GEOTECHNICAL INVESTIGATION
PROPOSED KAISER COMMERCE CENTER

13557 San Bernardino Avenue
Fontana, California
for
ProLogis

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

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A California Corporation

January 24, 2019

ProLogis
3546 Concours Street, Suite 100
Ontario, California 91764

Attention: Ms. Rachel Hickenbottom
Director, Construction and Development

Project No.: **18G220-1**

Subject: **Geotechnical Investigation**
Proposed Kaiser Commerce Center
13557 San Bernardino Avenue
Fontana, California

Dear Ms. Hickenbottom:

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.

Daniel W. Nielsen, RCE 77915
Project Engineer

Gregory K. Mitchell, GE 2364
Principal Engineer

Distribution: (1) Addressee

22885 Savi Ranch Parkway ▾ Suite E ▾ Yorba Linda ▾ California ▾ 92887
voice: (714) 685-1115 ▾ fax: (714) 685-1118 ▾ www.socalgeo.com

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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

- Demolition of the existing concrete tanks, former offices, pavements, and associated improvements will be necessary in order to facilitate the construction of the proposed development. Demolition should include all foundations, floor slabs, utilities and any other subsurface improvements associated with previous development of the site.
- Initial site preparation should also include stripping of the existing vegetation which consists of sparse grass and weed growth in localized areas of the site. These materials should be properly disposed of off-site.
- All of the borings encountered undocumented fill soils extending to depths of 6½ to 17± feet. Within the proposed building pad area, the fill soils extend to depths of up to 12± feet. One boring in the southeast portion of the proposed building pad area was terminated in fill soils at a depth of 6± feet due to refusal on an unknown obstruction. Native alluvial soils were encountered beneath the fill soils at all of the remaining borings. The native alluvium generally possesses medium dense to very dense relative densities. However, some loose alluvium was encountered to depths of up to 8± feet.
- Information provided by the client indicates that that two oily sludge basins were present in the southeastern portion of the site. These basins were since backfilled with soil and capped with asphalt. Two borings were performed within this former oily sludge basin area. These borings encountered artificial fill materials extending to depths of at least 6 feet to 17± feet below the existing pavement grade.
- Remedial grading is recommended within the proposed building area in order to remove the existing undocumented fill soils in their entirety. As discussed above, undocumented fill soils extend to depths of 6½ to 12± at the borings within the building pad area. It is also recommended that the proposed building pad area be overexcavated to a depth of at least 5 feet below proposed pad grade, in order to provide more uniform support characteristics for the proposed structure. Overexcavation within the new foundation areas is recommended to extend to a depth of at least 3 feet below proposed foundation bearing grade.
- 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. Additional overexcavation is recommended within a former sludge basin area, located in the southeast portion of the site, in order to remove highly compressible clayey silt materials located between depths of 2½ to 4½± feet. Additional overexcavation and/or stabilization may be required.

Building Foundation Recommendations

- Conventional shallow 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 = 150 psi/in
- Reinforcement is not considered to be necessary for geotechnical considerations.
- The actual thickness and reinforcement of the floor slab should be determined by the structural engineer

Pavements

ASPHALT PAVEMENTS (R = 40)					
Materials	**Thickness (inches)**				
	Parking Stalls (TI = 4.0)	Auto Drive Lanes (TI = 5.0)	Truck Traffic		
			(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3	3½	4	5
Aggregate Base	3	4	6	7	8
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS				
Materials	**Thickness (inches)**			
	Automobile Parking and Drive Areas (TI=4.0 & 5.0)	Truck Traffic		
		(TI =6.0)	(TI =7.0)	(TI =8.0)
PCC	5	5	6	7
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. 18P405R, dated October 29, 2018. 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 slab, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the street address of 13557 San Bernardino Avenue in Fontana, California. The site is bounded to the north by San Bernardino Avenue, to the south by a vacant lot, and to the east and west by commercial/industrial buildings. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The subject site consists of five (5) parcels, which total 10.13± acres in size. Parcel 8, which comprises the eastern 6.56± acres, was previously operated by Kaiser Steel as a wastewater treatment facility. Twelve (12) partially below-grade concrete tanks are present throughout this parcel. The tanks range in size from 30 to 80± feet in diameter and 3 to 15± feet in depth. A rectangular basin with dimensions of 150 by 180± feet is located in the southern area of this parcel. The basin was visually estimated to be about 15 feet deep. Two (2) former office buildings are located in the west and central areas of Parcel 8. These structures, 630 to 725± ft^2 in size, are of brick and wood-frame construction and are assumed to be supported on conventional shallow foundations with slab-on-grade floors. Ground surface cover in this area consists of asphaltic concrete. The pavements are generally in fair to poor condition with minor to moderate cracking throughout. Sparse weed growth is present in localized areas along the edges of pavement.

Based on information provided by the client, we understand that two oily sludge basins were present within the southeastern portion of Parcel 8. The oily sludge basins sludge have since been capped and backfilled with soil. The location of the former sludge basins, as indicated on Drawing No. 134819-A4, prepared by Shaw Environmental, Inc., is illustrated on Plate 2 in Appendix A of this report.

The four (4) western parcels are currently vacant. Three concrete slabs, 170 to 1,030± ft^2 in size, are present in the western area of these parcels. Ground surface cover in these parcels consists of crushed aggregate base.

Detailed topographic information was not available at the time of this report. However, based on topographic information obtained from Google Earth, the site topography (exclusive of the existing basins) ranges from 1058± feet mean sea level (msl) in the northern area of the site to 1053± feet msl in the southern area. The site topography slopes gently downward to the south at a gradient of 1± percent.

3.2 Proposed Development

Based on a site plan provided by the client, the site will be developed with a single commercial/industrial building, 164,960± ft^2 in size. The building will be constructed along the northern property line, and will include dock high doors along most of the south side. We expect that the building will be surrounded by asphaltic concrete pavements in automobile parking and drive areas and Portland cement concrete pavements in the truck court area. Several landscape planters and some concrete flatwork may also be included throughout the site.

Detailed structural information has not been provided. We assume that the new building will be a single-story structure of tilt-up concrete construction. The building may include a small area of second floor mezzanine. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of less than 3± feet are expected to be necessary to achieve the proposed site grades. Greater fills are expected to be necessary in the existing basin areas.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of seven (7) borings advanced to depths of 6 to 25± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff.

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

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

4.2 Geotechnical Conditions

Pavements

Asphaltic concrete pavements were encountered at the ground surface at Boring Nos. B-4 through B-7, inclusive. The pavements consist of 2 to 3± inches of asphaltic concrete. No discernible layer of aggregate base was observed at any of the boring locations.

Artificial Fill

Artificial fill soils were encountered at the ground surface or beneath the pavements at all of the boring locations. At Boring Nos. B-1 through B-3, the ground surface cover consisted of a surficial layer of aggregate base ranging between 1 and 3± inches in thickness. Beneath the aggregate base and the pavements, the artificial fill soils encountered at Boring Nos. B-1 through B-5 generally consist of loose to dense silty sands and gravelly sands with occasional sandy silt layers. Boring No. 5 was terminated in f the fill soils due to auger refusal conditions on an unknown obstruction. At Boing Nos. B-1 through B-4, the fill materials extend to depths of 6 to 12± feet. The fill materials possess a disturbed and mottled appearance and some of the recovered samples possess minor debris content, including metallic slag fragments, resulting in their classification as artificial fill.

Boring Nos. B-6 and B-7 were drilled within the area of the former oily sludge pits. The fill soils encountered at these boring locations generally consist of medium dense silty sands, sands, and sandy silts with varying gravel content. Some samples of these soils possessed occasional artificial debris content including slag. A soft, nearly saturated, clayey silt layer was encountered at depths between 2½ and 4½± feet at Boring No. B-6 and a medium stiff silty clay layer was encountered at depths between 12 and 17± feet at Boring No. B-7. The fill soils extend to depths of 6½ to 17± below the existing site grades and Boring Nos. B-6 and B-7, respectively.

Soils identified as possible fill were encountered beneath the fill soils at Boring No. B-6 between depths of 6½ and 14± feet below the existing site grades. The possible fill soils consist of medium dense well-graded sands and silty sands. These materials are similar in composition to some of the fill materials, but lack obvious indicators, such as a disturbed/mottled appearance or artificial debris, resulting in their classification as possible fill soils.

Alluvium

Native alluvium was encountered beneath the artificial fill or possible fill soils all of the boring locations, extending to at least the maximum depth explored of 25± feet below the existing site grades. The native alluvial soils encountered at the boring locations generally consist of medium dense sands and silty sands and medium dense to vey dense gravelly sands. Occasional strata of loose silty sands were encountered within the upper 8± 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 primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well in this database is located approximately 3,550 feet northeast of the site. Water level readings within this monitoring well indicate high groundwater levels of 268± feet (January 2010) below the ground surface.

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. Additionally, the samples recovered from Boring Nos. B-6 and B-7 were submitted to a subcontracted laboratory for specialized handling and testing protocol because these borings were performed in an area believed to have been contaminated by petroleum hydrocarbons. 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 and Plates A, B, and D, in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-9 in Appendix C of this report. This test is generally used to compare with 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-1 @ 0 to 5 feet	1.480	Severe (S2)
B-5 @ 0 to 5 feet	0.015	Not Applicable (S0)

Corrosivity Testing

A representative bulk sample of the near-surface soils was 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-1 @ 0 to 5 feet	1,320	7.1	25	50
B-5 @ 0 to 5 feet	7,200	8.1	4.0	3.4

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

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

6.1 Seismic Design Considerations

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

Faulting and Seismicity

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

Seismic Design Parameters

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2016 edition of the California Building Code (CBC). The CBC provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

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

2016 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.500
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.600
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

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and plasticity characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The California Geological Survey (CGS) has not yet conducted detailed seismic hazards mapping in the area of the subject site. The general liquefaction susceptibility of the site was determined by research of the San Bernardino County Official Land Use Plan, General Plan, Geologic Hazard Overlay. Map FH29D for the Fontana Quadrangle indicates that the subject site is not located within an area of liquefaction susceptibility. Based on the mapping performed by the county of San Bernardino and the subsurface conditions encountered at the boring locations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

All of the borings encountered artificial fill soils at the ground surface or beneath the pavements. The borings performed within the proposed building area encountered fill soils extending to depths between 6 to 12±. The fill soils possess variable densities, strengths, and composition. No documentation regarding the placement or compaction of the fill soils was provided to our office. Based on these considerations, the existing fill soils are not considered suitable, in their present condition, for the support of the new structure.

Demolition will be required at this site to remove the existing partially-below-grade tanks and buildings. Demotion of the tanks, building foundations, and floor slabs is expected to cause significant disturbance to the near-surface. Remedial grading is considered warranted within the proposed building pad area in order to remove the existing fill materials and any soils disturbed during demolition. These materials should be replaced as compacted structural fill.

Based on information provided to our office by the client, we understand that portions of the near surface soils in Parcel 8 may contain petroleum hydrocarbons, especially in former the former oily sludge basins area located in the southeast portion of Parcel 8. Boring Nos. B-6 and B-7 were performed within the former sludge basin area. Grading in these areas should be performed in accordance with the recommendations of the project environmental consultant.

Settlement

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

Expansion

The majority of 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.

Soluble Sulfates

The results of the soluble sulfate testing indicated sulfate concentrations of 0.158 and 1.480 percent for the selected samples of the on-site soils. Sulfate concentrations in soil between 0.2 and 2.0 percent are considered to constitute a severe sulfate exposure to concrete (exposure class S2) with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Due to the presence of severe sulfate concentrations, specialized concrete mix designs are considered to be necessary, with regard to sulfate protection purposes. Based on the S2 sulfate exposure class, the ACI requires that all concrete which will come into contact with the on-site soils incorporate the following characteristics:

- Cement Type: V (five)
- Minimum Compressive Strength (f'_c) = 4,500 lbs/in^2
- Maximum Water/Cement Ratio: 0.45

It is recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building area.

Corrosion Potential

The results of laboratory testing indicate that the tested samples of the on-site soils possess saturated resistivity values of 1,320 and 7,200 ohm-cm, and a pH values of 7.1 and 8.1. 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 considered to be corrosive to ductile iron pipe. Therefore, polyethylene encasement or some other appropriate method of protection may be required for iron pipes.** Since SCG does not practice in the area of corrosion engineering, the client may also wish to contact a corrosion engineer to provide a more thorough evaluation.

Only low concentrations (4.0 and 25 mg/kg) of chlorides were detected in the samples submitted for corrosivity testing. In general, soils possessing chloride concentrations in excess of 350 to 500 parts per million (ppm) are considered to be corrosive with respect to steel reinforcement within reinforced concrete. Based on the lack of any significant chlorides in the tested sample, the site is considered to have a C1 chloride exposure in accordance with the American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary. Therefore, a specialized concrete mix design for reinforced concrete for protection against chloride exposure is not considered warranted.

Shrinkage/Subsidence

Removal and recompaction of the artificial fill and near-surface native soils is estimated to result in an average shrinkage of 12 to 17 percent. It should be noted that this 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± 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.

Based on information provided to our office by the client, we understand that portions of Parcel 8 may be contaminated, especially the former sludge basin area located in the southeastern portion of Parcel 8. Grading within Parcel 8 and any other areas suspected of contamination should be performed in accordance with the recommendations of the project environmental consultant.

Site Stripping and Demolition

Demolition of the existing tanks, office buildings, sheds, pavements and associated improvements will be necessary in order to facilitate the construction of the proposed development. Demolition should include all foundations, floor slabs, utilities and any other subsurface improvements associated with previous development of the site. Any septic systems encountered during demolition and/or grading (if present) should be removed in their entirety. Any associated leach fields or other existing underground improvements should also be removed in their entirety.

Boring No. B-5 was terminated at a depth of 6± feet due to refusal on an unknown obstruction. A subsurface structure may be located in this area. This object should be evaluated by the geotechnical engineer during site grading and additional demolition and/or grading recommendations may be provided at that time.

Debris resultant from demolition should be disposed of offsite. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2-inch particle size, well mixed with the on-site soils, and incorporated into new structural fills.

Organic soils and any vegetation should be stripped and disposed of offsite. At the time of this report, sparse weed growth was present in localized areas throughout the site. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pad

Remedial grading is recommended within the proposed building pad area to remove the existing undocumented fill soils and the upper portion of the near surface native alluvial soils. The fill soils extend to depths of 6½ to 12± feet at the borings performed within the building pad area, and as discussed above, these materials are considered to represent undocumented fill. The existing fill soils should be removed in their entirety.

The overexcavation is also recommended to extend to depth of at least 5 feet below proposed building pad subgrade elevation. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 3 feet below proposed foundation bearing grade.

The overexcavation should extend at least 5 feet beyond the building perimeter, and to a horizontal extent equal to the depth of fill below the new foundations. If the proposed structure will incorporate any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

As discussed above, Boring No. B-5 was terminated at a depth of 6± feet due to refusal on an unknown obstruction. A subsurface structure may be located in this area. This object should be evaluated by the geotechnical engineer during site grading and additional demolition and/or grading recommendations may be provided at that time.

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

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches 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 area may then be raised to grade with previously excavated soils or imported structural fill.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining 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. Subgrade soils in areas of non-retaining site walls should be overexcavated to a depth of 2 feet below proposed bearing grade. In addition, any undocumented fill soils should be removed in their entirety. Based on the conditions encountered at the boring locations, the depth of undocumented fill will likely govern the depth of overexcavation because undocumented fill soil extend to depths of at least 6 feet at all of the boring locations. 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 and the lower strength alluvium in the new parking and drive areas is generally 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.

Additional overexcavation is recommended in the former sludge basin area in the southeast portion of the proposed parking area. Boring No. B-6 encountered a nearly saturated, highly compressible clayey silt layer within the fill materials located at depths between 2½ and 4½± feet. The overexcavation within the former sludge basin area should extend to a depth of at least 4 feet, and to a depth sufficient to remove the highly compressible clayey silt materials. Depending upon the conditions encountered at the overexcavation subgrade, addition overexcavation or stabilization or measures may be necessary. It should be noted that this additional overexcavation does not mitigate all of the undocumented fill materials in the former sludge basin area, which extend to depths of up to 17± feet at one of the boring locations. **If the recommended overexcavation in the former sludge basin area is not feasible due to environmental considerations, then our office should be contacted for alternative recommendations.**

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 undocumented fill soils and potentially compressible alluvium 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, (and to greater depths within the former sludge basin area, to be determined at the time of remedial grading) 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.

- In general, the on-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer. The existing soils present within Parcel 8 or any other areas suspected of contamination should also be approved by the environmental consultant prior to their reuse as fill. Soils excavated from the former sludge basin area are not expected to be suitable for reuse as fill.
- 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 should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. As an alternative, a clean sand (minimum Sand Equivalent of 30) may be placed within trenches and compacted in place (jetting or flooding is not recommended). 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 the 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.

Any soils used to backfill voids around subsurface utility structures, such as manholes or vaults, should be placed as compacted structural fill. If it is not practical to place compacted fill in these areas, then such void spaces may be backfilled with lean concrete slurry. Uncompacted pea gravel or sand is not recommended for backfilling these voids since these materials have a potential to settle and thereby cause distress of pavements placed around these subterranean structures.

6.4 Construction Considerations

Excavation Considerations

The near surface soils are predominately granular in nature. 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 below the existing site grades. 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 pad will be underlain by structural fill soils used to replace existing undocumented fill 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 structure may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Two (2) No. 5 rebars (1 top and 1 bottom).
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing 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 30-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 3000 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 floor of the new structure may be constructed as a conventional slab-on-grade supported on newly placed structural fill soils.

These fill soils are expected to extend to a depth of at least 5 feet below finished pad grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 6 inches.
- Modulus of Subgrade Reaction: k = 150 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 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 slab 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 silty sands and sands with occasional sandy silts and clayey silts. **Clayey silts or other potentially expansive clayey soils should not be used for retaining wall backfill.** 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 Silty Sands and Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		131 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	43 lbs/ft^3
	Active Condition (2h:1v backfill)	70 lbs/ft^3
	At-Rest Condition (level backfill)	65 lbs/ft^3

The walls should be designed using a soil-footing coefficient of friction of 0.30 and an equivalent passive pressure of 275 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 consisting of sands, silty sands, and sandy silts may be used to backfill the retaining walls. Clayey silts or other potentially expansive clayey soils should not be used to backfill retaining walls. However, all backfill material placed within 3 feet of the back-wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

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

All retaining wall backfill should be placed and compacted under engineering- controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557-91). 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 with occasional sandy silts and varying gravel content. Based on their classification, these materials are expected to possess good to excellent pavement support characteristics, with R-values in the range of 40 to 50. 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 40. 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 = 40)					
Materials	**Thickness (inches)**				
	Parking Stalls (TI = 4.0)	Auto Drive Lanes (TI = 5.0)	Truck Traffic		
			(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3	3½	4	5
Aggregate Base	3	4	6	7	8
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				
Materials	**Thickness (inches)**			
	Automobile Parking and Drive Areas (TI=4.0 & 5.0)	Truck Traffic		
		(TI =6.0)	(TI =7.0)	(TI =8.0)
PCC	5	5	6	7
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.

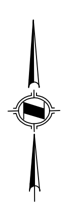
The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the 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

PROPOSED KAISER COMMERCE CENTER

FONTANA, CALIFORNIA

SCALE: 1" = 2400'

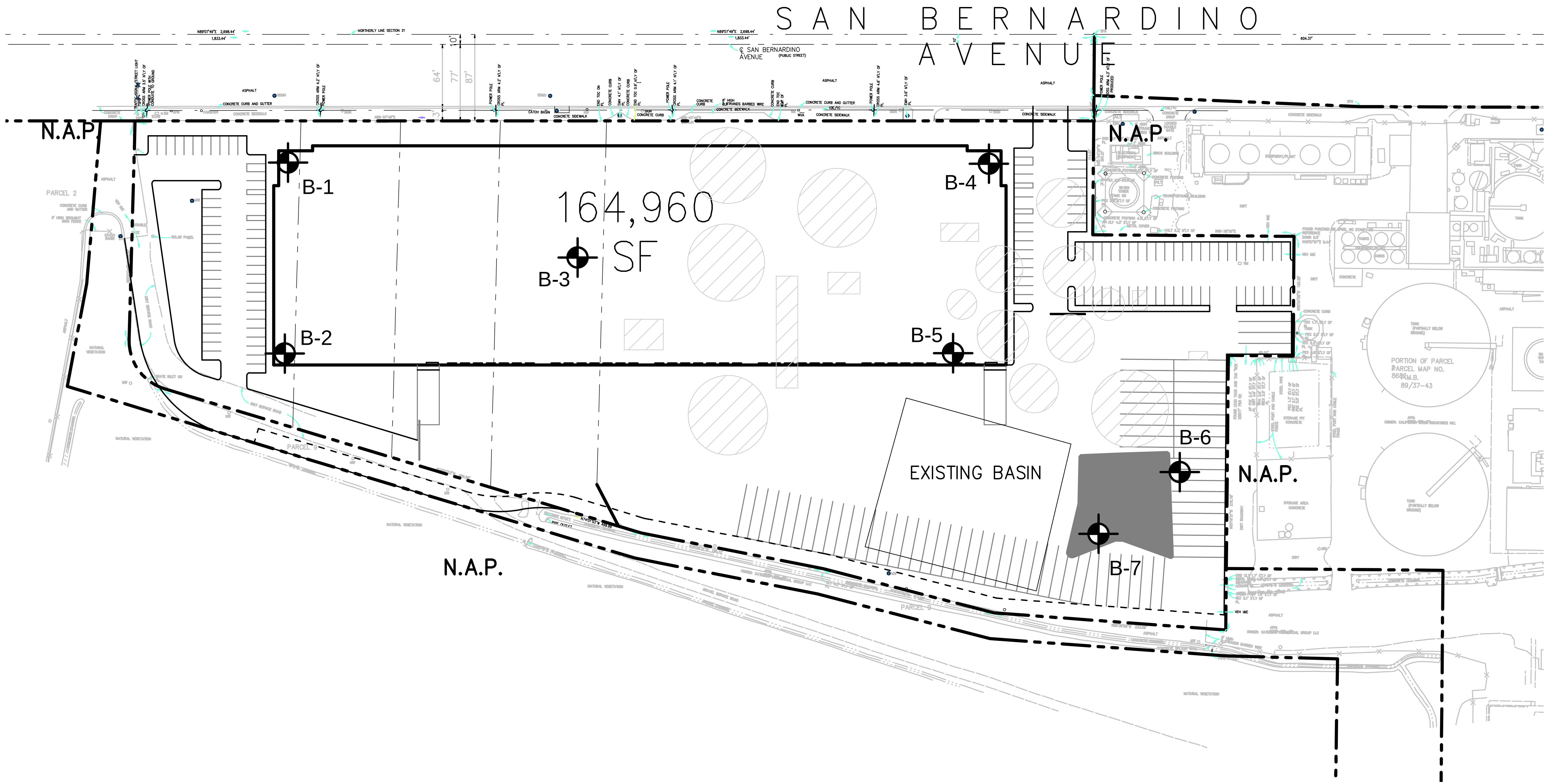
DRAWN: AL
CHKD: GKM

SCG PROJECT
18G220-1

PLATE 1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

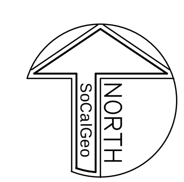


GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

APPROXIMATE LOCATION OF EXISTING STRUCTURES TO BE DEMOLISHED

APPROXIMATE LOCATION OF FORMER OILY SLUDGE BEDS AS INDICATED ON FIGURE 5-1 PREPARED BY SHAW ENVIRONMENTAL, INC. (DRAWING NUMBER 134819-A4)



NOTE: SITE PLAN PREPARED BY RGA.

BORING LOCATION PLAN

PROPOSED KAISER COMMERCE CENTER

FONTANA, CALIFORNIA

SCALE: 1" = 100'

DRAWN: JLL
CHKD: DWN

SCG PROJECT 18G220-1

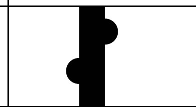
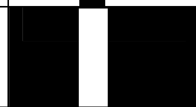
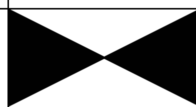
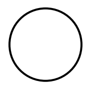
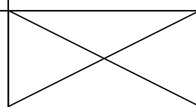
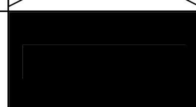
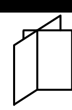
PLATE 2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

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

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

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

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

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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.: 18G220 DRILLING DATE: 1/3/18 WATER DEPTH: Dry
PROJECT: Proposed Kaiser Commerce Center DRILLING METHOD: Hollow Stem Auger CAVE DEPTH: 20 feet
LOCATION: Fontana, California LOGGED BY: Anthony Luna 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
					3± inches Aggregate base							
	X	25			FILL: Dark Brown Silty fine Sand, little medium Sand, trace fine Gravel, trace Slag, mottled, loose to medium dense-moist	112	9					
	X	10				96	8					
5	X	33			FILL: Brown Silty fine to coarse Sand, little fine Gravel, slightly mottled, medium dense-damp to moist	115	8					
	X	24			ALLUVIUM: Light Brown fine to coarse Sand, little Silt, medium dense-damp	114	3					
	X	39			Light Gray Gravelly fine to coarse Sand, trace Silt, medium dense to very dense-dry to damp	117	2					
10												
15	X	84/11"				121	2					
					Gray Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, medium dense-moist							
20	X	23				99	9					
					Brown fine to coarse Sand, little fine to coarse Gravel, very dense-dry to damp							
25	X	80/10"				116	2					
					Boring Terminated at 25'							

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 18G220
PROJECT: Proposed Kaiser Commerce Center
LOCATION: Fontana, California
DRILLING DATE: 1/3/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Anthony Luna
WATER DEPTH: Dry
CAVE DEPTH: 21 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					3± inches Aggregate base							
	X	46			FILL: Dark Gray Brown Silty fine to coarse Sand, little fine Gravel, trace Slag, dense-moist	115	8					
	X	27			FILL: Dark Brown Silty fine Sand, trace to little medium Sand, loose to medium dense-damp	110	4					
5	X	8				101	6					
	X	9			ALLUVIUM: Brown to Light Brown fine to medium Sand, loose-damp	95	3					
10	X	21										No Sample Recovered
					Brown to Light Gray Brown fine to coarse Sand, occasional Cobbles, little fine to coarse Gravel, medium dense-damp							
15	X	25				98	3					
					Light Gray Brown Silty fine Sand, trace medium Sand, medium dense-damp							
20	X	16				97	6					
25	X	21				106	3					

Boring Terminated at 25'

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 18G220
PROJECT: Proposed Kaiser Commerce Center
LOCATION: Fontana, California

DRILLING DATE: 1/3/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Anthony Luna

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

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					1± inch Aggregate base							
	X	83/11"			FILL: Brown to Orange Brown Silty fine to coarse Sand, trace Slag, little fine to coarse Gravel, very dense-dry	108	1					
	X	50/6"			FILL: Dark Brown Gravelly fine to coarse Sand, little Silt, very dense-damp to moist		7					Disturbed Sample
5	X	50/6"			FILL: Dark Gray Gravelly fine to coarse Sand, trace Silt, very dense-damp to moist	87	8					
	X	14			FILL: Gray Silty fine to medium Sand, trace Clay, trace fine Gravel, mottled, little Slag, little Iron oxide staining, loose to dense-moist to very moist	85	29					
	X	54				103	10					
10												
					ALLUVIUM: Light Gray fine to coarse Sand, trace fine Gravel, trace to little Silt, very dense-dry to damp							
	X	80					5					
15												
	X	50/6"					4					
20												
	X	82/11"					5					
25												

Boring Terminated at 25'

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 18G220
PROJECT: Proposed Kaiser Commerce Center
LOCATION: Fontana, California

DRILLING DATE: 1/3/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Anthony Luna

WATER DEPTH: Dry
CAVE DEPTH: 21 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					3± inches Asphaltic concrete, no discernible Aggregate base							
	X	7			FILL: Brown to Dark Brown Silty fine Sand, trace medium Sand, loose-damp to moist	108	7					
	X	7				111	11					
5	X	24			FILL: Brown to Dark Brown fine Sandy Silt, medium dense-moist to very moist	104	15					
	X	32			ALLUVIUM: Gray Brown Gravelly fine to coarse Sand, trace Silt, medium dense-dry to damp	128	3					
10	X	27				109	2					
15	X	37				118	2					
					Brown Silty fine Sand to fine Sandy Silt, trace Iron oxide staining, medium dense-very moist							
20	X	24				105	19					
					Gray Brown fine to coarse Sand, some fine to coarse Gravel, dense-dry to damp							
25	X	55				124	2					

Boring Terminated at 25'

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 18G220
PROJECT: Proposed Kaiser Commerce Center
LOCATION: Fontana, California
DRILLING DATE: 1/3/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Anthony Luna
WATER DEPTH: Dry
CAVE DEPTH:
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					2± inches Asphaltic concrete, no discernible Aggregate base							
	X	10			FILL: Brown to Dark Brown SIlty fine Sand, little medium to coarse Sand, trace fine Gravel, loose-damp to moist	114	10					
	X	14				94	10					
5	X	8				116	8					
					Boring Terminated at 6' due to refusal on unknown obstruction							

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-6

JOB NO.: 18G220 DRILLING DATE: 1/3/18 WATER DEPTH: Dry
PROJECT: Proposed Kaiser Commerce Center DRILLING METHOD: Hollow Stem Auger CAVE DEPTH: 21 feet
LOCATION: Fontana, California LOGGED BY: Anthony Luna READING TAKEN: At Completion

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
					2½± inches Asphaltic concrete, no discernible Aggregate base							
	X	17			FILL: Brown Silty fine Sand, some medium to coarse Sand, some fine to coarse Gravel, some metalic slag, medium dense-damp	101	5					
	X	5			FILL: Dark Brown to Red Clayey Silt, little fine Sand, soft-very moist to wet	43	95					
5	X	21			FILL: Dark Brown Silty fine Sand, little medium to coarse Sand, trace fine Gravel, medium dense-damp to moist	120	8					
	X	16			POSSIBLE FILL: Gray Brown fine to medium Sand, trace coarse Sand, trace Silt, trace Iron oxide staining, trace fine Gravel, medium dense-damp	107	4					
10	X	16				125	5					
					POSSIBLE FILL: Brown Silty fine Sand, trace medium Sand, medium dense-damp							
15	X	64			ALLUVIUM: Gray Brown fine to coarse Sand, some fine Gravel, dense-damp	131	3					
					Dark Gray Brown fine to coarse Sand, little fine Gravel, some Silt, medium dense-moist							
20	X	26				108	8					
					Gray Brown to Dark Gray Brown Silty fine Sand, little medium to coarse Sand, little fine Gravel, medium dense-moist							
25	X	15				114	9					

Boring Terminated at 25'

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

TEST BORING LOG **PLATE B-6**

BORING NO. B-7

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 18G220
PROJECT: Proposed Kaiser Commerce Center
LOCATION: Fontana, California

DRILLING DATE: 1/3/18
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Anthony Luna

WATER DEPTH: Dry
CAVE DEPTH: 21 feet
READING TAKEN: At Completion

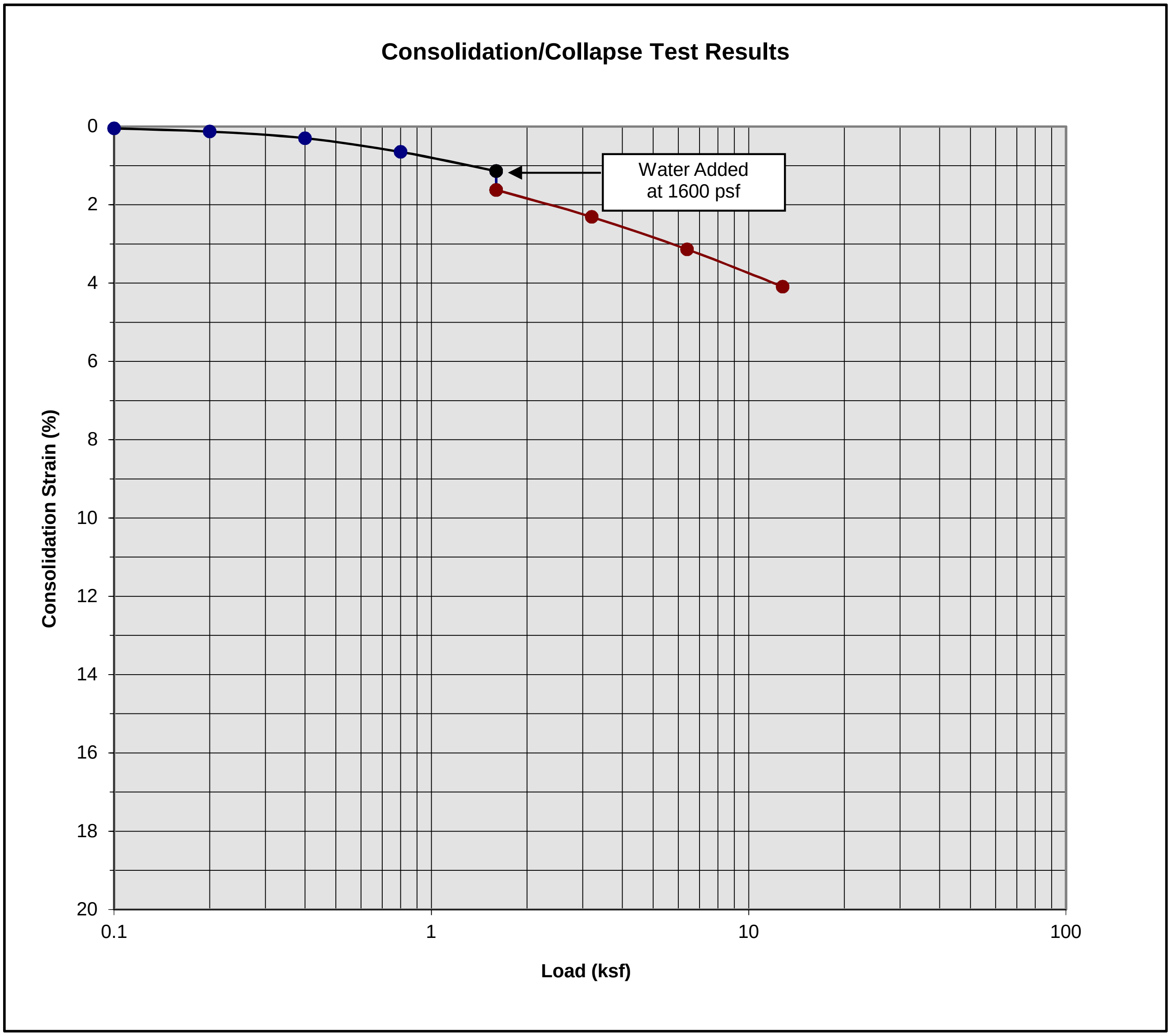
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION — SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					2½± inches Asphaltic concrete, no discernible Aggregate base							
	X	62			FILL: Dark Brown Silty fine to coarse Sand, some fine to coarse Gravel, mottled, very dense-moist	106	10					
	X	49			FILL: Gray Gravelly fine to coarse Sand, dense-moist	84	10					
5	X	85/8"			FILL: Light Gray to Gray fine to coarse Sand, some fine to coarse Gravel, Metal slag fragments, slight Organic odor, very dense-moist	92	8					
	X	88				108	8					
10	X	47			FILL: Dark to Black Silty fine Sand, some fine to coarse Gravel, slight Organic content, loose-very moist	94	15					
					FILL: Black Silty Clay, some fine to coarse Gravel, some fine to coarse Sand, strong Organic odor, medium stiff-moist							
15	X	11				90	11					
					ALLUVIUM: Brown Silty fine Sand, trace to little medium Sand, medium dense-damp							
20	X	34				101	6					
					Brown to Dark Brown Silty fine Sand to fine Sandy Silt, little Iron oxide staining, dense-very moist							
25	X	64				101	17					

Boring Terminated at 25'

TBL 18G220.GPJ SOCALGEO.GDT 1/24/19

TEST BORING LOG

APPENDIX C

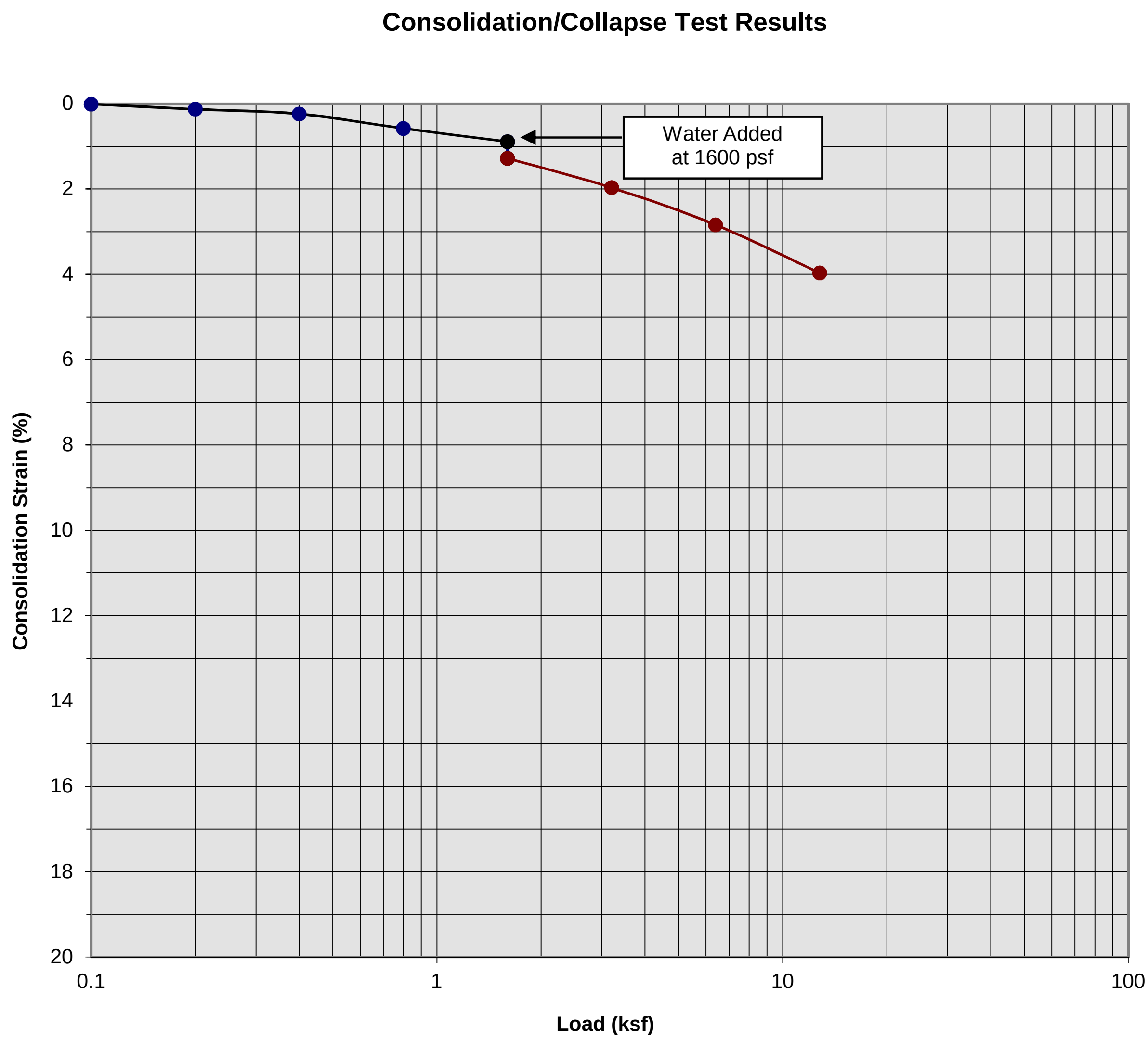


Classification: FILL: Dark Gray Brown Silty fine to coarse Sand, little fine Gravel

Boring Number:	B-2	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	1 to 2	Initial Dry Density (pcf)	114.9
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	119.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.48

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



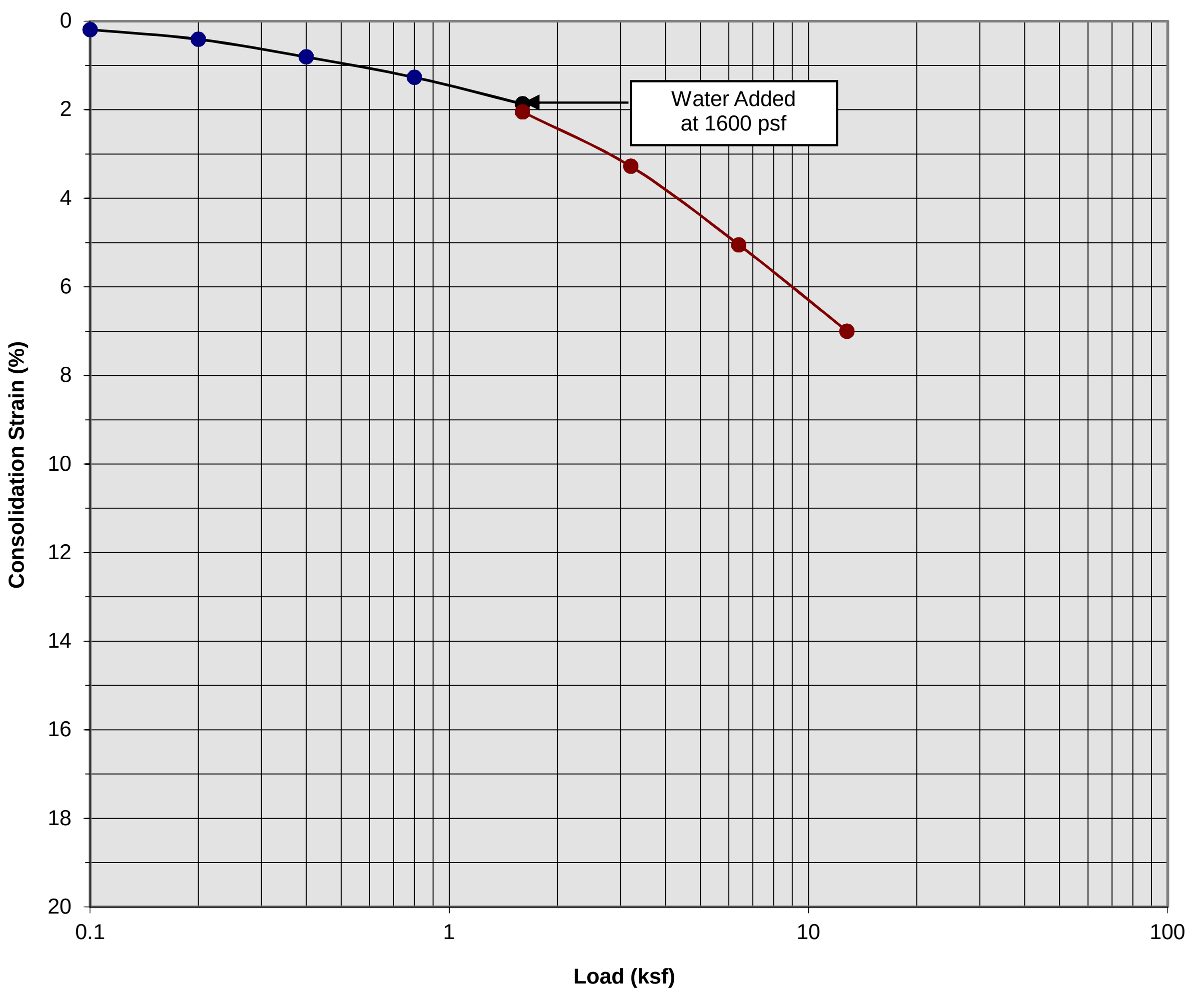
Classification: FILL: Dark Brown Silty fine Sand, trace to little medium Sand

Boring Number:	B-2	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	3 to 4	Initial Dry Density (pcf)	110.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.3
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.39

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

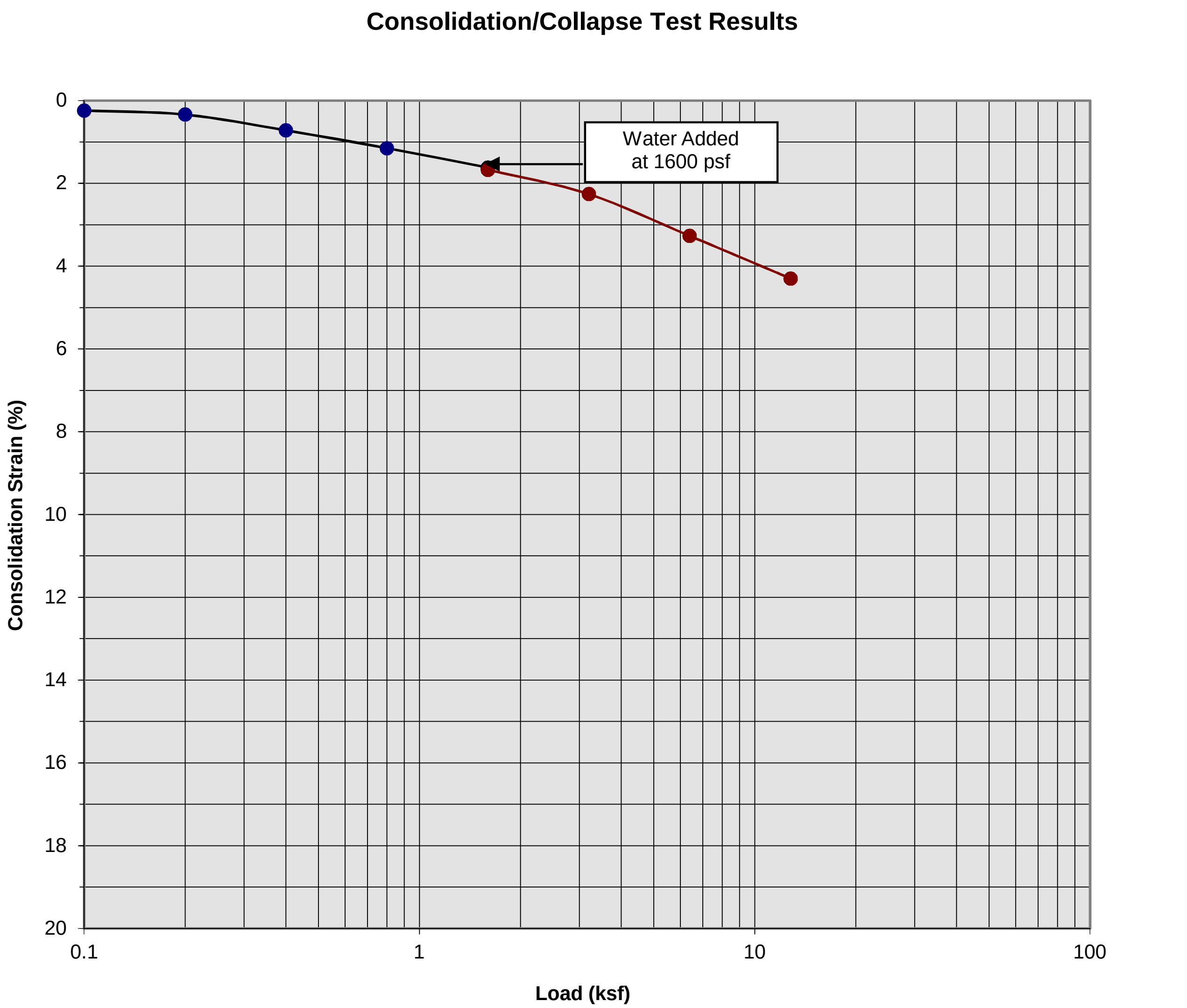


Classification: FILL: Dark Brown Silty fine Sand, trace to little medium Sand

Boring Number:	B-2	Initial Moisture Content (%)	6
Sample Number:	---	Final Moisture Content (%)	20
Depth (ft)	5 to 6	Initial Dry Density (pcf)	100.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	106.9
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.18

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

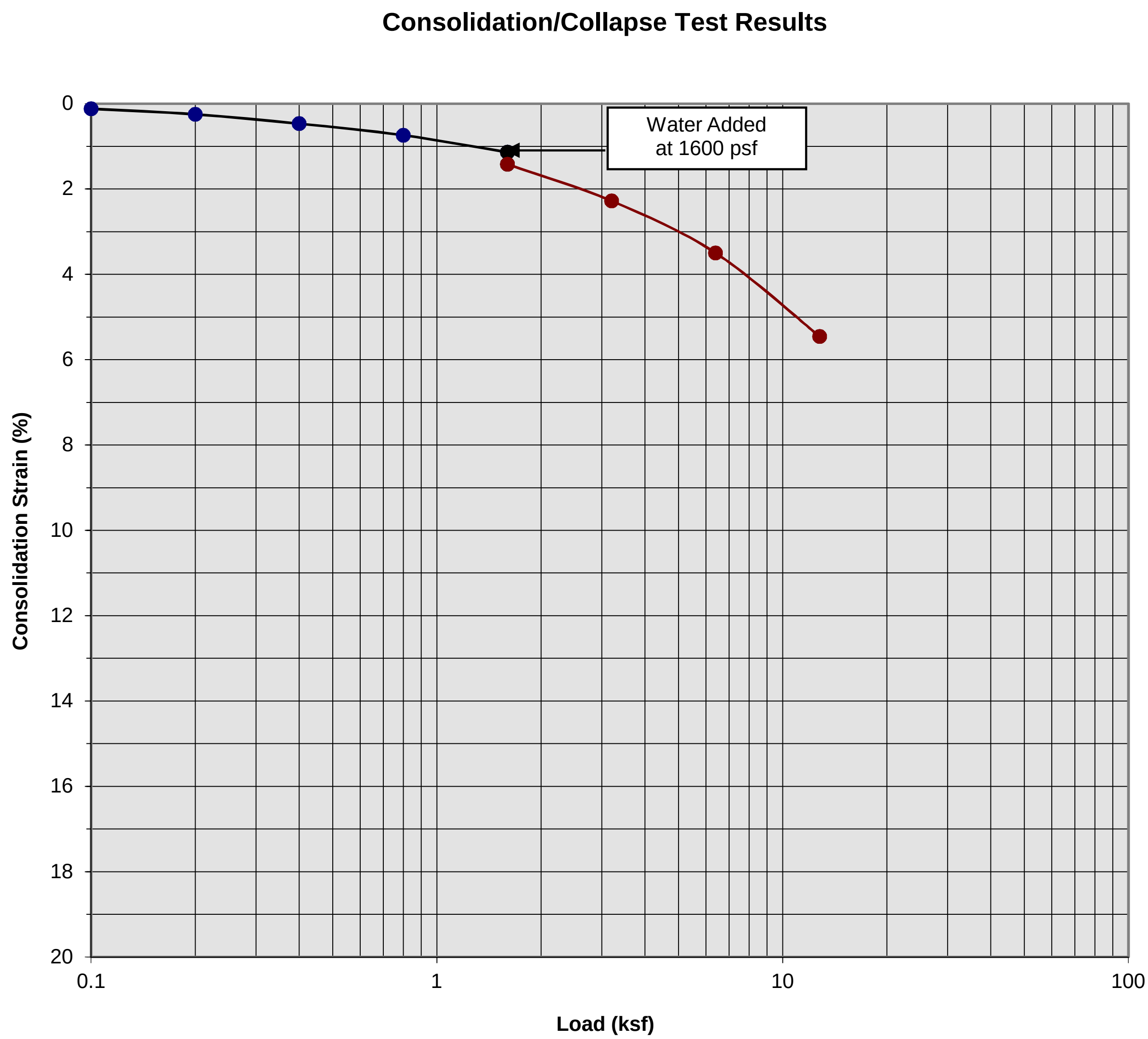


Classification: Brown to Light Brown fine to medium Sand

Boring Number:	B-2	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	22
Depth (ft)	7 to 8	Initial Dry Density (pcf)	100.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	102.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.05

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 4

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



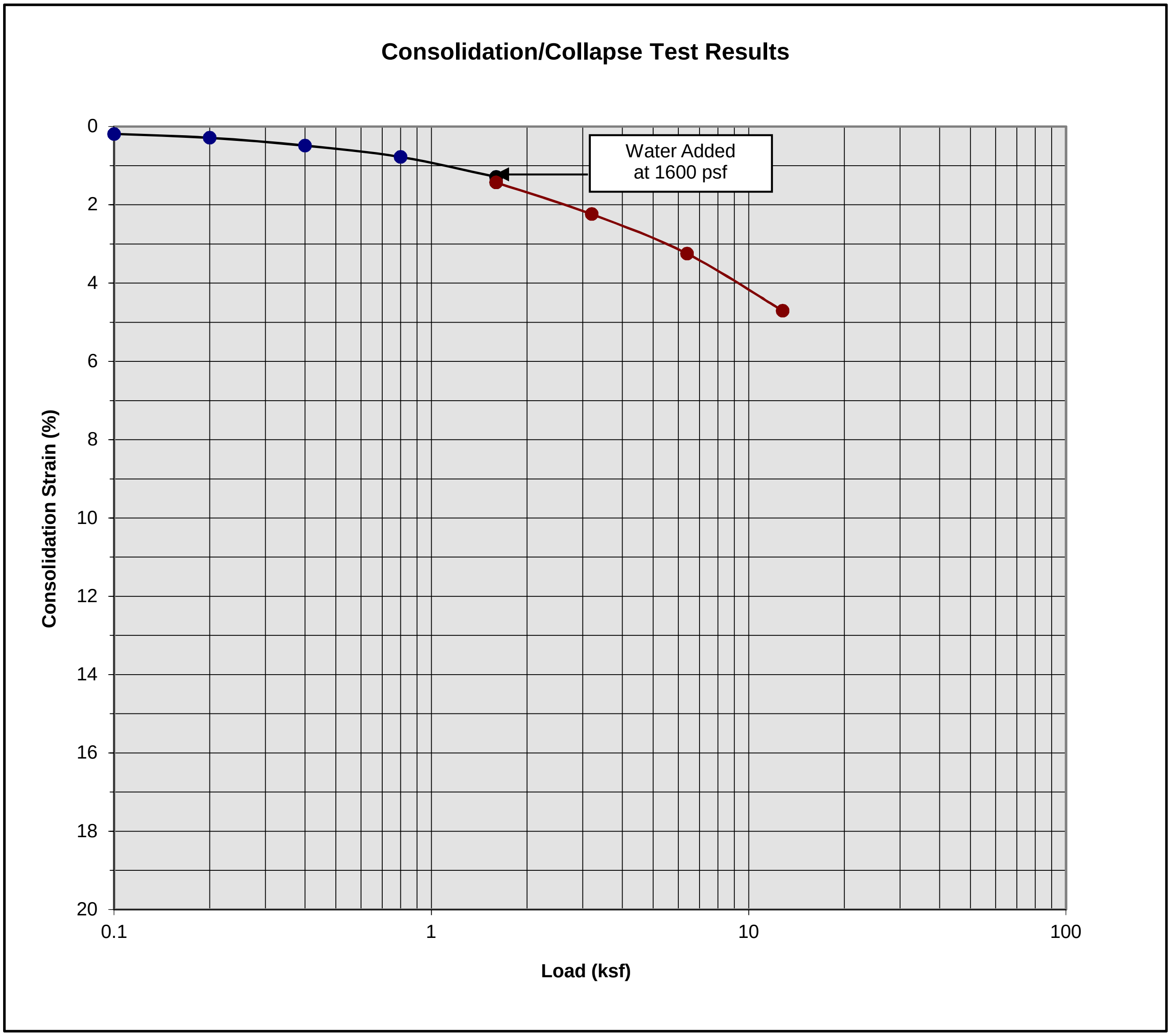
Classification: FILL: Brown to Dark Brown Silty fine Sand, trace medium Sand

Boring Number:	B-4
Sample Number:	---
Depth (ft)	1 to 2
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Initial Moisture Content (%)	7
Final Moisture Content (%)	18
Initial Dry Density (pcf)	107.5
Final Dry Density (pcf)	112.7
Percent Collapse (%)	0.28

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 5

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

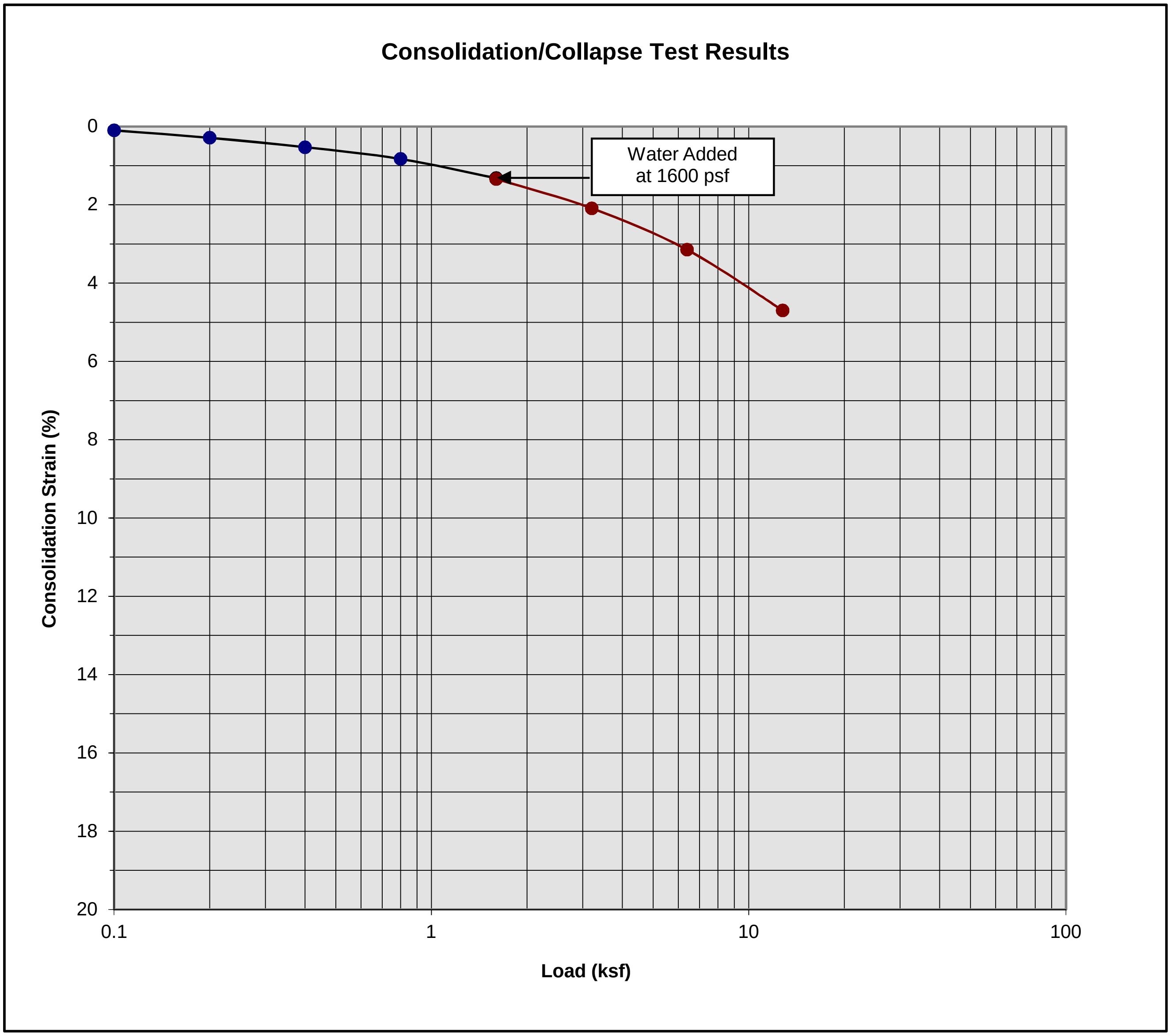


Classification: FILL: Brown to Dark Brown Silty fine Sand, trace medium Sand

Boring Number:	B-4	Initial Moisture Content (%)	11
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	3 to 4	Initial Dry Density (pcf)	110.6
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	116.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.14

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 6

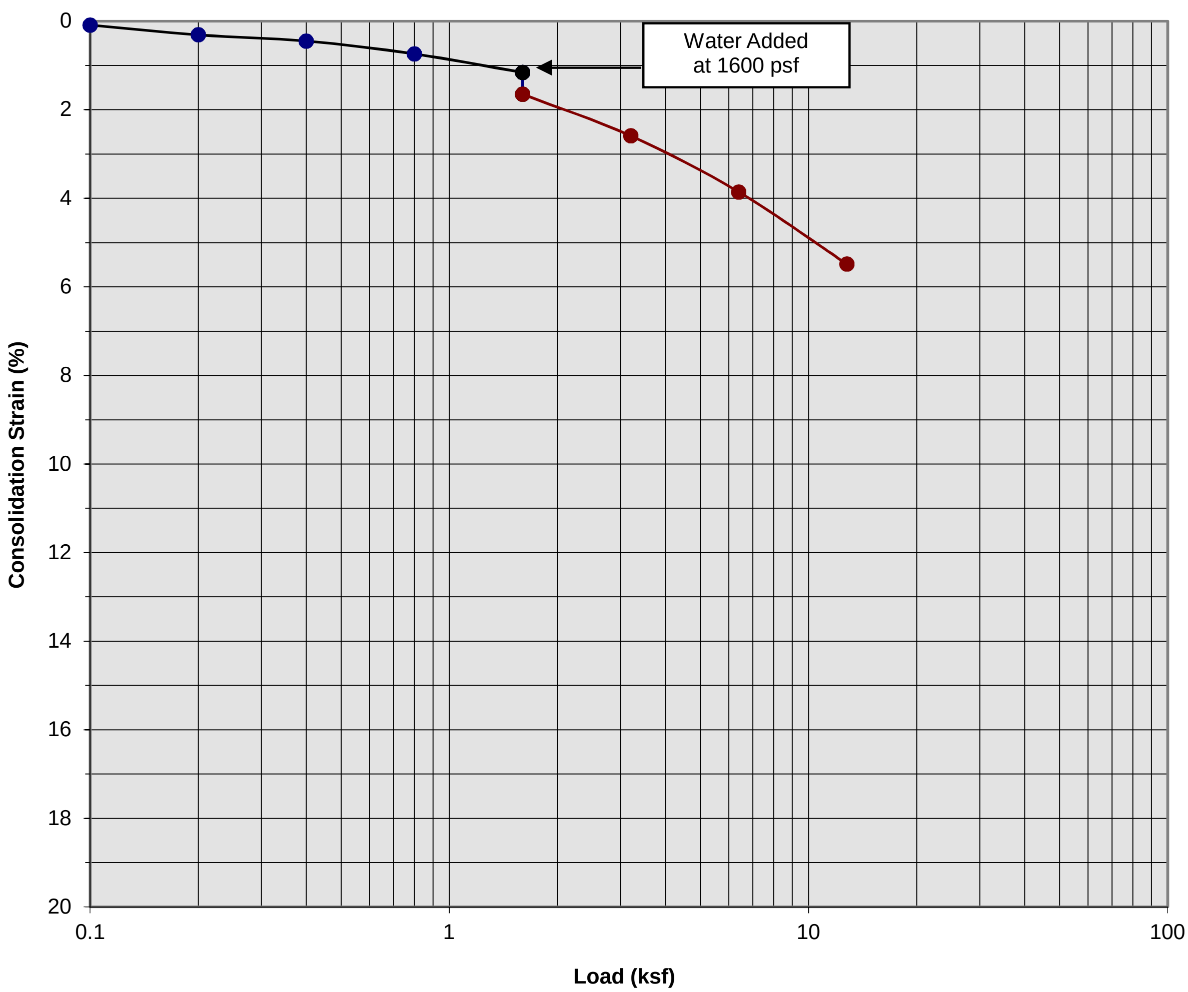
SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Classification: FILL: Brown to Dark Brown fine Sandy Silt

Boring Number:	B-4	Initial Moisture Content (%)	15
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	5 to 6	Initial Dry Density (pcf)	104.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	109.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.02

Consolidation/Collapse Test Results



Classification: Gray Brown Gravelly fine to coarse Sand, trace Silt

Boring Number:	B-4	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	11
Depth (ft)	7 to 8	Initial Dry Density (pcf)	123.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	130.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.49

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220
PLATE C- 8

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

SMITH-EMERY LABORATORIES
791 E. Washington Boulevard, Los Angeles, CA 90021
Tel. No. (213) 745-5333; Fax no.: (213) 741-8621

ASTM D2435-11

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

SEL File No.:	45834-1
SEL Report No.:	G-19-1476
Date:	1/17/19
BH No.:	6
Depth:	1-2'
Sample No.:	1
Moisture Content:	5.3
Saturation:	21.4
Voids Ratio	0.65
Dry Density:	100.1

Client:	Southern California Geotechnical
Project :	Proposed Kaiser Commerce Center PN186220
Location:	Fontana, CA
Description:	Dark Brown Silty SAND

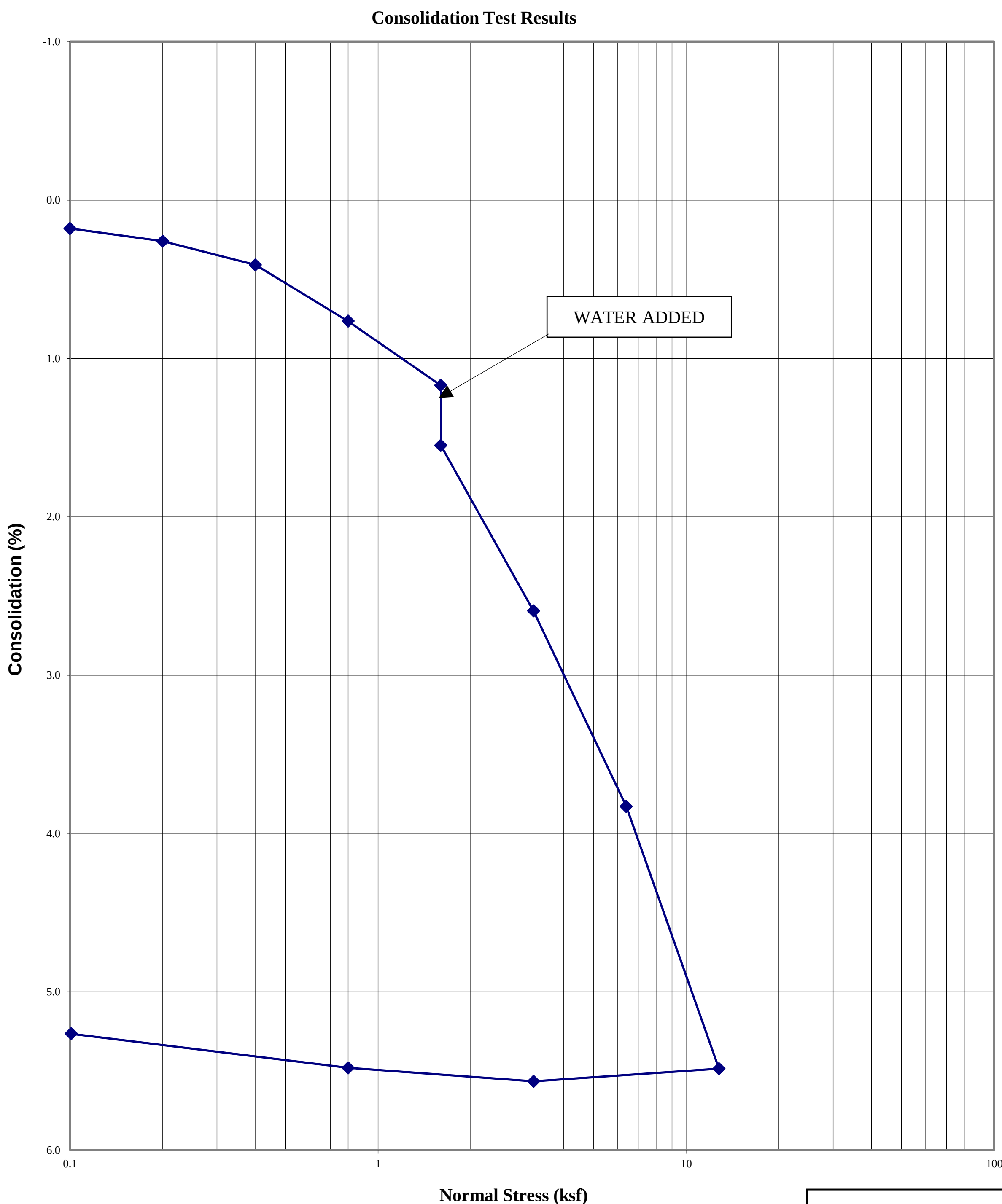


PLATE NO.: A

SMITH-EMERY LABORATORIES
791 E. Washington Boulevard, Los Angeles, CA 90021
Tel. No. (213) 745-5333; Fax no.: (213) 741-8621

SEL File No.: 45834-1
SEL Report No.: G-19-1476
Date: 1/17/19
BH No.: 6
Depth: 3-4'
Sample No.: 2
Moisture Content: 98.2
Saturation: 82.6
Voids Ratio 3.21
Dry Density: 40.0

ASTM D2435-11

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

Client: Southern California Geotechnical
Project : Proposed Kaiser Commerce Center PN186220
Location: Fontana, CA
Description: Reddish Brown SILT

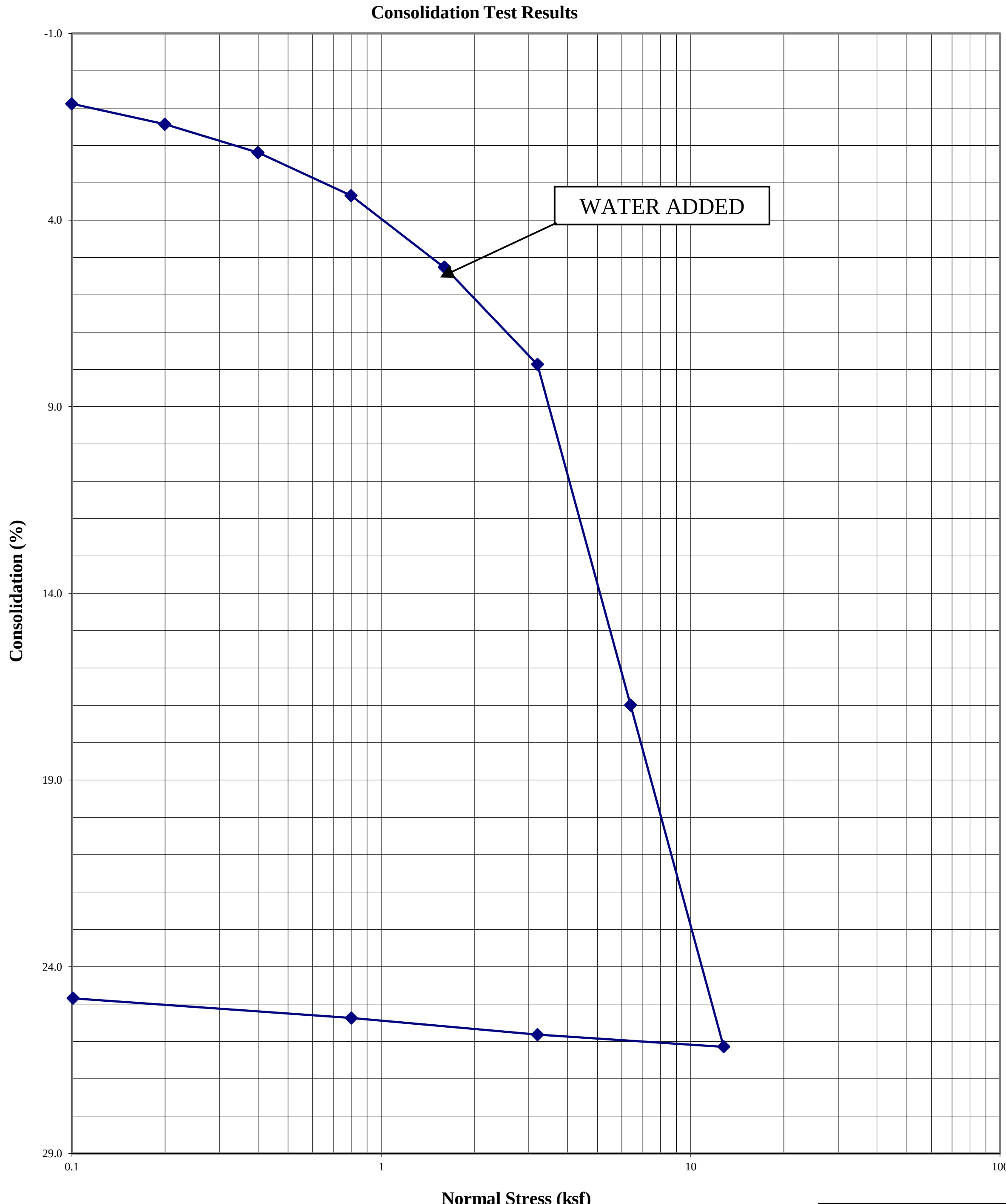


PLATE NO.: B

SMITH-EMERY LABORATORIES
791 E. Washington Boulevard, Los Angeles, CA 90021

ASTM D2435-11

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

SEL File No.:	45834-1
SEL Report No.:	G-19-1476
Date:	1/17/19
BH No.:	6
Depth:	7-8'
Sample No.:	4
Moisture Content:	4.1
Saturation:	19.2
Voids Ratio	0.56
Dry Density:	105.8

Client:	Southern California Geotechnical
Project :	Proposed Kaiser Commerce Center PN186220
Location:	Fontana, CA
Description:	Brown Poorly Graded SAND w/ Silt

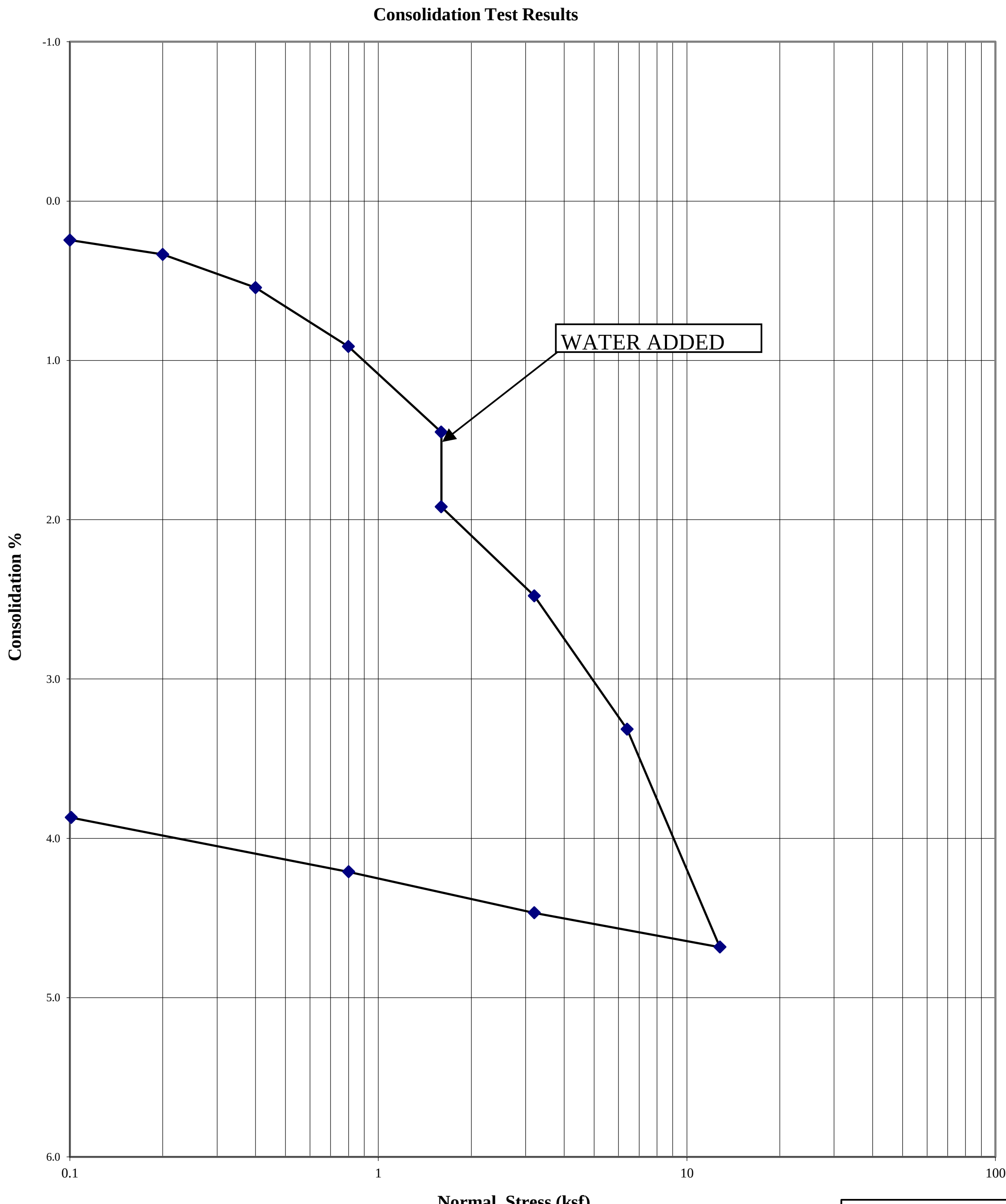
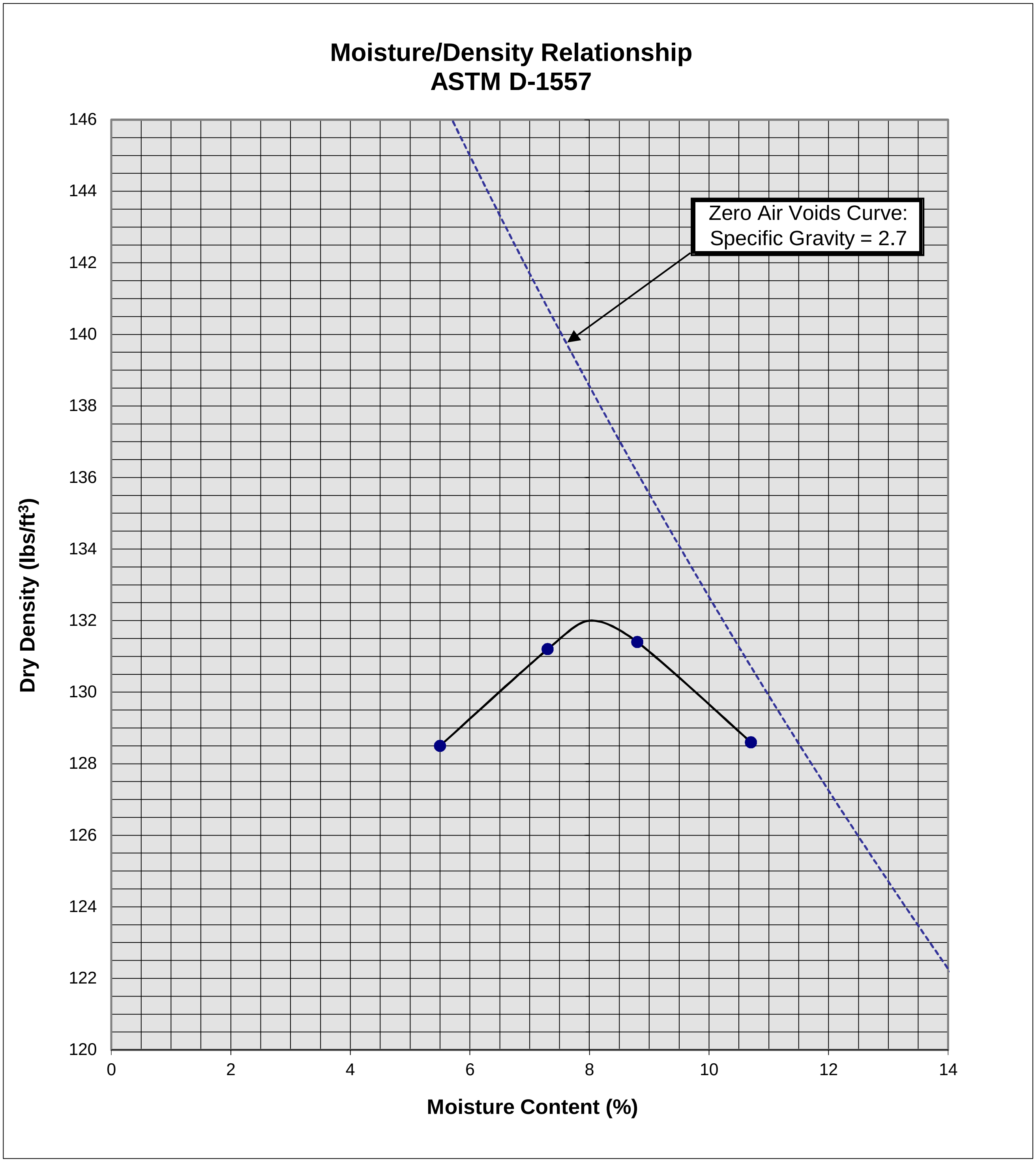


Plate No.: D



Soil ID Number	B-3 @ 0 to 5'
Optimum Moisture (%)	8
Maximum Dry Density (pcf)	132
Soil Classification	Brown Silty fine to coarse Sand, some fine to coarse Gravel, trace slag

Proposed Kaiser Commerce Center
Fontana, California
Project No. 18G220

PLATE C-9

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

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

General

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

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

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

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

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

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

Site Preparation

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

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

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

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

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

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

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

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

Compacted Fills

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

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

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

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

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

    - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

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

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

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

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

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

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

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

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

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

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

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

Foundations

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

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

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

Fill Slopes

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

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

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

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

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

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

Cut Slopes

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

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

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

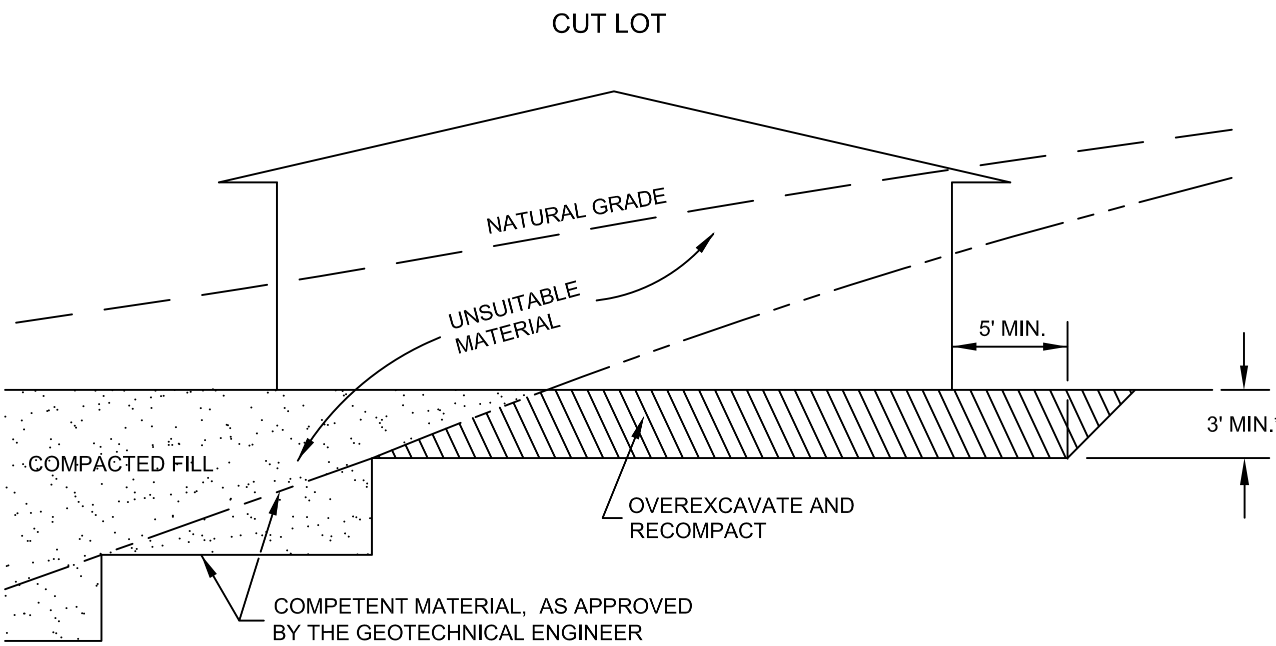
- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

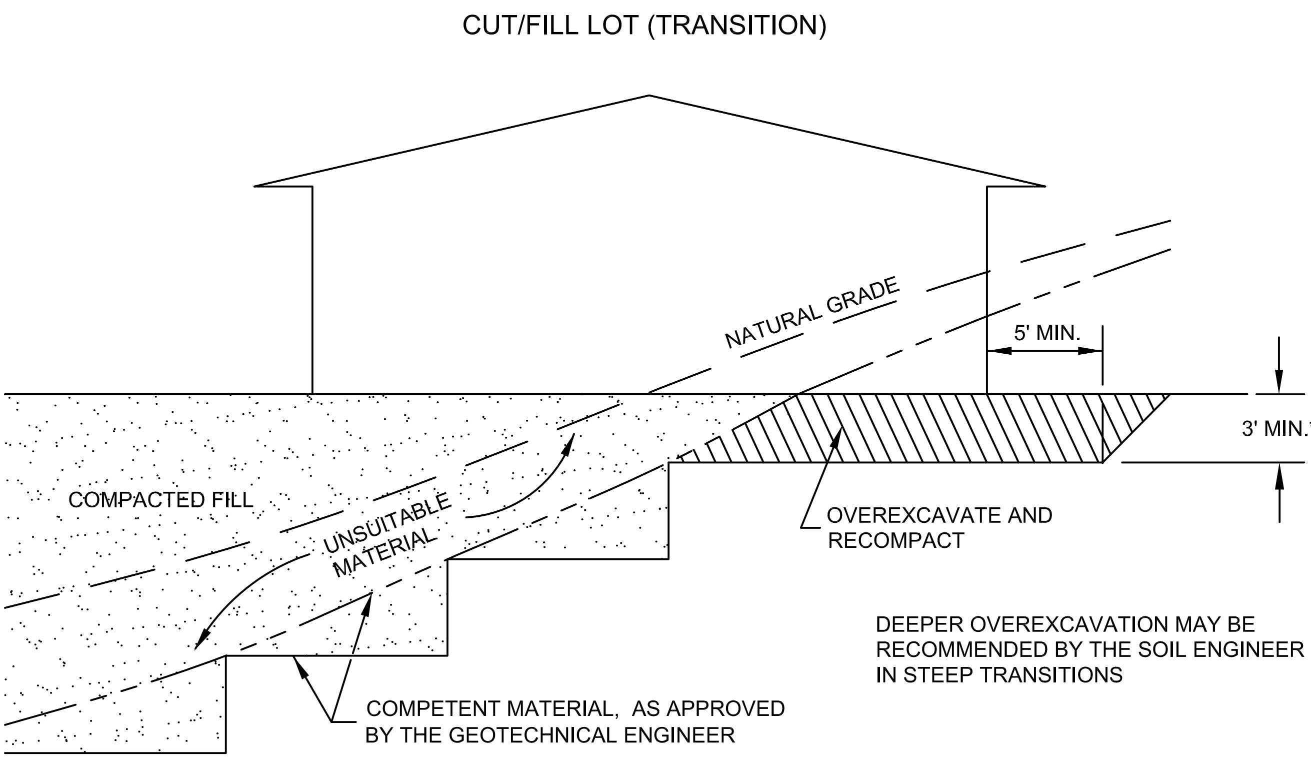
Subdrains

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

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

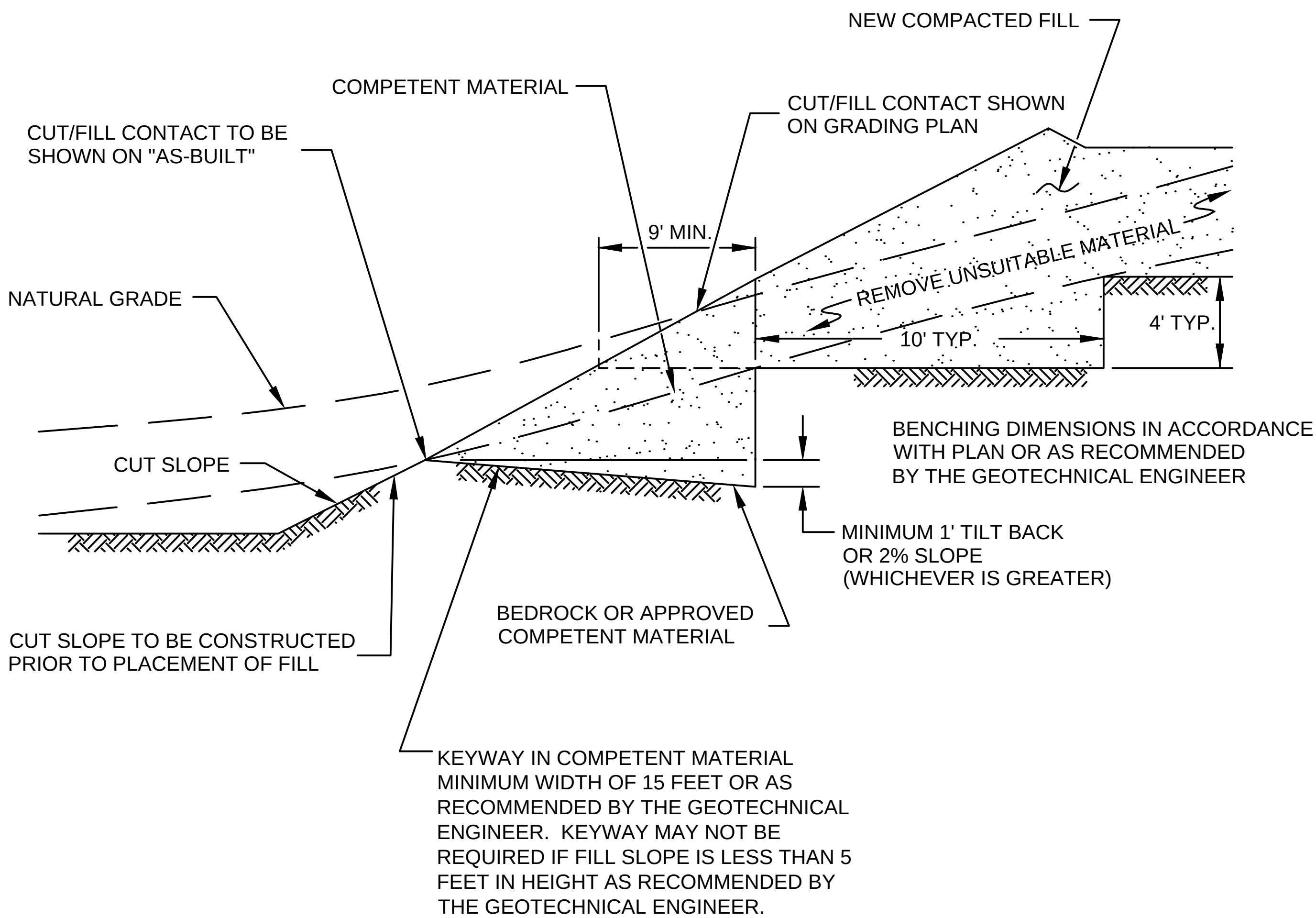
- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters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





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

TRANSITION LOT DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-1	



FILL ABOVE CUT SLOPE DETAIL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

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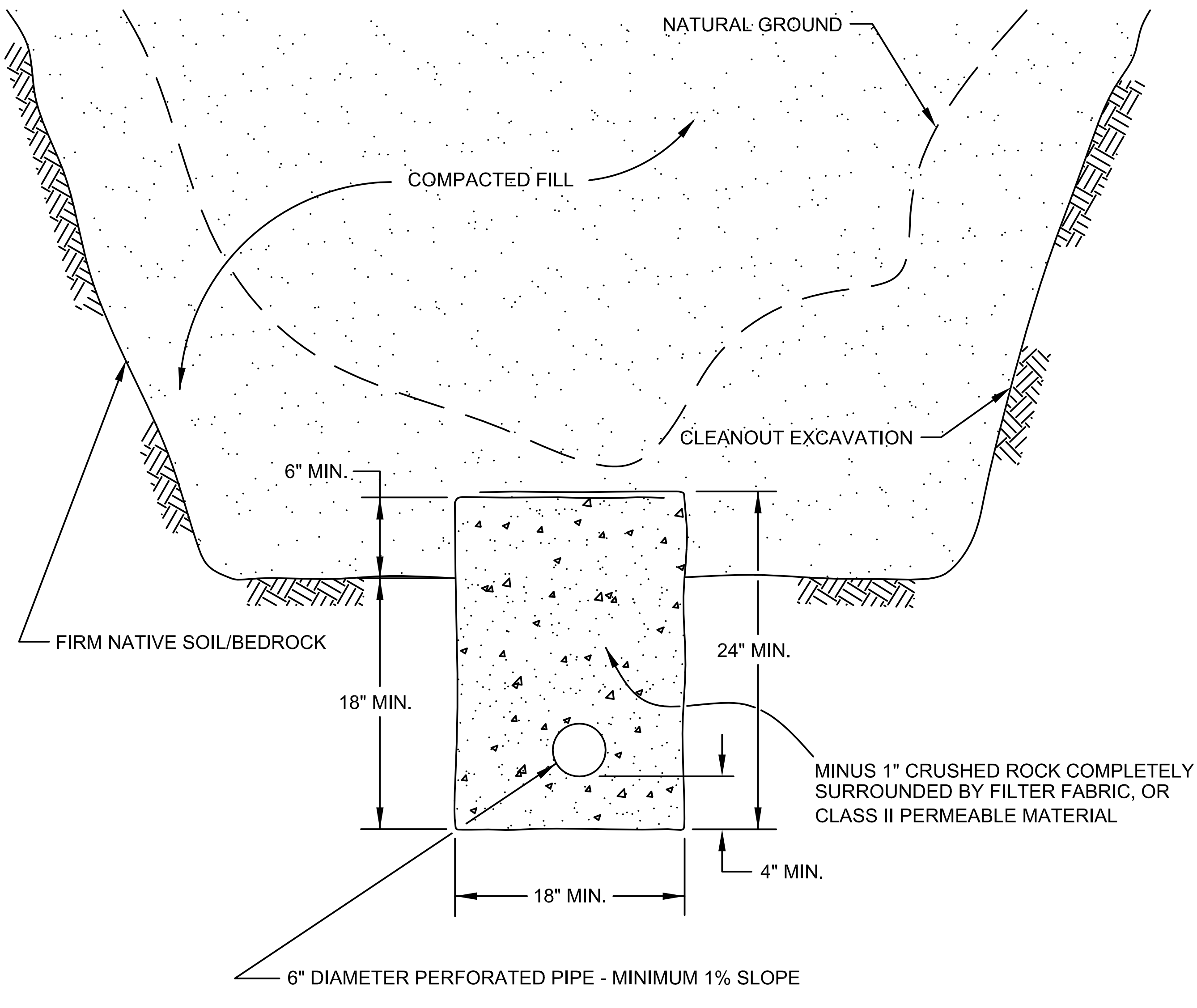

PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

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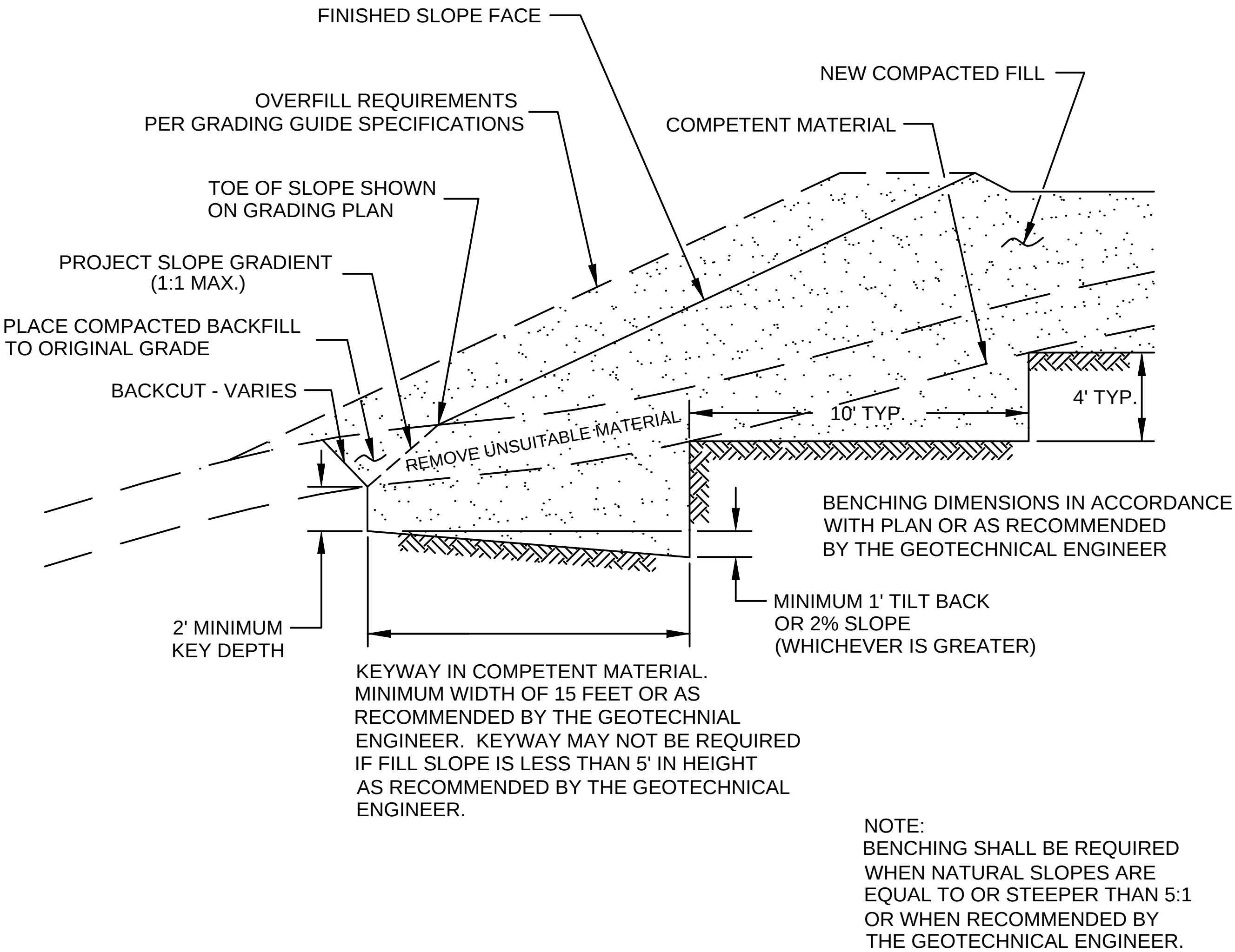

FILL ABOVE NATURAL SLOPE DETAIL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

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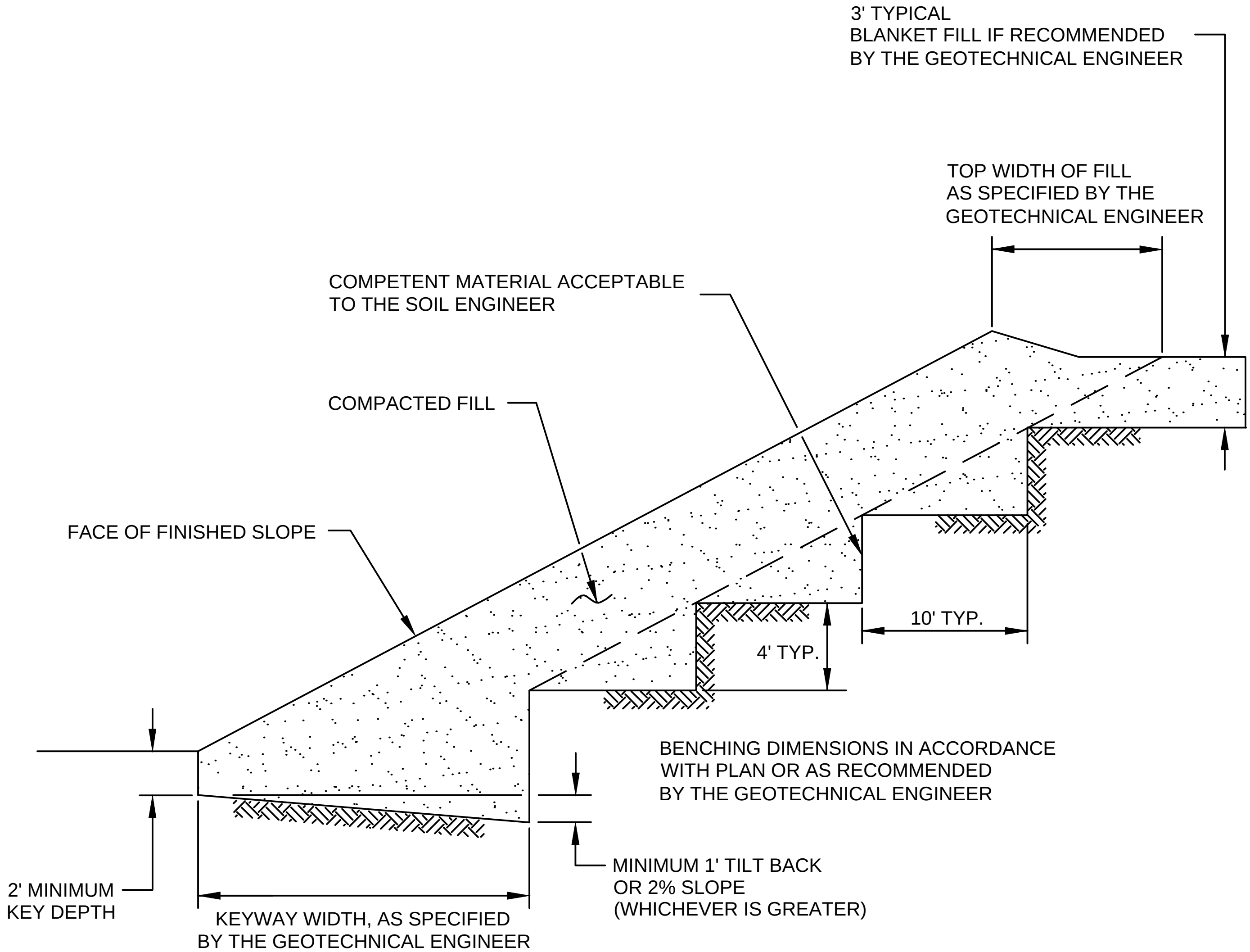
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

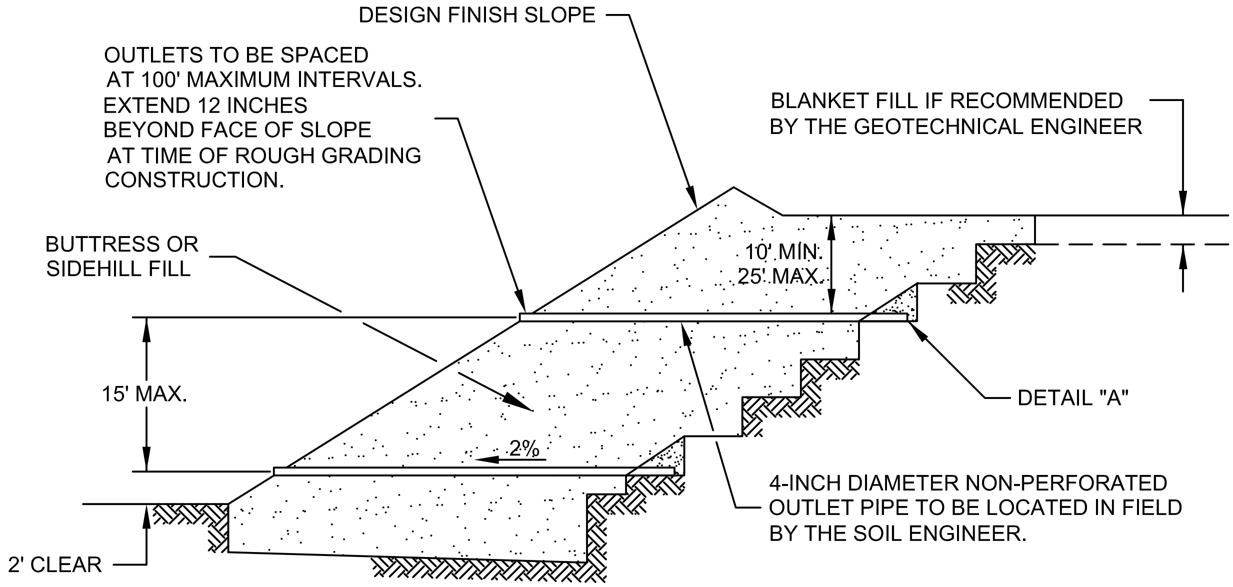
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



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

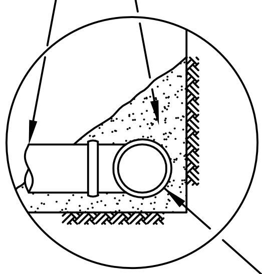
SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50

OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW



FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

DETAIL "A"

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

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

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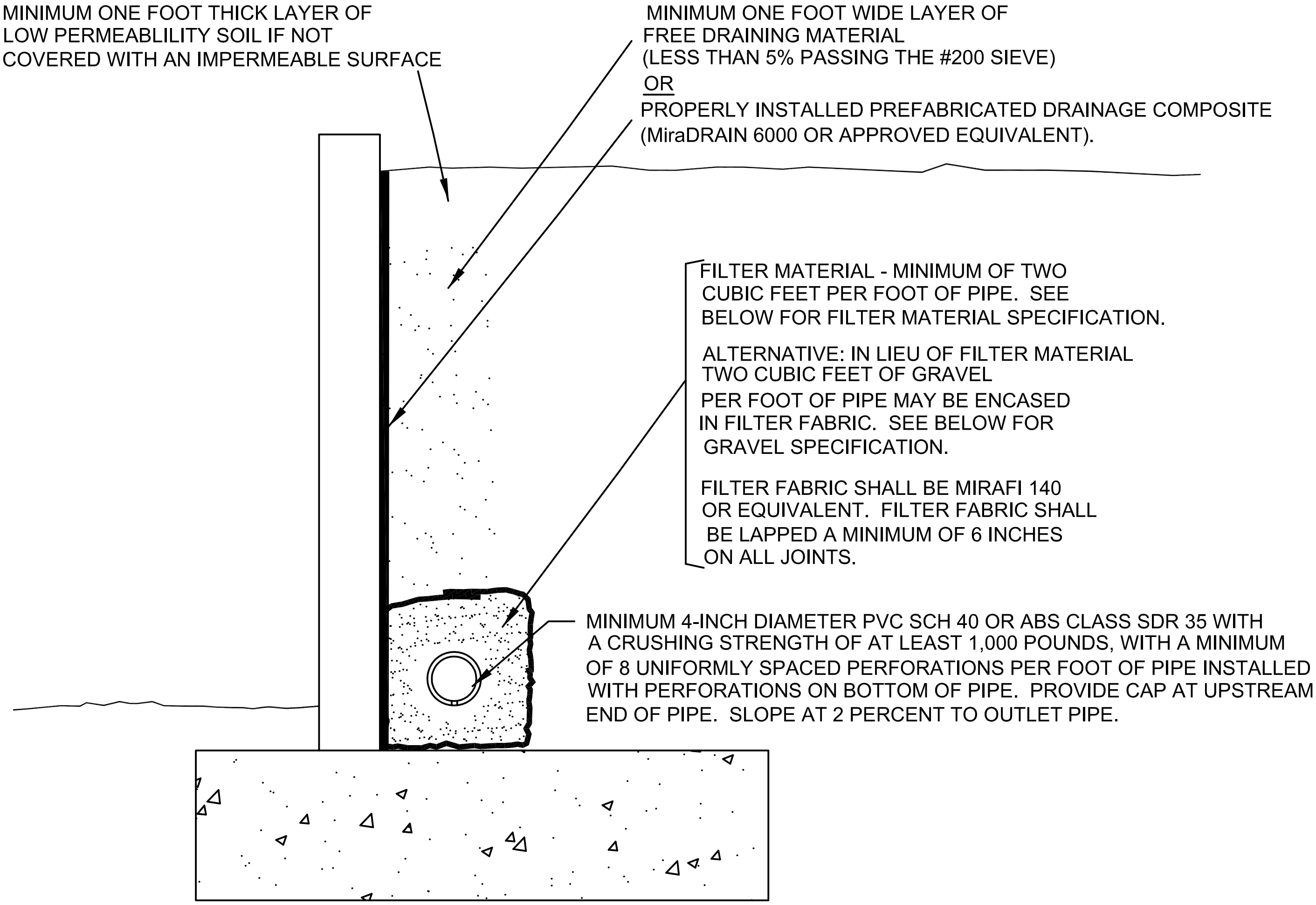
SOUTHERN CALIFORNIA GEOTECHNICAL



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

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

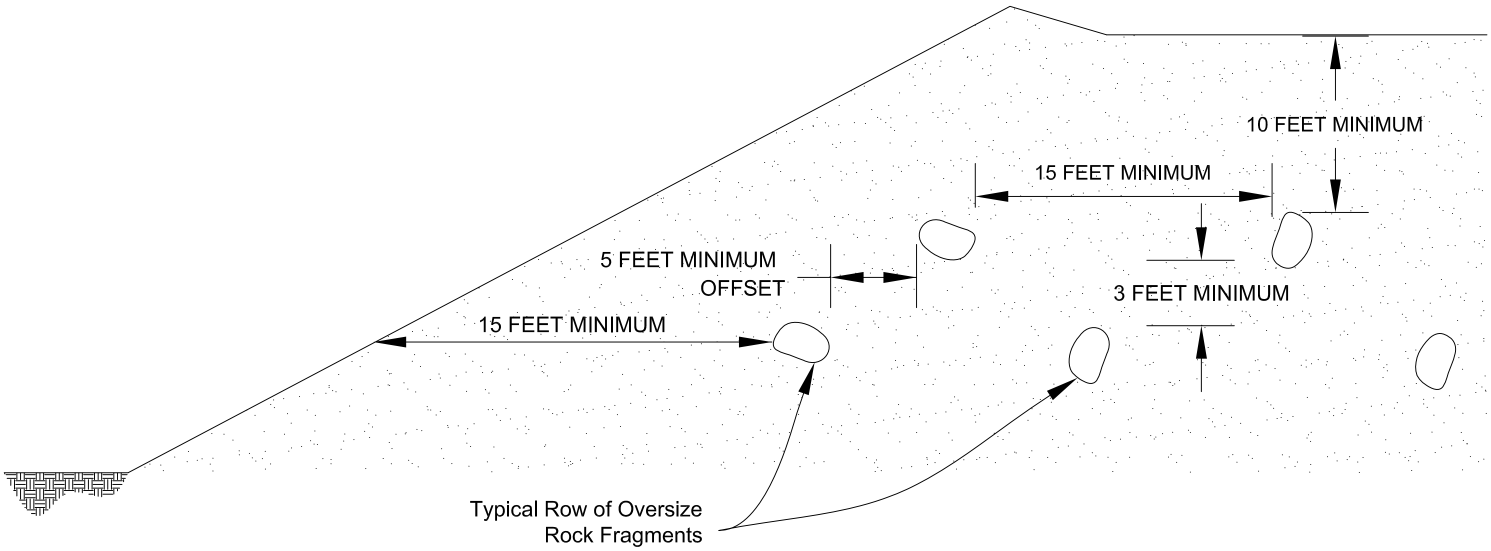
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

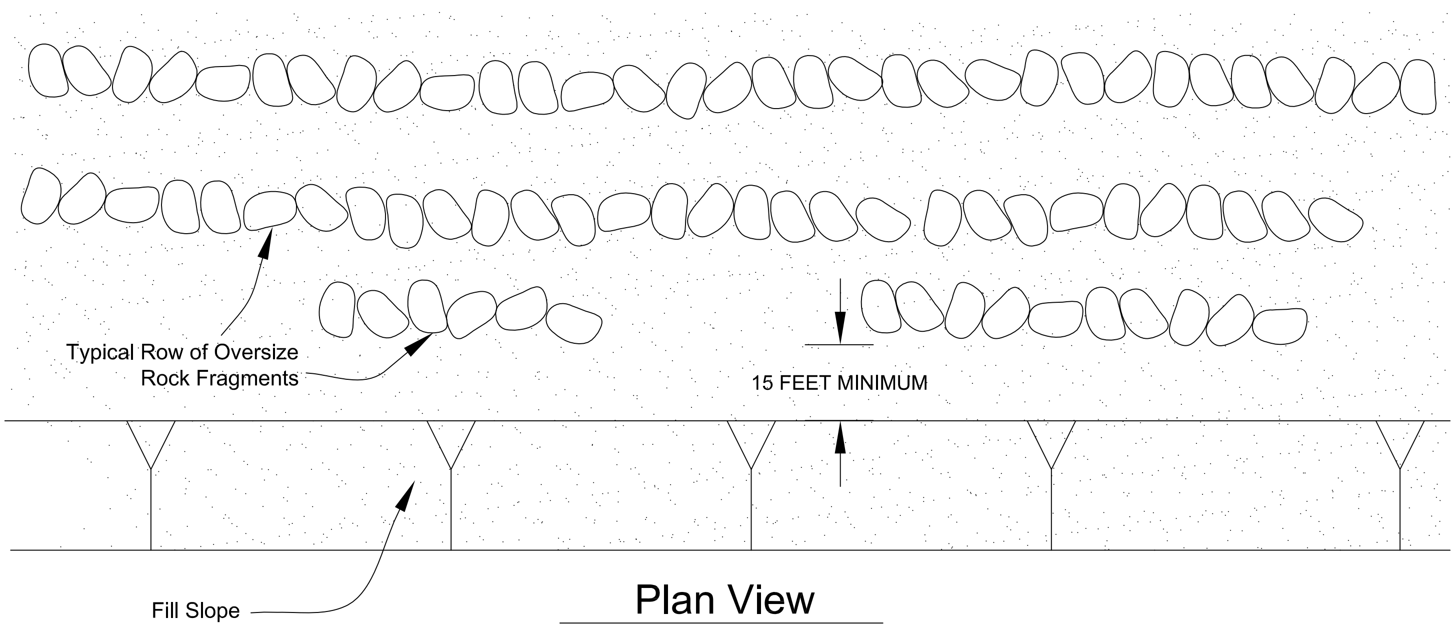
DRAWN: JAS
CHKD: GKM

PLATE D-7

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8

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SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

USGS Design Maps Summary Report

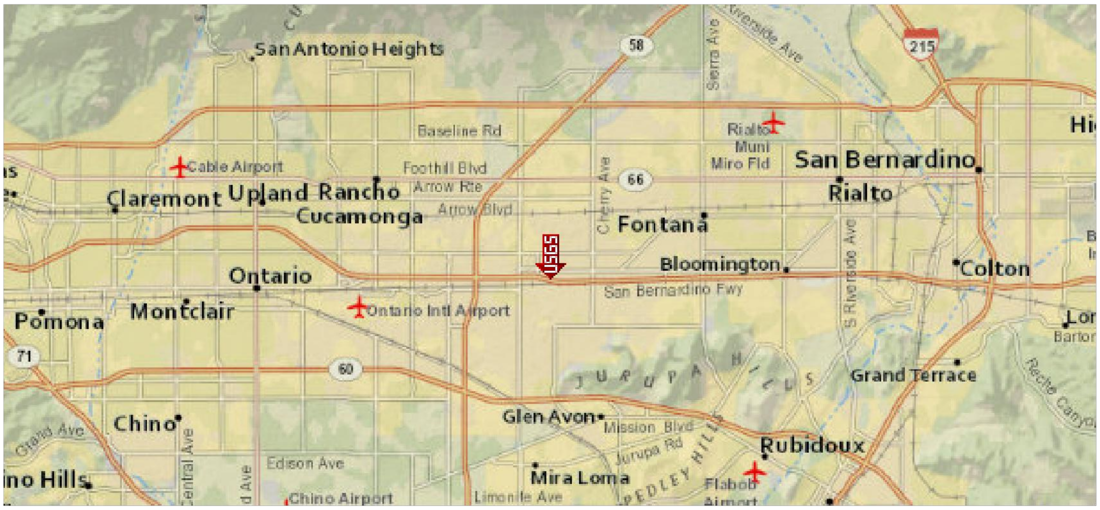
User–Specified Input

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 34.07649°N, 117.50941°W

Site Soil Classification Site Class D – "Stiff Soil"

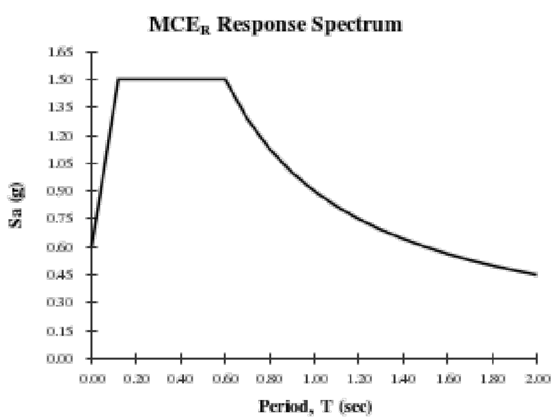
Risk Category I/II/III

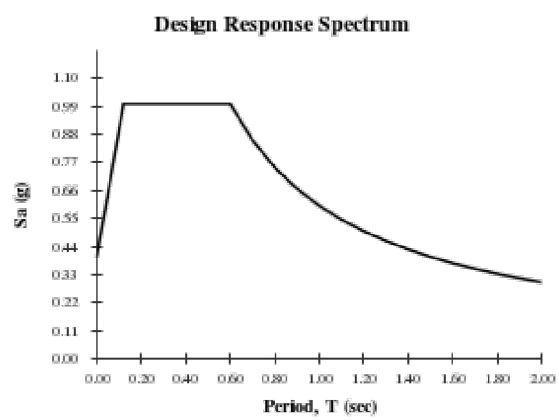


USGS–Provided Output

$S_S =$	1.500 g	$S_{MS} =$	1.500 g	$S_{DS} =$	1.000 g
$S_1 =$	0.600 g	$S_{M1} =$	0.900 g	$S_{D1} =$	0.600 g

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





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

SEISMIC DESIGN PARAMETERS

PROPOSED KAISER COMMERCE CENTER

FONTANA, CALIFORNIA

DRAWN: AL
CHKD: GKM

SCG PROJECT
18G220-1

PLATE E-1

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