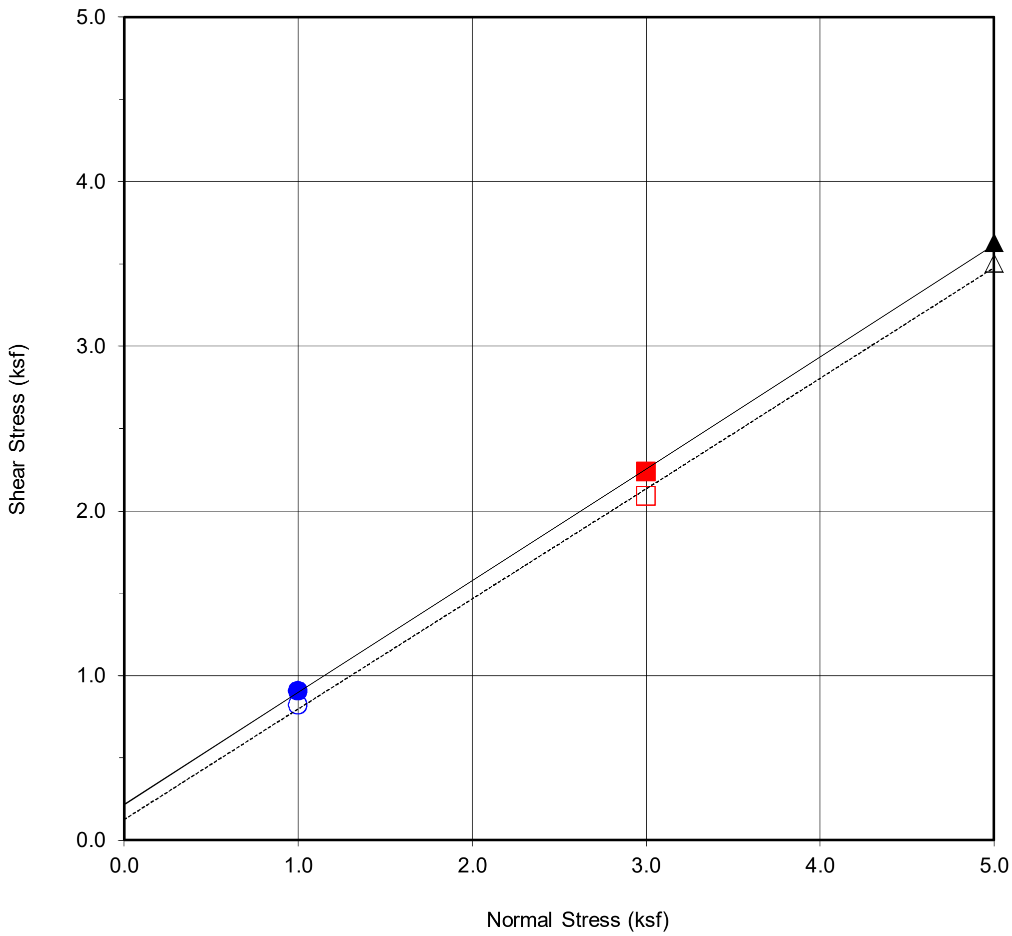
Consolidated Drained ASTM D-3080

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B4



Boring No.	B6
Sample No.	B6@2'
Depth (ft)	2
Sample Type:	Ring

Soil Identification:		
Brown Sandy Silt (ML)		
Strength Parameters		
	C (psf)	ϕ (°)
Peak	216	34.2
Ultimate	125	33.8

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.91	■ 2.24	▲ 3.63
Shear Stress @ End of Test (ksf)	○ 0.82	□ 2.09	△ 3.50
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	10.4	11.8	10.6
Initial Dry Density (pcf)	112.4	111.5	115.0
Initial Degree of Saturation (%)	56.0	62.5	61.5
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	16.2	15.6	14.8

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

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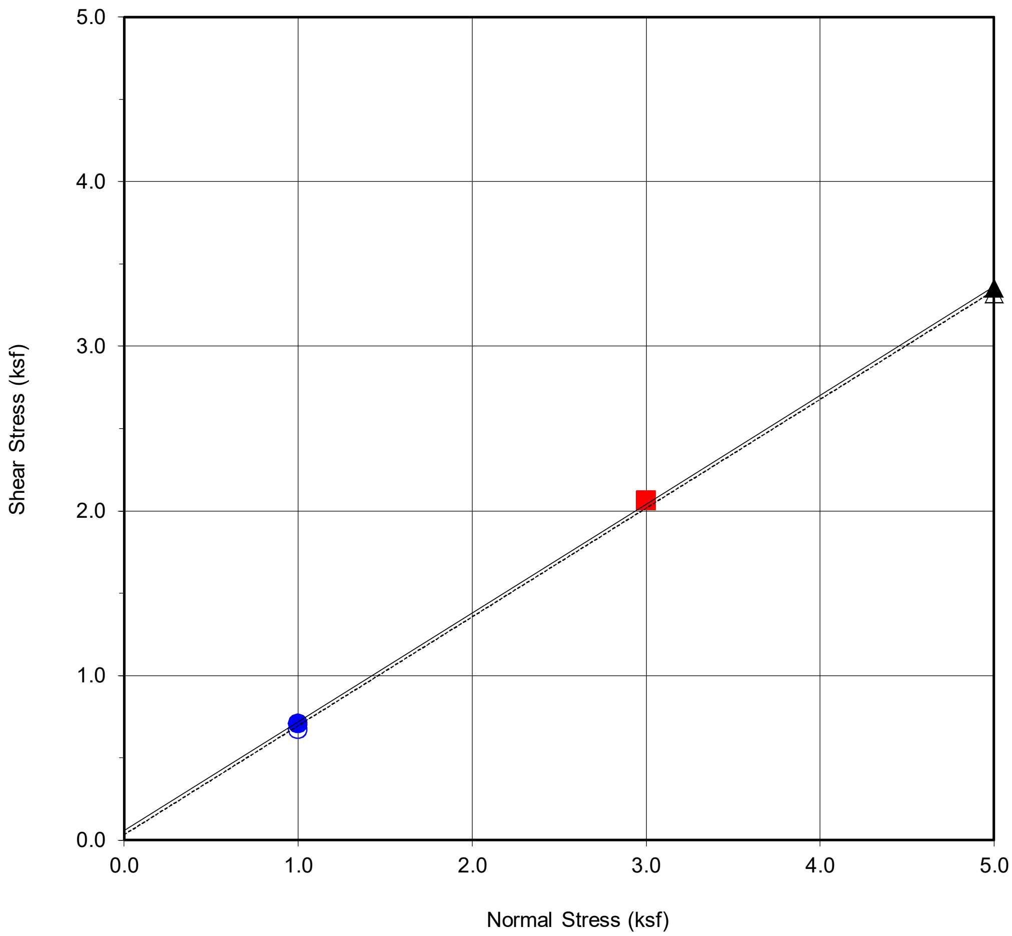
Figure B5



Boring No.	**B7**
Sample No.	**B7@0-5'**
Depth (ft)	**0-5'**
Sample Type:	Ring

Soil Identification:		
Brown Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ (°)
Peak	57	33.5
Ultimate	33	33.5

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.71	■ 2.06	▲ 3.35
Shear Stress @ End of Test (ksf)	○ 0.67	□ 2.06	△ 3.32
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	8.0	8.4	8.5
Initial Dry Density (pcf)	113.0	113.0	113.0
Initial Degree of Saturation (%)	43.8	46.4	46.9
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	8.1	5.8	6.8

GEOCON

DIRECT SHEAR TEST RESULTS

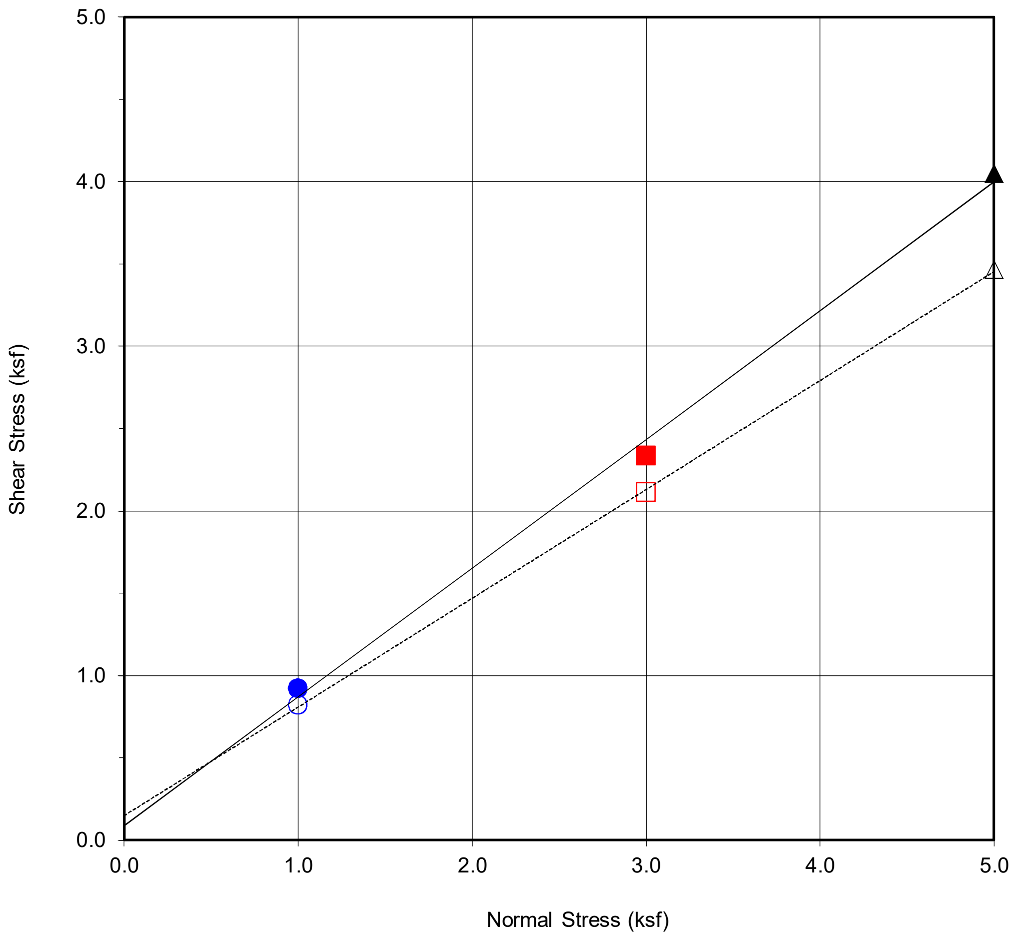
Consolidated Drained ASTM D-3080

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B6



Boring No.	B8
Sample No.	B8@2'
Depth (ft)	2
Sample Type:	Ring

Soil Identification:		
Brown Silty Sand (SM)		
Strength Parameters		
	C (psf)	ϕ (°)
Peak	87	38.0
Ultimate	149	33.5

Normal Stress (kip/ft2)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.92	■ 2.33	▲ 4.05
Shear Stress @ End of Test (ksf)	○ 0.82	□ 2.11	△ 3.46
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	8.9	9.9	12.7
Initial Dry Density (pcf)	99.4	100.3	101.0
Initial Degree of Saturation (%)	34.6	39.4	51.1
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	17.5	16.8	16.2

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DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

Checked by: JJK

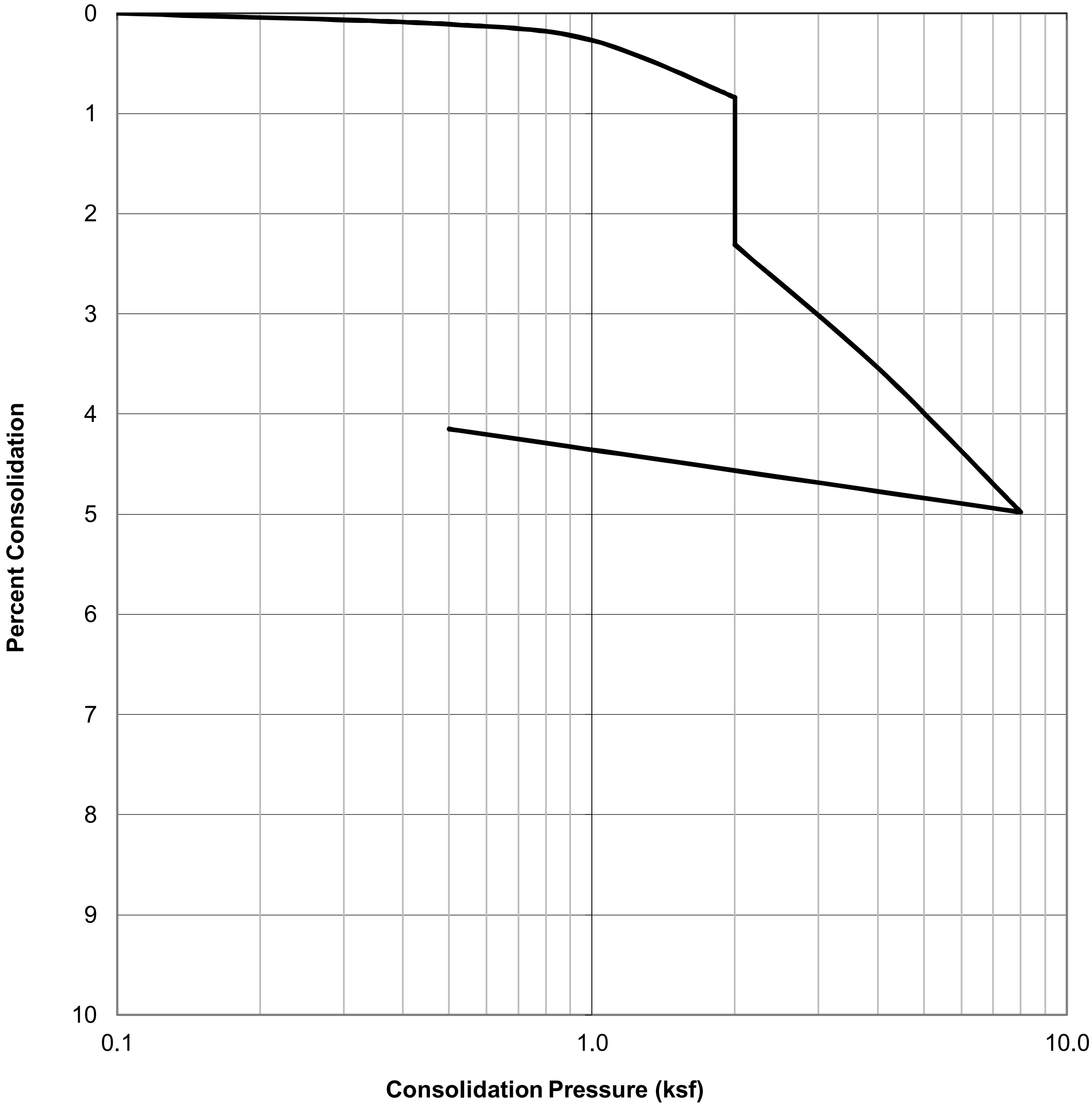
Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020

Figure B7

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@7	Light Brown Sandy Silt (ML)	104.1	3.5	16.3

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

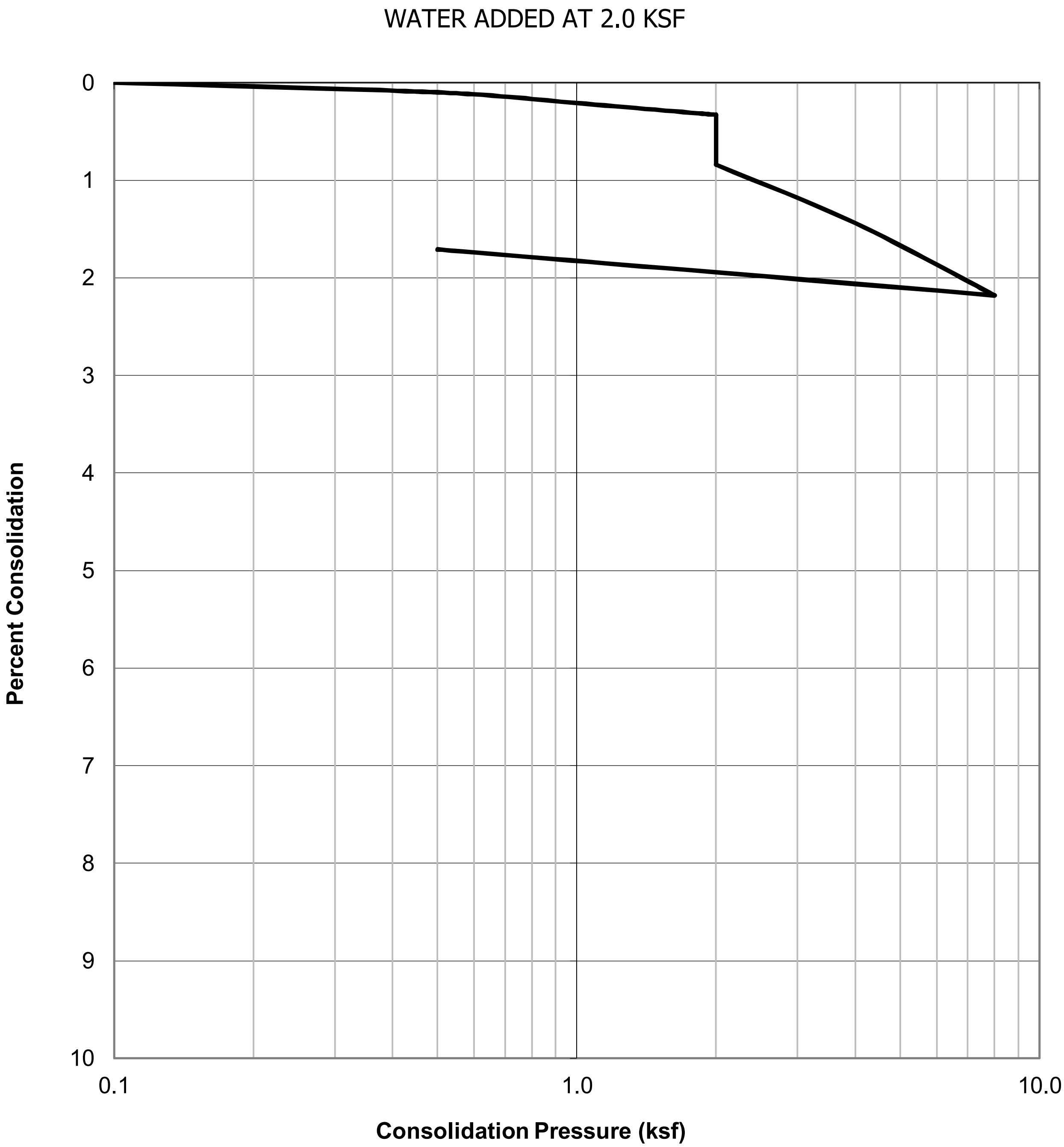
Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020

Figure B8



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@5	Brown Silty Sand (SM)	109.5	2.4	15.1

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

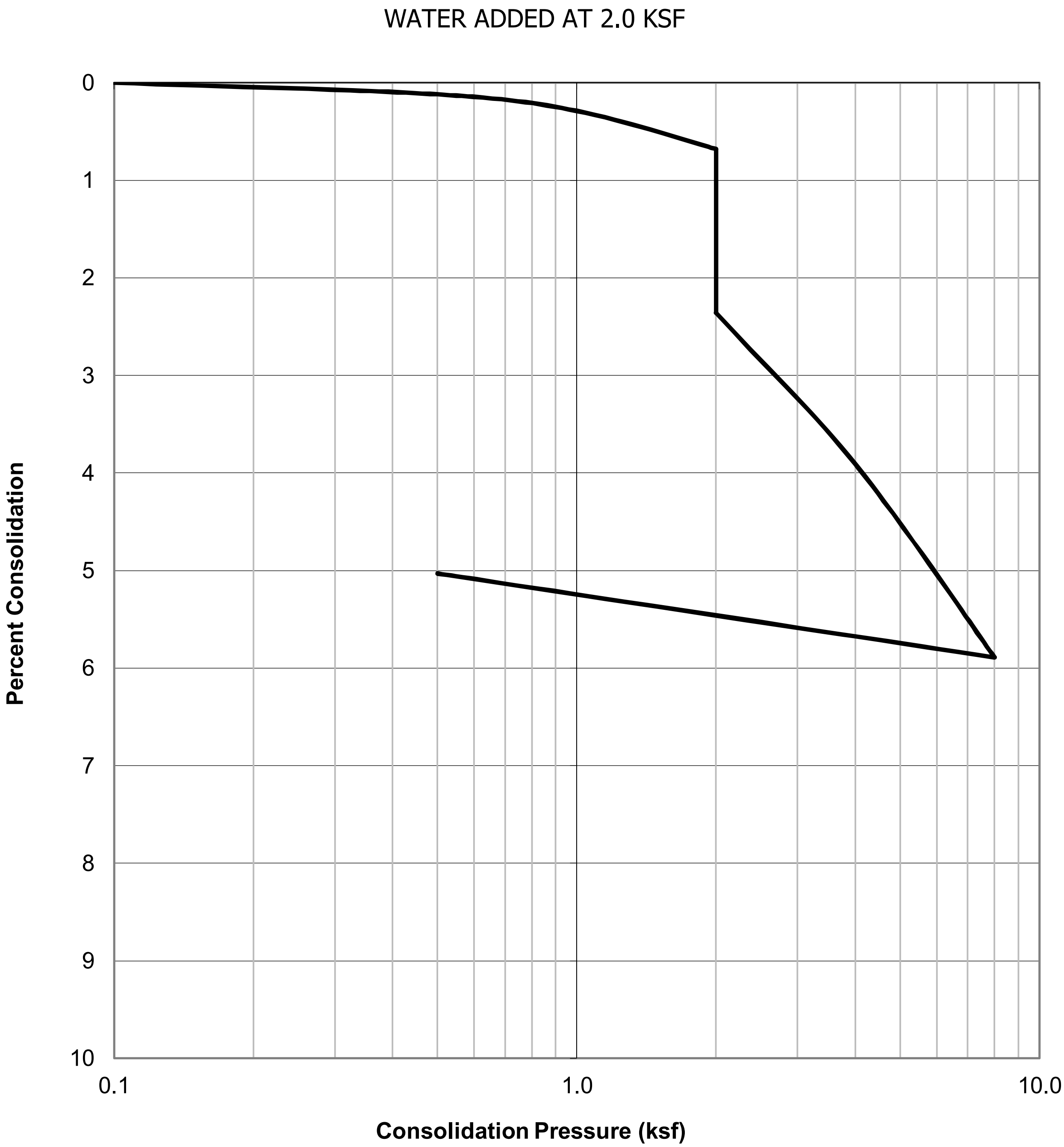
Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020

Figure B9



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@2	Brown Silt (ML)	107.8	7.4	16.9

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

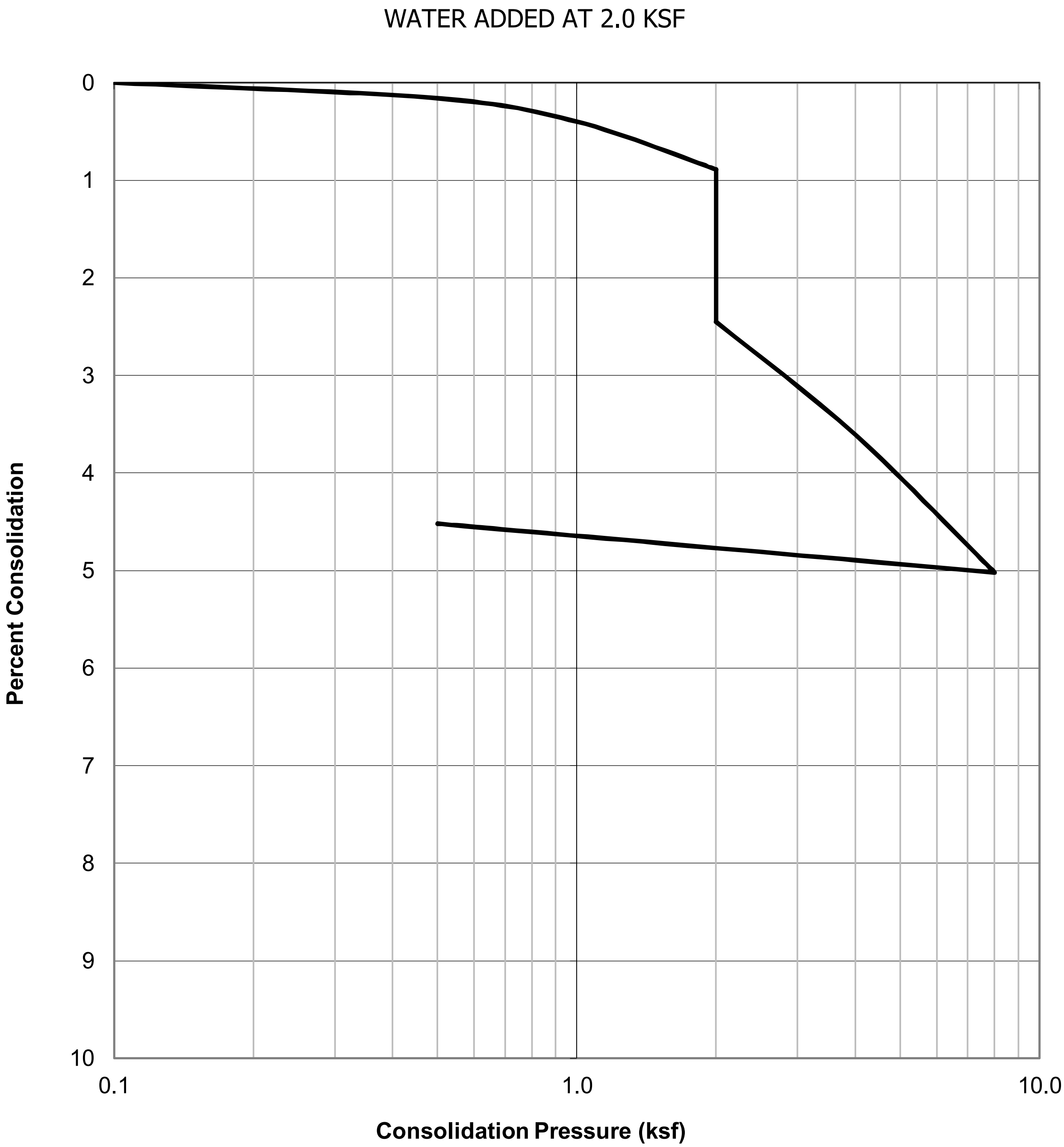
Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020

Figure B10



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@5	Light Brown Silt (ML)	111.9	2.4	14.0

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: JJK

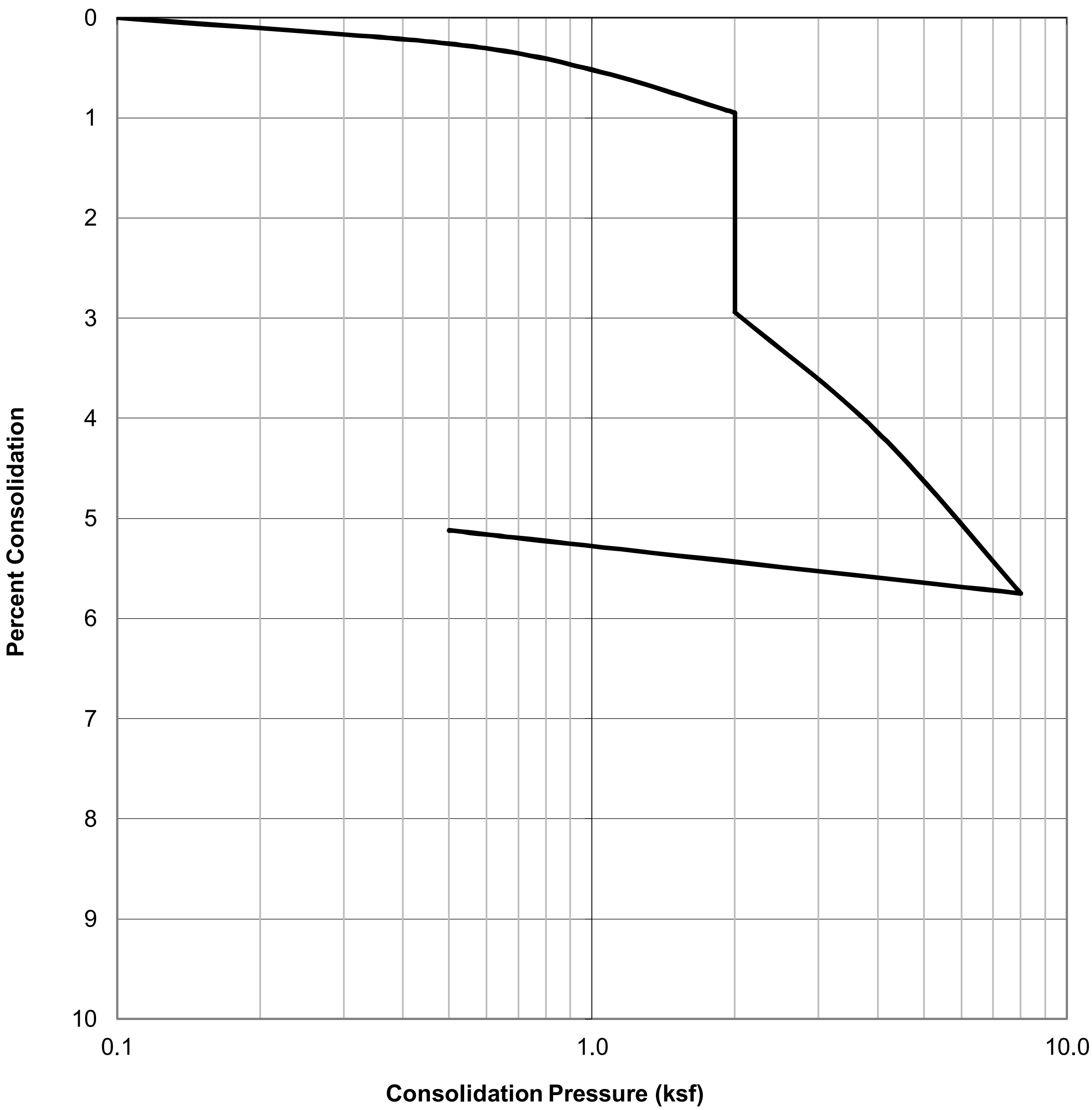
Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020

Figure B11

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@7	Light Brown Silt (ML)	104.2	3.3	16.6

GEOCON

CONSOLIDATION TEST RESULTS

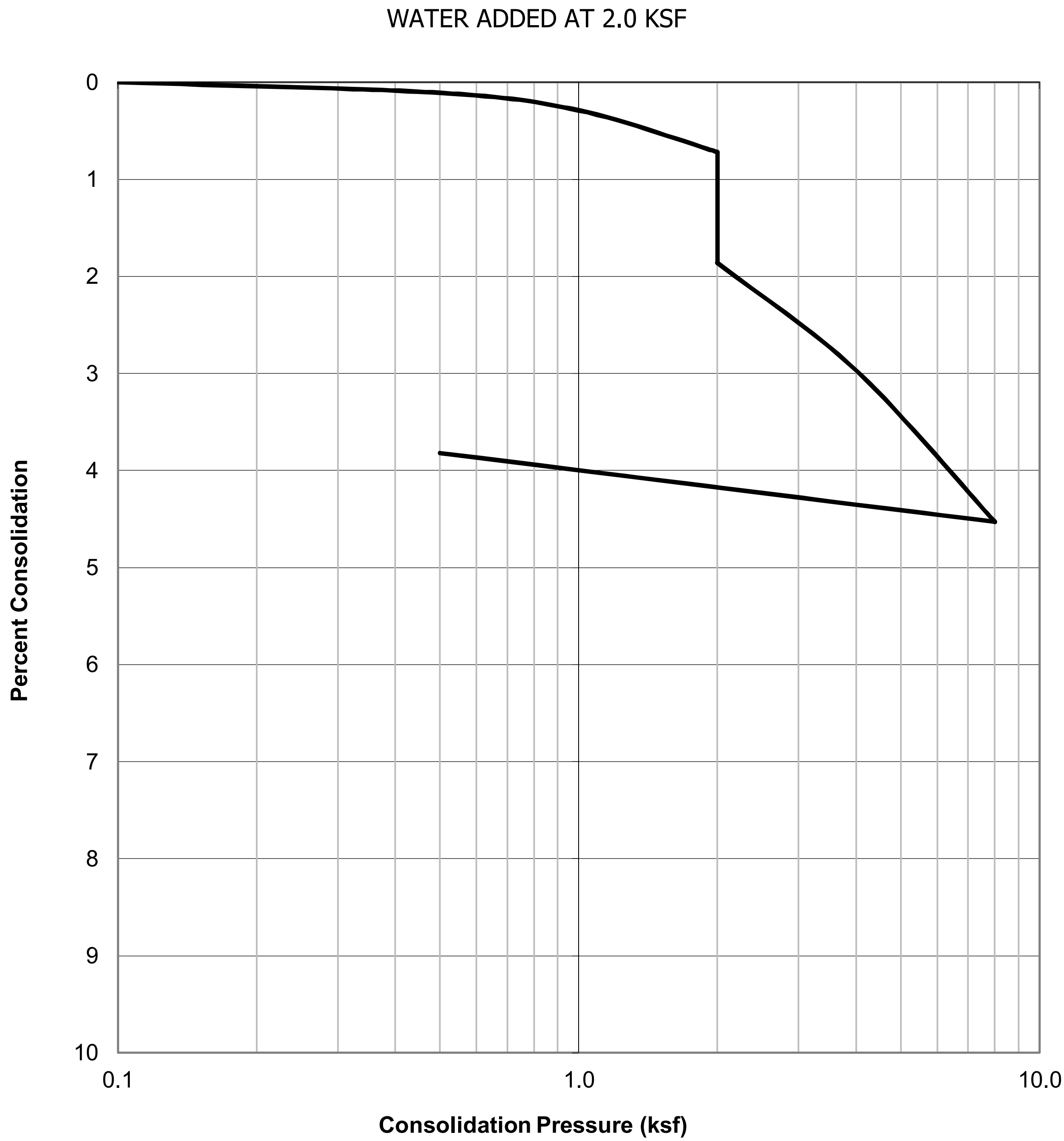
ASTM D-2435

Checked by: JJK

Project No.: T2746-99-10A

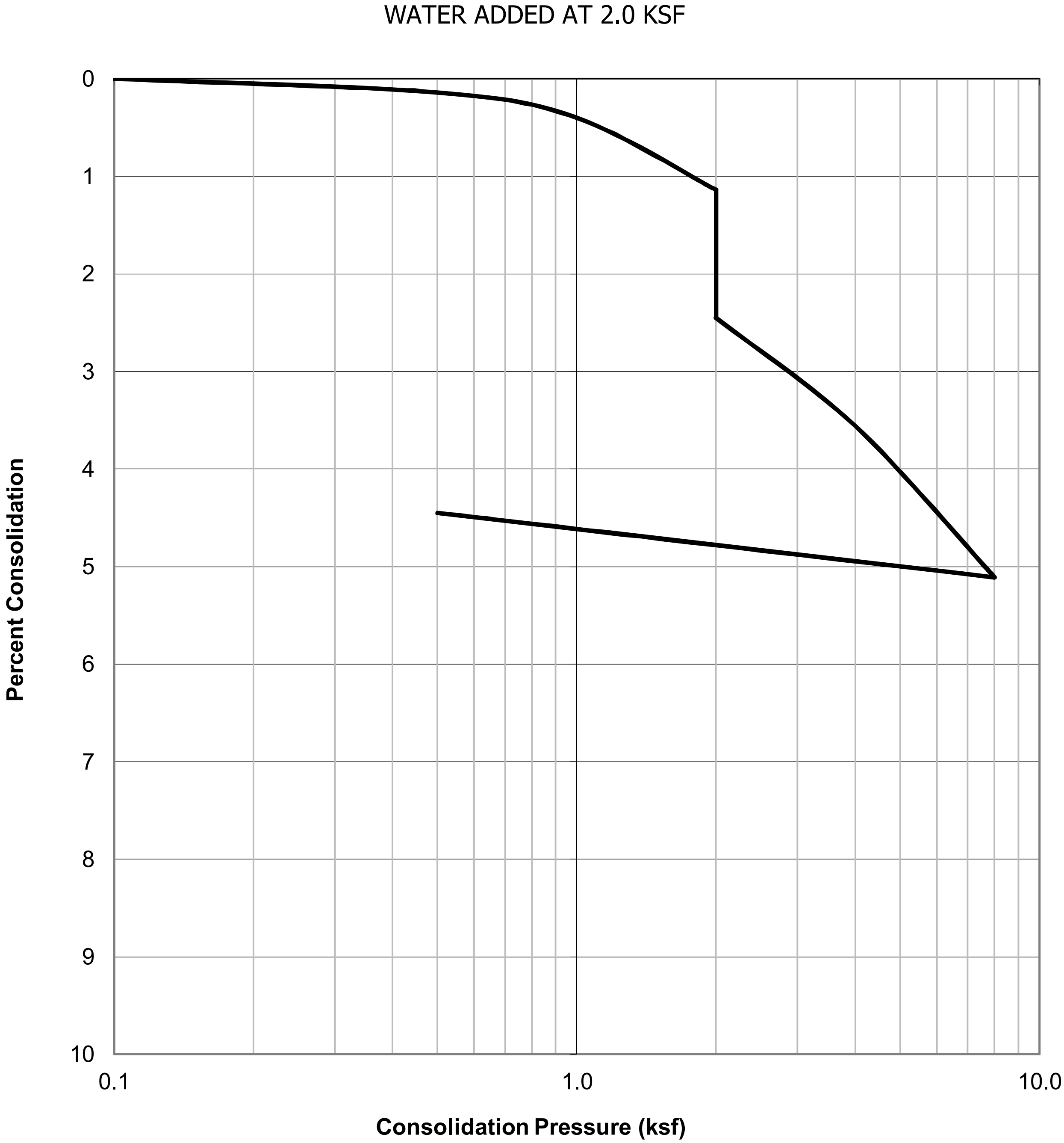
11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B12



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B7@10	Brown Silt (ML)	104.5	8.5	18.1

GEOCON	**CONSOLIDATION TEST RESULTS** ASTM D-2435	Project No.: T2746-99-10A
		11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA
	Checked by: JJK	FEB 2020 Figure B13



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B8@7	Light Brown Silt (ML)	104.6	10.7	17.7

GEOCON

CONSOLIDATION TEST RESULTS

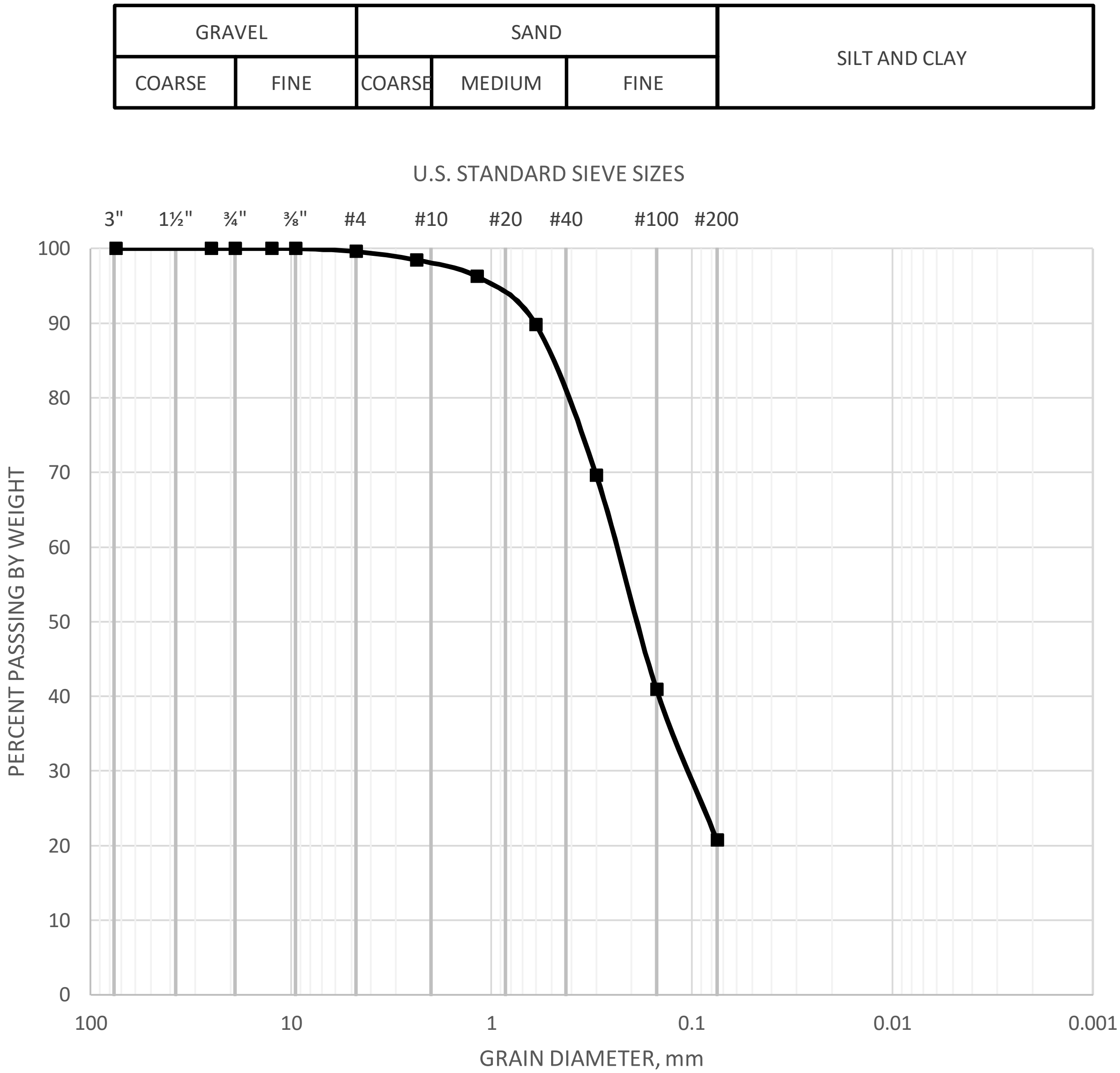
ASTM D-2435

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

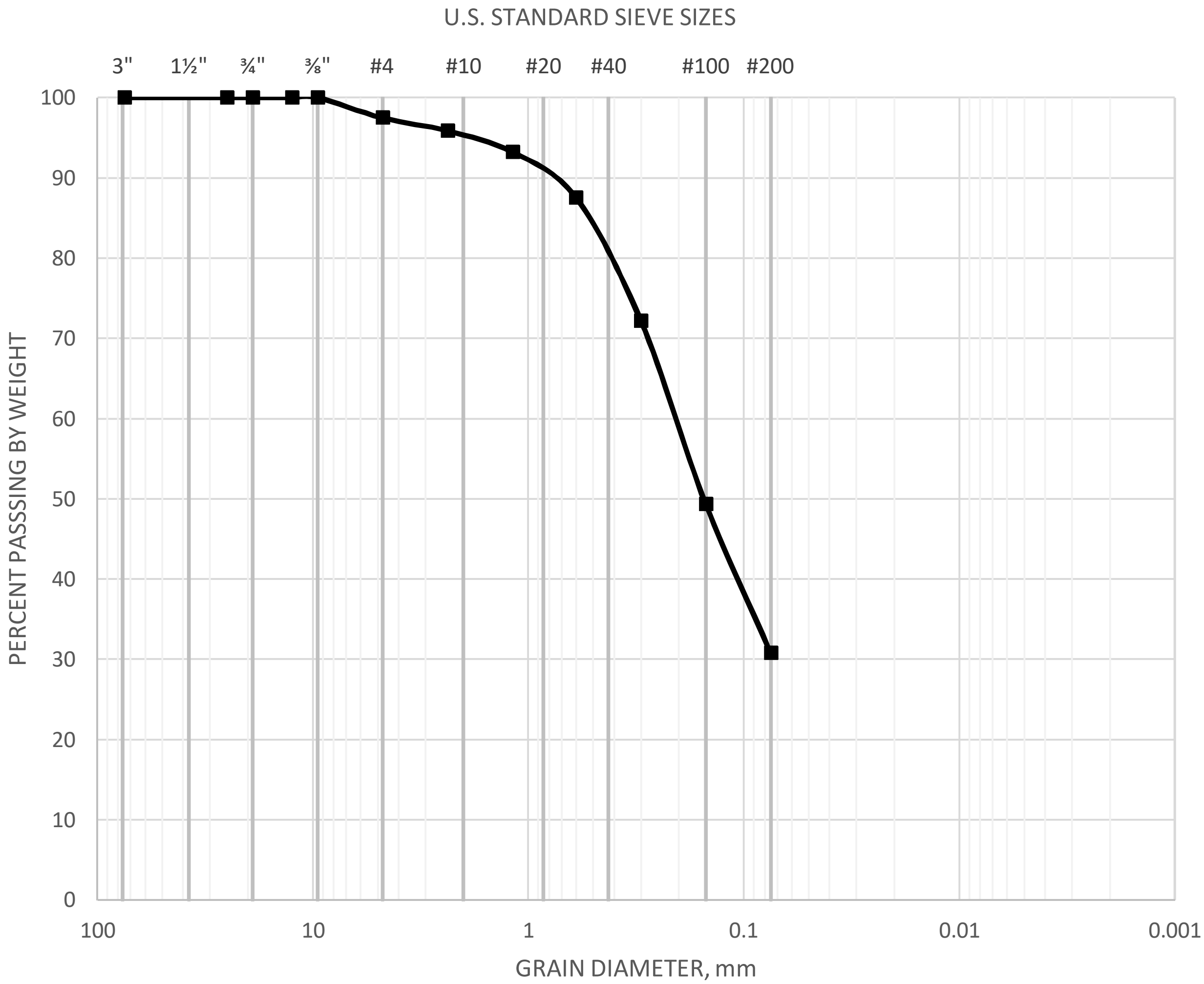
FEB 2020 Figure B14



SAMPLE	CLASSIFICATION	D60	D30	D10
B1@2'	Brown Silty Sand (SM)	2.36	0.68	0.25

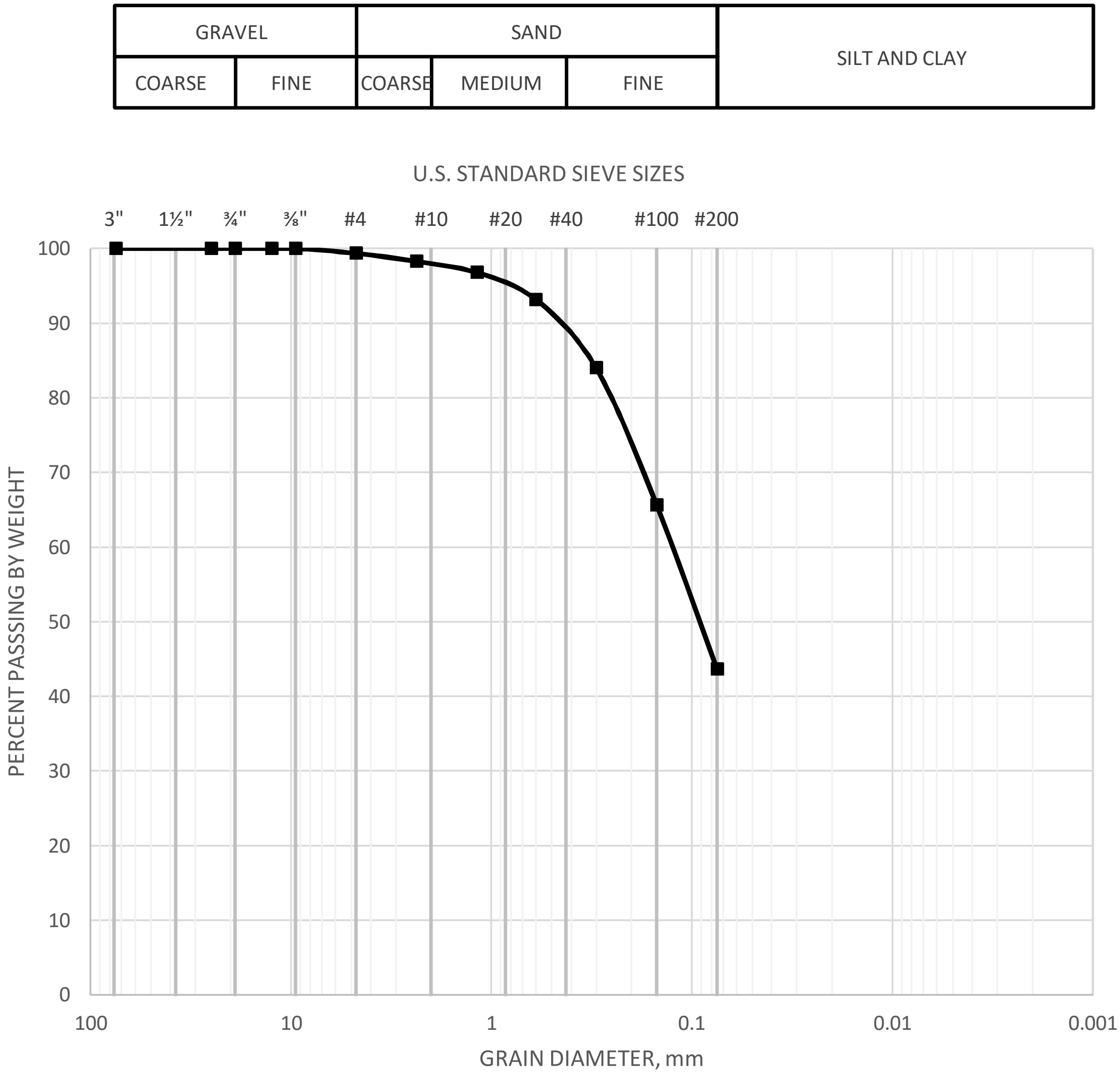
GEOCON	**GRAIN SIZE DISTRIBUTION** ASTM D-422	Project No.: T2746-99-10A
	Checked by: JJK	11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA
		FEB 2020 Figure B15

GRAVEL		SAND			SILT AND CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



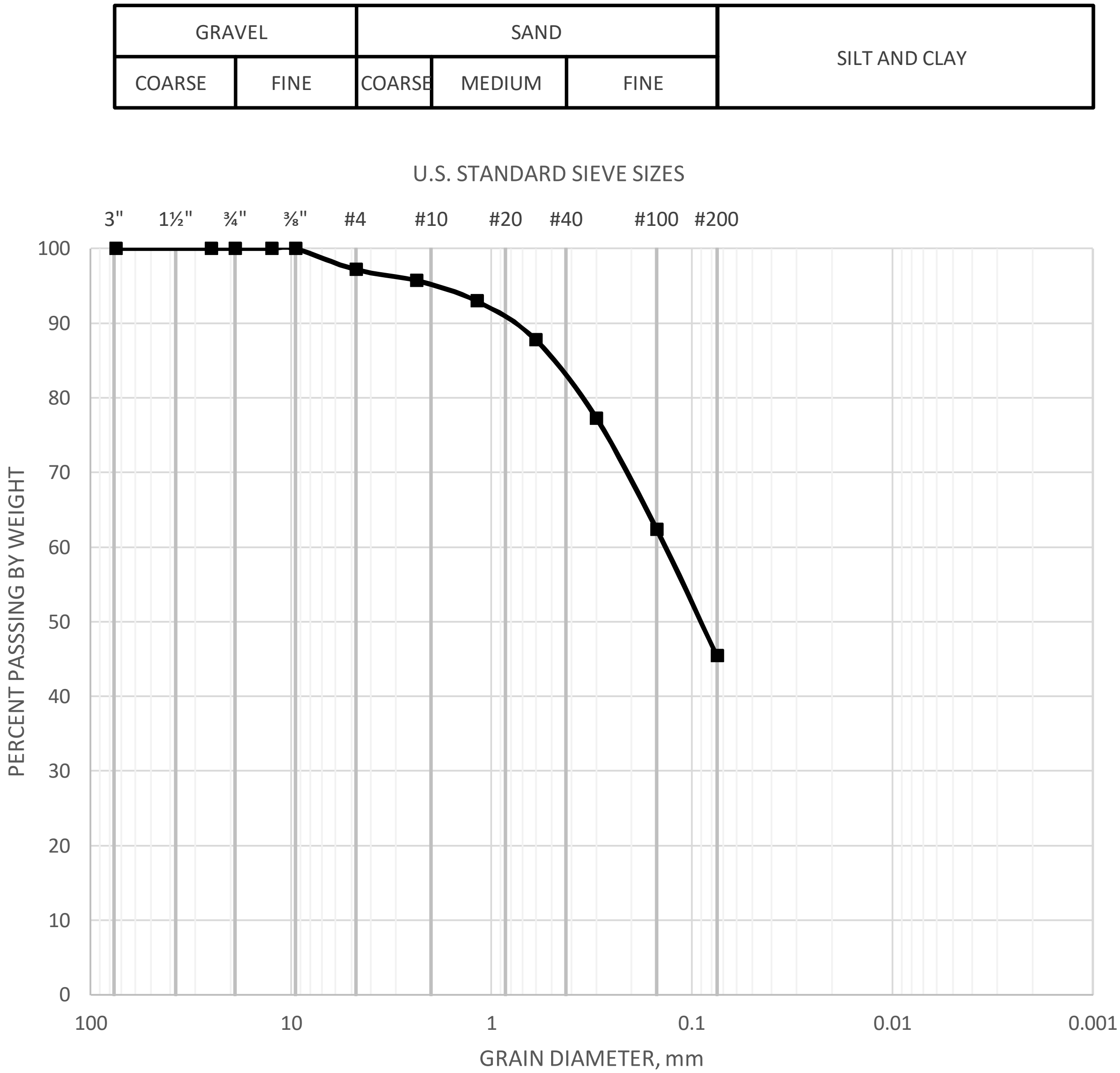
SAMPLE	CLASSIFICATION	D60	D30	D10
B3@2	Brown Silty Sand (SM)	2.36	0.68	0.25

GEOCON	**GRAIN SIZE DISTRIBUTION** ASTM D-422	Project No.: T2746-99-10A
		11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA
	Checked by: JJK	FEB 2020 Figure B16



SAMPLE	CLASSIFICATION	D60	D30	D10
B5@5'	Light Brown Silty Sand (SM)	2.36	0.68	0.25

GEOCON	**GRAIN SIZE DISTRIBUTION** ASTM D-422 Checked by: JJK	Project No.: T2746-99-10A 11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA FEB 2020 Figure B17



SAMPLE	CLASSIFICATION	D60	D30	D10
B6@2'	Brown Silty Sand (SM)	2.36	0.68	0.25

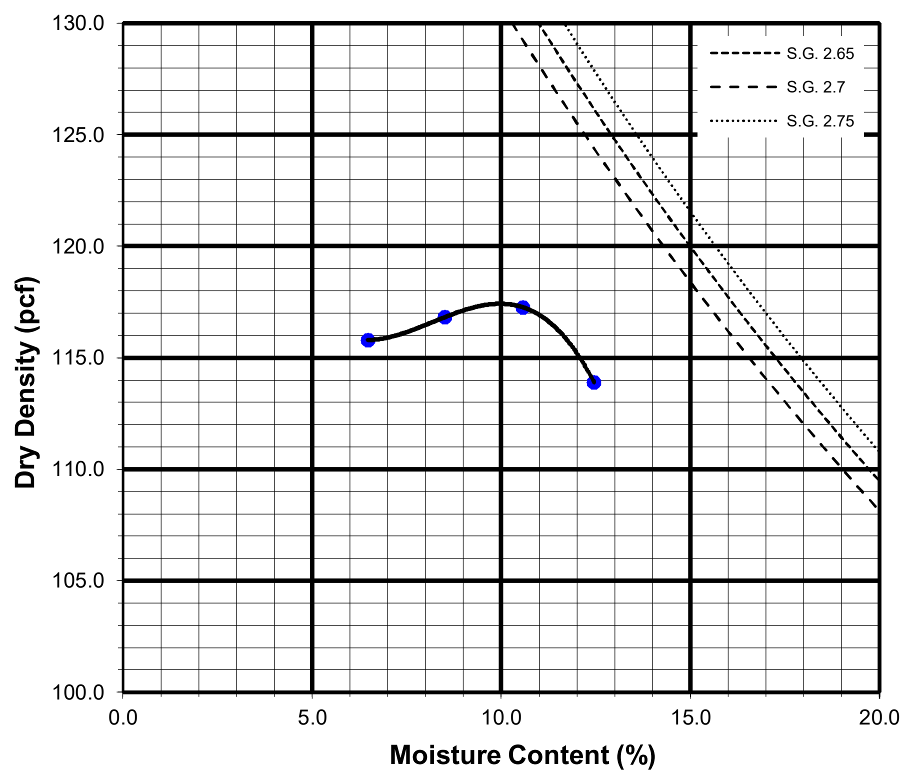
GEOCON	**GRAIN SIZE DISTRIBUTION** ASTM D-422	Project No.: T2746-99-10A
	Checked by: JJK	11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA
		FEB 2020 Figure B18

Sample No:

B1@0-5'	Light Brown Silty Sand (SM)

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6011	6063	6107	6083		
Weight of Mold	(g)	4148	4148	4148	4148		
Net Weight of Soil	(g)	1862	1915	1958	1935		
Wet Weight of Soil + Cont.	(g)	676.6	602.3	629.7	690.4		
Dry Weight of Soil + Cont.	(g)	644.3	564.9	582.4	630.3		
Weight of Container	(g)	145.4	125.3	134.7	147.7		
Moisture Content	(%)	6.5	8.5	10.6	12.5		
Wet Density	(pcf)	123.3	126.8	129.7	128.1		
Dry Density	(pcf)	115.8	116.8	117.3	113.9		

Maximum Dry Density (pcf)	**117.5**	**Optimum Moisture Content (%)**	**10.0**



Preparation Method: A

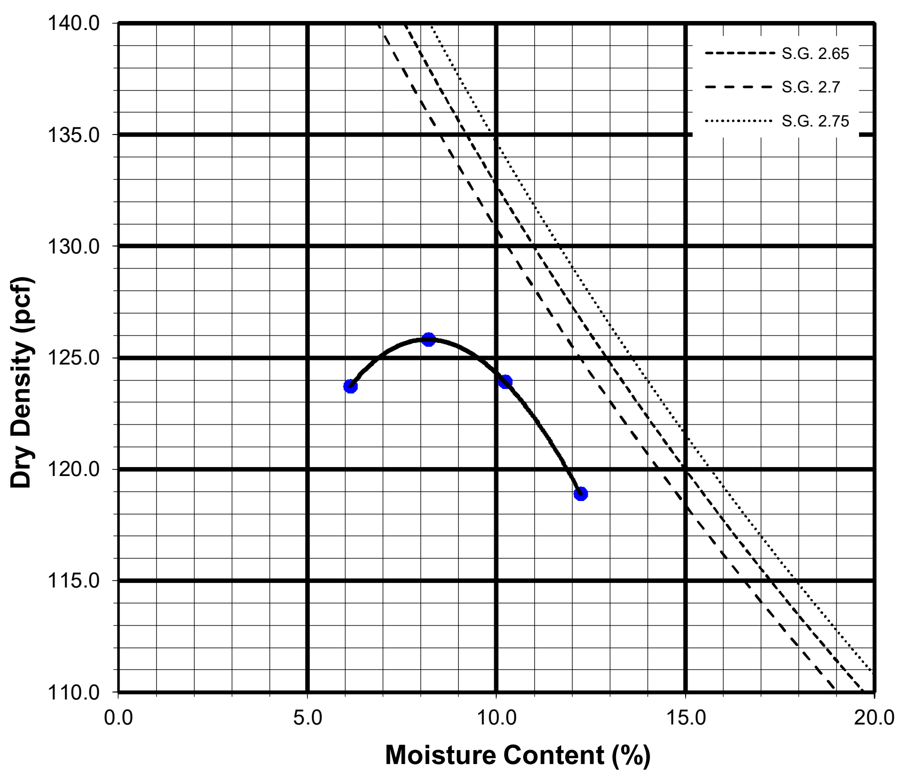
GEOCON	**MODIFIED COMPACTION TEST OF SOILS** ASTM D-1557	Project No.:	T2746-99-10A
		11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA	
	Checked by: JJK	FEB 2020	Figure B19

Sample No:

B7@0-5'	Brown Silty Sand (SM)

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6132	6205	6212	6164		
Weight of Mold	(g)	4148	4148	4148	4148		
Net Weight of Soil	(g)	1984	2056	2063	2016		
Wet Weight of Soil + Cont.	(g)	721.4	691.6	675.8	668.7		
Dry Weight of Soil + Cont.	(g)	688.2	650.4	624.8	611.6		
Weight of Container	(g)	147.3	148.3	125.8	144.6		
Moisture Content	(%)	6.1	8.2	10.2	12.2		
Wet Density	(pcf)	131.3	136.1	136.6	133.4		
Dry Density	(pcf)	123.7	125.8	123.9	118.9		

Maximum Dry Density (pcf)	**126.0**	**Optimum Moisture Content (%)**	**8.5**



Preparation Method: A

GEOCON	**MODIFIED COMPACTION TEST OF SOILS** ASTM D-1557	Project No.: T2746-99-10A
		11016-11098 SIERRA AVENUE FONTANA, CALIFORNIA
	Checked by: JJK	FEB 2020 Figure B20

B1@0-5'

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	772.2	792.7
Wt. of Mold	(gm)	367.9	367.9
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	487.5	792.7
Dry Wt. of Soil + Cont.	(gm)	462.7	370.9
Wt. of Container	(gm)	187.5	367.9
Moisture Content	(%)	9.0	14.5
Wet Density	(pcf)	122.0	128.0
Dry Density	(pcf)	111.9	111.7
Void Ratio		0.5	0.5
Total Porosity		0.3	0.3
Pore Volume	(cc)	69.6	69.6
Degree of Saturation	(%) [S_{meas}]	48.4	77.4

Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
1/28/2020	10:00	1.0	0	0.294
1/28/2020	10:10	1.0	10	0.2935
Add Distilled Water to the Specimen				
1/29/2020	10:00	1.0	1430	0.2935
1/29/2020	11:00	1.0	1490	0.2935

Expansion Index (EI meas) =	0
Expansion Index (Report) =	**0**

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2016 California Building Code, Section 1803.5.3

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

GEOCON

EXPANSION INDEX TEST RESULTS

ASTM D-4829

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B21

B7@0-5'

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	791.6	813.0
Wt. of Mold	(gm)	368.3	368.3
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	487.5	813.0
Dry Wt. of Soil + Cont.	(gm)	466.6	393.8
Wt. of Container	(gm)	187.5	368.3
Moisture Content	(%)	7.5	12.9
Wet Density	(pcf)	127.7	134.0
Dry Density	(pcf)	118.8	118.6
Void Ratio		0.4	0.4
Total Porosity		0.3	0.3
Pore Volume	(cc)	61.2	61.2
Degree of Saturation	(%) [S_{meas}]	48.7	83.3

Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
1/28/2020	10:00	1.0	0	0.254
1/28/2020	10:10	1.0	10	0.254
Add Distilled Water to the Specimen				
1/29/2020	10:00	1.0	1430	0.254
1/29/2020	11:00	1.0	1490	0.254

Expansion Index (EI meas) =	0
Expansion Index (Report) =	**0**

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2016 California Building Code, Section 1803.5.3
** Reference: 1997 Uniform Building Code, Table 18-I-B.

GEOCON

EXPANSION INDEX TEST RESULTS
ASTM D-4829

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B22

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

Sample No.	**pH**	**Resistivity (ohm centimeters)**
B1 @ 0-5'	7.2	11000 (Mildly Corrosive)
B7 @ 0-5'	7.1	8500 (Moderately Corrosive)

SUMMARY OF LABORATORY CHLORIDE CONTENT TEST RESULTS
EPA NO. 325.3

Sample No.	Chloride Ion Content (%)
B1@0-5'	0.006
B7@0-5'	0.006

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

Sample No.	**Water Soluble Sulfate (% SQ_4)**	**Sulfate Exposure***
B1@0-5'	0.000	S0
B7@0-5'	0.000	S0

GEOCON

CORROSIVITY TEST RESULTS

Checked by: JJK

Project No.: T2746-99-10A

11016-11098 SIERRA AVENUE
FONTANA, CALIFORNIA

FEB 2020 Figure B23

APPENDIX C

SUMMARY OF SEISMIC ANALYSIS

Company	Leighton Consulting, Inc.
Project Number	12691.011
Project Name	Proposed Chaffey College Fontana Campus
Project Location	11070 Sierra Avenue, Fontana, California
Date of MASW Survey	9/6/2022
Method	MASW Survey Line C

SITE CLASS DETERMINATION WITH SHEAR WAVE VELOCITY

Average Shear Wave Calculation (Vs)			
Depth (ft)	**Thickness, di (ft)**	**Shear Wave Velocity, Vs (ft/sec)**	**di/Vs**
0 to 4	4.0	871.0	0.005
4 to 8	4.0	871.0	0.005
8 to 12	4.0	878.0	0.005
12 to 17	5.0	914.0	0.005
17 to 23	6.0	958.0	0.006
23 to 30	7.0	1,025.0	0.007
30 to 37	7.0	1,099.0	0.006
37 to 44	7.0	1,159.0	0.006
44 to 52	8.0	1,239.0	0.006
52 to 60	8.0	1,324.0	0.006
60 to 70	10.0	1,352.0	0.007
70 to 80	10.0	1,380.0	0.007
80 to 90	10.0	1,406.0	0.007
90 to 100	10.0	1,430.0	0.007
	100.0		0.086

Average Shear Wave Vs (in top 100')	**1163.3 ft/sec**

Site Class Definitions		
Site Class	**Soil Profile Name**	**Shear Wave Velocity, Vs, ft/sec**
A	Hard Rock	Vs > 5,000
B	Rock	2,500 < Vs < 5,000
C	Very dense soil and soft rock	1,200 < Vs < 2,500
D	Stiff soil profile	600 < Vs < 1,200
E	Soft soil profile	Vs < 600

Site Class	**D**

Company	Leighton Consulting, Inc.
Project Number	12691.011
Project Name	Proposed Chaffey College Fontana Campus
Project Location	11070 Sierra Avenue, Fontana, California
Date of MASW Survey	9/6/2022
Method	MASW Survey Line B

SITE CLASS DETERMINATION WITH SHEAR WAVE VELOCITY

Average Shear Wave Calculation (Vs)			
Depth (ft)	**Thickness, di (ft)**	**Shear Wave Velocity, Vs (ft/sec)**	**di/Vs**
0 to 4	4.0	979.0	0.004
4 to 8	4.0	977.0	0.004
8 to 12	4.0	972.0	0.004
12 to 17	5.0	983.0	0.005
17 to 23	6.0	1,015.0	0.006
23 to 30	7.0	1,076.0	0.007
30 to 37	7.0	1,171.0	0.006
37 to 44	7.0	1,259.0	0.006
44 to 52	8.0	1,343.0	0.006
52 to 60	8.0	1,381.0	0.006
60 to 70	10.0	1,420.0	0.007
70 to 80	10.0	1,457.0	0.007
80 to 90	10.0	1,489.0	0.007
90 to 100	10.0	1,518.0	0.007
	100.0		0.080

Average Shear Wave Vs (in top 100') **1245.4 ft/sec**

Site Class Definitions		
Site Class	**Soil Profile Name**	**Shear Wave Velocity, Vs, ft/sec**
A	Hard Rock	Vs > 5,000
B	Rock	2,500 < Vs < 5,000
C	Very dense soil and soft rock	1,200 < Vs < 2,500
D	Stiff soil profile	600 < Vs < 1,200
E	Soft soil profile	Vs < 600

Site Class **C**

Determination of Site Class and Estimation of Shear Wave Velocity based on Field SPT Data

Project: 12691.011 Chaffey Fontana New Campus

Depth (ft)	di, Layer Thick (ft)	Field Blow Counts, Ni Corrected for Cs and sampler type Blows per foot (bpf)							Average Ni (bpf)	Ni Hammer Corr:	di / Ni
		LB-1	LB-2	LB-4	LB-6	LB-8	LB-10	LB-12		1.3	
5	7.5	12	16	21	16	14	19	16	16	21	0.35
10	5	10	10	14	28	24	22	29	20	25	0.20
15	5	16	8	9	16	38	40	10	20	25	0.20
20	5	58	10	27	53	31	20	12	30	39	0.13
25	5	56		13	23		97		47	61	0.08
30	5	70		12	24		15		30	39	0.13
35	5	32					25		29	37	0.13
40	5	31					49		40	52	0.10
45	5	50					52		51	66	0.08
50	7.5	35					95		65	85	0.09
60	10	40	*Assumed based on blowcount at 40'-50'						40	52	0.19
70	10	40							40	52	0.19
80	10	40							40	52	0.19
90	10	40							40	52	0.19
100	5	40							40	52	0.10
Summation:	100										2.34
										Navg = Sum(di) / Sum(di / Ni) =	**43**

Extract of ASCE 7-16 Table 20.3-1 Site Classification (2019 CBC 1613A.2.2):

Site Class	Soil Profile Name	Avg. N upper 100' from	to	Vs30 (ft/sec) from	to	Vs30 (m/s) from	to	Site Avg N	Interpolated vs30 (ft/s)
A	Hard Rock	-		5000	10000	1524	3048		
B	Rock	-		2500	5000	762	1524		
C	VD soil & soft rock	50.001	100	1200	2500	366	762		
D	Stiff Soil	**15**	**50**	600	1200	183	366	**43**	1074
E	Soft Soil	0	14.999	0	600	0	183		
F		-	-			0	0		

Site class, Table 20.3-1: D

Liquefaction Susceptibility Analysis: SPT Method

Leighton

Youd and Idriss (2001), Martin and Lew (1999)

Description: Chaffey New Fontana Campus; Case 1; PGAm 0.713; design GW 100; No overex 0
Project No.: 12691.011
October 2022

General Boring Information:

Boring No.	Existing GW Depth (ft)	Design GW Depth (ft)	Design Fill Height (ft)	Overex or mitig depth (ft)	Ground Surface Elev (ft)	design gw elve
LB-1	200	100	0	0	1050	950
LB-2	200	100	0	0	1050	950
LB-3	200	100	0	0	1055	955
LB-4	200	100	0	0	1053	953
LB-5	200	100	0	0	1054	954
LB-6	200	100	0	0	1051	951
LB-7	200	100	0	0	1052	952
LB-7	200	100	0	0	1053	953
LB-8	200	100	0	0	1053	953
LB-9	200	100	0	0	1052	952
LB-10	200	100	0	0	1051	951
LB-11	200	100	0	0	1053	953
LB-12	200	100	0	0	1053	953
						0
						0
						0
						0

Boring Location Coordinates X (ft)	Y (ft)

General Parameters:

a_{max} = 0.71g
M_W = 8.1
MSF eq: 1
MSF = 0.82
Hammer Efficiency = 84
C_E = 1.40
C_B = 1
C_S for SPT? TRUE
Unlined, but room for liner
Rod Stickup (feet) = 3
Ring sample correction = 0.65

Summary of Liquefaction Susceptibility Analysis: SPT Method

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Chaffey New Fontana Campus; Case 1; PGAm 0.713; design GW 100; No overex 0

Project No.: 12691.011

Boring No.	Approx. Layer Depth (ft)	Eleva-tion (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$ (assume CLEAN SAND)**	$CRR_{7.5}$ (w/o Plasticity Crit)	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-1	6.3 to 8.8	1043	7.5	2.5		80	108	14	2	1	9.1	823	16.2	24.5	0.173	0.282	0.282	822.5	0.46	0.55	**NonLiq**	0.08	0.6
LB-1	8.8 to 12.5	1040	10	3.8		**24**	108	16	2	1	10.4	1093	17.1	23.1	0.182	0.259	0.259	1092.5	0.45	0.55	**NonLiq**	0.21	0.6
LB-1	12.5 to 17.5	1035	15	5.0		20	110	13	1	1.21	15.7	1638	21.2	26.5	0.230	0.324	0.324	1637.5	0.45	0.54	**NonLiq**	0.13	0.3
LB-1	17.5 to 22.5	1030	20	5.0		7	120	45	1	1.3	58.5	2213	75.6	76.3	>Range	>Range	>Range	2212.5	0.44	0.54	**NonLiq**	0.02	0.2
LB-1	22.5 to 27.5	1025	25	5.0		**7**	120	43	1	1.3	55.9	2813	64.1	64.7	>Range	>Range	>Range	2812.5	0.44	0.53	**NonLiq**	0.02	0.2
LB-1	27.5 to 32.5	1020	30	5.0		7	120	54	1	1.3	70.2	3413	76.9	77.7	>Range	>Range	>Range	3412.5	0.43	0.53	**NonLiq**	0.01	0.2
LB-1	32.5 to 37.5	1015	35	5.0		10	120	25	1	1.3	32.5	4013	32.8	34.4	>Range	>Range	>Range	4012.5	0.41	0.50	**NonLiq**	0.09	0.2
LB-1	37.5 to 42.5	1010	40	5.0		**60**	120	24	1	1.29	31.0	4613	29.2	40.0	0.420	>Range	>Range	4612.5	0.39	0.48	**NonLiq**	0.03	0.1
LB-1	42.5 to 47.5	1005	45	5.0		75	120	39	1	1.3	50.7	5213	44.9	58.9	>Range	>Range	>Range	5212.5	0.37	0.46	**NonLiq**	0.02	0.0
LB-1	47.5 to 52.0	1000	50	4.5		70	120	27	1	1.29	34.9	5813	29.3	40.1	0.424	>Range	>Range	5812.5	0.36	0.43	**NonLiq**	0.02	0.0
LB-2	0 to 3.8	1048	2.5	3.8		65	120	34	2	1	22.1	300	39.4	52.3	>Range	>Range	>Range	300	0.46	0.56	**NonLiq**	0.00	1.2
LB-2	3.8 to 6.3	1045	5	2.5		20	120	25	2	1	16.3	600	29.0	34.9	0.411	>Range	>Range	600	0.46	0.56	**NonLiq**	0.06	1.2
LB-2	6.3 to 8.8	1043	7.5	2.5		40	120	17	2	1	11.1	900	18.9	27.6	0.202	0.357	0.357	900	0.46	0.55	**NonLiq**	0.08	1.1
LB-2	8.8 to 12.5	1040	10	3.8		25	110	16	2	1	10.4	1188	16.4	22.6	0.175	0.251	0.251	1187.5	0.45	0.55	**NonLiq**	0.24	1.0
LB-2	12.5 to 17.5	1035	15	5.0		**59**	110	7	1	1.1	7.7	1738	10.0	17.1	0.114	0.181	0.181	1737.5	0.45	0.54	**NonLiq**	0.44	0.8
LB-2	17.5 to 22.0	1030	20	4.5		75	110	9	1	1.13	10.2	2288	12.9	20.5	0.140	0.222	0.222	2287.5	0.44	0.54	**NonLiq**	0.32	0.3
LB-3	0 to 3.8	1053	2.5	3.8		35	110	24	2	1	15.6	275	27.8	38.4	0.364	>Range	>Range	275	0.46	0.56	**NonLiq**	0.02	0.8
LB-3	3.8 to 6.3	1050	5	2.5		40	110	24	2	1	15.6	550	27.8	38.4	0.364	>Range	>Range	550	0.46	0.56	**NonLiq**	0.04	0.8
LB-3	6.3 to 8.8	1048	7.5	2.5		45	110	13	2	1	8.5	825	15.1	23.1	0.161	0.258	0.258	825	0.46	0.55	**NonLiq**	0.09	0.8
LB-3	8.8 to 12.5	1045	10	3.8		55	110	14	2	1	9.1	1100	14.9	22.9	0.159	0.255	0.255	1100	0.45	0.55	**NonLiq**	0.21	0.7
LB-3	12.5 to 17.5	1040	15	5.0		95	110	7	1	1.1	7.7	1650	10.3	17.4	0.116	0.185	0.185	1650	0.45	0.54	**NonLiq**	0.38	0.5
LB-3	17.5 to 22.0	1035	20	4.5		95	110	14	1	1.22	17.1	2200	22.1	31.6	0.244	>Range	>Range	2200	0.44	0.54	**NonLiq**	0.09	0.1
LB-4	0 to 3.8	1051	2.5	3.8		60	105	13	2	1	8.5	263	15.1	23.1	0.161	0.259	0.259	262.5	0.46	0.56	**NonLiq**	0.04	1.1
LB-4	3.8 to 6.3	1048	5	2.5		55	105	32	2	1	20.8	525	37.1	49.6	>Range	>Range	>Range	525	0.46	0.56	**NonLiq**	0.01	1.0
LB-4	6.3 to 8.8	1046	7.5	2.5		60	105	30	2	1	19.5	788	35.6	47.7	>Range	>Range	>Range	787.5	0.46	0.55	**NonLiq**	0.01	1.0
LB-4	8.8 to 12.5	1043	10	3.8		60	105	21	2	1	13.7	1050	22.9	32.5	0.255	>Range	>Range	1050	0.45	0.55	**NonLiq**	0.07	1.0
LB-4	12.5 to 17.5	1038	15	5.0		**84**	105	8	1	1.12	9.0	1575	12.3	19.8	0.134	0.213	0.213	1575	0.45	0.54	**NonLiq**	0.29	1.0
LB-4	17.5 to 22.5	1033	20	5.0		5	110	21	1	1.3	27.3	2113	36.1	36.1	>Range	>Range	>Range	2112.5	0.44	0.54	**NonLiq**	0.08	0.7
LB-4	22.5 to 27.5	1028	25	5.0		**49**	110	11	1	1.15	12.6	2663	14.9	22.8	0.159	0.255	0.255	2662.5	0.44	0.53	**NonLiq**	0.41	0.6
LB-4	27.5 to 32.0	1023	30	4.5		40	120	11	1	1.14	12.5	3238	14.1	21.9	0.151	0.241	0.241	3237.5	0.43	0.53	**NonLiq**	0.18	0.2

Boring No.	Approx. Layer Depth (ft)	Elevation (ft)	SPT Depth (ft)	Approx Layer Thickness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$ (assume CLEAN SAND)**	$CRR_{7.5}$ (w/o Plasticity Crit)	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-5	0 to 3.8	1052	2.5	3.8		**49**	110	30	2	1	19.5	275	34.8	46.8	>Range	>Range	>Range	275	0.46	0.56	**NonLiq**	0.00	0.1
LB-5	3.8 to 6.3	1049	5	2.5		60	110	29	2	1	18.9	550	33.6	45.4	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.01	0.1
LB-5	6.3 to 8.8	1047	7.5	2.5		60	110	38	2	1	24.7	825	44.0	57.8	>Range	>Range	>Range	825	0.46	0.55	**NonLiq**	0.01	0.1
LB-5	8.8 to 12.5	1044	10	3.8		25	110	25	2	1	16.3	1100	26.6	34.0	0.329	>Range	>Range	1100	0.45	0.55	**NonLiq**	0.08	0.1
LB-5	12.5 to 17.5	1039	15	5.0		**5**	110	26	1	1.3	33.8	1650	45.2	45.2	>Range	>Range	>Range	1650	0.45	0.54	**NonLiq**	0.02	0.0
LB-5	17.5 to 22.0	1034	20	4.5		5	120	65	1	1.3	84.5	2225	108.9	108.9	>Range	>Range	>Range	2225	0.44	0.54	**NonLiq**	0.01	0.0
LB-6	0 to 3.8	1049	2.5	3.8		10	115	23	2	1	15.0	288	26.7	28.1	0.330	0.374	0.374	287.5	0.46	0.56	**NonLiq**	0.04	0.6
LB-6	3.8 to 6.3	1046	5	2.5		5	115	24	2	1	15.6	575	27.8	27.8	0.364	0.364	0.364	575	0.46	0.56	**NonLiq**	0.15	0.5
LB-6	6.3 to 8.8	1044	7.5	2.5		60	105	22	2	1	14.3	850	25.1	35.1	0.294	>Range	>Range	850	0.46	0.55	**NonLiq**	0.03	0.4
LB-6	8.8 to 12.5	1041	10	3.8		60	110	43	2	1	28.0	1119	45.4	59.5	>Range	>Range	>Range	1118.8	0.45	0.55	**NonLiq**	0.01	0.4
LB-6	12.5 to 17.5	1036	15	5.0		30	110	13	1	1.21	15.7	1669	20.9	28.8	0.227	0.403	0.403	1668.8	0.45	0.54	**NonLiq**	0.13	0.4
LB-6	17.5 to 22.5	1031	20	5.0		5	120	41	1	1.3	53.3	2244	68.4	68.4	>Range	>Range	>Range	2243.8	0.44	0.54	**NonLiq**	0.02	0.2
LB-6	22.5 to 27.5	1026	25	5.0		70	120	18	1	1.26	22.6	2844	25.8	36.0	0.309	>Range	>Range	2843.8	0.44	0.53	**NonLiq**	0.14	0.2
LB-6	27.5 to 32.0	1021	30	4.5		75	120	19	1	1.26	24.0	3444	26.1	36.3	0.316	>Range	>Range	3443.8	0.43	0.53	**NonLiq**	0.07	0.1
LB-7	0 to 3.8	1050	2.5	3.8		5	115	17	2	1	11.1	288	19.7	19.7	0.212	0.212	0.212	287.5	0.46	0.56	**NonLiq**	0.11	0.4
LB-7	3.8 to 6.3	1047	5	2.5		5	115	19	2	1	12.4	575	22.0	22.0	0.243	0.243	0.243	575	0.46	0.56	**NonLiq**	0.18	0.3
LB-7	6.3 to 8.8	1045	7.5	2.5		70	105	22	2	1	14.3	850	25.1	35.1	0.294	>Range	>Range	850	0.46	0.55	**NonLiq**	0.03	0.1
LB-7	8.8 to 12.5	1042	10	3.8		70	120	42	2	1	27.3	1131	44.1	58.0	>Range	>Range	>Range	1131.3	0.45	0.55	**NonLiq**	0.01	0.0
LB-7	12.5 to 17.5	1037	15	5.0		5	120	24	1	1.3	31.2	1731	40.8	40.8	>Range	>Range	>Range	1731.3	0.45	0.54	**NonLiq**	0.02	0.0
LB-7	17.5 to 22.0	1032	20	4.5		5	120	37	1	1.3	48.1	2331	60.5	60.5	>Range	>Range	>Range	2331.3	0.44	0.54	**NonLiq**	0.02	0.0
LB-8	0 to 3.8	1051	2.5	3.8		**22**	115	25	2	1	16.3	288	29.0	35.6	0.411	>Range	>Range	287.5	0.46	0.56	**NonLiq**	0.02	0.3
LB-8	3.8 to 6.3	1048	5	2.5		5	125	22	2	1	14.3	588	25.5	25.5	0.303	0.303	0.303	587.5	0.46	0.56	**NonLiq**	0.16	0.3
LB-8	6.3 to 8.8	1046	7.5	2.5		80	120	34	2	1	22.1	894	37.8	50.4	>Range	>Range	>Range	893.75	0.46	0.55	**NonLiq**	0.01	0.1
LB-8	8.8 to 12.5	1043	10	3.8		25	120	37	2	1	24.1	1194	37.9	46.5	>Range	>Range	>Range	1193.8	0.45	0.55	**NonLiq**	0.02	0.1
LB-8	12.5 to 17.5	1038	15	5.0		5	120	29	1	1.3	37.7	1794	48.4	48.4	>Range	>Range	>Range	1793.8	0.45	0.54	**NonLiq**	0.02	0.1
LB-8	17.5 to 22.0	1033	20	4.5		5	120	24	1	1.3	31.2	2394	38.8	38.8	>Range	>Range	>Range	2393.8	0.44	0.54	**NonLiq**	0.08	0.1
LB-9	0 to 3.8	1050	2.5	3.8		40	115	9	2	1	5.9	288	10.4	17.5	0.117	0.187	0.187	287.5	0.46	0.56	**NonLiq**	0.13	0.3
LB-9	3.8 to 6.3	1047	5	2.5		45	115	24	2	1	15.6	575	27.8	38.4	0.364	>Range	>Range	575	0.46	0.56	**NonLiq**	0.04	0.2
LB-9	6.3 to 8.8	1045	7.5	2.5		45	120	34	2	1	22.1	869	38.4	51.0	>Range	>Range	>Range	868.75	0.46	0.55	**NonLiq**	0.01	0.1
LB-9	8.8 to 12.5	1042	10	3.8		10	125	36	2	1	23.4	1175	37.1	38.8	>Range	>Range	>Range	1175	0.45	0.55	**NonLiq**	0.07	0.1
LB-9	12.5 to 17.5	1037	15	5.0		5	125	75	2	1	48.8	1800	62.5	62.5	>Range	>Range	>Range	1800	0.45	0.54	**NonLiq**	0.01	0.0
LB-9	17.5 to 22.0	1032	20	4.5		5	120	25	1	1.3	32.5	2413	40.2	40.2	>Range	>Range	>Range	2412.5	0.44	0.54	**NonLiq**	0.03	0.0

Boring No.	Approx. Layer Depth (ft)	Elevation (ft)	SPT Depth (ft)	Approx Layer Thickness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$ (assume CLEAN SAND)**	$CRR_{7.5}$ (w/o Plasticity Crit)	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-10	0 to 3.8	1049	2.5	3.8		40	105	9	2	1	5.9	263	10.4	17.5	0.117	0.187	0.187	262.5	0.46	0.56	**NonLiq**	0.11	0.6
LB-10	3.8 to 6.3	1046	5	2.5		45	115	29	2	1	18.9	538	33.6	45.4	>Range	>Range	>Range	537.5	0.46	0.56	**NonLiq**	0.01	0.5
LB-10	6.3 to 8.8	1044	7.5	2.5		70	110	24	2	1	15.6	819	27.9	38.5	0.366	>Range	>Range	818.75	0.46	0.55	**NonLiq**	0.02	0.5
LB-10	8.8 to 12.5	1041	10	3.8		70	110	33	2	1	21.5	1094	35.3	47.3	>Range	>Range	>Range	1093.8	0.45	0.55	**NonLiq**	0.02	0.5
LB-10	12.5 to 17.5	1036	15	5.0		5	120	31	1	1.3	40.3	1669	53.6	53.6	>Range	>Range	>Range	1668.8	0.45	0.54	**NonLiq**	0.01	0.5
LB-10	17.5 to 22.5	1031	20	5.0		**20**	110	16	1	1.26	20.1	2244	25.8	31.5	0.309	>Range	>Range	2243.8	0.44	0.54	**NonLiq**	0.10	0.5
LB-10	22.5 to 27.5	1026	25	5.0		5	120	75	1	1.3	97.5	2819	111.6	111.6	>Range	>Range	>Range	2818.8	0.44	0.53	**NonLiq**	0.01	0.3
LB-10	27.5 to 32.5	1021	30	5.0		54	120	13	1	1.17	15.2	3419	16.6	24.9	0.176	0.290	0.290	3418.8	0.43	0.53	**NonLiq**	0.19	0.3
LB-10	32.5 to 37.5	1016	35	5.0		80	120	20	1	1.25	25.1	4019	25.3	35.3	0.298	>Range	>Range	4018.8	0.41	0.50	**NonLiq**	0.08	0.1
LB-10	37.5 to 42.5	1011	40	5.0		80	120	38	1	1.3	49.4	4619	46.5	60.8	>Range	>Range	>Range	4618.8	0.39	0.48	**NonLiq**	0.02	0.1
LB-10	42.5 to 47.5	1006	45	5.0		5	120	40	1	1.3	52.0	5219	46.0	46.0	>Range	>Range	>Range	5218.8	0.37	0.46	**NonLiq**	0.02	0.0
LB-10	47.5 to 52.0	1001	50	4.5		5	120	73	1	1.3	94.9	5819	79.6	79.6	>Range	>Range	>Range	5818.8	0.36	0.43	**NonLiq**	0.01	0.0
LB-11	0 to 3.8	1051	2.5	3.8		5	110	12	2	1	7.8	275	13.9	**13.9**	0.149	0.149	0.149	275	0.46	0.56	**NonLiq**	0.25	0.9
LB-11	3.8 to 6.3	1048	5	2.5		20	110	32	2	1	20.8	550	37.1	43.7	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.01	0.7
LB-11	6.3 to 8.8	1046	7.5	2.5		80	110	29	2	1	18.9	825	33.6	45.3	>Range	>Range	>Range	825	0.46	0.55	**NonLiq**	0.01	0.7
LB-11	8.8 to 12.5	1043	10	3.8		45	110	35	2	1	22.8	1100	37.3	49.8	>Range	>Range	>Range	1100	0.45	0.55	**NonLiq**	0.01	0.7
LB-11	12.5 to 17.5	1038	15	5.0		10	110	15	1	1.25	18.8	1650	25.1	26.5	0.294	0.325	0.325	1650	0.45	0.54	**NonLiq**	0.14	0.7
LB-11	17.5 to 22.5	1033	20	5.0		**34**	110	9	1	1.13	10.2	2200	13.2	20.6	0.142	0.223	0.223	2200	0.44	0.54	**NonLiq**	0.33	0.5
LB-11	22.5 to 27.5	1028	25	5.0		30	120	21	1	1.3	27.3	2775	31.5	41.1	>Range	>Range	>Range	2775	0.44	0.53	**NonLiq**	0.04	0.2
LB-11	27.5 to 32.0	1023	30	4.5		10	120	18	1	1.25	22.4	3375	24.7	26.1	0.286	0.315	0.315	3375	0.43	0.53	**NonLiq**	0.16	0.2
LB-12	0 to 3.8	1051	2.5	3.8		10	110	12	2	1	7.8	275	13.9	15.1	0.149	0.161	0.161	275	0.46	0.56	**NonLiq**	0.14	0.7
LB-12	3.8 to 6.3	1048	5	2.5		30	110	25	2	1	16.3	550	29.0	38.2	0.411	>Range	>Range	550	0.46	0.56	**NonLiq**	0.04	0.5
LB-12	6.3 to 8.8	1046	7.5	2.5		90	115	36	2	1	23.4	831	41.5	54.8	>Range	>Range	>Range	831.25	0.46	0.55	**NonLiq**	0.01	0.5
LB-12	8.8 to 12.5	1043	10	3.8		90	115	44	2	1	28.6	1119	46.5	60.8	>Range	>Range	>Range	1118.8	0.45	0.55	**NonLiq**	0.01	0.5
LB-12	12.5 to 17.5	1038	15	5.0		**49**	115	9	1	1.13	10.2	1694	13.5	21.2	0.145	0.231	0.231	1693.8	0.45	0.54	**NonLiq**	0.19	0.5
LB-12	17.5 to 22.0	1033	20	4.5		70	115	10	1	1.15	11.5	2269	14.6	22.5	0.156	0.250	0.250	2268.8	0.44	0.54	**NonLiq**	0.28	0.3

Summary of Liquefaction Susceptibility Analysis: SPT Method

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Chaffey New Fontana Campus; Case 3; PGAm 0.713; design GW 100; Overex./scarify 5

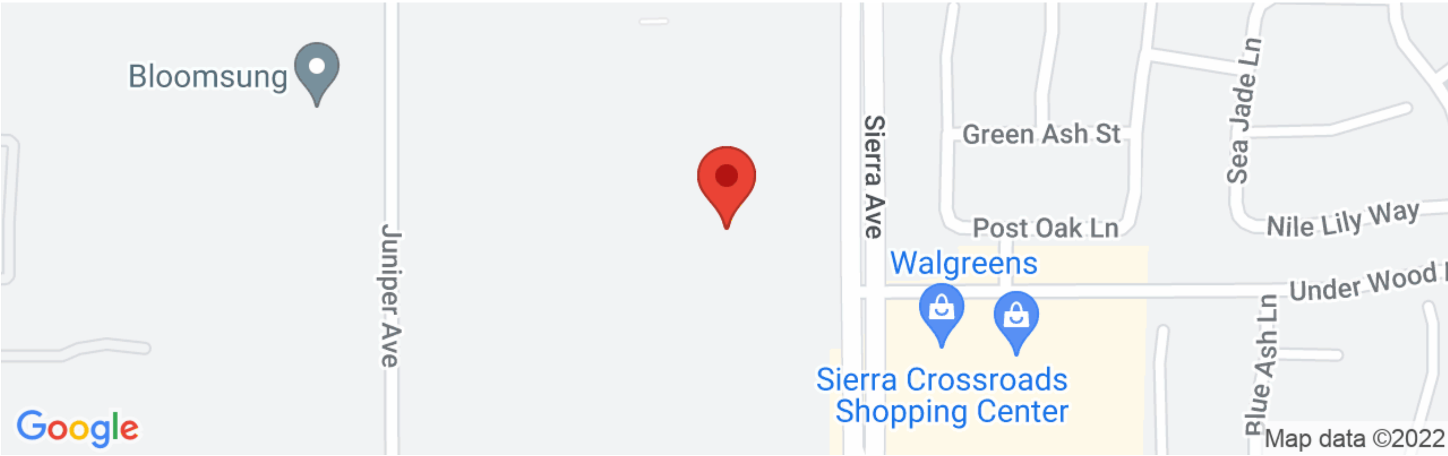
Project No.: 12691.011

Boring No.	Approx. Layer Depth (ft)	Eleva-tion (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$ (assume CLEAN SAND)**	$CRR_{7.5}$ (w/o Plasticity Crit)	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement (in.)**
LB-1	5.0 to 6.3	1045	5	1.3		40	110	18	2	1	11.7	550	20.9	30.1	0.227	>Range	>Range	550	0.46	0.56	**NonLiq**	0.03	0.7
LB-1	6.3 to 8.8	1043	7.5	2.5		80	108	14	2	1	9.1	823	16.2	24.5	0.173	0.282	0.282	822.5	0.46	0.55	**NonLiq**	0.08	0.6
LB-1	8.8 to 12.5	1040	10	3.8		**24**	108	16	2	1	10.4	1093	17.1	23.1	0.182	0.259	0.259	1092.5	0.45	0.55	**NonLiq**	0.21	0.6
LB-1	12.5 to 17.5	1035	15	5.0		20	110	13	1	1.21	15.7	1638	21.2	26.5	0.230	0.324	0.324	1637.5	0.45	0.54	**NonLiq**	0.13	0.3
LB-1	17.5 to 22.5	1030	20	5.0		7	120	45	1	1.3	58.5	2213	75.6	76.3	>Range	>Range	>Range	2212.5	0.44	0.54	**NonLiq**	0.02	0.2
LB-1	22.5 to 27.5	1025	25	5.0		**7**	120	43	1	1.3	55.9	2813	64.1	64.7	>Range	>Range	>Range	2812.5	0.44	0.53	**NonLiq**	0.02	0.2
LB-1	27.5 to 32.5	1020	30	5.0		7	120	54	1	1.3	70.2	3413	76.9	77.7	>Range	>Range	>Range	3412.5	0.43	0.53	**NonLiq**	0.01	0.2
LB-1	32.5 to 37.5	1015	35	5.0		10	120	25	1	1.3	32.5	4013	32.8	34.4	>Range	>Range	>Range	4012.5	0.41	0.50	**NonLiq**	0.09	0.2
LB-1	37.5 to 42.5	1010	40	5.0		**60**	120	24	1	1.29	31.0	4613	29.2	40.0	0.420	>Range	>Range	4612.5	0.39	0.48	**NonLiq**	0.03	0.1
LB-1	42.5 to 47.5	1005	45	5.0		75	120	39	1	1.3	50.7	5213	44.9	58.9	>Range	>Range	>Range	5212.5	0.37	0.46	**NonLiq**	0.02	0.0
LB-1	47.5 to 52.0	1000	50	4.5		70	120	27	1	1.29	34.9	5813	29.3	40.1	0.424	>Range	>Range	5812.5	0.36	0.43	**NonLiq**	0.02	0.0
LB-2	0 to 3.8	1048	2.5	3.8	OX	65	120	50	1	1.3	65.0	300	116.0	144.2	>Range	>Range	>Range	300	0.46	0.56	**NonLiq**	0.00	1.1
LB-2	3.8 to 5.0	1045	5	1.3	OX	20	120	50	1	1.3	65.0	600	116.0	128.9	>Range	>Range	>Range	600	0.46	0.56	**NonLiq**	0.00	1.1
LB-2	5.0 to 6.3	1045	5	1.3		20	120	25	2	1	16.3	600	29.0	34.9	0.411	>Range	>Range	600	0.46	0.56	**NonLiq**	0.03	1.1
LB-2	6.3 to 8.8	1043	7.5	2.5		40	120	17	2	1	11.1	900	18.9	27.6	0.202	0.357	0.357	900	0.46	0.55	**NonLiq**	0.08	1.1
LB-2	8.8 to 12.5	1040	10	3.8		25	110	16	2	1	10.4	1188	16.4	22.6	0.175	0.251	0.251	1187.5	0.45	0.55	**NonLiq**	0.24	1.0
LB-2	12.5 to 17.5	1035	15	5.0		**59**	110	7	1	1.1	7.7	1738	10.0	17.1	0.114	0.181	0.181	1737.5	0.45	0.54	**NonLiq**	0.44	0.8
LB-2	17.5 to 22.0	1030	20	4.5		75	110	9	1	1.13	10.2	2288	12.9	20.5	0.140	0.222	0.222	2287.5	0.44	0.54	**NonLiq**	0.32	0.3
LB-3	0 to 3.8	1053	2.5	3.8	OX	35	110	50	1	1.3	65.0	275	116.0	144.2	>Range	>Range	>Range	275	0.46	0.56	**NonLiq**	0.00	0.8
LB-3	3.8 to 5.0	1050	5	1.3	OX	40	110	50	1	1.3	65.0	550	116.0	144.2	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.00	0.8
LB-3	5.0 to 6.3	1050	5	1.3		40	110	24	2	1	15.6	550	27.8	38.4	0.364	>Range	>Range	550	0.46	0.56	**NonLiq**	0.02	0.8
LB-3	6.3 to 8.8	1048	7.5	2.5		45	110	13	2	1	8.5	825	15.1	23.1	0.161	0.258	0.258	825	0.46	0.55	**NonLiq**	0.09	0.8
LB-3	8.8 to 12.5	1045	10	3.8		55	110	14	2	1	9.1	1100	14.9	22.9	0.159	0.255	0.255	1100	0.45	0.55	**NonLiq**	0.21	0.7
LB-3	12.5 to 17.5	1040	15	5.0		95	110	7	1	1.1	7.7	1650	10.3	17.4	0.116	0.185	0.185	1650	0.45	0.54	**NonLiq**	0.38	0.5
LB-3	17.5 to 22.0	1035	20	4.5		95	110	14	1	1.22	17.1	2200	22.1	31.6	0.244	>Range	>Range	2200	0.44	0.54	**NonLiq**	0.09	0.1
LB-4	0 to 3.8	1051	2.5	3.8	OX	60	105	50	1	1.3	65.0	263	116.0	144.2	>Range	>Range	>Range	262.5	0.46	0.56	**NonLiq**	0.00	1.0
LB-4	3.8 to 5.0	1048	5	1.3	OX	55	105	50	1	1.3	65.0	525	116.0	144.2	>Range	>Range	>Range	525	0.46	0.56	**NonLiq**	0.00	1.0
LB-4	5.0 to 6.3	1048	5	1.3		55	105	32	2	1	20.8	525	37.1	49.6	>Range	>Range	>Range	525	0.46	0.56	**NonLiq**	0.00	1.0
LB-4	6.3 to 8.8	1046	7.5	2.5		60	105	30	2	1	19.5	788	35.6	47.7	>Range	>Range	>Range	787.5	0.46	0.55	**NonLiq**	0.01	1.0
LB-4	8.8 to 12.5	1043	10	3.8		60	105	21	2	1	13.7	1050	22.9	32.5	0.255	>Range	>Range	1050	0.45	0.55	**NonLiq**	0.07	1.0
LB-4	12.5 to 17.5	1038	15	5.0		**84**	105	8	1	1.12	9.0	1575	12.3	19.8	0.134	0.213	0.213	1575	0.45	0.54	**NonLiq**	0.29	1.0

Boring No.	Approx. Layer Depth (ft)	Elevation (ft)	SPT Depth (ft)	Approx Layer Thickness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$ (assume CLEAN SAND)**	$CRR_{7.5}$ (w/o Plasticity Crit)	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement (in.)**
LB-4	17.5 to 22.5	1033	20	5.0		5	110	21	1	1.3	27.3	2113	36.1	36.1	>Range	>Range	>Range	2112.5	0.44	0.54	**NonLiq**	0.08	0.7
LB-4	22.5 to 27.5	1028	25	5.0		**49**	110	11	1	1.15	12.6	2663	14.9	22.8	0.159	0.255	0.255	2662.5	0.44	0.53	**NonLiq**	0.41	0.6
LB-4	27.5 to 32.0	1023	30	4.5		40	120	11	1	1.14	12.5	3238	14.1	21.9	0.151	0.241	0.241	3237.5	0.43	0.53	**NonLiq**	0.18	0.2
LB-5	0 to 3.8	1052	2.5	3.8	OX	**49**	110	50	1	1.3	65.0	275	116.0	144.2	>Range	>Range	>Range	275	0.46	0.56	**NonLiq**	0.00	0.1
LB-5	3.8 to 5.0	1049	5	1.3	OX	60	110	50	1	1.3	65.0	550	116.0	144.2	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.00	0.1
LB-5	5.0 to 6.3	1049	5	1.3		60	110	29	2	1	18.9	550	33.6	45.4	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.01	0.1
LB-5	6.3 to 8.8	1047	7.5	2.5		60	110	38	2	1	24.7	825	44.0	57.8	>Range	>Range	>Range	825	0.46	0.55	**NonLiq**	0.01	0.1
LB-5	8.8 to 12.5	1044	10	3.8		25	110	25	2	1	16.3	1100	26.6	34.0	0.329	>Range	>Range	1100	0.45	0.55	**NonLiq**	0.08	0.1
LB-5	12.5 to 17.5	1039	15	5.0		**5**	110	26	1	1.3	33.8	1650	45.2	45.2	>Range	>Range	>Range	1650	0.45	0.54	**NonLiq**	0.02	0.0
LB-5	17.5 to 22.0	1034	20	4.5		5	120	65	1	1.3	84.5	2225	108.9	108.9	>Range	>Range	>Range	2225	0.44	0.54	**NonLiq**	0.01	0.0
LB-6	0 to 3.8	1049	2.5	3.8	OX	10	115	50	1	1.3	65.0	288	116.0	119.4	>Range	>Range	>Range	287.5	0.46	0.56	**NonLiq**	0.00	0.5
LB-6	3.8 to 5.0	1046	5	1.3	OX	5	115	50	1	1.3	65.0	575	116.0	116.0	>Range	>Range	>Range	575	0.46	0.56	**NonLiq**	0.00	0.5
LB-6	5.0 to 6.3	1046	5	1.3		5	115	24	2	1	15.6	575	27.8	27.8	0.364	0.364	0.364	575	0.46	0.56	**NonLiq**	0.07	0.5
LB-6	6.3 to 8.8	1044	7.5	2.5		60	105	22	2	1	14.3	850	25.1	35.1	0.294	>Range	>Range	850	0.46	0.55	**NonLiq**	0.03	0.4
LB-6	8.8 to 12.5	1041	10	3.8		60	110	43	2	1	28.0	1119	45.4	59.5	>Range	>Range	>Range	1118.8	0.45	0.55	**NonLiq**	0.01	0.4
LB-6	12.5 to 17.5	1036	15	5.0		30	110	13	1	1.21	15.7	1669	20.9	28.8	0.227	0.403	0.403	1668.8	0.45	0.54	**NonLiq**	0.13	0.4
LB-6	17.5 to 22.5	1031	20	5.0		5	120	41	1	1.3	53.3	2244	68.4	68.4	>Range	>Range	>Range	2243.8	0.44	0.54	**NonLiq**	0.02	0.2
LB-6	22.5 to 27.5	1026	25	5.0		70	120	18	1	1.26	22.6	2844	25.8	36.0	0.309	>Range	>Range	2843.8	0.44	0.53	**NonLiq**	0.14	0.2
LB-6	27.5 to 32.0	1021	30	4.5		75	120	19	1	1.26	24.0	3444	26.1	36.3	0.316	>Range	>Range	3443.8	0.43	0.53	**NonLiq**	0.07	0.1
LB-7	0 to 3.8	1050	2.5	3.8	OX	5	115	50	1	1.3	65.0	288	116.0	116.0	>Range	>Range	>Range	287.5	0.46	0.56	**NonLiq**	0.00	0.2
LB-7	3.8 to 5.0	1047	5	1.3	OX	5	115	50	1	1.3	65.0	575	116.0	116.0	>Range	>Range	>Range	575	0.46	0.56	**NonLiq**	0.00	0.2
LB-7	5.0 to 6.3	1047	5	1.3		5	115	19	2	1	12.4	575	22.0	22.0	0.243	0.243	0.243	575	0.46	0.56	**NonLiq**	0.09	0.2
LB-7	6.3 to 8.8	1045	7.5	2.5		70	105	22	2	1	14.3	850	25.1	35.1	0.294	>Range	>Range	850	0.46	0.55	**NonLiq**	0.03	0.1
LB-7	8.8 to 12.5	1042	10	3.8		70	120	42	2	1	27.3	1131	44.1	58.0	>Range	>Range	>Range	1131.3	0.45	0.55	**NonLiq**	0.01	0.0
LB-7	12.5 to 17.5	1037	15	5.0		5	120	24	1	1.3	31.2	1731	40.8	40.8	>Range	>Range	>Range	1731.3	0.45	0.54	**NonLiq**	0.02	0.0
LB-7	17.5 to 22.0	1032	20	4.5		5	120	37	1	1.3	48.1	2331	60.5	60.5	>Range	>Range	>Range	2331.3	0.44	0.54	**NonLiq**	0.02	0.0
LB-8	0 to 3.8	1051	2.5	3.8	OX	**22**	115	50	1	1.3	65.0	288	116.0	130.8	>Range	>Range	>Range	287.5	0.46	0.56	**NonLiq**	0.00	0.2
LB-8	3.8 to 5.0	1048	5	1.3	OX	5	125	50	1	1.3	65.0	588	116.0	116.0	>Range	>Range	>Range	587.5	0.46	0.56	**NonLiq**	0.00	0.2
LB-8	5.0 to 6.3	1048	5	1.3		5	125	22	2	1	14.3	588	25.5	25.5	0.303	0.303	0.303	587.5	0.46	0.56	**NonLiq**	0.08	0.2
LB-8	6.3 to 8.8	1046	7.5	2.5		80	120	34	2	1	22.1	894	37.8	50.4	>Range	>Range	>Range	893.75	0.46	0.55	**NonLiq**	0.01	0.1
LB-8	8.8 to 12.5	1043	10	3.8		25	120	37	2	1	24.1	1194	37.9	46.5	>Range	>Range	>Range	1193.8	0.45	0.55	**NonLiq**	0.02	0.1
LB-8	12.5 to 17.5	1038	15	5.0		5	120	29	1	1.3	37.7	1794	48.4	48.4	>Range	>Range	>Range	1793.8	0.45	0.54	**NonLiq**	0.02	0.1
LB-8	17.5 to 22.0	1033	20	4.5		5	120	24	1	1.3	31.2	2394	38.8	38.8	>Range	>Range	>Range	2393.8	0.44	0.54	**NonLiq**	0.08	0.1

Boring No.	Approx. Layer Depth (ft)	Eleva-tion (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$ (assume CLEAN SAND)**	$CRR_{7.5}$ (w/o Plasticity Crit)	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-9	0 to 3.8	1050	2.5	3.8	OX	40	115	50	1	1.3	65.0	288	116.0	144.2	>Range	>Range	>Range	287.5	0.46	0.56	**NonLiq**	0.00	0.1
LB-9	3.8 to 5.0	1047	5	1.3	OX	45	115	50	1	1.3	65.0	575	116.0	144.2	>Range	>Range	>Range	575	0.46	0.56	**NonLiq**	0.00	0.1
LB-9	5.0 to 6.3	1047	5	1.3		45	115	24	2	1	15.6	575	27.8	38.4	0.364	>Range	>Range	575	0.46	0.56	**NonLiq**	0.02	0.1
LB-9	6.3 to 8.8	1045	7.5	2.5		45	120	34	2	1	22.1	869	38.4	51.0	>Range	>Range	>Range	868.75	0.46	0.55	**NonLiq**	0.01	0.1
LB-9	8.8 to 12.5	1042	10	3.8		10	125	36	2	1	23.4	1175	37.1	38.8	>Range	>Range	>Range	1175	0.45	0.55	**NonLiq**	0.07	0.1
LB-9	12.5 to 17.5	1037	15	5.0		5	125	75	2	1	48.8	1800	62.5	62.5	>Range	>Range	>Range	1800	0.45	0.54	**NonLiq**	0.01	0.0
LB-9	17.5 to 22.0	1032	20	4.5		5	120	25	1	1.3	32.5	2413	40.2	40.2	>Range	>Range	>Range	2412.5	0.44	0.54	**NonLiq**	0.03	0.0
LB-10	0 to 3.8	1049	2.5	3.8	OX	40	105	50	1	1.3	65.0	263	116.0	144.2	>Range	>Range	>Range	262.5	0.46	0.56	**NonLiq**	0.00	0.5
LB-10	3.8 to 5.0	1046	5	1.3	OX	45	115	50	1	1.3	65.0	538	116.0	144.2	>Range	>Range	>Range	537.5	0.46	0.56	**NonLiq**	0.00	0.5
LB-10	5.0 to 6.3	1046	5	1.3		45	115	29	2	1	18.9	538	33.6	45.4	>Range	>Range	>Range	537.5	0.46	0.56	**NonLiq**	0.00	0.5
LB-10	6.3 to 8.8	1044	7.5	2.5		70	110	24	2	1	15.6	819	27.9	38.5	0.366	>Range	>Range	818.75	0.46	0.55	**NonLiq**	0.02	0.5
LB-10	8.8 to 12.5	1041	10	3.8		70	110	33	2	1	21.5	1094	35.3	47.3	>Range	>Range	>Range	1093.8	0.45	0.55	**NonLiq**	0.02	0.5
LB-10	12.5 to 17.5	1036	15	5.0		5	120	31	1	1.3	40.3	1669	53.6	53.6	>Range	>Range	>Range	1668.8	0.45	0.54	**NonLiq**	0.01	0.5
LB-10	17.5 to 22.5	1031	20	5.0		**20**	110	16	1	1.26	20.1	2244	25.8	31.5	0.309	>Range	>Range	2243.8	0.44	0.54	**NonLiq**	0.10	0.5
LB-10	22.5 to 27.5	1026	25	5.0		5	120	75	1	1.3	97.5	2819	111.6	111.6	>Range	>Range	>Range	2818.8	0.44	0.53	**NonLiq**	0.01	0.3
LB-10	27.5 to 32.5	1021	30	5.0		54	120	13	1	1.17	15.2	3419	16.6	24.9	0.176	0.290	0.290	3418.8	0.43	0.53	**NonLiq**	0.19	0.3
LB-10	32.5 to 37.5	1016	35	5.0		80	120	20	1	1.25	25.1	4019	25.3	35.3	0.298	>Range	>Range	4018.8	0.41	0.50	**NonLiq**	0.08	0.1
LB-10	37.5 to 42.5	1011	40	5.0		80	120	38	1	1.3	49.4	4619	46.5	60.8	>Range	>Range	>Range	4618.8	0.39	0.48	**NonLiq**	0.02	0.1
LB-10	42.5 to 47.5	1006	45	5.0		5	120	40	1	1.3	52.0	5219	46.0	46.0	>Range	>Range	>Range	5218.8	0.37	0.46	**NonLiq**	0.02	0.0
LB-10	47.5 to 52.0	1001	50	4.5		5	120	73	1	1.3	94.9	5819	79.6	79.6	>Range	>Range	>Range	5818.8	0.36	0.43	**NonLiq**	0.01	0.0
LB-11	0 to 3.8	1051	2.5	3.8	OX	5	110	50	1	1.3	65.0	275	116.0	116.0	>Range	>Range	>Range	275	0.46	0.56	**NonLiq**	0.00	0.7
LB-11	3.8 to 5.0	1048	5	1.3	OX	20	110	50	1	1.3	65.0	550	116.0	128.9	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.00	0.7
LB-11	5.0 to 6.3	1048	5	1.3		20	110	32	2	1	20.8	550	37.1	43.7	>Range	>Range	>Range	550	0.46	0.56	**NonLiq**	0.01	0.7
LB-11	6.3 to 8.8	1046	7.5	2.5		80	110	29	2	1	18.9	825	33.6	45.3	>Range	>Range	>Range	825	0.46	0.55	**NonLiq**	0.01	0.7
LB-11	8.8 to 12.5	1043	10	3.8		45	110	35	2	1	22.8	1100	37.3	49.8	>Range	>Range	>Range	1100	0.45	0.55	**NonLiq**	0.01	0.7

Latitude, Longitude: 34.0526, -117.4368



Date	10/6/2022, 5:28:14 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.595	MCE_R ground motion. (for 0.2 second period)
S_1	0.6	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.595	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.063	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.648	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.713	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.816	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.943	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.595	Factored deterministic acceleration value. (0.2 second)
S1RT	0.681	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.748	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.648	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.776	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.935	Mapped value of the risk coefficient at short periods
C_{R1}	0.909	Mapped value of the risk coefficient at a period of 1 s
C_V	1.419	Vertical coefficient

DISCLAIMER

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U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (u...

Latitude

Decimal degrees

34.0526

Longitude

Decimal degrees, negative values for western longitudes

-117.4368

Site Class

259 m/s (Site class D)

Spectral Period

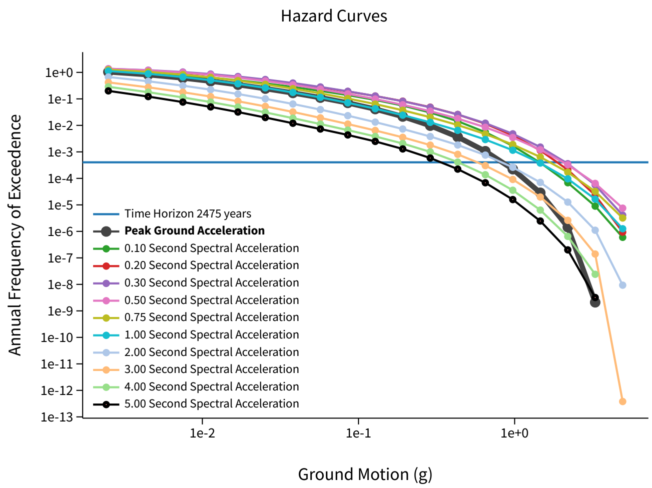
Peak Ground Acceleration

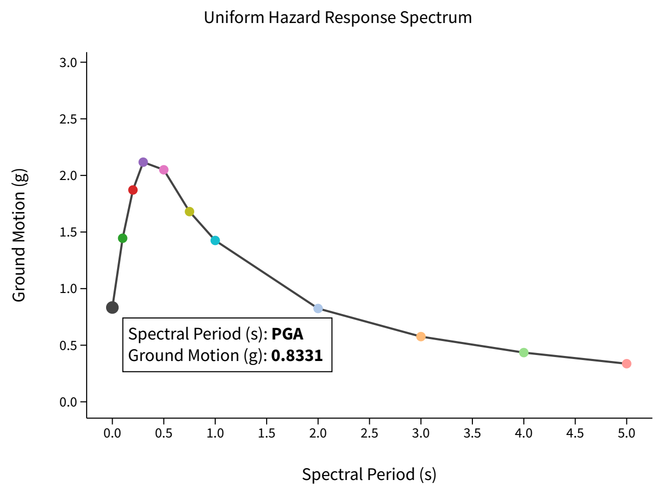
Time Horizon

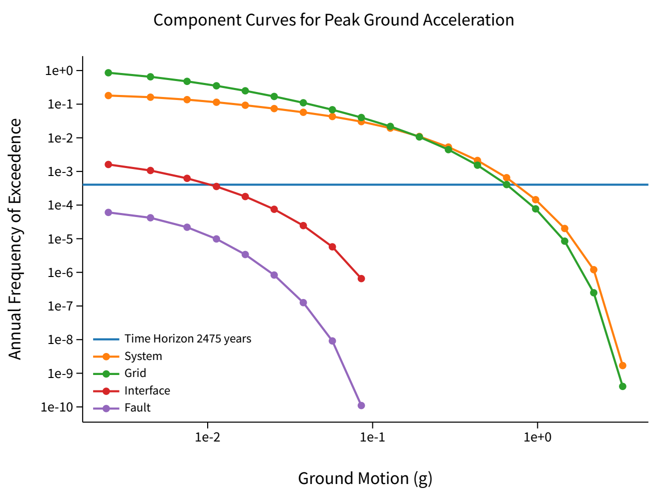
Return period in years

2475

Hazard Curve





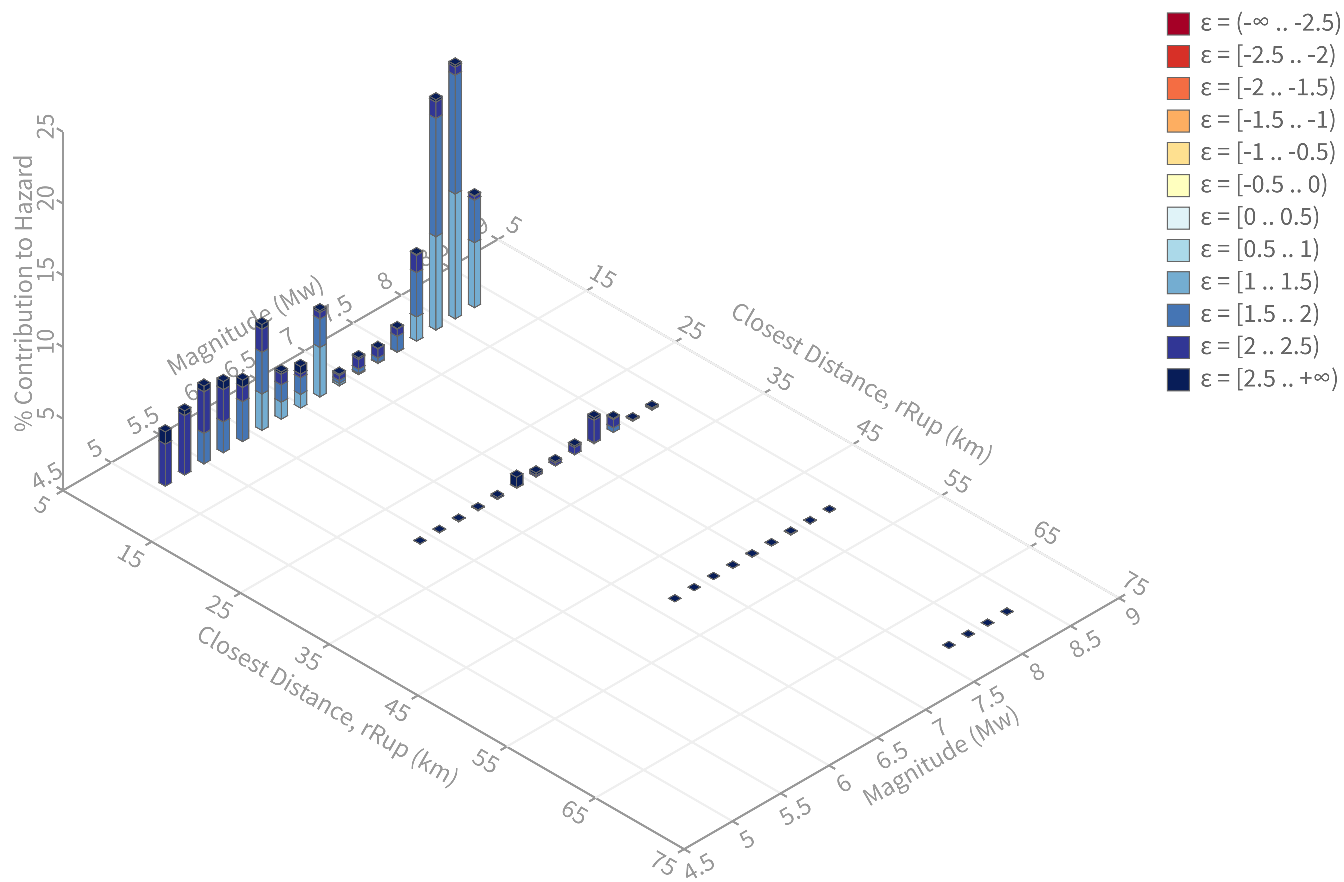


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.83313798 g

Recovered targets

Return period: 3163.7189 yrs
Exceedance rate: 0.00031608371 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.05 %

Mean (over all sources)

m: 7.05
r: 12.66 km
ε_0: 1.79 σ

Mode (largest m-r bin)

m: 8.1
r: 14.12 km
ε_0: 1.54 σ
Contribution: 17.69 %

Mode (largest m-r-ε_0 bin)

m: 8.1
r: 11.54 km
ε_0: 1.32 σ
Contribution: 8.7 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							32.36
San Jacinto (San Bernardino) [3]		11.65	8.04	1.46	117.328°W	34.106°N	59.50	11.61
San Andreas (San Bernardino N) [4]		19.32	7.88	1.90	117.323°W	34.199°N	32.67	9.10
Fontana (Seismicity) [1]		5.59	6.59	1.48	117.477°W	34.087°N	315.93	3.55
San Jacinto (Lytle Creek connector) [2]		10.83	8.00	1.41	117.365°W	34.129°N	37.84	3.27
Cucamonga [0]		14.61	7.44	1.84	117.480°W	34.178°N	343.99	1.02
UC33brAvg_FM32	System							31.76
San Jacinto (San Bernardino) [3]		11.65	8.03	1.46	117.328°W	34.106°N	59.50	11.51
San Andreas (San Bernardino N) [4]		19.32	7.88	1.89	117.323°W	34.199°N	32.67	9.23
San Jacinto (Lytle Creek connector) [2]		10.83	7.99	1.41	117.365°W	34.129°N	37.84	3.28
Fontana (Seismicity) [1]		5.59	6.59	1.48	117.477°W	34.087°N	315.93	2.93
UC33brAvg_FM31 (opt)	Grid							17.96
PointSourceFinite: -117.437, 34.111		8.01	5.72	1.89	117.437°W	34.111°N	0.00	5.31
PointSourceFinite: -117.437, 34.111		8.01	5.72	1.89	117.437°W	34.111°N	0.00	5.31
PointSourceFinite: -117.437, 34.120		8.79	5.69	2.00	117.437°W	34.120°N	0.00	1.41
PointSourceFinite: -117.437, 34.120		8.79	5.69	2.00	117.437°W	34.120°N	0.00	1.41
UC33brAvg_FM32 (opt)	Grid							17.92
PointSourceFinite: -117.437, 34.111		8.01	5.71	1.89	117.437°W	34.111°N	0.00	5.31
PointSourceFinite: -117.437, 34.111		8.01	5.71	1.89	117.437°W	34.111°N	0.00	5.31
PointSourceFinite: -117.437, 34.120		8.79	5.69	2.00	117.437°W	34.120°N	0.00	1.41
PointSourceFinite: -117.437, 34.120		8.79	5.69	2.00	117.437°W	34.120°N	0.00	1.41

APPENDIX D

EARTHWORK AND GRADING GUIDE SPECIFICATIONS

Leighton

LEIGHTON CONSULTING, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

Table of Contents

1.0 <u>General</u>

1.1 <u>Intent</u>: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 <u>The Geotechnical Consultant of Record</u>: Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The

Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General: Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety: The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill: All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.3 Lift Thickness: Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

7.4 Observation and Testing: The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

APPENDIX E

CGS NOTE 48 CHECKLIST
WITH REFERENCES TO THIS REPORT

Leighton

California Geological Survey - Note 48

Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings
November 2019

Note 48 is used by the California Geological Survey (CGS) to review the geology, seismology, and geologic hazards evaluated in reports that are prepared under California Code of Regulations (CCR), Title 24, California Building Code (2019 CBC). CCR Title 24 applies to California Public Schools, Hospitals, Skilled Nursing Facilities, and Essential Services Buildings. The Building Official for public schools is the Division of the State Architect (DSA). Hospitals and Skilled Nursing Facilities in California are under the jurisdiction of the Office of Statewide Health Planning & Development (OSHPD). The California Geological Survey serves as an advisor under contract with these two state agencies.

Project Name: Chaffey New Fontana Campus   Location: 11070 Sierra Avenue, Fontana, CA

OSHPD or DSA File #: ____________   Reviewed By: ____________

Date Reviewed: ____________   California Certified Engineering Geologist #: _____

Checklist Item or Topic Within Consulting Report NA = not applicable NR = not addressed by consultant and therefore not reviewed at this time	Adequately Described; Satisfactory	Additional Information Needed

Project Location

1. Site Location Map, Street Address, County Name: Correctly plot site on a 7½-minute USGS topographic quadrangle base-map.	Figure 1, Cover letter	
2. Plot Plan with Exploration Data and Building Footprint: Show locations of borings, CPTs, trenches or other explorations.	Figure 2, Section 1.2	
3. Site Coordinates: Latitude & Longitude.	Section 2.5.2	

Engineering Geology/Site Characterization

4. Regional Geology and Regional Fault Maps: Concise page-sized illustrations with site plotted.	Figure 3; Figure 5	
5. Geologic Map of Site: Detailed (large-scale) geologic map with proper symbols and geologic legend.	Figure 3	
6. Geologic Hazard Zones: *(If applicable)* Discuss proposed structures in relation to CGS official map showing Zones of Required Investigation for any seismic hazards (liquefaction, landslide, tsunami, fault rupture) and/or any pertinent geologic hazard map from the Safety Element of the local agency (city/county).	Section 2.6; Figure 6	
7. Subsurface Geology: Adequate subsurface exploration: One boring or exploration shaft per 5000 ft^2, with minimum of two for any one building (CBC §1803A.3.1). Borings of adequate depth to characterize hazards and geotechnical properties. CPTs with correlated borings (upload data files). Engineering geologic description summarized from boreholes or trench logs. Summarize ground water conditions.	Section 2.3; 2.4	
8. Geologic Cross Sections: Two or more interpretive geologic sections, based on site exploration data, with pertinent foundations and site grading. Depict extent of liquefiable soils.	Figure 4a; Figure 4b	
9. Geotechnical Testing of Representative Samples: Broad suite of appropriate geotechnical tests.	Appendices A , B	
10. Consideration of Geology in Geotechnical Engineering Recommendations: Discuss engineering geologic aspects of excavation/grading/fill activities, foundations and support of structures. Include geologic and geotechnical inspections and problems anticipated during grading. Provide all information as required by CBC §1803A.7, including special design and construction provisions for settlement and bearing capacity failure of foundations bearing on weak/soft, collapsible, liquefiable, or expansive soils. Consideration of seismic compression of fills; and cut/fill differential settlement.	Section 3.2; 3.3	
11. Conditional Geotechnical Topics: *(If applicable)* Including but not limited to – **A. Basement and retaining wall design** – demonstrate conformance with CBC §1807A.2 and §1803A.5.12. **B. Deep foundations** – demonstrate conformance with CBC §1803A.5.5, §1803A.5.12, §1810A, and ASCE 7 §12.13. **C. Effects of construction on adjacent structures**, including temporary shoring/underpinning.	Figure 9; Section 3.6; 3.10	

Seismology & Calculation of Earthquake Ground Motion

12. Evaluation of Historical Seismicity: Describe briefly how historical earthquakes have affected site.	Section 2.5.3; Figure 5	
13. Classify the Geologic Subgrade (Site Class): ASCE 7, Chapter 20. Provide justification.	Section 2.5.2	
14. General Procedure Ground Motion Analysis: Follows CBC §1613A.2. Report parameters S_S, S_1, S_{DS}, S_{D1}, and T_S. Tools available at: https://earthquake.usgs.gov/hazards/designmaps/.	Section 2.5.2, 3.6	
15. Site-Specific Ground Motion Hazard Analysis: *(Assumed to be required for Site Class D, E & F unless specific Exception enumerated in ASCE 7 §11.4.8 is invoked.)* Required in ASCE 7, §11.4.8. See requirements in ASCE 7, §21.2 to §21.5 *and* Supplement No. 1, and in CBC §1803A.6. CGS suggests a table showing: **(a)** 2%-in-50-years probabilistic spectrum, **(b)** risk coefficients (if using ASCE 7 §21.2.1.1, Method 1), **(c)** probabilistic MCE_R, **(d)** 84th percentile deterministic spectrum, *if allowed,* **(e)** *scaled* deterministic spectrum, (§21.2.2), **(f)** site-specific MCE_R (§21.2.3), **(g)** 80% of *modified* General Response Spectrum (§21.3), **(h)** design response spectrum (§21.3). Also provide S_{DS} and S_{D1} values per ASCE 7 §21.4.	Section 2.5.2	
16. Deaggregated Seismic Source Parameters: *(If applicable)* If needed for liquefaction or slope stability analysis, or for earthquake record selection, provide controlling magnitude (M) and fault distance (R). Might be either deterministic or deaggregate for modal M and R.	Section 2.5.2	

Checklist Item or Topic Within Consulting Report NA = not applicable NR = not addressed by consultant and therefore not reviewed at this time	Adequately Described; Satisfactory	Additional Information Needed
17. Time Histories of Earthquake Ground Motion: *(If applicable)* Develop target spectra (MCE_R or conditional mean). Justify selected earthquake records. Scale or spectral match to meet ASCE 7 §12.9.2 or §16.2 for linear or non-linear response history analysis, respectively. Show initial and scaled time histories and response spectra.	NA	

Fault Rupture Hazard Evaluation

18. Active Faulting & Coseismic Deformation Across Site: Discuss active faults at the site or projecting toward it. Address location of faults and their activity level. See CGS Special Publication 42. Show location of proposed structures in relation to any potential fault rupture hazard; show location of fault investigation trenches, and recommended setbacks from fault trace (minimum 50-feet).	Section 2.5.1	

Liquefaction/Seismic Settlement Analysis

19. Geologic Setting for Occurrence of Liquefaction: Perform *screening* analysis to identify where the following conditions apply: (1) depth of highest historical ground water surface <50 ft, and (2) low-density, non-plastic and low plasticity alluvium, typically with *SPT* $(N_1)_{60}$<30	Section 2.4, 2.6.1	
20. Seismic Settlement Calculations: *(If applicable)* Evaluate both saturated and unsaturated layers of the entire soil column. Provide calculations (no estimates) and report all input parameters. Evaluate liquefaction triggering using highest historical ground water elevation and PGA_M (CBC §1803A.5.12) and calculate liquefaction settlement for each layer where FS<1.3 (CGS SP117A). Seismic differential settlement (ASCE 7-16, §12.13.9) should be determined from multiple borings defining the full liquefiable interval and located to adequately define lateral variability. If fewer deep borings are available, then assume half of total settlement across a horizontal distance of 30 feet. Report results in terms that include horizontal dimension.	Section 2.6.1	
21. Other Liquefaction Effects: *(If applicable)* Bearing capacity failure (ASCE 7, §12.13.9.1), surface manifestation (i.e., sand boils), and/or lateral spread (refer to CGS SP117A).	Section 2.6.1	
22. Mitigation Options for Liquefaction/Seismic Settlement: *(If applicable)* Discuss effectiveness of options to mitigate liquefaction effects. Where liquefiable soils are identified, see ASCE 7, §12.13.9, for foundation design. If ground improvement is proposed, discuss performance objectives, provide measurable acceptance criteria, and recommend field verification program.	Section 2.6.1	

Slope Stability Analysis

23. Geologic Setting for Occurrence of Landslides: Characterize the potential for landsliding both on and off-site affecting proposed project.	Section 2.6.4	
24. Determination of Static and Dynamic Strength Parameters: *(If applicable)* Conduct appropriate laboratory tests to determine material strength for both static and dynamic conditions.	Section 2.6.4	
25. Determination of Pseudo-Static Coefficient (K_{eq}): *(If applicable)* Recommended procedure available from CGS Special Publication 117A. Recommend using design-level ground motion based on geometric mean and without risk coefficient (i.e., $(PGA_M)/1.5$), or discuss with CGS.	Section 2.6.4	
26. Identify Critical Slip Surfaces for Static and Dynamic Analyses: *(If applicable)* Failure surfaces should be modeled to include existing slip surfaces, discontinuities, geologic structure and stratigraphy; include appropriate ground water conditions.	Section 2.6.4	
27. Dynamic Site Conditions: *(If applicable)* Site response analysis and topographic effects should be considered, if appropriate.	Section 2.6.4	
28. Mitigation Options for Landsliding/Other Slope Failure: *(If applicable)* Discuss effectiveness of options to mitigate landsliding/slope failure effects. Acceptance criteria for ground-improvement schemes.	Section 2.6.4	

Other Geologic Hazards or Adverse Site Conditions

These exceptional geologic hazards do not occur statewide; however, they may be pertinent to a particular site. Where these conditions exist, relevant information should be communicated to the design team.

29. Expansive Soils	Section 2.3.2	
30. Corrosive/Reactive Geochemistry of Geologic Subgrade: soluble sulfates and corrosive soils.	Section 2.3.3, 2.3.4	
31. Conditional Geologic Assessment: Including but not limited to - **A. Hazardous materials** methane gas, hydrogen-sulfide gas, tar seeps; **B. Volcanic eruption**; **C. Flooding** Riverine (FEMA FIRMs or local zoning for 100-year flood); see CBC §1612A. Also consider alluvial fan flooding & dam inundation. Is the site elevated or protected from the hazard; **D. Tsunami and seiche inundation**; see ASCE 7, Chapter 6; zone maps at web site ASCE7tsunami.online; **E. Radon-222 gas**; **F. Naturally occurring asbestos** in geologic formations associated with serpentine; refer to CGS SP 124; **G. Hydrocollapse** of alluvial fan soils due to anthropic use of water; **H. Regional subsidence**; **I. Clays and cyclic softening**.	Section 2.6.3 Section 2.6.5 Section 2.6.6	

Report Documentation

32. Geology, Seismology, and Geotechnical References	References	
33. Certified Engineering Geologist: (CBC §1803A)	Cover Letter	
34. Registered Geotechnical Engineer: (CBC §1803A)	Cover Letter	