# GEOTECHNICAL INVESTIGATION
# PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

100 - 200 West Sinclair Street
Perris, California
for
First Industrial Realty Trust, Inc.

SoCalGeo
SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

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A California Corporation

August 8, 2022

First Industrial Realty Trust, Inc.
898 North Pacific Coast Highway, Suite 175
El Segundo, California 90245

Attention: Mr. Felipe Coundouriotis
Senior Investment Analyst

Project No.: **22G122-4**

Subject: **Geotechnical Investigation**
Proposed Commercial/Industrial Building
100 – 200 West Sinclair Street
Perris, California

Dear Mr. Coundouriotis:

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

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

Respectfully Submitted,

**SOUTHERN CALIFORNIA GEOTECHNICAL, INC.**

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# 1.0 EXECUTIVE SUMMARY

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

**Geotechnical Design Considerations**

- Artificial fill soils were encountered at most of the boring locations, extending from the ground surface to depths of 2½ to 6± feet. The existing fill soils are considered to represent undocumented fill. These soils, in their present condition, are not considered suitable for support of the foundation or floor slab loads of the new structure.
- The artificial fill soils are underlain by native alluvial soils. The results of laboratory testing indicate that the near-surface soils within the upper 7± feet possess a potential for some consolidation when exposed to load increases in the range of those that will be exerted by the new foundations.
- Remedial grading is recommended to remove the undocumented artificial fill soils and a portion of the near-surface alluvial soils from the proposed building pad area in order to replace them as compacted structural fill.
- Based on conditions encountered at the boring locations and maps published by Riverside County, liquefaction is not a significant design concern for this project.

**Site Preparation**

- The site plan provided to our office indicates that the existing structures and pavements at the subject site will be demolished in order to facilitate the construction of the proposed development. Demolition should include removal of foundations, floor slabs, pavements, utilities and other subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should be disposed of off-site. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2-inch particle size, mixed with sandy on-site soils, and incorporated into new structural fills or it may be processed into crushed miscellaneous base (CMB).
- Initial site stripping should include vegetation and topsoil. Removal of numerous trees will be required. Tree removal should include complete removal of the root masses.
- Remedial grading is recommended to be performed within the proposed building area in order to remove the undocumented fill soils, which extend to depths of up to 6 feet at the boring locations. The soils within the proposed building area should also be overexcavated to a depth of 6 feet below existing grade and to a depth of at least 4 feet below proposed building pad subgrade elevations.
- The soils within the proposed foundation influence zones should be overexcavated to a depth of at least 3 feet below proposed foundation bearing grade.
- Following completion of the overexcavation, the exposed soils should be scarified to a depth of at least 12 inches and moisture conditioned to at least 2 to 4 percent above optimum moisture content. The overexcavation subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.

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

**Building Foundations**
- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft$^2$ maximum allowable soil bearing pressure.
- Reinforcement consisting of at least four (4) No. 5 rebars (2 top and 2 bottom) in strip footings, due to the presence of potentially expansive soils. Additional reinforcement may be necessary for structural considerations.

**Building Floor Slab**
- Conventional Slab-on-Grade: minimum 6 inches thick.
- Modulus of Subgrade Reaction: k = 120 psi/in.
- Reinforcement consisting of No. 3 rebars at 16 inches on center in both directions due to the presence of potentially expansive soils. The actual thickness and reinforcement of the floor slab should be provided by the structural engineer.

**Pavement Design Recommendations**

| ASPHALT PAVEMENTS (R=30) | | | | | |
|---|---|---|---|---|---|
| **Materials** | **Thickness (inches)** | | | | |
| | Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0) | Truck Traffic | | | |
| | | TI = 6.0 | TI = 7.0 | TI = 8.0 | TI = 9.0 |
| Asphalt Concrete | 3 | 3½ | 4 | 5 | 5½ |
| Aggregate Base | 6 | 8 | 10 | 11 | 13 |
| Compacted Subgrade | 12 | 12 | 12 | 12 | 12 |

| PORTLAND CEMENT CONCRETE PAVEMENTS (R=30) | | | | |
|---|---|---|---|---|
| **Materials** | **Thickness (inches)** | | | |
| | Autos and Light Truck Traffic (TI = 5.0 to 6.0) | Truck Traffic | | |
| | | TI = 7.0 | TI = 8.0 | TI = 9.0 |
| PCC | 5 | 5½ | 6½ | 8 |
| Compacted Subgrade (95% minimum compaction) | 12 | 12 | 12 | 12 |

## 2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 22P120-2, dated June 29, 2022. 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 site is located at 100 - 200 West Sinclair Street in Perris, California. The site is bounded to the north, south, and east by vacant parcels and to the west by Barrett Avenue. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of two irregularly-shaped parcels, 18.85± acres in size. The site is presently developed with two (2) warehouse buildings, 161,000 and 52,185± $ft^2$ in size, located in the north-central and south-central areas of the site, respectively. The buildings are surrounded by Portland cement concrete pavements in the loading dock areas and asphaltic concrete (AC) pavements in the parking areas. The asphaltic concrete pavements were in fair to poor condition with moderate cracking throughout. Ground surface cover also includes open-graded gravel in the northwestern area and exposed soil in the western area of the site. Concrete flatwork and landscape planters are present throughout the eastern parking area and along the property lines. The planters include medium to large trees and exposed soil.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations made at the time of the subsurface investigation, the site slopes downward to the north at a gradient of less than 2± percent.

## 3.2 Proposed Development

SCG was provided with a conceptual site plan prepared by HPA Architecture (Scheme 7A). Based on Scheme 7A, the site will be developed with one (1) new warehouse building, 436,410± $ft^2$ in size, located in the north-central area of the site. Dock-high doors will be constructed along most of the southern and northern building walls. The building will be surrounded by asphaltic concrete pavements in the parking and drive lanes, Portland cement concrete pavements in the loading dock areas, and limited areas of concrete flatwork and landscape planters throughout the site. The southern portion of the site will be developed into a parking lot.

Detailed structural information has not been provided. It is assumed the building will be of tilt-up concrete construction, typically supported on conventional shallow foundations with a concrete slab-on-grade floor. 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 crawl spaces or new basements, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of up to 5± feet are expected to be necessary to achieve the proposed site grades.

## 3.3 Previous Studies

SCG previously performed a geotechnical investigation at the subject site as presented in our geotechnical report dated March 4, 2022.

As part of the previous investigation, SCG performed a total of six (6) borings advanced to depths of 15 to 25± feet below the existing site grades. Artificial fill soils were encountered beneath the pavements/slab at several of the boring locations, extending to depths of 4½ to 6± feet. The fill soils generally consisted of loose to medium dense silty fine to medium sands and fine to medium sandy silts. Native alluvium was encountered beneath the fill soils at the boring locations. The alluvial soils generally consisted of loose to medium dense fine sandy silts, clayey fine sands, fine to coarse sands, silty fine to medium sands, and stiff to hard silty clays extending to at least the maximum depth explored of 25± feet. The boring logs and laboratory test results from the previous study have been incorporated into this report.

# 4.0 SUBSURFACE EXPLORATION

## 4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this updated investigation consisted of three (3) additional borings identified as Boring Nos. B-7 through B-9, advanced to depths of 20 to 25± feet below the existing site grades. This report therefore includes a total of nine (9) borings, identified as borings B-1 through B-9. The borings were logged during drilling by a member of our staff.

Previous borings were advanced with hollow-stem augers, by a limited access, track-mounted drilling rig. Recent 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 locations of the previous and recent borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

## 4.2 Geotechnical Conditions

Pavements

Asphaltic Concrete (AC) pavements were encountered at Boring Nos. B-4 through B-6, B-8 and B-9. The pavement section was measured to consist of 3 to 8±-inches of AC over 4 to 10±-inches of Aggregate Base (AB). Open graded gravel was encountered at the surface of Boring Nos. B-1 and B-2 that measured 1± inch thick. At Boring No. B-3, Portland cement concrete was encountered and measured to be 6± inches thick.

Artificial Fill

Artificial fill soils were encountered at the ground surface or beneath the pavements at Boring Nos. B-3 through B-9, extending to depths ranging from 2½ to 6± feet below existing site grades. The fill soils consist of medium dense fine to medium sandy silts, clayey fine sands, and fine to medium sandy silts. In addition, very stiff silty clays were encountered within the fill soils. A mottled and disturbed appearance was observed in the fill soils, resulting in their classification as artificial fill. Occasional trash debris were also observed in the fill soils.

Alluvium

Native alluvium was encountered at the surface or beneath the fill soils at each boring, extending to at least the maximum explored depth of 25± feet below existing site grades. The alluvium consists of medium dense to dense fine sandy silts, loose to medium dense silty fine to medium sands, and medium dense to dense clayey fine to medium sands. Trace to little Calcareous veining were observed in some of the alluvial soils. Occasional trace to little clay content was also observed in the alluvium.

Groundwater

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

Recent water level data was obtained from the California State Water Resources Control Board, GeoTracker, website, https://geotracker.waterboards.ca.gov/. One monitoring well on record is located 210± feet south of the site. Water level readings within this monitoring well indicate a high groundwater level of 79± feet below the ground surface in February 2015.

# 5.0 LABORATORY TESTING

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

Classification

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 evaluated for selected relatively undisturbed ring samples. These densities were evaluated 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 evaluated 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.

Expansion Index

The expansion potential of the on-site soils was evaluated in general accordance with ASTM D-4829 as required by the California Building Code. The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water, and allowed to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the EI testing are as follows:

| Sample Identification | Expansion Index | Expansive Potential |
|---|---|---|
| B-1 @ 0 to 5 feet | 36 | Low |
| B-2 @ 0 to 5 feet | 25 | Low |
| B-9 @ 0 to 5 feet | 13 | Very Low |

Consolidation

Selected soil samples have been tested to evaluate their consolidation and collapse 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 evaluate their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-8 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

Representative bulk samples have been tested for 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 Plates C-9 and C-10 in Appendix C of this report. These tests are generally used to with compare the dry 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 result of the soluble sulfate testing is not yet available. 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 | 0.017 | Not Applicable (S0) |
| B-5 @ 0 to 5 feet | 0.007 | Not Applicable (S0) |
| B-9 @ 0 to 5 feet | 0.007 | Not Applicable (S0) |

Corrosivity Testing

Representative bulk samples of the near-surface soils were submitted to a subcontracted corrosion engineering laboratory to identify potentially 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 | 600 | 7.3 | 311 | 145 |
| B-5 @ 0 to 5 feet | 3,760 | 8.3 | 9.9 | 6.3 |
| B-9 @ 0 to 5 feet | 201,000 | 8.4 | 61.2 | 26.0 |

# 6.0 CONCLUSIONS AND RECOMMENDATIONS

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

The recommendations are contingent upon 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 confirm 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 evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The potential for other geologic hazards such as seismically induced settlement, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The 2019 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2019 edition of the California Building Code (CBC), which was adopted on January 1, 2020.

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

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

**2019 CBC SEISMIC DESIGN PARAMETERS**

| Parameter | | Value |
|---|---|---|
| Mapped Spectral Acceleration at 0.2 sec Period | $S_S$ | 1.500 |
| Mapped Spectral Acceleration at 1.0 sec Period | $S_1$ | 0.572 |
| 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 | $S_{M1}$ | 0.988 |
| Design Spectral Acceleration at 0.2 sec Period | $S_{DS}$ | 1.000 |
| Design Spectral Acceleration at 1.0 sec Period | $S_{D1}$ | 0.659 |

It should be noted that the site coefficient $F_v$ and the parameters $S_{M1}$ and $S_{D1}$ were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the 2019 CBC. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2019 CBC using the value of $S_1$

obtained from the Seismic Design Maps Tool, assuming that a site-specific ground motion hazards analysis is not required for the proposed buildings at this site.

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 Riverside County GIS website indicates that the subject site is located within a zone of low liquefaction susceptibility. In addition, the subsurface conditions encountered at the boring locations are not considered to be conducive to liquefaction. These conditions consist of moderate to high strength native alluvial soils and no evidence of a long-term groundwater table within 25 feet of the ground surface. In addition, research of available well data indicates that the groundwater depths in the area of the site are more than 70 feet below grade. Based on these considerations, liquefaction is not considered to be a design concern for this project.

## 6.2 Geotechnical Design Considerations

General

Most of the borings encountered artificial fill materials, extending to depths of 2½ to 6± feet. Based their strength characteristics and a lack of documentation regarding the placement and compaction of the existing fill materials, these soils are considered to consist of undocumented fill, likely placed during previous development or grading of the site. Therefore, these materials are not suitable for the support of the foundation and floor slab loads of the proposed building. In addition, significant disturbance of the upper 3 to 4 feet of soil is expected to occur during demolition of the existing structure and other improvements. Based on these conditions, remedial grading is considered warranted within the proposed building area to completely remove the existing artificial fill soils and the upper portion of the near-surface native alluvium and replace these soils as compacted structural fill.

Settlement

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

Expansion

Laboratory testing performed on representative samples of the near-surface soils indicates that these materials possess a very low to low expansion potential (EI = 13 to 36). Based on the presence of potentially expansive soils at this site, care should be given to proper moisture conditioning the building pad subgrade soils to a moisture content of 2 to 4 percent above the ASTM D-1557 optimum during site grading. It is recommended that additional expansion index testing be conducted at the completion of rough grading to confirm the expansion potential of the as-graded building pad.

Soluble Sulfates

The results of the soluble sulfate testing indicate that the tested soil samples possess levels of soluble sulfates that are considered to be “not applicable” (S0) with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to confirm 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 on-site soils possess saturated resistivities in the range of 600 to 201,000 ohm-cm, and pH values of 7.3 to 8.4. 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. Resistivity and pH are two of the five factors that enter into the evaluation procedure. Redox potential, relative soil moisture content and sulfides are also included. Although sulfide testing was not part of the scope of services for this project, 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 severely corrosive to ductile iron pipe. Therefore, polyethylene encasement or some other appropriate method of protection will be required for buried iron pipes.**

Low to moderate concentrations (9.9 to 311 mg/kg) of chlorides were detected in the samples submitted for corrosivity testing. In general, soils possessing chloride concentrations in excess of 500 parts per million (ppm) are considered to be corrosive with respect to steel reinforcement within reinforced concrete. Based on these test results, 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.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested sample possess nitrate concentrations of 6.3 to 145 mg/kg. **Based on these test**

**result, some of the on-site soils are considered to be corrosive to copper pipe, and some type of protection will be required.**

Since SCG does not practice in the area of corrosion engineering, we recommend that the client contact a corrosion engineer to provide a more thorough evaluation.

Shrinkage/Subsidence

Based on the results of the laboratory testing, removal and recompaction of the near-surface native alluvium will result in an estimated average shrinkage of 4 to 12 percent. It should be noted that the potential shrinkage estimate is based on dry density testing performed on small-diameter samples taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated trenches where in-place densities are evaluated 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

It is recommended that we be provided with copies of the finalized grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

## 6.3 Site Grading Recommendations

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

Site Stripping and Demolition

Demolition of the existing structure and pavements should include foundations, floor slabs, pavements, septic systems, utilities and other subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should be disposed of off-site. Alternatively, concrete and asphalt debris may be pulverized to a maximum 2-inch particle size, well-mixed with the sandy on-site soils, and incorporated into new structural fills or it may be processed to create crushed miscellaneous base (CMB).

Initial site preparation should also include stripping of surficial vegetation and organic soils. Based on conditions encountered at the time of the subsurface exploration, removal of numerous medium to large trees will be necessary within landscaped areas along the property lines and within landscaped planters. These landscaped areas also include some shrubs, grass and other vegetation. Vegetation, organic topsoil, and tree root masses should be removed during site stripping. These materials should be disposed of off-site. The actual extent of site stripping should be evaluated in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered. Soils disturbed during demolition should be removed and replaced with compacted fill soils.

<u>Treatment of Existing Soils: Building Pad</u>

Remedial grading should be performed within the proposed building pad area in order to remove the existing undocumented fill soils, and a portion of the existing alluvium. The undocumented fill soils extend to depths of 2½ to 6± feet at most of the boring locations within the building area. The soils within the proposed building pad area should also be overexcavated to a depth of 6 feet below existing grade and to a depth of at least 4 feet below proposed building pad subgrade elevation. The proposed foundation influence zones within the industrial building should be overexcavated to a depth of at least 3 feet below proposed foundation bearing grade.

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

Following completion of the overexcavation, the subgrade soils within the overexcavation areas should be evaluated by the geotechnical engineer to confirm 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 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. Deeper undocumented fill soils may also exist at locations not explored by our borings.

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 at 2 to 4 percent above optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.

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

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 3 feet below foundation bearing grade and replaced as compacted structural fill. Existing fill soils in these areas should be removed. Subgrades for erection pads for concrete tilt-up walls are considered to be a part of the foundation system and should also be overexcavated. Additional overexcavation may be required if porous or collapsible alluvium is encountered, as discussed above. 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.

If the full lateral extent of overexcavation is not achievable for the proposed walls, the foundations should be redesigned using a lower bearing pressure. The geotechnical engineer of record should be contacted for recommendations pertaining to this type of condition.

Treatment of Existing Soils: Parking and Drive Areas

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

Subgrade preparation in the new parking and drive areas should initially consist of removal of soils disturbed during stripping. The geotechnical engineer should then evaluate the subgrade to identify areas of additional unsuitable soils. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 2 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength alluvial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

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

Treatment of Existing Soils: Flatwork Areas

Subgrade preparation in the new flatwork areas should initially consist of removal of soils disturbed during stripping and possible demolition operations. The geotechnical engineer should then evaluate the subgrade to identify areas of additional unsuitable soils. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned or air dried to 2 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 subject site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

As noted previously, the subject site is underlain by low expansive soils. Support of new flatwork on low expansive soils carries minor additional risk with respect to flatwork movement and potential distress. This report provides recommendations for moisture conditioning and additional steel reinforcement in the flatwork areas in order to minimize the potential effects of the expansive soils. However, if additional protection is desired, the client should consider the placement of a 1 to 2-foot thick layer of non-expansive soil beneath flatwork.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 2 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of debris to the satisfaction of the geotechnical engineer.
- Grading and fill placement activities should be completed in accordance with the requirements of the 2019 CBC and the grading code of the city of Perris and/or the county of Riverside.
- Fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

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, utility trench backfill soils 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). Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Perris and/or the county of Riverside. Utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

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

## 6.4 Construction Considerations

Excavation Considerations

The near-surface soils generally consist of silty sands and clayey sands, with some zones of sandy clays and sandy silts. Some of these materials will likely be subject to minor 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. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. Excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Moisture Sensitive Subgrade Soils

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

Unstable subgrade soils may be encountered at the base of the overexcavations within the proposed building area. The extent of unstable subgrade soils will, to a large degree depend on methods used by the contractor to avoid adding additional moisture to these soils or disturbing soils which already possess high moisture contents. If grading occurs during a period of relatively wet weather, an increase in subgrade instability should also be expected.

If the construction schedule dictates that site grading will occur during a period of wet weather, allowances should be made for costs and delays associated with drying the on-site soils or import of a drier, less moisture sensitive fill material. Grading during wet or cool weather may also increase the depth of overexcavation in the pad area.

Groundwater

The static groundwater table is considered to exist at a depth greater than 25± feet below existing grade. 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 newly placed structural fill soils extending to depths of at least 3 feet below foundation bearing grade. Based on this subsurface profile, the proposed structure may be supported on 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: Four (4) No. 5 rebars (2 top and 2 bottom), due to the presence of potentially expansive soils.

- 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 exterior doorways. Flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on standard geotechnical practice. Additional rigidity 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 at least 90 percent of the ASTM D-1557 maximum dry density. 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 2 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, under static conditions. Differential movements are expected to occur over a 50-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

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

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

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

## 6.6 Floor Slab Design and Construction

Subgrades which will support the 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 proposed structure may be constructed as a conventional slab-on-grade, supported on newly placed structural fill, extending to a depth of at least 4 feet below finished pad grade. Based on geotechnical considerations, the floor slab may be designed as follows:

- Minimum slab thickness: 6 inches.
- Modulus of Subgrade Reaction: 120 psi/in.
- Minimum slab reinforcement: Reinforcement consisting of No. 3 rebars at 16 inches on center in both directions due to the presence of potentially expansive soils. 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 then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where such moisture sensitive floor coverings are expected. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated and moisture transmission through the slab is acceptable, the vapor barrier may be eliminated.
- Moisture condition the floor slab subgrade soils to 2 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 confirm adequate thickness and reinforcement.

## 6.7 Exterior Flatwork Design and Construction

Subgrades which will support new exterior slabs-on-grade for sidewalks, patios, and other concrete flatwork, should be prepared in accordance with the recommendations contained in the ***Grading Recommendations*** section of this report. Based on geotechnical considerations, exterior slabs on grade may be designed as follows:

- Minimum slab thickness: 4½ inches.
- Minimum slab reinforcement: No. 3 bars at 18 inches on center, in both directions.
- The flatwork at building entry areas should be structurally connected to the perimeter foundation that is recommended to span across the door opening. This recommendation is designed to reduce the potential for differential movement at this joint.
- Moisture condition the flatwork subgrade soils to at least 2 to 4 percent of optimum moisture content, to a depth of at least 12 inches. Adequate moisture conditioning should be verified by the geotechnical engineer 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.
- Control joints should be provided at a maximum spacing of 8 feet on center in two directions for slabs and at 6 feet on center for sidewalks. Control joints are intended to direct cracking. Minor cracking of exterior concrete slabs on grade should be expected.

Expansion or felt joints should be used at the interface of exterior slabs on grade and fixed structures to permit relative movement.

## 6.8 Retaining Wall Design and Construction

Although not indicated on the site plan, some small (less than 6 feet in height) retaining walls may be required in truck court area and 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, sandy silts, and clayey sands. Some zones of sandy clays were also encountered near the ground surface. **The sandy clays and silty clays are not recommended to be used as retaining wall backfill.** Based on their classifications, the on-site silty sands, sandy silts and clayey sands are expected to possess a friction angle of at least 30 degrees when compacted to 90 percent of the ASTM-1557 maximum dry density.

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

RETAINING WALL DESIGN PARAMETERS

| **Design Parameter** | | **Soil Type**<br>On-Site Silty Sands, Sandy Silts, Clayey Sands |
|---|---|---|
| Internal Friction Angle ($\phi$) | | 30° |
| Unit Weight | | 135 lbs/ft$^3$ |
| Equivalent Fluid Pressure: | Active Condition (level backfill) | 45 lbs/ft$^3$ |
| | Active Condition (2h:1v backfill) | 73 lbs/ft$^3$ |
| | At-Rest Condition (level backfill) | 68 lbs/ft$^3$ |

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

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

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

Seismic Lateral Earth Pressures

In accordance with the 2019 CBC, retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

Retaining Wall Foundation Design

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

Backfill Material

On-site sandy soils may be used to backfill the retaining walls. However, backfill material placed within 3 feet of the back-wall face should have a particle size no greater than 3 inches. **The on-site sandy clays and silty clays are not recommended to be used as retaining wall backfill.** 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.

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

Subsurface Drainage

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

- A weep hole drainage system typically consisting of a series of 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, 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. The actual design of this type of system should be evaluated by the civil engineer to confirm that the drainage system possesses the adequate capacity and slope for its intended use.

Weep holes or a footing drain will not be required for building stem walls.

## 6.9 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, sandy silts, clayey sands, and sandy clays. These soils are generally considered to possess fair pavement support characteristics with estimated R-values ranging from 30 to 40. The subsequent pavement design is therefore based upon an assumed R-value of 30. 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 confirm that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer evaluate 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 |
| 9.0 | 93 |

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. The above traffic indices allow for 1,000 automobiles per day.

| ASPHALT PAVEMENTS (R=30) | | | | | |
|---|---|---|---|---|---|
| **Materials** | **Thickness (inches)** | | | | |
| | Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0) | Truck Traffic | | | |
| | | TI = 6.0 | TI = 7.0 | TI = 8.0 | TI = 9.0 |
| Asphalt Concrete | 3 | 3½ | 4 | 5 | 5½ |
| Aggregate Base | 6 | 8 | 10 | 11 | 13 |
| 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 evaluated by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

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

| PORTLAND CEMENT CONCRETE PAVEMENTS (R=30) | | | | |
|---|---|---|---|---|
| **Materials** | **Thickness (inches)** | | | |
| | Autos and Light Truck Traffic (TI = 5.0 to 6.0) | Truck Traffic | | |
| | | TI = 7.0 | TI = 8.0 | TI = 9.0 |
| PCC | 5 | 5½ | 6½ | 8 |
| Compacted Subgrade (95% minimum compaction) | 12 | 12 | 12 | 12 |

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

# 7.0 GENERAL COMMENTS

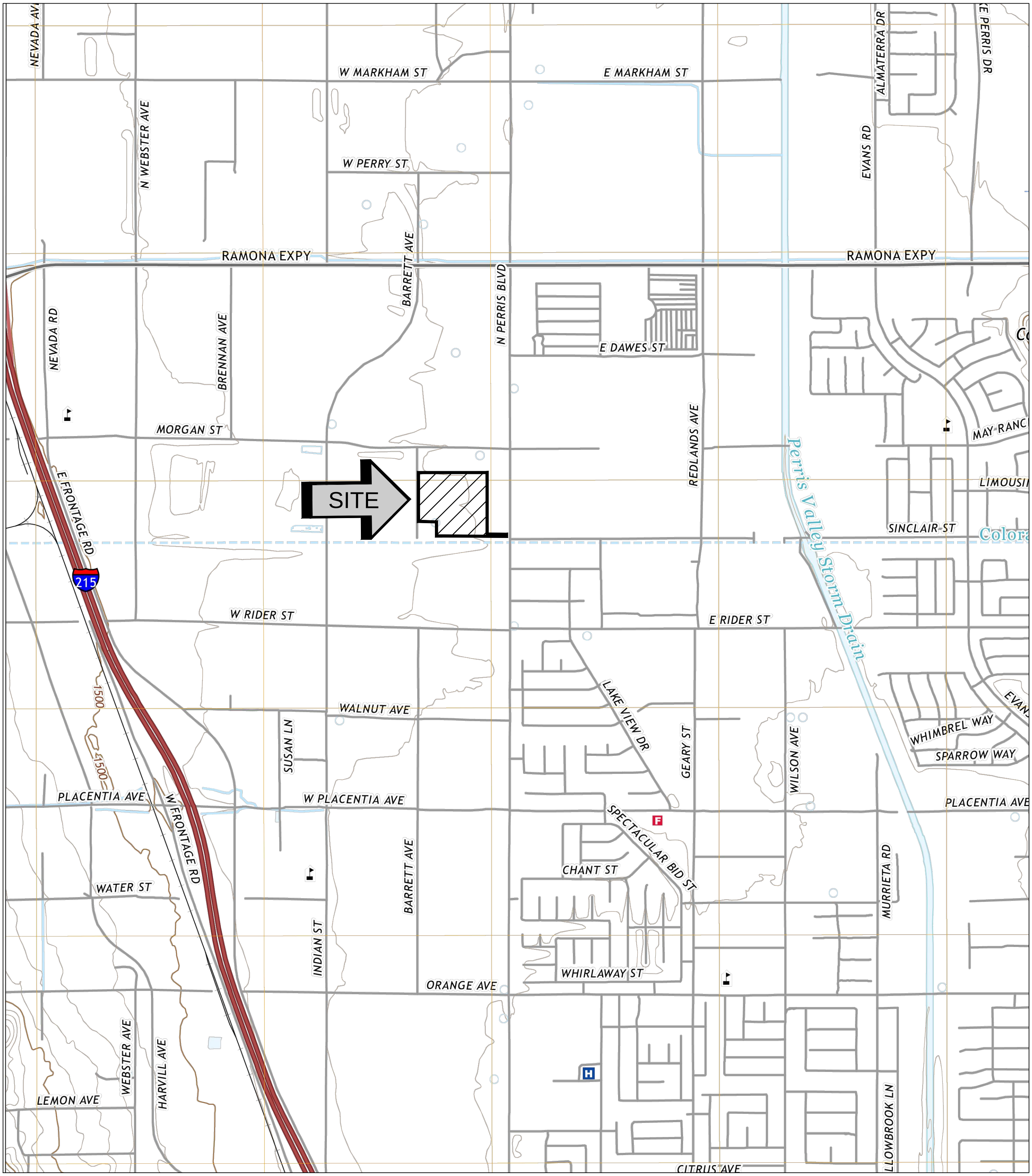
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other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

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to evaluate 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 confirm 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 confirm 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: USGS TOPOGRAPHIC MAP OF THE PERRIS QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA, 2021.

**SITE LOCATION MAP**

PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

PERRIS, CALIFORNIA

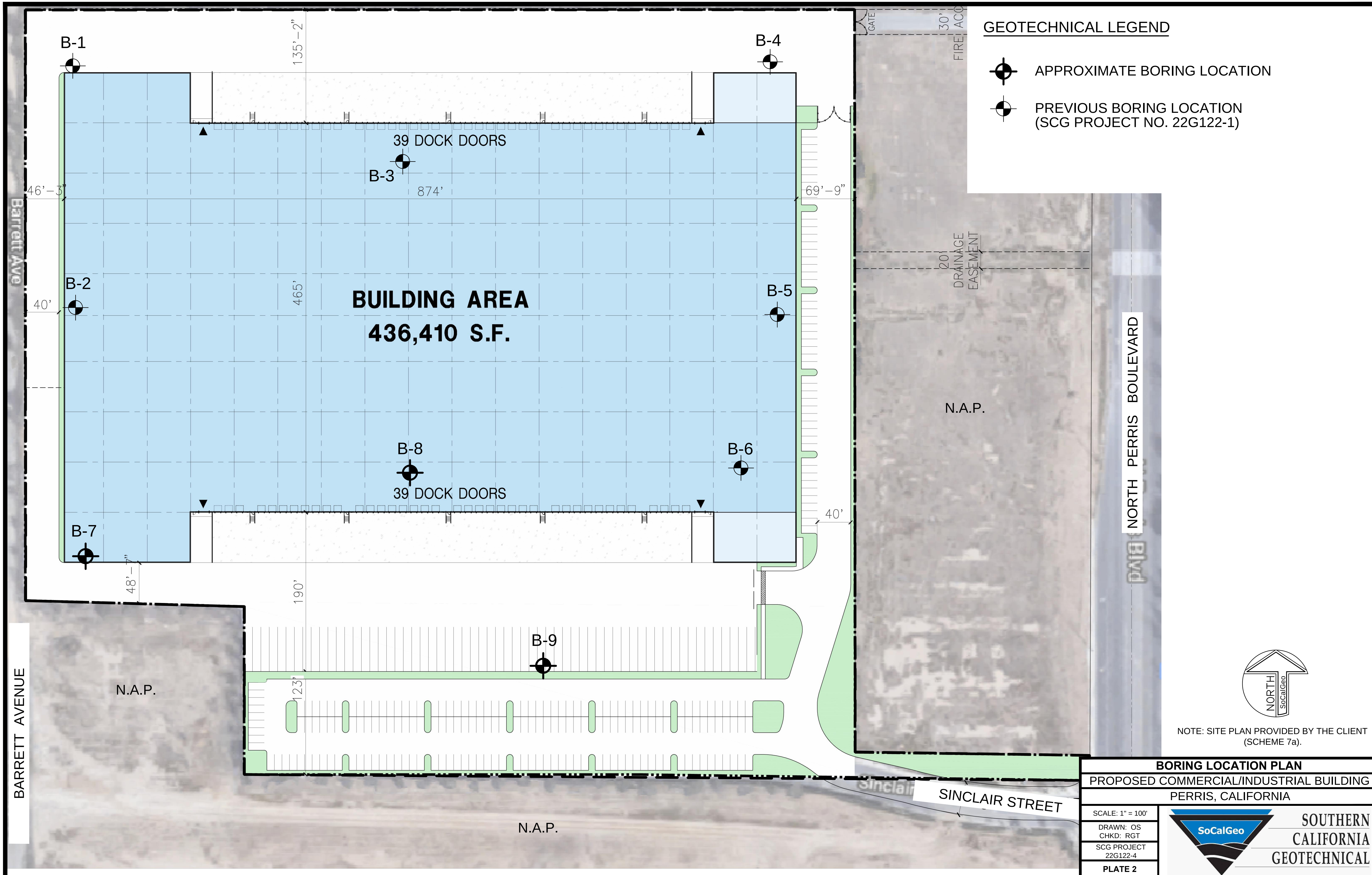
SCALE: 1" = 2000'

DRAWN: OS
CHKD: RGT

SCG PROJECT
22G122-4

**PLATE 1**

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL




**BORING LOCATION PLAN**

PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

PERRIS, CALIFORNIA

SCALE: 1" = 100'

DRAWN: OS

CHKD: RGT

SCG PROJECT 22G122-4

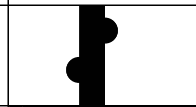
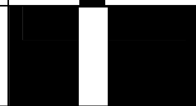
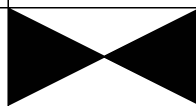
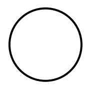
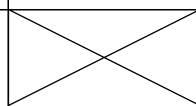
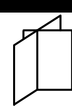
**PLATE 2**

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

# BORING NO. B-1

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 2/4/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 5 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1± inch open graded gravel | | | | | | | |
| | X | 28 | | | ALLUVIUM: Brown fine Sandy Clay to Clayey fine Sand, some Silt, trace medium to coarse Sand, slightly cemented, very stiff/medium dense-damp to moist | 113 | 6 | | | | | EI = 36 @ 0 to 5 feet |
| | X | 32 | 4.5 | | | 114 | 7 | | | | | |
| 5 | X | 21 | 4.5 | | | 108 | 7 | | | | | |
| | X | 34 | | | Brown Silty fine Sand to fine Sandy Silt, trace medium Sand, medium dense-damp to moist | 120 | 8 | | | | | |
| | X | 26 | | | Brown fine to coarse Sand, medium dense-damp | 113 | 2 | | | | | |
| 10 | | | | | Brown Silty fine to medium Sand, trace Clay, slightly cemented, medium dense-dry to damp | | | | | | | |
| | | | | | Brown fine Sandy Silt, trace medium Sand, medium dense-moist | | | | | | | |
| | X | 22 | | | | | 10 | | | | | |
| 15 | | | | | | | | | | | | |
| | | | | | Brown Clayey fine Sand, little Silt, trace Calcareous nodules, very dense-moist | | | | | | | |
| | X | 86 | | | | | 10 | | | | | |
| 20 | | | | | | | | | | | | |
| | | | | | Boring Terminated at 20' | | | | | | | |

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

# BORING NO. B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
*A California Corporation*

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 2/4/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 8 feet
READING TAKEN: At Completion

| FIELD RESULTS | | | | | DESCRIPTION | LABORATORY RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
| | | | | | 1± inch open graded gravel | | | | | | | |
| | X | 14 | 3.0 | | ALLUVIUM: Gray Brown Silty Clay, little fine Sand, little Calcareous nodules/veining, slightly cemented, stiff-moist to very moist | | 21 | | | | | EI = 25 @ 0 to 5 feet |
| | X | 11 | | | Gray Brown fine Sandy Silt, little Clay, slightly cemented, medium dense-very moist | | 11 | | | | | |
| 5 | | | | | | | | | | | | |
| | X | 18 | | | Brown Silty fine to medium Sand, little Clay, medium dense-damp | | 8 | | | | | |
| | X | 15 | | | Brown fine Sandy Silt, medium dense-damp | | 7 | | | | | |
| 10 | | | | | | | | | | | | |
| | | | | | Brown Clayey fine Sand, some Silt, medium dense-moist | | | | | | | |
| | X | 18 | | | | | 12 | | | | | |
| 15 | | | | | | | | | | | | |
| | X | 21 | | | | | 12 | | | | | |
| 20 | | | | | | | | | | | | |
| | X | 26 | | | | | 13 | | | | | |
| 25 | | | | | | | | | | | | |
| | | | | | Boring Terminated at 25' | | | | | | | |

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

# BORING NO. B-3

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 2/4/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

| FIELD RESULTS | | | | | | LABORATORY RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION<br>SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
| | | | | | 6± inches Portland cement concrete | | | | | | | |
| | X | 35 | | | FILL: Brown Silty fine to medium Sand, medium dense-damp to moist | 130 | 9 | | | | | |
| | X | 24 | | | @ 3 feet, trace Clay | 126 | 9 | | | | | |
| 5 | X | 24 | 4.5 | | ALLUVIUM: Brown Clayey fine Sand to fine Sandy Clay, little medium Sand, medium dense to very stiff-moist | 119 | 12 | | | | | |
| | X | 34 | | | Brown Silty fine to medium Sand, little coarse Sand, medium dense-damp to moist | 117 | 5 | | | | | |
| 10 | X | 37 | | | | 115 | 7 | | | | | |
| | | | | | Gray Brown fine to medium Sand, little coarse Sand, medium dense-damp | | | | | | | |
| | X | 20 | | | | | 3 | | | | | |
| 15 | | | | | Boring Terminated at 15' | | | | | | | |

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

# BORING NO. B-4

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 2/4/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

WATER DEPTH: Dry
CAVE DEPTH: 8 feet
READING TAKEN: At Completion

| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION<br>SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 4± inches Asphaltic concrete; 6± inches Aggregate base | | | | | | | |
| | X | 12 | | | FILL: Brown Silty fine to medium Sand, trace to little Clay, loose to medium dense-damp to moist | 113 | 11 | | | | | |
| | X | 8 | | | | 112 | 8 | | | | | |
| 5 | | | | | | | | | | | | |
| | X | 5 | | | ALLUVIUM: Brown fine to medium Sand, trace coarse Sand, loose-moist | 114 | 5 | | | | | |
| | X | 14 | | | Gray Brown fine to coarse Sand, medium dense-damp | 128 | 3 | | | | | |
| 10 | | | | | | | | | | | | |
| | | | | | Gray Brown fine to medium Sandy Silt, medium dense-very moist | | | | | | | |
| | X | 18 | | | | 119 | 17 | | | | | |
| 15 | | | | | | | | | | | | |
| | | | | | Brown fine Sandy Clay, some Silt, very stiff-damp to moist | | | | | | | |
| | X | 23 | 3.0 | | | | 10 | | | | | |
| 20 | | | | | | | | | | | | |
| | | | | | Brown fine Sandy Silt, trace medium Sand, medium dense-moist to very moist | | | | | | | |
| | X | 28 | | | | | 14 | | | | | |
| 25 | | | | | | | | | | | | |
| | | | | | Boring Terminated at 25' | | | | | | | |

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

# BORING NO. B-5

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 2/4/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

| FIELD RESULTS | | | | | | LABORATORY RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION<br>SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
| | | | | | 3½± inches Asphaltic concrete; 4± inches Aggregate base | | | | | | | |
| | X | 13 | | | FILL: Brown Silty fine to medium Sand, little Clay, loose-moist | 119 | 8 | | | | | |
| | X | 14 | | | @ 3 feet, little to some Clay | 119 | 9 | | | | | |
| 5 | X | 21 | | | ALLUVIUM: Brown fine Sandy Silt, trace to little medium Sand, trace to little Clay, medium dense-moist | 123 | 10 | | | | | |
| | X | 23 | | | | 118 | 12 | | | | | |
| | X | 19 | | | Gray Brown fine to coarse Sand, trace Silt, medium dense-damp | 102 | 3 | | | | | |
| 10 | | | | | | | | | | | | |
| | | | | | Brown fine Sandy Silt, trace medium Sand, medium dense-damp to moist | | | | | | | |
| | X | 22 | | | | | 8 | | | | | |
| 15 | | | | | | | | | | | | |
| | | | | | Brown Clayey fine Sand, little Silt, trace medium Sand, little Calcareous nodules/veining, medium dense-very moist | | | | | | | |
| | X | 27 | | | | | 17 | | | | | |
| 20 | | | | | | | | | | | | |
| | | | | | Boring Terminated at 20' | | | | | | | |

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

# BORING NO. B-6

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 2/4/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Jamie Hayward

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

| FIELD RESULTS | | | | | | LABORATORY RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION<br>SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
| 0 | | | | | 3± inches Asphaltic concrete; 4± inches Aggregate base | | | | | | | |
| | | | | | FILL: Brown fine to medium Sandy Silt, trace coarse Sand, medium dense-moist | | | | | | | |
| 5 | X | 15 | | | | | 12 | | | | | |
| | | | | | ALLUVIUM: Brown fine Sandy Silt, little medium Sand, medium dense to dense-moist | | | | | | | |
| 10 | X | 32 | | | | | 14 | | | | | |
| 15 | X | 14 | | | | | 12 | | | | | |
| | | | | | Brown Silty Clay, little fine Sand, cemented, hard-moist | | | | | | | |
| 20 | X | 38 | 4.5 | | | | 15 | | | | | |
| | | | | | Boring Terminated at 20' | | | | | | | |

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

# BORING NO. B-7

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 7/15/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Caleb Brackett

WATER DEPTH: Dry
CAVE DEPTH: 17 feet
READING TAKEN: At Completion

| FIELD RESULTS | | | | | | LABORATORY RESULTS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION<br>SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
| | | | | | FILL: Dark Brown fine to medium Sandy Silt, trace coarse Sand, medium dense-damp | | | | | | | |
| | X | 20 | | | | 113 | 5 | | | | | |
| | | | | | ALLUVIUM: Brown Silty fine to coarse Sand, trace fine Gravel, loose-damp | | | | | | | |
| | X | 12 | | | | 107 | 3 | | | | | |
| | | | | | Brown fine Sandy Silt, little medium Sand, trace Clay, trace to little Calcareous veining, medium dense-moist | | | | | | | |
| 5 | X | 16 | | | | 107 | 12 | | | | | |
| | X | 20 | | | | 123 | 11 | | | | | |
| | | | | | Brown Silty fine to medium Sand, trace coarse Sand, little Clay, medium dense-damp | | | | | | | |
| | X | 24 | | | | 112 | 9 | | | | | |
| 10 | | | | | | | | | | | | |
| | | | | | Brown fine Sandy Silt, trace medium Sand, medium dense-moist to very moist | | | | | | | |
| | X | 24 | | | | | 15 | | | | | |
| 15 | | | | | | | | | | | | |
| | X | 38 | | | @ 18½ feet, little medium Sand | | 8 | | | | | |
| 20 | | | | | | | | | | | | |
| | | | | | Dark Brown Clayey fine to medium Sand, trace to little coarse Sand, little Silt, medium dense-moist | | | | | | | |
| | X | 29 | | | | | 9 | | | | | |
| 25 | | | | | | | | | | | | |
| | | | | | Boring Terminated at 25' | | | | | | | |

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

# BORING NO. B-8

SOUTHERN CALIFORNIA GEOTECHNICAL
*A California Corporation*

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 7/15/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Caleb Brackett

WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

| FIELD RESULTS | | | | | DESCRIPTION | LABORATORY RESULTS | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | SURFACE ELEVATION: --- MSL | DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | |
| | | | | | ASPHALT: 8±-inches of Asphaltic Concrete with 6±-inches of Aggregate Base | | | | | | | |
| | X | 10 | | | FILL: Brown Clayey fine Sand, little Silt, medium dense-damp to moist | | 10 | | | | | |
| | X | 8 | | | ALLUVIUM: Brown Silty fine to medium Sand, trace coarse Sand, loose-moist | | 8 | | | | | |
| 5 | | | | | | | | | | | | |
| | X | 7 | | | Brown fine Sandy Silt, trace medium Sand, loose-moist | | 10 | | | | | |
| | X | 18 | | | Brown Silty fine to medium Sand, medium dense-moist to very moist | | 8 | | | | | |
| 10 | | | | | | | | | | | | |
| | X | 19 | | | | | 9 | | | | | |
| 15 | | | | | | | | | | | | |
| | X | 29 | | | @ 18½ feet, trace coarse Sand, trace Clay | | 14 | | | | | |
| 20 | | | | | | | | | | | | |
| | | | | | Boring Terminated at 20' | | | | | | | |

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

# BORING NO. B-9

JOB NO.: 22G122-4
PROJECT: Proposed C/I Building
LOCATION: Perris, CA

DRILLING DATE: 7/15/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Caleb Brackett

WATER DEPTH: Dry
CAVE DEPTH: 17 feet
READING TAKEN: At Completion

SURFACE ELEVATION: --- MSL

| FIELD RESULTS: DEPTH (FEET) | SAMPLE | BLOW COUNT | POCKET PEN. (TSF) | GRAPHIC LOG | DESCRIPTION | LABORATORY RESULTS: DRY DENSITY (PCF) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PASSING #200 SIEVE (%) | ORGANIC CONTENT (%) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ASPHALT: 4±-inches Asphaltic Concrete with 10±-inches of Aggregate Base | | | | | | | |
| | X | 24 | | | FILL: Dark Brown fine to medium Sandy Silt, medium dense-damp | 118 | 6 | | | | | EI = 13 @ 0-5' |
| | X | 29 | | | FILL: Brown Silty Clay, trace fine to medium Sand, trace PVC pipe, well cemented, trace PVC pipe, medium dense-damp | 121 | 7 | | | | | |
| 5 | X | 14 | | | ALLUVIUM: Brown Silty fine to medium Sand, trace coarse Sand, loose to medium dense-damp | 109 | 6 | | | | | |
| | X | 18 | | | | 110 | 7 | | | | | |
| 10 | X | 23 | | | Brown fine Sandy Silt, trace medium Sand, trace Clay, well cemented, medium dense-moist | 113 | 12 | | | | | |
| 15 | X | 19 | | | Brown Silty fine to medium Sand, trace coarse Sand, medium dense-damp | | 7 | | | | | |
| 20 | X | 22 | | | Brown fine Sandy Silt, trace medium Sand, trace Clay, well cemented, medium dense-damp | | 7 | | | | | |
| 25 | X | 37 | | | Brown Clayey fine to medium Sand, little Silt, trace to little coarse Sand, well cemented, dense-moist | | 11 | | | | | |

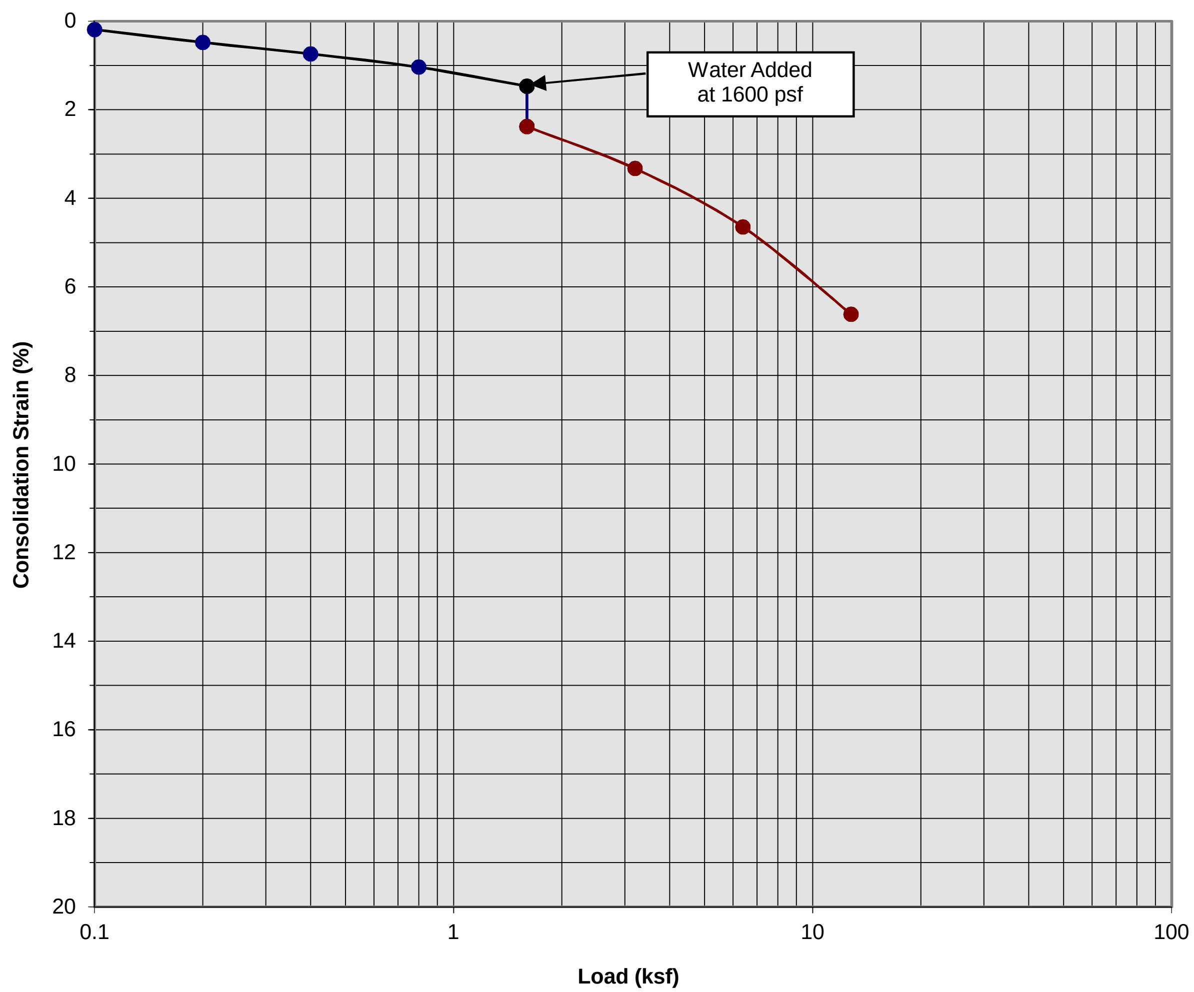
Boring Terminated at 25'

TBL 22G122-4 (COMBINED WITH -1).GPJ SOCALGEO.GDT 8/10/22

**TEST BORING LOG**

# APPENDIX C

**Consolidation/Collapse Test Results**



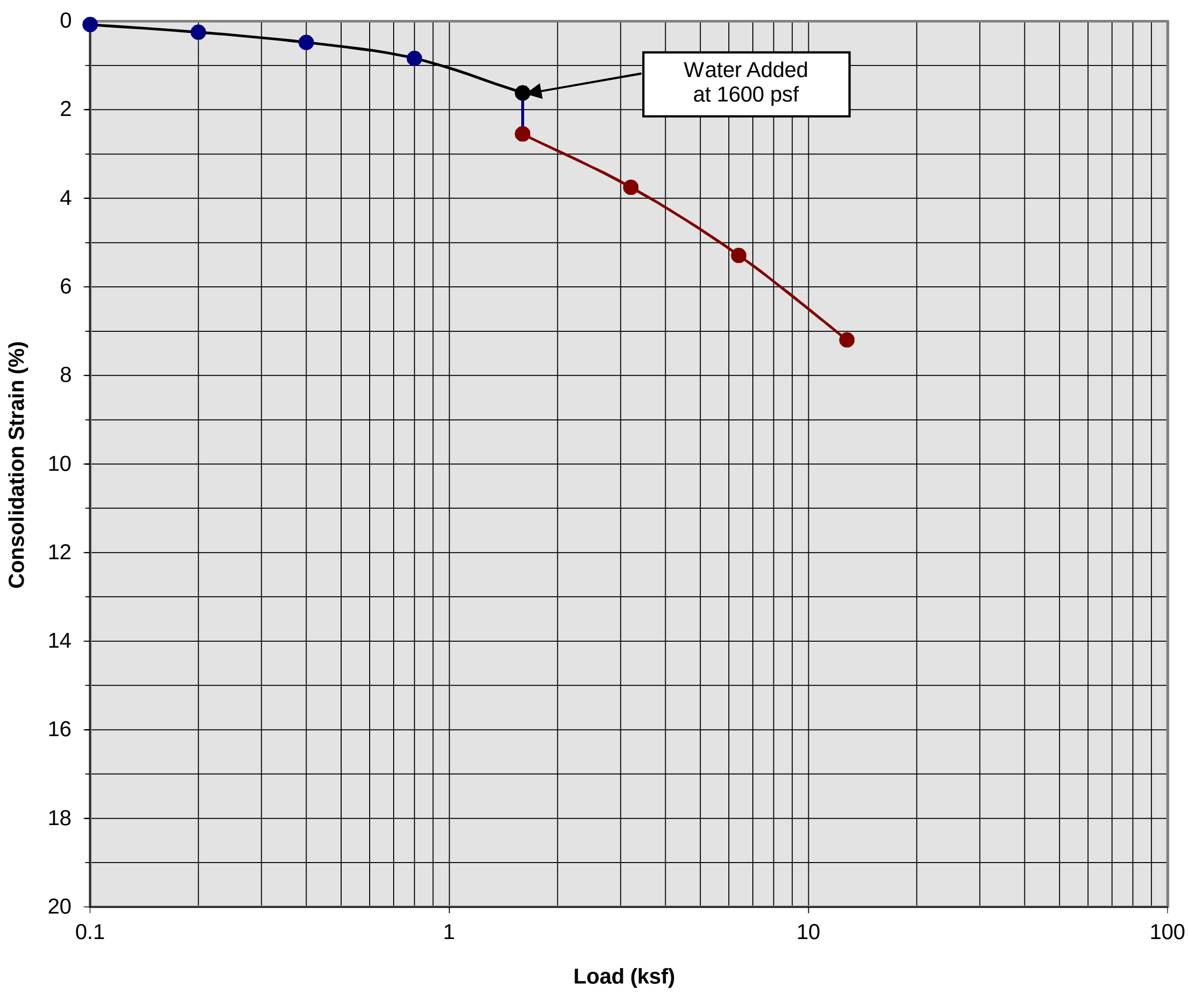

Classification: FILL: Brown Silty fine to medium Sand, little Clay

| | | | |
|---|---|---|---|
| Boring Number: | B-5 | Initial Moisture Content (%) | 10 |
| Sample Number: | --- | Final Moisture Content (%) | 13 |
| Depth (ft) | 3 to 4 | Initial Dry Density (pcf) | 117.5 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 124.5 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 0.91 |

Proposed Commercial/Industrial Building
Perris, Calfornia
Project No. 22G122-4
**PLATE C- 1**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

## Consolidation/Collapse Test Results




Classification: Brown fine Sandy Silt, trace to little medium Sand and Clay

| | | | |
|---|---|---|---|
| Boring Number: | B-5 | Initial Moisture Content (%) | 10 |
| Sample Number: | --- | Final Moisture Content (%) | 14 |
| Depth (ft) | 5 to 6 | Initial Dry Density (pcf) | 122.3 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 131.8 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 0.93 |

Proposed Commercial/Industrial Building
Perris, Calfornia
Project No. 22G122-4
**PLATE C- 2**

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
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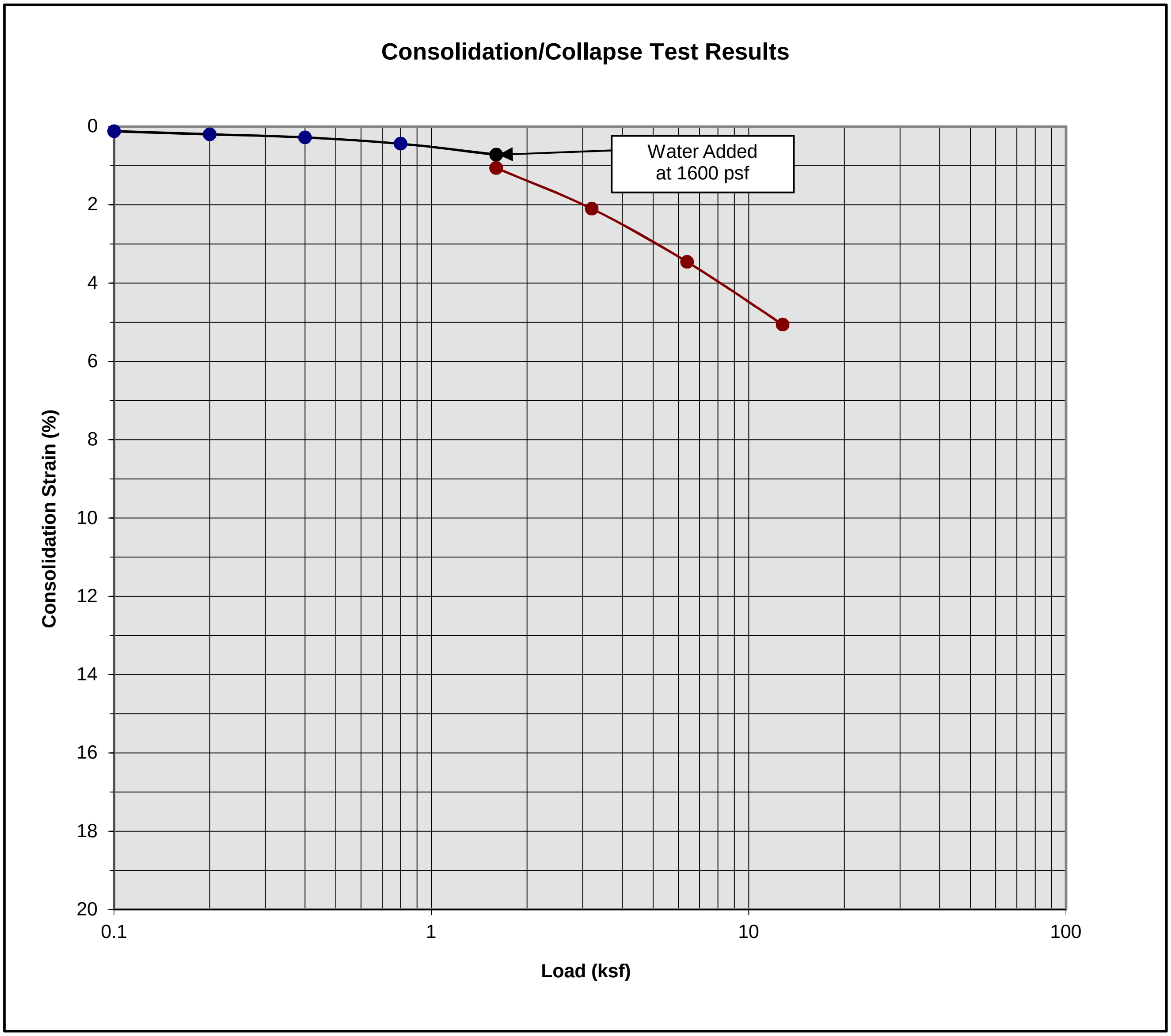
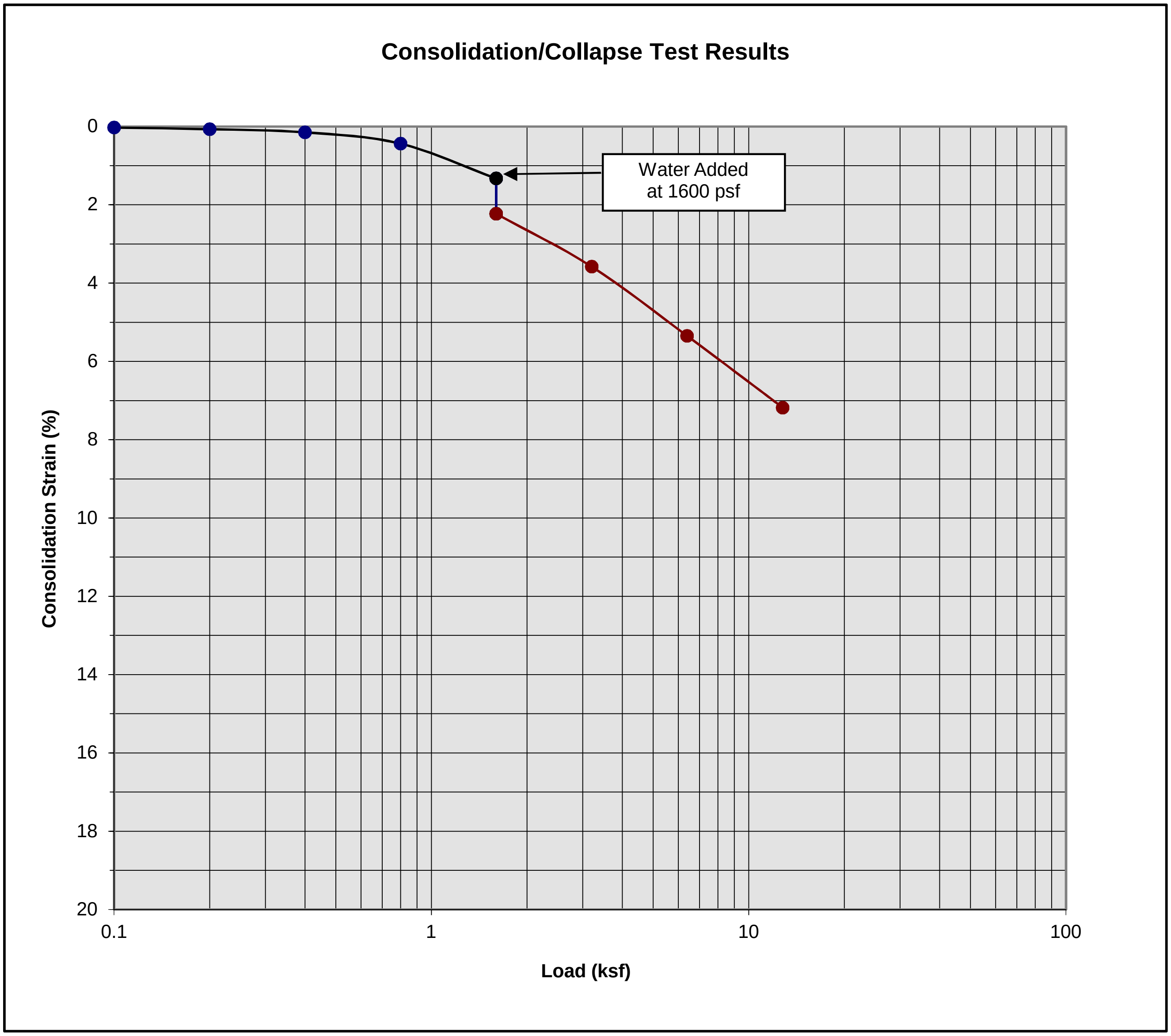



Classification: Brown fine Sandy Silt, trace to little medium Sand and Clay

| | | | |
|---|---|---|---|
| Boring Number: | B-5 | Initial Moisture Content (%) | 11 |
| Sample Number: | --- | Final Moisture Content (%) | 14 |
| Depth (ft) | 7 to 8 | Initial Dry Density (pcf) | 117.6 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 124.1 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 0.34 |

Proposed Commercial/Industrial Building
Perris, Calfornia
Project No. 22G122-4
**PLATE C- 3**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

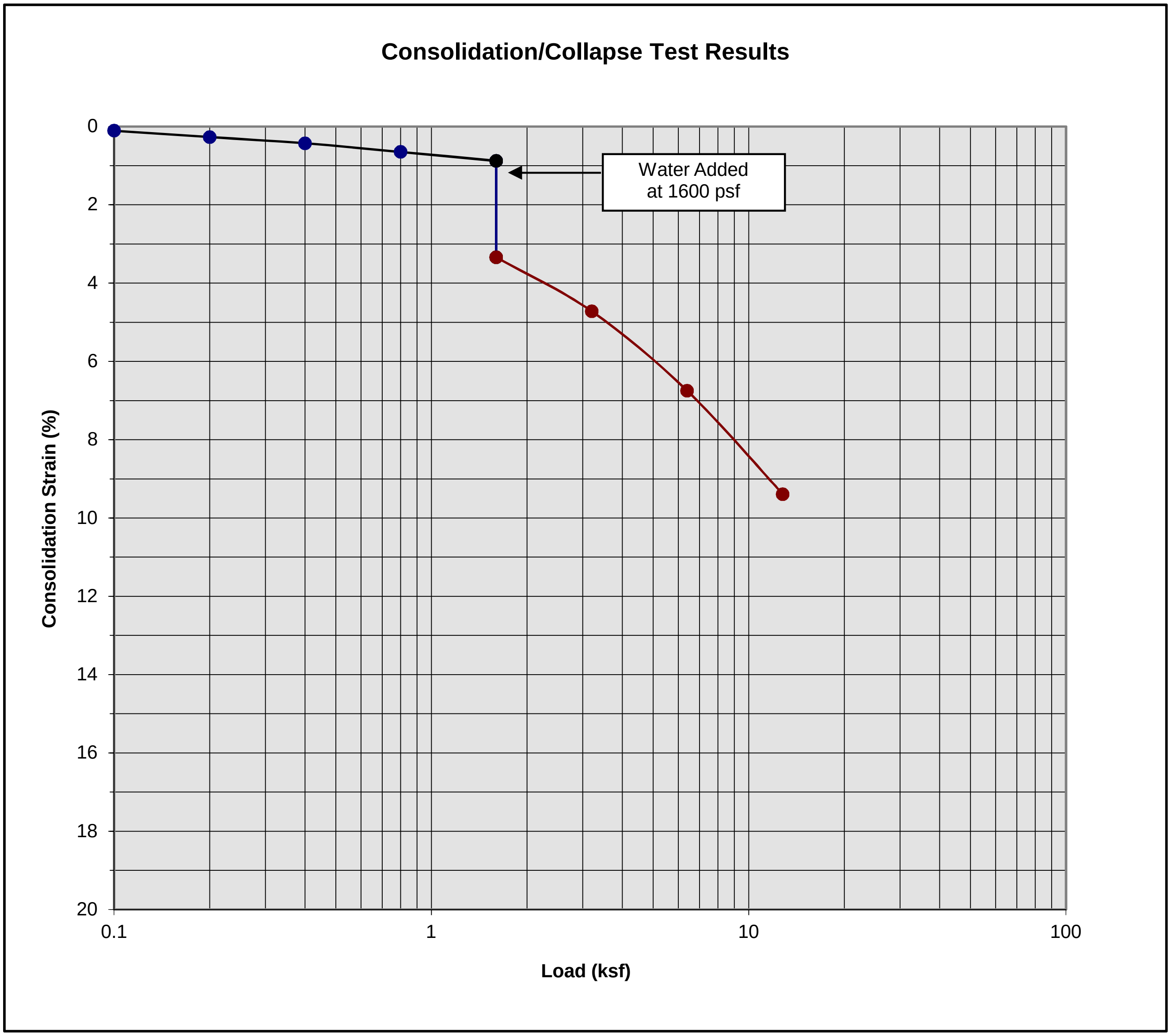



Classification: Gray Brown fine to coarse Sand, trace Silt

| | | | |
|---|---|---|---|
| Boring Number: | B-5 | Initial Moisture Content (%) | 3 |
| Sample Number: | --- | Final Moisture Content (%) | 17 |
| Depth (ft) | 9 to 10 | Initial Dry Density (pcf) | 102.0 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 110.4 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 0.90 |

Proposed Commercial/Industrial Building
Perris, Calfornia
Project No. 22G122-4
**PLATE C- 4**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



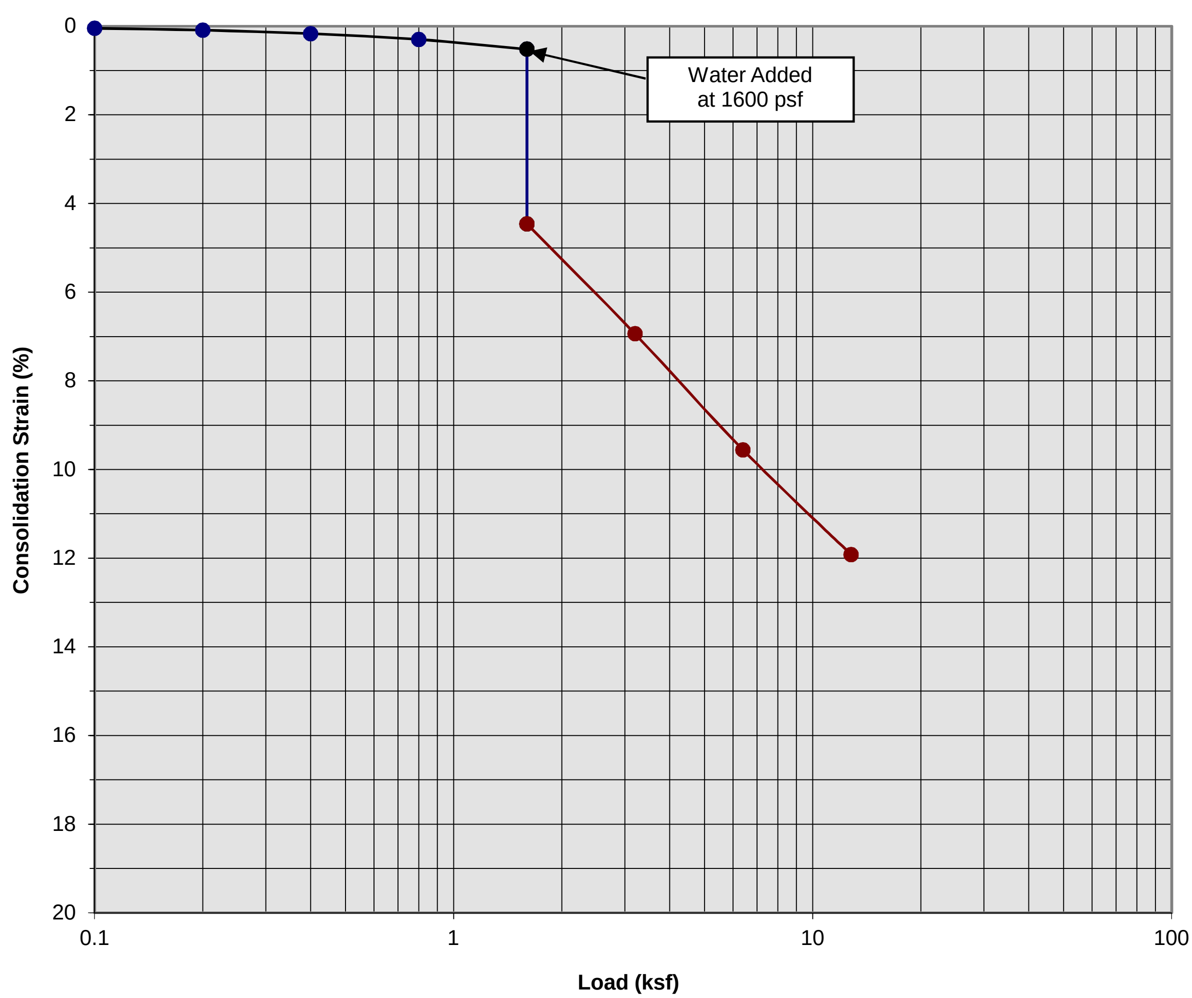

Classification: FILL: Brown Silty Clay, trace fine to medium Sand

| | | | |
|---|---|---|---|
| Boring Number: | B-9 | Initial Moisture Content (%) | 8 |
| Sample Number: | --- | Final Moisture Content (%) | 12 |
| Depth (ft) | 3 to 4 | Initial Dry Density (pcf) | 121.0 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 125.2 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 2.46 |

Proposed Commercial/Industrial Building
Perris, California
Project No. 22G122-4
**PLATE C- 5**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

## Consolidation/Collapse Test Results

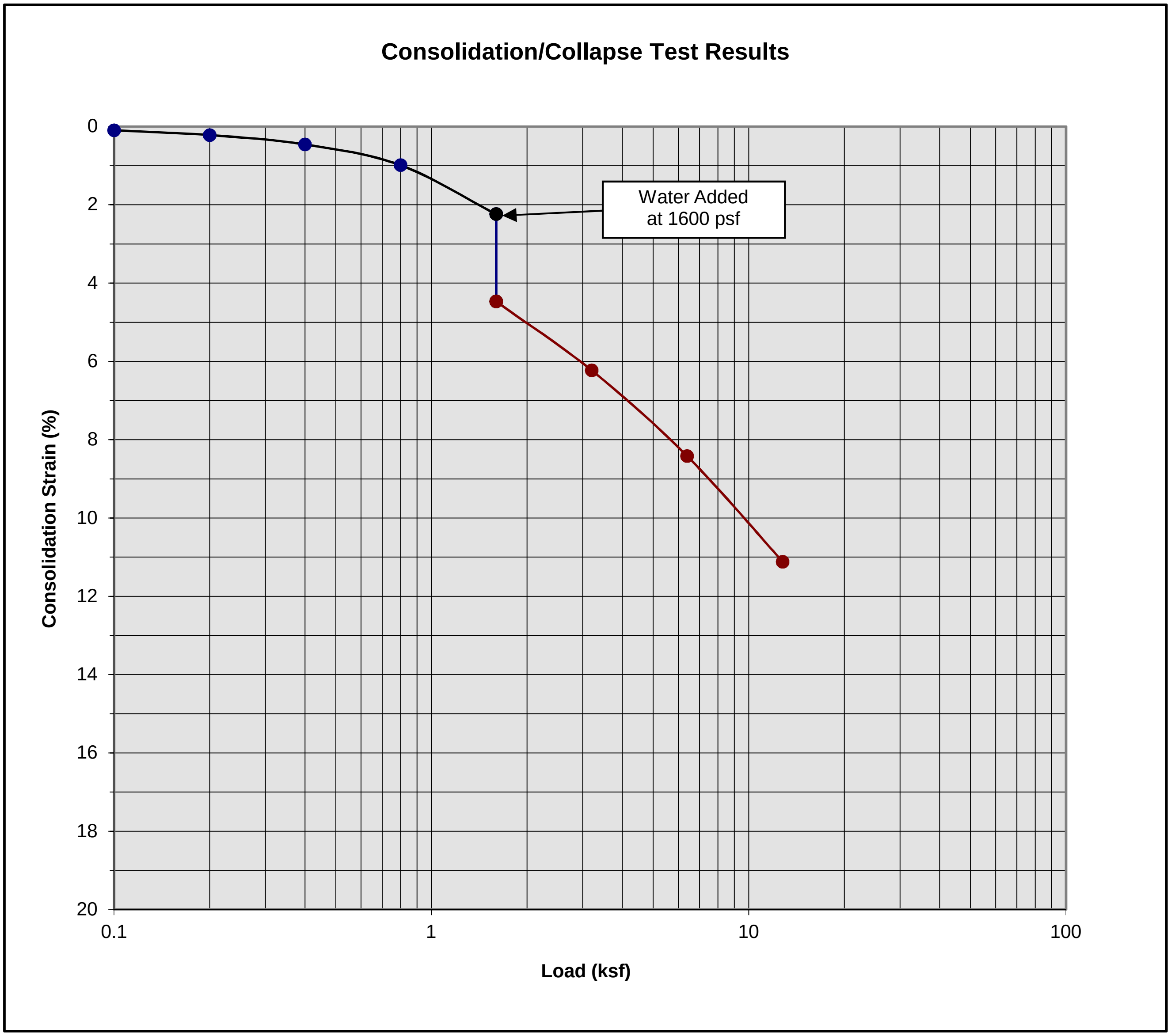



Classification: Brown Silty fine to medium Sand, trace coarse Sand

| | | | |
|---|---|---|---|
| Boring Number: | B-9 | Initial Moisture Content (%) | 6 |
| Sample Number: | --- | Final Moisture Content (%) | 13 |
| Depth (ft) | 5 to 6 | Initial Dry Density (pcf) | 102.8 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 109.1 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 3.94 |

Proposed Commercial/Industrial Building
Perris, California
Project No. 22G122-4
**PLATE C- 6**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL A California Corporation



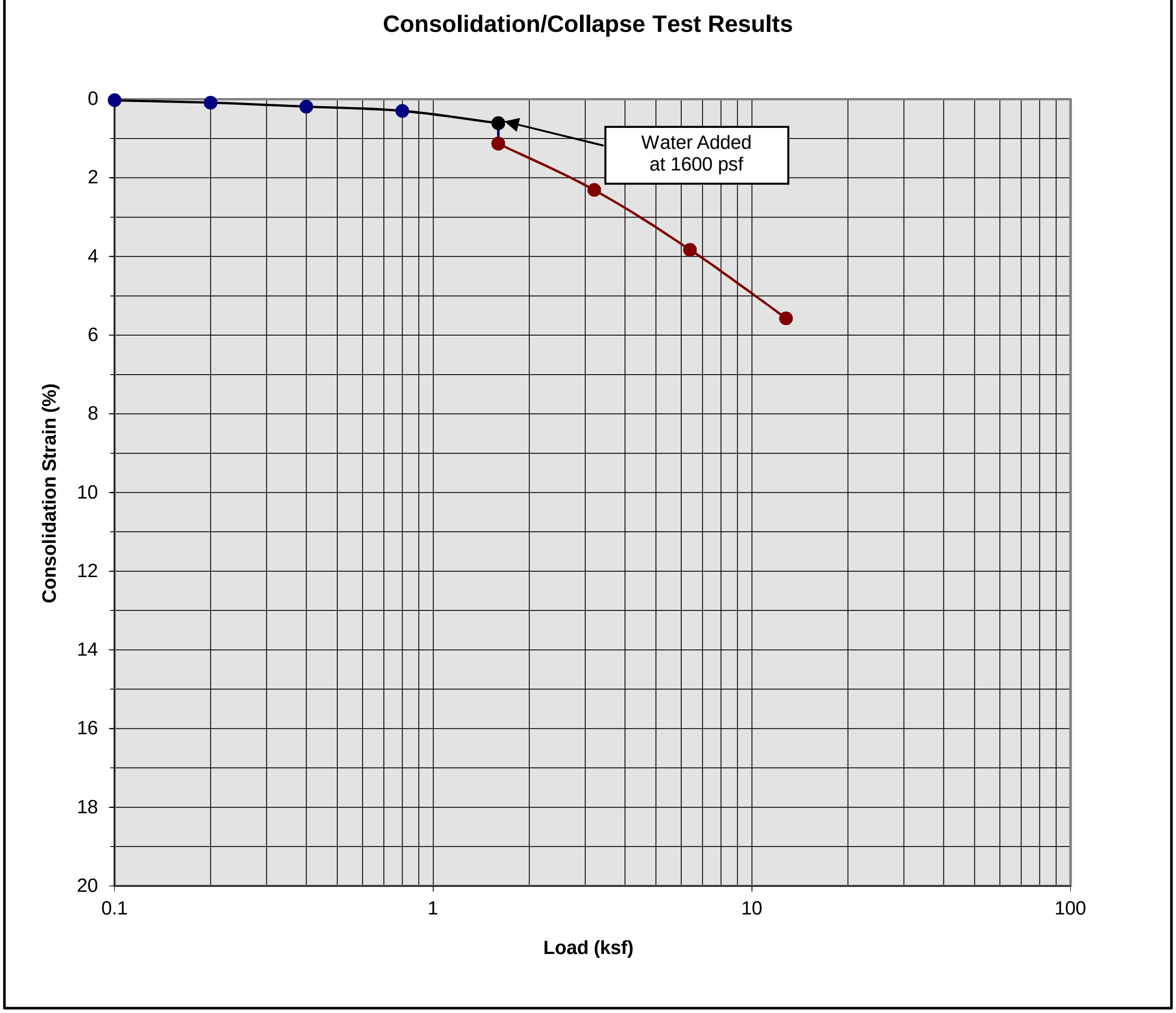

Classification: Brown Silty fine to medium Sand, trace coarse Sand

| | | | |
|---|---|---|---|
| Boring Number: | B-9 | Initial Moisture Content (%) | 7 |
| Sample Number: | --- | Final Moisture Content (%) | 15 |
| Depth (ft) | 7 to 8 | Initial Dry Density (pcf) | 110.0 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 120.5 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 2.23 |

Proposed Commercial/Industrial Building
Perris, California
Project No. 22G122-4
**PLATE C- 7**

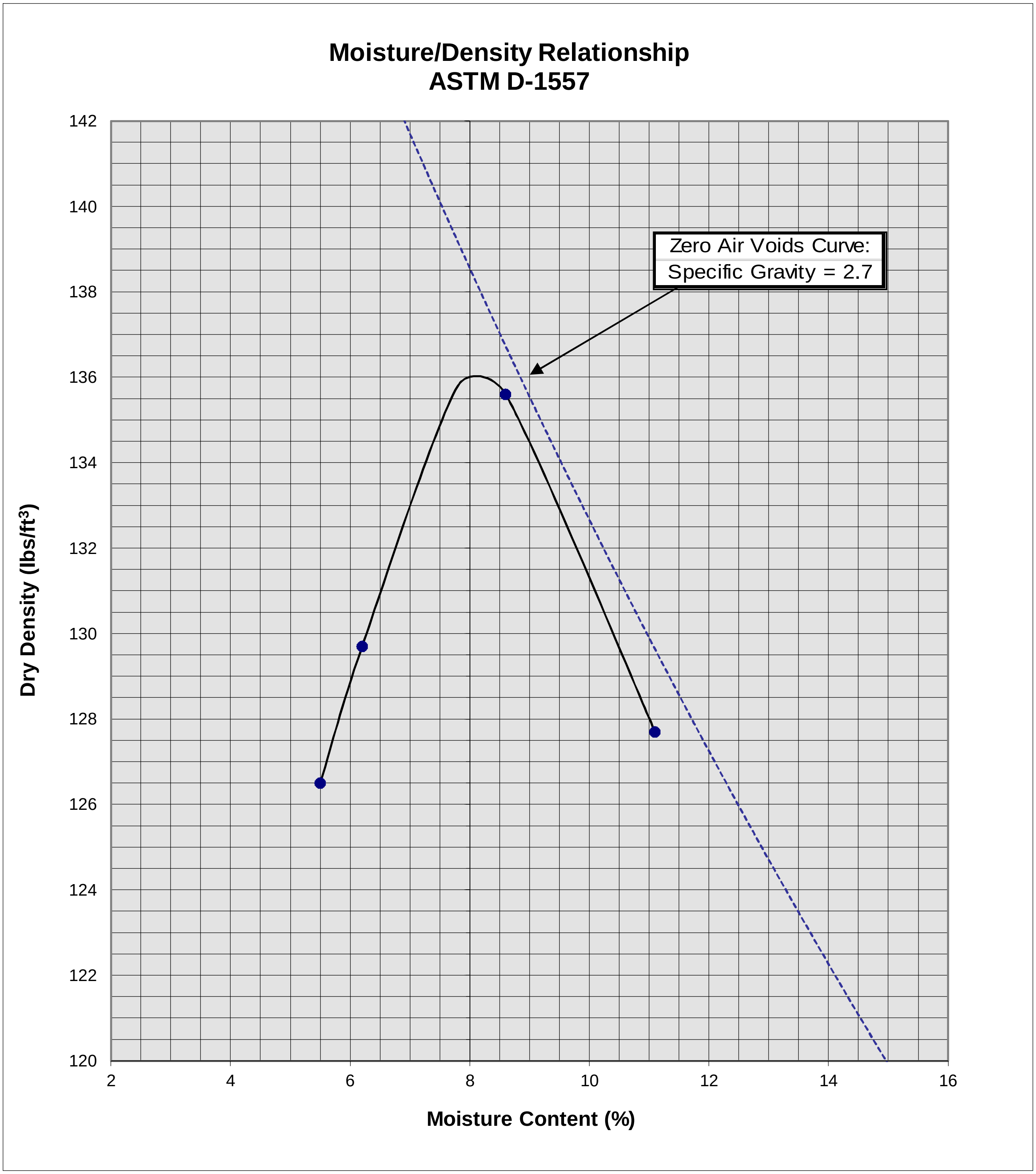
SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

## Consolidation/Collapse Test Results




Classification: Brown fine Sandy Silt, trace Clay, trace medium Sand

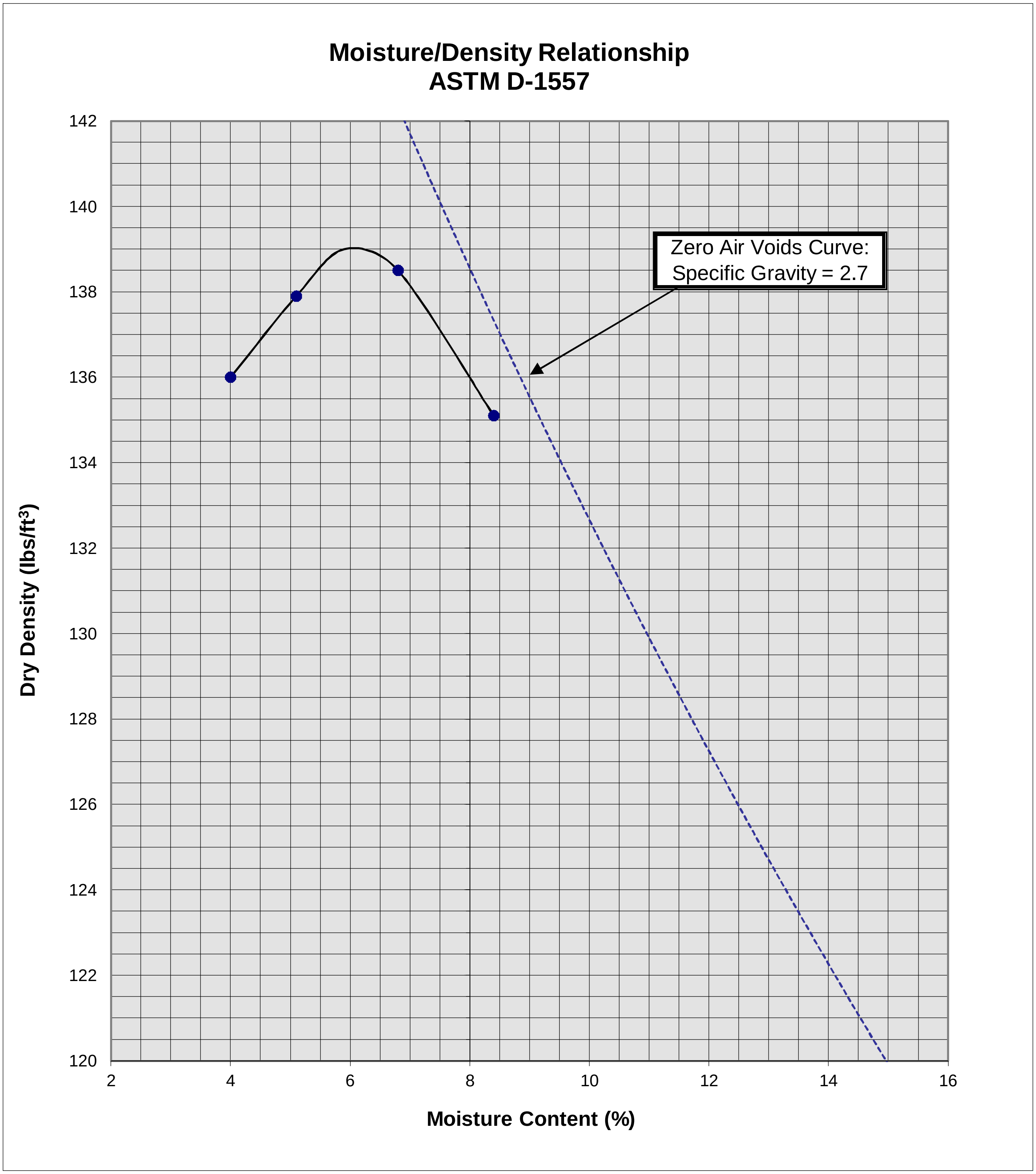
| | | | |
|---|---|---|---|
| Boring Number: | B-9 | Initial Moisture Content (%) | 12 |
| Sample Number: | --- | Final Moisture Content (%) | 16 |
| Depth (ft) | 9 to 10 | Initial Dry Density (pcf) | 112.7 |
| Specimen Diameter (in) | 2.4 | Final Dry Density (pcf) | 117.8 |
| Specimen Thickness (in) | 1.0 | Percent Collapse (%) | 0.52 |




| Soil ID Number | | B-5 @ 0-5' |
|---|---|---|
| Optimum Moisture (%) | | 8.0 |
| Maximum Dry Density (pcf) | | 136 |
| Soil Classification | Brown Silty fine to medium Sand little Clay | |
| | | |

Proposed Commercial/Industrial Building
Perris, California
Project No. 22G122-4
**PLATE C- 9**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation




| | | |
|---|---|---|
| Soil ID Number | | B-7 @ 0-5' |
| Optimum Moisture (%) | | 6.0 |
| Maximum Dry Density (pcf) | | 139 |
| Soil Classification | Dark Brown to brown fine to medium Sandy Silt to Silty fine to coarse Sand | |

# APPENDIX D

# GRADING GUIDE SPECIFICATIONS

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

## General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.
- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.
- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.
- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.
- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.
- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

## Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.
- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

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

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

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

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

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

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

Compacted Fills

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Foundations

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

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

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

Fill Slopes

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

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

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

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

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

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

Cut Slopes

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

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

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

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

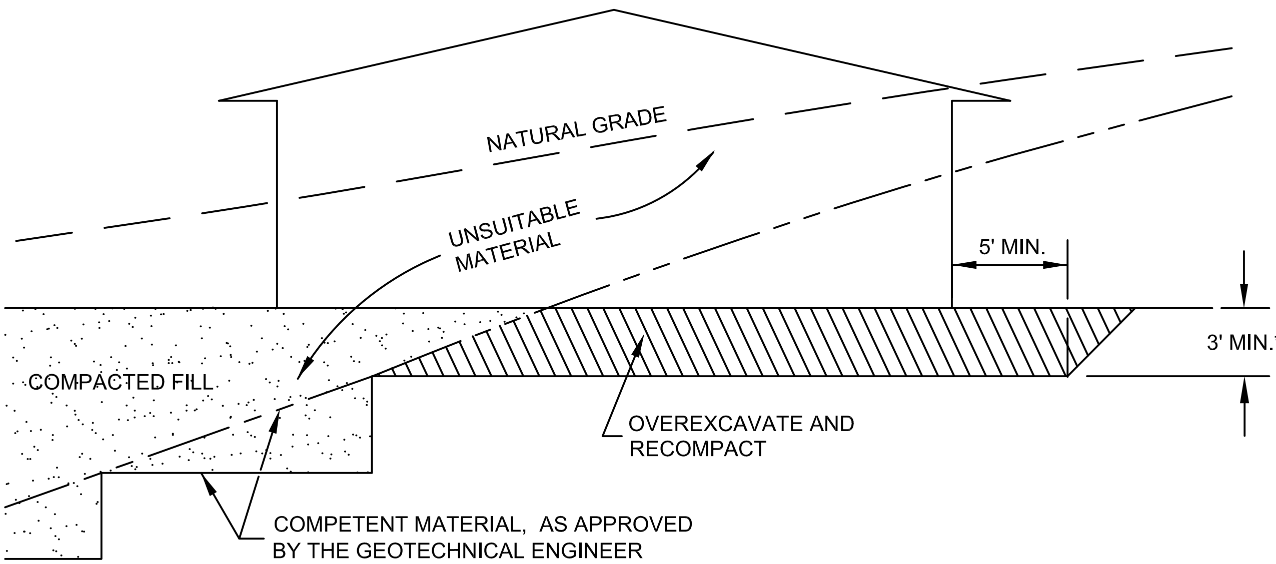
Subdrains

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

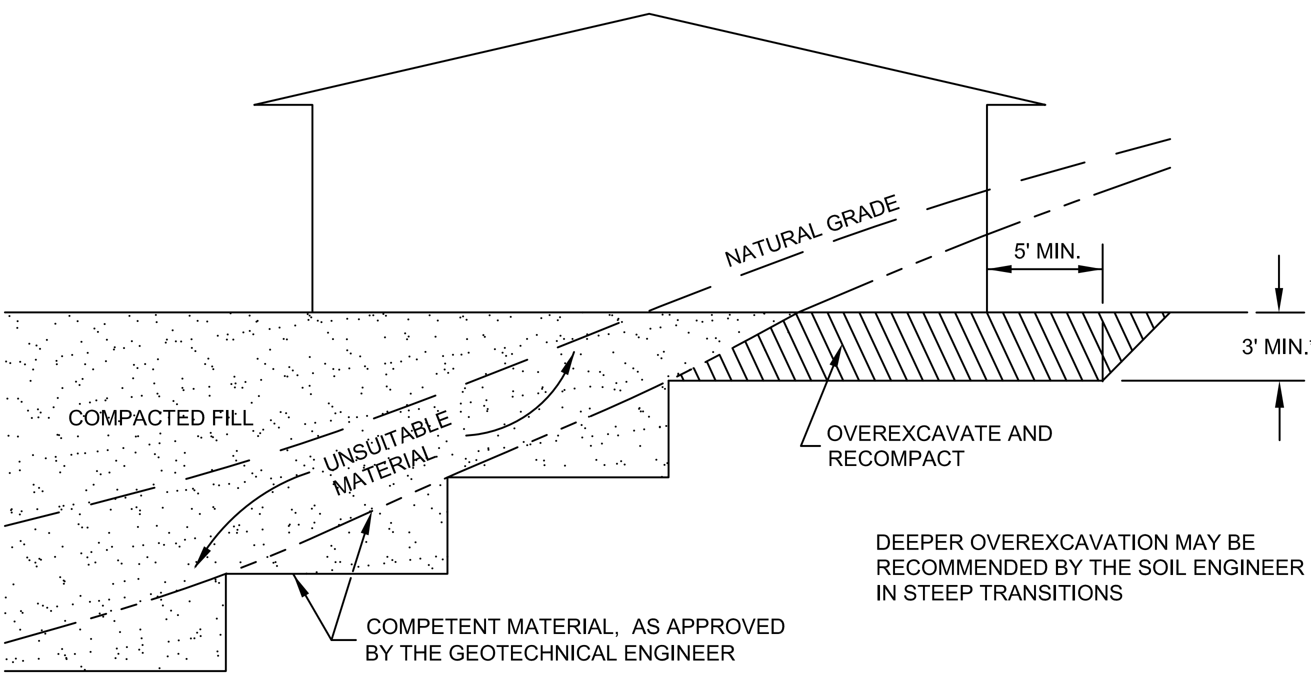
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

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

## CUT LOT




## CUT/FILL LOT (TRANSITION)




DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOIL ENGINEER IN STEEP TRANSITIONS

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

**TRANSITION LOT DETAIL**

GRADING GUIDE SPECIFICATIONS

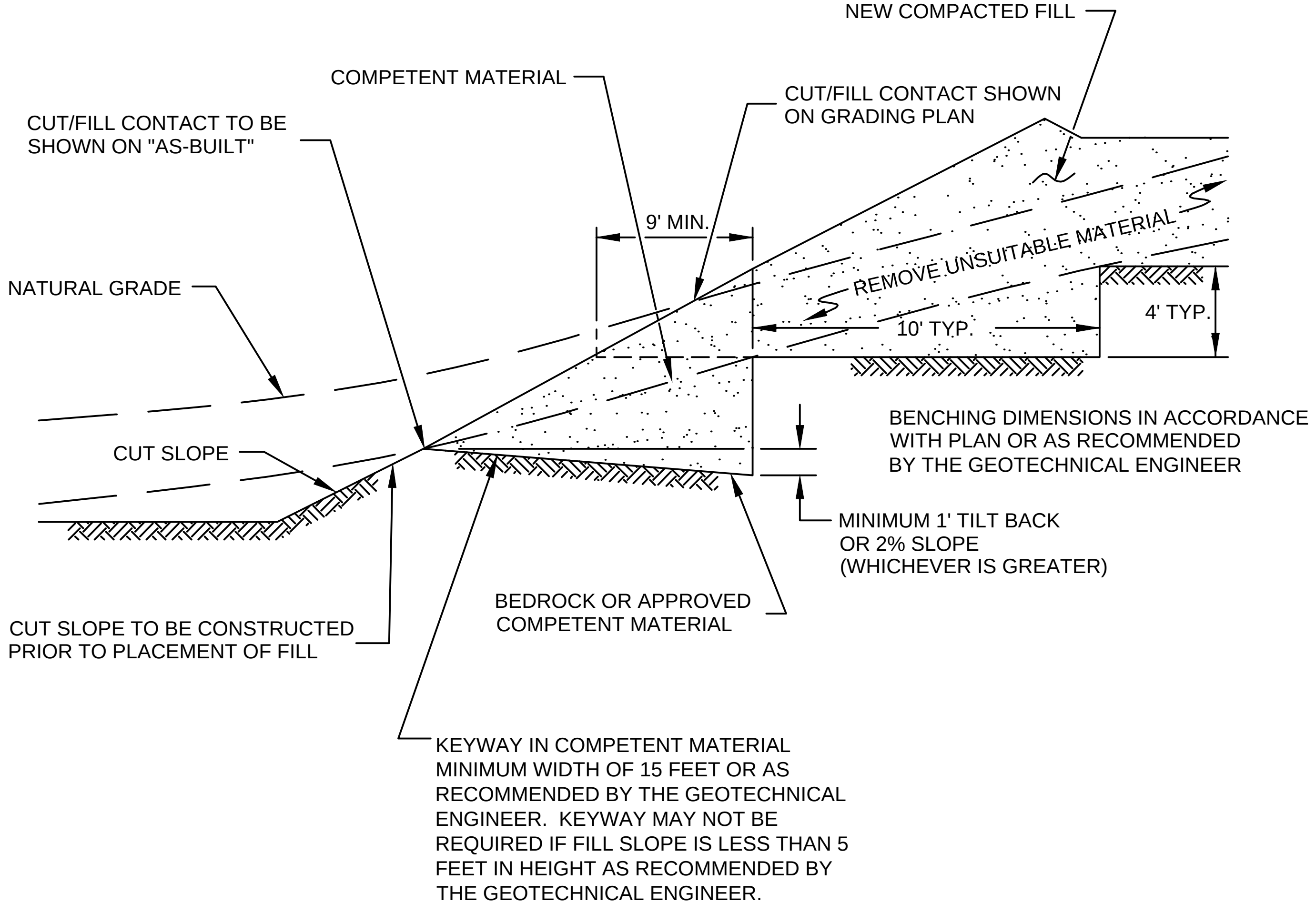
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

**PLATE D-1**

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL




**FILL ABOVE CUT SLOPE DETAIL**

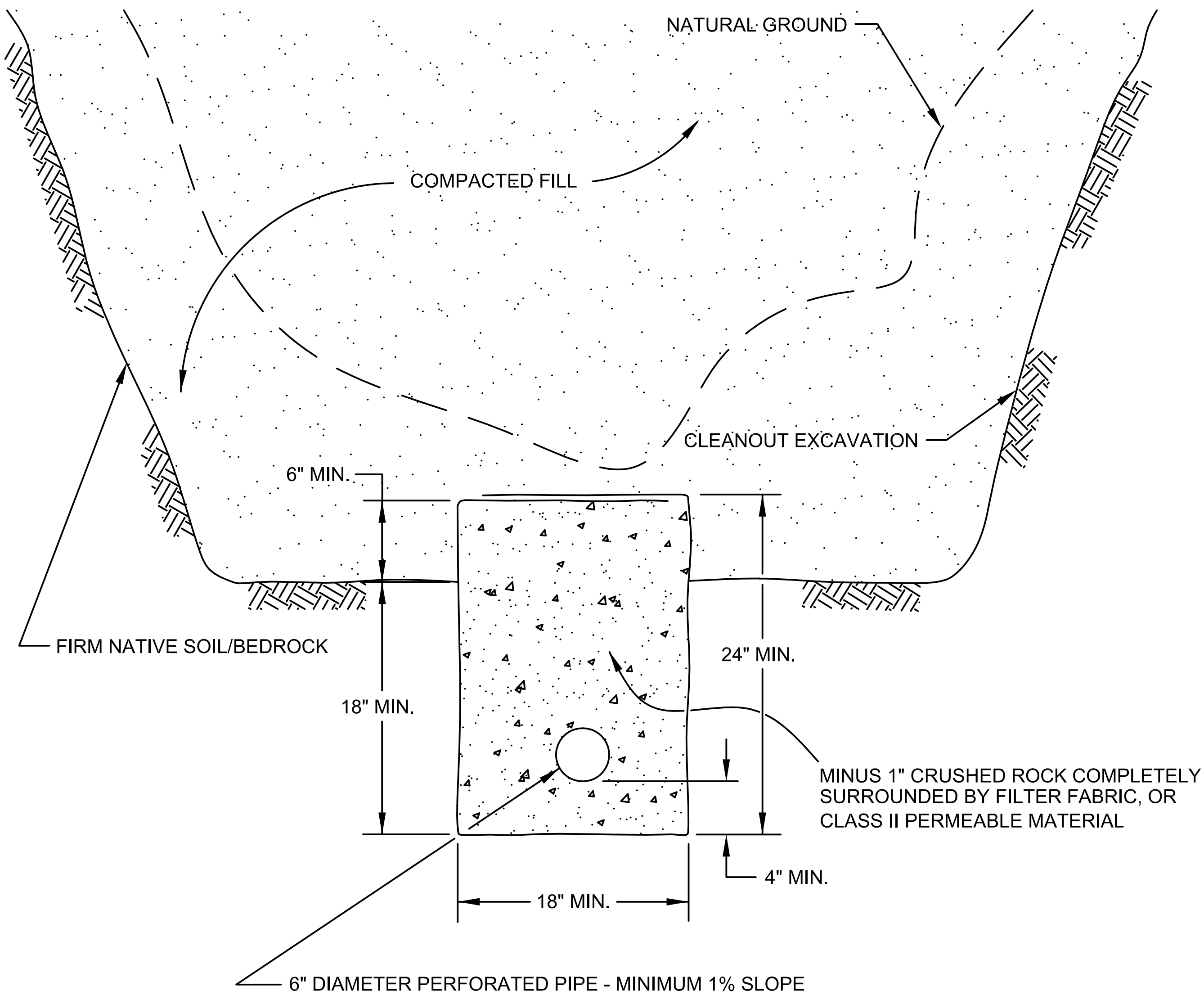
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

**PLATE D-2**

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL




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

**SCHEMATIC ONLY**
**NOT TO SCALE**

**CANYON SUBDRAIN DETAIL**

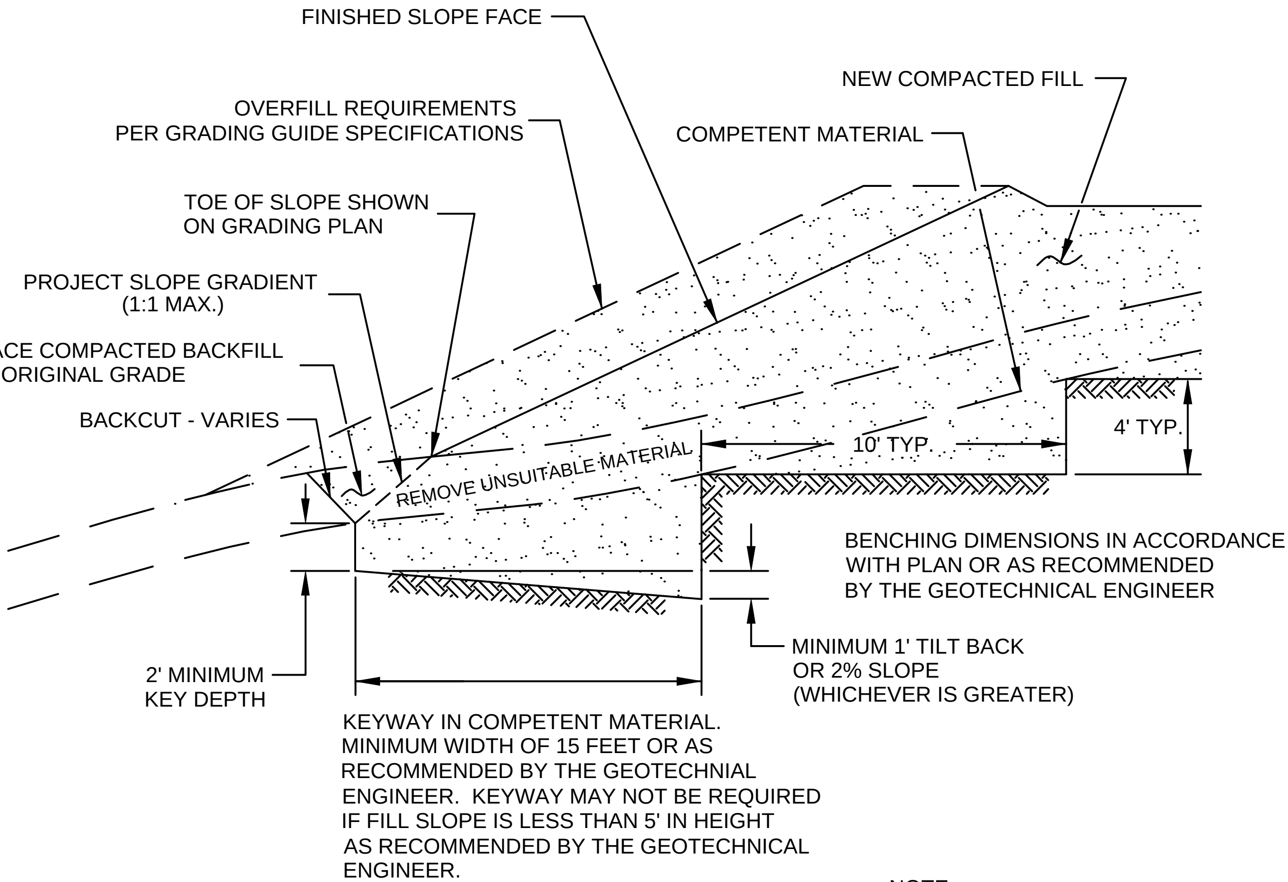
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

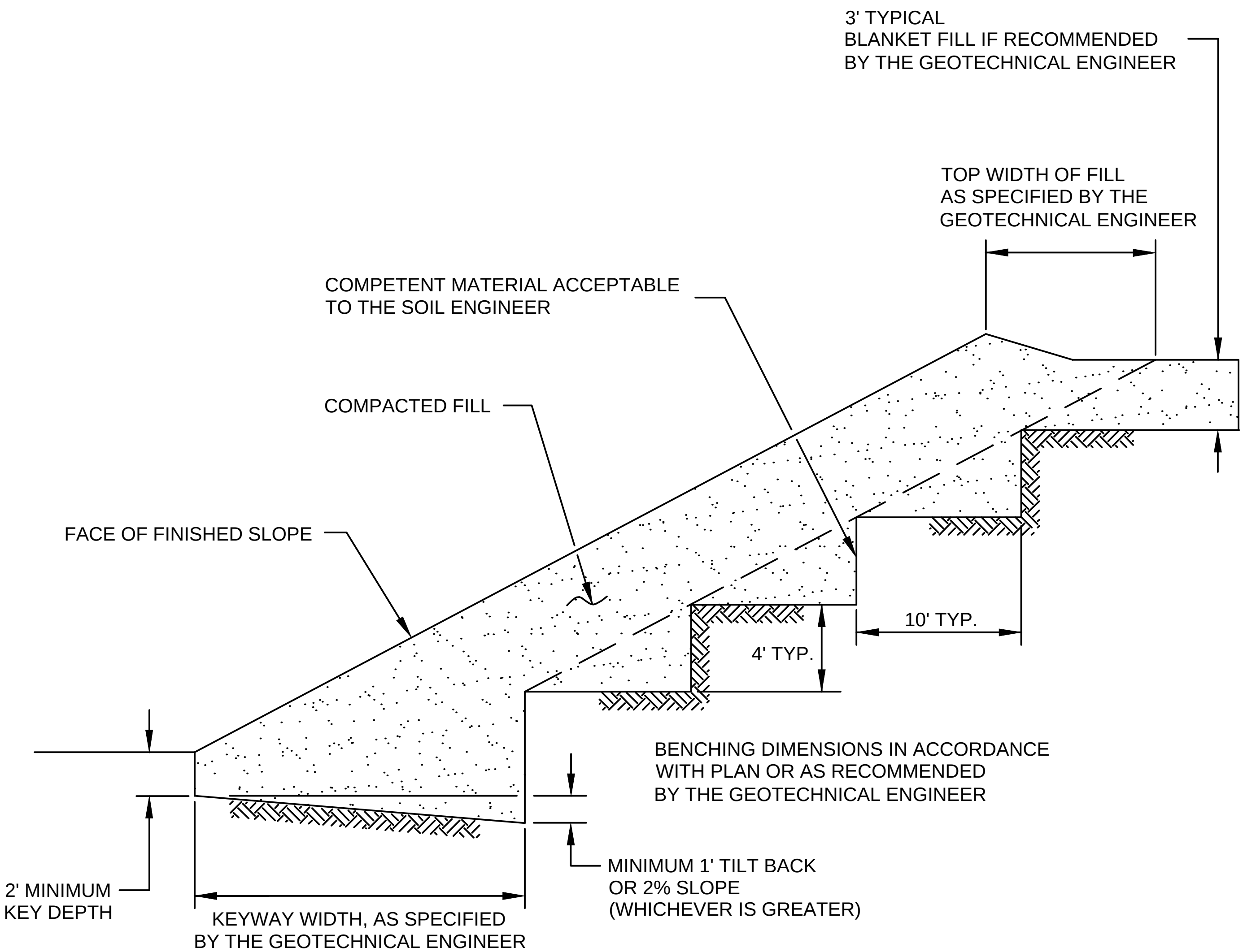
**PLATE D-3**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL




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

| FILL ABOVE NATURAL SLOPE DETAIL | |
|---|---|
| GRADING GUIDE SPECIFICATIONS | |
| NOT TO SCALE | SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL |
| DRAWN: JAS<br>CHKD: GKM | |
| **PLATE D-4** | |




**STABILIZATION FILL DETAIL**

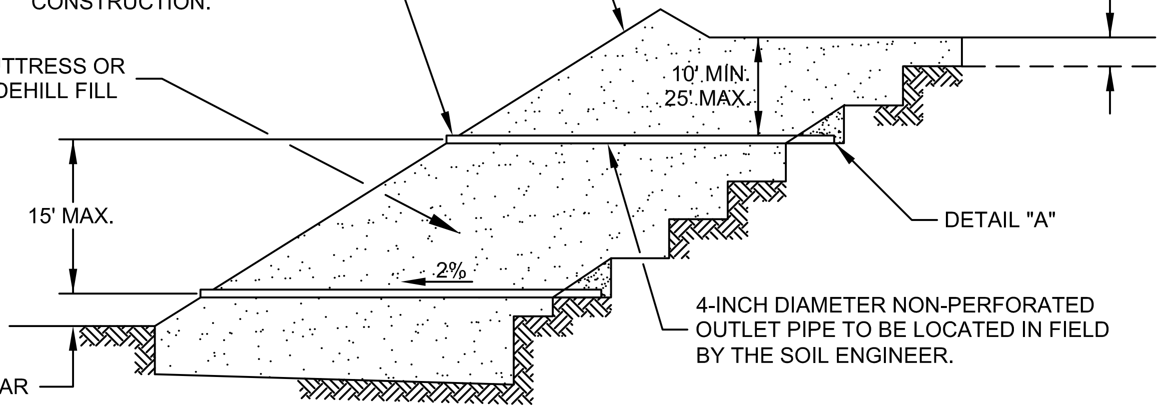
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

**PLATE D-5**

SOUTHERN CALIFORNIA GEOTECHNICAL



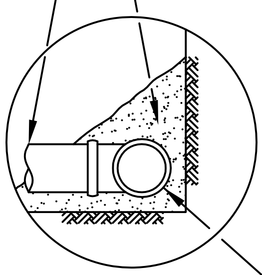

"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50




DETAIL "A"

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

**SLOPE FILL SUBDRAINS**

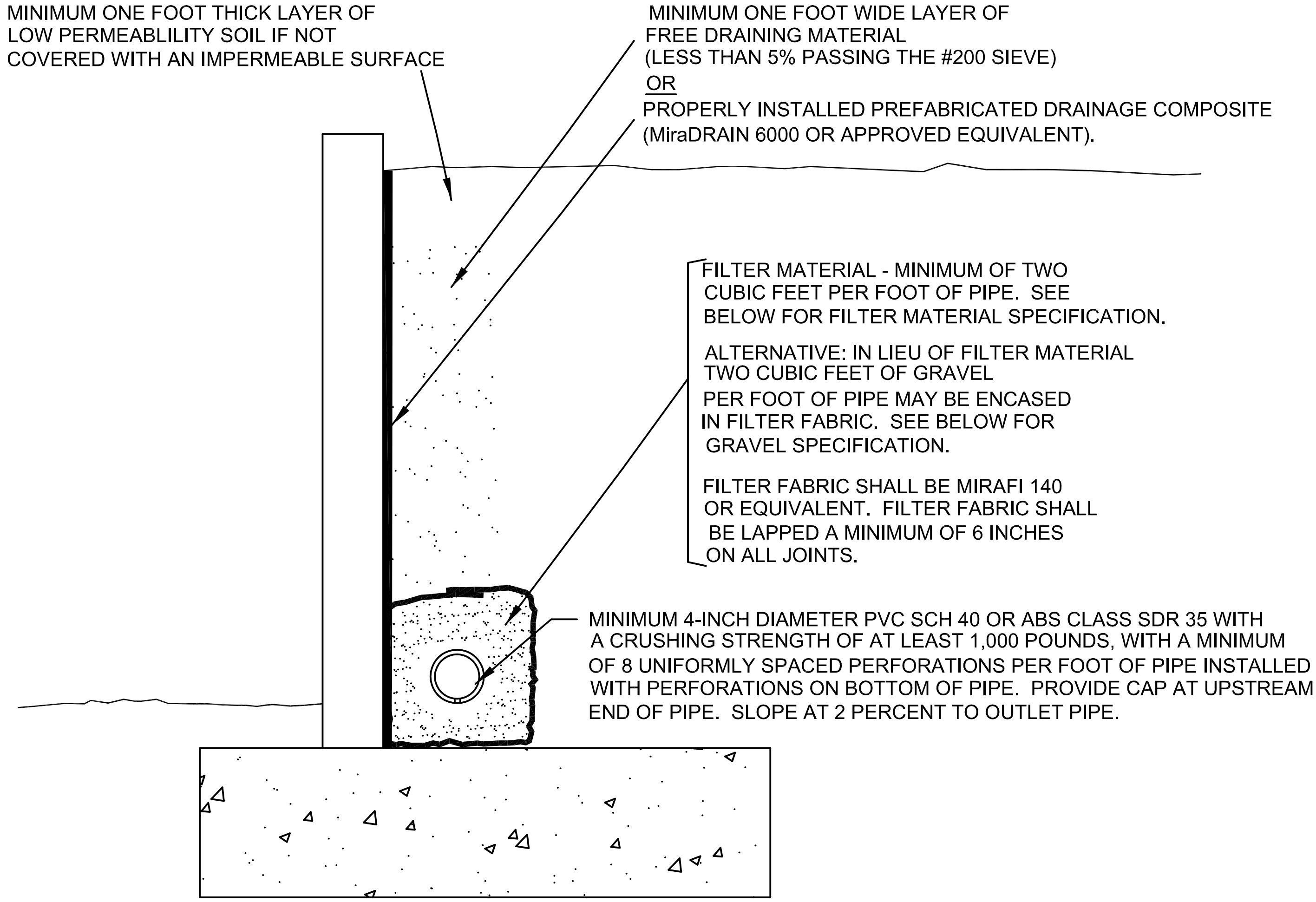
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

**PLATE D-6**

SOUTHERN CALIFORNIA GEOTECHNICAL




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

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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

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

SAND EQUIVALENT = MINIMUM OF 50

**RETAINING WALL BACKDRAINS**

GRADING GUIDE SPECIFICATIONS

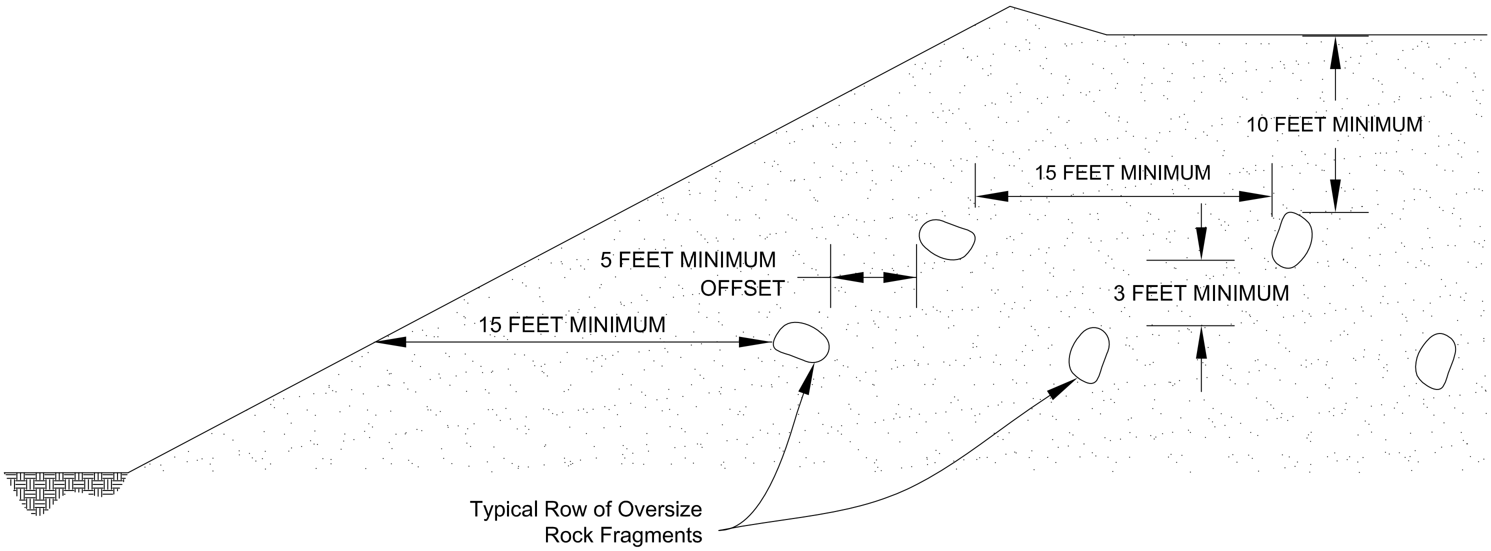
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

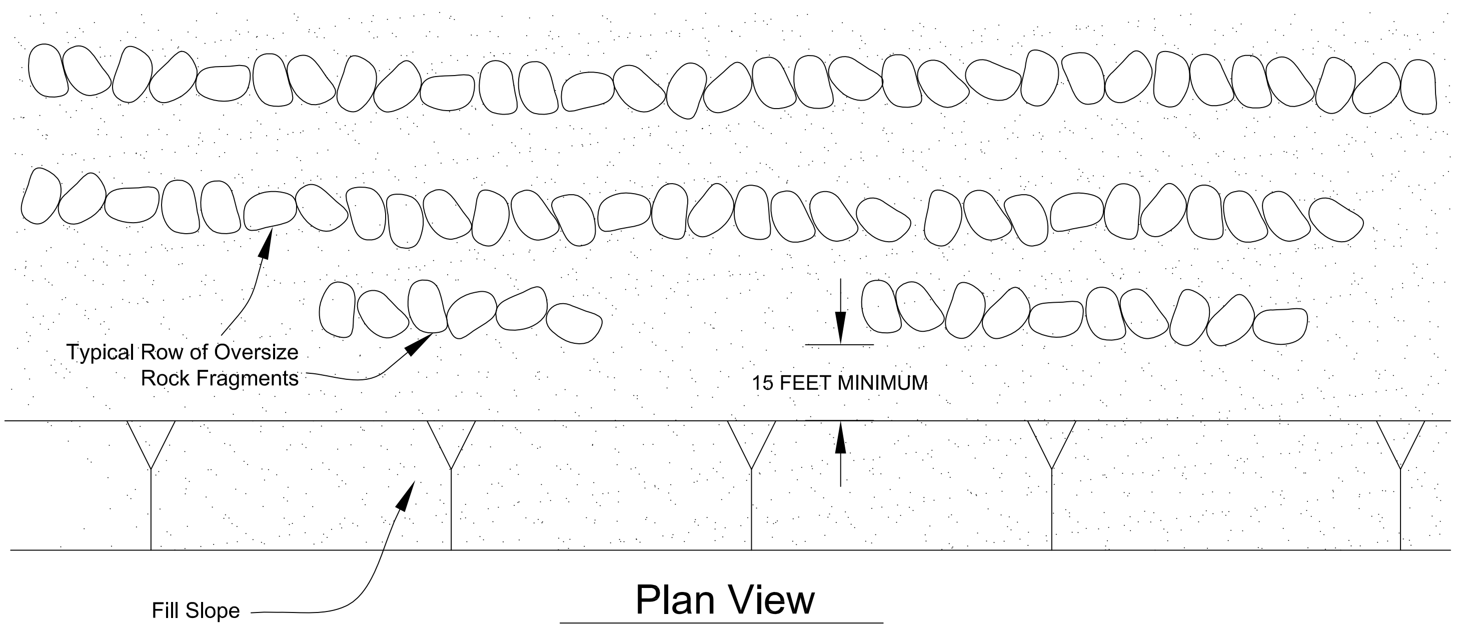
**PLATE D-7**

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL




Section View




Plan View

**PLACEMENT OF OVERSIZED MATERIAL**

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

**PLATE D-8**

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

# APPENDIX E

OSHPD

**Latitude, Longitude: 33.835521, -117.228469**


| | |
|---|---|
| **Date** | 7/25/2022, 3:18:24 PM |
| **Design Code Reference Document** | ASCE7-16 |
| **Risk Category** | III |
| **Site Class** | D - Stiff Soil |

| Type | Value | Description |
|---|---|---|
| $S_S$ | 1.5 | $MCE_R$ ground motion. (for 0.2 second period) |
| $S_1$ | 0.572 | $MCE_R$ ground motion. (for 1.0s period) |
| $S_{MS}$ | 1.5 | Site-modified spectral acceleration value |
| $S_{M1}$ | null -See Section 11.4.8 | Site-modified spectral acceleration value |
| $S_{DS}$ | 1 | Numeric seismic design value at 0.2 second SA |
| $S_{D1}$ | null -See Section 11.4.8 | Numeric seismic design value at 1.0 second SA |

| Type | Value | Description |
|---|---|---|
| SDC | null -See Section 11.4.8 | Seismic design category |
| $F_a$ | 1 | Site amplification factor at 0.2 second |
| $F_v$ | null -See Section 11.4.8 | Site amplification factor at 1.0 second |
| PGA | 0.5 | $MCE_G$ peak ground acceleration |
| $F_{PGA}$ | 1.1 | Site amplification factor at PGA |
| $PGA_M$ | 0.55 | Site modified peak ground acceleration |
| $T_L$ | 8 | Long-period transition period in seconds |
| SsRT | 1.53 | Probabilistic risk-targeted ground motion. (0.2 second) |
| SsUH | 1.639 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration |
| SsD | 1.5 | Factored deterministic acceleration value. (0.2 second) |
| S1RT | 0.572 | Probabilistic risk-targeted ground motion. (1.0 second) |
| S1UH | 0.627 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration. |
| S1D | 0.6 | Factored deterministic acceleration value. (1.0 second) |
| PGAd | 0.5 | Factored deterministic acceleration value. (Peak Ground Acceleration) |
| $C_{RS}$ | 0.934 | Mapped value of the risk coefficient at short periods |
| $C_{R1}$ | 0.912 | Mapped value of the risk coefficient at a period of 1 s |

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

**SEISMIC DESIGN PARAMETERS - 2019 CBC**

PROPOSED COMMERCIAL/INDUSTRIAL BUILDING

PERRIS, CALIFORNIA

DRAWN: OS
CHKD: RGT

SCG PROJECT
22G122-4

**PLATE E-1**

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL