Appendix E
Geotechnical Investigation

FONTANA FOOTHILLS COMMERCE CENTER
DRAFT EIR

GEOTECHNICAL INVESTIGATION
TWO PROPOSED
COMMERCIAL/INDUSTRIAL BUILDINGS

NEC Jurupa Avenue and Juniper Avenue
Fontana, California
for
REDA Acquisitions and Clarion Partners
Acquisitions, LLC

SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

April 22, 2020

REDA Acquisitions
and Clarion Partners Acquisitions, LLC
4450 MacArthur Boulevard, Suite 100
Newport Beach, California 92660

Attention: Mr. Chad Manista

Project No.: **19G191-1R**

Subject: **Geotechnical Investigation**
Two Proposed Commercial/Industrial Buildings
NEC Jurupa Avenue and Juniper Avenue
Fontana, California

Gentlemen:

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

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

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

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1.0 EXECUTIVE SUMMARY

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

Site Preparation Recommendations

- Initial site preparation should include stripping of any topsoil or vegetation. At the time of the site investigation, ground surface cover consisted of sparse to moderate native grass and weed growth with several large trees within the site. In addition, the site was previously utilized as a citrus grove. Any organic materials, including root-masses should be removed in their entirety. These materials should be disposed of off-site. Any resultant excavations should be backfilled with compacted structural fill.
- Demolition of the residences and associated improvements will be required as part of the new development. Demolition procedures should include all foundations, floor slabs, utilities, septic systems and any other subsurface improvements that will not remain in place for use with the new development. Debris resultant from demolition activities should be disposed of off-site.
- The near-surface soils generally consist of artificial fill soils extending to depths of 1½ to 3± feet below existing site grades. However, Boring No. B-6, located along the western boundary of the site encountered artificial fill soils extending to a depth of 6½± feet. It is possible that the fill soils may be a result of removal of the previous citrus trees. The artificial fill soils possess varying strengths and unfavorable consolidation/collapse characteristics.
- Based on the varying densities and the moderate potential for consolidation/collapse of the near-surface soils, remedial grading is recommended to be performed within the proposed building pad areas. The existing soils within the proposed building areas should be overexcavated to a depth of 4 feet below existing grade and to a depth of 4 feet below proposed pad grade. Within the building area, the proposed foundation influence zones should be overexcavated to a depth of 3 feet below proposed foundation bearing grade. The overexcavation should also extend to a sufficient depth to remove any artificial fill soils.
- Additional soils classified as possible fill were encountered at Boring Nos. B-2, B-3, and B-4, extending to depths of 3 to 12± feet. The possible fill soils should be further evaluated at the time of rough grading. If they are determined to consist of artificial fill soils, they should be overexcavated in their entirety.
- Boring No. B-5 encountered very moist and possibly unstable soils extending between the depths of 5½ to 12± feet. The moisture content of the soils encountered between the depths of 5½ to 12½ feet are 18 and 24 percent. These soils may be encountered at the recommended bottom of overexcavations within the northern building pad. Additional removals or stabilization procedures may be required if these materials are encountered at the base of the recommended overexcavation. Recommendation regarding the treatment of very moist soils that may be encountered at the base of the recommended overexcavation are included with this report.
- After overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be overexcavated. The resulting soils should be scarified and moisture conditioned to achieve a moisture content of 0 to 4 percent above optimum moisture, to a depth of at least 12 inches. The

overexcavation subgrade soils should then be recompacted under the observation of the geotechnical engineer. The previously excavated soils may then be replaced as compacted structural fill.

- The new pavement and flatwork subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundation Recommendations

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

Building Floor Slab Recommendations

- Conventional Slab on Grade, at least 6 inches thick
- Modulus of Subgrade Reaction: k = 125 psi/in
- Reinforcement is not considered to be necessary for geotechnical considerations.
- The actual thickness and reinforcement of the floor slabs should be determined by the structural engineer, based on the imposed slab loading.

Pavements

ASPHALT PAVEMENTS (R = 50)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	3	4	5	5	7
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 19P280R, dated July 3, 2019. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the northeast corner of Jurupa Avenue and Juniper Avenue in Fontana, California. The site is bounded to the north by a Home Depot and a vacant lot, to the west by Juniper Avenue, to the south by Jurupa Avenue, and to the east by single-family residences and vacant lots. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of twelve (12) rectangular-shaped parcels which total 33.54± acres in size. The assessor's parcel numbers (APN) included for the subject site are:

0255-101-14	0255-101-20	0255-101-21
0255-101-12	0255-101-11	0255-110-22
0255-110-21	0255-110-16	0255-110-17
0255-110-18	0255-110-19	0255-111-25

The majority of the parcels are developed with single-family residences, attached/detached wooden garages/sheds and metal canopies. The existing residences are single-story structures of wood-framed and stucco construction, assumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. The existing residences are generally surrounded by concrete pavements with isolated areas of asphaltic concrete pavements, gravel pavements, and landscaped areas. The existing pavements are in poor to fair condition with moderate to severe cracking throughout. The ground surface cover for the remainder of the site generally consists of exposed soil with sparse to moderate native grass and weed growth. Several medium-to-large trees are present throughout the site. It should be noted that the southeastern parcel is an active nursery, and it contains several planter areas.

Detailed topographic information was not available at the time of this report. However, based on topographic information obtained from Google Earth, the site topography ranges from 1061± feet mean sea level (msl) in the northwestern corner of the site to 1041± feet msl in the southern region of the site. The site topography generally slopes downward to the south at an estimated gradient of less than 2 percent.

3.2 Proposed Development

Based on the conceptual grading plan provided to our office (identified as Scheme 9 prepared by HPA, Inc.), the proposed development will consist of two (2) commercial/industrial buildings (identified as Building 1 and Building 2). Building 1 will be located in the northern region of the site and will possess an approximate footprint of 432,580 ft^2. Building 2 will be located in the southern region of the site and will possess an approximate footprint of 325,450 ft^2. Dock-high doors will be constructed along a portion of the west side of Building 1 and a portion of the north side of Building 2. The new buildings are expected to be surrounded by asphaltic concrete

pavements in the parking and drive lane areas, Portland cement concrete pavements in the loading dock areas, landscaped areas and concrete flatwork.

Detailed structural information has not been provided. It is assumed that the proposed buildings will be single-story structures of concrete tilt-up construction, typically supported on conventional shallow foundations with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

Preliminary grading plans were not available at the time of this report. Based on the existing topography, and assuming a relatively balanced site, cuts and fills of up to 5± feet are expected to be necessary to achieve the proposed site grades within the proposed building areas. The proposed buildings are not expected to incorporate any significant below-grade construction such as basements or crawl spaces. It should be noted that this estimate does not include any remedial grading recommendations which are presented in a subsequent section of this report.

3.3 Concurrent Study

SCG recently performed infiltration testing for the site, the results of which are presented in the infiltration report referenced as follows:

> Results of Infiltration Testing, Two Proposed Commercial/Industrial Buildings, NEC Jurupa Avenue and Juniper Avenue, Fontana, California, prepared for REDA Acquisitions and Clarion Partners Acquisitions, LLC, prepared by SCG, SCG Project No. 19G191-2, dated September 23, 2019.

As part of this study four (4) backhoe-excavated trenches were advanced to depths of 9½ to 10± feet below the existing site grades. Artificial fill soil was encountered at the ground surface at Infiltration Trench No. I-2, extending to a depth of 2½± feet below the existing site grades. The fill soils consist of loose to medium dense silty fine sand with little medium to coarse sands and trace fine gravel. The fill soil possesses a disturbed appearance and a 1-foot-diameter, intact concrete pipe was exposed 1± foot below the ground surface at Trench No. I-2, resulting in its classification as artificial fill.

Native alluvium was encountered below the artificial fill soil at Trench No. I-2 and at the ground surface at all of the remaining infiltration trench locations. The near-surface alluvial soils, generally extending from the ground surface to 1± foot below the existing site grades at Infiltration Trench Nos. I-1, I-3, and I-4, consist of very loose to loose silty fine to medium sands with little coarse sand, and trace to little fine to coarse gravel. At greater depths, the alluvial soils generally consist of loose to medium dense silty fine sands, fine sandy silts, fine sands, and fine to coarse sands with varying amounts of medium to coarse sands and fine to coarse gravel, extending to at least the maximum depth explored of 10± feet below the existing site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of eight (8) borings (identified as Boring Nos. B-1 through B-8) advanced to depths of 15 to 25± feet below the existing site grades. An additional boring was intended to be performed in the northeast region of the site, however this portion of the site was not accessible to the drilling equipment at the time of our site investigation. It should also be noted that the building footprint of Building 1 was flipped to the east since the time of our subsurface exploration. Therefore, one (1) boring and one (1) infiltration trench are located within the proposed building area. However, based on our understanding of the subsurface profile discussed below, additional subsurface exploration is not considered necessary for this site. All of the borings were logged during the drilling by a member of our staff.

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

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

4.2 Geotechnical Conditions

Artificial Fill

Artificial fill soils were encountered at the ground surface at Boring Nos. B-2, B-4, B-6 and B-7, extending to depths of 1½ to 6½± feet below the existing site grades. The fill soils generally consist of loose to medium dense silty sands, with varying fine gravel content. The fill soils possess a disturbed appearance, resulting in their classification as artificial fill.

Possible Fill

Additional soils classified as possible fill soils were encountered at the ground surface at Boring No. B-3 and beneath the fill soils at Boring Nos. B-2 and B-4, extending to depths of 3 to 12±

feet below the existing site grades. The possible fill soils generally consist of medium dense to dense silty fine sands and gravelly fine to coarse sands to fine to coarse sandy gravel. These soils possess a slight disturbed appearance, but lack obvious indicators of fill, such as debris content, resulting in their classification as possible fill. The possible fill soils should be evaluated at the time of grading to determine if they consist of artificial fill materials. The evaluation should include a visual inspection for debris, mottling, or a disturbed appearance.

Alluvium

Native alluvium was encountered at the ground surface at Boring Nos. B-1, B-5 and B-8, and beneath the artificial fill and possible fill soils at the remaining boring locations, extending to at least the maximum depth explored of 25± feet below the existing site grades. The alluvial soils generally consist of medium dense silty fine sands and fine sandy silts, with varying medium to coarse sands and fine gravel content. Boring No. B-4 encountered a layer of dense to very dense fine to coarse sands, with little fine gravel and silt content at depths of 17 to 25± feet. Boring No. B-5 encountered a layer of stiff clayey silt, with little fine sand content at depths of 5½ to 12± feet.

Groundwater

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

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The water level data was obtained from the California Department of Water Resources website, http://wdl.water.ca.gov/waterdatalibrary/. The nearest monitoring well in this database is located approximately ½ mile northwest from the site. Water level readings within this monitoring well indicate a high groundwater level of 225± feet below the ground surface, in October 1924.

5.0 LABORATORY TESTING

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

Classification

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

Density and Moisture Content

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

Consolidation

Selected soil samples have been tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-8 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

One representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-9 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes

into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	Sulfate Classification
B-3 @ 0 to 5 feet	<0.001	Not Applicable (S0)
B-8 @ 0 to 5 feet	0.005	Not Applicable (S0)

Corrosivity Testing

Representative bulk samples of the near-surface soils were submitted to a subcontracted corrosion engineering laboratory to determine if the near-surface soils possess corrosive characteristics with respect to common construction materials. The corrosivity testing included a determination of the electrical resistivity, pH, and chloride and nitrate concentrations of the soils, as well as other tests. The results of some of these tests are presented below.

Sample Identification	Saturated Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Nitrates (mg/kg)
B-3 @ 0 to 5 feet	12,400	7.6	Not Detected	13
B-8 @ 0 to 5 feet	6,800	7.3	5.3	43

6.0 CONCLUSIONS AND RECOMMENDATIONS

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

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

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

6.1 Seismic Design Considerations

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

Faulting and Seismicity

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

Seismic Design Parameters

The California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). However, it is also possible that the proposed development may be designed using the 2019 CBC, which will be adopted on January 1, 2020. Therefore, this report provides design parameters for both the 2016 CBC and the 2019 CBC. Other design consultants should verify the version of the code under which the proposed development will be submitted.

The 2016 and 2019 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-10 and ASCE 7-16, upon which the 2016 CBC and 2019 CBC are based, respectively. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The tables below were created using data obtained from the application. The output generated from this program is included as Plates E-1A (2016 CBC) and E-1B (2019 CBC) in Appendix E of this report. Based on this output, the following parameters may be utilized for the subject site:

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.500
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.600
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.900
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.600

The 2019 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_1 value greater than 0.2. However, Section 11.4.8 of ASCE 7-16 also indicates an exception to the requirement for a site-specific ground motion hazard analysis for certain structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) indicates that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." **Based on our understanding of the proposed development, the seismic design parameters presented below were calculated assuming that the exception in Section 11.8.4 applies to the proposed structures at this site. However, the structural engineer should verify that this exception is applicable to the proposed structures.** Based on the exception, the spectral response accelerations presented below were calculated using the site coefficients (F_a and F_v) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2019 CBC.

2019 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped MCE_R Acceleration at 0.2 sec Period	S_S	1.590
Mapped MCE_R Acceleration at 1.0 sec Period	S_1	0.600
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.590
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.020
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.060
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.680

It should be noted that the site coefficient F_v and the parameters S_{M1} and S_{D1} were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the 2019 CBC. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2019 CBC using the value of S_1 obtained from the Seismic Design Maps Tool, assuming that a site-specific ground motion hazards analysis is not required for the proposed buildings at this site.

6.2 Geotechnical Design Considerations

General

The site is generally underlain by artificial fill soils, extending to depths of 1½ to 6½± feet at the boring locations. These artificial fill soils may have been a result of the removal of the previous citrus trees. Based on their disturbed appearance, these soils are classified as artificial fill. The fill soils are not considered suitable to support the foundations and floor slabs of the proposed buildings due to their variable strengths and densities. Based on these considerations, remedial grading is warranted within the proposed building areas in order to remove all of the soils classified as artificial fill and a portion of the underlying native alluvium in order to replace these materials as compacted structural fill.

Settlement

The recommended remedial grading will remove the existing fill soils from the new building areas as well as a portion of the upper alluvium and replace these materials as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation possess more favorable consolidation and collapse characteristics and will not be subject to significant load increases from the foundations of the new structures. Provided that the recommended remedial grading is completed, the post-construction settlements of the proposed structures are expected to be within tolerable limits.
areas.

Expansion

The near-surface soils generally consist of sands and silty sands with no appreciable clay content. These materials have been visually classified as non-expansive. Therefore, no design

considerations related to expansive soils are considered warranted for this site. Expansion index testing should be performed during rough grading procedures to verify the expansion index potential of the soils placed within the completed building pads.

Soluble Sulfates

The result of the soluble sulfate testing indicated sulfate concentrations of up to 0.005 percent for the selected samples of the on-site soils. These concentrations are considered to be not applicable (S0) with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building areas.

Corrosion Potential

The results of laboratory testing indicate that the on-site soils possess saturated resistivity values of 6,800 to 12,400 ohm-cm, and pH values of 7.3 to 7.6. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Sulfides, and redox potential are factors that are also used in the evaluation procedure. We have evaluated the corrosivity characteristics of the on-site soils using resistivity, pH, and moisture content. Based on these factors, and utilizing the DIPRA procedure, the on-site soils are not considered to be corrosive to ductile iron pipe. **However, SCG does not practice in the area of corrosion engineering. Therefore, the client may also wish to contact a corrosion engineer to provide a more thorough evaluation.** Additional corrosivity testing may be performed following rough grade procedures to verify the corrosivity potential of the on-site soils.

Shrinkage/Subsidence

Removal and recompaction of the artificial fill and near-surface native soils is estimated to result in an average shrinkage of 4 to 12 percent. However, the estimated shrinkage of the individual soil layers at the site is highly variable, locally ranging from 0 to 16 percent shrinkage. It should be noted that the shrinkage estimate is based on the results of dry density testing performed on small-diameter samples of the existing soils taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1 to 0.15± feet. This estimate may be used for grading in areas that are underlain by native alluvial soils.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be

dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

No grading or foundation plans were available at the time of this report. It is therefore recommended that we be provided with copies of the preliminary plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

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

Site Stripping and Demolition

Initial site stripping should include removal of any surficial vegetation from the site. Stripping should include the moderate to heavy native grass and weeds, several large trees, small to medium bushes and sparse trash debris spread throughout the site. Removal of the tress should include removal of the underlying root masses and organic material, with the resulting excavation being backfilled with compacted structural fill. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Demolition of the existing structures and pavements will be necessary in order to facilitate the construction of the proposed development. Demolition should include all foundations, floor slabs, pavements, septic systems, utilities and any other subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should be disposed of off-site.

Treatment of Existing Soils: Building Pads

Remedial grading should be performed within the proposed building areas in order to remove the artificial fill soils in their entirety, and a portion of the underlying native alluvial soils. Based on conditions encountered at the boring locations, the existing soils within the proposed building areas are recommended to be overexcavated to a depth of at least 4 feet below existing grade and to a depth of at least 4 feet below proposed building pad subgrade elevation, whichever is greater. The depth of overexcavation should also be sufficient to remove any artificial fill soils.

Where not encompassed within the general building pad overexcavations, additional overexcavation should be performed within the influence zones of the new foundations, to provide for a new layer of compacted structural fill extending to a depth of 3 feet below proposed bearing grade.

The overexcavation areas should extend at least 5 feet beyond the building foundations and perimeters. If the proposed structures incorporate any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

As discussed in previous sections of this report, it is unknown whether or not the root masses of the former citrus trees were removed at the time the trees were stripped from the site. If any significant tree root masses are encountered during grading, they should be removed in their entirety, prior to the replacement of any soils as compacted structural fill.

Following completion of the overexcavation, the subgrade soils within the building areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structures. This evaluation should include proofrolling and probing to identify any soft, loose or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if loose, porous, or low density native soils are encountered at the base of the overexcavation. The possible fill soils should be further evaluated at the time of grading. If these are determined to be undocumented fill soils, they should be removed in their entirety.

Based on the conditions encountered at the exploratory boring locations, some zones of very moist soils may be encountered at or near the base of the recommended overexcavation. Stabilization of the exposed overexcavation subgrade soils may be necessary. Scarification and air drying of these materials may be sufficient to obtain a stable subgrade. However, if highly unstable soils are identified, and if the construction schedule does not allow for delays associated with drying, mechanical stabilization, usually consisting of coarse crushed stone or geotextile, could be necessary. In this event, the geotechnical engineer should be contacted for supplementary recommendations. Typically, an unstable subgrade can be stabilized using a suitable geotextile fabric, such as Mirafi RS580i, and/or a 12 to 18-inch thick layer of coarse (2 to 4-inch particle size) crushed stone. Crushed asphalt and concrete debris resultant from demolition could also be used as a subgrade stabilization material. Other options, including lime or cement treatment are also available. Typically, an unstable subgrade may be stabilized by treating the upper 12 inches of subgrade material with cement to a concentration of 5 percent (by dry weight of soil).

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches and moisture conditioned to achieve a moisture content of 0 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The building pad areas may then be raised to grade with previously excavated soils or imported structural fill.

<u>Treatment of Existing Soils: Retaining Walls and Site Walls</u>

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

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

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing undocumented fill soils in the new parking and drive areas is not considered warranted, with the exception of areas where lower strength or unstable soils are identified by the geotechnical engineer during grading.

Subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations. The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength alluvial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

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

Fill Placement

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

Imported Structural Fill

All imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve).

Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

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

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

6.4 Construction Considerations

Excavation Considerations

The near surface soils are predominately granular in composition. These materials will likely be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 2h:1v. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Groundwater

The static groundwater table at this site is considered to exist at a depth greater than 25± feet. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pads will be underlain by structural fill soils used to replace existing fill and a portion of the near-surface alluvial soils. These new structural fill soils are expected to extend to depths of at least 3 feet below proposed foundation bearing grade. Based on this subsurface profile, the proposed structures may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.

- Minimum wall/column footing width: 14 inches/24 inches.

- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).

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

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

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

Foundation Construction

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

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

Estimated Foundation Settlements

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

Lateral Load Resistance

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

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

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

6.6 Floor Slab Design and Construction

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

- Minimum slab thickness: 6 inches.

- Modulus of Subgrade Reaction: k = 125 psi/in

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

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

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

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

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

6.7 Retaining Wall Design and Construction

Small retaining walls are expected to be necessary in the area of the new truck loading docks and may also be required to facilitate the new site grades. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. We have provided parameters assuming the use of on-site soils for retaining wall backfill. The on-site soils generally consist of sands and silty sands. Based on their classification, these materials are expected to possess a friction angle of at least 30 degrees.

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

RETAINING WALL DESIGN PARAMETERS

Design Parameter		**Soil Type** On-Site Sands and Silty Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		125 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	42 lbs/ft^3
	Active Condition (2h:1v backfill)	67 lbs/ft^3
	At-Rest Condition (level backfill)	63 lbs/ft^3

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

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

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive

resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed structural fill. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Seismic Lateral Earth Pressures

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

Backfill Material

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

It is recommended that a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls, be placed against the face on the back side of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. A 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils.

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557-91). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

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

- A weep hole drainage system typically consisting of a series of 4-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 8-foot on-center spacing. The weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be

wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system.

6.8 Pavement Design Parameters

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

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The on-site soils generally consist of silty sands and sands. Based on their classification, these materials are expected to possess good to excellent pavement support characteristics, with R-values in the range of 50 to 60. Since R-value testing was not included in the scope of services for this project, the subsequent pavement design is based upon an assumed R-value of 50. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

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

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

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

ASPHALT PAVEMENTS (R = 50)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	3	4	5	5	7
Compacted Subgrade	12	12	12	12	12

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

Portland Cement Concrete

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

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

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

7.0 GENERAL COMMENTS

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

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

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

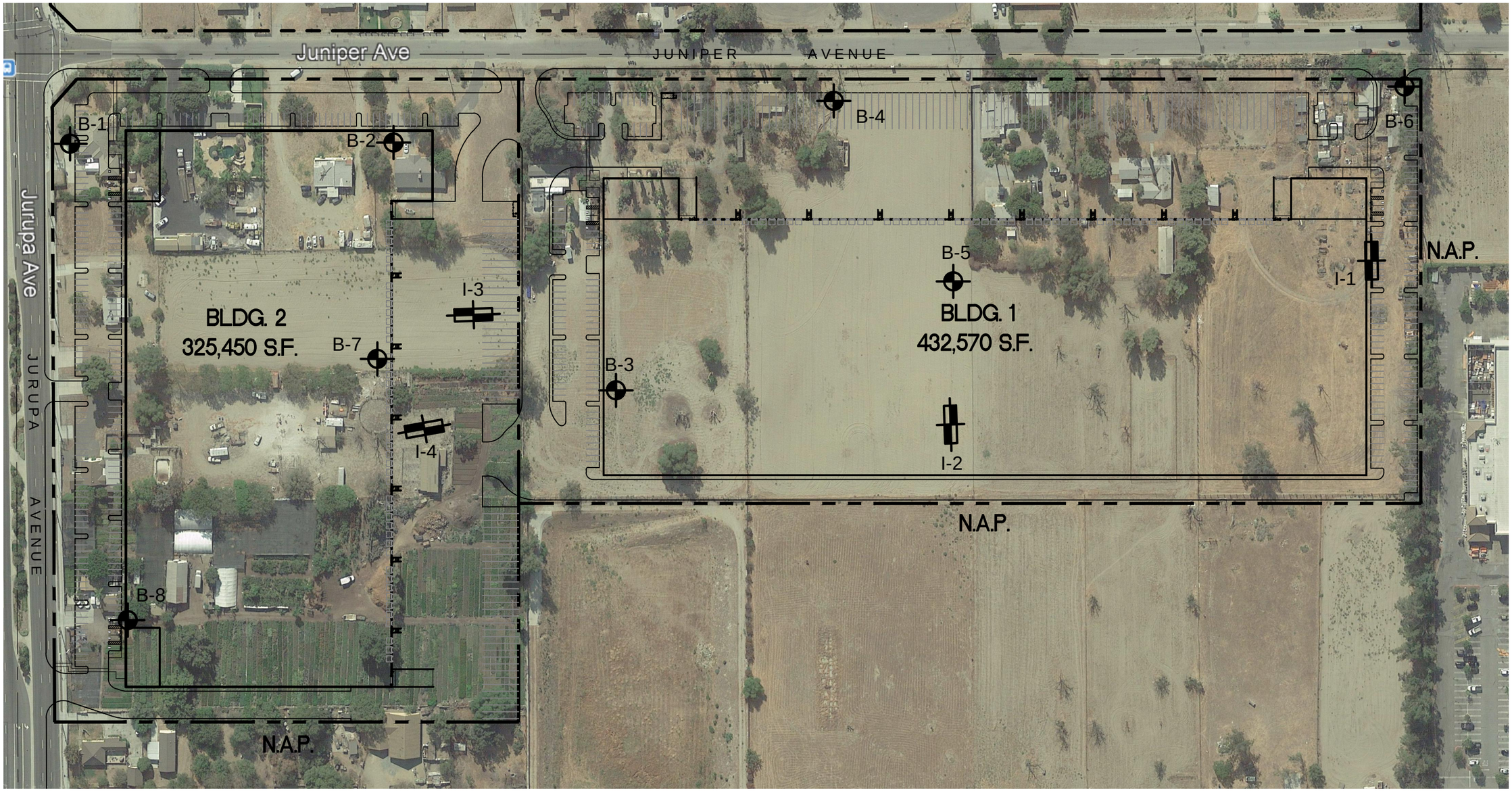
The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A

SOURCE: SAN BERNARDINO COUNTY
THOMAS GUIDE, 2013

SITE LOCATION MAP
TWO PROPOSED COMMERCIAL/INDUSTRIAL BUILDINGS
FONTANA, CALIFORNIA
SCALE: 1" = 2400'
DRAWN: JLL CHKD: RGT
SCG PROJECT 19G191-1
PLATE 1

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

APPROXIMATE INFILTRATION TEST LOCATION FROM CONCURRENT STUDY (SCG PROJECT NO. 19G191-2)

NORTH
SoCalGeo

NOTE: SITE PLAN PREPARED BY HPA, INC.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

BORING LOCATION PLAN

TWO PROPOSED COMMERCIAL/INDUSTRIAL BUILDINGS

FONTANA, CALIFORNIA

SCALE: 1" = 150'

DRAWN: JLL
CHKD: RGT

SCG PROJECT
19G191-1

PLATE 2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

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

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

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 19 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine Sand, trace medium Sand, loose-damp							
		11				104	3					
		12				107	5					
5		17			Brown Silty fine to medium Sand, trace coarse Sand, medium dense-damp to moist	118	8					
		17				108	6					
10		15				115	5					
15		19				107	8					
					Brown to Red Brown Silty fine Sand, little Clay, medium dense-moist to very moist							
20		14					10					
		16					13					
25					Boring Terminated at 25'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 13 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Light Gray Brown Silty fine to coarse Sand, some fine Gravel, medium dense-dry to damp							
	X	20					2					
					POSSIBLE FILL: Light Brown Silty fine Sand, trace fine root fibers, trace roots, medium dense-damp		4					
					ALLUVIUM: Light Brown Silty fine Sand, trace medium Sand, medium dense-damp							
	X	12					4					
5												
	X	13					4					
					@ 6-7½ feet, 2" fine Sandy Silt lens, trace fine root fibers							
					Light Gray fine Sandy Silt, medium dense-damp to moist							
	X	12					8					
10												
	X	16					3					
15												
	X	14					4					
20												
					Boring Terminated at 20'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 11 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					POSSIBLE FILL: Light Brown Silty fine Sand, trace fine Gravel, little fine root fibers, medium dense-dry to damp							
	X	25				111	2					
	X	35				110	2					
5	X	20			ALLUVIUM: Light Gray Silty fine to medium Sand, medium dense-dry to damp	113	1					
	X	19				105	5					
					Light Brown fine Sandy Silt, trace medium to coarse Sand, medium dense-damp							
10	X	19				104	8					
					Gray Silty fine Sand, medium dense-damp							
15	X	19				104	5					
20	X	15					6					
					Boring Terminated at 20'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 9 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Light Brown Silty fine to medium Sand, trace coarse Sand, little fine Gravel, loose to medium dense-dry							
		10				103	1					
		20				109	1					
5		47			POSSIBLE FILL: Light Gray Brown Gravelly fine to coarse Sand to fine to coarse Sandy Gravel, dense to very dense-dry		1					No Sample Recovered
		61					1					No Sample Recovered
		32			POSSIBLE FILL: Light Brown Silty fine Sand, trace medium to coarse Sand, some fine to coarse Gravel, dense-dry to damp		2					
10												
					ALLUVIUM: Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, medium dense-damp							
		21					4					
15												
					Gray Brown fine to coarse Sand, little fine Gravel, trace to little Silt, dense to very dense-damp							
		50					3					
20												
		44					2					
25												
					Boring Terminated at 25'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 3 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
	X	16			ALLUVIUM: Light Gray Brown Silty fine Sand, trace to little medium to coarse Sand, trace fine Gravel, medium dense-dry to damp		2					
	X	12					2					
5												
	X	9	1.75		Gray Brown Silt, little Clay, trace fine Sand, medium stiff-very moist		18					
	X	6	1.0				24					
10												
					Brown Silty fine Sand, with 2" fine to coarse Sand lens, medium dense-moist							
	X	13					11					
15												
					Boring Terminated at 15'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Light Brown Silty fine Sand, little medium to coarse Sand, little fine Gravel, medium dense-dry to damp							
	X	22				107	2					
	X	35				110	3					
5	X	26				106	2					
					ALLUVIUM: Light Gray Brown fine Sandy Silt, slightly porous, medium dense-damp							
	X	26				101	3					
10	X	32				102	6					
					Light Gray Brown Silty fine Sand, medium dense-damp							
15	X	16					3					
20	X	18					4					
					Light Brown Silty fine Sand to fine Sandy Silt, medium dense-damp							
25	X	16					5					
					Boring Terminated at 25'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-7

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 11 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
	X	13			FILL: Light Gray Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, medium dense-dry to damp		2					
	X	13			ALLUVIUM: Light Brown Silty fine Sand, trace medium Sand, medium dense-damp		3					
5												
	X	16			Light Gray Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, medium dense-damp		3					
	X	16					2					
10					Light Brown fine Sandy Silt, medium dense-dry to damp							
					Light Gray Brown Silty fine Sand to fine Sandy Silt, medium dense-dry to damp							
	X	14					5					
15												
	X	27					2					
20												
					Boring Terminated at 20'							

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SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-8

JOB NO.: 19G191
PROJECT: Two Proposed C/I Buildings
LOCATION: Fontana, California

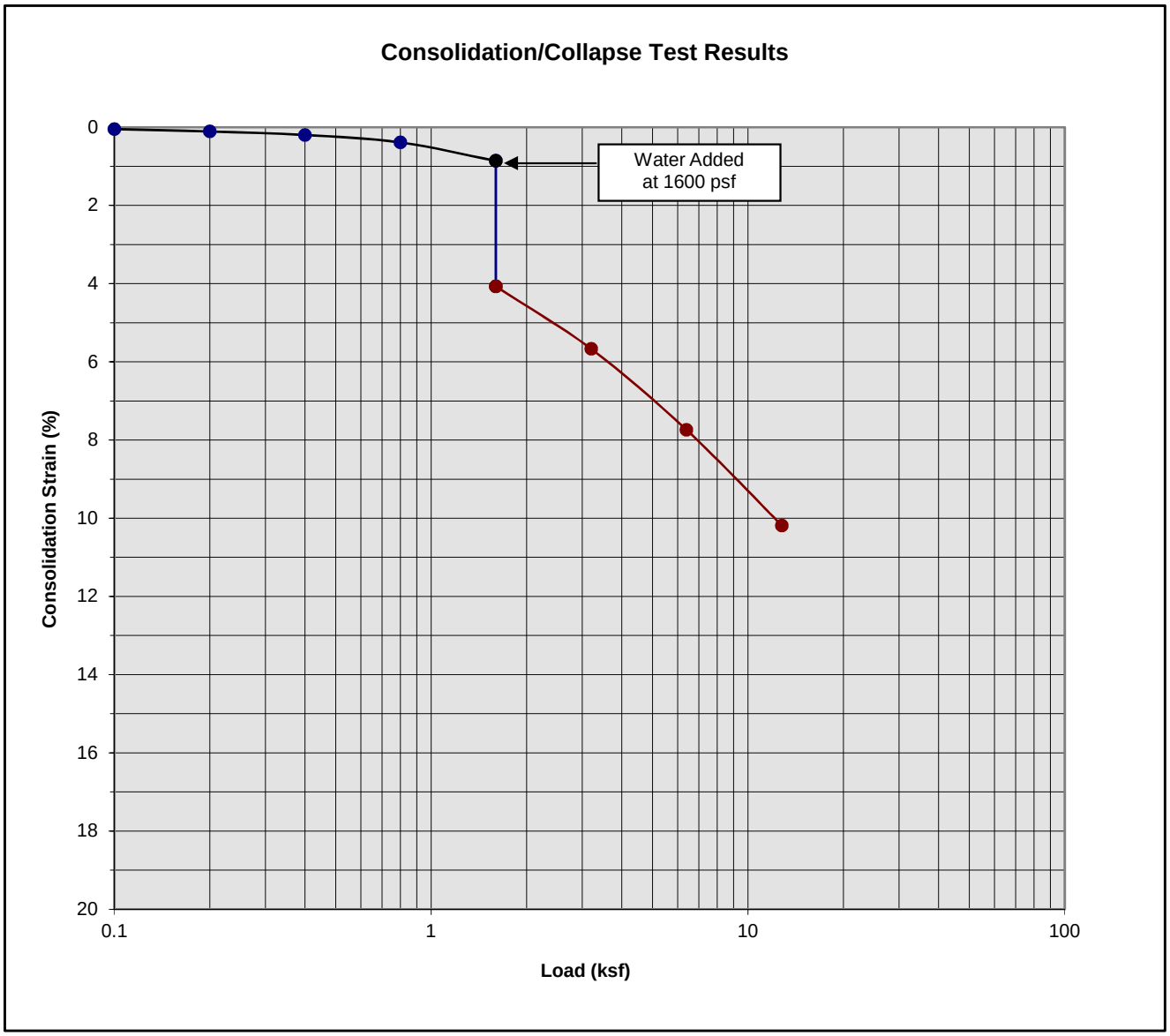
DRILLING DATE: 8/30/19
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joseph Lozano Leon

WATER DEPTH: Dry
CAVE DEPTH: 13 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		13			ALLUVIUM: Brown Silty fine Sand, trace medium to coarse Sand, loose to medium dense-damp	107	4					
		16				110	5					
5		16				118	7					
		16				118	7					
		20			Brown Silty fine to medium Sand, little coarse Sand, slightly porous, medium dense-damp to moist	110	8					
10												
		23				114	7					
15												
		16					5					
20					Boring Terminated at 20'							

TBL 19G191.GPJ SOCALGEO.GDT 9/24/19

APPENDIX C

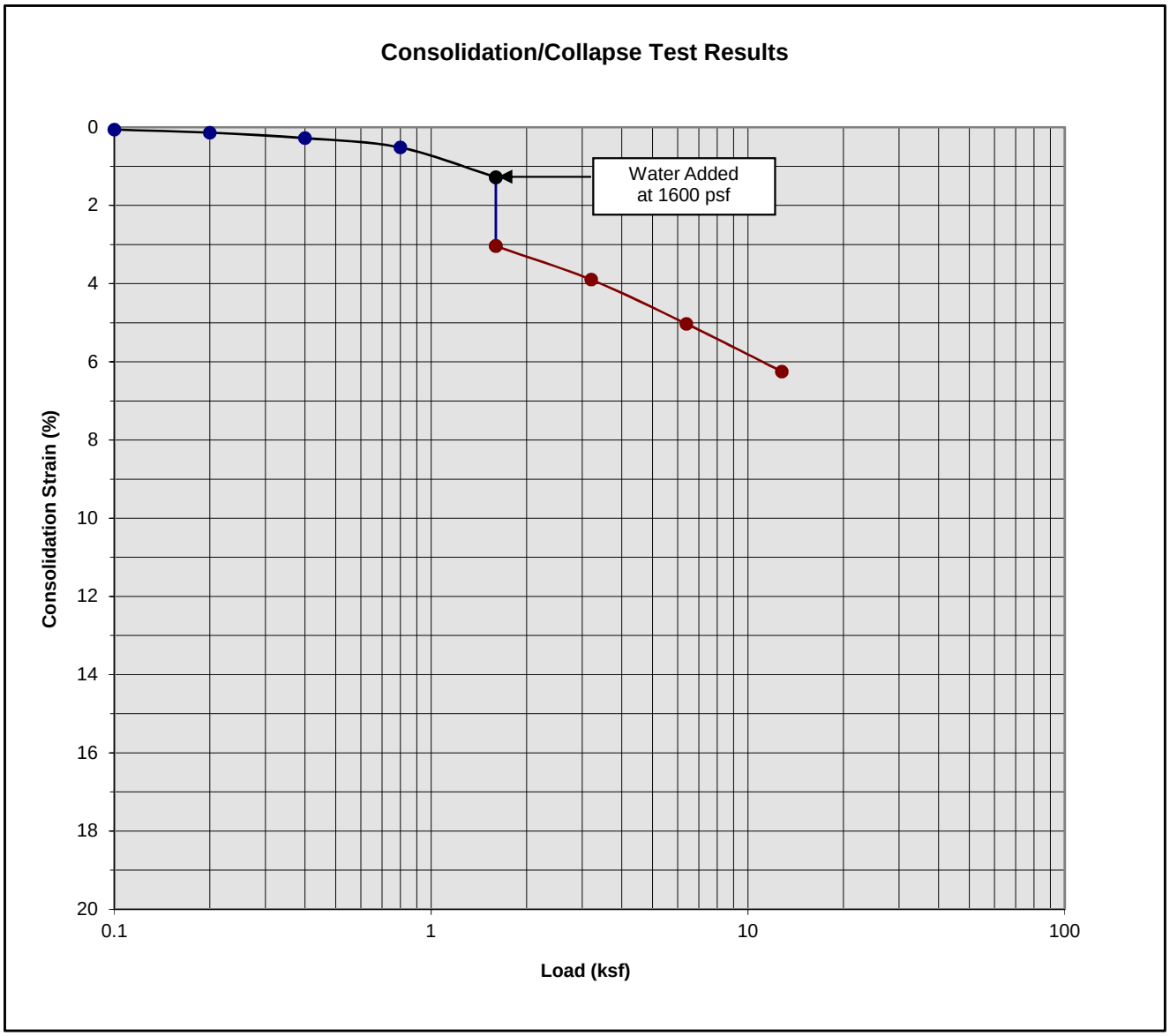


Classification: POSSIBLE FILL: Light Brown Silty fine Sand, trace fine Gravel

Boring Number:	B-3	Initial Moisture Content (%)	2
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	3 to 4	Initial Dry Density (pcf)	110.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	122.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	3.21

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

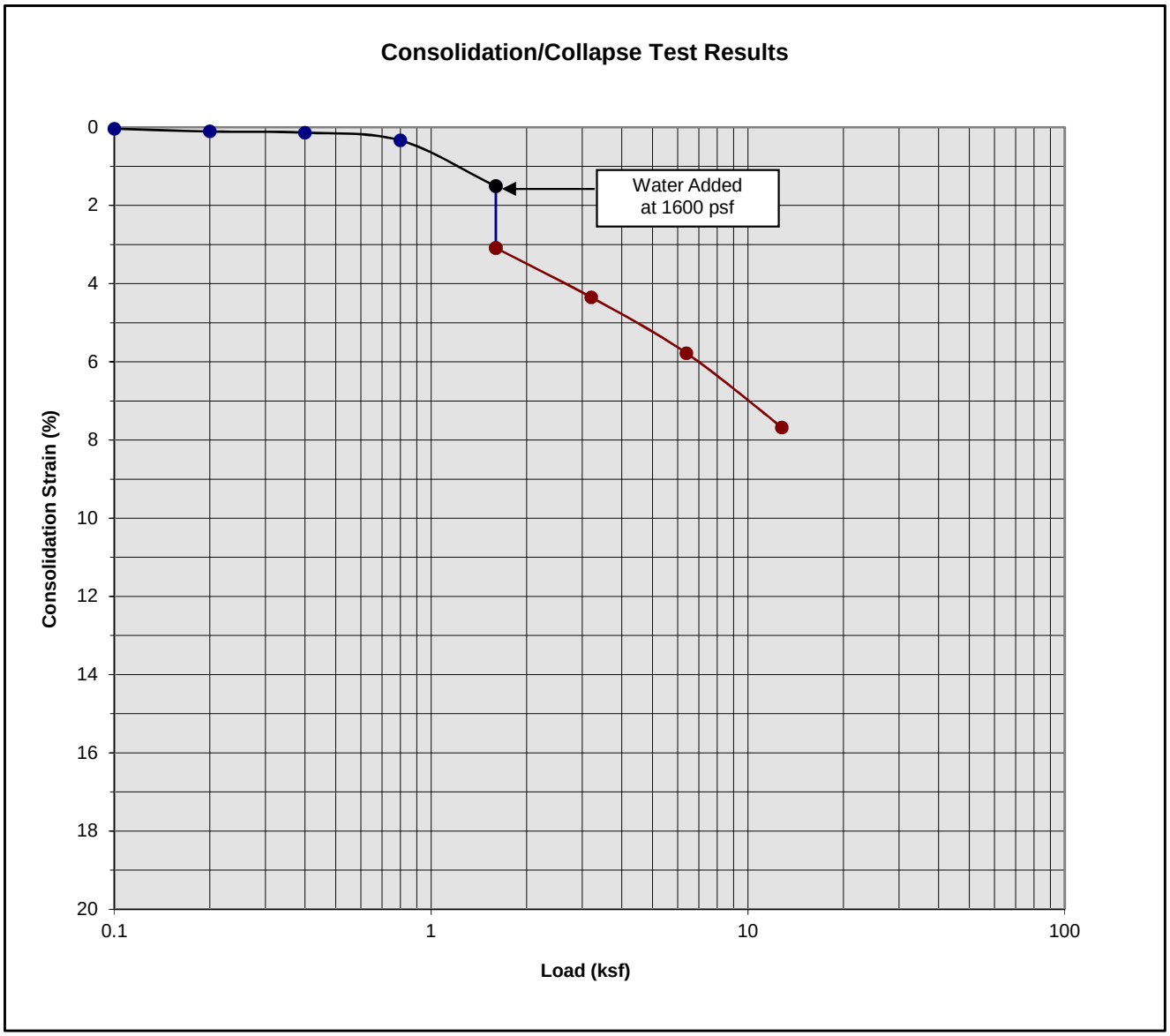


Classification: Light Gray Silty fine to medium Sand

Boring Number:	B-3	Initial Moisture Content (%)	1
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	5 to 6	Initial Dry Density (pcf)	113.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	120.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.76

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

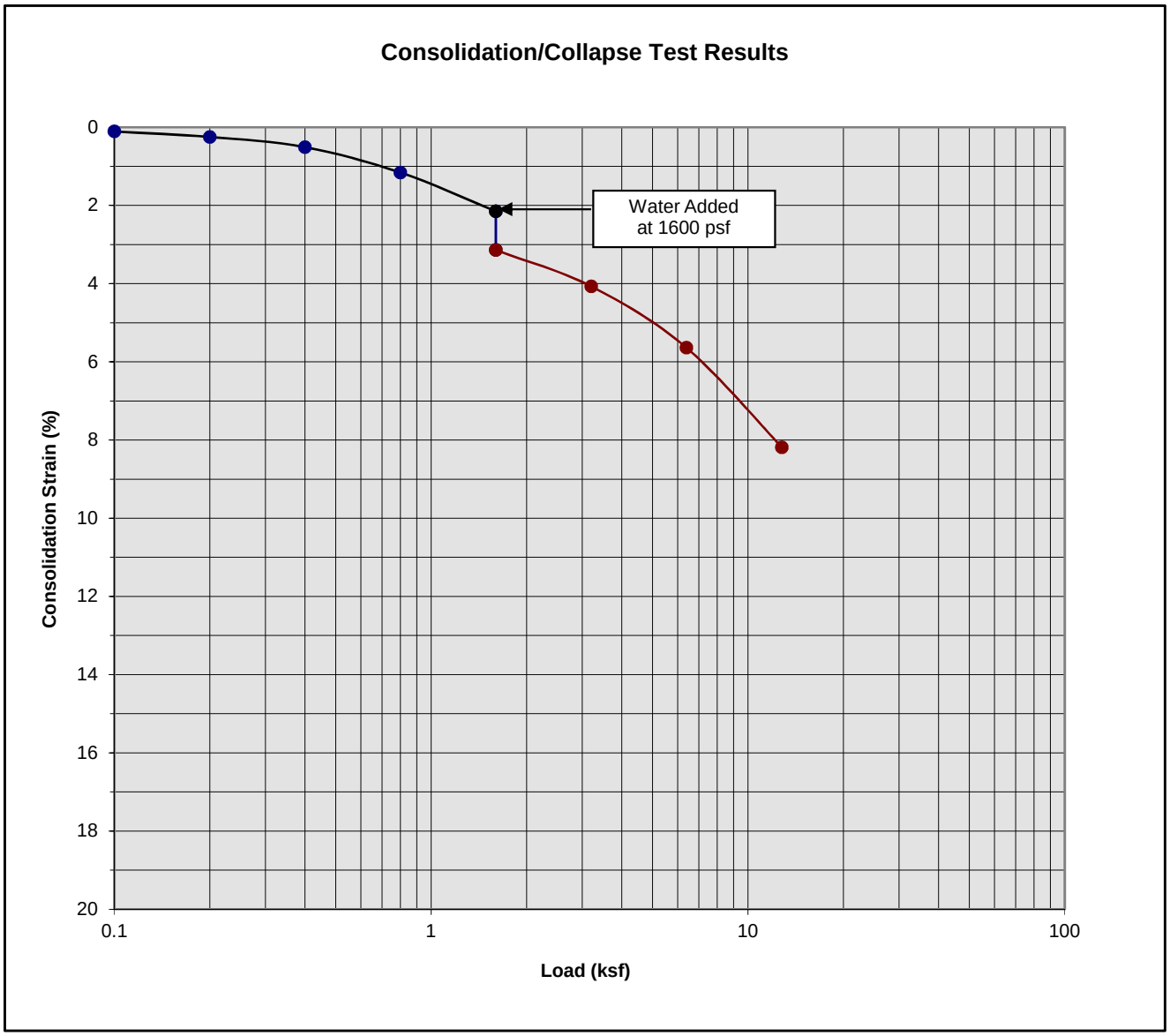


Classification: Light Brown fine Sandy Silt, trace medium to coarse Sand

Boring Number:	B-3	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	7 to 8	Initial Dry Density (pcf)	105.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	113.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.58

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

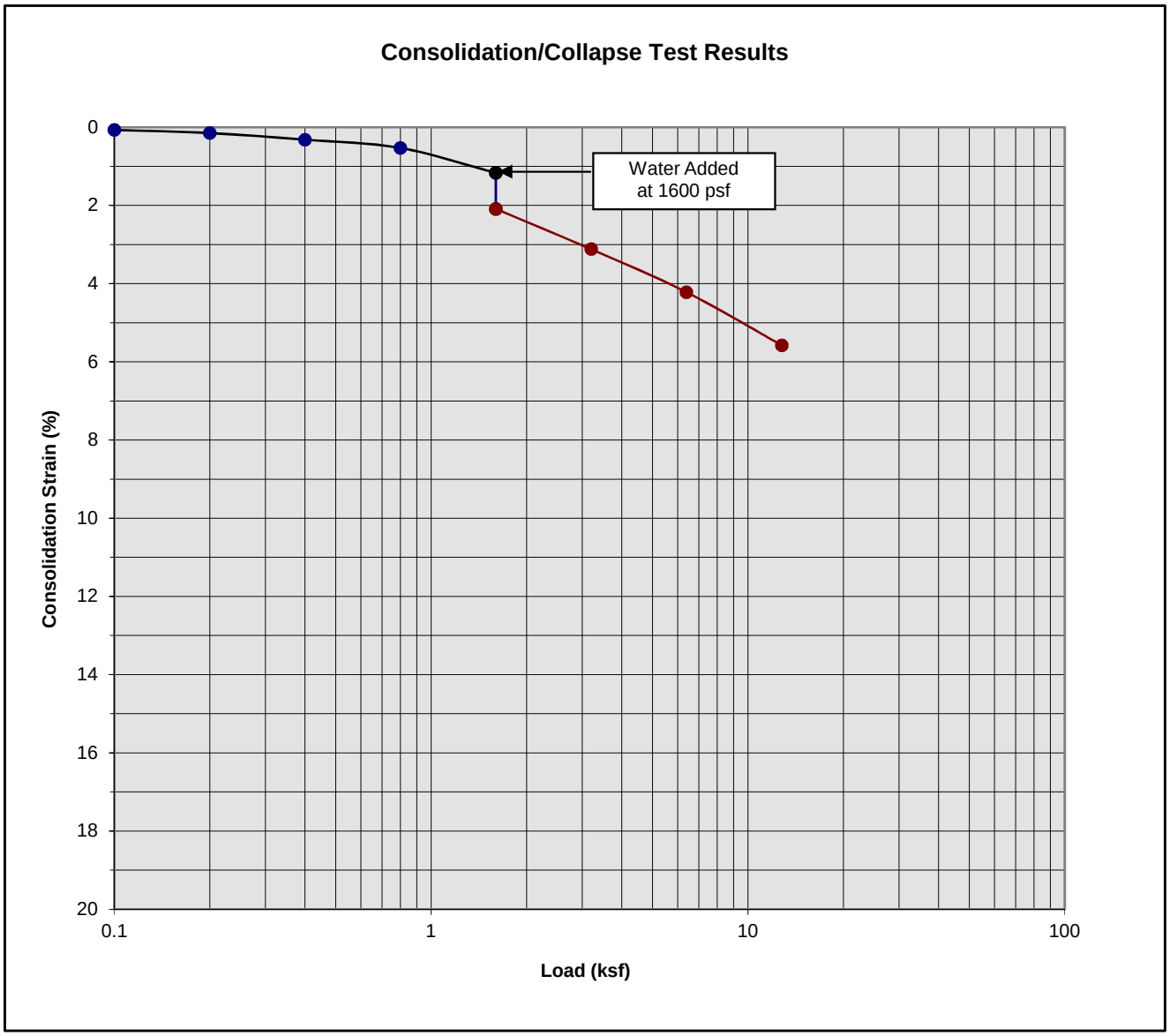


Classification: Light Brown fine Sandy Silt, trace medium to coarse Sand

Boring Number:	B-3	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	24
Depth (ft)	9 to 10	Initial Dry Density (pcf)	104.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	113.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.99

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

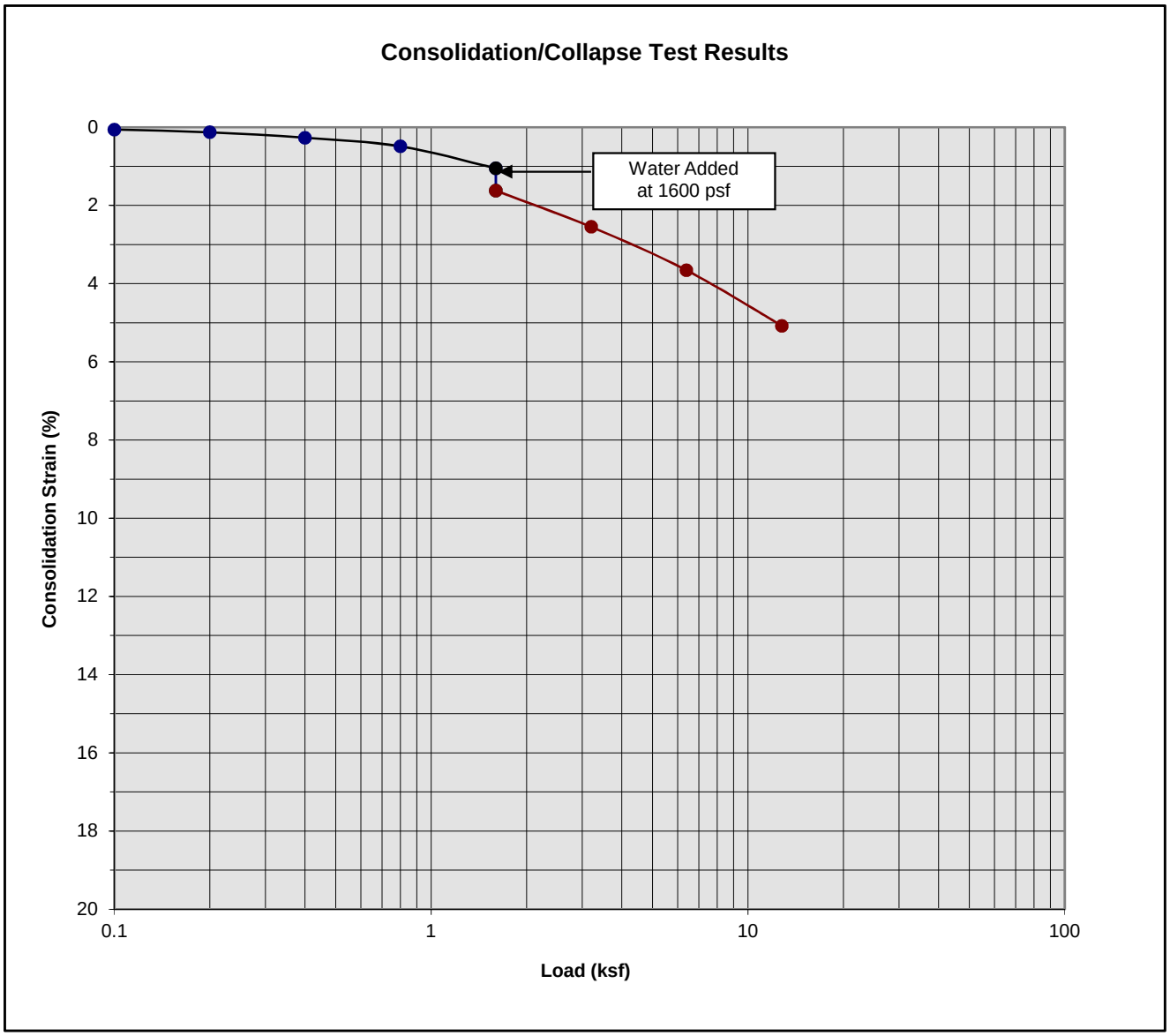


Classification: Brown Silty fine Sand, trace medium to coarse Sand

Boring Number:	B-8	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	3 to 4	Initial Dry Density (pcf)	110.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	116.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.92

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

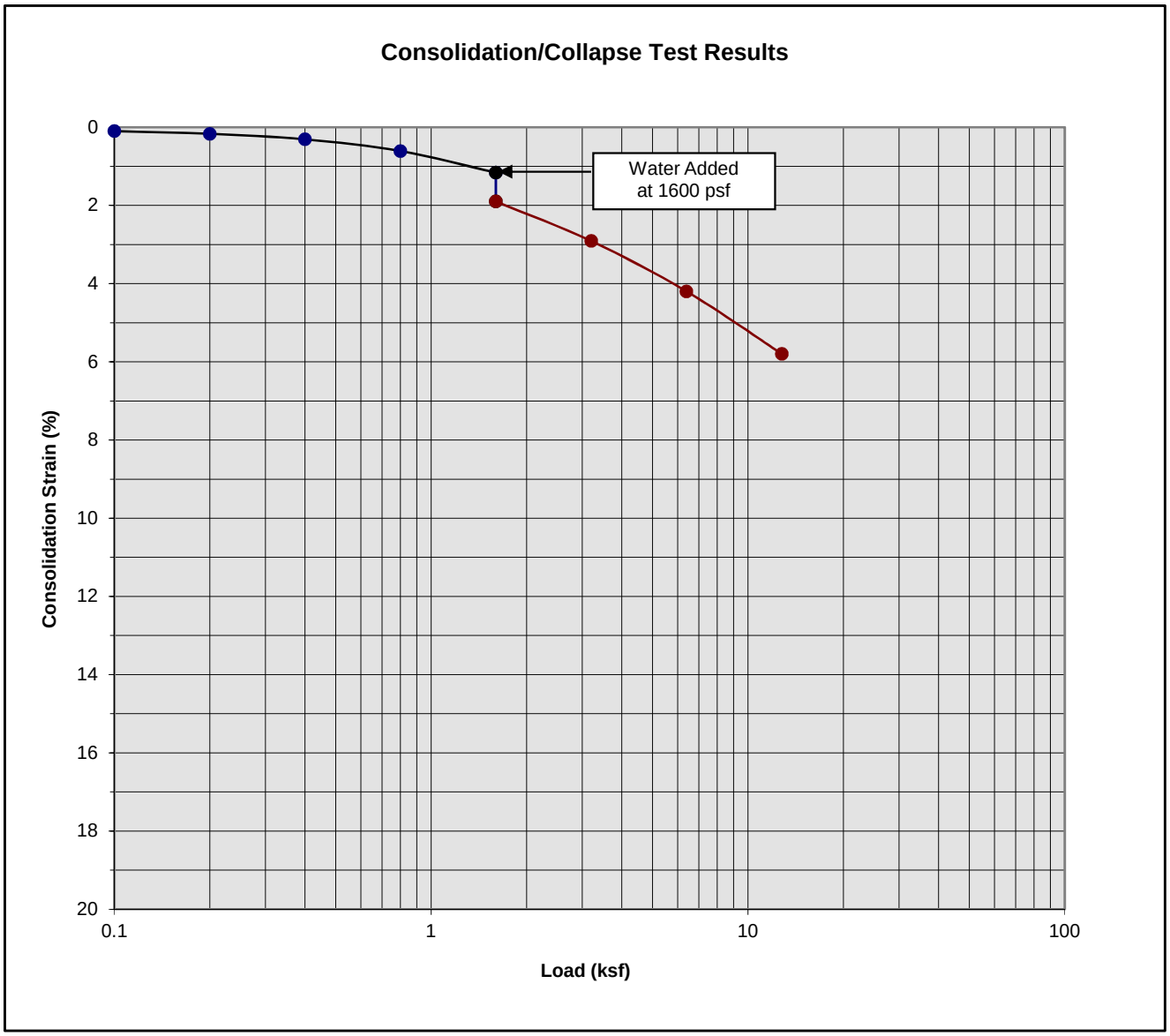


Classification: Brown Silty fine Sand, trace medium to coarse Sand

Boring Number:	B-8	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	5 to 6	Initial Dry Density (pcf)	118.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.57

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 6

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

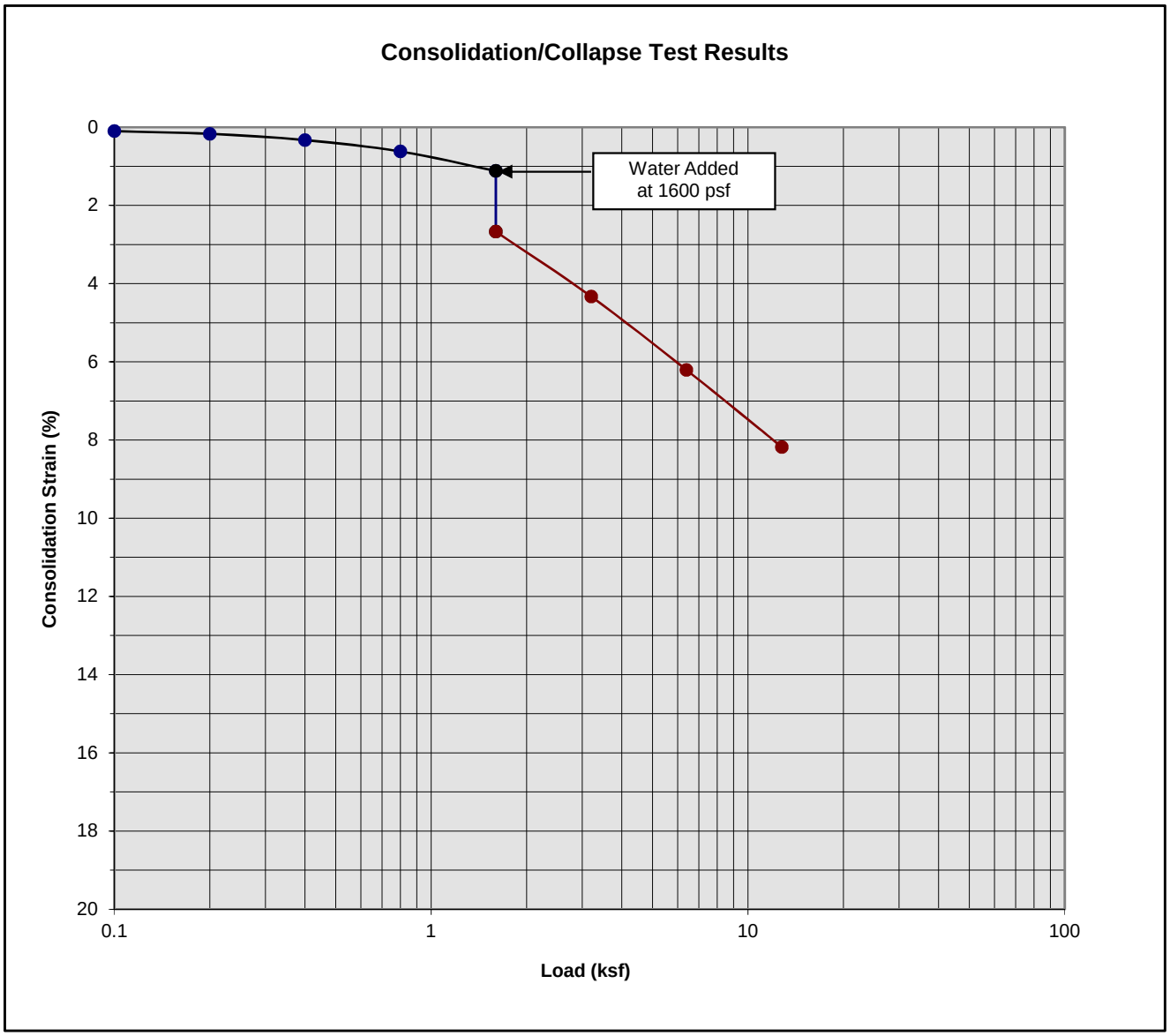


Classification: Brown Silty fine Sand, trace medium to coarse Sand

Boring Number:	B-8	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	7 to 8	Initial Dry Density (pcf)	118.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	125.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.74

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 7

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

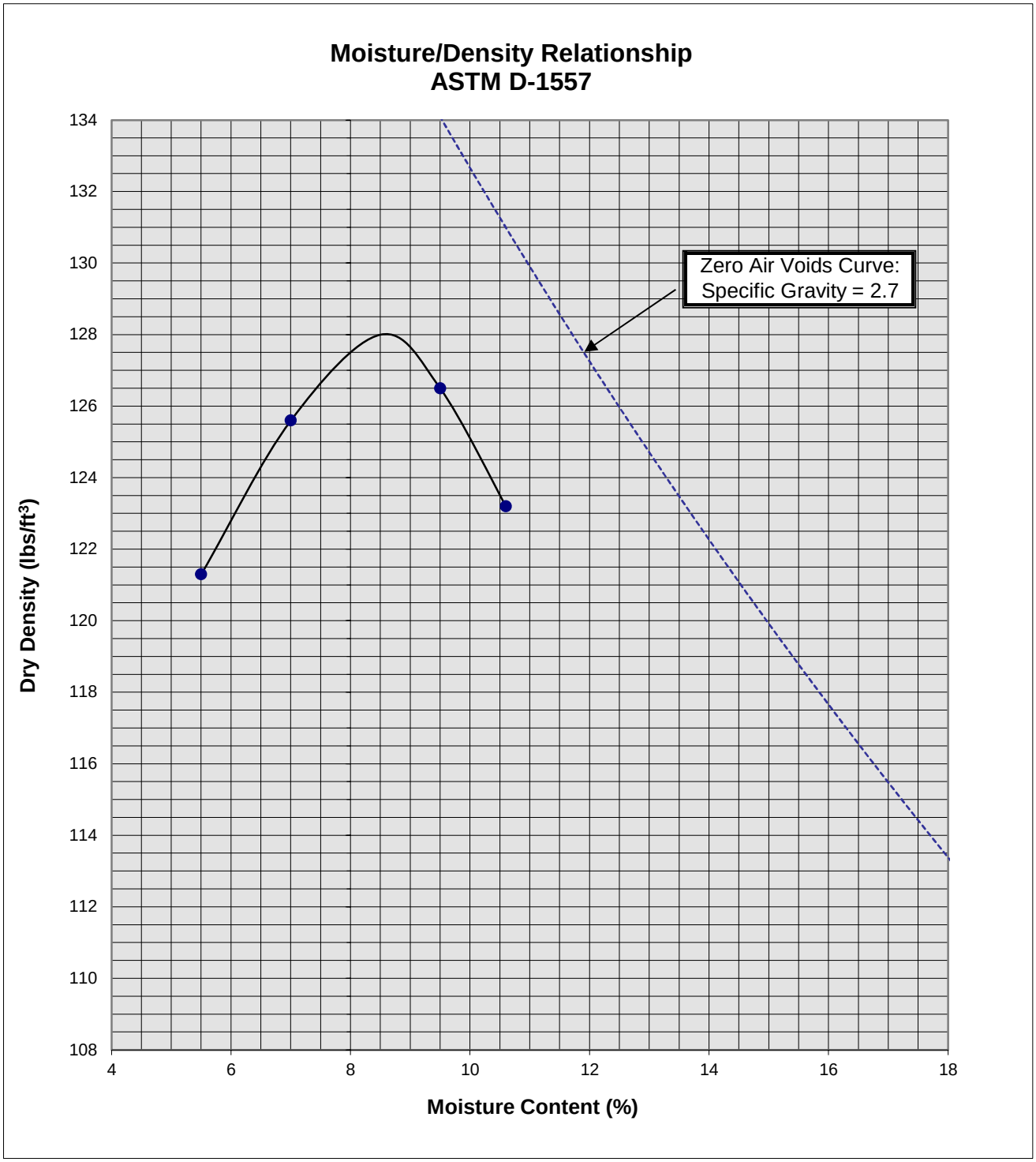


Classification: Brown Silty fine to medium Sand, little coarse Sand

Boring Number:	B-8	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	9 to 10	Initial Dry Density (pcf)	110.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.55

Proposed Warehouse Development
Fontana, California
Project No. 19G191
PLATE C- 8

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-3 @ 0 to 5'
Optimum Moisture (%)	8.5
Maximum Dry Density (pcf)	128
Soil Classification	Light Brown Silty fine Sand, trace fine Gravel

Two Proposed Commercial/Industrial Buildings
Fontana, California
Project No. 19G191
PLATE C- 9

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

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

General

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

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

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

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

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

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

Site Preparation

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

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

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

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

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

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

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

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

Compacted Fills

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Foundations

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

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

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

Fill Slopes

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

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

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

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

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

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

Cut Slopes

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

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

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

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

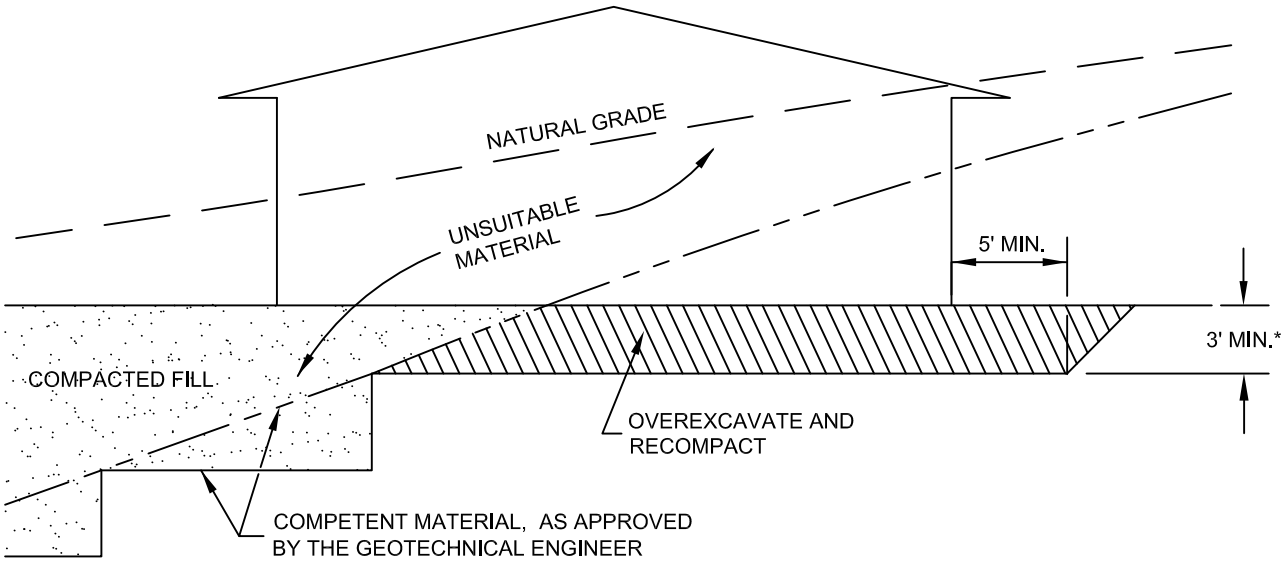
Subdrains

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

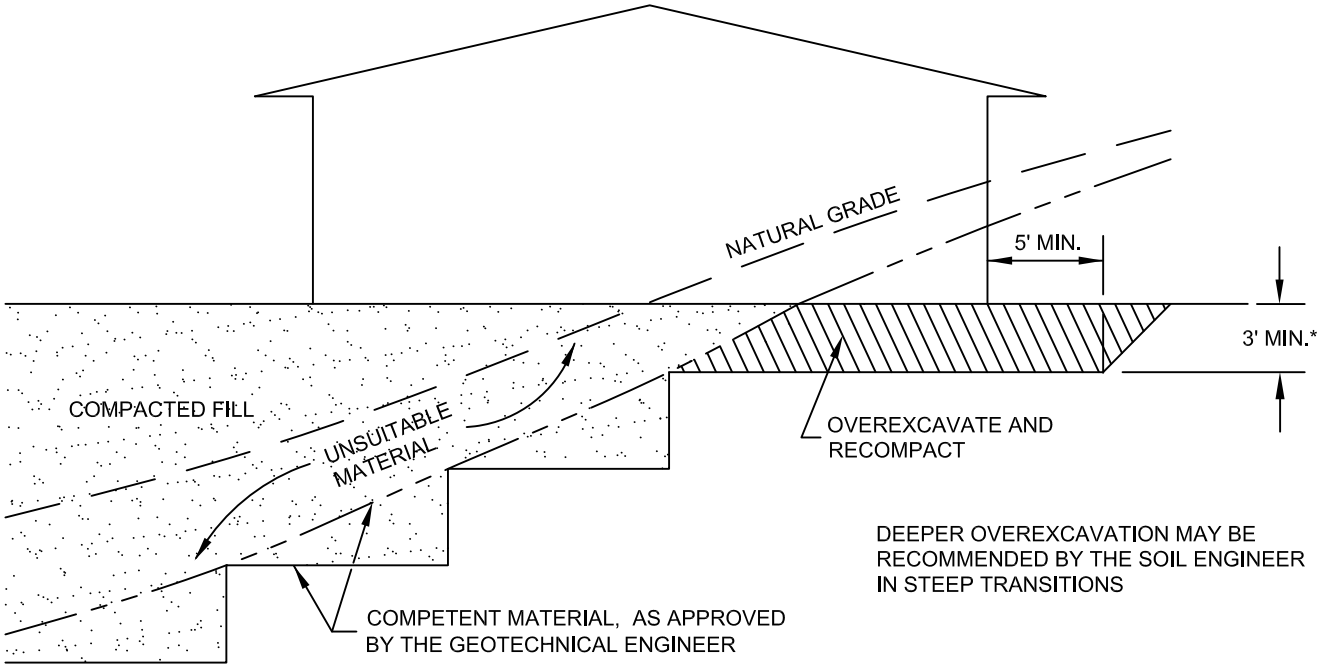
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

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

CUT LOT



CUT/FILL LOT (TRANSITION)



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

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

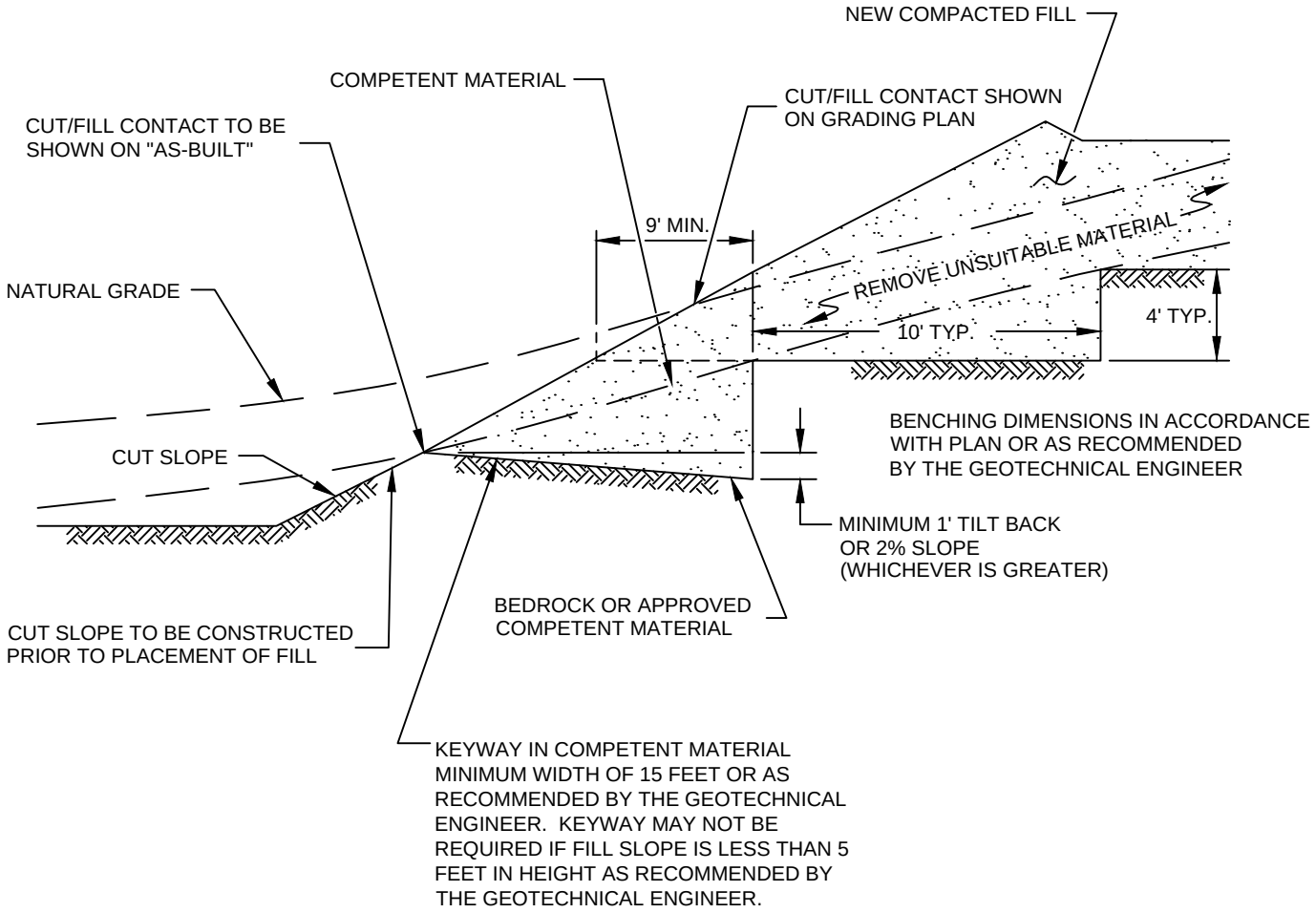
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

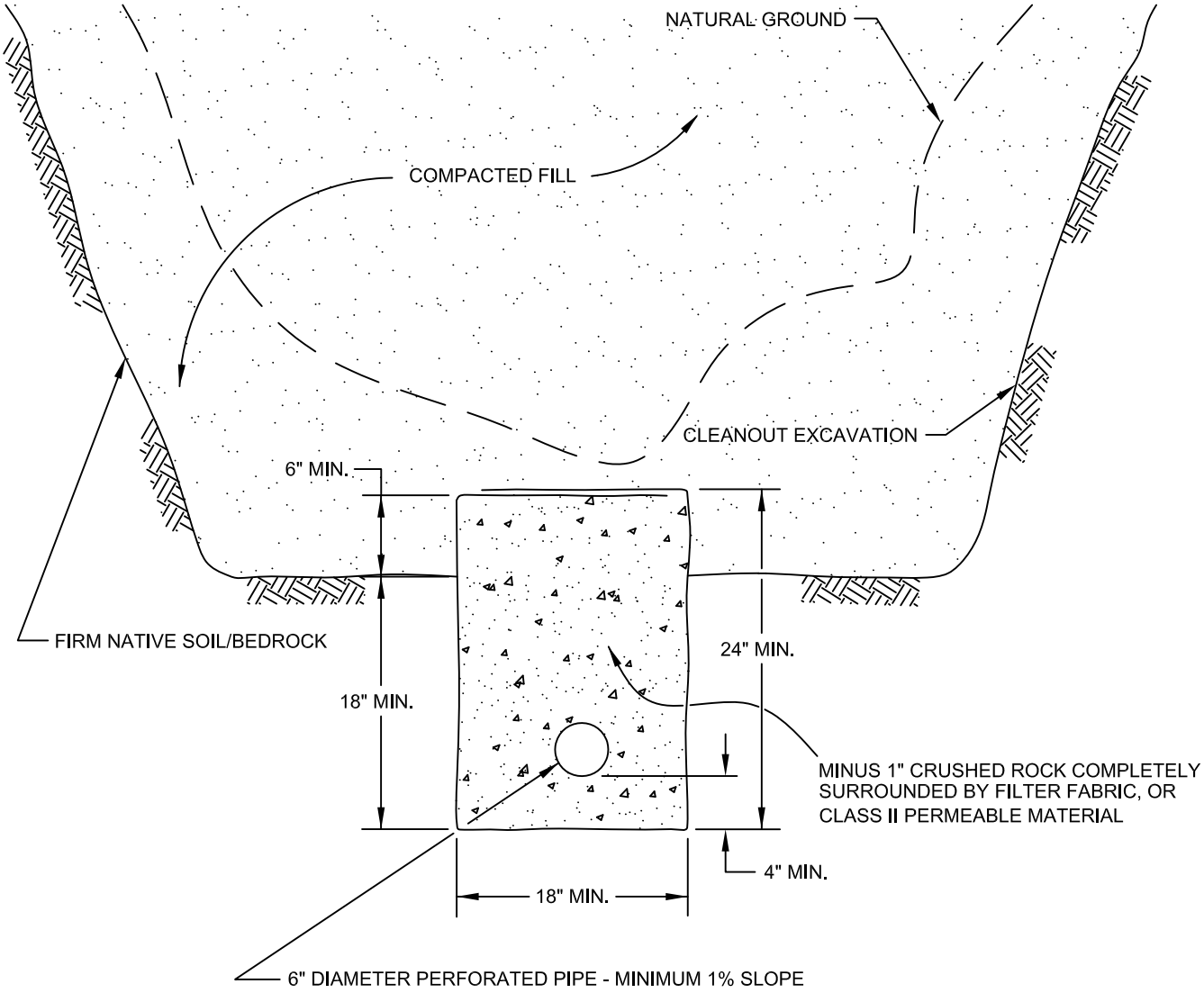
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



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

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

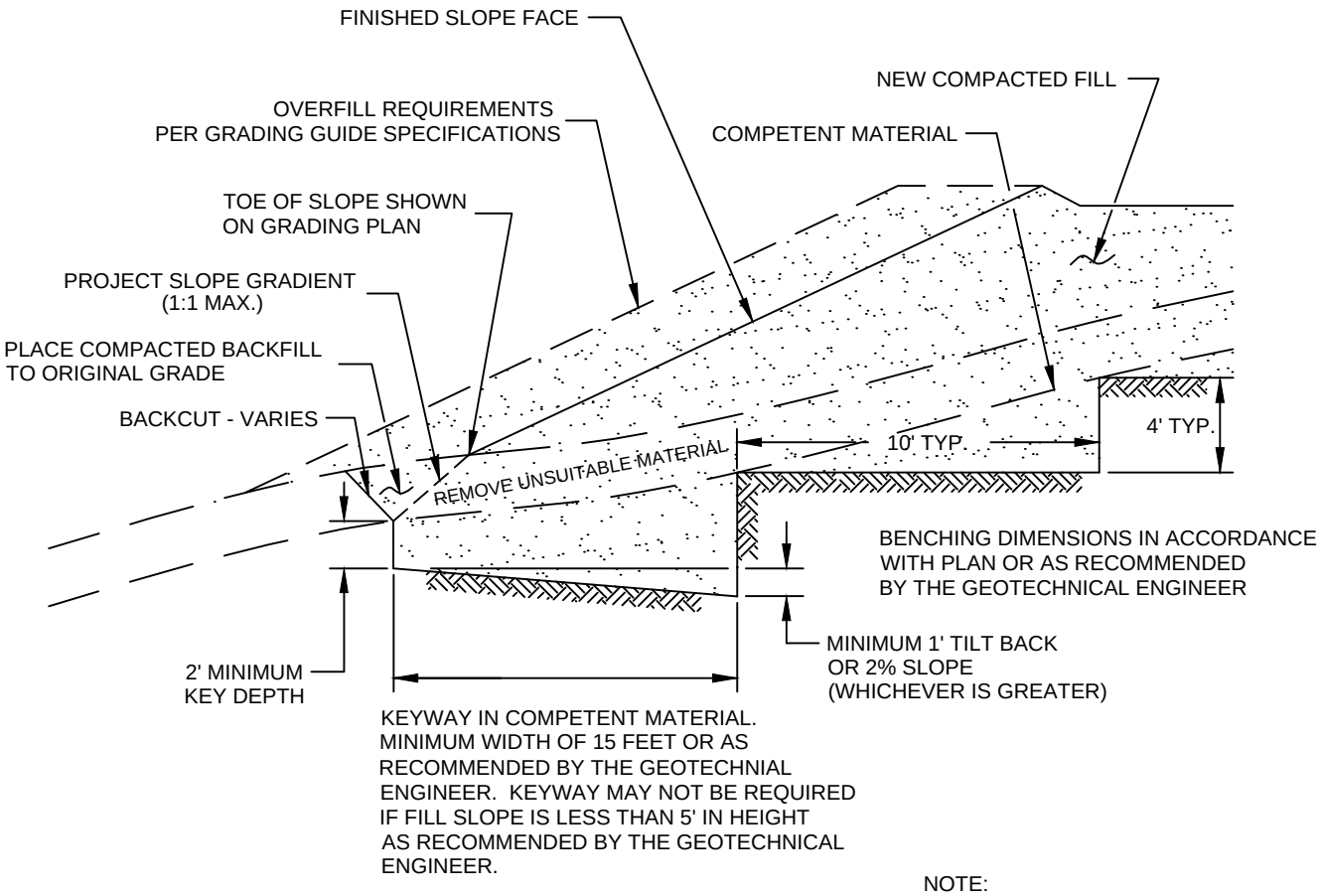
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SOUTHERN CALIFORNIA GEOTECHNICAL



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

FILL ABOVE NATURAL SLOPE DETAIL

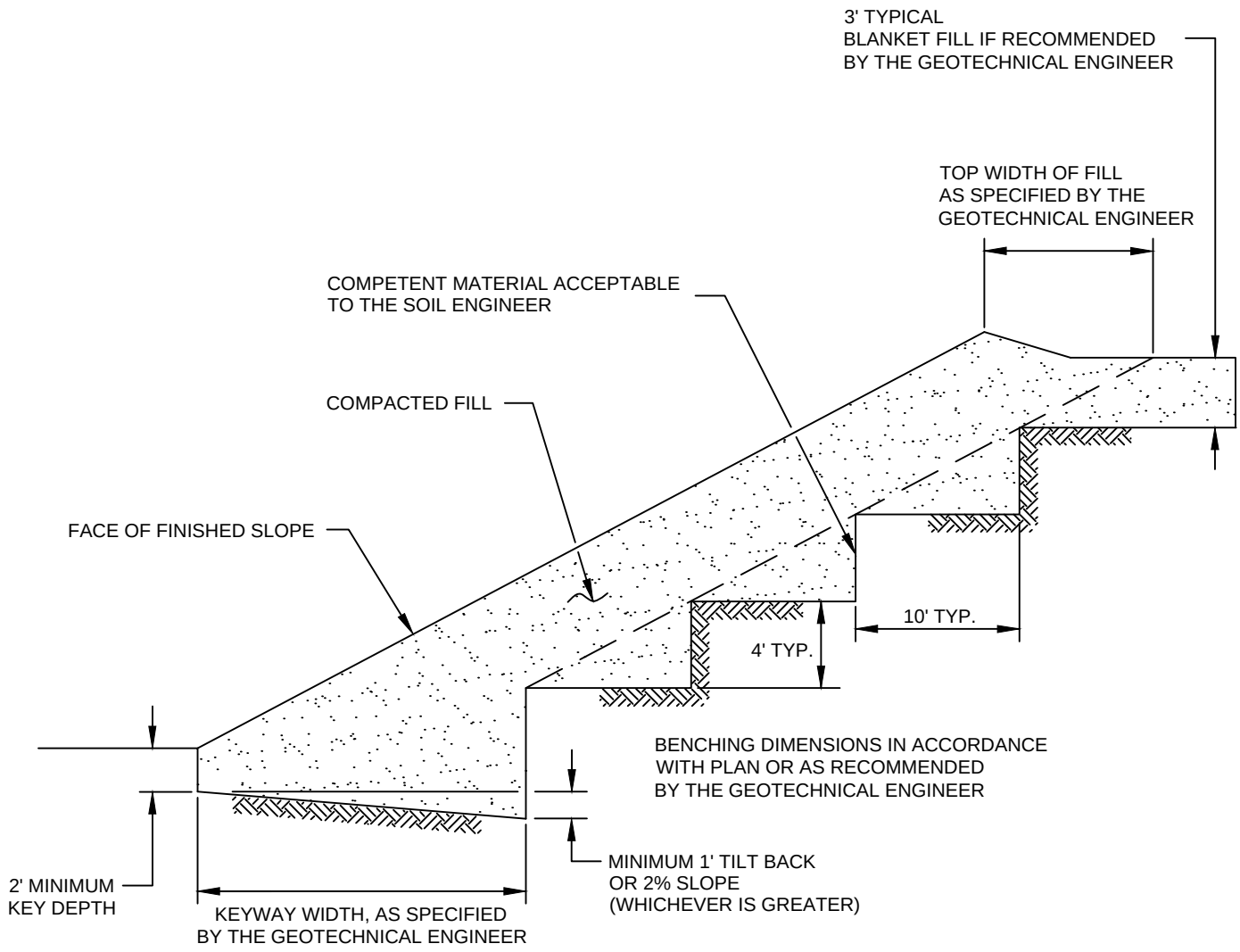
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

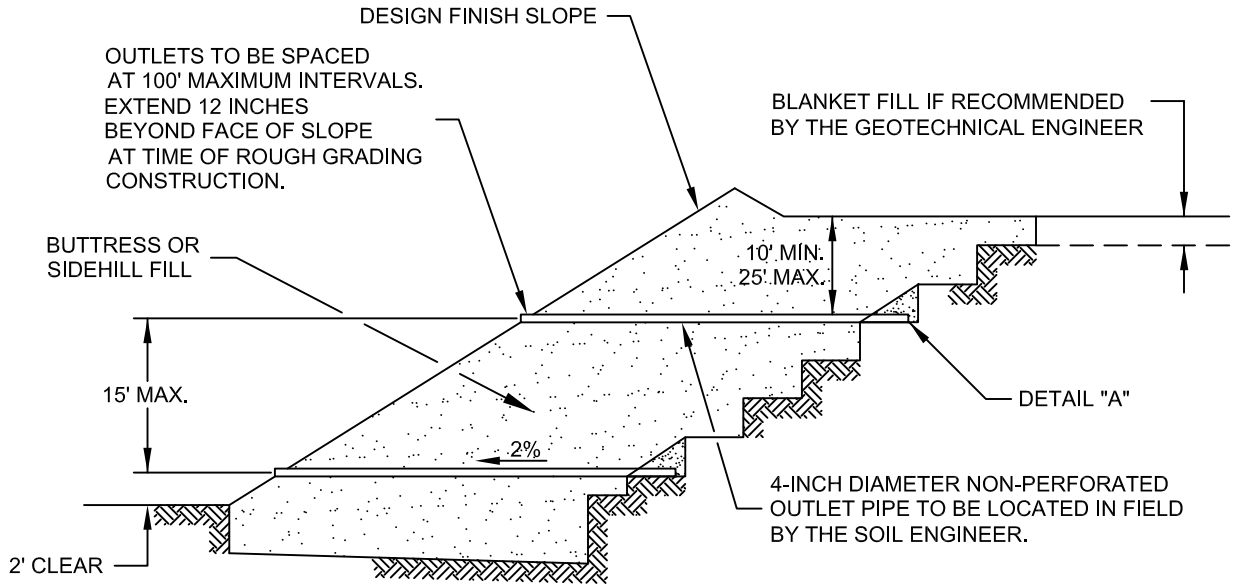
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SOUTHERN CALIFORNIA GEOTECHNICAL



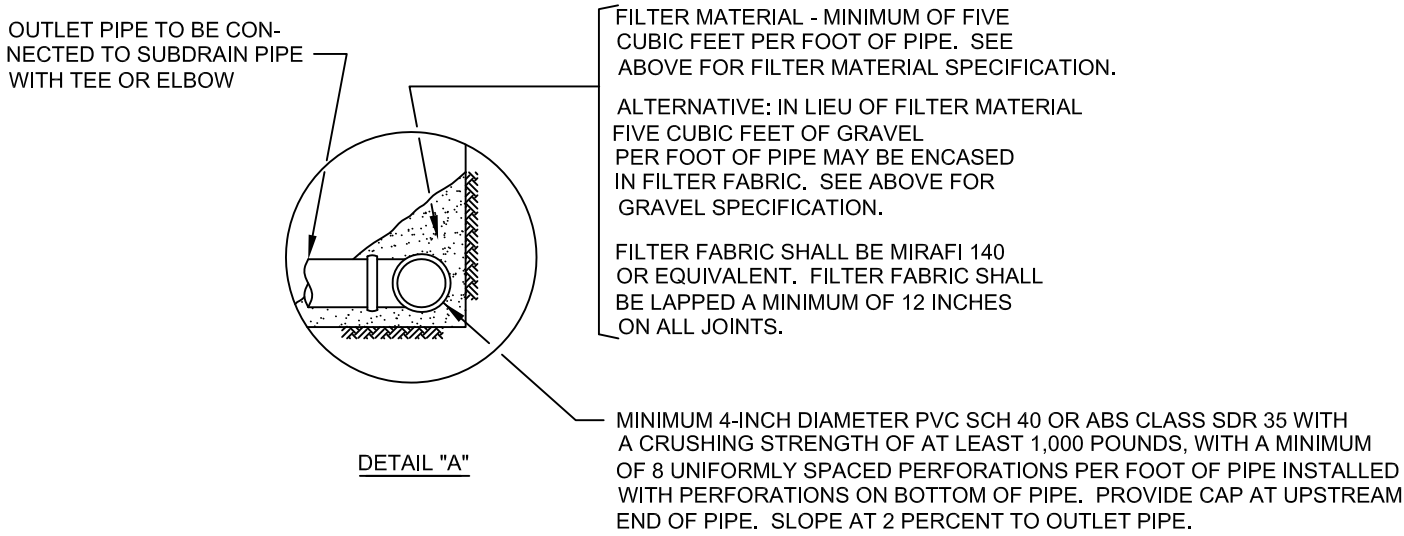
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

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

SLOPE FILL SUBDRAINS

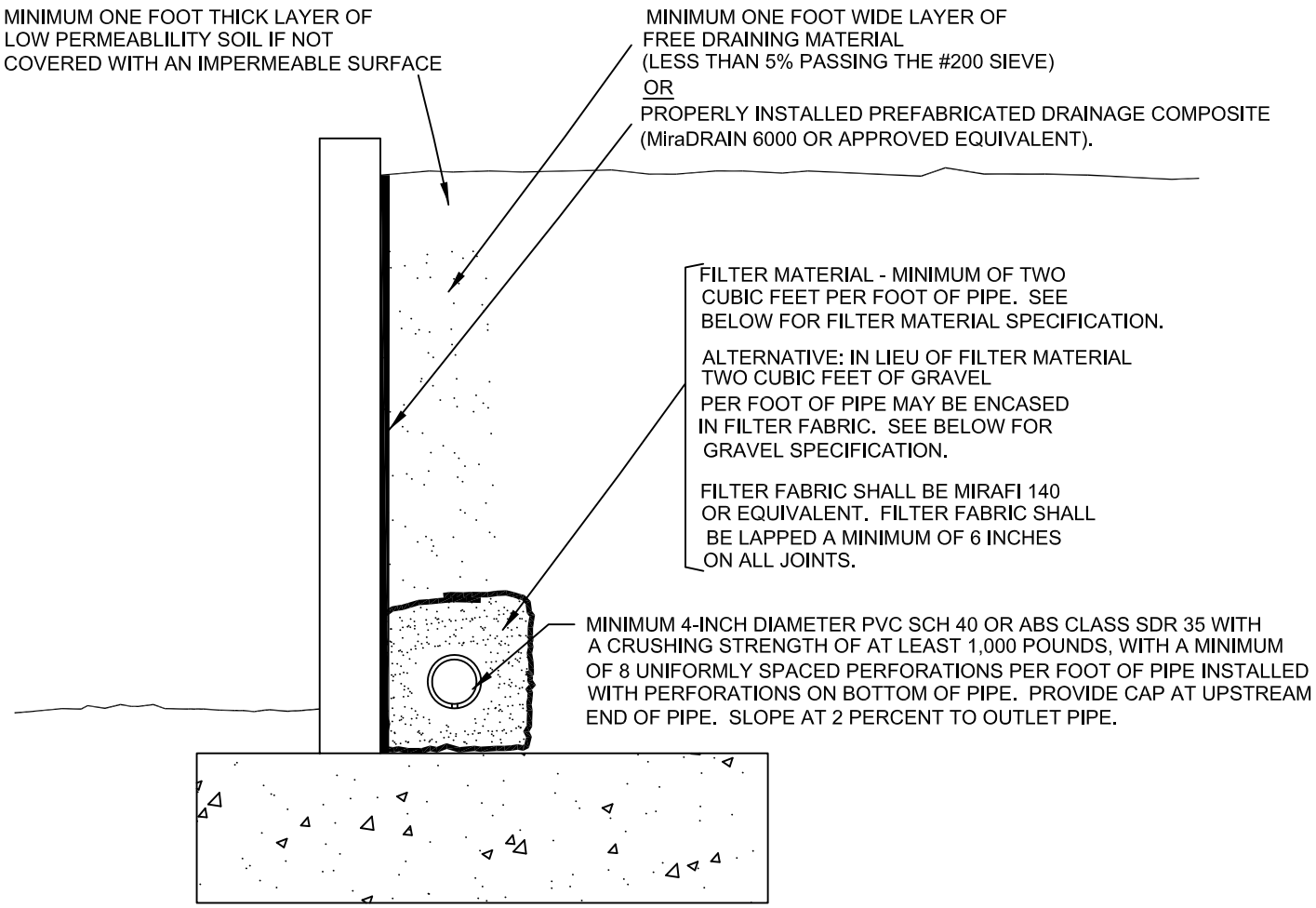
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SOUTHERN CALIFORNIA GEOTECHNICAL



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

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

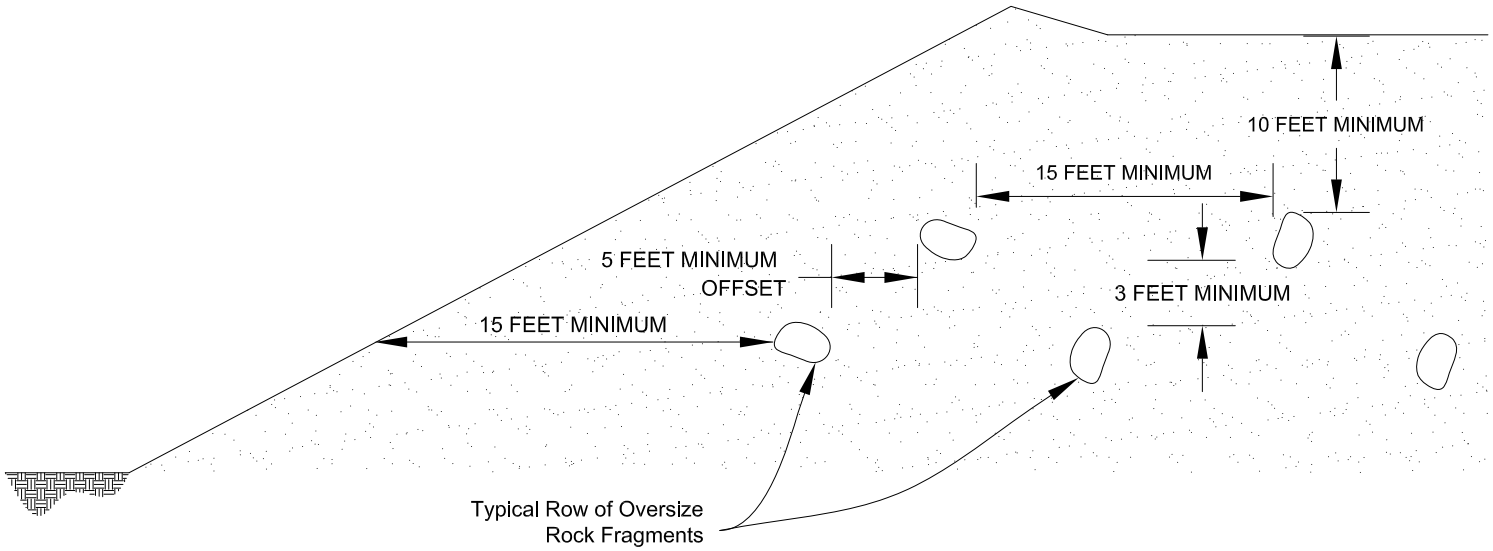
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

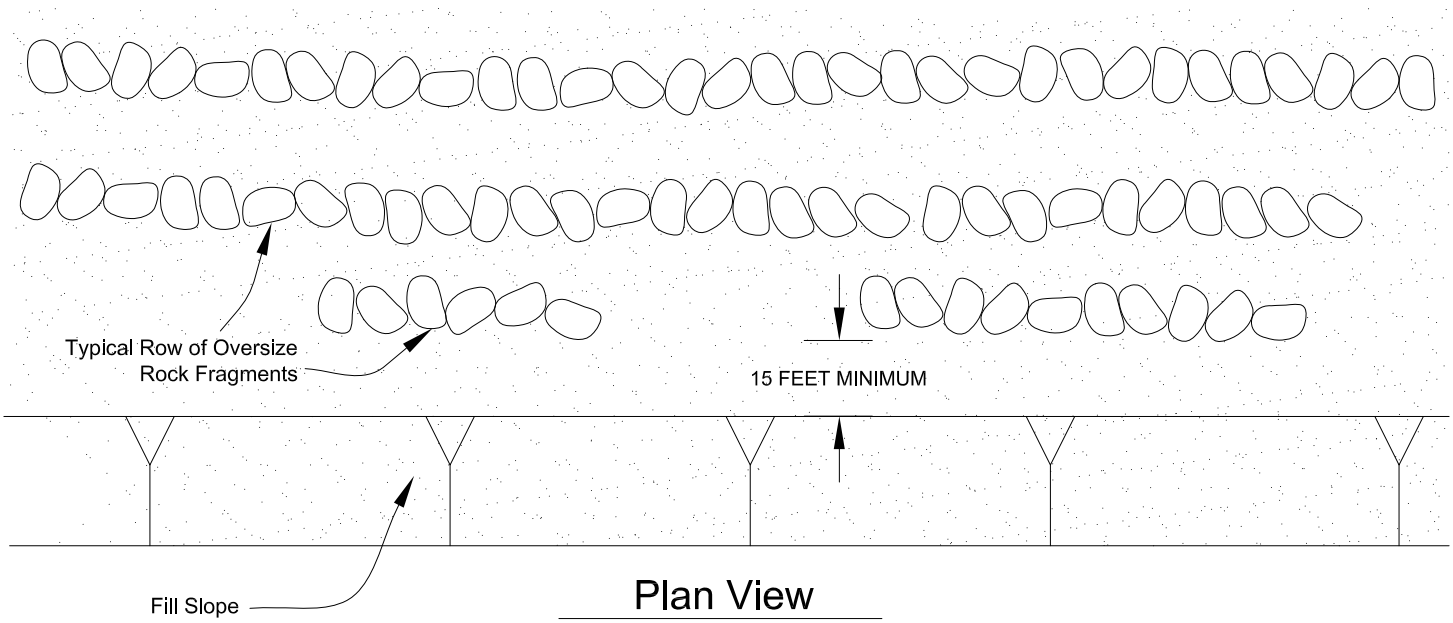
DRAWN: JAS
CHKD: GKM

PLATE D-7

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8

SOUTHERN CALIFORNIA GEOTECHNICAL

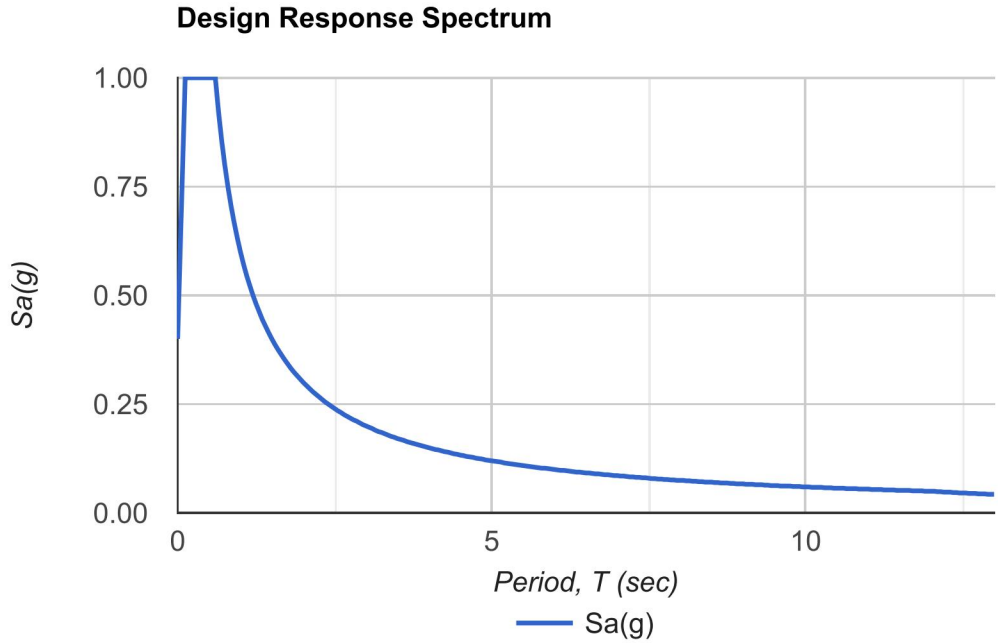
APPENDIX E

OSHPD

Latitude, Longitude: 34.050751, -117.438329

Date	8/31/2019, 11:26:46 AM
Design Code Reference Document	ASCE7-10
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description	Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)	SDC	D	Seismic design category
S_1	0.6	MCE_R ground motion. (for 1.0s period)	F_a	1	Site amplification factor at 0.2 second
S_{MS}	1.5	Site-modified spectral acceleration value	F_v	1.5	Site amplification factor at 1.0 second
S_{M1}	0.9	Site-modified spectral acceleration value	PGA	0.503	MCE_G peak ground acceleration
S_{DS}	1	Numeric seismic design value at 0.2 second SA	F_{PGA}	1	Site amplification factor at PGA
S_{D1}	0.6	Numeric seismic design value at 1.0 second SA	PGA_M	0.503	Site modified peak ground acceleration



SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2016 CBC

TWO PROPOSED COMMERCIAL/INDUSTRIAL BUILDINGS

FONTANA, CALIFORNIA

DRAWN: SAM
CHKD: RGT

SCG PROJECT
19G191-1

PLATE E-1A

SOUTHERN CALIFORNIA GEOTECHNICAL

OSHPD

Latitude, Longitude: 34.050751, -117.438329

Date	9/20/2019, 2:05:05 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.59	MCE_R ground motion. (for 0.2 second period)
S_1	0.6	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.59	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.06	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	0.646	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.711	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.803	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.928	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.59	Factored deterministic acceleration value. (0.2 second)
S1RT	0.675	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.742	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.646	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.935	Mapped value of the risk coefficient at short periods
C_{R1}	0.91	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2019 CBC

TWO PROPOSED COMMERCIAL/INDUSTRIAL BUILDINGS

FONTANA, CALIFORNIA

DRAWN: SAM
CHKD: RGT

SCG PROJECT
19G191-1

PLATE E-1B

SOUTHERN CALIFORNIA GEOTECHNICAL

April 23, 2020

FFCC Land Ventures, LLC
4450 MacArthur Boulevard, Suite 100
Newport Beach, California 92660

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Attention: Mr. Chad Manista

Project No.: **19G191-3**

Subject: **Response Report to 3rd Party Review Comments**
Two Proposed Commercial/Industrial Buildings
NEC Jurupa Avenue and Juniper Avenue
Fontana, California

Reference: Two Proposed Commercial/Industrial buildings, NEC Jurupa Avenue and Juniper Avenue, Fontana, California, prepared by Southern California Geotechnical, Inc. (SCG) for REDA Acquisitions and Clarion Partners Acquisitions, Inc., SCG Project No. 19G191-1, dated September 24, 2019.

Gentlemen:

In accordance with the request of EPD Solutions, we have prepared this report to address the review comments generated by Michael Baker International (MBI), a third-party reviewer for the city of Fontana, following their review of the referenced geotechnical investigation. Each of the comments issued by the reviewer are presented below, followed by SCG response. A copy of the review sheet is enclosed with this correspondence for reference purposes. In order to response to the review comments, SCG prepared a revised geotechnical investigation. The reviewer should be provided with the revised report, dated April 22, 2020.

MBI 1: *Provide boring numbers for all referenced to "boring" or "borings" in the executive Summary.*

SCG: We have complied with the reviewer's request. However, the Executive Summary presents a general description of the geotechnical design considerations for the project. As indicated in the Executive summary "Since this summary is not all inclusive, it should be read in complete context with the entire report."

MBI 2: *Provide range of anticipated over-excavation depths based on range of existing depths of fill and/or upper part of alluvium relative to existing grade in borings.*

SCG: The report recommends the general building pad overexcavation to extend to a depth of 4 feet below existing grade, and 4 feet below proposed pad elevation, whichever is deepest. The overexcavation is also recommended to extend 3 feet below new foundations. In addition, the recommends all undocumented fill soils to be removed in their entirety, at the boring locations, the artificial fill soils extend to depths of 1½ to 6½± feet below existing site grades.

MBI 3: *Describe criteria to be used to "evaluate" "possible fill soils" in B-2, B-3, and B-4 during grading.*

SCG: The possible fill soils are to be evaluated by a representative of the geotechnical engineer at the time or grading. Once the recommended depth of overexcavation has been achieved, the possible fill soils should be evaluated by means of visual observation and inspection for obvious indicators of fill such as debris, mottling, or a disturbed appearance. Any soils identified as artificial fill at the time of grading should be removed in their entirety.

MBI 4: *Include "high moisture contents" in description of soils from 5.5 to 12 feet in B-5 which is located in the approx. middle of one building. Also include the discussion of these soils from the Executive Summary (page 1). Provide note that treatment and stabilization of high moisture soil is also discussed on page 15.*

SCG: The text "high moisture contents" is not part of our geotechnical investigation. Our report includes the discussion of a zone of very moist soils encountered at Boring No. B-5. As indicated on the Boring Log for Boring No. B-5, the moisture contents of the soil samples recovered at depths of 6 and 8½ feet are 18 and 24 percent, respectively. Therefore, the very moist soils are expected to extend within a zone identified between the depths of 5½ to 12½± feet at Boring No. B-5.

MBI 5: *Recommend additional testing for soluble sulfate and corrosion potential during post-grading.*

SCG: Our recommendation for soluble sulfate testing following completion of the building pad is already included in Page 13 of the report. In accordance with the reviewer's request, additional corrosivity testing will be performed following completion of rough grading.

MBI 6: *Need lab test results for direct shear (use sample of silty fine sand which predominates in the over-excavation interval). Phi angle of 30 degree is apparently assumed elsewhere in the report (page 20).*

SCG: The on-site soils are generally comprised of silty fine sands, with varying medium to coarse sand and gravel content. Our experience is that these materials when compacted to at least 90 percent of the ASTM D-1557 maximum dry density will possess a friction angle (phi) of at least 30 degrees. At this time, direct shear testing is not considered warranted as part of the design phase of the project. Direct shear testing may be performed during rough grading in order to verify the strengths of the materials utilized within the building pads.

MBI 7: *Plate C-9 is mentioned in Max Dry Density but is missing from Appendix C.*

SCG: Plate C-9 is now included in the revised report.

MBI 8: *Need lab test results for expansion potential (use clayey soil from B-1 and B-5). 'Non-expansive soils' are apparently assumed elsewhere in the report, including foundation design. Recommend additional expansion potential testing during post-grading.*

SCG: Although an isolated zone of clayey materials was encountered at Boring No. B-5, these materials are not considered to be representative of the near-surface subsurface profile at the site. As previously discussed, the on-site soils are generally comprised of silty fine sands, with varying medium to coarse sand and gravel content. These materials are considered to possess a very low to non-expansive potential. At this time, expansion index testing is not considered necessary as expansion is not considered a design concern for this project. Additional testing may be performed during remedial grading to verify the expansion index potential of the soils using within the building pads.

MBI 9: *Liquefaction and dry sand settlement should be discussed in Section 6.2. Liquefaction might not be a concern due to assumed groundwater depth of 225 feet (page 7). However, the high moisture soil in B-5 from 5.5 to 12 feet should be evaluated. Also, it is customary to drill a 50 foot boring on alluvial sites to confirm lack of perched seepage or other high moisture soils (like in B- 5) within the potential liquefaction interval. Dry sand settlement should be evaluated.*

SCG: As indicated in our report, research from nearby monitoring wells indicate the groundwater level to be present at depths greater that 200± feet. Therefore, as indicated in the project soils report, liquefaction is not considered to be a design concern for the project. Furthermore, the site is not within a mapped "Zone of Required Investigation," therefore, a 50-foot-deep boring is not considered warranted. As previously discussed, the very moist soils encountered at Boring No. B-5 are not considered representative of the on-site soil conditions, and are not indicative of a perched groundwater condition. In addition, clayey soils encountered at Boring No. B-5 are not considered to be susceptible to liquefaction due to their cohesive characteristics.

As requested by the reviewer, we analyzed the seismically induced settlement potential of the unsaturated soil layers at the site. For the purpose of providing a preliminary analysis as to the potential of seismic settlement of dry sands, we have evaluated the top 25 feet of the materials encountered at two of the boring locations. For this analysis, we utilized a site acceleration consistent with maximum considered earthquake ground motions, as required by the 2019 CBC. The peak ground acceleration (PGA_M) was determined in accordance with Section 11.8.3 of ASCE 7-16. The web-based software application SEAOC/OSHPD Seismic Design Maps Tool (described in the previous section) was used to determine PGA_M, based on ASCE 7-16 as the building code reference document. The PGA_M for this site is 0.646g. An associated earthquake magnitude was obtained from the USGS Unified Hazard Tool, Interactive Deaggregation application available on the USGS website. The deaggregated mean magnitude is 7.04, based on the peak ground acceleration and soil classification D.

The methodology we used to analyze the seismically induced settlement potential of the unsaturated soil layers located above the historic high groundwater level is discussed in "Procedure to Evaluate Earthquake-Induced Settlement in Dry Sandy Soils," by Daniel Pradel (April 1998 with October 1998 errata).

The analysis was performed using data obtained from Boring Nos. B-1 and B-6, for soils layers extending to a depth of 25± feet below the existing site grades. At greater depths, an analysis of the seismic settlement of dry sands is not considered warranted based on the medium dense relative densities of the existing soils, which are expected to get denser with depth, and the dense well-graded gravelly sands encountered at Boring No. B-5. The top 4 and 6½± feet of the existing soils were excluded from the analysis since these materials will be removed and replaced as structural fill during the building pad overexcavation procedures.

As part of the settlement analysis, limited grain size analysis was performed on selected soil samples from Borings No. B-1 and B-6. The sieve analysis was performed in accordance with ASTM D-1140. These samples were washed over a #200 sieve to determine the percentage of fine-grained material in each sample, which is defined as the material which passes the #200 sieve. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are as follows.

Sample Identification	**Percent Passing #200 Sieve**
B-1 @ 5 to 6 feet	22
B-1 @ 7 to 8 feet	26
B-1 @ 9 to 10 feet	28
B-1 @ 14 to 15 feet	23
B-1 @ 18½ to 20 feet	22
B-1 @ 23½ to 25 feet	26
B-6 @ 7 to 8 feet	64
B-6 @ 9 to 10 feet	60
B-6 @ 13½ to 15 feet	35
B-6 @ 18½ to 20 feet	24
B-6 @ 23½ to 25 feet	52

The settlement analyses are included on the enclosed spreadsheets. The results of our analysis indicate seismic settlement from unsaturated soil layers of 0.58 inches and 0.25 inches for Boring Nos. B-1 and B-6, respectively. The associated differential settlements are expected to be on the order of 0.4± inch. The estimated differential settlements could be assumed to occur across a distance of 100 feet indicating maximum angular distortions of less than 0.001 inch per inch. The estimated differential settlement and resulting angular distortion are within tolerable limits. Therefore, we do not recommend further mitigation for the anticipated displacement. The recommendations presented in the referenced geotechnical investigation remain applicable for the site.

MBI 10: *In "Treatment of Existing Soils" need to specify a range of over-excavation depths relative to existing grade. Grading contractors may otherwise be justified in claiming an 'extra' if the over-excavation exceeds the stated "4 feet" below existing grade or pad subgrade.*

SCG: The overexcavation recommendations, as stated, are considered sufficient to assist grading contractors in providing base estimates of the required earthwork activities. The report further discusses potential areas of additional removals, such as additional fill soils and treatment of overly moist soils, so that the project can included allowances for those that may be encountered during grading.

MBI 11: *Foundation design apparently assumes "non-expansive soils" which needs to be substantiated by lab testing (see page 9 comment).*

SCG: See our response to MBI 8.

MBI 12: *A phi angle of 30 degrees is apparently assumed in Retaining Wall Design Parameters, which needs to be substantiated by lab testing (see page 8 comment).*

SCG: See our response to MBI 6.

MBI 13: *Backfill Material. Report states that "On-site soils may be used to backfill the retaining walls." and "The retaining wall backfill materials should be well graded." The shallow fill and alluvium is primarily silty fine to medium sands which are not well graded, and thus "on- site soils" may not be suitable for wall backfill.*

SCG: This is an incorrect interpretation by the reviewer. The on-site soils are predominantly granular in nature, comprised of silty fine sands, with varying amounts of medium to coarse sands and gravel. These materials are considered to be suitable for use as retaining wall backfill material.

MBI 14: *Recommend R-value testing during post-grading. The shallow fill and alluvium is mainly silty fine to medium sands which may not have the "assumed" R-value of 50.*

SCG: Based on our experience, the silty fine to medium sands are expected to possess R-values greater than 50. We have been involved with a significant number of projects in the vicinity of the project site, and have a very good understanding of the geotechnical properties associated with the type of materials encountered at the subject site. As stated in the geotechnical report, R-value testing is recommended to be performed at the completion of rough grading.

MBI 15: *Include boring B-3 which is apparently not depicted on Plate 2.*

SCG: Boring No. B-3 is now included in Plate 2 of the revised report.

MBI 16: *Provide Plate C-9 which is missing from Appendix C.*

SCG: Plate C-9 is now included in the report.

Closure

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

Respectfully Submitted,
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Pablo Montes Jr.
Staff Engineer

Robert G. Trazo, GE 2655
Principal Engineer

Enclosures: Seismic Settlement of Dry Sands (2 pages)
Review Comments (13 pages)

Distribution: (1) Addressee