ATTACHMENT D.6

GEOTECHNICAL REPORT

Project No. G3355-42-01
November 25, 2025

Santa Fe Flores LP
P.O. Box 903
Ranch Santa Fe, California 92067

Attention: Mr. Paul Mayer

Subject: UPDATE TO GEOTECHNICAL INVESTIGATION
SAN MARCOS RESIDENCES
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

References:
1. (Appendix A) *Geotechnical Investigation, San Marcos Residences, 2972 South Santa Fe Avenue, San Marcos, California*, prepared by Geocon Incorporated, dated August 12, 2024 (Project No. G3355-42-01).
2. (Appendix B) *Permanent Shoring, MSE, and Anchor Plex Wall Recommendations, San Marcos Residences, 2972 South Santa Fe Avenue, San Marcos, California*, prepared by Geocon Incorporated, dated October 17, 2024 (Project No. G3355-42-01).
3. *Tentative Subdivision Map for Condominium Purposes for 2972 & 2982 S. Santa Fe Avenue, San Marcos, California],* prepared by PLSA, undated.

Dear Mr. Mayer:

In accordance with your request, we have prepared this update to the geotechnical investigation for the subject project. Based on information provided and Reference 3, we understand the project consists of constructing 46 townhouse units within 6 buildings. We have updated the geologic map and cross sections in Reference 1 using a CAD file of Reference 1 to show the revised project limits and proposed development (see Figures 1 and 2).

Based on our review of Reference 3, the recommendations contained in References 1 and 2 remain applicable to the design and construction of the proposed project.

Should you have any questions regarding this update letter, or if we may be of further service, please contact the undersigned at your convenience.

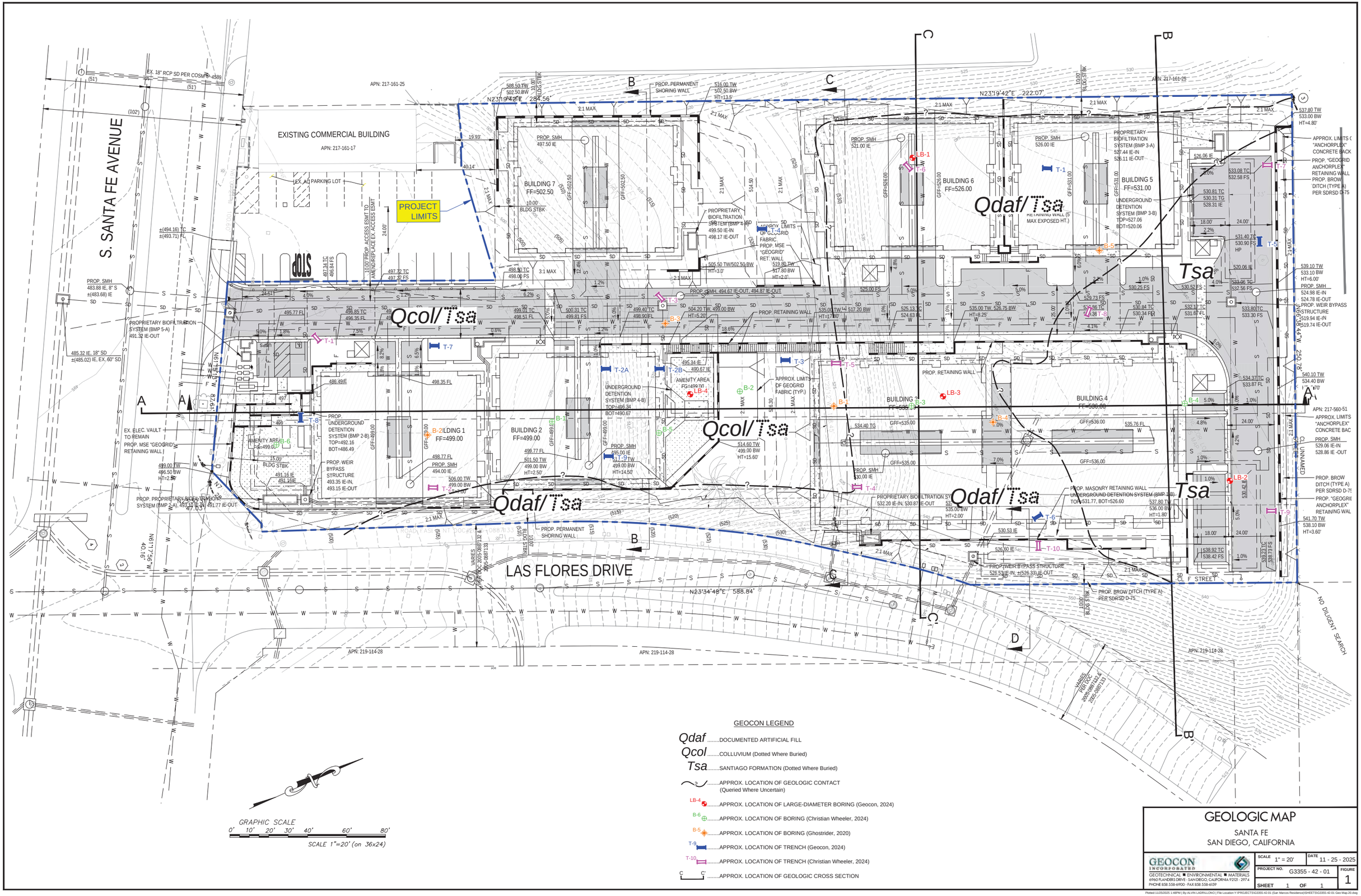
Very truly yours,

GEOCON INCORPORATED

Rodney C. Mikesell
GE 2533

RCM:arm

(e-mail) Addressee



GEOCON LEGEND

- Qdaf ..... DOCUMENTED ARTIFICIAL FILL
- Qcol ..... COLLUVIUM (Dotted Where Buried)
- Tsa ..... SANTIAGO FORMATION (Dotted Where Buried)
- ..... APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- LB-4 ..... APPROX. LOCATION OF LARGE-DIAMETER BORING (Geocon, 2024)
- B-6 ..... APPROX. LOCATION OF BORING (Christian Wheeler, 2024)
- B-5 ..... APPROX. LOCATION OF BORING (Ghostrider, 2020)
- T-9 ..... APPROX. LOCATION OF TRENCH (Geocon, 2024)
- T-10 ..... APPROX. LOCATION OF TRENCH (Christian Wheeler, 2024)
- C C' ..... APPROX. LOCATION OF GEOLOGIC CROSS SECTION

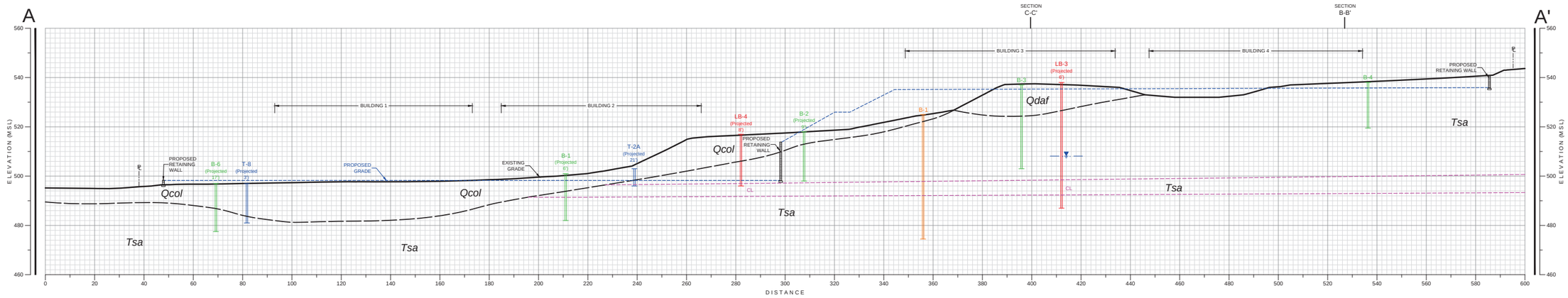
GEOLOGIC MAP

SANTA FE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE	1" = 20'
DATE	11 - 25 - 2025
PROJECT NO.	G3355 - 42 - 01
FIGURE	1
SHEET	1 OF 1

Plotted:11/25/2025 1:48PM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G3355-42-01 (San Marcos Residence)\SHEETS\G3355-42-01 Geo Map 20.dwg



GEOLOGIC CROSS-SECTION A-A'

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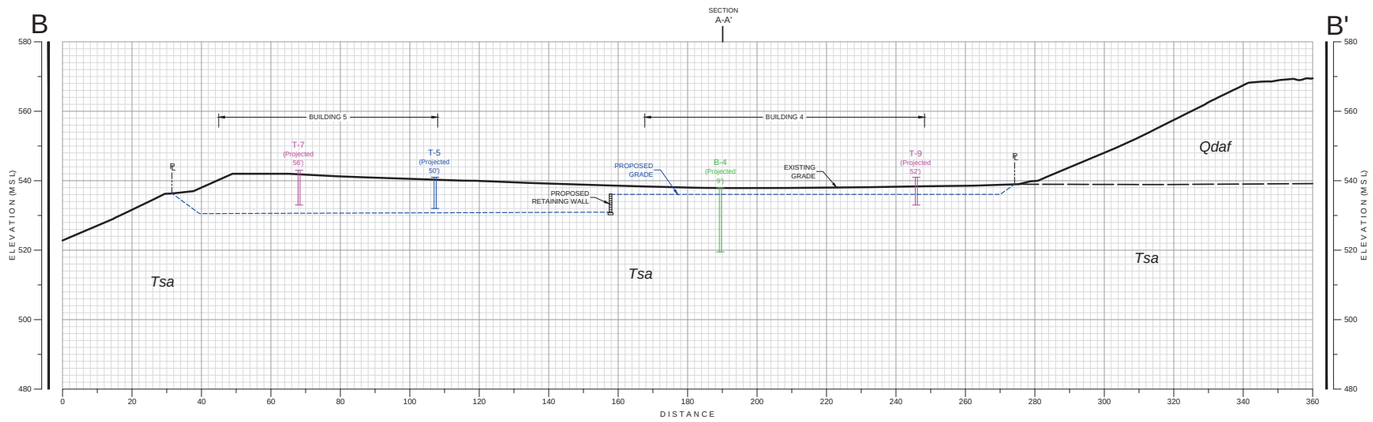

GEOLOGIC CROSS-SECTION B-B'

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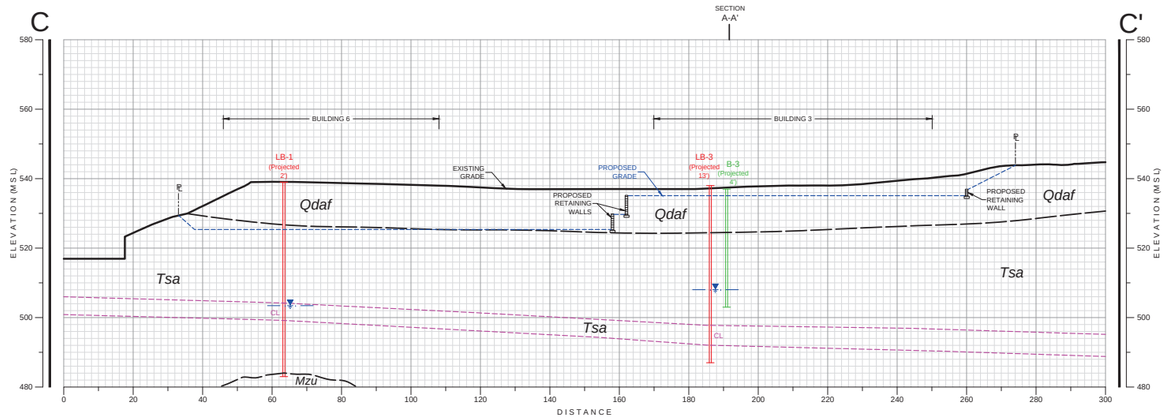


GEOLOGIC CROSS-SECTION C-C'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- Qdaf ..... DOCUMENTED ARTIFICIAL FILL
- Qcol ..... COLLUVIUM
- Tsa ..... SANTIAGO FORMATION
- Mzu ..... METAVOLCANIC AND METASEDIMENTARY ROCK
- ..... APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- LB-4 ..... APPROX. LOCATION OF LARGE-DIAMETER BORING (Geocon, 2024)
- B-6 ..... APPROX. LOCATION OF BORING (Christian Wheeler, 2024)
- ..... APPROX. LOCATION OF BORING (Ghostrider, 2020)
- T-8 ..... APPROX. LOCATION OF TRENCH (Geocon, 2024)
- T-9 ..... APPROX. LOCATION OF TRENCH (Christian Wheeler, 2024)
- ..... APPROX. LOCATION WHERE SEEPAGE ENCOUNTERED
- CL ..... FRACTURED CLAYSTONE LAYER (Queried Where Uncertain)

GEOLOGIC CROSS SECTION

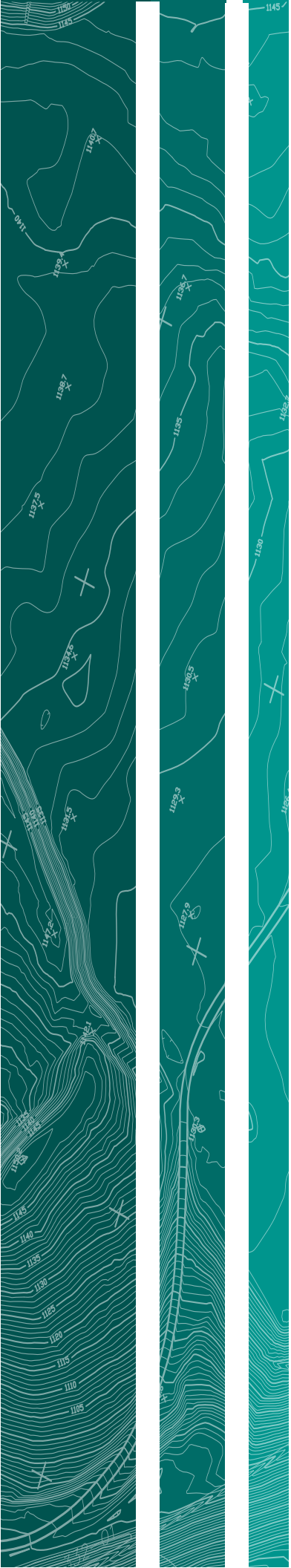
SANTA FE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE	1" = 20'	DATE	11 - 25 - 2025
PROJECT NO.	G3355 - 42 - 01	FIGURE	2
SHEET	1 OF 1		

Plotted:11/25/2025 11:10AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G3355-42-01 (San Marcos Residence)\SHEETS\G3355-42-01 XSections 20.dwg

APPENDIX A



GEOCON
INCORPORATED

GEOTECHNICAL INVESTIGATION

SAN MARCOS RESIDENCES
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

AUGUST 12, 2024
PROJECT NO. G3355-42-01

PREPARED FOR:

SANTA FE FLORES LP
RANCHO SANTA FE, CALIFORNIA

Project No. G3355-42-01
August 12, 2024

Santa Fe Flores LP
P.O. Box 903
Rancho Santa Fe, California 92067

Attention: Mr. Paul Mayer

Subject: GEOTECHNICAL INVESTIGATION
SAN MARCOS RESIDENCES
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

Dear Mr. Mayer:

In accordance with your request, and in accordance with our proposal (No. SD-24-1066-P-GT, dated June 3, 2024), we herein submit the results of our geotechnical investigation for the subject site. We performed our investigation to evaluate soil and geologic conditions and potential geologic hazards at the site and to provide geotechnical design parameters for the proposed improvements. The accompanying report contains the results of our study with conclusions and recommendations pertinent to geotechnical aspects of the project. The site is suitable for the planned development provided the recommendations in this report are followed.

If you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Jake P. Shelton
PG 10302

Rupert S. Adams
CEG 2561

Rodney C. Mikesell
GE 2533

JPS:RSA:RCM:am

(e-mail) Addressee

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report contains the results of our geotechnical investigation performed for the 2.5-acre property located north of South Santa Fe Avenue and west of North Las Flores Drive in San Marcos, California (see Vicinity Map). The purpose of this investigation is to evaluate surface and subsurface soil conditions; general site geology; and to identify geotechnical constraints that may impact the proposed development.

Vicinity Map

The scope of this investigation included reviewing readily available published geologic literature; reviewing previous geotechnical investigation reports prepared for the site (see List of References); drilling four large diameter borings; down-hole logging the large diameter borings; excavating nine exploratory test pits; laboratory analysis of soil samples collected during our field investigation; engineering analysis; and preparing this report. The approximate locations of the current and previous exploratory borings and test pits are depicted on the Geologic Map, Figure 1.

Appendix A contains the exploratory borings and test pit logs and details of the field investigation. Appendix B has the results of our laboratory testing. Appendix C contains boring logs and laboratory testing from previous geotechnical reports prepared for the property.

2. SITE AND PROJECT DESCRIPTION

The property is an approximately 2.5-acre undeveloped parcel, located north of South Santa Fe Avenue and West of North Las Flores Drive in San Marcos, California. It is bordered by commercial/industrial buildings on the north and west sides, and a convenience store at the southwest corner. The property is terraced into three relatively level pads with approximate elevations of 500 feet, 518 feet, and 535 feet Mean Sea Level (MSL).

Based on review of historical aerial photographs, farm and commercial buildings were present on the north and south sides of the property, respectively. The buildings were demolished circa 1990 and 2010. Historical aerial photographs also show several episodes of grading around 1964, 1990, 2005, and 2007. A report prepared by Christian Wheeler documents grading that took place in 2005 and 2007. The existing site conditions are shown in the figure below.

Existing Site Conditions

We understand preliminary plans are to construct six townhome buildings with paved roadways, parking areas, landscaping, hardscape, and utilities. Grading will consist of cuts and fills of approximately 16 feet. Grading will result in a fill over cut slope with a height up to approximately 36 feet. Retaining walls with heights up to approximately 10 feet are planned.

3. PREVIOUS INVESTIGATIONS

As part of this study, we reviewed geotechnical reports prepared by Ghostrider Incorporated (2020), Christian Wheeler Engineering (2022), and Nova Engineering (2016). We have included boring logs and laboratory data from these reports in Appendix C. The geologic interpretation of the site presented in this report may differ from previous reports and supersedes what is presented in the referenced geotechnical reports.

4. GEOLOGIC SETTING

The site is located in the coastal plain within the southern portion of the Peninsular Ranges Geomorphic Province of southern California. The coastal plain of San Diego County is underlain by a thick sequence of sedimentary rocks that range in age from Upper Cretaceous through the Pleistocene. The sedimentary units are deposited on Cretaceous and Jurassic age igneous and metamorphic rock. The San Diego County coastal plain is dissected by the potentially active La Nacion Fault Zone and the active Rose Canyon Fault Zone.

5. SOIL AND GEOLOGIC CONDITIONS

The site is underlain by documented artificial fill, Quaternary-age colluvium, Eocene-age Santiago Formation, and Jurassic-age rock mapped as Metasedimentary and Metavolcanic Rock (Kennedy & Tan, 2007). The soil and geologic units encountered during our investigation are described below, and on the boring logs in Appendix A. The approximate surface and subsurface distribution of soil and geologic units is shown on the Geologic Map (Figure 1) and Geologic Cross-Sections (Figure 2).

5.1. Documented Artificial Fill (Qdaf)

Documented artificial fill was encountered in borings LB-1 and LB-3, and in test pits TP-1, -5, and -6. The fill was placed during past site grading activities documented by Christian Wheeler in 2005 and 2007 (Christian Wheeler, 2022). The fill consisted of soft to stiff, damp to moist, sandy clay and medium dense, moist, clayey sand with varying amounts of gravel and possesses a “high” expansion potential (expansion index of greater than 90 and less than 130). Fill thicknesses ranged from about 1-foot to

13.5 feet. The upper 5 feet of fill is unsuitable in its current condition to support structural fill or settlement- sensitive improvements and will require remedial grading.

5.2. Colluvium (Qcol)

Colluvium was encountered in boring LB-4; and at test pits TP-2, 3, 4, 7, 8, and 9. The thickness of the colluvium ranged from about 4 to 14 feet. The colluvium consists of stiff to hard, damp to moist, sandy clay and possesses a “high” to “very high” expansion potential (expansion index of greater than 90). The upper 5 feet of colluvium is unsuitable in its current condition to support structural fill or settlement- sensitive improvements and will require remedial grading.

5.3. Santiago Formation (Tsa)

Santiago Formation was encountered in test pits TP-1 through TP- 9 at depths between about 1 and 14 feet below surface elevations; and was encountered at the ground surface at boring LB-2. Santiago Formation consists of dense to very dense, weakly to moderately cemented, silty sandstone that excavates to a damp, fine to medium grained, silty sand; and stiff to firm, weakly to moderately indurated, sandy claystone that excavated to damp, sandy clay. Based on previous laboratory testing performed by others, the clayey portion of the Santiago Formation possesses a “very high” expansion potential (expansion index of greater than 130) and may need to be undercut in structural improvement areas depending on the grading option selected (see Section 8.5).

5.4. Metavolcanic Rock (Mzu)

Metavolcanic Rock was encountered in boring LB-1 at a depth of about 55 feet below surface elevation. The rock consisted of highly weathered metavolcanic rock that excavated to a damp, fine to coarse grained silty sand. The rock is suitable to support settlement sensitive improvements.

6. GROUNDWATER

We encountered seepage in borings LB-1, -2, and -3 at depths of 35, 21, and 30 feet, respectively. It is not uncommon for groundwater or shallow seepage to develop where none previously existed. Groundwater and seepage is dependent on seasonal precipitation, irrigation, land use, among other factors, and varies as a result. Proper surface drainage will be important to the performance of the project.

7. GEOLOGIC HAZARDS

7.1. Ground Rupture

The USGS (2016) and Kennedy & Tan (2007) show that there are no mapped Quaternary faults crossing or trending toward the site. The site is not located within a currently established Alquist-Priolo Earthquake Fault Zone (CEG, 2021a). The closest active fault is the Newport-Inglewood-Rose Canyon fault zone located approximately 13 miles to the west. There are no active faults, potentially active faults, inactive faults, presumed inactive faults, or activity unknown faults at the site or trending toward the site. The risk associated with ground rupture hazard is low.

7.2. Seismicity

Considerations important in seismic design include frequency and duration of motion and soil conditions underlying the site. The seismic design of structures should be evaluated in accordance with the 2022 California Building Code currently adopted by the local agency. The risk associated with strong seismic ground motion hazard is high; however, the risk is no greater than that for the site vicinity.

7.3. Liquefaction

Considering the lack of shallow permanent groundwater and the density and age of the underlying geologic units, the risk associated with seismically induced soil liquefaction hazard is low.

7.4. Landslides

We did not observe any evidence of landsliding during our investigation. Kennedy & Tan (2007) show that there are no landslides mapped at the site or in an area that could impact the site. The risk associated with ground movement hazard due to landsliding is low.

7.5. Tsunamis and Seiches

The site is not located within a California Tsunami Hazard Area (CGS, 2021b). There are no lakes or reservoirs located near the site. The risk associated with inundation hazard due to tsunami or seiche is low.

7.6. Flooding

The site is not mapped in an area associated with flood risk (FEMA, 2012). The risk associated with flooding is low.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. General

8.1.1. It is our opinion that the site is suitable for the planned improvements, provided the recommendations presented herein are implemented during design and construction of the project.

8.1.2. The site is underlain by documented artificial fill, colluvium, Santiago Formation, and Metavolcanic Rock. The fill ranges from approximately 1 to 13.5 feet thick but may be deeper in unexplored areas of the site. Colluvium extends to depths between about 4 and 14 feet below existing grades but may be thicker in unexplored areas of the site.

8.1.3. The fill, colluvium, and clayey portions of the Santiago Formation exhibit a "high" to "very high" expansion potential. Portions of the fill and colluvium will require remedial grading and/or chemical stabilization, i.e., lime treatment.

8.1.4. No significant geologic hazards were observed or are known to exist on the site that would adversely affect site development.

8.1.5. It is our opinion that there are no active, potentially active, or inactive faults traversing the site, based on our review of Kennedy & Tan (2007), CGS (2001a), and USGS (2016).

8.1.6. We encountered seepage in borings LB-1, -2, and -3 at depths of 35, 21, and 30 feet, respectively; however, seepage could be encountered during grading operations in areas not explored, especially during the rainy season.

8.1.7 The existing highly expansive fill, colluvium and Santiago Formation can be reused as compacted fill, provided the appropriate foundation categories for shallow foundations provided herein are used in design. Alternative grading options are presented herein to mitigate the expansion potential of clayey soils, including lime stabilization and replacement of the highly expansive soils with low expansive material. Recommendations for each are presented in the grading section of this report.

8.1.8 If lime treatment is desired, a supplemental study should be performed to determine the actual amount (percentage) of lime to stabilize the near surface clayey materials. Typically,

5 to 6 percent of lime is needed to stabilize the soil.

8.1.9. Depending on the grading option chosen, the planned structures can be supported on a conventional shallow foundation system or post-tensioned system bearing on properly compacted fill soil or Santiago Formation.

8.1.10. Proper drainage should be maintained in order to preserve the engineering properties of the fill. Recommendations for site drainage are provided herein.

8.1.11. Subsurface conditions observed may be extrapolated to reflect general soil/geologic conditions; however, some variations in subsurface conditions between boring and trench locations should be anticipated.

8.2. Excavation and Soil Characteristics

8.2.1. Excavation of the in-situ soil should be possible with moderate to heavy effort using conventional heavy-duty equipment. Excavation of the formational materials will require very heavy effort and may generate oversized material (material greater than 12-inches in dimension) using conventional heavy-duty equipment during the grading operations. Oversized material can be incorporated into landscape use or deep compacted fill areas, if available. The grading and improvement contractors should review this report and evaluate the proper equipment to use for the planned excavations.

8.2.2. The soil encountered in the field investigation is considered “expansive” (expansion index [EI] greater than 20) as defined by 2022 California Building Code (CBC) Section 1803.5.3. The following table presents soil classifications based on the expansion index. Based on laboratory testing and our experience in the site vicinity, we expect the onsite soil possesses a “high” to “very high” expansion potential (EI greater than 90).

EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	ASTM D 4829 Expansion Classification	2022 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.3. We performed laboratory tests on samples of the site soils to evaluate the percentage of water-soluble sulfate content. Appendix B presents results of the laboratory water-soluble sulfate content tests. The test results indicate the on-site soils at the locations tested possess a "S0" sulfate exposure to concrete structures as defined by 2022 CBC Section 1904 and ACI 318-19 Chapter 19. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

8.2.4. We tested a soil sample for pH and resistivity and chloride concentrations to aid in evaluating the corrosion potential. Appendix B presents the laboratory test results.

8.2.5. Geocon does not practice in the field of corrosion engineering; therefore, further evaluation by a corrosion engineer may be needed if improvements susceptible to corrosion are planned.

8.3. Slope Stability

8.3.1 We performed slope stability analyses using the two-dimensional computer program GeoStudio created by Geo-Slope International Ltd. Output of the computer program including the calculated factor of safety and the failure surface is presented in Appendix D.

8.3.2 Our calculations indicate the proposed and existing slopes, constructed of on-site materials, should have calculated factors of safety (FOS) of at least 1.5 under static conditions, for both deep-seated failure and shallow sloughing conditions when the recommendations of this report are followed. The results of our slope stability analysis are presented in Appendix D.

8.3.3 We recommend the construction of a stability fill where Santiago Formation or highly expansive soils are exposed on proposed slope faces. The stability fill should have a minimum width of 15 feet measured from the slope face. A typical buttress/stability fill detail is presented in Section 8.5.

8.3.4 All cut slope excavations should be observed during grading by an engineering geologist to verify that soil and geologic conditions do not differ significantly from those anticipated.

8.3.5 Slopes should be landscaped with drought-tolerant vegetation having variable root depths and requiring minimal landscape irrigation. In addition, slopes should be drained and properly maintained to reduce erosion.

8.4. Subdrains

8.4.1. With the exception of subdrains for retaining walls and stability fills, no other subdrains will be required.

8.5. Grading Recommendations

8.5.1. Grading should be performed in accordance with the recommendations provided in this report, the Recommended Grading Specifications contained in Appendix E, and the local Grading Ordinance. Geocon should observe grading operations on a full-time basis and provide compaction testing and observation during the fill placement.

8.5.2. A preconstruction conference should be held at the site with the city inspector, owner, grading and underground contractors, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.5.3. Site preparation should begin with the removal of deleterious material, construction debris, and vegetation. The depth of vegetation removal should be such that soil exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site. Concrete or asphalt should not be mixed with the fill soil unless approved by the geotechnical engineer.

8.5.4. Abandoned foundations and buried utilities should be removed, and the resultant excavations or trenches backfilled with properly compacted soil as part of the remedial grading.

8.5.5. **Option 1 – Use of On-Site Soil and Foundations for Expansive Soils:** Fill and colluvium should be removed to a depth of at least 5 feet below existing grade in fill areas and 5 feet below proposed grade in areas of cut. In building pad areas, removals must result in at least 2 feet of compacted fill below building foundations. The existing fill and colluvium can be used as compacted fill, provided the recommendations for “Foundations for Expansive Soils” are utilized in design and construction. Where the Santiago Formation is encountered in the excavation, the removal can be terminated (exception where undercutting for a cut to fill

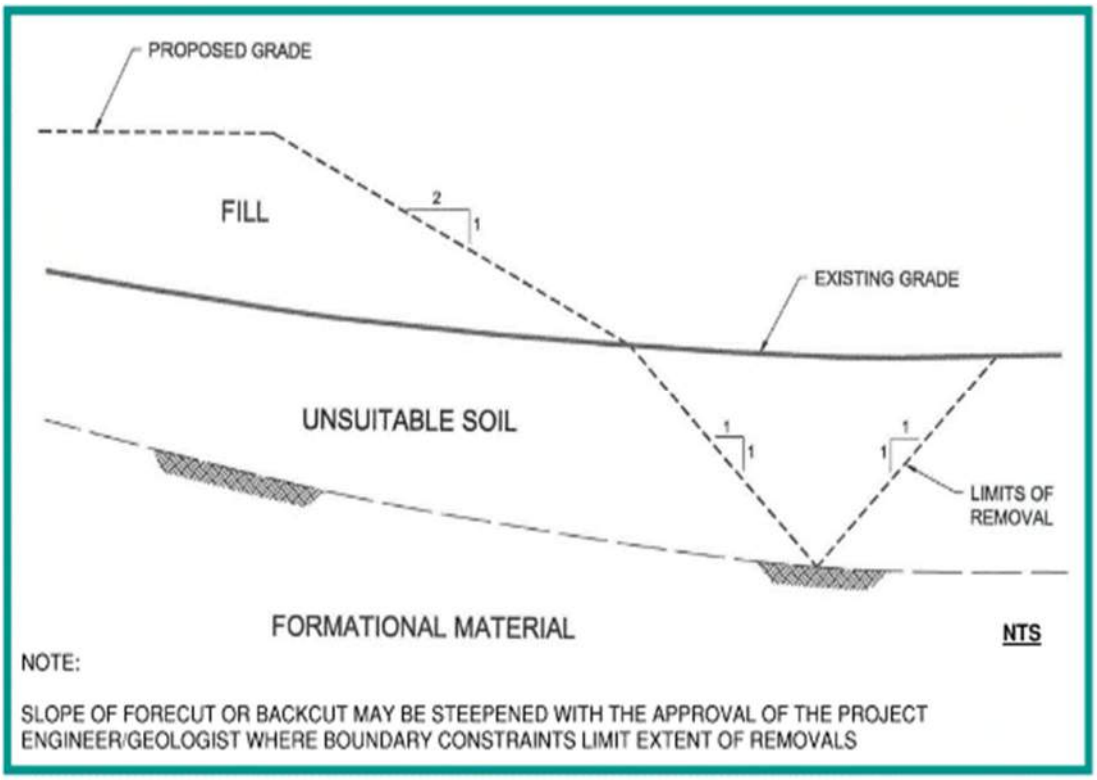
transition is required). Actual removal depths should be determined during grading by a representative of Geocon Incorporated.

8.5.6. **Option 2 – Lime Treatment of On-Site Expansive Soils:** Existing soils (fill, colluvium and Santiago Formation) should be removed to a depth of at least 5 feet below existing or proposed grade, whichever is deeper and replaced with lime treated soil. In building pad areas, the removals and lime treatment must extend to a depth of at least 2 feet below building foundations. For surface improvements outside of building pads, lime treatment should extend to at least 3 feet below finish subgrade. Outside of building pads, the Santiago Formation below 3 feet from subgrade can be left in-place. Additional recommendations for lime treatment are provided in Section 8.6.

8.5.7. **Option 3 – Removal and Replacement of Expansive Soils**: Existing soils (fill, colluvium and Santiago Formation) should be removed to a depth of at least 5 feet below existing or proposed grade, whichever is deeper. In building pad areas, the removals must extend to a depth of at least 2 feet below building foundations. The removals should be replaced with imported soil possessing a “very low” to “medium” expansive potential (Expansion Index of 90 or less). For surface improvements outside of building pads, replacement of imported soil should extend to at least 3 feet below finish subgrade. Outside of building pads, the Santiago Formation below 3 feet from subgrade can be left in-place.

8.5.8. Prior to fill being placed, the existing ground surface should be scarified, moisture conditioned as necessary, and compacted to a depth of at least 12 inches. The site should then be brought to final subgrade elevations with fill compacted in layers. Layers of fill should be about 6 to 8 inches in loose thickness and no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content in accordance with ASTM Test Procedure D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing fill. Overly wet materials will require drying and/or mixing with drier soils to facilitate proper compaction.

8.5.9. Where not restricted by property lines, protected open space, or exiting improvements, removal of compressible surficial soils should extend beyond the toe of fill slopes a horizontal distance equal to the depth of the remedial removal, in accordance with the typical detail shown below.



8.5.10. Overly wet soils, if encountered, will require drying and/or mixing with drier soils to facilitate proper compaction.

8.5.11. All cleanouts performed during remedial grading should be observed by a representative of Geocon Incorporated prior to placement and compaction of fill. The limits and depth of remedial cleanouts should be surveyed by the Project Civil Engineer.

8.5.12. If Option 1 grading is selected, building pads with cut-fill transitions should be undercut at least 5 feet, sloped 1 percent to the adjacent street or deepest fill, and replaced with properly compacted fill to reduce the potential for differential settlement. The grading should be performed such that the proposed foundation for the structures will bear entirely on either properly compacted fill or on native formational soil. Footings for individual buildings should not be founded on both compacted fill and native formation.

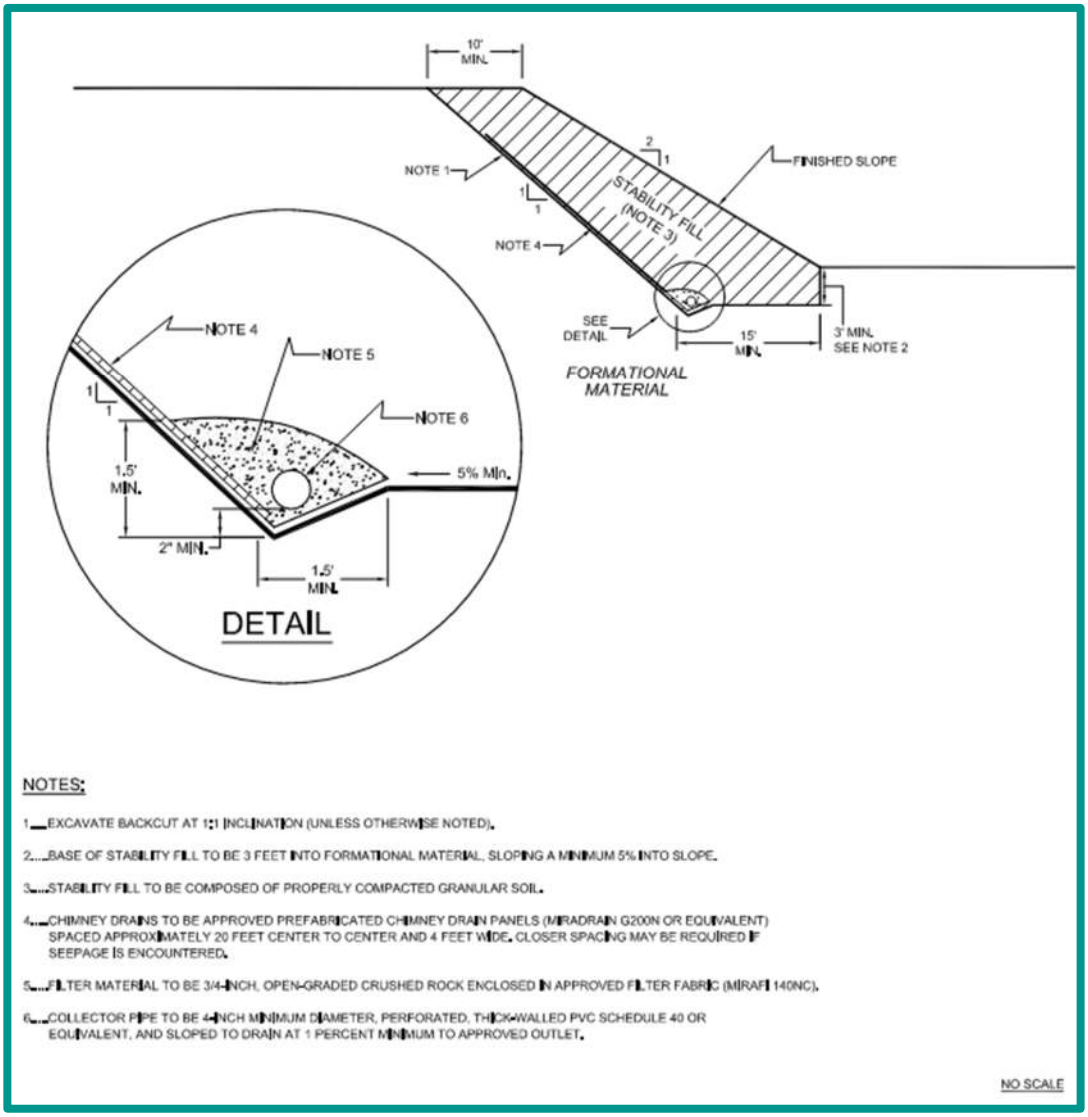
8.5.13. The following table provides a summary of the grading recommendations.

SUMMARY OF GRADING RECOMMENDATIONS

Area	Grading Recommendations
All Improvement Areas	**Option 1**: Remove and recompact the upper 5 feet of fill and colluvium below existing grading in fill areas and 5 feet below proposed grade in cut areas. Foundations for expansive soils should be used in design and construction. **Option 2:** Existing soils (fill, colluvium and Santiago Formation) should be removed to a depth of at least 5 feet below existing or proposed grade, whichever is deeper and replaced with lime treated soil. In surface improvement areas outside of the building pad, the treatment zone can be reduced to 3 feet, although the remedial removal of 5 feet still applies, but can be terminated where the Santiago Formation is encountered below 3 feet. **Option 3:** Replace the upper 5 feet of soils below existing or planned grades (whichever is deeper) with import select soil possessing "very low" to "medium" expansion potential. In surface improvement areas outside of the building pad, the import zone can be reduced to 3 feet, although the remedial removal of 5 feet still applies, but can be terminated where the Santiago Formation is encountered below 3 feet.
Slopes	Cut slopes should be observed during grading by an engineering geologist. Stability fills are required for cut slopes exposing the Santiago Formation. The need for slope stabilization measures should be evaluated during slope excavation.
Building Pads	Footings founded on compacted fill. Undercutting required where cut to fill transition occurs.
Lateral Grading Limits	10 Feet Outside of Building Pads
	5 Feet Outside of Surface Improvement Areas
Exposed Bottoms of Excavations	Scarify Upper 12 Inches

8.5.14. Cut slope excavations including fill slope shear keys should be observed during grading operations to check that soil and geologic conditions do not differ significantly from those expected.

8.5.15. Cut slope excavations exposing the Santiago Formation or highly expansive soils should be constructed in accordance with the stability detail shown below.



8.5.16 Construction of fill slopes should begin with excavation of a fill slope keyway in accordance with the Fill Slope Keyway detail shown in the *Recommended Grading Specifications* in Appendix E.

8.5.17 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular "soil" fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of less than 90 or at least 35 percent sand size particles should be acceptable as "granular" fill. Soils of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength.

8.5.18. Fill slopes should be overbuilt at least 2 feet and cut back or be compacted by backrolling with a loaded sheepsfoot roller during grading at vertical intervals not to exceed 4 feet. The slopes should be track-walked at the completion of each slope with a D8 or larger bulldozer such that the fill is compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content to the face of the finished slope.

8.5.19. Imported fill should consist of the characteristics presented in the following table. Geocon Incorporated should be notified of the import soil source and should perform laboratory testing of import soil prior to its arrival at the site to determine its suitability as fill material.

SUMMARY OF IMPORT FILL RECOMMENDATIONS

Soil Characteristic	Values
Expansion Potential	"Very Low" to "Medium" (Expansion Index of 90 or less)
Particle Size	Maximum Dimension Less Than 3 Inches
	Generally Free of Debris

8.6. In-Situ Lime-Treated Highly Expansive Soils (Option 2 Grading)

8.6.1. Existing highly to very highly expansive soils should be removed to the depths discussed in Section 8.5.

8.6.2. Geocon Incorporated should be retained during the overexcavation operations on a full-time basis to identify areas where loose, soft, or dry materials extend deeper than the recommended overexcavation and may require additional remedial grading. The actual depth of removal should be determined during grading operations.

8.6.3. The excavation bottom should be scarified to a depth of 12 inches, moisture conditioned to approximately 3 to 6 percent above optimum moisture content, and recompacted to a minimum relative compaction of 90 percent in accordance with ASTM D 1557.

8.6.4. Soils replaced within the excavation should be treated with lime. A supplemental study will be needed to establish the optimal percentage of lime needed to effectively treat the soil. For preliminary estimates, the soil should then be mixed with approximately 5 percent quick lime by dry weight, uniformly moisture conditioned to 1 to 3 percent above optimum

moisture content, placed in 6- to 8-inch-thick loose layers, and compacted to a relative compaction of at least 90 percent.

8.6.5. A supplemental study, including laboratory water-soluble sulfate content, R-value, and plasticity index testing, will be required to determine the actual percentage of quick lime required to stabilize the expansive soil.

8.6.6. The lime-treated soils should be compacted in accordance with the recommendations contained in Section 24-2 of the 2018 *Caltrans Manual*, Section 301-5 of the 2021 *Standard Specifications for Public Works (Greenbook)*, and the Section 301 of the *2021 City of San Diego Standard Specifications For Public Works Construction (The Whitebook)*.

8.6.7. Due to the recommended lime content and clayey nature of the soils, difficult compaction should be expected. The lime treatment option will substantially reduce the potential for expansion of the soil at the site. Minor expansion-related movement of the hardscape may still occur. Pavement section designs for driveway and parking areas using lime-treated subgrade soils have been included herein.

8.7. Temporary Excavation Slopes

8.7.1. The recommendations included herein are provided for stable excavations. It is the contractor's responsibility to ensure all excavations, temporary slopes, and trenches are properly constructed and maintained in accordance with applicable OSHA guidelines to maintain safety and the stability of the excavations and adjacent improvements. These excavations should not be allowed to become saturated or to dry out. Surcharge loads should not be permitted to a distance equal to the height of the excavation from the top of the excavation. The top of the excavation should be a minimum of 15 feet from the edge of existing improvements. Excavations steeper than those recommended or closer than 15 feet from an existing surface improvement should be shored in accordance with applicable OSHA codes and regulations. Geocon Incorporated should be contacted to provide vertical shoring recommendations, if needed.

8.8. Seismic Design Criteria – 2022 California Building Code

8.8.1. The following table summarizes site-specific design criteria obtained from the 2022 California Building Code (CBC; Based on the 2018 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. We used SEAOC (2020)

to calculate the seismic design parameters. The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2022 CBC and Table 20.3-1 of ASCE 7-16. The values presented herein are for the risk-targeted maximum considered earthquake (MCE_R). Sites designated as Site Class D, E and F may require additional analyses if requested by the project structural engineer and client.

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2022 CBC Reference
Site Class	C	Section 1613.2.2
MCER Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.901g	Figure 1613.2.1(1)
MCER Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.332g	Figure 1613.2.1(2)
Site Coefficient, F_A	1.2	Table 1613.2.3(1)
Site Coefficient, F_V	1.5	Table 1613.2.3(2)
Site Class Modified MCER Spectral Response Acceleration (short), S_{MS}	1.081g	Section 1613.2.3 (Eqn 16-36)
Site Class Modified MCER Spectral Response Acceleration – (1 sec), S_{M1}	0.499g	Section 1613.2.3 (Eqn 16-37)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.721g	Section 1613.2.4 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.332g	Section 1613.2.4 (Eqn 16-39)

8.8.2. The following table presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

ASCE 7-16 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Mapped MCEG Peak Ground Acceleration, PGA	0.389g	Figure 22-7
Site Coefficient, F_{PGA}	1.2	Table 11.8-1
Modified MCEG Peak Ground Acceleration, P_{GAM}	0.467g	Section 11.8.3 (Eqn 11.8-1)

8.8.3. Conformance to the criteria in this section for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur in

the event of a large earthquake. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.8.4. The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category II and a Seismic Design Category D. The following table presents a summary of the risk categories in accordance with ASCE 7-16.

ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

8.9 Foundation and Concrete Slab Recommendations for Expansive Soils (Option 1 Grading)

8.9.1 The foundation recommendations herein are for expansive soils (Option 1 Grading). The proposed structures should be supported on a post-tensioned foundation system.

8.9.2 The post-tensioned systems (foundation dimensions and embedment depths, slab thickness and steel placement) should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC 10.5-12 *Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive Soils* or *WRI/CRSI Design of Slab-on-Ground Foundations*, as required by the 2022 California Building Code Section 1808.6.2. Although this procedure was developed for expansive soil conditions, it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should

incorporate the geotechnical parameters presented in the following table based on the guidelines presented in the PTI DC 10.5 design manual.

POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI) DC10.5 Design Parameters	Foundation Category
	IV
Thornthwaite Index	-20
Equilibrium Suction	3.9
Edge Lift Moisture Variation Distance, e_M (Feet)	3.8
Edge Lift, y_M (Inches)	2.19
Center Lift Moisture Variation Distance, e_M (Feet)	7.3
Center Lift, y_M (Inches)	1.05

8.9.3 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

8.9.4 If the structural engineer proposes a post-tensioned foundation design method other than PTI, DC 10.5:

- The deflection criteria presented herein are still applicable.
- Interior stiffener beams should be used.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depth should be at least 30-inches. The embedment depth should be measured from the lowest adjacent pad grade.

8.9.5 Our experience indicates post-tensioned slabs may be susceptible to excessive edge lift from tensioning, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

8.9.6 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints form between the

footings/grade beams and the slab during the construction of the post-tension foundation system unless designed by the structural engineer.

8.9.7 Isolated footings outside of the slab area, if present, should have the minimum embedment depth of 30 inches. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams in both directions. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.

8.9.8 Interior stiffening beams should be incorporated into the design of the foundation system in accordance with the PTI design procedures.

8.9.9 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

8.9.10 The following table provides additional foundation design recommendations.

ADDITIONAL FOUNDATION RECOMMENDATIONS

Parameter	Value
Allowable Bearing Capacity	2,000 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Allowable Bearing Capacity	4,000 psf
Estimated Total Settlement	1 Inch
Estimated Differential Settlement	1 Inch in 40 Feet

8.9.11 The bearing capacity values presented herein are for dead plus live loads and may be increased by one-third for transient loads due to wind or seismic forces.

8.9.12 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

8.10 Foundation and Concrete Slab Recommendations (Options 2 and 3 Grading)

8.10.1 The foundation recommendations herein assume grading under either Option 2 or 3 is performed and the buildings are underlain by "very low" to "medium" expansive soils (EI of 90 or less).

8.10.2 The proposed structure can be supported on a shallow foundation system founded entirely on properly compacted fill. Foundations for the structure should consist of continuous strip footings and isolated spread footings. The following table provides a summary of the foundation design recommendations.

SUMMARY OF FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Continuous Foundation Width, W_C	12 inches
Minimum Isolated Foundation Width, W_I	24 inches
Minimum Foundation Depth, D	24 Inches Below Lowest Adjacent Grade
Minimum Concrete Reinforcement	4 No. 5 Bars, 2 at the Top and 2 at the Bottom
Allowable Bearing Capacity (Compacted Fill)	2,000 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Allowable Bearing Capacity (Compacted fill)	4,000 psf
Estimated Total Static Settlement	1-Inch
Estimated Differential Static Settlement	¾ Inch in 40 Feet
Footing Size Used for Settlement	6-Foot Square
Design Expansion Index	90 or less

8.10.3 The bearing capacity values presented herein are for dead plus live loads and may be increased by one-third for transient loads due to wind or seismic forces.

8.10.4 We should observe the foundation excavations prior to the placement of reinforcing steel to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. Foundation modifications may be required if unexpected soil conditions are encountered.

8.10.5 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

8.10.6 Interior concrete slabs for the structures should be constructed in accordance with the table below.

MINIMUM INTERIOR CONCRETE-SLAB-ON-GRADE RECOMMENDATIONS

Parameter	Value
Minimum Concrete Slab Thickness	5 inches
Minimum Concrete Reinforcement	No. 3 Bars 18 Inches on Center, Both Directions
Typical Slab Underlayment	3 to 4 Inches of Sand/Gravel/Base
Design Expansion Index	90 or less

8.10.7 The concrete-slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting expected loads.

8.10.8 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI) DC10.5 as required by the 2022 California Building Code Section 1808.6.2. Although this procedure was developed for expansive soil conditions, we understand it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented in the following table based on the guidelines presented in the PTI, DC10.5 design manual.

POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI) DC10.5 Design Parameters	Value
Thornthwaite Index	-20
Equilibrium Suction	3.9
Edge Lift Moisture Variation Distance, e_M (feet)	4.9
Edge Lift, y_M (inches)	1.58
Center Lift Moisture Variation Distance, e_M (feet)	9.0
Center Lift, y_M (inches)	0.66

8.10.9 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

8.10.10 If the structural engineer proposes a post-tensioned foundation design method other than the 2022 CBC (PTI DC10.5):

- The criteria presented in the above Table are still applicable.
- Interior stiffener beams should be used.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 24 inches. The embedment depths should be measured from the lowest adjacent pad grade.

8.10.11 Our experience indicates post-tensioned slabs are susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. Current PTI design procedures primarily address the potential center lift of slabs but, because of the placement of the reinforcing tendons in the top of the slab, the resulting eccentricity after tensioning reduces the ability of the system to mitigate edge lift. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

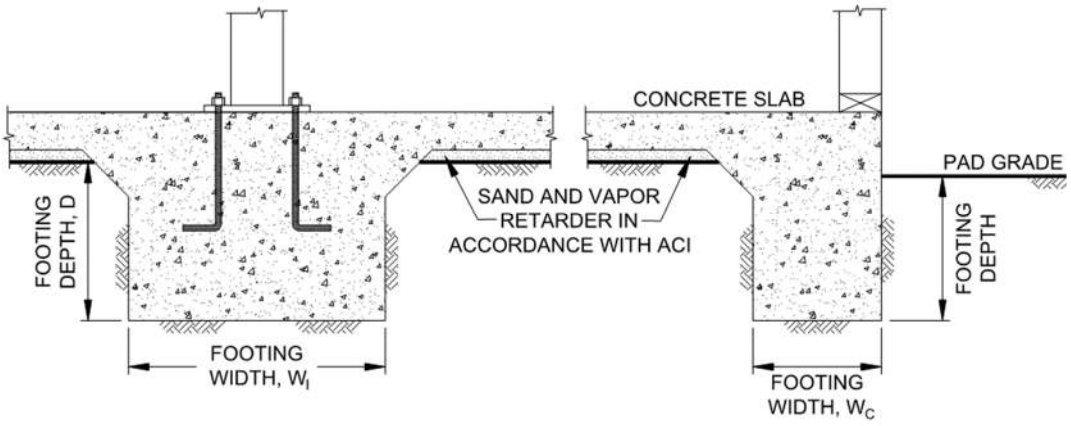
8.10.12 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints form between the footings/grade beams and the slab during the construction of the post-tension foundation system unless designed by the project structural engineer.

8.10.13 Isolated footings, if present, should have the minimum embedment depth and width recommended for conventional foundations. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams in both directions.

8.10.14 Consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness.

8.11 Foundations Recommendations – General (Applicable to Grading Options 1 through 3)

8.11.1. The foundations should be embedded in accordance with the recommendations herein and the Wall/Column Footing Dimension Detail. The embedment depths should be measured from the lowest adjacent pad grade for both interior and exterior footings. Footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope (unless designed with a post-tensioned foundation system as discussed herein).



Wall/Column Footing Dimension Detail

8.11.2 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

8.11.3 The project foundation engineer, architect, or developer should determine the thickness of the slab bedding. It is common to have 3 to 4 inches of sand in the southern California region. We should be contacted to provide recommendations if the bedding sand is thicker than 6 inches.

8.11.4 The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab. The foundation design engineer should present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the specifications presented on the foundation plans.

8.11.5 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

8.11.6 Where buildings or other improvements are planned near the top of a slope 3:1 (horizontal:vertical) or steeper, special foundation and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high or cut slopes regardless of height, footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.
- When located next to a descending 3:1 (horizontal:vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to H/3 (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. A post-tensioned slab and foundation system or mat foundation system can be used to reduce the potential for distress in the structures associated with strain softening and lateral fill extension. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.
- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.
- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height, and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.

- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures which would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

8.11.7 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present), differential settlement of fill soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

8.11.8 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute when establishing crack-control spacing. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

8.11.9 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

8.11.10 We should observe the foundation excavations prior to the placement of reinforcing steel to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. If unexpected soil conditions are encountered, foundation modifications may be required.

8.12 Exterior Concrete Flatwork

8.12.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations presented in the following table. The recommended steel reinforcement would help reduce the potential for cracking. Even if these recommendations are followed, concrete flatwork placed on expansive soils could potential heave resulting in panel uplift and cracking.

MINIMUM CONCRETE FLATWORK RECOMMENDATIONS

Expansion Index, EI	Minimum Steel Reinforcement* Options	Minimum Thickness
EI ≤ 90	6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh	4 inches
	No. 3 Bars 18 inches on center, Both Directions	
EI> 90	No. 4 Bars 18 inches on center, Both Directions	5 Inches
	8 inch Thickened Edge that tapers back to 5 inches at a horizontal distance of 2 feet	

*In excess of 8 feet square.

8.12.2 The subgrade soil should be properly moisturized and compacted prior to the placement of steel and concrete. The subgrade soil should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content in accordance with ASTM D 1557.

8.12.3 Where concrete is placed on expansive soils, the subgrade should be moisture conditioned to 5 to 8 percent above optimum moisture content and compacted to at least 88 percent relative compaction. The subgrade moisture content should be maintained until concrete is placed. The concrete should not be allowed to dry prior to placing concrete.

8.12.4 Concrete flatwork adjacent to landscape areas is not recommended for Option 1 grading. Where this cannot be avoided, the sidewalk should have a turn down edge that extends at least 12 inches into the subgrade.

8.12.5 Even with the incorporation of the recommendations of this report, the exterior concrete flatwork has a potential to experience some uplift due to expansive soil beneath grade. The steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork. Periodic maintenance should be expected due to the presence of expansive soils.

8.12.6 Concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted

in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be verified prior to placing concrete. Base materials will not be required below concrete improvements.

8.12.7 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.12.8 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.13. Retaining Walls

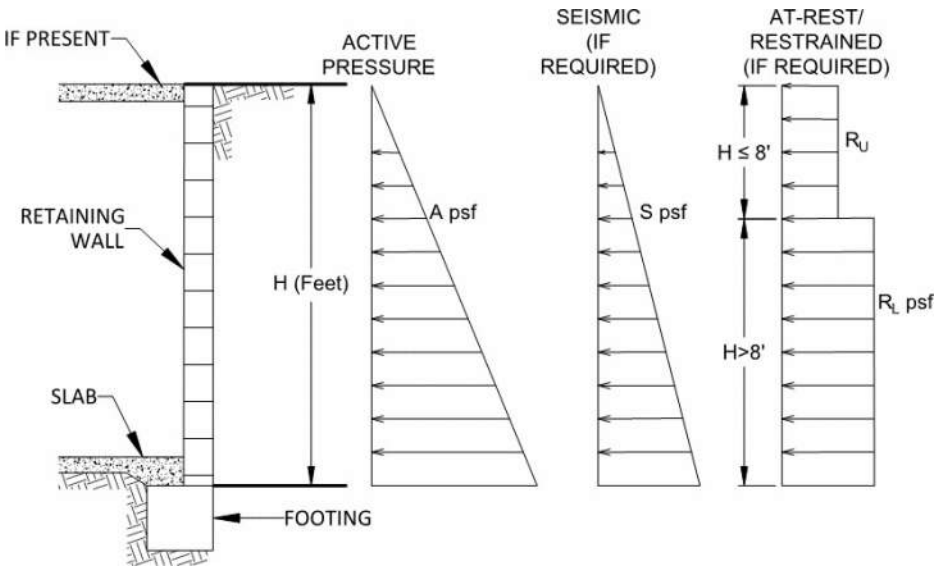
8.13.1. Walls that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall should be designed using the values presented on the following table. Soil with an expansion index (EI) greater than 50 should not be used as backfill soil behind retaining walls. **Soil with an expansion index of 50 or less will need to be imported**.

RETAINING WALL DESIGN RECOMMENDATIONS

Parameter	Value
Active Soil Pressure, A (Level Backfill)	35 pcf EFD* H ft
Active Soil Pressure, A (2:1 max Sloping Backfill)	50 pcf EFD* H ft
Seismic Pressure, S	15H psf
At-Rest/Restrained Walls Additional Uniform Pressure (0 to 8 Feet High)	7H psf
At-Rest/Restrained Walls Additional Uniform Pressure (8+ Feet High)	13H psf
Expansion Index for Imported Soil	EI $\leq$ 50

*H equals the height of the retaining portion of the wall in feet.
EFD = equivalent fluid density

8.13.2. The project retaining walls should be designed as shown in the Retaining Wall Loading Diagram.



Retaining Wall Loading Diagram

8.13.3. Where walls are restrained from movement at the top (at-rest condition), an additional uniform pressure should be applied to the wall.

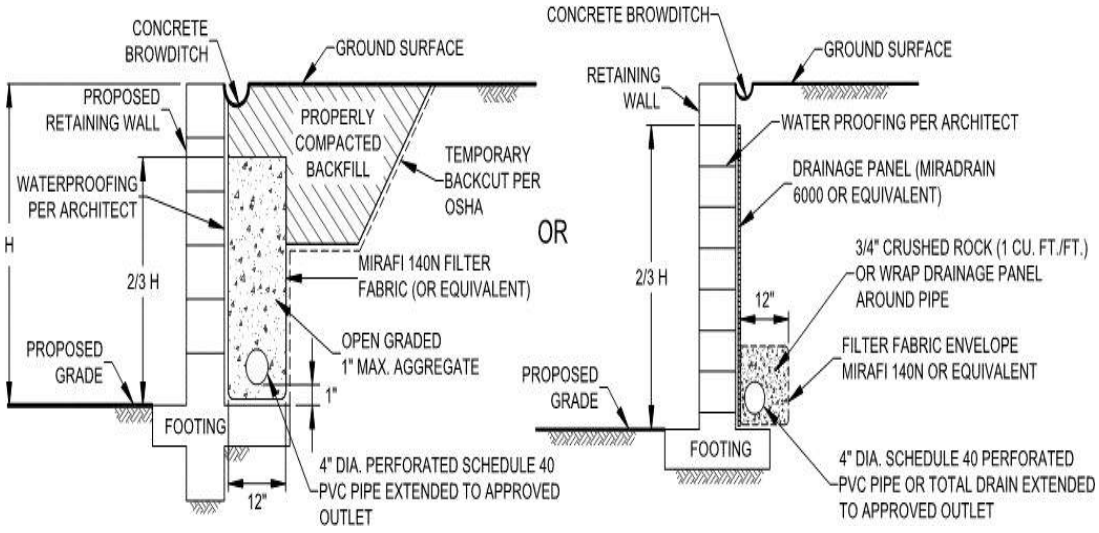
8.13.4. The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613 of the 2022 CBC or Section 11.6 of ASCE 7-16. For structures assigned to Seismic Design Category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section

1803.5.12 of the 2022 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall.

8.13.5. Retaining walls should be designed to ensure stability against overturning sliding, and excessive foundation pressure. Where a keyway is extended below the wall base with the intent to engage passive pressure and enhance sliding stability, it is not necessary to consider active pressure on the keyway.

8.13.6. Drainage openings through the base of the wall (weep holes) should not be used where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall.

8.13.7. The recommendations herein assume a properly compacted, granular (EI of 50 or less), free-draining backfill soil and that no hydrostatic forces or imposed surcharge load. The retaining wall should be properly drained as shown in the Typical Retaining Wall Drainage Detail. If conditions different than those described are expected, or if specific drainage details are desired, Geocon should be contacted for additional recommendations.



Typical Retaining Wall Drainage Detail

8.13.8. In general, wall foundations should be designed in accordance with the following table. The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, retaining wall foundations should be deepened such that

the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

SUMMARY OF RETAINING WALL FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Retaining Wall Foundation Width	12 inches
Minimum Retaining Wall Foundation Depth	24 Inches (Option 1 Grading)
	12 inches (Option 2 and 3 Grading)
Minimum Concrete Reinforcement	Per Structural Engineer
Allowable Bearing Capacity	2,000 psf
Bearing Capacity Increase	500 psf per Foot of Depth
	300 psf per Foot of Width
Maximum Allowable Bearing Capacity	4,000 psf
Estimated Total Settlement	1 Inch
Estimated Differential Settlement	1 Inch in 40 Feet

8.13.9. The recommendations presented herein are applicable for the design of rigid concrete or masonry retaining walls. Should other types of walls (such as mechanically stabilized earth [MSE] walls) be planned, Geocon should be consulted for additional recommendations.

8.13.10. Soil contemplated for use as retaining wall backfill, including imported soils, should be identified in the field prior to backfill. At that time, Geocon should be provided samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength.

8.13.11. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs are used

8.14. Lateral Loading

8.14.1. The following table should be used to help design the proposed structures and improvements to resist lateral loads for the design of footings or shear keys. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the

surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

SUMMARY OF LATERAL LOAD DESIGN RECOMMENDATIONS

Parameter	Value
Passive Pressure Fluid Density	300 pcf
Passive Pressure Fluid Density Adjacent to and/or on Descending Slopes	150 pcf
Coefficient of Friction (Concrete and Soil)	0.35
Coefficient of Friction (Along Vapor Barrier)	0.2 to 0.25*

*Per manufacturer's recommendations.

8.14.2. The passive and frictional resistant loads can be combined for design purposes. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

8.15 Preliminary Pavement Recommendations

8.15.1 We calculated the flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) using an estimated Traffic Index (TI) of 5.0, 5.5, 6.0, and 7.0 for parking stalls, driveways, medium truck traffic areas, and heavy truck traffic areas, respectively. The project civil engineer should review the pavement designations to determine appropriate locations for pavement thickness. The final pavement sections should be based on the R-Value of the subgrade soil encountered at final subgrade elevation. We have assumed an R-Value of 5 for untreated, subgrade soils, 15 for imported subgrade soils with an expansion index less than 90, 50 for lime-treated subgrade soils, and 78 for base materials, for the purposes of this preliminary analysis. The table below presents the preliminary flexible pavement sections.

PRELIMINARY FLEXIBLE PAVEMENT SECTION

Location	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Parking Stalls for Automobiles and Light-Duty Vehicles	5.0	5	3	10
		15	3	8
		50	3	4
Driveways for Automobiles and Light-Duty Vehicles	5.5	5	3	12
		15	3	10
		50	3	4
Medium Truck Traffic Areas	6.0	5	3.5	13
		15	3.5	11
		50	3.5	4
Driveways for Heavy Truck Traffic	7.0	5	4	16
		15	4	13
		50	4	5

8.15.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

8.15.3 Aggregate base should conform to Section 26-1.02B of the *Standard Specifications for The State of California Department of Transportation (Caltrans)* with a ¾-inch maximum size aggregate. Asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook)*.

8.15.4 We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330-21 *Commercial Concrete Parking Lots and Site Paving Design and Construction – Guide.* The table below provides the traffic categories and design parameters used for the calculations for 20-year design life.

TRAFFIC CATEGORIES

Traffic Category	Description	Reliability (%)	Slabs Cracked at End of Design Life (%)
A	Car Parking Areas and Access Lanes	60	15
B	Entrance and Truck Service Lanes	60	15
E	Heavy Truck Traffic	75	15

8.15.5 We used the parameters presented in the table below to calculate the pavement design sections. We should be contacted to provide updated design sections, if necessary.

RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of Subgrade Reaction, k	50 pci
Modulus of Rupture for Concrete, M_R	500 psi
Concrete Compressive Strength	3,000 psi
Concrete Modulus of Elasticity, E	3,150,000 psi

8.15.6 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in the table below.

RIGID PAVEMENT RECOMMENDATIONS

Traffic Category	Trucks Per Day	Portland Cement Concrete, T (Inches)
A = Car Parking Areas and Access Lanes	< 10	5.5
B = Entrance and Truck Service Lanes	< 10	6
E = Heavy Truck Traffic	< 10	7

8.15.7 For Option 2 and 3 Grading, the PCC vehicular pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Under Option 1 Grading, the subgrade should be moisture conditioned to a minimum of 5 percent above optimum moisture content and compacted to at least 90 percent relative compaction.

8.15.8 The trash-truck pad should be large enough such that all wheels are on the concrete pad during the loading operations.

8.15.9 Adequate joint spacing based on ACI guidelines should be incorporated into the design and construction of the rigid pavement.

8.15.10 Under Grading Option 1, the slabs should be reinforced with No. 4 steel bars spaced 18 inches on center and positioned near the slab midpoint. Reinforcing steel will not be necessary within the concrete pavement for Grading Options 2 and 3. .

8.15.11 Perimeter curbs adjacent to landscape areas should extend at least 6 inches below the bottom of the pavement aggregate base. In lieu of extending the perimeter curb, an impermeable liner should be installed.

8.15.12 Concrete flatwork should be structurally connected to the curbs to help reduce potential offsets between the curbs and the flatwork.

8.15.13 To control the location and spread of concrete shrinkage cracks, crack-control joints should be included in the design of the concrete-pavement slab. Crack-control joints should be sealed with an appropriate sealant to prevent the migration of water through the control joint to the subgrade materials. The depth of the crack-control joints should be in accordance with ACI guidelines.

8.15.14 Construction joints should be provided at the interface between areas of concrete placed at different times during construction. The project structural engineer should provide details for load transfer.

8.15.15 Concrete curb/gutter should be placed on soil subgrade compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to slightly above optimum moisture content. Cross-gutters should be placed on subgrade soil compacted to a dry density of at least 95 percent of the laboratory maximum dry density near to slightly above optimum moisture content(Option 2 and 3 Grading). Under Option 1 Grading, the subgrade should be moisture conditioned to a minimum of 5 percent above optimum moisture content and compacted to at least 90 percent relative compaction. Base materials should not be placed below the curb/gutter, or cross-gutters so water is not able to migrate from the adjacent parkways to the pavement sections. Where flatwork is located directly adjacent

to the curb/gutter, the concrete flatwork should be structurally connected to the curbs to help reduce the potential for offsets between the curbs and the flatwork.

8.16. Storm Water Management

8.16.1. If storm water management devices are not properly designed and constructed, there is a risk for distress to improvements and property located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water being detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed.

8.17. Site Drainage and Moisture Protection

8.17.1. Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2022 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.17.2. In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

8.17.3. Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

8.17.4. Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends

at least 6 inches below the bottom of the base material should be considered.

8.18. Grading and Foundation Plan Review

8.18.1. Geocon Incorporated should review the grading and building foundation plans for the project prior to final design submittal to evaluate if additional analyses and/or recommendations are required.

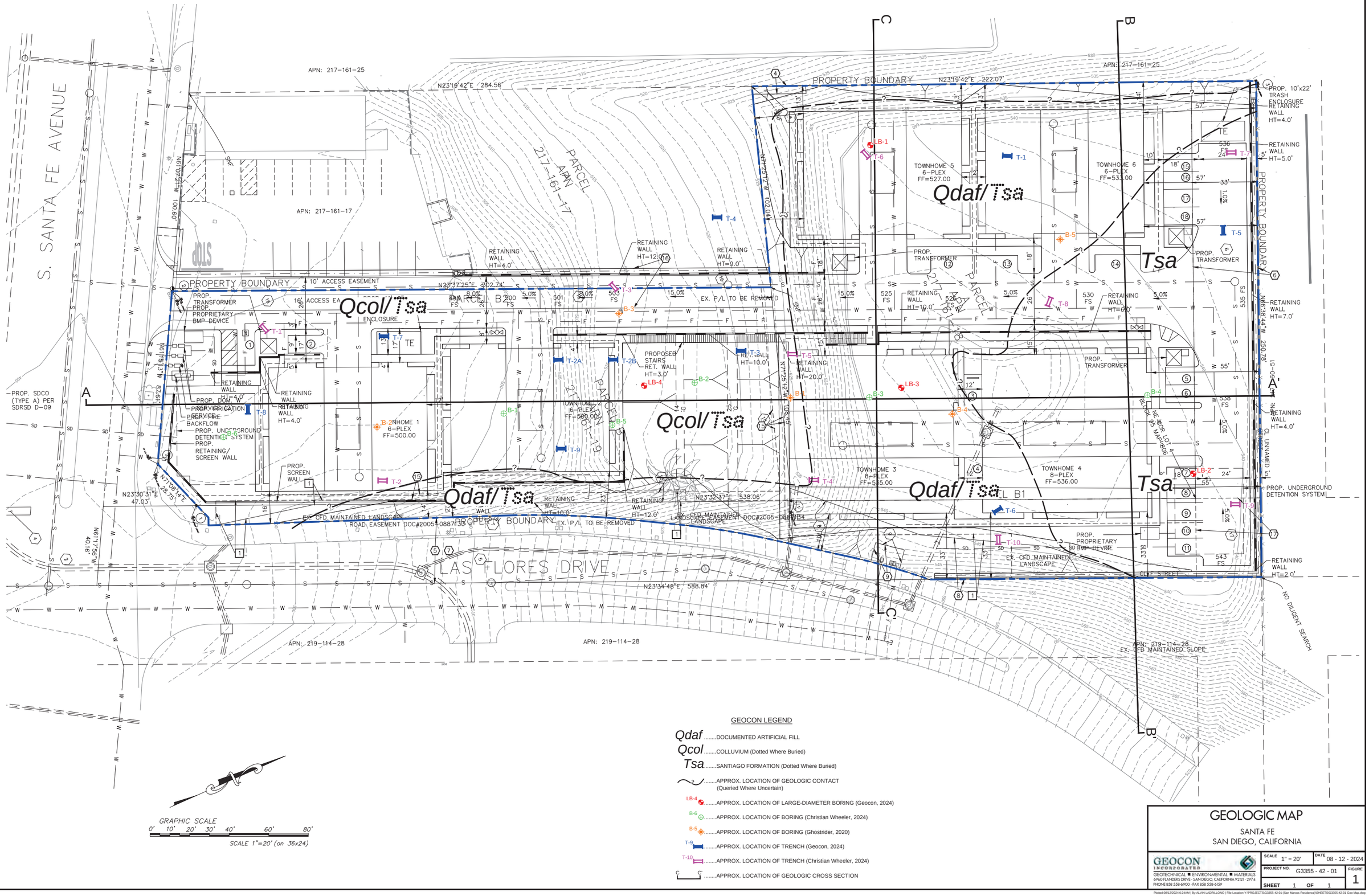
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



GEOCON LEGEND

- *Qdaf* ..... DOCUMENTED ARTIFICIAL FILL
- *Qcol* ..... COLLUVIUM (Dotted Where Buried)
- *Tsa* ..... SANTIAGO FORMATION (Dotted Where Buried)
- ..... APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- LB-4 ..... APPROX. LOCATION OF LARGE-DIAMETER BORING (Geocon, 2024)
- B-6 ..... APPROX. LOCATION OF BORING (Christian Wheeler, 2024)
- B-5 ..... APPROX. LOCATION OF BORING (Ghostrider, 2020)
- T-9 ..... APPROX. LOCATION OF TRENCH (Geocon, 2024)
- T-10 ..... APPROX. LOCATION OF TRENCH (Christian Wheeler, 2024)
- C C' ..... APPROX. LOCATION OF GEOLOGIC CROSS SECTION

GRAPHIC SCALE
0' 10' 20' 30' 40' 60' 80'
SCALE 1"=20' (on 36x24)

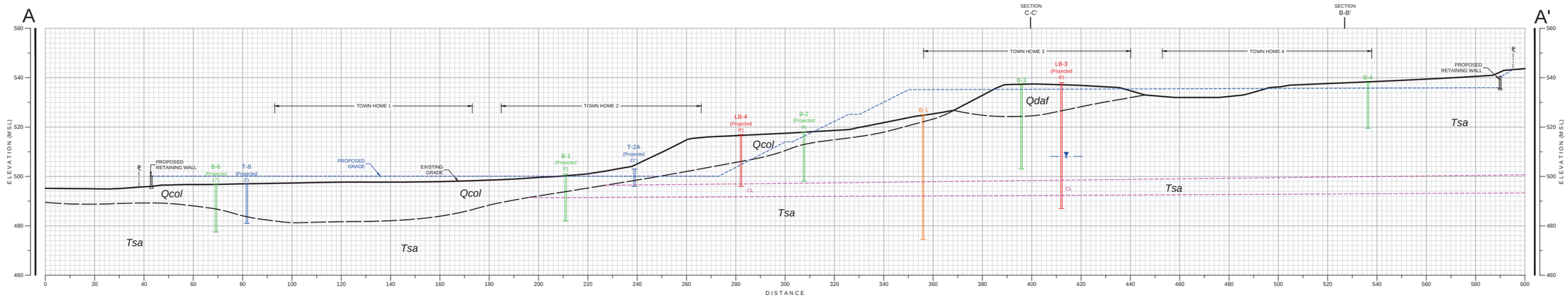
GEOLOGIC MAP

SANTA FE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

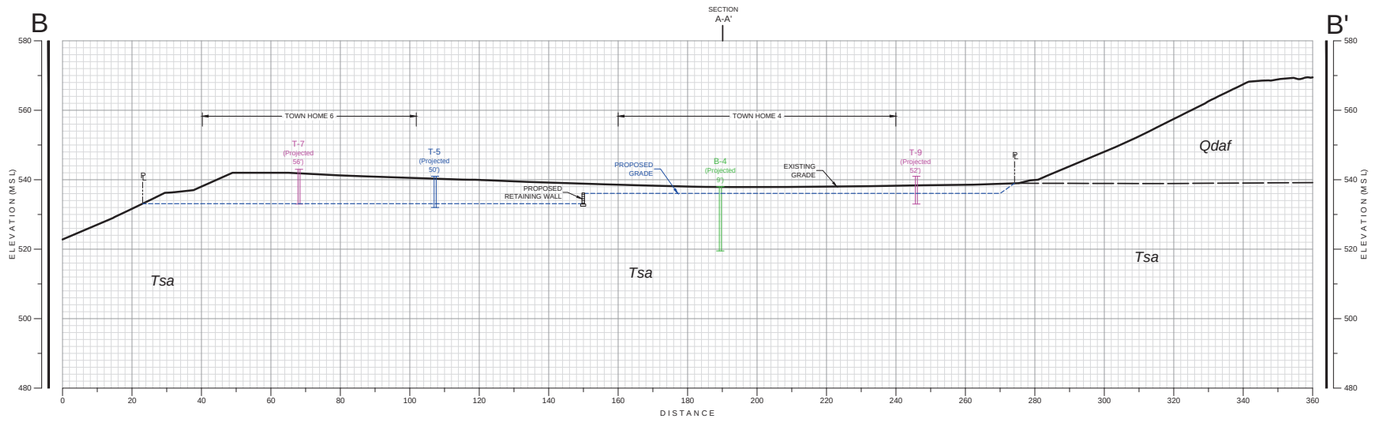
SCALE	DATE
1" = 20'	08 - 12 - 2024
PROJECT NO.	FIGURE
G3355 - 42 - 01	1
SHEET 1 OF 1	

Plotted:08/12/2024 6:24AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G3355-42-01 (San Marcos Residence)\SHEETS\G3355-42-01 Geo Map.dwg



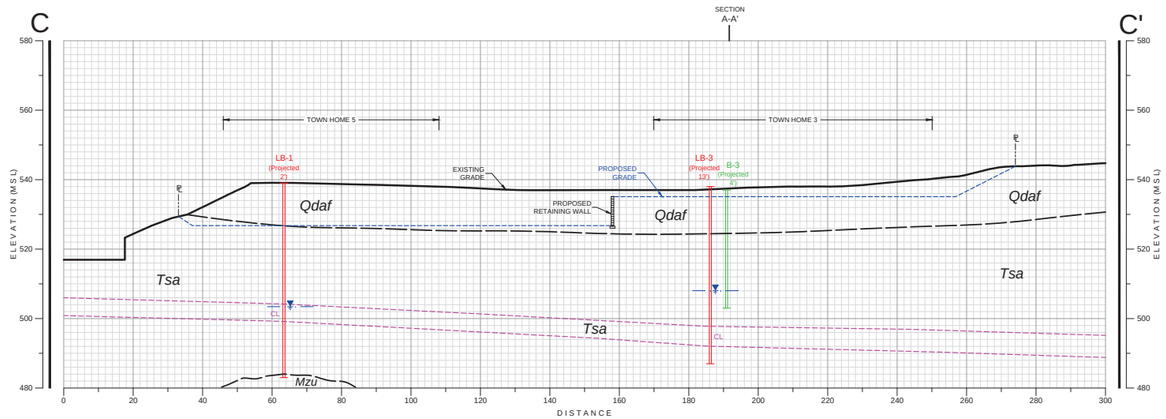
GEOLOGIC CROSS-SECTION A-A'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 20' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION C-C'

SCALE: 1" = 20' (Vert. = Horiz.)

GEOCON LEGEND

- Qdaf ..... DOCUMENTED ARTIFICIAL FILL
- Qcol ..... COLLUVIUM
- Tsa ..... SANTIAGO FORMATION
- Mzu ..... METAVOLCANIC AND METASEDIMENTARY ROCK
- ..... APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- LB-4 ..... APPROX. LOCATION OF LARGE-DIAMETER BORING (Geocon, 2024)
- B-6 ..... APPROX. LOCATION OF BORING (Christian Wheeler, 2024)
- ..... APPROX. LOCATION OF BORING (Ghostrider, 2020)
- T-8 ..... APPROX. LOCATION OF TRENCH (Geocon, 2024)
- T-9 ..... APPROX. LOCATION OF TRENCH (Christian Wheeler, 2024)
- ..... APPROX. LOCATION WHERE SEEPAGE ENCOUNTERED
- CL ..... FRACTURED CLAYSTONE LAYER (Queried Where Uncertain)

GEOLOGIC CROSS SECTION

SANTA FE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858.558-6900 - FAX 858.558-6159

SCALE	1" = 20'
DATE	08 - 12 - 2024
PROJECT NO.	G3355 - 42 - 01
FIGURE	2
SHEET	1 OF 1

Plotted:08/12/2024 8:22AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G3355-42-01 (San Marcos Residence)\SHEETS\G3355-42-01 XSections.dwg

APPENDIX A

APPENDIX A
FIELD INVESTIGATION

We performed our field investigation on July 1st and 2nd, 2024. Our investigation consisted of drilling four large diameter borings using a truck-mounted drill rig equipped with a bucket auger, down-hole logging of the large diameter borings, and excavating nine exploratory test pits using a backhoe excavator equipped with 36-inch bucket. The large diameter borings were excavated to depths between about 20 and 55 feet, and the test pits were excavated to depths between about 4 to 16 feet. A geologist logged the subsurface conditions of the site and collected samples for testing. The approximate locations of the exploratory borings and test pits are shown in Figure 1.

The soil conditions encountered in the borings were visually examined, classified, and logged in general conformance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). Exploratory boring and test pit logs are presented herein. The logs depict the various soil types encountered and indicate the depths at which samples were obtained.

PROJECT NO. G3355-42-01

BORING LB 1

ELEV. (MSL.) **539'** DATE COMPLETED **07/01/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**DOCUMENTED ARTIFICIAL FILL (Qdaf)** Stiff, damp to moist, dark grayish brown to dark brown, Sandy CLAY; trace roots			
4				CH	Very stiff, moist, dark brown, Fat CLAY			
6	LB1-1					PUSH	108.4	22.5
8					-Gravel and cobble up to 6-inches in diameter; subangular to subrounded			
10	LB1-2					1	111.7	19.8
14				CL	**SANTIAGO FORMATION (Tsa)** Very stiff to hard, moist, olive gray, fine-grained Sandy CLAYSTONE; moderately indurated, mottled orange			
16	LB1-3					3		
16				SC	Medium dense, moist, yellowish brown, Clayey SANDSTONE; moderately weathered, abundant shells and calcium carbonate, oxidized contact with above unit			
18				ML	Hard, moist, olive to olive gray, SILTSTONE; abundant fractures with sand and gypsum infill			
20	LB1-4			CL	Hard, moist, light reddish gray, CLAYSTONE; abundant fractures with gypsum infill	3		
22				ML	Hard, moist, olive, fine-grained Sandy SILTSTONE; abundant fractures with oxidized sand infill and gypsum			
24					-Becomes gray			
24	LB1-5					2	104.8	20.6
26				SC	Very dense, moist, yellowish brown, Clayey, fine-grained SANDSTONE; moderately cemented, calcium carbonate staining			
26				CL	Very stiff, moist, brown to dark brown, CLAYSTONE; abundant fractures with yellow sand infill and gypsum, oxidized sand fractures			
28								

Figure A-1,
Log of Boring LB 1, Page 1 of 2

G3355-42-01 BORING.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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

GEOCON

PROJECT NO. G3355-42-01

BORING LB 1

ELEV. (MSL.) **539'** DATE COMPLETED **07/01/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB1-6			SM	Very dense, moist, light grayish brown, Silty, fine-grained SANDSTONE; yellow mottling, some gypsum filled fractures	6	105.6	20.0
32								
34								
36	LB1-7		▽	CL	Very stiff to hard, moist to wet, brown, CLAYSTONE; abundant fractures with yellow oxidation and gypsum, seepage along fractures, fissured with waxy parting surfaces	5		
38								
40	LB1-8			ML	Hard, moist to wet, olive, SILTSTONE; well cemented, abundant fracturing	5		
42								
44								
46	LB1-9				-Abundant yellow oxidation and gypsum filled fractures	8		
48					-Becomes gray			
50	LB1-10				-Becomes light olive	8		
52								
54								
56	LB1-11				**Igneous Rock (Metavolcanic and Metasedimentary Rock; Mzu):** Weak, highly weathered, brown, METAVOLCANIC ROCK	8		
					BORING TERMINATED AT 56 FEET Seepage encountered below 35 feet Caving not encountered			

Figure A-1,
Log of Boring LB 1, Page 2 of 2

G3355-42-01 BORING.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ▽ ... SEEPAGE

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

PROJECT NO. G3355-42-01

BORING LB 2

ELEV. (MSL.) **539'** DATE COMPLETED **07/01/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		SM	**SANTIAGO FORMATION (Tsa)** Dense to very dense, moist, light grayish brown, Silty, fine-grained SANDSTONE			
2		SC	Very dense, moist, brown to olive brown, Clayey, fine-grained SANDSTONE			
4						
6	LB2-1			4		
8		CL	Very stiff to hard, moist, olive, CLAYSTONE; abundant high angle fractures with yellow oxidized infill and gypsum infill			
10	LB2-2			3		
12			-Abrupt contact			
14		CL	Stiff, moist, yellowish brown, Sandy CLAYSTONE; abundant calcium and shells; moderately indurated			
16	LB2-3	ML	Firm to stiff, moist. olive, Sandy SILTSTONE; with reddish brown mottling	1		
18			-Becomes grayish brown; abundant fractures; laminated			
20	LB2-4		▽	2		
22		CL	Firm, moist to wet, yellowish brown, CLAYSTONE; seepage			
		ML	Hard, moist to wet, grayish brown, SILTSTONE; abundant oxidized fractures			
24		CL	At 23.75 feet: 1/2" to 1" thick olive, CLAYSTONE; fissured, no apparent remolding, continuous around hole (Bearing 325º,<50º DDD)			
		CL	Hard, moist to wet, brown, CLAYSTONE; abundant fractures with oxidized infill and gypsum infill; seepage intensifies below			
26	LB2-5			3		
28						

Figure A-2,
Log of Boring LB 2, Page 1 of 2

G3355-42-01 BORING.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ▽ ... SEEPAGE

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

GEOCON

PROJECT NO. G3355-42-01

BORING LB 2

ELEV. (MSL.) **539'** DATE COMPLETED **07/01/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB2-6			CL		8		
32								
34				CL	Hard, moist to wet, brown, CLAYSTONE; abundant fractures with yellow oxidized and gypsum infill			
36	LB2-7					8		
38				ML	Hard, moist to wet, bluish gray, SILTSTONE			
40	LB2-8					10		
					BORING TERMINATED AT 41 FEET Seepage encountered below 21 feet Caving not encountered			

Figure A-2,
Log of Boring LB 2, Page 2 of 2

G3355-42-01 BORING.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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

PROJECT NO. G3355-42-01

BORING LB 3

ELEV. (MSL.) **538'** DATE COMPLETED **07/02/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SC	**DOCUMENTED ARTIFICIAL FILL (Qdaf)** Medium dense, moist, brown to dark brown, Clayey SAND; gravel and cobble up to 8-inches in diameter			
4				CL	Stiff, moist, brown, Sandy CLAY; some gravel			
6	LB3-1					2	110.9	16.4
10	LB3-2			CH	Very stiff, moist, dark brown, CLAY	1	107.7	20.4
12				CL	**SANTIAGO FORMATION (Tsa)** Very stiff, moist, light olive, fine-grained Sandy CLAYSTONE; with silt; orange and yellow mottling; disturbed during grading			
14				ML	Hard, moist, olive brown, SILTSTONE			
16	LB3-3			CL	Abrupt contact Stiff, moist, yellowish brown, Sandy CLAYSTONE; abundant calcium and shells	4	101.4	22.4
18				CL	-Concretion Hard, moist, olive to yellowish brown, fine-grained, Sandy CLAYSTONE; orange mottling; massive			
20	LB3-4			CL ML	Soft, damp, gray, CLAYSTONE; few parting surfaces with gypsum; no apparent remolding	3	94.6	27.6
22					Hard, moist, gray, SILTSTONE; abundant fractures with oxidized infill and gypsum At 21.7 feet: 6-inch thick concretion			
24								
26	LB3-5			SM	Very dense, moist, gray, Silty, fine-grained SANDSTONE; orange mottling	5		
28			▽	ML	Stiff, moist, brown, SILTSTONE; abundant fractures with oxidized infill and gypsum			

G3355-42-01 BORING.GPJ

Figure A-3,
Log of Boring LB 3, Page 1 of 2

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ▽ ... SEEPAGE

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

PROJECT NO. G3355-42-01

BORING LB 3

ELEV. (MSL.) **538'** DATE COMPLETED **07/02/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	LB3-6			ML	-Seepage below 30 feet	5		
32					-Large fracture with gypsum; increase in seepage			
34								
36	LB3-7				-Becomes light gray; weathered	6		
38				SM ML	Medium dense, moist, light olive, Silty, fine-grained SANDSTONE; yellow mottling Hard, moist to wet, brown to olive, SILTSTONE			
40	LB3-8			CL	Hard, moist to wet, olive, CLAYSTONE; abundant fractures with orange mottling and gypsum; low and high angle fractures, weakly fissured; few pockets of soft clay	6		
42	LB3-11				Hard, wet (heavy seepage), gray to yellowish brown mottled, CLAYSTONE; moderately to highly fissured with numerous polished and striated parting surfaces; some soft clay			
44								
46	LB3-9					6		
48				ML	Hard, moist to wet, gray, SILTSTONE			
50	LB3-10					5		
					BORING TERMINATED AT 51 FEET Seepage encountered below 30 feet Caving not encountered			

Figure A-3,
Log of Boring LB 3, Page 2 of 2

G3355-42-01 BORING.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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

PROJECT NO. G3355-42-01

BORING LB 4

ELEV. (MSL.) **517'** DATE COMPLETED **07/02/2024**

EQUIPMENT **EZ BORE 140** BY: **K. HAASE**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0								
				CL	**DOCUMENTED ARTIFICIAL FILL (Qdaf)** Stiff, moist, dark brown, Sandy CLAY			
2								
4	LB4-1					1		
6	LB4-2 LB4-3					3		
8	LB4-4					2		
10	LB4-5					1		
				CL	**SANTIAGO FORMATION (Tsa)** Very stiff, moist, grayish olive, Sandy CLAYSTONE			
12								
14								
	LB4-6			SM	Very dense, moist, olive, Silty, fine-grained SANDSTONE	2		
16								
18								
20	LB4-7			CL	Hard, moist, brown, CLAYSTONE	3		
					BORING TERMINATED AT 21 FEET Seepage not encountered Caving not encountered			

Figure A-4,
Log of Boring LB 4, Page 1 of 1

G3355-42-01 BORING.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1 ELEV. (MSL.) 540' DATE COMPLETED 07/01/2024 EQUIPMENT Backhoe Excavator BY: J. SHELTON	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**UNDOCUMENTED FILL (Qudf)** Firm to stiff, damp to moist, brown to olive brown, Sandy CLAY; blocky -Becomes less weathered, moist, lithic fragments of Santiago Formation			
2					-Gravel and cobble up to 5" in diameter (metavolcanic clasts)			
4	T1-1				-Becomes very stiff, moist to wet, trace orange mottling, silty clay; trace cobble			
6								
8								
10				CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, moist, olive brown, Sandy CLAYSTONE; weakly to moderately indurated			
					TRENCH TERMINATED AT 10 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-1,
Log of Trench T 1, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G3355-42-01

TRENCH T 2A

ELEV. (MSL.) **503'** DATE COMPLETED **07/01/2024**

EQUIPMENT **Backhoe Excavator** BY: **J. SHELTON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**COLLUVIUM (Qcol)** Soft to stiff, damp, brown, Sandy, lean CLAY; some calcium carbonate, trace plant roots			
2								
4								
				CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, damp to moist, light brown to orangish brown, Sandy CLAYSTONE; weakly to moderately indurated, some calcium carbonate, fissile, waxy in texture -Becomes olive green, some gypsum infilled fractures, slightly polished			
6								
					TRENCH TERMINATED AT 7 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-2,
Log of Trench T 2A, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

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

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

GEOCON

PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2B ELEV. (MSL.) 515' DATE COMPLETED 07/01/2024 EQUIPMENT Backhoe Excavator BY: J. SHELTON	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0	T2B-1			CL	**COLLUVIUM (Qcol)** Soft, damp, brown, Sandy, lean CLAY; some calcium carbonate; trace plant roots			
2								
4								
6					-Becomes stiff			
8								
10								
12					TRENCH TERMINATED AT 12 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-3,
Log of Trench T 2B, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 3 ELEV. (MSL.) 520' DATE COMPLETED 07/01/2024 EQUIPMENT Backhoe Excavator BY: J. SHELTON	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**COLLUVIUM (Qcol)** Soft, dry to damp, brown, Sandy, lean CLAY			
2								
4	T3-1			CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, damp, light olive brown, Sandy CLAYSTONE; weakly to moderately indurated, abundant calcium carbonate, fissile			
6								
					TRENCH TERMINATED AT 7.5 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-4,
Log of Trench T 3, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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

GEOCON

PROJECT NO. G3355-42-01

TRENCH T 4

ELEV. (MSL.) **520** DATE COMPLETED **07/01/2024**

EQUIPMENT **Backhoe Excavator** BY: **J. SHELTON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**COLLUVIUM (Qcol)** Soft, damp, brown, Sandy, lean CLAY; some calcium carbonate; some plant debris			
2								
4				CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, damp, light brown to orangish brown, Sandy CLAYSTONE; weakly to moderately indurated; 4"-5" thick sea shell bed, abundant calcium carbonate			
6								
8					-Abundant gypsum infilled fractures -Becomes olive green			
10					TRENCH TERMINATED AT 10 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-5,
Log of Trench T 4, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 5 ELEV. (MSL.) 541' DATE COMPLETED 07/01/2024 EQUIPMENT Backhoe Excavator BY: J. SHELTON MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**UNDOCUMENTED FILL (Qudf)** Soft, dry to damp, brown, Sandy, lean CLAY			
2	T5-1			CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, damp, brown to olive green, Sandy CLAYSTONE; weakly to moderately indurated, fissile, waxy			
4								
6								
8					-Abundant sea shells			
					TRENCH TERMINATED AT 9 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-6,
Log of Trench T 5, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 6 ELEV. (MSL.) 539 DATE COMPLETED 07/01/2024 EQUIPMENT Backhoe Excavator BY: J. SHELTON	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**UNDOCUMENTED FILL (Qudf)** Stiff, damp, brown, Sandy, lean CLAY			
2								
4								
6				CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, damp, olive green, Sandy CLAYSTONE; weakly to moderately indurated, fissile, waxy			
8					TRENCH TERMINATED AT 8 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-7,
Log of Trench T 6, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G3355-42-01

TRENCH T 7

ELEV. (MSL.) **498'** DATE COMPLETED **07/01/2024**

EQUIPMENT **Backhoe Excavator** BY: **J. SHELTON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T7-1			CL	**COLLUVIUM (Qcol)** Soft, dry to damp, brown, Sandy, lean CLAY			
2					-Some calcium carbonate			
4								
6								
8	T7-2			CL	**SANTIAGO FORMATION (Tsa)** Stiff, damp, orange brown to olive green, Sandy CLAYSTONE; weakly indurated, abundant gypsum			
10					-Waxy in appearance -Becomes olive green			
12					TRENCH TERMINATED AT 12 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-8,
Log of Trench T 7, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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

GEOCON

PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.) 497' DATE COMPLETED 07/01/2024 EQUIPMENT Backhoe Excavator BY: J. SHELTON MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**COLLUVIUM (Qcol)** Soft, dry to damp, brown, Sandy, lean CLAY; some calcium carbonate			
2					-Becomes dark brown			
4								
6								
8								
10					-Becomes mottled olive green and orange brown; some gravel (resembles crushed aggregate)			
12								
14				CL	**SANTIAGO FORMATION (Tsa)** Stiff, damp, olive green to orange brown, Sandy CLAYSTONE; weakly indurated, some gypsum			
16					TRENCH TERMINATED AT 16 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-9,
Log of Trench T 8, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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GEOCON

PROJECT NO. G3355-42-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	**TRENCH T 9** ELEV. (MSL.) **503'** DATE COMPLETED **07/01/2024** EQUIPMENT **Backhoe Excavator** BY: **R. ADAMS**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**COLLUVIUM (Qcol)** Soft, damp, brown to grayish brown, Sandy CLAY; porous with abundant caliche throughout			
2								
				CL	**SANTIAGO FORMATION (Tsa)** Stiff to hard, damp, gray to yellowish gray, interbedded CLAYSTONE and Silty CLAYSTONE; fissile with gypsum veins, along parting surfaces, some infilled fractures. few pockets of soft clay. no notable well developed remolded zone or parting surfaces but occasional weakly striated surfaces observed, highly weathered			
4								
6								
8					TRENCH TERMINATED AT 8 FEET Groundwater or seepage not encountered Backfilled on 07/01/2024			

Figure A-10,
Log of Trench T 9, Page 1 of 1

G3355-42-01 TRENCH.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)

... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR ... SEEPAGE

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APPENDIX B

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected samples were tested for *in-situ* dry density and moisture content, maximum dry density and optimum moisture content, direct shear, consolidation, expansion potential, grain size distribution, plasticity index, soluble sulfate content, chloride content, and pH resistivity. The results of our laboratory tests are presented in the following tables and graphs.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D 1557-02

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T1-1	Brown to olive brown, Sandy CLAY	113.6	17.0
T2B-1	Brown, Sandy, lean CLAY	109.2	16.4

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS ASTM D 4829-03

Sample No.	Geologic Unit	Moisture Content		Dry Density (pcf)	Expansion Index	Expansion Classification
		Before Test (%)	After Test (%)			
T1-1	Qdaf	13.6	31.4	97.5	121	High
T2B-1	Qcol	15.1	37.3	91.4	147	Very High
T5-1	Qcol	15.5	42.8	90.8	224	Very High
T7-1	Qcol	14.5	35.1	94.7	138	Very High

SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS CALIFORNIA TEST NO. 417

Sample No.	Water-Soluble Sulfate (%)	Sulfate Exposure
T1-1	0.053	S0
T2-1	0.070	S0
T5-1	0.057	S0

SUMMARY OF LABORATORY WATER-SOLUBLE CHLORIDE ION CONTENT TEST RESULTS AASHTO TEST NO. T 291

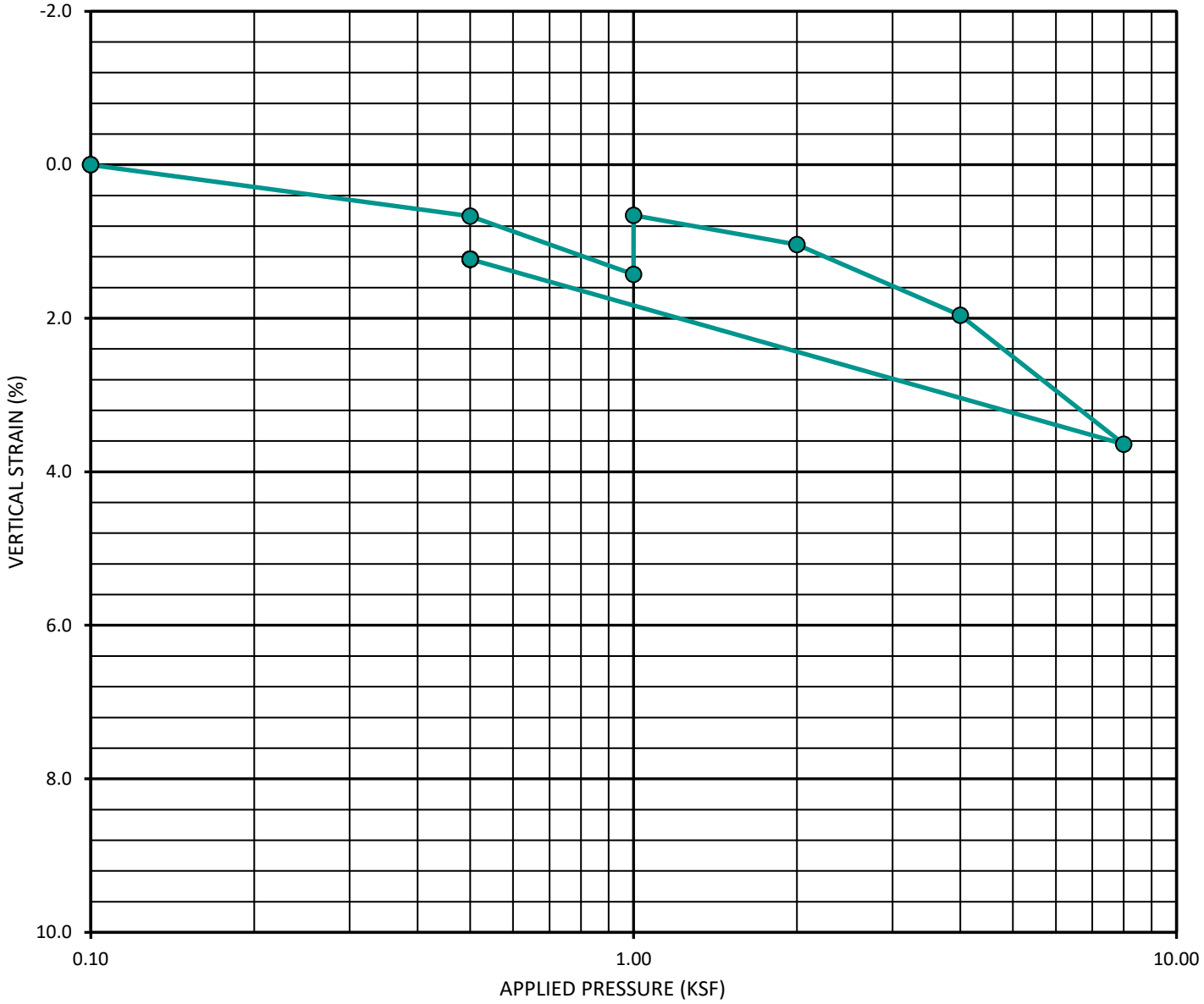
Sample No.	Chloride Ion Content ppm (%)
T1-1	0.026
T2-1	0.040
T5-1	0.071

SAMPLE NO.: **LB1-2**

SAMPLE DEPTH (FT): **10**

GEOLOGIC UNIT: **Qdaf**

TEST INFORMATION	
INITIAL DRY DENSITY (PCF):	111.7
INITIAL WATER CONTENT (%):	19.8%
SAMPLE SATURATED AT (KSF):	1.0
INITIAL SATURATION (%):	100+



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6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121-2974
PHONE 858 558-6900 - FAX 858 558-6159

CONSOLIDATION CURVE - ASTM D 2435

SAN MARCOS RESIDENCES

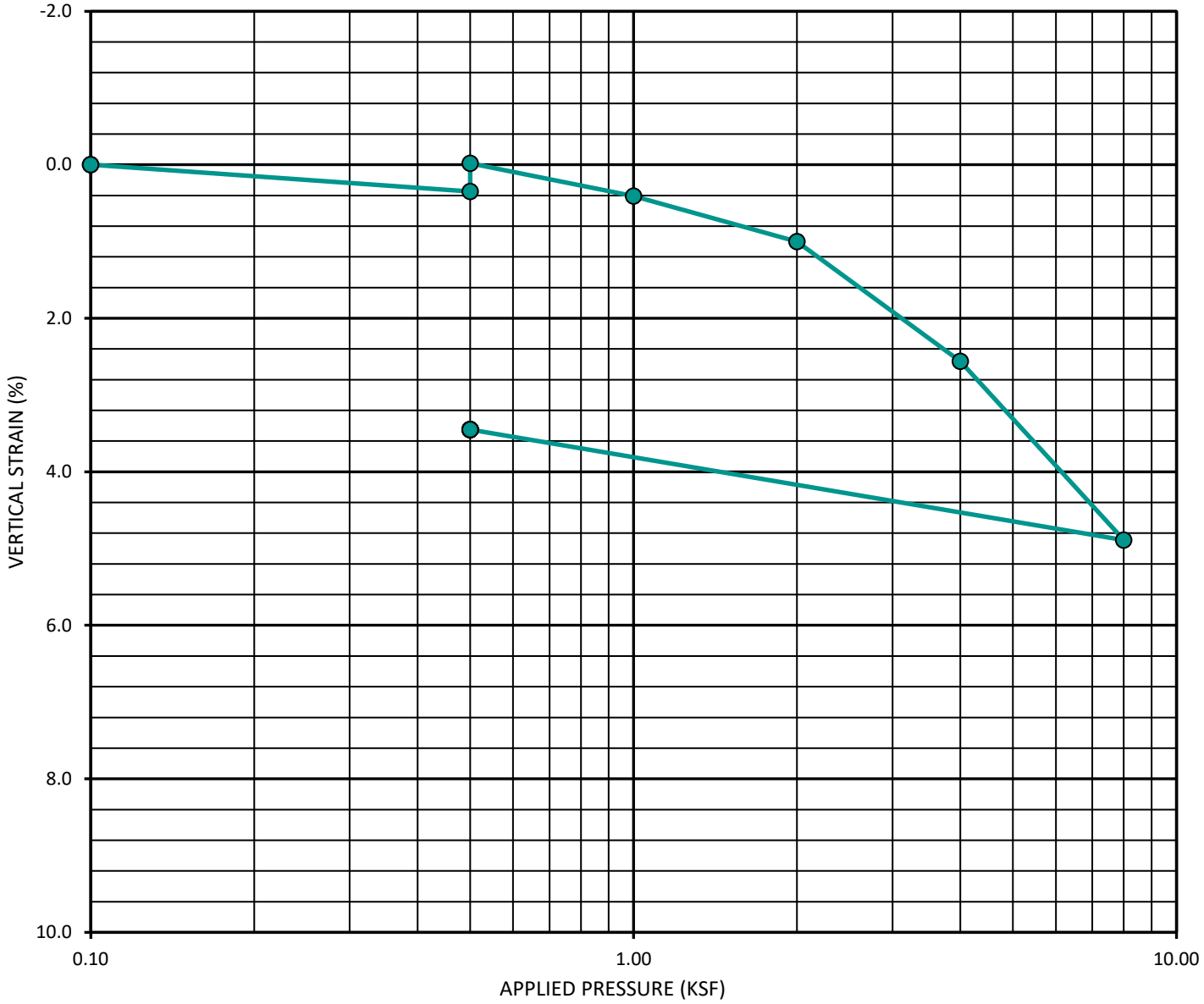
PROJECT NO.: G3355-42-01

SAMPLE NO.: **LB3-1**

SAMPLE DEPTH (FT): **5**

GEOLOGIC UNIT: **Qdaf**

TEST INFORMATION	
INITIAL DRY DENSITY (PCF):	110.9
INITIAL WATER CONTENT (%):	16.4%
SAMPLE SATURATED AT (KSF):	0.5
INITIAL SATURATION (%):	87.9%



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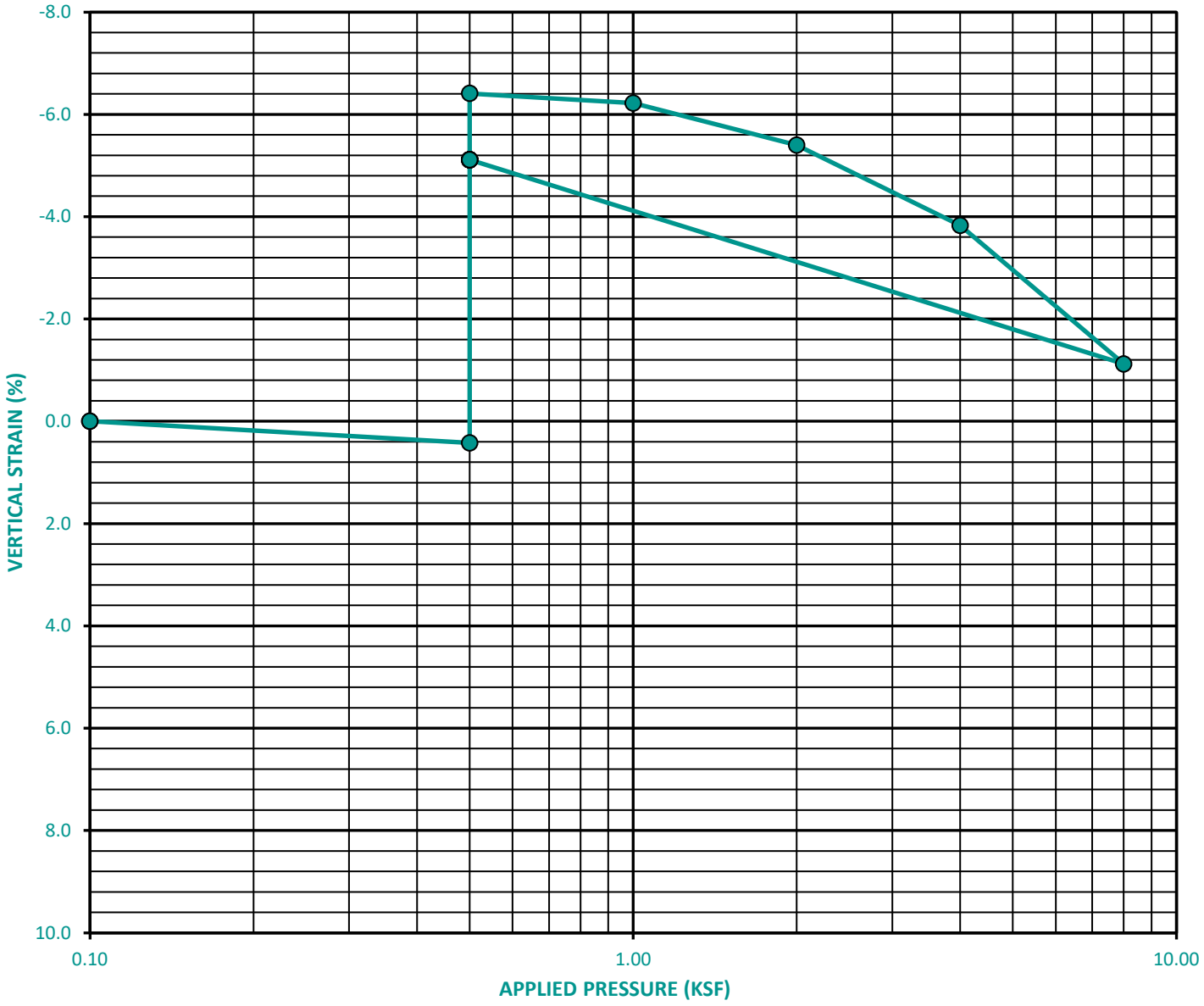
CONSOLIDATION CURVE - ASTM D 2435

SAN MARCOS RESIDENCES

PROJECT NO.: G3355-42-01

SAMPLE NO.:	LB4-2	**GEOLOGIC UNIT:**	Qdaf
SAMPLE DEPTH (FT):	5.5		

TEST INFORMATION	
INITIAL DRY DENSITY (PCF):	102.7
INITIAL WATER CONTENT (%):	21.5%
SAMPLE SATURATED AT (KSF):	.5
INITIAL SATURATION (%):	92.7%



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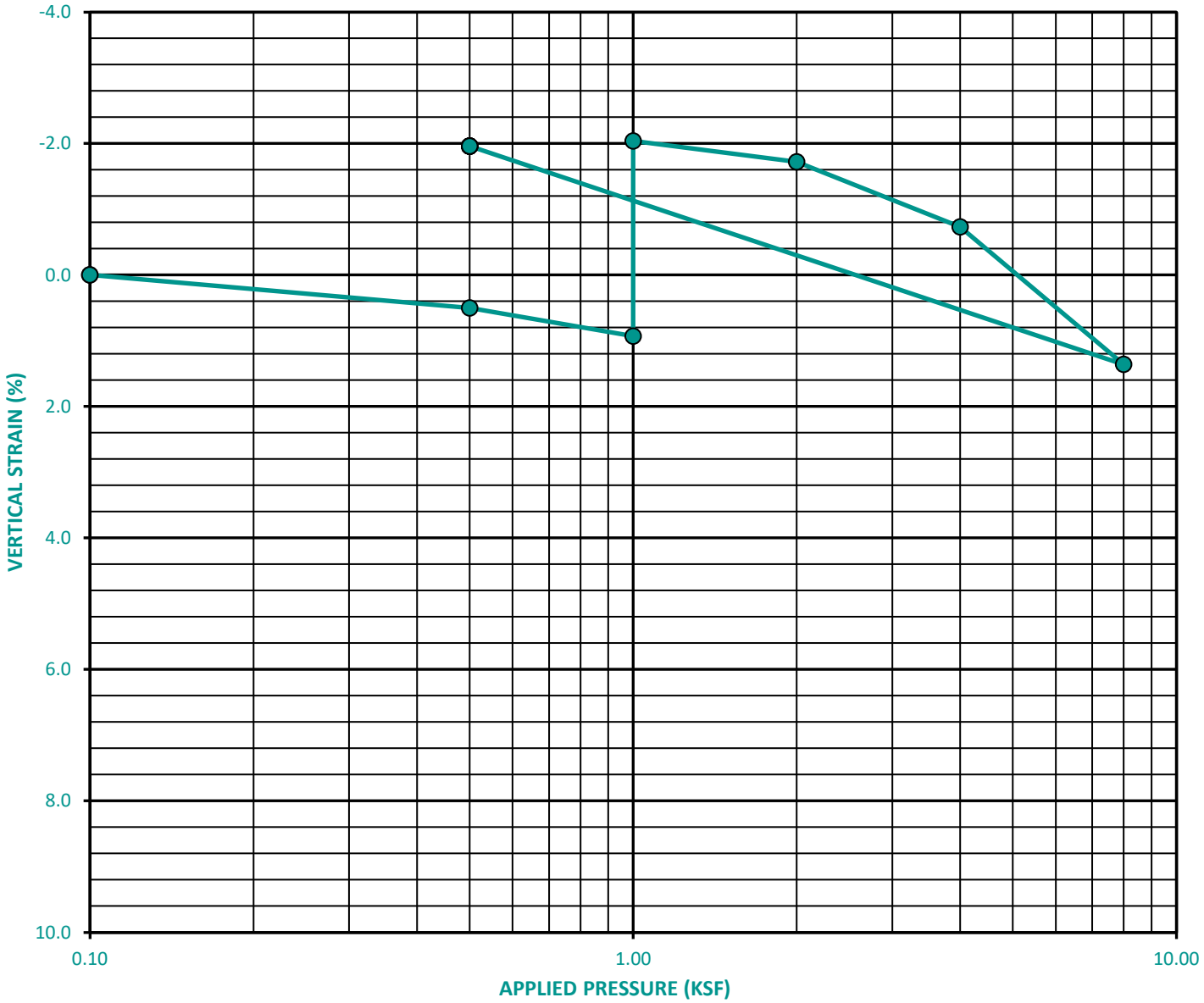
CONSOLIDATION CURVE - ASTM D 2435

SAN MARCOS RESIDENCES

PROJECT NO.: G3355-42-01

SAMPLE NO.:	LB4-4	**GEOLOGIC UNIT:**	Qdaf
SAMPLE DEPTH (FT):	7.5		

TEST INFORMATION	
INITIAL DRY DENSITY (PCF):	101.4
INITIAL WATER CONTENT (%):	22.8%
SAMPLE SATURATED AT (KSF):	1.0
INITIAL SATURATION (%):	95.1%



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CONSOLIDATION CURVE - ASTM D 2435

SAN MARCOS RESIDENCES

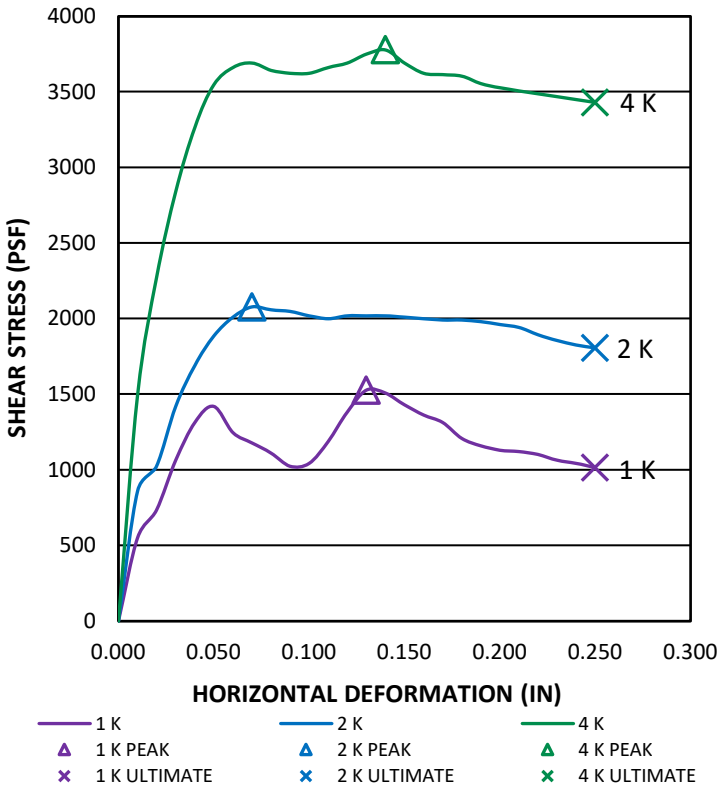
PROJECT NO.: G3355-42-01

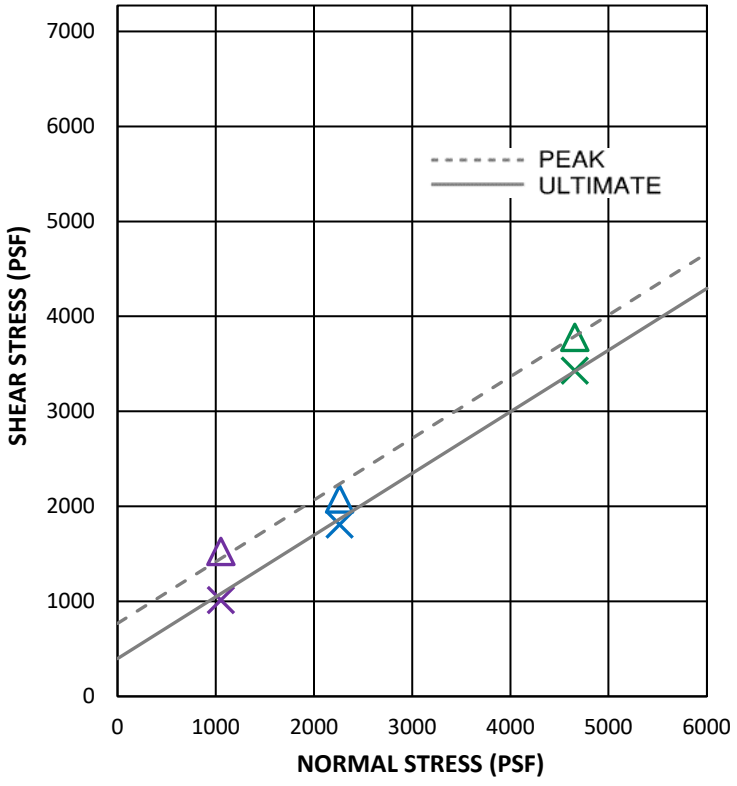
SAMPLE NO.:	**LB1-5**	GEOLOGIC UNIT:	**Tsa**
SAMPLE DEPTH (FT):	**25**	NATURAL/REMOLDED:	**N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
ACTUAL NORMAL STRESS (PSF):	1053.8	2261.4	4657.4	--
WATER CONTENT (%):	21.0	20.9	19.9	20.6
DRY DENSITY (PCF):	103.0	104.7	106.5	104.8

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
WATER CONTENT (%):	23.6	23.5	22.6	23.2
PEAK SHEAR STRESS (PSF):	1527	2077	3778	--
ULT.-E.O.T. SHEAR STRESS (PSF):	1014	1807	3430	--

RESULTS		
PEAK	COHESION, C (PSF)	770
	FRICTION ANGLE (DEGREES)	33
ULTIMATE	COHESION, C (PSF)	400
	FRICTION ANGLE (DEGREES)	33





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DIRECT SHEAR - AASHTO T-236

SAN MARCOS RESIDENCES

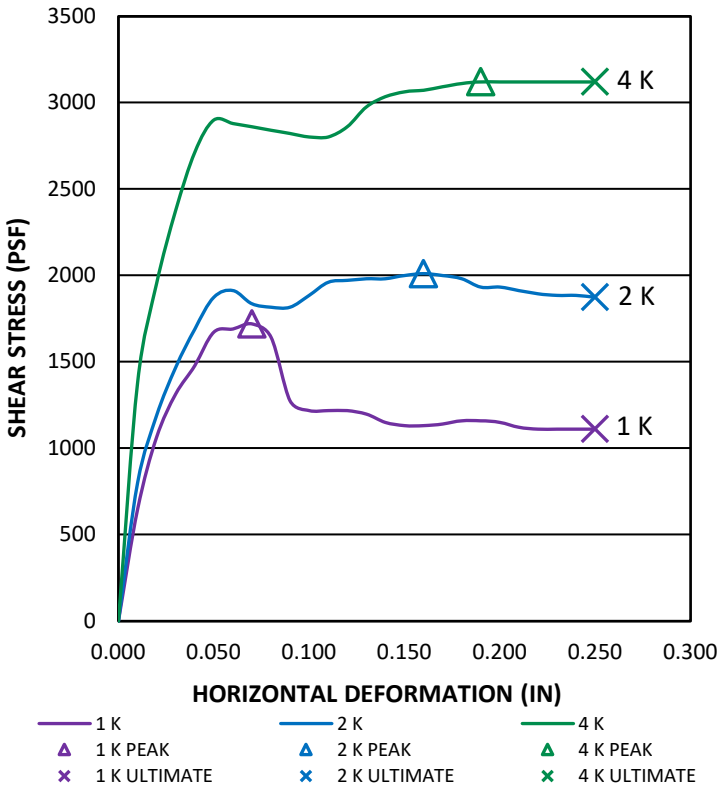
PROJECT NO.: G3355-42-01

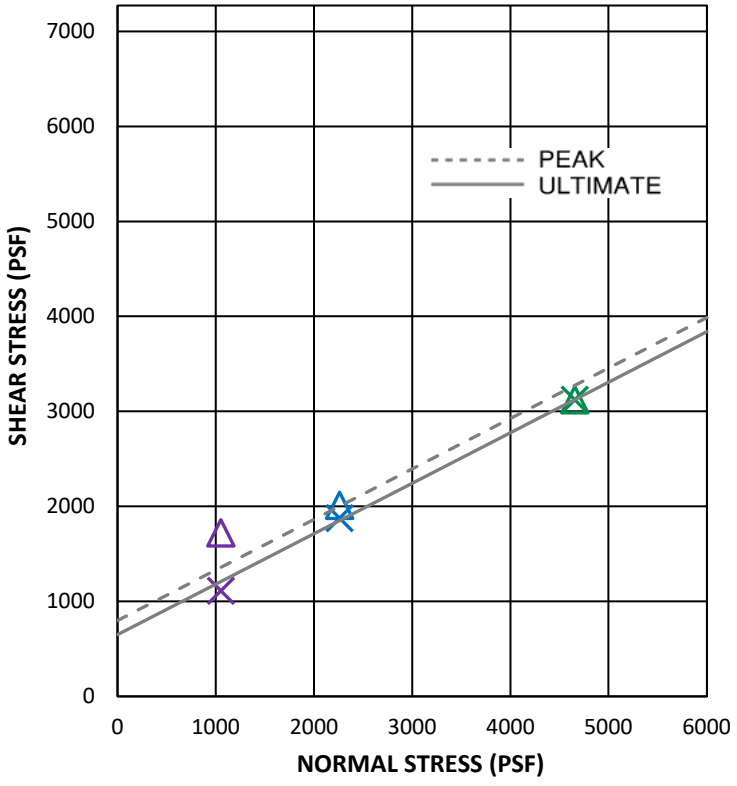
SAMPLE NO.:	**LB1-6**	GEOLOGIC UNIT:	**Tsa**
SAMPLE DEPTH (FT):	**30**	NATURAL/REMOLDED:	**N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
ACTUAL NORMAL STRESS (PSF):	1053.8	2261.4	4657.4	--
WATER CONTENT (%):	20.9	20.4	18.8	20.0
DRY DENSITY (PCF):	105.1	104.9	106.7	105.6

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
WATER CONTENT (%):	21.9	23.0	22.2	22.4
PEAK SHEAR STRESS (PSF):	1720	2010	3121	--
ULT.-E.O.T. SHEAR STRESS (PSF):	1111	1874	3121	--

RESULTS		
PEAK	COHESION, C (PSF)	800
	FRICTION ANGLE (DEGREES)	28
ULTIMATE	COHESION, C (PSF)	650
	FRICTION ANGLE (DEGREES)	28





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DIRECT SHEAR - AASHTO T-236

SAN MARCOS RESIDENCES

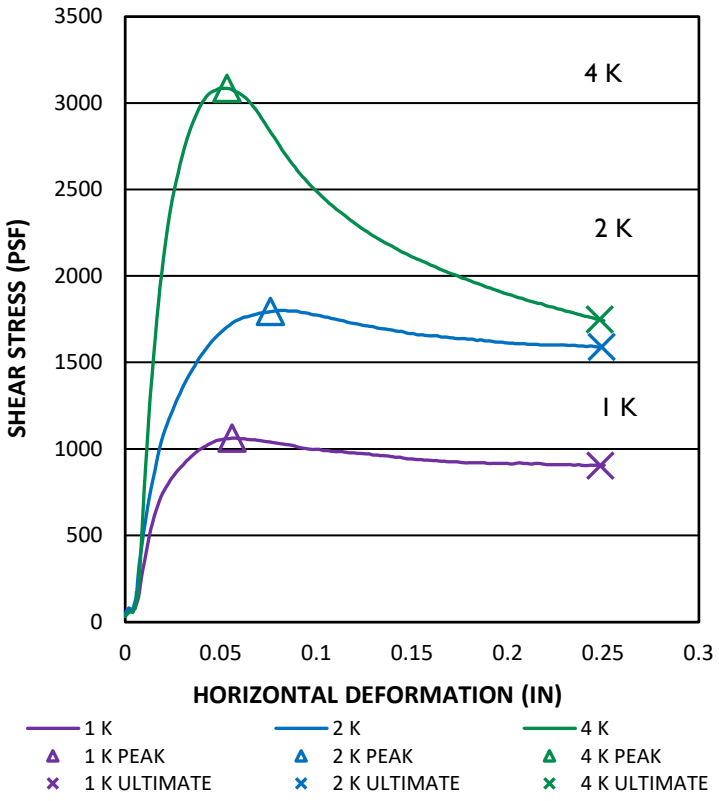
PROJECT NO.: G3355-42-01

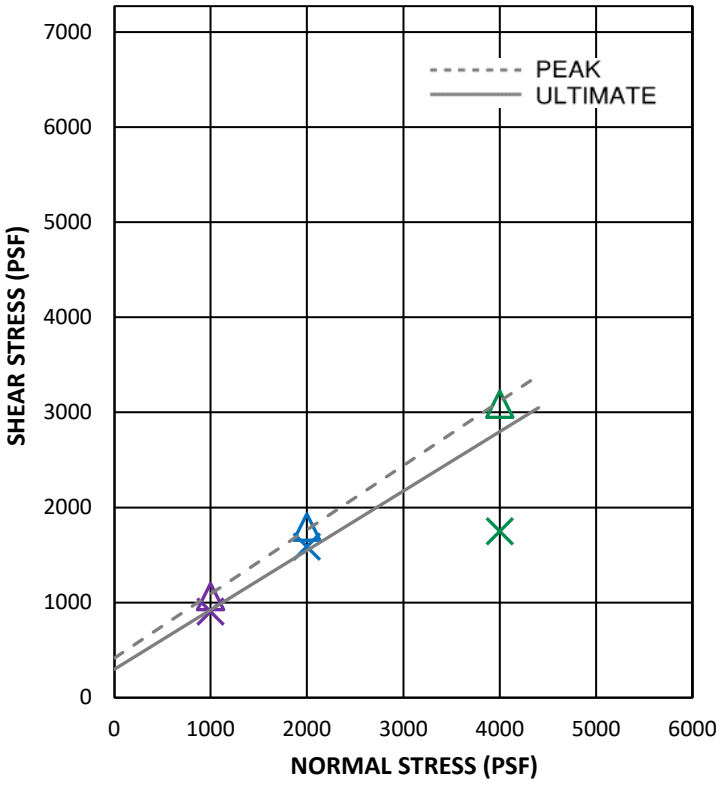
SAMPLE NO.:	**LB1-7**	GEOLOGIC UNIT:	**Tsa**
SAMPLE DEPTH (FT):	**35**	NATURAL/REMOLDED:	**N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
ACTUAL NORMAL STRESS (PSF):	1000	2000	4000	--
WATER CONTENT (%):	27.0	24.5	29.0	26.8
DRY DENSITY (PCF):	94.8	98.0	93.0	95.3

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
WATER CONTENT (%):	28.8	27.1	30.6	28.8
PEAK SHEAR STRESS (PSF):	1063	1794	3085	--
ULT.-E.O.T. SHEAR STRESS (PSF):	904	1589	1749	--

RESULTS		
PEAK	COHESION, C (PSF)	420
	FRICTION ANGLE (DEGREES)	34
ULTIMATE	COHESION, C (PSF)	300
	FRICTION ANGLE (DEGREES)	32





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AASHTO T-236

SAN MARCOS RESIDENCES

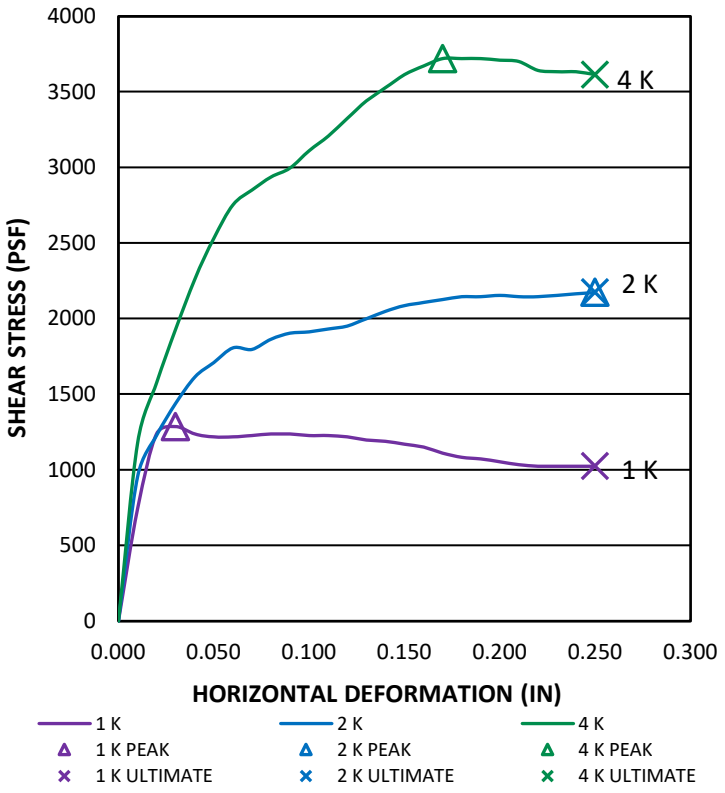
PROJECT NO.: G3355-42-01

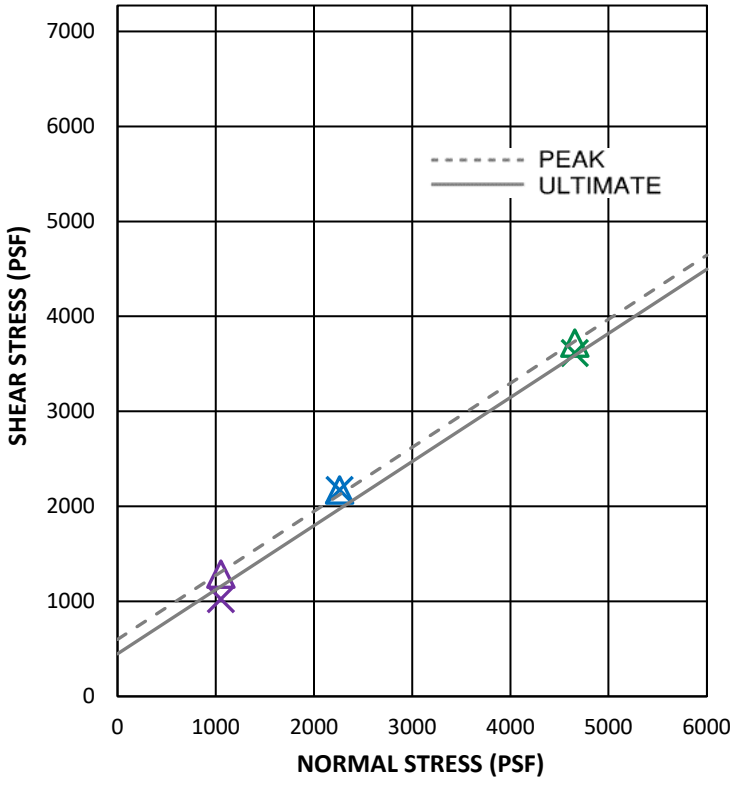
SAMPLE NO.:	**LB3-3**	GEOLOGIC UNIT:	**Tsa**
SAMPLE DEPTH (FT):	**15**	NATURAL/REMOLDED:	**N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
ACTUAL NORMAL STRESS (PSF):	1053.8	2261.4	4657.4	--
WATER CONTENT (%):	21.9	22.8	22.5	22.4
DRY DENSITY (PCF):	103.2	101.0	100.2	101.4

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
WATER CONTENT (%):	24.3	25.4	25.5	25.0
PEAK SHEAR STRESS (PSF):	1285	2174	3720	--
ULT.-E.O.T. SHEAR STRESS (PSF):	1024	2174	3614	--

RESULTS		
PEAK	COHESION, C (PSF)	600
	FRICTION ANGLE (DEGREES)	34
ULTIMATE	COHESION, C (PSF)	450
	FRICTION ANGLE (DEGREES)	34





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DIRECT SHEAR - AASHTO T-236

SAN MARCOS RESIDENCES

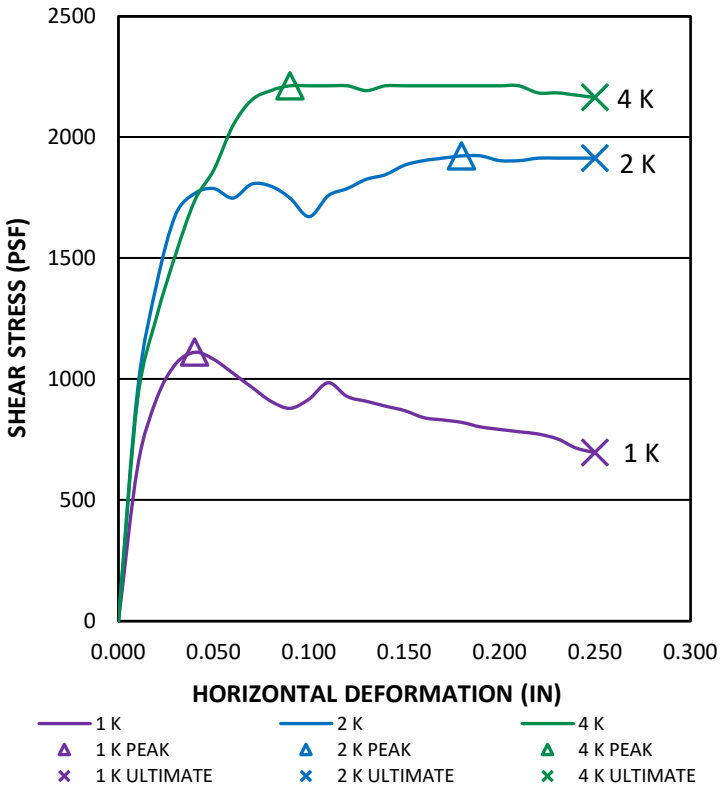
PROJECT NO.: G3355-42-01

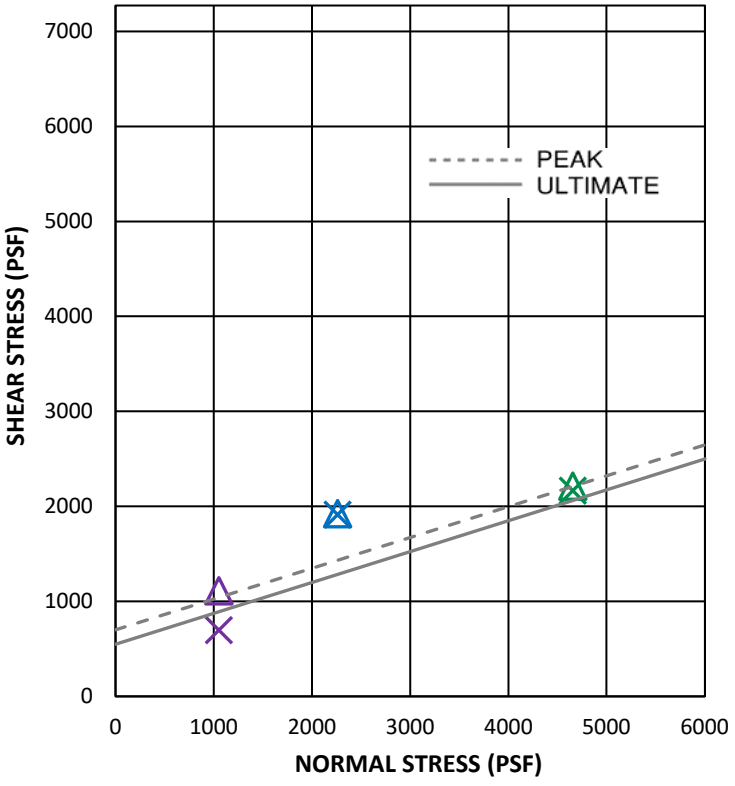
SAMPLE NO.:	**LB3-4**	GEOLOGIC UNIT:	**Tsa**
SAMPLE DEPTH (FT):	**20**	NATURAL/REMOLDED:	**N**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
ACTUAL NORMAL STRESS (PSF):	1053.8	2261.4	4657.4	--
WATER CONTENT (%):	27.9	26.4	28.4	27.6
DRY DENSITY (PCF):	93.6	96.8	93.4	94.6

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
WATER CONTENT (%):	29.6	28.2	31.1	29.7
PEAK SHEAR STRESS (PSF):	1111	1923	2213	--
ULT.-E.O.T. SHEAR STRESS (PSF):	696	1913	2164	--

RESULTS		
PEAK	COHESION, C (PSF)	700
	FRICTION ANGLE (DEGREES)	18
ULTIMATE	COHESION, C (PSF)	550
	FRICTION ANGLE (DEGREES)	18





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DIRECT SHEAR - AASHTO T-236

SAN MARCOS RESIDENCES

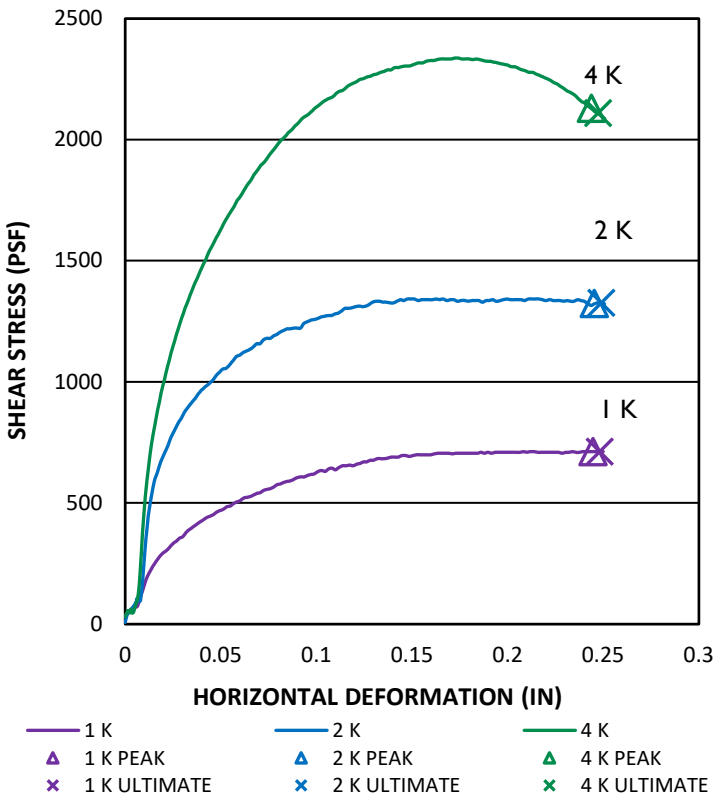
PROJECT NO.: G3355-42-01

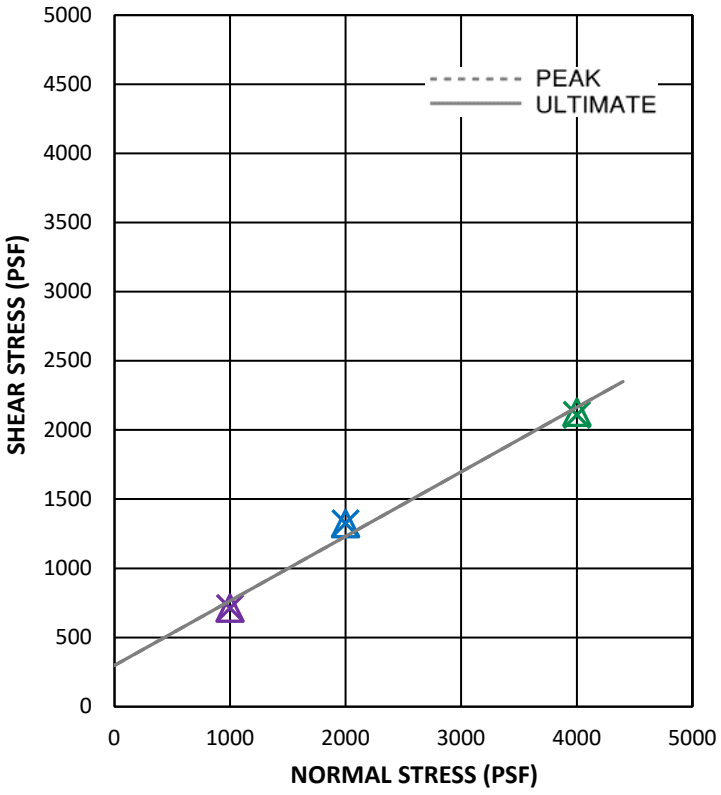
SAMPLE NO.:	**LB3-11**	GEOLOGIC UNIT:	**Tsa**
SAMPLE DEPTH (FT):	**42.5-43.5**	NATURAL/REMOLDED:	**R**

INITIAL CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
ACTUAL NORMAL STRESS (PSF):	1000	2000	4000	--
WATER CONTENT (%):				
DRY DENSITY (PCF):				

AFTER TEST CONDITIONS				
NORMAL STRESS TEST LOAD	**1 K**	**2 K**	**4 K**	**AVERAGE**
WATER CONTENT (%):				
PEAK SHEAR STRESS (PSF):	712	1323	2129	--
ULT.-E.O.T. SHEAR STRESS (PSF):	712	1326	2110	--

RESULTS		
PEAK	COHESION, C (PSF)	300
	FRICTION ANGLE (DEGREES)	25
ULTIMATE	COHESION, C (PSF)	300
	FRICTION ANGLE (DEGREES)	25





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DIRECT SHEAR - AASHTO T-236 (FULLY SOFTENED)

SAN MARCOS RESIDENCES

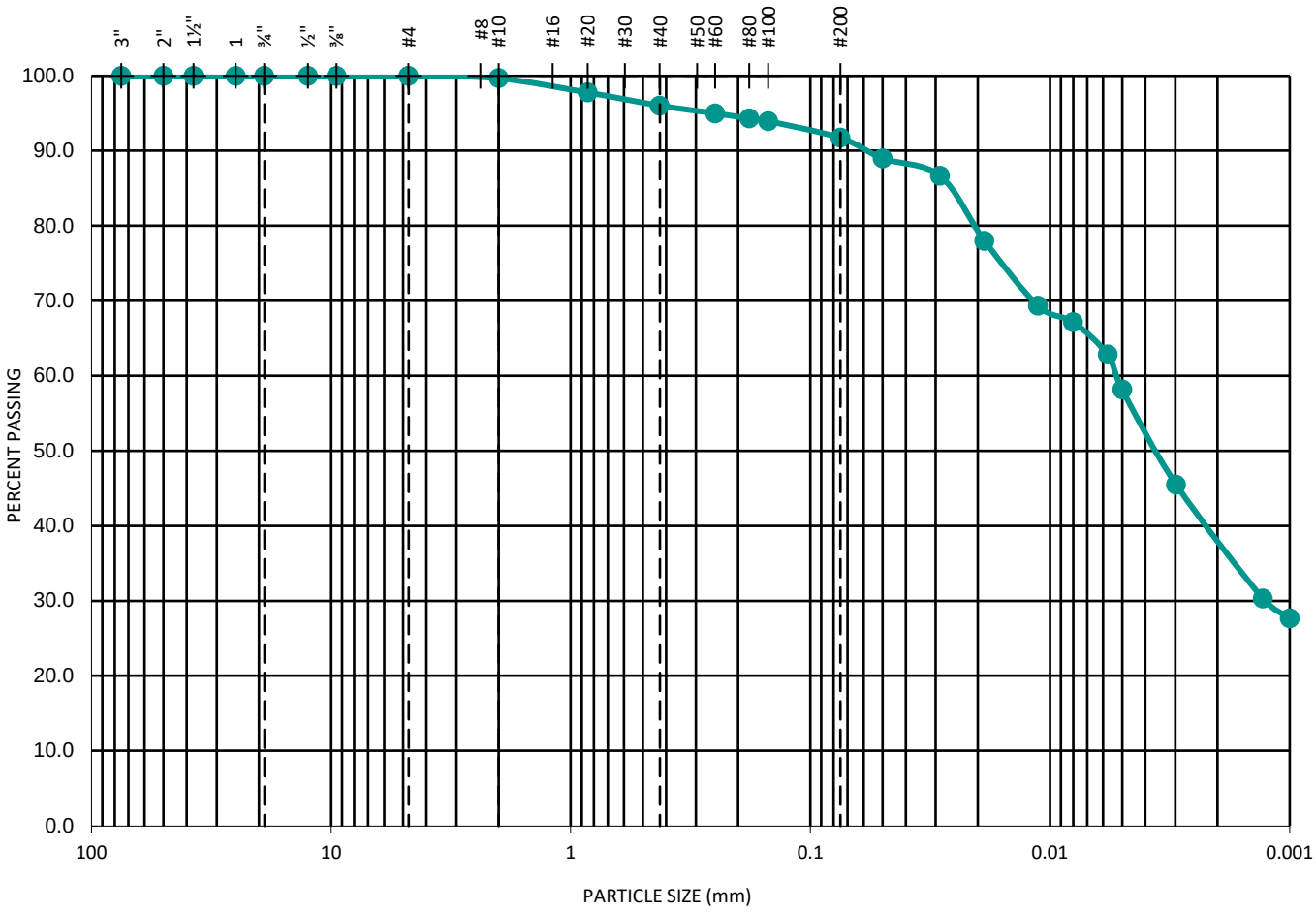
PROJECT NO.: G3355-42-01

SAMPLE NO.: **LB3-11** GEOLOGIC UNIT: **Tsa**

SAMPLE DEPTH (FT.): **42.5-43.5**

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

U.S. STANDARD SIEVE SIZE



TEST DATA					
D_{10} (mm)	D_{30} (mm)	D_{60} (mm)	C_c	C_u	SOIL DESCRIPTION
--	0.00126	0.00529	--	--	Sandy, lean CLAY

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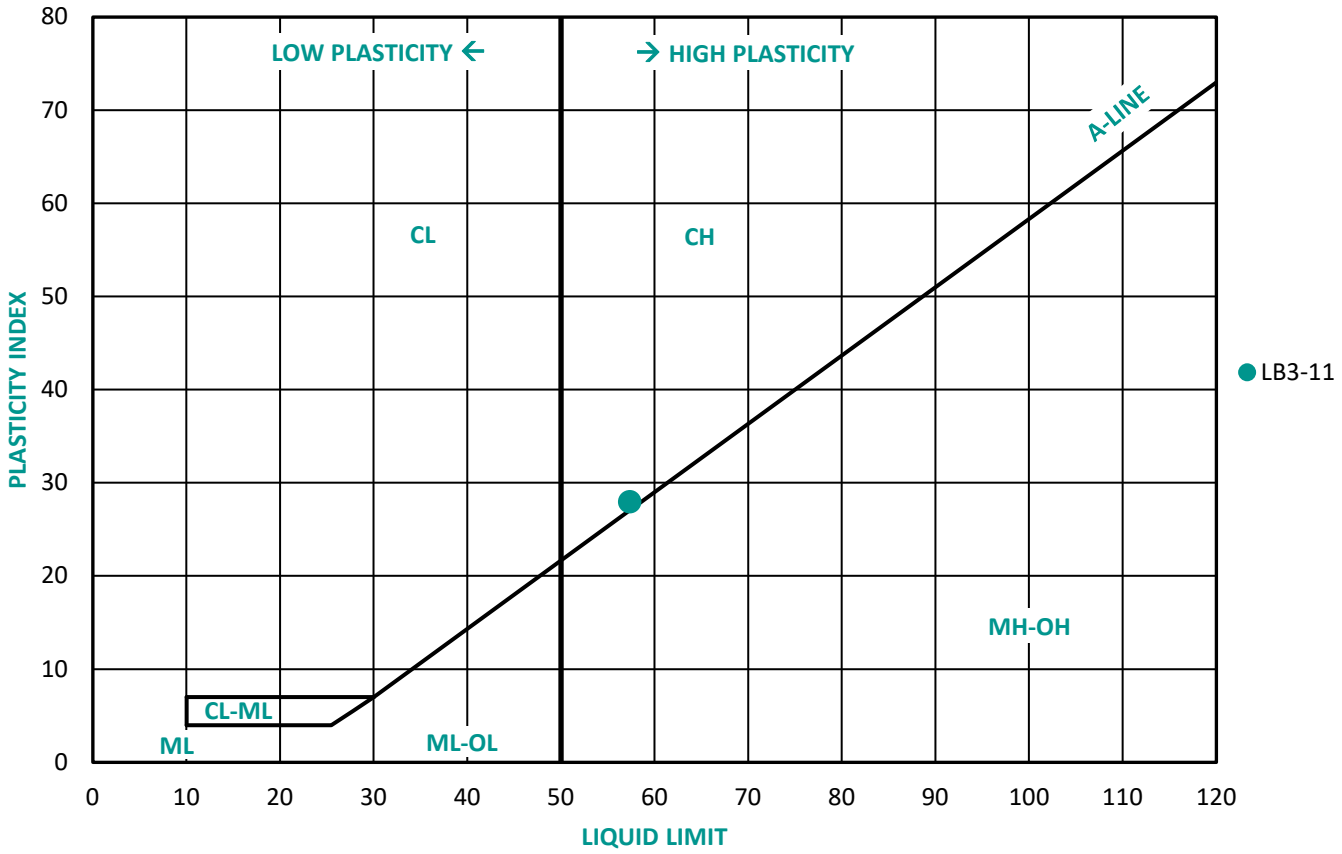
SIEVE ANALYSES - ASTM D 135 & D 422

SAN MARCOS RESIDENCES

PROJECT NO.: G3355-42-01

TEST RESULTS					
SAMPLE NO.	GEOLOGIC UNIT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SOIL TYPE
LB3-11	Tsa	57	29	28	CH



SOIL TYPE DESCRIPTION	
CH	High-Plasticity Clay
CL	Low-Plasticity Clay
ML	Low-Plasticity Silt
CL-ML	Low-Plasticity Clay to Low-Plasticity Silt
MH-OH	High-Plasticity Silt to High-Plasticity, Organic Silt
ML-OL	Low-Plasticity Silt to Low-Plasticity, Organic Silt

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PLASTICITY INDEX - ASTM D 4318

SAN MARCOS RESIDENCES

PROJECT NO.: G3355-42-01

APPENDIX C

APPENDIX C

BORING LOGS AND LABORATORY TESTING
NOVA ENGINEERING (2016),
GHOSTRIDER INCORPORATED (2020),
AND CHRISTIAN WHEELER ENGINEERING (2022)

FOR

SAN MARCOS RESIDENCES
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

PROJECT NO. G3355-42-01

Appendix A

Subsurface Explorations

LOG OF TEST BORING B-1

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	501'	Drive Type:	140lbs/30 inches
Proposed Elevation:	±500'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CH	**Slopewash (Qsw):** Brown, dry, medium stiff, FAT CLAY with reddish iron staining, upper 18" disturbed.							
				Moist, very stiff.	34	Cal		14.6	105.8		
				Very moist, greenish-gray to yellowish-brown.							
5					29	Cal		25.0	95.7		
			CL	**Santiago Formation (Tsa):** Greenish-gray to purplish-gray, moist, hard, SILTY CLAY with precipitate deposits and crystals in fractures.	50/5"	Cal					
10											
				Greenish-gray, some iron staining.	50/5"	Cal					
15											
					50/4"	Cal					
20				Terminated at 19 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-2

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	518'	Drive Type:	140lbs/30 inches
Proposed Elevation:	512'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	CH	**Slopewash (Qsw):** Greenish-brown to yellowish-brown, dry, medium stiff, FAT CLAY with some gravels. Expansion Index = 158 (Very High)							SA
		Moist, very stiff.							EI
		Very moist, greenish-gray to yellowish-brown.							MD PI SO4 DS
5	CH	**Santiago Formation (Tsa):** Olive gray, moist, hard, FAT CLAY with precipitate deposits, reddish-orange staining.	50/4"	Cal		16.1	109.2		
	CL	Greenish-gray to yellowish-brown, very moist, hard, SILTY CLAY with orangish iron staining.							
10		Orange iron staining.	50/4"	Cal		21.4	99.1		
15		Yellow iron staining.	50/4"	Cal					
		Purplish-gray, precipitate deposits and crystals in fractures.	50/2.5"	Cal					
20		Terminated at 20 feet. No groundwater or seepage encountered.							
25									
30									

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-2

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-3

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	537'	Drive Type:	140lbs/30 inches
Proposed Elevation:	532'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Documented Artificial Fill (Qdaf):** Light brown, dry to damp, stiff, SILTY CLAY.							
				Very stiff, moist.	32	Cal					
				Gravels from 4' to 6'.							
5					50/3"**	Cal		10.5	105.4		
				Stiff, greenish-gray to dark brown.							
					22	Cal		19.3	104.7		
10											
				Dark brown, very moist, stiff, SANDY CLAY with trace organics.							
			CH	**Santiago Formation (Tsa):** Greenish-gray to yellowish-brown, moist, hard, FAT CLAY with reddish-orangish iron staining, precipitate deposits and crystals in fractures.	50/5½"	Cal					
15											
					58	Cal					
20				Abundant precipitates, crystals in fractures and reddish-orange iron staining.	50/4"	Cal					
25			CL	Purplish-gray to greenish-gray, very moist, hard, SILTY CLAY.	50/5½"	Cal					
30				Continued on A-4							

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁹⁹ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-3

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-3 (cont.)

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	537'	Drive Type:	140lbs/30 inches
Proposed Elevation:	532'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
30			CL	**Santiago Formation (Tsa):** Purplish-gray to greenish-gray, very moist, hard, SILTY CLAY with reddish-orangish iron staining and precipitate deposits and crystals in fractures.	50/5"	Cal					
35				Terminated at 34 feet. No groundwater or seepage encountered.							
40											
45											
50											
55											
60											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁹⁹ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-4

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-4

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	538'	Drive Type:	140lbs/30 inches
Proposed Elevation:	532'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Santiago Formation (Tsa):** Greenish-gray to yellowish-brown, dry, stiff, SILTY CLAY with precipitate deposits and crystal in fractures and yellowish iron staining.							
				Moist, very stiff.							
				Highly weathered from 0' to 3'.							
5				Hard.							
					50/5"	Cal		18.9	105.4		DS
				Very moist.							
10					93	Cal		24.6	95.1		
15					50/5"	Cal					
					50/3"	Cal*					
20				Terminated at 18.5 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-5

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-5

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	516'	Drive Type:	140lbs/30 inches
Proposed Elevation:	512'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CH	**Slopewash (Qsw):** Medium brown, moist, stiff, FAT CLAY.							
				Very stiff.							
5					37	Cal		17.8	104.1		Con
				Very moist.							
10					50/4"**	Cal		23.4	104.1		Con
			CL	**Santiago Formation (Tsa):** Greenish-gray to yellowish-brown, moist, hard, SILTY CLAY with precipitate deposits in fractures, abundant reddish-orange iron staining.							
15					65	Cal					
				Yellowish iron staining.							
					50/5"	Cal					
20				Terminated at 19 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-6

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-6

Date Logged:	8/29/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	497'	Drive Type:	140lbs/30 inches
Proposed Elevation:	±500'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CH	**Slopewash (Qsw):** Dark brown, moist, stiff, FAT CLAY with reddish iron staining, disturbed from 0' to 2'.							
				Very stiff.	43	Cal		16.1	107.0		
5					50	Cal					
10			CL	**Santiago Formation (Tsa):** Olive gray, moist, very stiff, SILTY CLAY with abundant white precipitate deposits and crystals in fractures, reddish-orangish iron staining, moderately weathered from 10' to 16'. Below 16' slightly weathered.	47	Cal					
15				Olive gray, moist, hard.	65	Cal					
					69	Cal					
20				Terminated at 19.5 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-7

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-1

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	496.5'	Drive Type:	N/A
Finish Elevation:	±496'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CH	**Slopewash (Qsw):** Brown, dry, medium stiff, FAT CLAY, upper 12" disturbed with AC debris, reddish iron staining.							
1				Dark brown, very moist, stiff, with reddish iron staining.							
2											
3				Very stiff.							
4						CK		18.0	93.5		
5											
6											
7											
8											
9				Reddish-brown to olive gray, mottled.							
10						CK					
11											
12			CL	**Santiago Formation (Tsa):** Olive gray, very moist, very stiff, SILTY CLAY with orangish iron staining and abundant gypsum crystals in fractures, highly weathered.							
13						CK					
14				Terminated at 14 feet. No groundwater or seepage encountered.							
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-8

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-2

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	500'	Drive Type:	N/A
Finish Elevation:	±500'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Light grayish-brown, damp, loose to medium dense, very fine- to coarse-grained, SILTY SAND with gravels.							
2			CH	**Slopewash (Qsw):** Brown to reddish-brown, very moist, medium stiff, FAT CLAY, mottled.							
4				Stiff.		CK		24.0	98.8		
8			CL	**Santiago Formation (Tsa):** Olive gray to purplish-brown, very moist, very stiff, SILTY CLAY, mottled with orangish iron staining and gypsum crystals in fractures, highly weathered.		CK					
11				Terminated at 11 feet. No groundwater or seepage encountered.		CK					

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-9

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-3

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	515'	Drive Type:	N/A
Finish Elevation:	512'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CH	**Slopewash (Qsw):** Grayish-brown, dry, medium stiff, FAT CLAY with white precipitate deposits and trace shell fragments.							
1											
2				Damp, very stiff.							
3				Moist.							
4											
5						CK		15.9	98.1		
6											
7				Brown.							
8						CK					
9			CL	**Santiago Formation (Tsa):** Light olive gray, moist, very stiff, SANDY CLAY, highly weathered, mottled.		CK					
10				White, hard.							
11						CK					
				Terminated at 11.5 feet. No groundwater or seepage encountered.							
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ❞ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-10

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-4

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	526'	Drive Type:	N/A
Finish Elevation:	±512'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Documented Artificial Fill (Qdaf):** Grayish-brown, dry, soft, SANDY CLAY with gravel, upper 2' disturbed by landscaping operations. Expansion Index = 116 (High)							HA EI MD SO4 DS
2				Moist, very stiff.		CK					
4			CH	**Santiago Formation (Tsa):** Olive gray, very moist, hard, FAT CLAY with yellow precipitate deposits, moderately weathered. Expansion Index = 139 (Very High)		CK		22.9	98.7		HA EI MD PI SO4 DS
6				Terminated at 6 feet. No groundwater or seepage encountered.							

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-11

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-5

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	526'	Drive Type:	N/A
Finish Elevation:	±512'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Documented Artificial Fill (Qdaf):** Grayish-brown, dry, medium stiff, SANDY CLAY, upper 12" decompacted.							
1				Moist, very stiff.							
2											
3				Very moist.		CK		26.5	88.7		
4											
5											
6			CH	**Santiago Formation (Tsa):** Olive gray, moist, very stiff, FAT CLAY with orangish iron staining and white precipitate deposits infractures, moderately weathered.		CK		26.5	88.7		
7											
8				Terminated at 7.5 feet. No groundwater or seepage encountered.							
9											
10											
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁹⁹ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-12

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-6

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	539'	Drive Type:	N/A
Finish Elevation:	±532'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Documented Artificial Fill (Qdaf):** Light greenish-gray, dry, medium stiff, SANDY CLAY, upper 1.5' decompacted and dry.							
1											
2				Damp, stiff.		CK					
3				Dark brown, very stiff, SILTY CLAY.							
4						CK					
5											
6											
7				Dark greenish-gray, organic scent, trace organics.							
8						CK					
9											
10				Terminated at 9.5 feet. No groundwater or seepage encountered.							
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-13

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-7

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	543'	Drive Type:	N/A
Finish Elevation:	535'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Santiago Formation (Tsa):** Dark olive gray, damp, medium stiff, SILTY CLAY with orangish iron staining and white precipitate deposits in fractures, upper 12" disturbed.							
1				Moist, hard.							
2											
3						CK					
4				Light olive brown to yellowish-brown, SILTY CLAY with sand.							
5						CK					
6											
7											
8				Fossiliferous concretion bed at 8' to 9'. Hard digging.							
9											
10				Terminated at 10 feet. No groundwater or seepage encountered.							
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-14

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-8

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	438'	Drive Type:	N/A
Finish Elevation:	532'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Santiago Formation (Tsa):** Olive gray, damp, medium stiff, SILTY CLAY with orangish iron staining and white precipitate deposits in fractures, upper 12" disturbed, highly fractured/weathered to 3'.							
1				Moist, very stiff.							
2											
3				Hard.							
4											
5				SANDY CLAY.		CK		26.3	94.5		
6											
7											
8						CK					
9				Terminated at 9 feet. No groundwater or seepage encountered.							
10											
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-15

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-9

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	541'	Drive Type:	N/A
Finish Elevation:	534'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Santiago Formation (Tsa):** Light olive gray, dry, medium stiff, SILTY CLAY, upper 12" disturbed.							
1				Very stiff.							
2				Hard, SANDY CLAY, orangish iron staining.							
3						CK					
4				Fossiliferous concretion at 4' to 4.5'.							
5				Brown.							
6											
7											
8						CK		23.5	95.3		
9				Terminated at 9 feet. No groundwater or seepage encountered.							
10											
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-16

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST TRENCH T-10

Date Logged:	8/29/22	Equipment:	Cat 430 Backhoe
Logged By:	DJF	Auger Type:	24" Bucket
Existing Elevation:	540'	Drive Type:	N/A
Finish Elevation:	532'	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			CL	**Documented Artificial Fill (Qdaf):** Dark grayish-brown, damp, medium stiff, SILTY CLAY.							
1				Moist, very stiff.							
2											
3			SC	**Santiago Formation (Tsa):** White, moist, very dense, very fine- to medium-grained, CLAYEY SAND.							
				Fossiliferous concretion at 3.5' to 4".							
4			CL	Greenish-gray, moist, hard, SILTY CLAY.							
5											
6						CK		17.8	111.0		
7											
8											
9				Terminated at 9 feet. No groundwater or seepage encountered.							
10											
11											
12											
13											
14											
15											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁹⁹ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

SAN MARCOS RESIDENCES
2972-2982 S. SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

DATE:	DECEMBER 2022	JOB NO.:	2220399.01
BY:	SD	APPENDIX:	A-17

CHRISTIAN WHEELER ENGINEERING

Appendix B

Laboratory Test Results

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. Brief descriptions of the tests performed are presented below:

a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System and are presented on the exploration logs in Appendix A.

b) **MOISTURE-DENSITY: MOISTURE-DENSITY:** In-place moisture contents and dry densities were determined for a selected soil sample in accordance with ATM D 1188 and D 2937. The results are summarized in the subsurface exploration logs presented in Appendix A.

c) **DIRECT SHEAR:** a direct shear test was performed on selected samples of the on-site soils in accordance with ASTM D3080.

d) **EXPANSION INDEX TEST:** Expansion index tests were performed on selected remolded soil samples in accordance with ASTM D 4829.

e) **GRAIN SIZE DISTRIBUTION:** The grain size distribution of selected samples was determined in accordance with ASTM C136 and/or ASTM D422.

f) **ATTERBERG LIMITS:** The Liquid Limit, Plastic Limit and Plastic Index of selected soil samples were determined in accordance with ASTM D424.

g) **SOLUBLE SULFATE CONTENT:** The soluble sulfate content of selected soil samples was determined in accordance with California Test Methods 417.

h) **CONSOLIDATION TEST:** Consolidation tests were performed on selected undisturbed samples in accordance with ASTM D 2435.

LABORATORY TEST RESULTS

SAN MARCOS RESIDENCES

2972-2982 SOUTH SANTA FE AVENUE

SAN MARCOS, CALIFORNIA

MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT (ASTM D1557)

Sample Location	**Boring B-2 @ 0-5'**	**Trench T-4@ 0-3½'**	**Trench T-4 @ 3½'-6'**
Sample Description	Brown Silty Clay (CH)	Grayish-Brown Silty Clay (CL)	Light Brown Silty Clay (CH)
Maximum Density	108.5 pcf	116.8 pcf	108.6 pcf
Optimum Moisture	15.2 %	13.5 %	15.6 %

DIRECT SHEAR (ASTM D3080)

Sample Location	**Boring B-2 @ 0'-5'**	**Boring B-4 @ 5½'**	**Trench T-4@ 0-3½'**
Sample Type	Remolded to 90%	Undisturbed	Remolded to 90%
Friction Angle	14°	20°	18°
Cohesion	400 psf	800 psf	400 psf

EXPANSION INDEX TESTS (ASTM D4829)

Sample Location	**Boring B-2 @ 0'-5'**	**Trench T-4@ 0-3½'**	**Trench T-4 @ 3½'-6'**
Initial Moisture	15.8 %	13.0 %	15.2 %
Initial Dry Density	91.4 pcf	100.5 pcf	94.5 pcf
Final Moisture	38.7 %	29.9 %	35.4 %
Expansion Index	158 (Very High)	116 (High)	139 (Very High)

GRAIN SIZE DISTRIBUTION (ASTM D422)

Sample Location	**Boring B-2 @ 0-5'**	**Trench T-4@ 0-3½'**	**Trench T-4@ 3½'-6'**
Sieve Size	*Percent Passing*	*Percentage Passing*	*Percentage Passing*
1½"		100	
1"	100	96	
¾"	99	95	
½"	99	94	
⅜"	98	93	
#4	96	89	
#8	100	86	100
#16	99	83	99
#30	99	79	99
#50	97	75	98
#100	94	69	97
#200	86	61	93
0.05 mm	82	60	
0.005 mm	63	38	
0.001 mm	55	28	

LABORATORY TEST RESULTS (CONT.)

ATTERBERG LIMITS (ASTM D424)

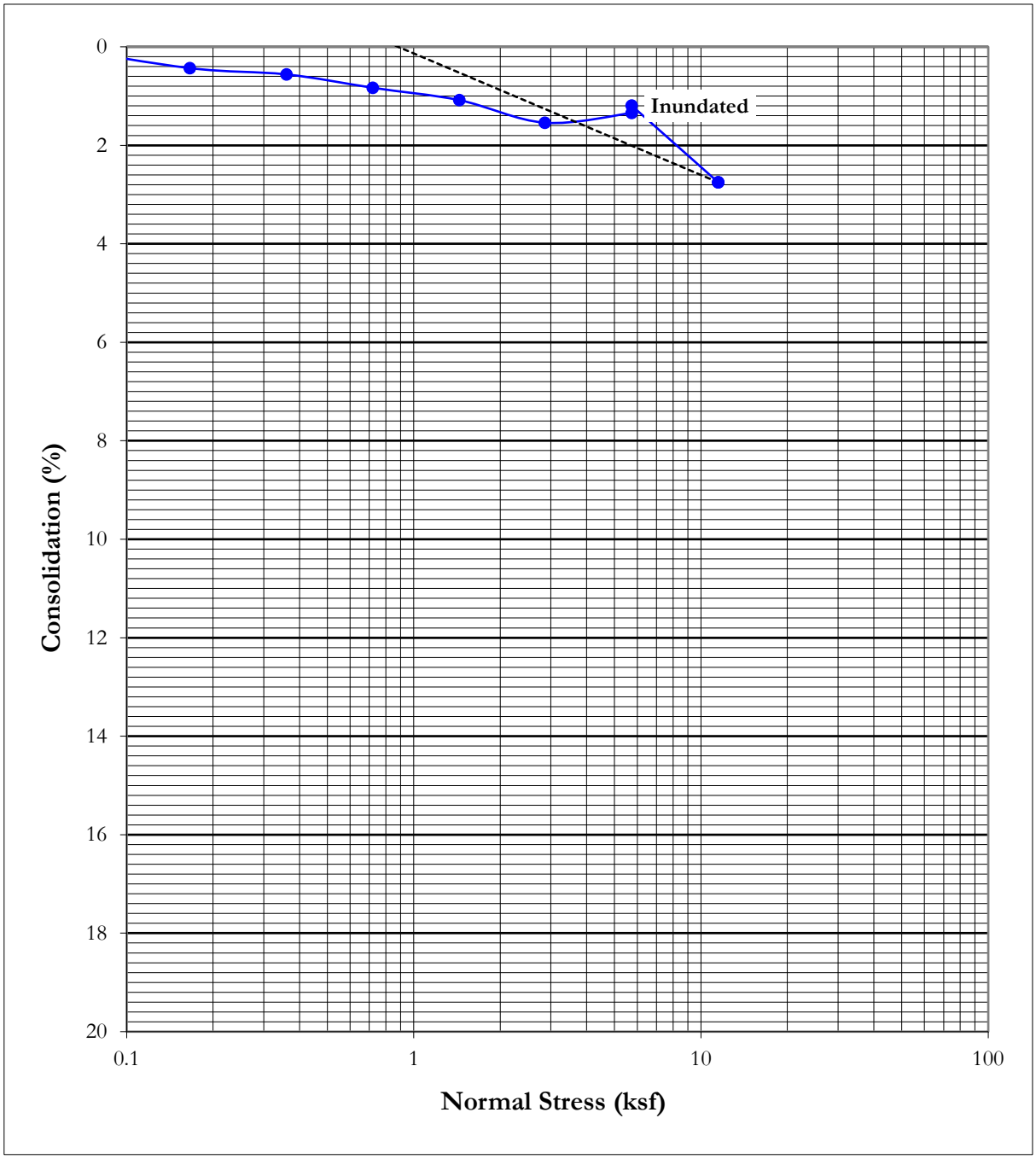
Sample Location	**Boring B-2 @ 0-5'**	**Trench T-4@ 3½' -6'**
Liquid Limit	66	59
Plastic Limit	25	24
Plasticity Index	41 (CH)	35 (CH)

SOLUBLE SULFATES (CALIFORNIA TEST 417)

Sample Location	**Boring B-2 @ 0-5'**	**Trench T-4@ 0-3½'**	**Trench T-4@ 3½' -6'**
Soluble Sulfate	0.022 % (SO_4)	0.045 % (SO_4)	0.048 % (SO_4)

CONSOLIDATION TEST

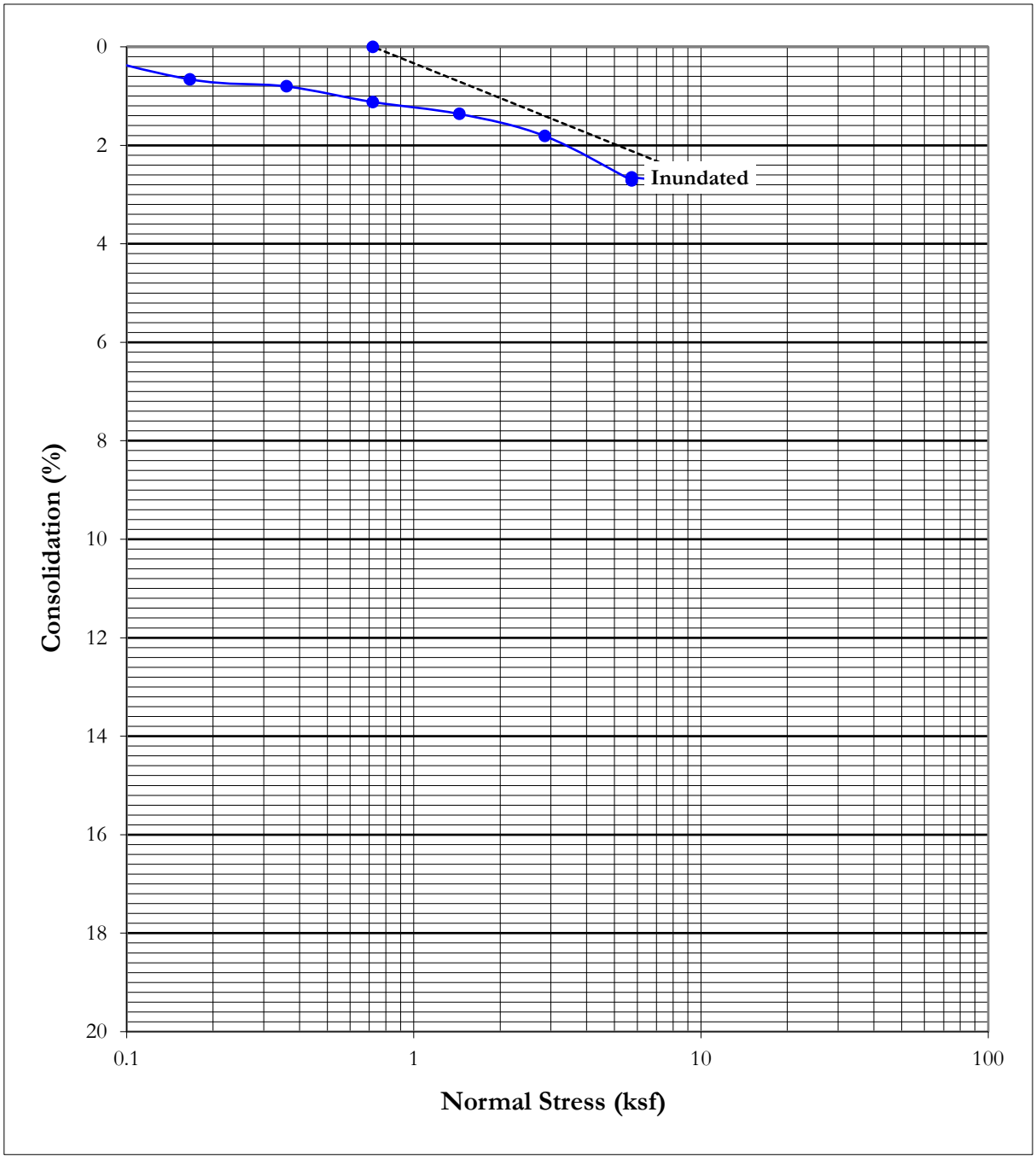
ASTM D2435



CHRISTIAN WHEELER ENGINEERING	SAN MARCOS RESIDENCES 2972-2982 SOUTH SANTA FE AVENUE			B-5 @ 5½'
	BY: DBA	DATE: DEC 2022	REPORT NO.:2220399.01	PLATE NO.: B-3

CONSOLIDATION TEST

ASTM D2435



CHRISTIAN WHEELER ENGINEERING	SAN MARCOS RESIDENCES 2972-2982 SOUTH SANTA FE AVENUE		B-5 @ 9½'	
	BY: DBA	DATE: DEC 2022	REPORT NO.:2220399.01	PLATE NO.: B-4

Appendix B

Exploratory Logs

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM Visual-Manual Procedure (ASTM D2488)					CONSISTENCY / RELATIVE DENSITY
MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	CRITERIA
Coarse-Grained Soils* More than 50 % Retained on No. 200 Sieve	Gravels 50 % or more of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels	GW	Well Graded Gravels and Gravel-Sand Mixtures, Little or no Fines	Reference: 'Foundation Engineering', Peck, Hansen, Thornburn, 2nd Edition.
			GP	Poorly Graded Gravels and Gravel-Sand Mixtures, Little or no Fines	Standard Penetration Test Granular Soils
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**	Penetration Resistance, N, (Blows / Foot) / Relative Density
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**	0 - 4 Very Loose
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines	4 - 10 Loose
			SP	Poorly Graded Sands and Gravely Sands, Little or no Fines	10 - 30 Medium
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**	30 - 50 Dense
			SC	Clayey Sands, Sand-Clay Mixtures**	> 50 Very Dense
Fine Grained Soils* 50 % or more Passes No. 200 Sieve	Silts and Clays Liquid Limits 50 % or less		ML	Inorganic Silts, Sandy Silts, Rock Flour	Standard Penetration Test Cohesive Soils
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays	Penetration Resistance, N, (Blows / Foot) / Consistency / Unconfined Compressive Strength, (Tons / Sq. Ft.)
			OL	Organic Silts and Organic silty Clays of Low Plasticity	< 2 Very Soft < 0.25
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts	2 - 4 Soft 0.25 - 0.5
			CH	Inorganic Clays of High Plasticity, Fat Clays	4 - 8 Medium 0.5 - 1.0
			OH	Organic Clays of Medium to High Plasticity	8 - 15 Stiff 1.0 - 2.0
					15 - 30 Very Stiff 2.0 - 4.0
					> 30 Hard > 4.0
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils	

* Based on material passing the 3-inch sieve.

** More than 12% passing the No. 200 sieve; 5% to 12% passing No. 200 sieve requires use of duel symbols (i.e., SP-SM GP-GM, SP-SC, GP-GC, etc.); Border line classifications are designated as CH/CL, GM/SM, SP/SW, etc.

U.S. Standard Sieve Size 12" 3" 3/4" #4 #10 #40 #200

Unified Soil Classification Designation	Boulders	Cobbles	Gravel		Sand			Silt and Clay
			Coarse	Fine	Coarse	Medium	Fine	

Moisture Condition

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible moisture.
Wet	Visible free water, usually below the water table.

Material Quantity

Trace	< 5 %
Slightly	5 - 12%
Little	12 - 25%
Some	25 - 50 %

Other Symbols

C - Core Sample
S - SPT Sample
B - Bulk Sample
CK - Chunk Sample
R - Ring Sample
N - Nuclear Gauge Test
∇ - Water Table

Date:	Simplified USCS Soils Classification Chart	ETERNIA	Figure
3/26/2019			B-1
Drawn By:			
L.B.			

GHOSTRIDER

SUBSURFACE EXPLORATION LOG
BORING NO. 1

Project Name: San Marcos Apts. Date: 5/6/2020 Logged By: D.J. / Gostrider
Type of Rig: Drill Rig Drive Wt.: 140 lbs. Elevation: From Surface
Drill Hole Dia.: 6" Drop: 30" Depth of Boring (ft.): 50.5

Depth (ft.)	Sample Type	No. of Blows per 6"	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
			SC					**0'-3' - Dark Brown Clayey Sand with Gravel, Moist, Loose**
0.0								
2.5								
5.0	R	5,13,15	CL	97.4	16.0			Yellowish Brown Sandy Clay, Moist, Stiff
7.5	R	7,12,17	CL	100.3	25.3			Grayish Brown Clay, Moist, Stiff
10.0	R	4,15,29	CL	102.6	21.4			Grayish Brown Sandy Clay, Moist, Very Stiff
12.5								
15.0	R	10,20,32	CL	100.7	23.7			Yellowish Brown Sandy Clay, Moist, Very Stiff
17.5								
20.0	R	10,19,18	CL	100.5	23.0			Dark Brown Clay with Yellowish Streaking, Moist, Very Stiff
22.5								
25.0	R	11,23,44	CL	102.3	23.4			Light Grayish Brown Sandy Clay, Moist, Very Stiff
27.5								
30.0	S	10,20,39	CL		23.7			Grayish Brown Clay with Sand, Moist, Very Stiff
32.5								
35.0	S	9,17,24	CL		21.4			Grayish Brown Clay with Sand, Moist, Very Stiff
37.5								
40.0	S	9,24,34	CL		18.0			Grayish Brown Clay with Sand, Moist, Very Stiff
42.5								
45.0	S	10,21,31	CL		20.8			Greenish Brown Sandy Clay, Moist, Very Stiff
47.5								
50.0	S	18,50,-	CL		24.8			Greenish Brown Sandy Clay, Moist, Hard
52.5								Hole Refusal at 51', Backfilled with Slurry

S - SPT Sample R - Ring Sample B - Bulk Sample D - Disturbed Sample

GHOSTRIDER

SUBSURFACE EXPLORATION LOG
BORING NO. 2

Project Name: San Marcos Devlop. Date: 5/6/2020
Type of Rig: Drill Rig Drive Wt.: 140 lbs.
Drill Hole Dia.: 6" Drop: 30"

Project No.:
Logged By: D.J. / Ghostrider
Elevation: From Surface
Depth of Boring (ft.): 20.5'

Depth (ft.)	Sample Type	No. of Blows per 6"	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
			SC					**0'-3' - Dark Brown Clayey Sand with Gravel, Moist, Loose**
1								
2								
3	R	2,3,6	CL	96.5	25.0			Yellowish Brown Sandy Clay, Moist, Stiff
4								
5								
6	R	14,20,26	CL	112.2	16.8			Yellowish Brown Sandy Clay, Moist, Very Stiff
7								
8								
9								
10	B	7,13,19	CL		17.7			Olive Green Brown Sandy Clay, Moist, Stiff
11								
12								
13								
14								
15	R	9,21,22	CL	107.9	19.3			OliveGreen Brown Sandy Clay, Moist, Very Stiff
16								
17								
18								
19								
20	B	9,17,23	CL		18.4			Olive Reddish Brown Sandy Clay, Moist, Very Stiff
								Hole Abandoned at 20' - Backfilled with Cuttings
21								
22								

S - SPT Sample R - Ring Sample B - Bulk Sample D - Disturbed Sample

SUBSURFACE EXPLORATION LOG
BORING NO. 3

Project Name: San Marcos Devlop. Date: 5/6/2020
Type of Rig: Drill Rig Drive Wt.:
Drill Hole Dia.: 6" Drop:

Project No.:
Logged By: D.J. / Ghostrider
Elevation: From Surface
Depth of Boring (ft.): 20.5'

Depth (ft.)	Sample Type	No. of Blows per 6"	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
			SC					**0'-3' - Dark Brown Clayey Sand with Gravel, Moist, Loose**
1								
2								
3	R	6,6,7	SC	103.8	20.6			Dark Brown Clayey Sand with Grave, Moist, Loose
4								4'-5.5' - Dark Brown Sandy Clay, Moist, Loose
5	R	4,6,10	CL	115.6	12.8			Dark Brown Sandy Clay, Moist Loose
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

S - SPT Sample R - Ring Sample B - Bulk Sample D - Disturbed Sample

GHOSTRIDER

SUBSURFACE EXPLORATION LOG
BORING NO. 4

Project Name: San Marcos Devlop. Date: 5/10/2020 Logged By: L.B. / Ghostrider
Type of Rig: Hand Auger Drive Wt.: N/A Elevation: From Surface
Drill Hole Dia.: 3" Drop: N/A Depth of Boring (ft.): 15'

Depth (ft.)	Sample Type	No. of Blows per 6"	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
			SC					**0'-4.5' - Dark Brown Clayey Sand with Gravel, Moist, Loose**
1								
2								
3	R	N/A	SC	110.5	13.1			Dark Brown Clayey Sand with Gravel, Moist, Loose
4								
5								
6	R	N/A	CL	101.5	15.7			Gryaish Brown Sandy Clay, Moist, Dense
7								
8								
9								
10	R	N/A	CL	103.5	20.1			Yellowish Brown Clay with Sand, Moist, Stiff
11								
12								
13								
14								
15	R	N/A	CL	100.1	22.3			Yellowish Brown Sandy Clay, Moist, Very Stiff Hole Abandoned at 15', Backfilled with Cuttings
16								
17								
18								
19								
20								
21								
22								

S - SPT Sample R - Ring Sample B - Bulk Sample D - Disturbed Sample

GHOSTRIDER

SUBSURFACE EXPLORATION LOG
BORING NO. 5

Project Name: San Marcos Devlop. Date: 5/10/2020 Logged By: L.B. / Ghostrider
Type of Rig: Hand Auger Drive Wt.: N/A Elevation: From Surface
Drill Hole Dia.: 3" Drop: N/A Depth of Boring (ft.): 15'

Depth (ft.)	Sample Type	No. of Blows per 6"	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
			SC					**0'-6' - Dark Brown Clayey Sand with Gravel, Moist, Loose**
1								
2								
3	R	N/A	SC	109.9	10.1			Dark Brown Clayey Sand with Gravel, Moist, Loose
4								
5	R	N/A	SC	110.3	13.5			Dark Brown Clayey Sand, Moist, Loose
6								
7								
8								
9								
10	R	N/A	CL	100.1	20.0			Yellowish Brown Sandy Clay, Moist, Stiff Hole Abandoned at 10.5', Backfilled with Cuttings
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								

S - SPT Sample R - Ring Sample B - Bulk Sample D - Disturbed Sample

Appendix B

Exploratory Logs

Appendix C

Laboratory Testing

Dry Density and Moisture Content

Date Tested: 5/20/2020

Boring #	Sample #	Depth (ft)	Dry Density (pcf)	Moisture Content (%)	Description
B-1	2	5'	97.4	16.0%	Yellowish Brown Sandy Clay
B-1	3	7.5'	100.3	25.3%	Grayish Brown Clay
B-1	4	10'	102.6	21.4%	Grayish Brown Sandy Clay
B-1	5	15'	100.7	23.7%	Yellowish Brown Sandy Clay
B-1	6	20'	100.5	23.0%	Dark Brown Clay with Yellowish Streaks
B-1	7	25'	102.3	23.4%	Light Gray Brown Sandy Clay
B-2	1	3'	96.5	25.0%	Yellowish Brown Clay with Sand
B-2	2	6'	112.2	16.8%	Yellowish Brown Sandy Clay
B-2	4	15'	107.9	19.3%	Olive Green Brown Clay with Sand
B-3	1	2.5'	103.8	20.6%	Dark Brown Clayey Sand with Gravel
B-3	2	5'	115.6	12.8%	Dark Brown Sandy Clay

Performed in General Accordance with ASTM D7263 B and D2216

GHOSTRIDER	Project Name	FIGURE
TECH: L.B.	Santa Fe Apartments	C-1
DATE: 11-Jun-20		

Dry Density and Moisture Content

Date Tested: 5/20/2020

Boring #	Sample #	Depth (ft)	Dry Density (pcf)	Moisture Content (%)	Description
B-4	1	3'	110.5	13.1%	Dark Brown Clayey Sand with Gravel
B-4	2	6'	101.5	15.7%	Grayish Brown Sandy Clay
B-4	3	10'	103.5	20.1%	Yellowish Brown Clay with Sand
B-4	4	15'	100.1	22.3%	Yellowish Brown Sandy Clay
B-5	1	2.5'	109.9	10.1%	Dark Brown Clayey Sand with Gravel
B-5	2	5'	110.3	13.5%	Dark Brown Clayey Sand
B-5	3	10'	100.1	20.0%	Yellowish Brown Sandy Clay

Performed in General Accordance with ASTM D7263 B and D2216

GHOSTRIDER	Project Name	FIGURE
TECH: L.B.	Santa Fe Apartments	C-2
DATE: 11-Jun-20		

Materials Finer than No. 200 Sieve

Date Tested	5/15/2020	5/15/2020	5/15/2020	5/15/2020	5/15/2020	5/15/2020
Boring No	B-1	B-1	B-1	B-1	B-1	B-1
Sample No.	2	3	4	5	6	7
Depth, ft.	5'	7.5'	10'	15'	20'	25'
Dry Weight before wash, g	94.1	127.4	122.5	114.9	147.2	104.5
Dry Weight After Wash, g	29.3	3.9	16.5	18.5	61.8	21.5
Weight Loss, No. 200, g	64.8	123.5	106	96.4	85.4	83
Passing No. 200, %	68.9	96.9	86.5	83.9	58.0	79.4
Sample Description	Yellowish Brown Sandy Clay	Grayish Brown Clay	Grayish Brown Sandy Clay	Yellowish Brown Sandy Clay	Dark Brown Clay with Yellowish Streaks	Light Gray Brown Sandy Clay

Date Tested	5/15/2020	5/15/2020	5/15/2020			
Boring No	B-1	B-1	B-1			
Sample No.	9	10	11			
Depth, ft.	35'	40'	45'			
Dry Weight before wash, g	163.3	145.3	233.6			
Dry Weight After Wash, g	12.4	10.6	40.2			
Weight Loss, No. 200, g	150.9	134.7	193.4			
Passing No. 200, %	92.4	92.7	82.8			
Sample Description	Grayish Brown Clay with Sand	Grayish Brown Clay with Sand	Greenish Brown Sandy Clay			

TEST PERFORMED IN ACCORDANCE WITH ASTM D 1140

GHOSTRIDER	**Project Name**	FIGURE
Tech: LB	**Santa Fe Apartments**	**C-3**
DATE: 6/11/2020		

Materials Finer than No. 200 Sieve

Date Tested	5/16/2020	5/16/2020	5/16/2020	5/16/2020	5/16/2020	
Boring No	B-2	B-2	B-2	B-2	B-2	
Sample No.	1	2	3	4	5	
Depth, ft.	3'	6'	10'	15'	20'	
Dry Weight before wash, g	156.5	97.4	159.5	145	185.8	
Dry Weight After Wash, g	14.3	9.9	5.1	5.2	22.7	
Weight Loss, No. 200, g	142.2	87.5	154.4	139.8	163.1	
Passing No. 200, %	90.9	89.8	96.8	96.4	87.8	
Sample Description	Yellowish Brown Clay with Sand	Yellowish Brown Sandy Clay	Olive Green Brown Clay with Sand	Olive Green Brown Clay with Sand	Olive Reddish Brown Sandy Clay	

Date Tested	5/16/2020	5/16/2020				
Boring No	B-3	B-3				
Sample No.	1	2				
Depth, ft.	2.5'	5'				
Dry Weight before wash, g	161.9	144.3				
Dry Weight After Wash, g	82.4	54.9				
Weight Loss, No. 200, g	79.5	89.4				
Passing No. 200, %	49.1	62.0				
Sample Description	Dark Brown Clayey Sand with Gravel	Dark Brown Sandy Clay				

TEST PERFORMED IN ACCORDANCE WITH ASTM D 1140

GHOSTRIDER	Project Name	FIGURE
Tech: AE	Santa Fe Apartments	C-4
DATE: 6/11/2020		

Materials Finer than No. 200 Sieve

Date Tested	5/16/2020	5/16/2020	5/16/2020	5/16/2020		
Boring No	B-4	B-4	B-4	B-4		
Sample No.	1	2	3	4		
Depth, ft.	3'	6'	10'	15'		
Dry Weight before wash, g	210.3	185.9	191.5	203.5		
Dry Weight After Wash, g	120.5	21.1	15.9	26.7		
Weight Loss, No. 200, g	89.8	164.8	175.6	176.8		
Passing No. 200, %	42.7	88.6	91.7	86.9		
Sample Description	Dark Brown Clayey Sand w/ Gravel	Grayish Brown Sandy Clay	Yellowish Brown Clay with Sand	Yellowish Brown Sandy Clay		

Date Tested	5/16/2020	5/16/2020	5/16/2020			
Boring No	B-5	B-5	B-5			
Sample No.	1	2	3			
Depth, ft.	2.5'	5'	10'			
Dry Weight before wash, g	265.5	220.1	189.3			
Dry Weight After Wash, g	193.5	131.5	21.3			
Weight Loss, No. 200, g	72	88.6	168			
Passing No. 200, %	27.1	40.3	88.7			
Sample Description	Dark Brown Clayey Sand w/ Gravel	Dark Brown Clayey Sand	Yellowish Brown Sandy Clay			

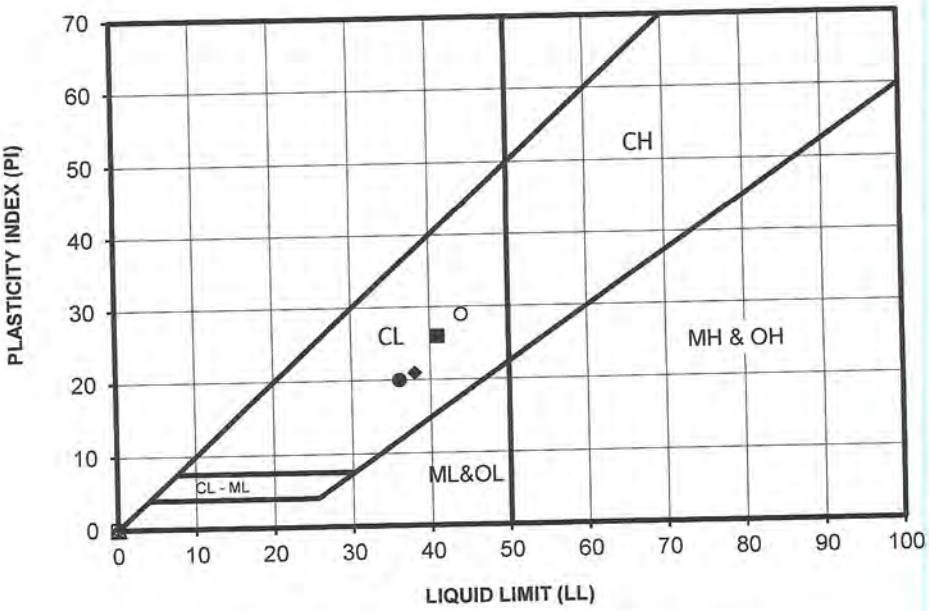
TEST PERFORMED IN ACCORDANCE WITH ASTM D 1140

GHOSTRIDER	Project Name	FIGURE
Tech: AE	Santa Fe Apartments	C-5
DATE: 6/11/2020		

ATTERBERG LIMITS TEST RESULTS

Date Tested : 5/17/2020

SYMBOL	SAMPLE NAME	DEPTH (ft)	LL	PL	PI	USCS CLASSIFICATION (Minus No. 40 Sieve Fraction)	USCS Entire Sample
●	B-1	5'	36	16	20	CL	CL
■	B-1	20'	41	15	26	CL	CL
◆	B-3	2.5'	38	17	21	CL	CL
○	B-4	15'	44	15	29	CL	CL
□							
△							
+							
◇							



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

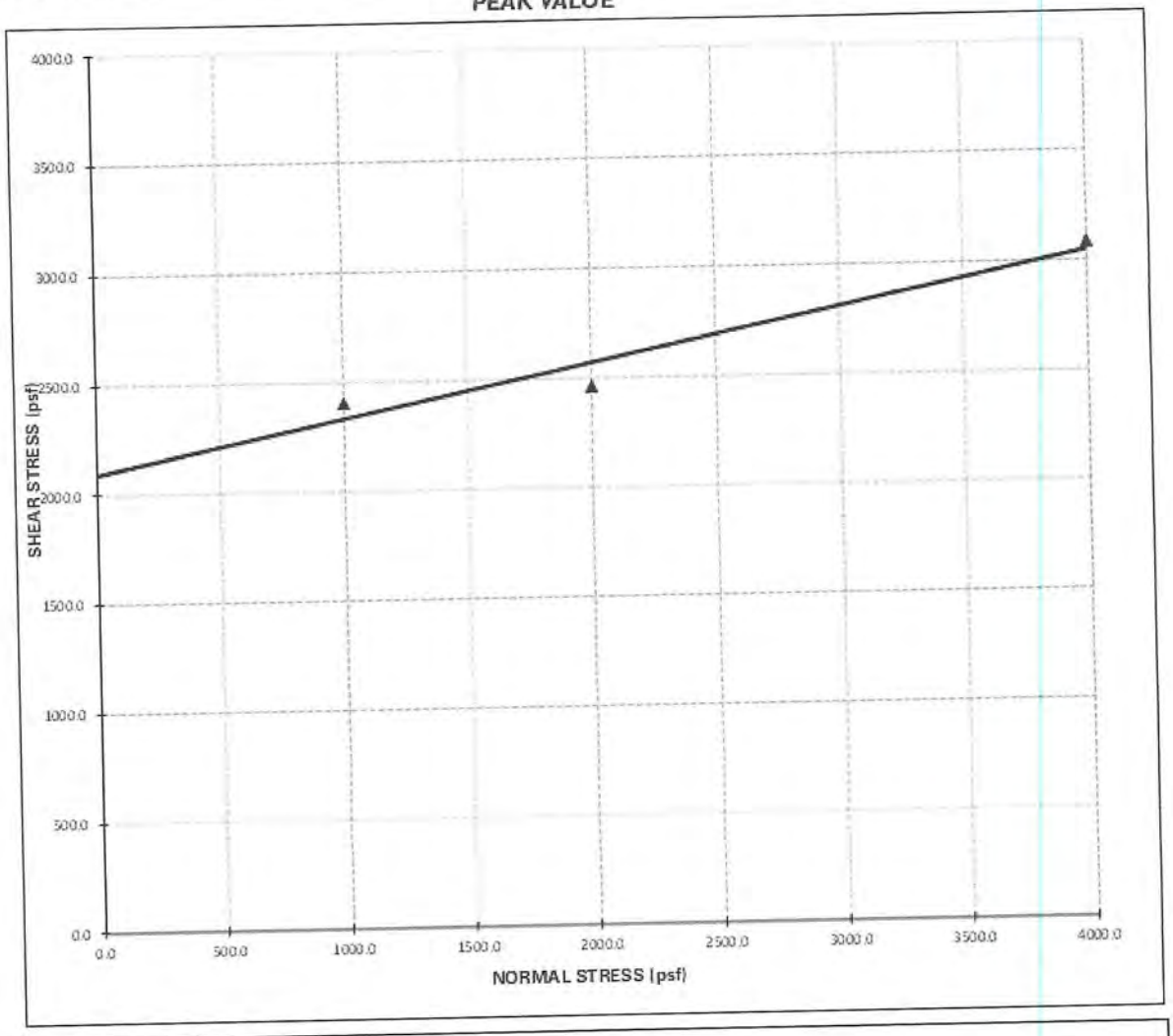
GHOSTRIDER	**Project Name:**	FIGURE
TECH:L.B.	**Santa Fe Apartments**	**C-6**
28-Jun-20		

GEOTEK

DIRECT SHEAR TEST

Project Name:	2972 Santa Fe, San Marcos	**Sample Location:**	B-1 @ 6
Project Number:	19-2118C	**Date Tested:**	6/8/2020

PEAK VALUE



Shear Strength: Φ = 13.5 ° C = 2088.00 psf

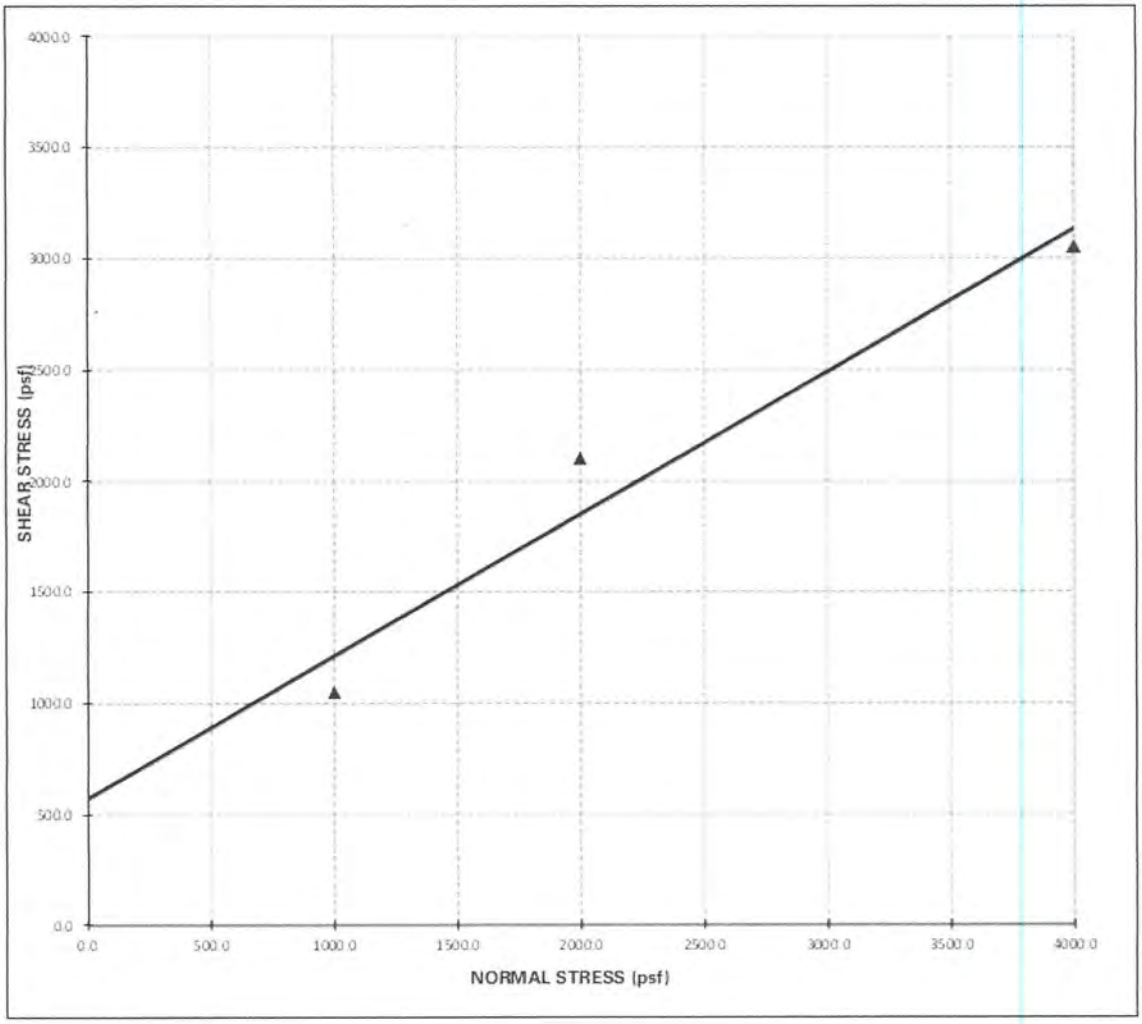
Notes:
1 - The soil specimens sheared were "undisturbed" ring samples.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

DIRECT SHEAR TEST

Ultimate Value

Project Name:	2972 Santa Fe, San Marcos	***Sample Location:***	B-1 @ 6
Project Number:	19-2118C	***Date Tested:***	6/8/2020



Shear Strength: Φ = **32.6** ° **C = 570.00 psf**

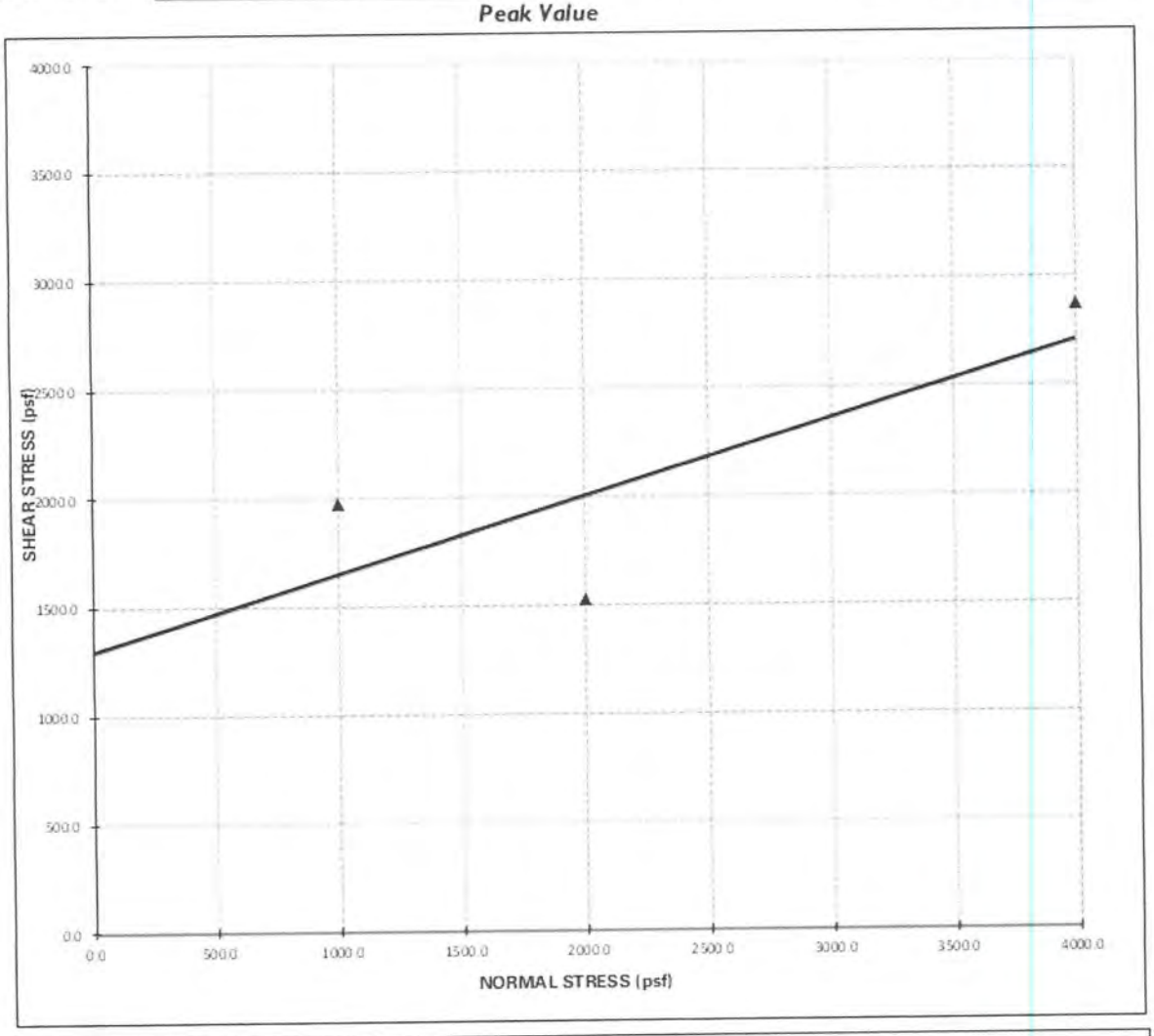
Notes: 1 - The soil specimens sheared were "undisturbed" ring samples.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

DIRECT SHEAR TEST

Project Name:	2972 Santa Fe, San Marcos	***Sample Location:***	B-4 @ 15
Project Number:	19-2118C	***Date Tested:***	6/8/2020

Peak Value



Shear Strength: Φ = **19.4** ° **C = 1296.00 psf**

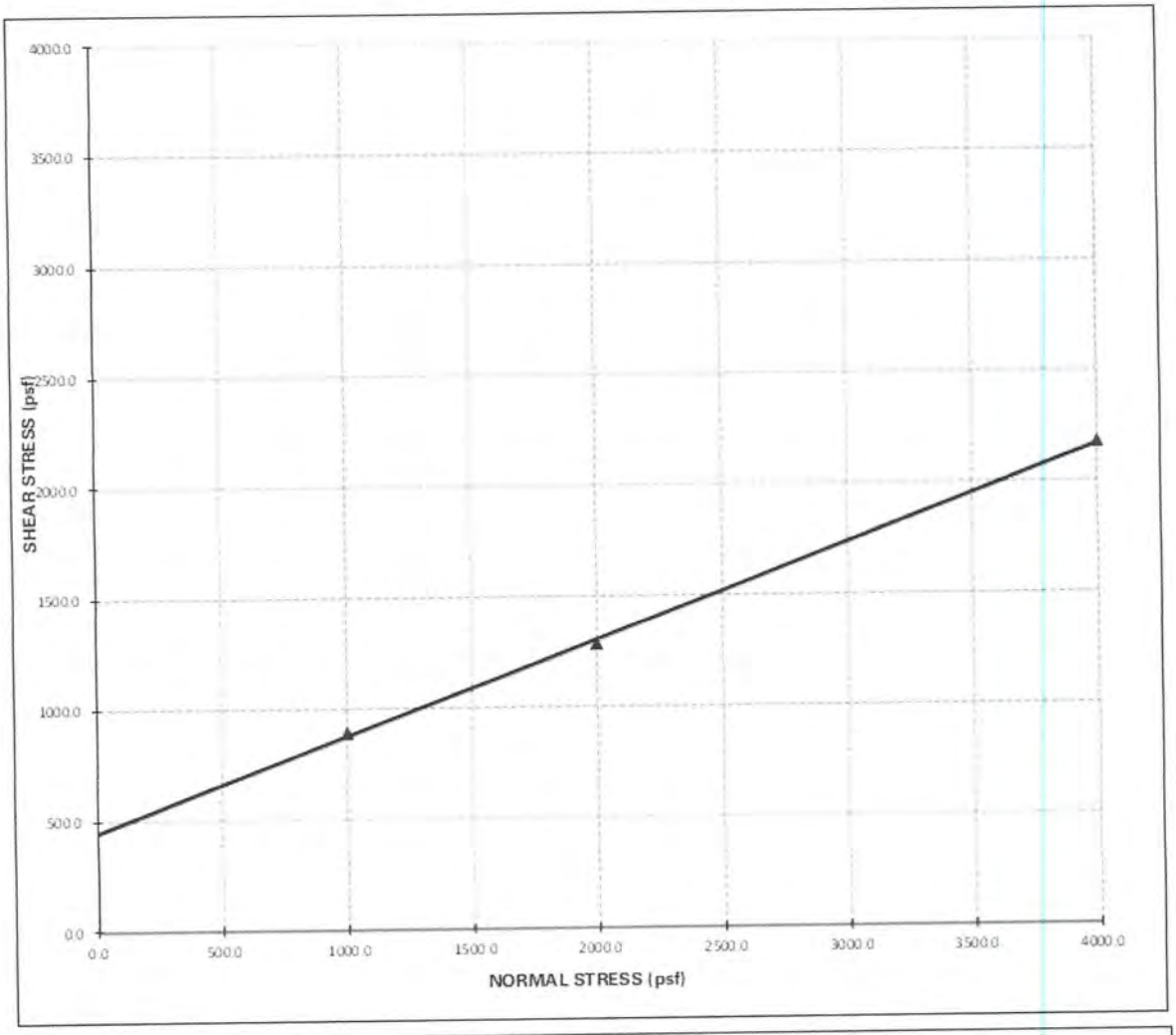
Notes: 1 - The soil specimens sheared were "undisturbed" ring samples.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

DIRECT SHEAR TEST

Ultimate Value

Project Name:	2972 Santa Fe, San Marcos	***Sample Location:***	B-4 @ 15
Project Number:	19-2118C	***Date Tested:***	6/8/2020



Shear Strength: Φ = 23.3 ° C = 444.00 psf

Notes:
1 - The soil specimens sheared were "undisturbed" ring samples.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

Expansion Index (ASTM D4829)

Location	Sample No.	Depth (ft)	Sample Description
B-1	Bulk	3'-8'	Yellowish Brown Clay with Sand

Density Determination	Trial #1	Trial #2
Weight Compacted Sample and Rin	724.7	
Weight of Ring	367.4	
Net Weight of Sample	357.3	
Wet Density, pcf	108.3	
Dry Density, pcf	94.3	

Moisture Determination		
Wet Weight of Sample, g	200.8	
Dry Weight of Sample, g	174.9	
Moisture Content, %	14.8%	

Expansion Index	154	
Corrected Expansion Index	**155**	**(VERY HIGH)**
% Saturation	50.8	

Expansion Readings			
DATE	TIME	READING	
5/20/2020	7:00 AM	0.1475	
5/20/2020	7:10 AM	0.1474	<< Add Water
5/22/2020	9:00 AM	0.3011	<< Final

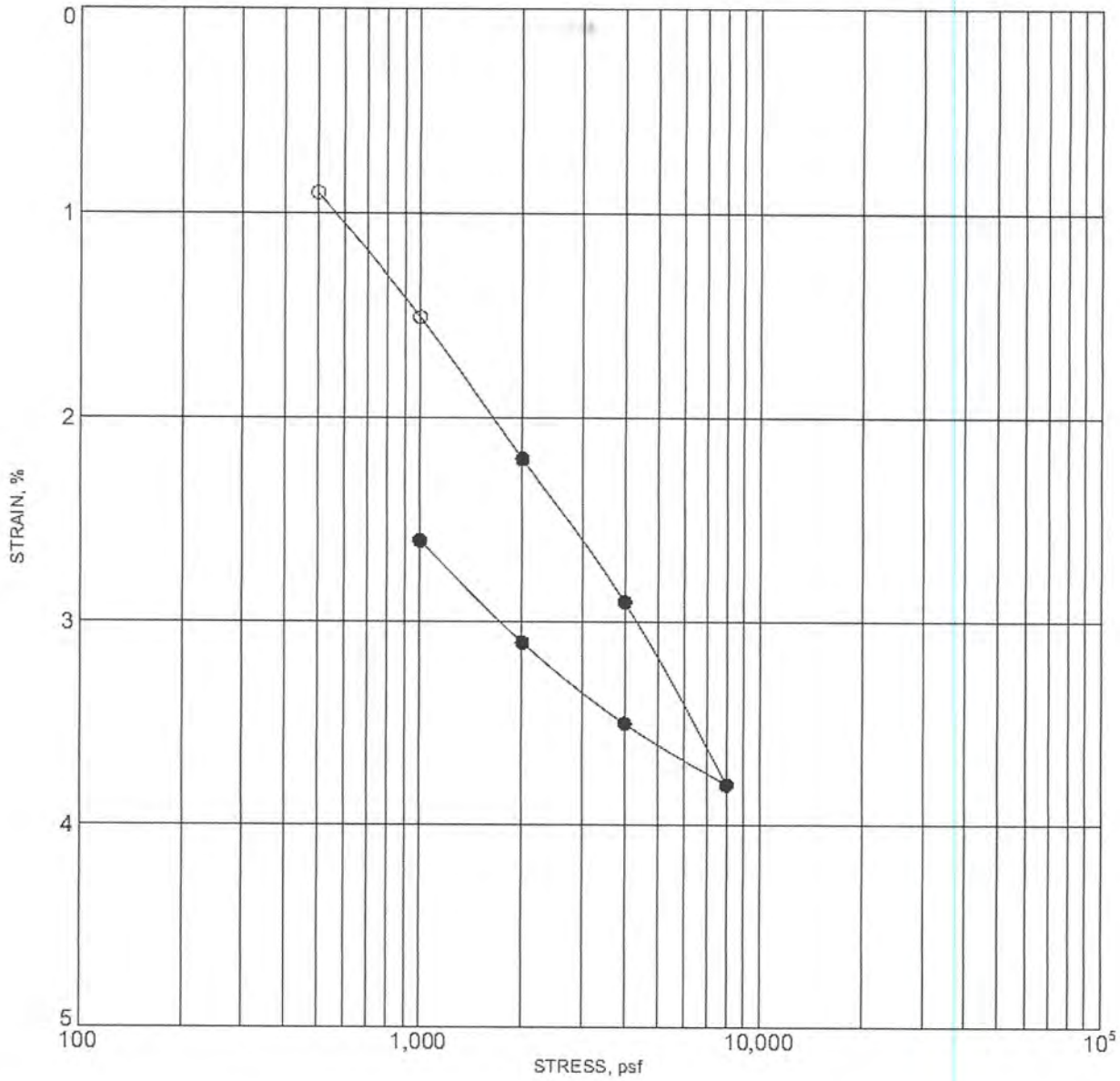
Moisture Content after Test	
Wet+Ring	797.7
Dry	311.2
	38.3%

GHOSTRIDER

TECH: L.B.

DATE: 6/28/2020

Project Name	FIGURE
Santa Fe Apartments	C-11



BORING NO. :	B-1	DEPTH (ft) :	6.0-7.5
DESCRIPTION :	SANDY CLAY (CL)		

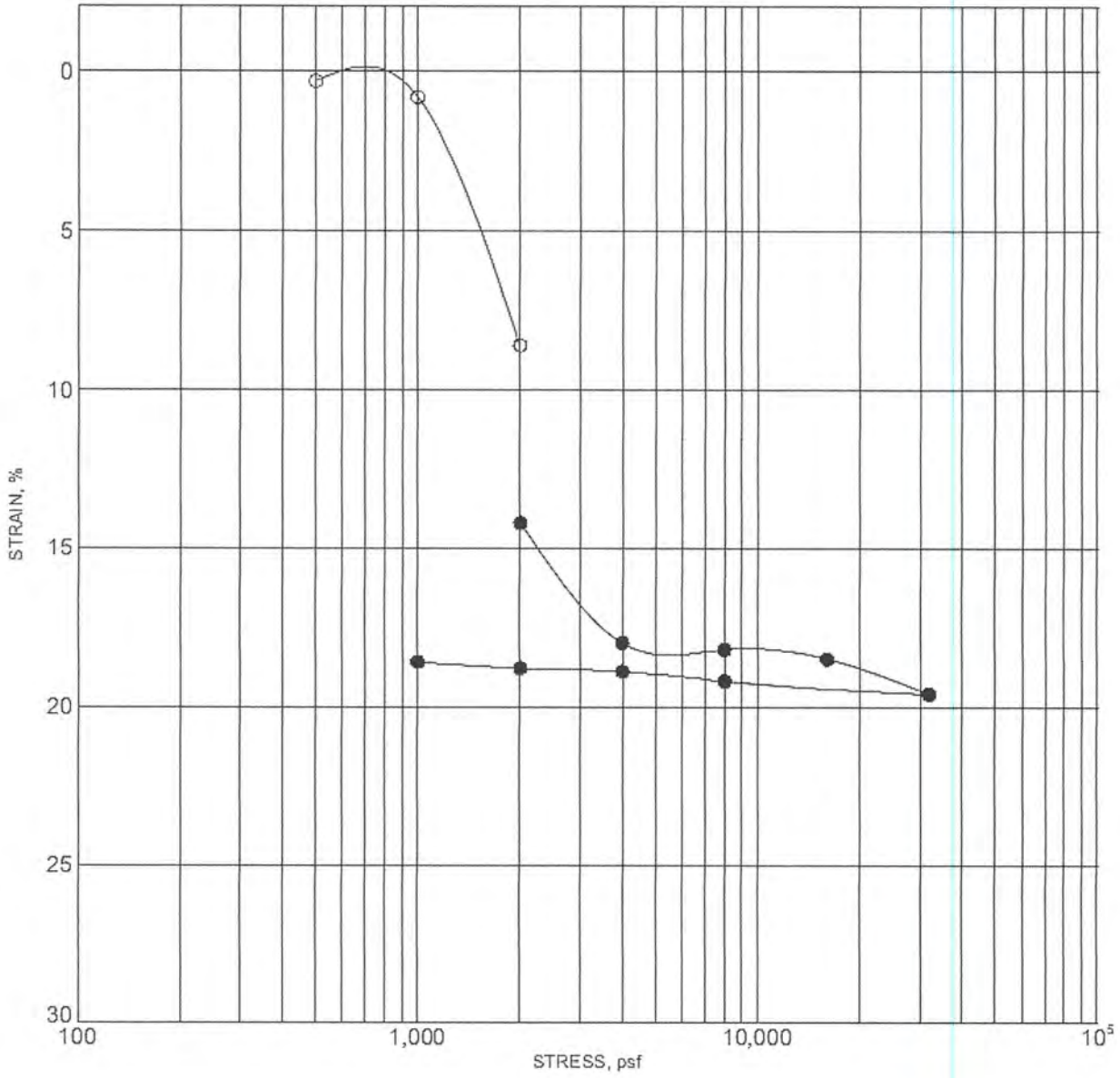
	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	21	106.43	97	0.569

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

CONSOLIDATION TEST RESULTS

Converse Consultants Santa Fe Apartments C-12

Project No. 20-81-188-01 Drawing No. B-1



BORING NO. :	B-4	DEPTH (ft) :	20.0-21.5
DESCRIPTION :	SANDY CLAY (CL)		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	23	99.89	93	0.650
FINAL				

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

CONSOLIDATION TEST RESULTS

Converse Consultants Santa Fe Apartments C-13

Project No. 20-81-188-01 Drawing No.

Soil Analysis Lab Results

Client: Ghostrider
Job Name: Santa Fe Apts
Client Job Number: 19-2118C
Project X Job Number:
S200602A June 4, 2020

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd	Minimum	**pH**
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)	
B-1, S-3	7.5	8,941.6	0.8942	625.2	0.0625	1,005	302	5.10

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

APPENDIX B

LOGS OF BORINGS BY NOVA

BORING LOG

BORING NO.: B-1

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 21.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN; FIRM; MOIST; SILTY CLAY WITH SOME SAND (CL)			
2					BROWN/GRAY WITH ORANGE/TAN MIX; NO SAND			
4				13				
6				12	AT 6.0 FT BECOMES BROWN			
8					BECOMES OLIVE-GRAY, RED-BROWN AND BROWN			
10				24				
12								
14								
16				14				
18								
20				22				
22					BORING TERMINATED AT 21.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

Nova Services

BORING LOG

BORING NO.: B-2

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 21.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN-BROWN AND GRAY MIX; FIRM TO STIFF; VERY MOIST; SILTY CLAY (CL)			
2								
				49	ROCK DISTURBED BLOWCOUNTS			
4								
6				18	BECOMES VERY MOIST			
8								
10				38	SOME GRAVEL SIZE ROCK			
12								
14								
16				39	OCCASIONAL GRAVEL SIZE ROCK			
18								
20				23				
22					BORING TERMINATED AT 21.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

Nova Services

BORING LOG

BORING NO.: B-3

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: 503 feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 21.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN/GRAY/REDDISH BROWN; STIFF; VERY MOIST; SILTY CLAY (CL)			
2				20				
500								
4								
6				19				
8					BECOMES WET			
10				11				
12								
490								
14								
16				11				
18					BECOMES OLIVE GRAY			
20				14				
22					BORING TERMINATED AT 21.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
480								
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

Nova Services

BORING LOG

BORING NO.: B-4

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 21.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN/GRAY/BROWN/OLIVE GRAY; STIFF; VERY MOIST; SILTY CLAY (CL)			
2				20				
4								
6		ML		9	LIGHT TAN; FIRM; MOIST; CLAYEY SILT (ML)			
8		CL			LIGHT BROWN/OLIVE GRAY/BROWN; STIFF; MOIST; SILTY CLAY (CL)			
10				20				
12								
14								
16				14				
18								
20		ML		35	LIGHT GRAY; VERY STIFF; MOIST; CLAYEY SILT (ML)			
22					BORING TERMINATED AT 21.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

Nova Services

BORING LOG

BORING NO.: P-1

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 5.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN-BROWN AND GRAY AND ORANGE MIX; FIRM; MOIST; SILTY CLAY (CL)			
2								
4				12				
6					BORING TERMINATED AT 5.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
8								
10								
12								
14								
16								
18								
20								
22								
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

BORING LOG

BORING NO.: P-2

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 5.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN-BROWN, GRAY-REDDISH BROWN MIX; STIFF TO VERY STIFF; VERY MOIST; SILTY CLAY (CL)			
4				31				
6					BORING TERMINATED AT 5.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

BORING LOG

BORING NO.: P-3

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 5.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN-BROWN AND GRAY TO OLIVE GRAY; STIFF; VERY MOIST; SILTY CLAY (CL)			
2								
4				21				
6					BORING TERMINATED AT 5.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
8								
10								
12								
14								
16								
18								
20								
22								
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

Nova Services

BORING LOG

BORING NO.: P-4

PROJECT: BOSSTICK SAN MARCOS
PROJECT NO.: 2016428
BORING LOCATION:
ELEVATION AND DATUM: feet ± (MSL)
DRILLING CONTRACTOR: CAL PAC DRILLING
DATE STARTED: 5/2/2016 **DATE FINISHED:** 5/2/2016
DRILLING METHOD: 8" DIAMETER HOLLOW STEM AUGER
TOTAL BORING DEPTH: 7.5 feet
DRILLING EQUIPMENT: B-61
DEPTH TO WATER START: NA **FINISH:** NA
SAMPLING METHOD: MOD CAL, SPT
LOGGED BY: HE
HAMMER WT.: 140 LBS **DROP:** 30 INCH
REVIEWED BY: WM

ELEVATION (MSL) / DEPTH (FT.)	SOIL STRATIGRAPHY	USCS CLASSIFICATION	SAMPLER TYPE	BLOWS/FT.	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	LAB TESTS
0		CL			FILL: LIGHT BROWN-BROWN AND OLIVE GRAY-GRAY MIX; STIFF; MOIST; SILTY CLAY (CL)			
4				50/5"				
6		SC/CL		15	BECOMES LIGHT BROWN; MOIST; SILTY TO CLAYEY SAND (SL)			
8					BORING TERMINATED AT 7.5 FT. NO GROUNDWATER ENCOUNTERED, NO CAVING.			
10								
12								
14								
16								
18								
20								
22								
24								
26								

SAMPLER KEY: BULK SPT MOD. CAL. NO RECOVERY

Nova Services

APPENDIX D

LABORATORY ANALYTICAL TESTING BY NOVA

SAMPLE LOCATION	SAMPLE DEPTH (ft)	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (pcf)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (inch)	EXPANSION INDEX	EXPANSION POTENTIAL
B 2-B3	1' - 5'	11.5	105.0	21.5	0.075	66	Medium

Expansion Index	Expansion Potential
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
131 and above	Very High

NOVA

EXPANSION INDEX

BOSSTICK GEO
BOSSTICK AVE
SAN MARCOS, CALIFORNIA

DATE	PROJECT NO.	FIGURE
09/14	2016428	**B-1**

Sample Location	Sample Depth (ft)	pH	Resistivity (Ohm-cm)	Sulfate Content (ppm)	Sulfate Content (%)	Chloride Content (ppm)	Chloride Content (%)
B-2&B-3	1.0'-5.0'	7.1	420	1590	0.159	64	0.006

NOVA

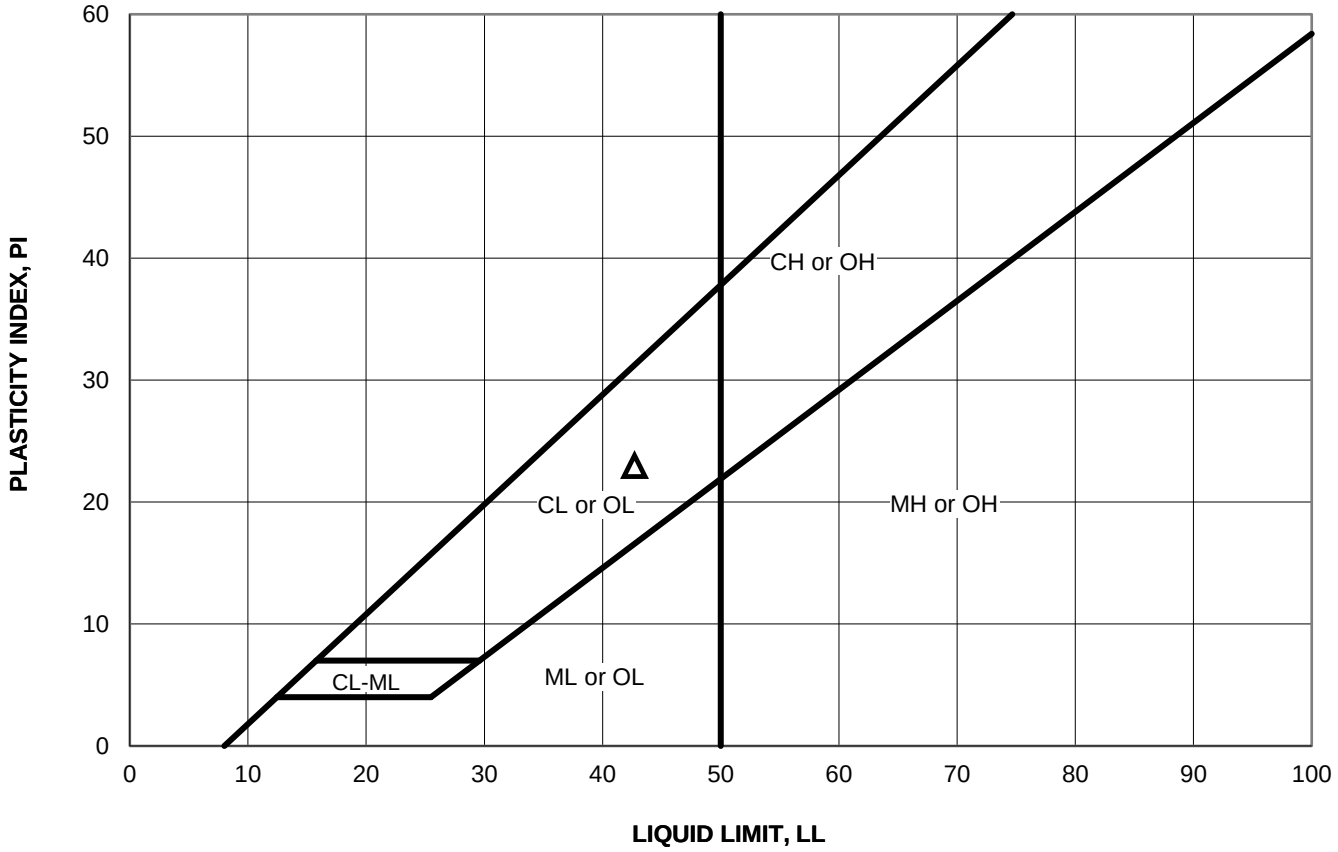
CORROSIVITY TEST RESULTS

BOSSTICK AVENUE
BOSSTICK AVENUE
SAN MARCOS, CALIFORNIA

DATE	PROJECT NO.	FIGURE
05/16	2016428	**B-2**

SYMBOL	SAMPLE LOCATION	SAMPLE DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS (% Finer than No. 40)	USCS (Entire Sample)
Δ	B2 & B3	1-5'	43	20	23	CL	CL

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

NOVA

ATTERBERG LIMIT TEST RESULTS

Bosstick Geo.
Bosstick Ave.
San Marcos, CA

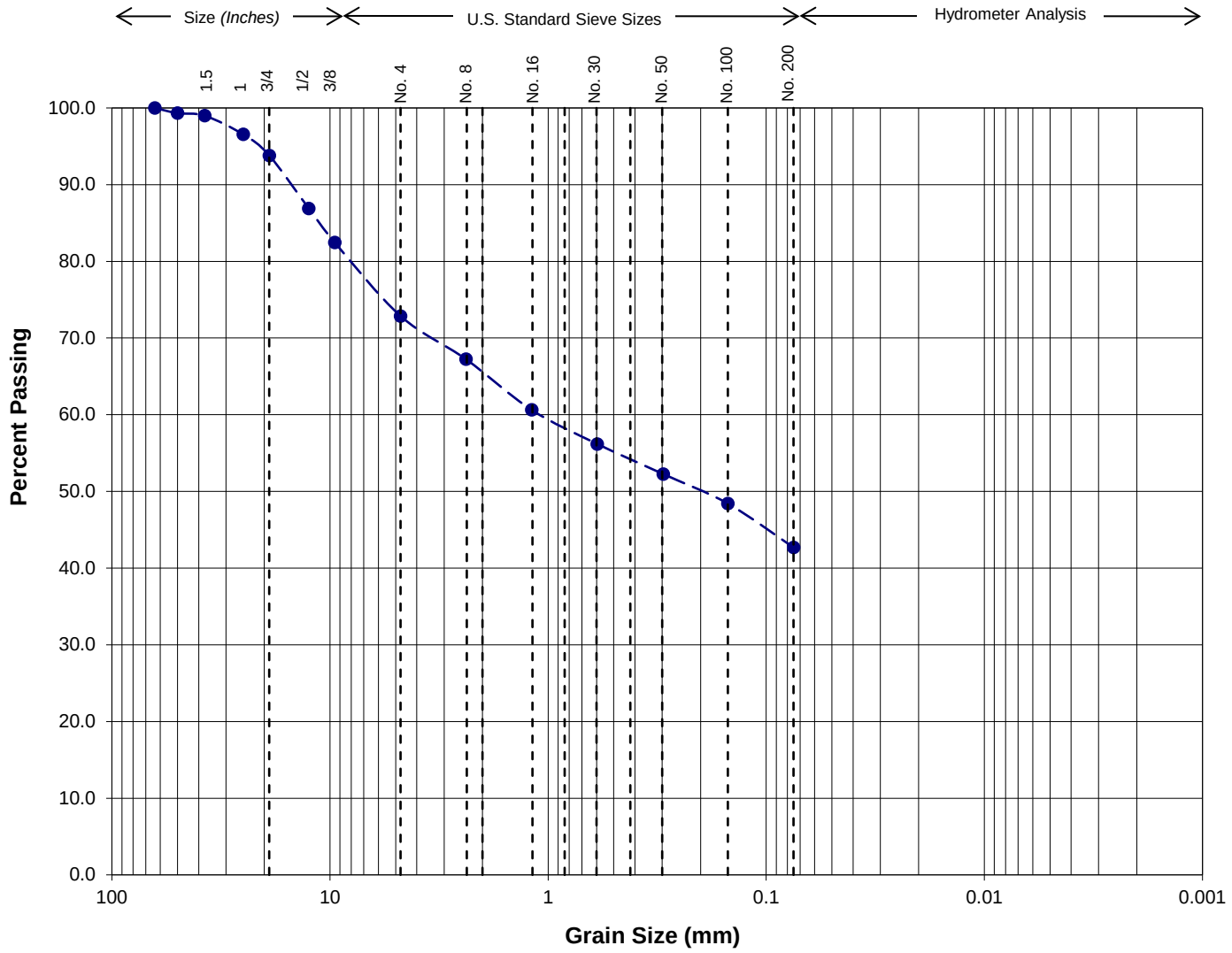
DATE	PROJECT NO.	FIGURE
4/11/2016	2016428	**B-3**

MOISTURE - DENSITY TEST DATA
(ASTM D 2937)

Page No. 1

Project Name:		BOSSTICK			Project No.:	2016428		Technician:	JA	Date:	05/16
Lab No.		6181	6182	6183	6184	6186	6188				
Sample Location		B-1	B-1	B-2	B-2	B-3	B-4				
Sample Depth (ft)		2.5'	6.0'	2.5'	6.0'	2.5'	2.5'				
Visual Soil Classification	Top										
	Bottom										
Torvane Shear (tsf)											
Pocket Penetrometer (tsf)											
WEIGHTS											
Weight of Moist Soil + Rings (g)		943	748.3	815.3	975.1	939.4	962.6				
Number of Rings		5	4	4	5	5	5				
Weight of Dry Soil + Rings (g)		820.4	638.1	754.0	890.5	826.2	833.3				
Weight of All Rings (g)		214.1	169.6	168.8	210.6	218.7	213.8				
Wt. of Moist Soil (No Rings)		728.9	578.7	646.5	764.5	720.7	748.8				
Wt. of Dry Soil (No Rings)		606.3	468.5	585.2	679.9	607.5	619.5				
Notes:		GRAYISH/ OLIVE SILTY CLAY	OLIVE CLAYEY SILT	OLIVE SILTY CLAY W/GRAVEL	DARK GRAY OLIVE CLAYEY SILT W/GRAVEL	OLIVE CLAYEY SILT	OLIVE CLAYEY SILT				
RESULTS											
Wet Density (pcf)		122.8	121.8	136.1	128.8	121.4	126.1				
Moisture Content (%)		20.2	23.5	10.5	12.4	18.6	20.9				
Dry Density (pcf)		102.1	98.6	123.2	114.5	102.3	104.3				
Degree of Saturation (%)		86.5	92.1	81.2	74.2	80.1	94.5				
Remarks											

Moisture-Density RINGS 6181,6182,6183,6184,6186,6188



GRAVEL		SAND			SILT OR CLAY
Coarse	Fine	Coarse	Medium	Fine	

Sample Location:	B-2 & B-3
Depth (ft):	1.0' - 5.0'
USCS Soil Type:	CL
Passing No. 200 (%):	43

NOVA

GRADATION ANALYSIS TEST RESULTS

BOSSTICK
BOSSTICK BLVD
SAN MARCOS, CALIFORNIA

DATE	PROJECT NO.	FIGURE
5/9/2016	2016428	**B-4**

APPENDIX D

APPENDIX D

SLOPE STABILITY EVALUATION

General

Slope stability analyses were performed on Cross-Sections A-A' and B-B' shown on Figures 1 and 2. The slope stability analyzes utilized the information on the preliminary grading study plans provided by PLSA with respect to proposed site conditions. Slope stability was evaluated for the proposed fill/cut slopes located in the south-central portion of the site and existing slopes and retaining wall located along the northeast and northwest perimeters of the site. Slope geometry, geologic structure, and calculated factors of safety for each cross section analyzed are presented on the figures in this Appendix.

The computer program, *Slope/W* from GeoSlope 2018, distributed by Geo-Slope International, was utilized to perform slope stability analyses. This program uses conventional slope stability equations and a two-dimensional limit-equilibrium method to calculate the factor of safety against deep-seated failure. For our analyses, the Morgenstern-Price method with circular failure mode was utilized.

The computer program searches for the most critical failure surface based on geometry and soil strength parameters. The computer program searches for the critical failure surface based on input parameters. The critical failure surface for each analysis is shown on computer generated output directly above the failure surface (which is shown as the hatched area on the figure).

Shear Strength Parameters

Shear strength parameters used in the analyses are based on laboratory direct shear testing performed for our investigation, and our experience with similar soil conditions. The results of the laboratory direct shear testing are presented in Appendix B.

Shear strength values used in our analyses are shown in the table below. The shear strength values are also shown in stability output figures.

SHEAR STRENGTH USED IN SLOPE STABILITY ANALYSES

Soil Type	Angle of Internal Friction (degrees)	Cohesion (psf)
Qcf (Compacted Fill)	25	250
Tsa (Santiago Formation)	25	320

Summary of Stability Analyses

The table below summarizes the stability analyses performed for this study. The calculated factor-of-safety for proposed and existing slopes is included on the table.

SUMMARY OF STABILITY ANALYSES

Cross Section	Location	Condition of Slope Stability Analysis	Calculated Factor of Safety
A-A'	South-Central	Proposed slope, 2:1 cut/fill slope, circular-mode analysis, static condition	1.94
B-B'	Northeast Perimeter	Existing slope, 2:1 fill slope, circular-mode analysis, static condition	1.83
B-B'	Northwest Perimeter	Existing slope and approximately 10-foot retaining wall (point load corresponding to an equivalent fluid pressure of 35H psf applied), 2:1 cut slope, circular-mode analysis, static conditions	1.57

Surficial Slope Stability Analysis

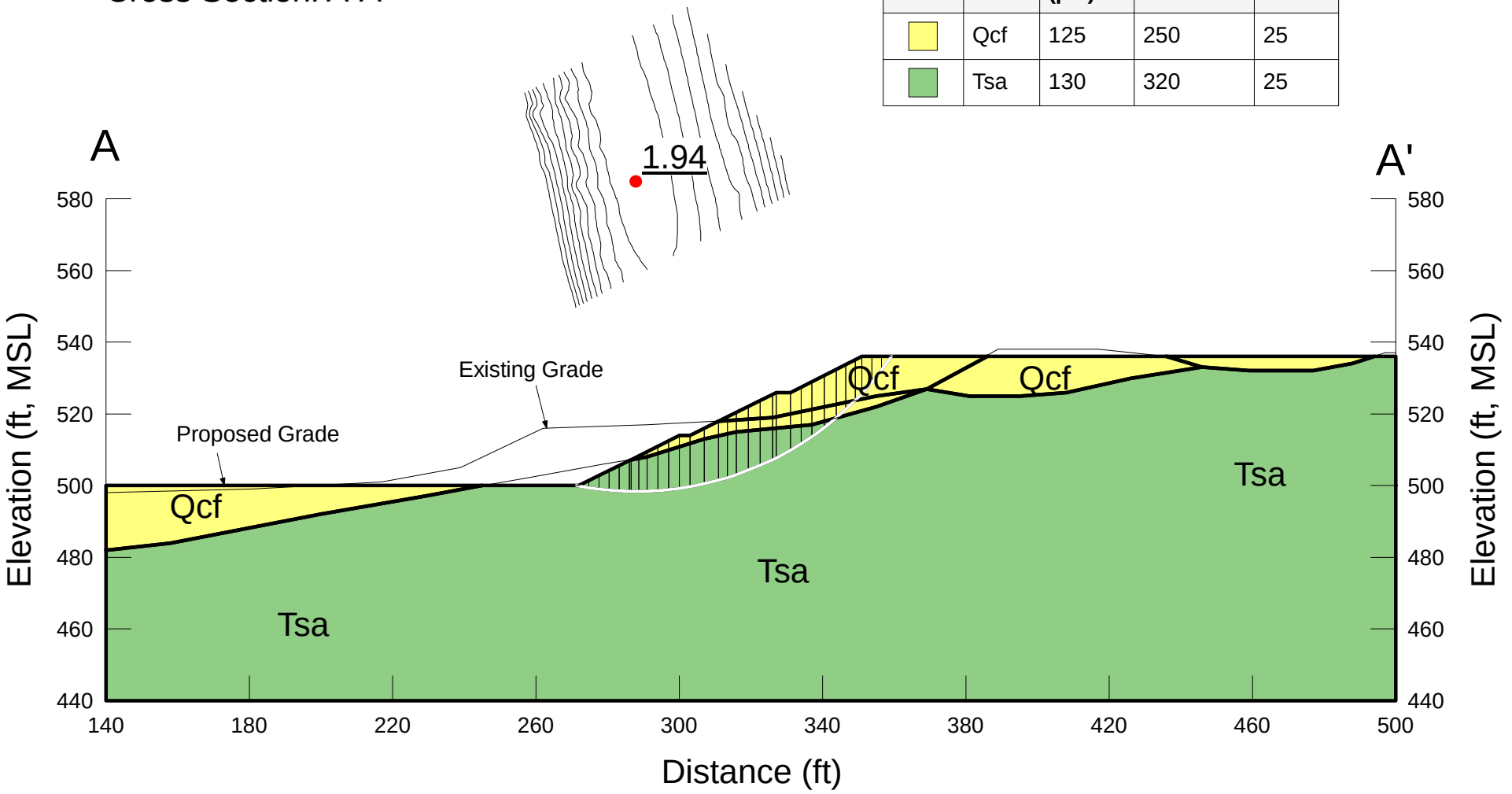
We evaluated surficial slope stability of proposed and existing slopes with inclinations as steep as 2:1 (horizontal:vertical) and the results indicate a calculated factor of safety of at least 1.5 under static conditions. The surficial slope stability analysis for the existing and proposed sloping conditions is summarized in the following table.

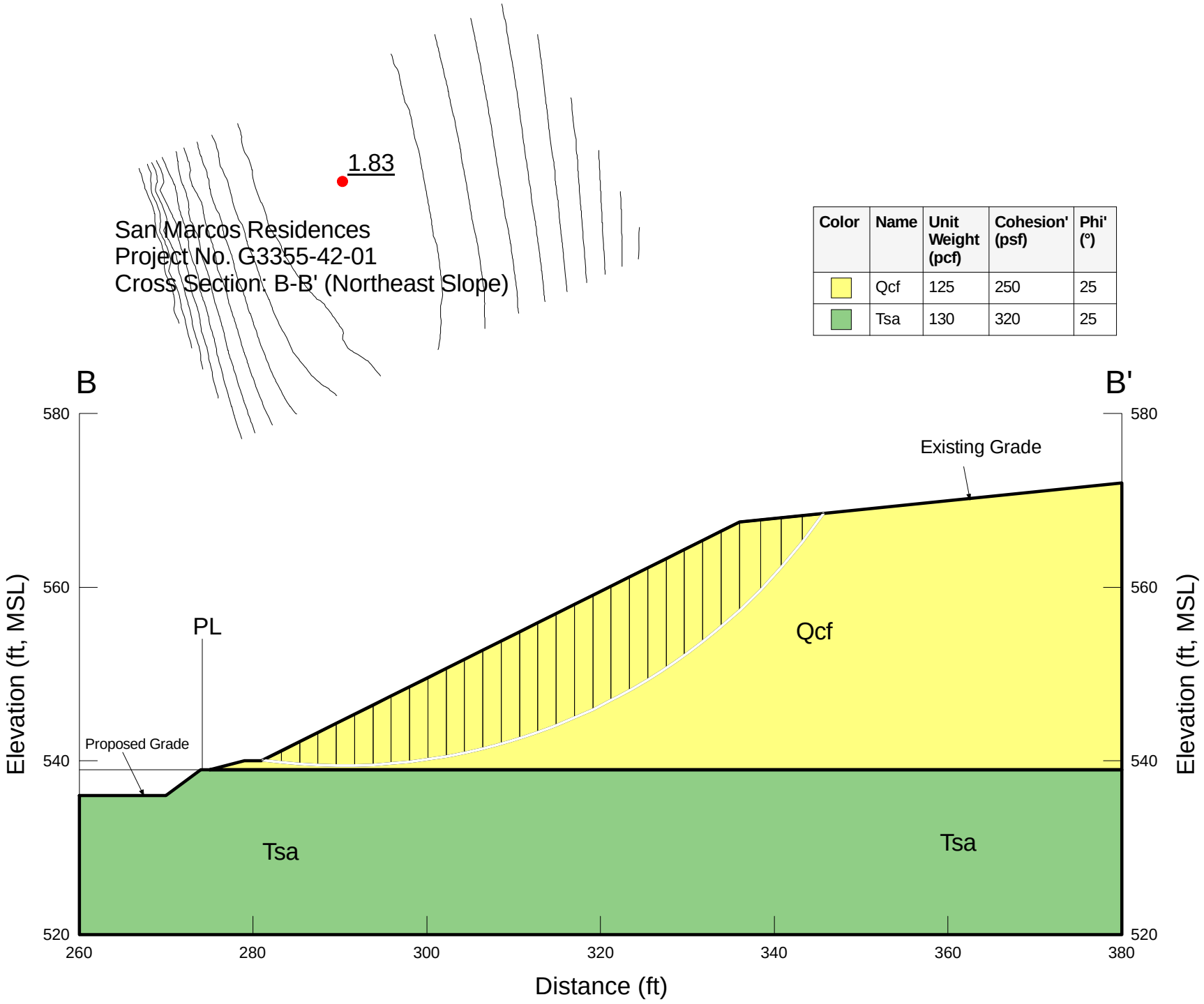
SURFICIAL SLOPE STABILITY EVALUATION

Parameter	Value
Slope Height, H	∞
Vertical Depth of Saturation, Z (feet)	3
Slope Inclination, I (Horizontal to Vertical)	2:1
Total Soil Unit Weight, γ (pcf)	130
Water Unit Weight, γ_W (pcf)	62.4
Friction Angle, ϕ (Degrees)	25
Cohesion, C (psf)	250
Factor of Safety = $(C+(\gamma+\gamma_W)Z\cos^2 I \tan\phi)/(\gamma Z \sin I \cos I)$	2.1

San Marcos Residences
Project No. G3355-42-01
Cross Section: A-A'

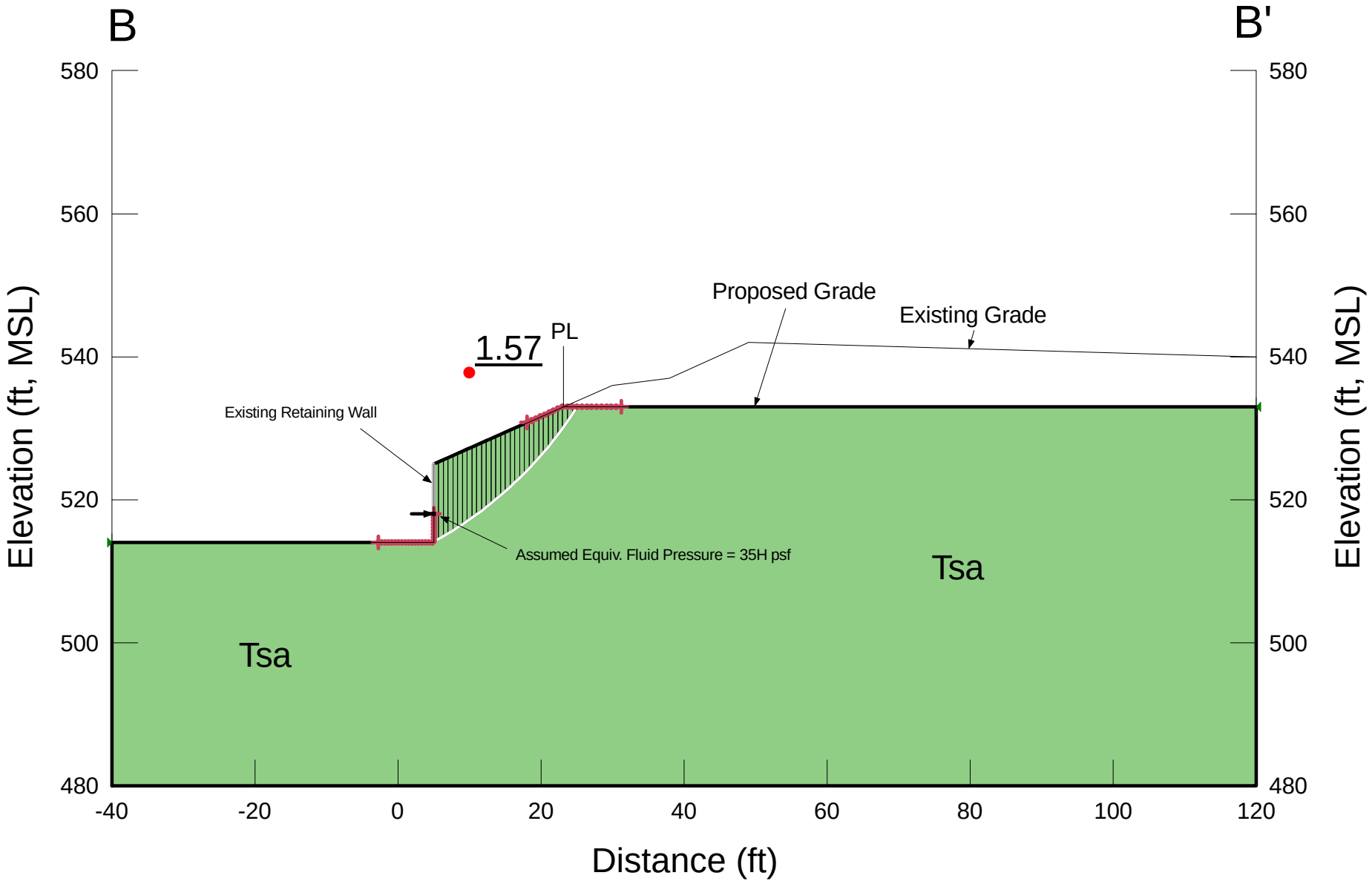
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Qcf	125	250	25
	Tsa	130	320	25




1.83
San Marcos Residences
Project No. G3355-42-01
Cross Section: B-B' (Northeast Slope)
Color
Name
Unit Weight (pcf)
Cohesion' (psf)
Phi' (°)
Qcf
125
250
25
Tsa
130
320
25
B
B'
Existing Grade
PL
Qcf
Proposed Grade
Tsa
Tsa
Elevation (ft, MSL)
Elevation (ft, MSL)
580
560
540
520
260
280
300
320
340
360
380
Distance (ft)

San Marcos Residences
Project No. G3355-42-01
Cross Section: B-B' (Northwest Slope)

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Tsa	130	320	25



APPENDIX E

APPENDIX E

RECOMMENDED GRADING SPECIFICATIONS

FOR

SAN MARCOS RESIDENCES
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

PROJECT NO. G3355-42-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

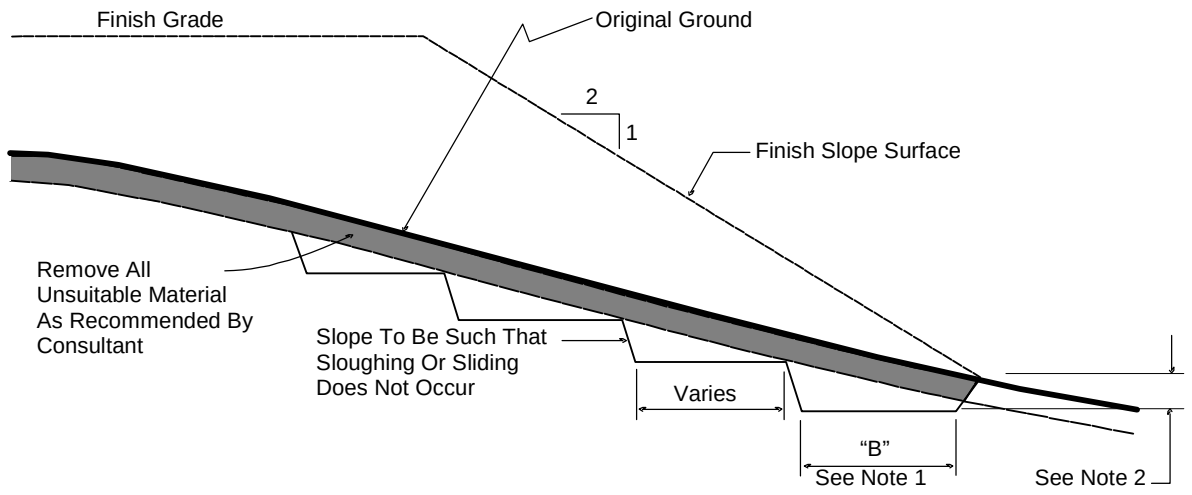
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES:

(1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in

maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the

rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock*

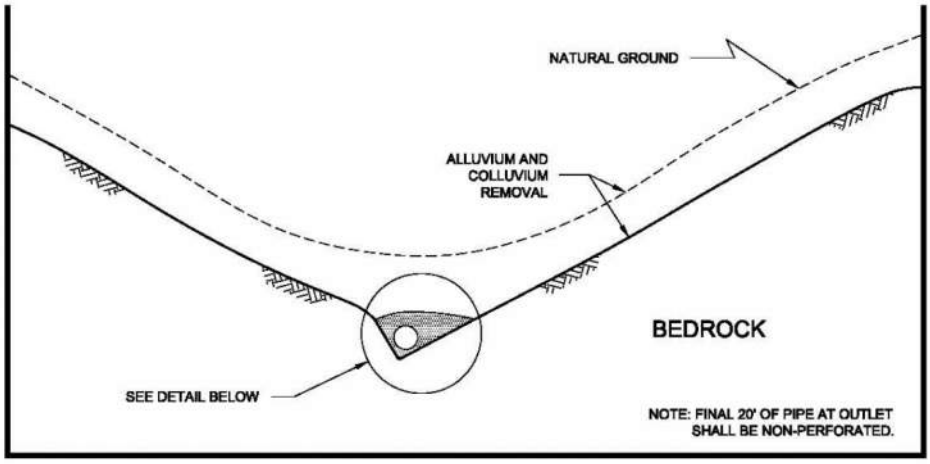
should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

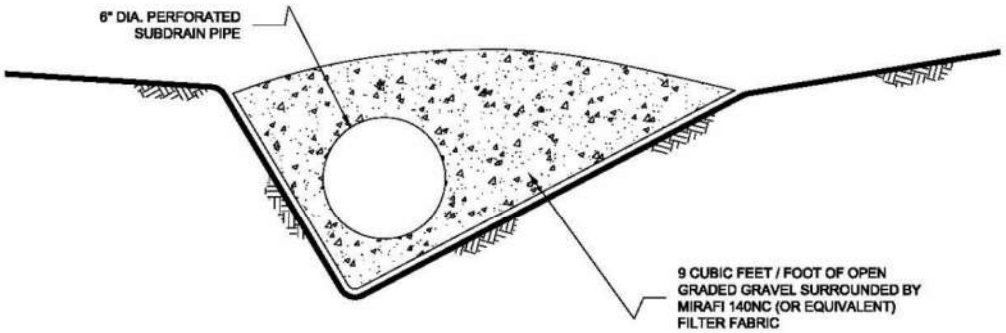
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

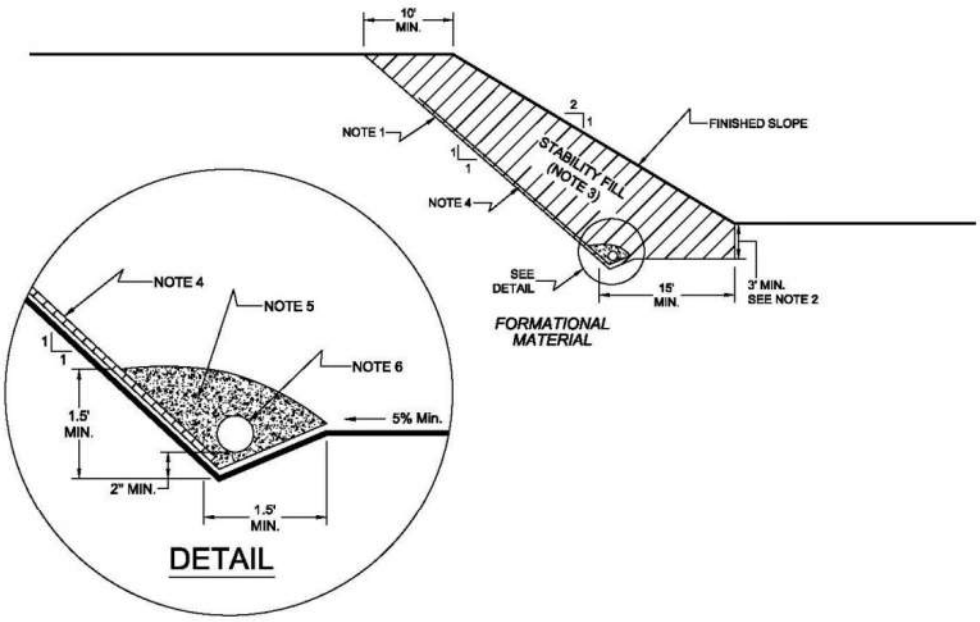
1.....8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS
IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS
LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

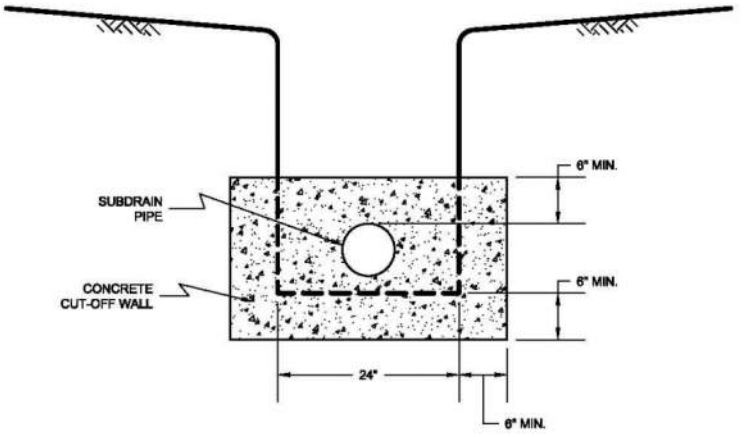
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

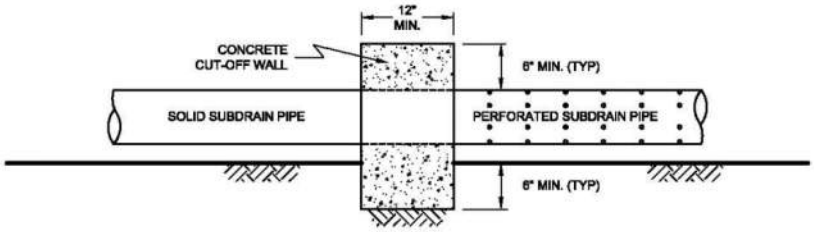
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

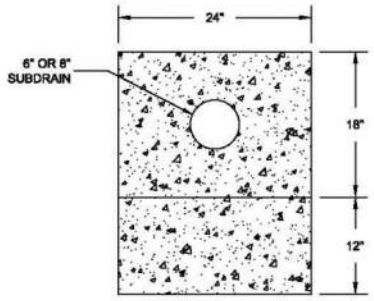


NO SCALE

7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

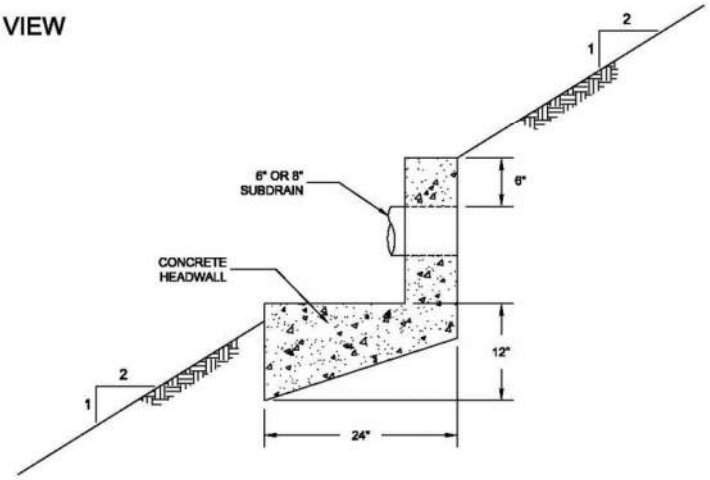
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after

burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in

geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

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CGS (2021b), *Tsunami Inundation Maps and Data,* web application for accessing tsunami inundation hazard, https://www.conservation.ca.gov/cgs/tsunami/maps, accessed July 26, 2024;

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APPENDIX B

Project No. G3355-42-01
October 17, 2024

Santa Fe Flores LP
P.O. Box 903
Ranch Santa Fe, California 92067

Attention: Mr. Paul Mayer

Subject: PERMANENT SHORING, MSE, AND ANCHOR PLEX WALL RECOMMENDATIONS
SAN MARCOS RESIDENCES
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA

References:
1. *Geotechnical Investigation, San Marcos Residences, 2972 South Santa Fe Avenue, San Marcos, California*, prepared by Geocon Incorporated, dated August 12, 2024 (Project No. G3355-42-01).
2. *Retaining Wall Quantities Study [for San Marcos Residences, San Marcos, California],* prepared by PLSA, dated October 3, 2024.
3. *Retaining Wall Backfill Remedial Earthwork Study [for San Marcos Residences, San Marcos, California],* prepared by PLSA, dated October 3, 2024.

Dear Mr. Mayer:

In accordance with your request, we have prepared this report to provide recommendations for permanent shoring walls, Mechanically Stabilized Earth (MSE) retaining walls, and Anchor Plex walls for the proposed project.

We understand the project will consist of the construction of seven townhome complexes and will include the construction of numerous retaining walls. Based on the referenced retaining wall studies, MSE wall heights will vary from approximately 3 feet to 18 feet, Anchor Plex Wall heights will be 3 feet to 6 feet, and the shoring wall heights will be 5 feet to 16 feet. Recommendations for the walls are provided hereafter.

EXCAVATION SLOPES, PERMANENT SHORING AND TIEBACKS

Geocon Incorporated is not responsible for site safety and the stability of the proposed excavations. It is the contractor's responsibility to ensure all excavations, temporary slopes, and trenches are properly constructed and maintained in accordance with applicable OSHA guidelines in order to maintain safety and the stability of the excavations and adjacent improvements. These excavation sidewalls should not be allowed to become saturated or to dry out. Surcharge loads should not be permitted to a distance equal to the height of the excavation from the top of the excavation. The top of the excavation should be a minimum of 15 feet from the edge of existing improvements. Excavation walls steeper than those recommended or closer than 15 feet from an existing surface improvement should be shored in accordance with applicable OSHA codes and regulations.

The design of shoring is governed by soil and groundwater conditions, and by the depth and width of the excavated area. Continuous support of the excavation face can be provided by a system of soldier piles and facing consisting of wood lagging, shotcrete, or other applicable techniques. Excavations exceeding 15 feet could require tieback anchors to provide additional wall support.

The condition of existing buildings, streets, sidewalks, and other structures and improvements around the perimeter of the planned excavation should be documented prior to the start of shoring and excavation work. Special attention should be given to documenting existing cracks or other indications of differential settlement within these adjacent areas. Settlement-sensitive underground utilities should be inspected and videotaped prior to construction to check the integrity of pipes. In addition, monitoring points should be established indicating location and elevation around the excavation and on existing buildings. These points should be monitored on a weekly basis during excavation work and monthly thereafter. Inclinometers should be installed and monitored behind any shoring sections that will be advanced deeper than 30 feet below the existing ground surface.

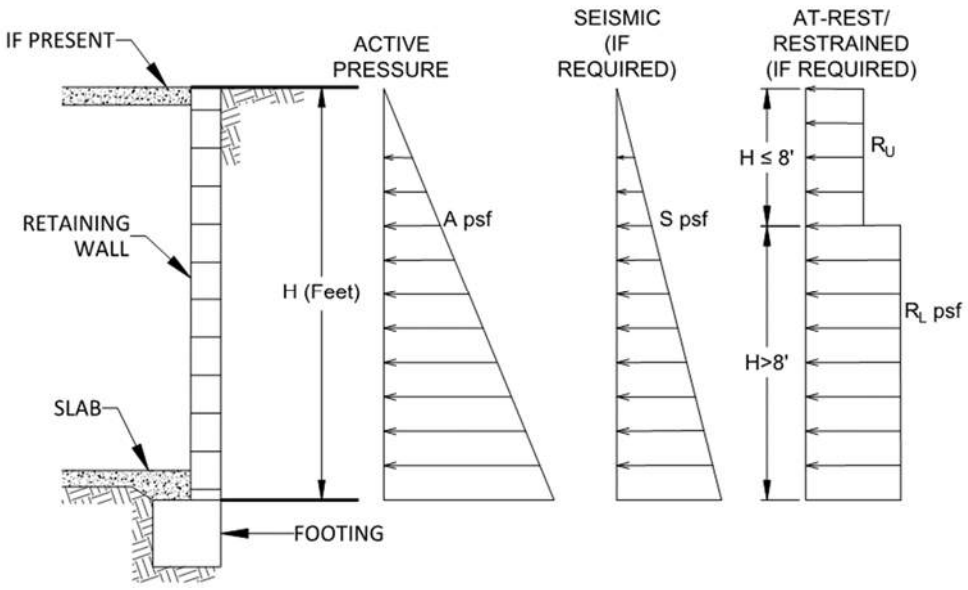
In general, ground conditions are suited for soldier pile and tieback anchor wall construction techniques; however, gravel, cobble, and cemented layers could be encountered that could be difficult to drill. Raveling could result along the unsupported portions of excavations if cohesionless sands are encountered.

Permanent shoring walls should be designed using the values presented in the following table. Additional lateral earth pressure due to the surcharging effects from construction equipment, stockpiles, adjacent structures, and traffic should be considered, where appropriate, during design of the shoring system.

SUMMARY OF PERMANEMT SHORING WALL RECOMMENDATIONS

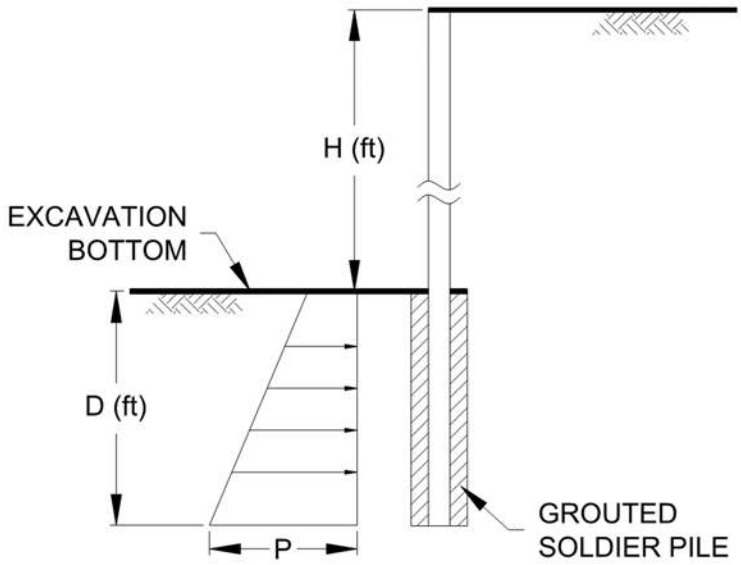
Parameter	Value
Active Soil Pressure, A (Fluid Density, Level Ground)	45 pcf
Active Soil Pressure, A (Fluid Density, 2:1 Sloping Backfill)	65 pcf
Seismic Pressure, S	15H psf
At-Rest/Restrained Walls Additional Uniform Pressure (0 to 8 Feet High)	7H psf
At-Rest/Restrained Walls Additional Uniform Pressure (8+ Feet High)	13H psf
Passive Pressure, P	350D + 500 psf
Effective Zone Angle, E	32 degrees
Maximum Design Lateral Movement	1 Inch
Maximum Design Vertical Movement	½ Inch
Expected Expansion Index for the Subject Property	EI> 90

H equals the height of the retaining portion of the wall in feet
D equals the embedment depth of the retaining wall in feet



Retaining Wall Loading Diagram

The passive resistance can be assumed to act over a width of three pile diameters. Typically, soldier piles are embedded a minimum of 0.5 times the maximum height of the excavation (this depth is to include footing excavations) if tieback anchors are not employed. The project structural engineer should determine the actual embedment depth.



Passive Pressures on Shoring

Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall. Where walls are restrained from movement at the top (at-rest condition), an additional uniform pressure should be applied to the wall. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added to the upper 10 feet of the retaining wall.

The structural engineer should determine the Seismic Design Category for the project in accordance with Section 1613 of the 2022 CBC or Section 11.6 of ASCE 7-16. For structures assigned to Seismic Design Category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2022 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall.

We should observe the drilled shafts for the soldier piles prior to the placement of concrete reinforcement to check that the exposed soil conditions are similar to those expected and that pile excavations have been extended to the appropriate design depths. If unexpected soil conditions are encountered, foundation modifications could be required.

Earth pressures acting on a shoring wall could cause movement of the shoring toward the excavation and result in ground subsidence outside of the excavation. It is essential that the soldier pile and tieback system allow very limited amounts of lateral displacement. Horizontal movement of the shoring wall should be accurately monitored and recorded during excavation and anchor construction.

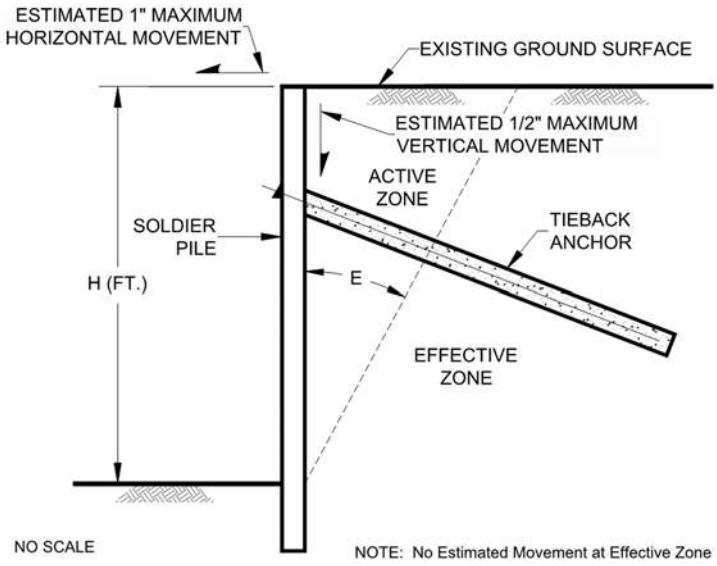
Survey points should be established at the top of the pile on at least 20 percent of the soldier piles. An additional point located at an intermediate point between the top of the pile and the base of the excavation should be monitored on at least 20 percent of the piles if tieback anchors will be used. These points should be monitored on a weekly basis during excavation work and monthly thereafter until the permanent support system is constructed.

The project civil engineer should provide the location, depth, and pipe type of the underground utilities to the shoring engineer to help select the shoring type and shoring design. The shoring system should be designed to limit horizontal soldier pile movement to a maximum of 1 inch. The amount of horizontal deflection can be assumed to be essentially zero along the Active Zone and Effective Zone boundary. The magnitude of movement for intermediate depths and distances from the shoring wall can be linearly interpolated.

Shoring walls greater than 15-feet high may need tieback anchors to mitigated excessive movement of the top of the exaction.

Tieback anchors should be designed, constructed, and tested in conformance with FHWA (1999) or PTI (2014). The testing method should be stated on the shoring plan.

Tieback anchors employed in shoring should be designed such that anchors fully penetrate the Active Zone behind the shoring. The Active Zone can be considered the wedge of soil from the face of the shoring to a plane extending upward from the base of the excavation as shown on the Active Zone Detail. Normally, tieback anchors are contractor-designed and installed, and there are numerous anchor construction methods available. Non-shrinkage grout should be used for the construction of the tieback anchors.



Active Zone Detail

Post grouting of the bonded portion of the anchor will increase the soil-grout bond strength. A pressure grouting tube should be installed during the construction of the tieback.

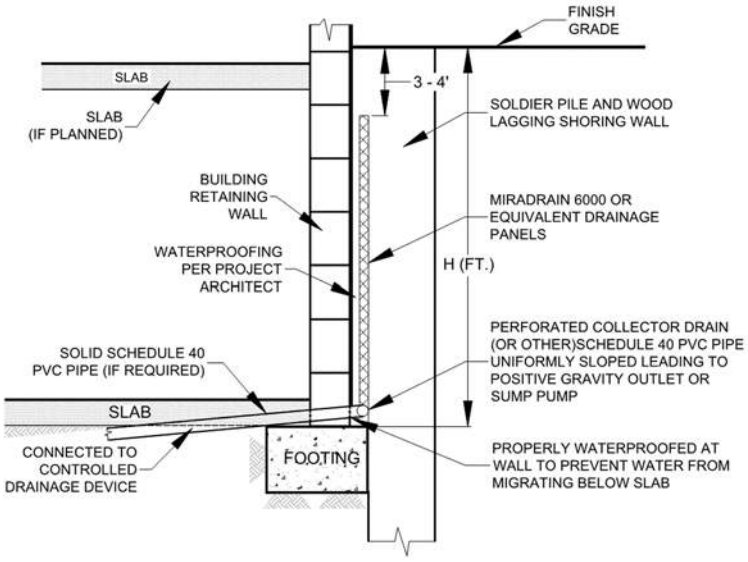
Anchor capacity should be evaluated using the strength parameters shown in the following table.

SOIL STRENGTH PARAMETERS FOR PERMANENT SHORING

Description	Cohesion (psf)	Friction Angle (Degrees)
Properly Compacted Fill (Qcf)	250	25
Documented Artificial Fill (Qdaf)	250	25
Colluvium (Qcol)	200	20
Santiago Formation (Tsa)	500	30

Lagging should keep pace with excavation. The excavation should not be advanced deeper than five feet below the bottom of lagging at any time. These unlagged gaps should only be allowed to stand for short periods of time to decrease the probability of soil instability and should never be unsupported overnight. Proper backfilling between the back of lagging and excavation walls should be done to reduce lateral movement behind the supported excavation. The excavation should not have advanced further than four feet below a row of tiebacks prior to those tiebacks being tested and locked off.

The shoring system should incorporate a drainage system for the proposed retaining wall as shown herein.



Shoring Retaining Wall Drainage Detail

The project civil engineer should provide an accurate survey of existing utilities and other underground structures adjacent to the shoring wall should be conducted. The survey should include both locations and depths of existing utilities. Locations of anchors should be adjusted as necessary during the design and construction process to accommodate the existing and proposed utilities.

MSE AND ANCHOR PLEX WALL RECOMMENDATIONS

MSE retaining walls consist of modular block facing units with geogrid reinforced earth behind the block. The reinforcing grid attaches to the block units and is typically placed at specified vertical intervals and embedment lengths. The grid length and spacing will be determined by the wall design engineer.

Anchor Plex walls consist of reinforced modular block facing units and a structural no-fines concrete backfill that attaches itself to the wall facing. The system eliminates the need for the construction of an MSE reinforced zone. The planned Anchor Plex wall is planned along the north perimeter of the site and will likely expose native Santiago Formation in the foundation and retained zones of the wall.

The geotechnical parameters listed in the table below can be used for preliminary design of the MSE walls. These values assume soil utilized within the reinforced zones of the wall will be from import soils with an EI of less than 50. The foundation zone is the area where the footing is embedded, the reinforced zone is the area of wall reinforcing grids and backfill, and the retained zone is the area behind the reinforced zone.

GEOTECHNICAL PARAMETERS FOR MSE WALLS

Parameter	Reinforced Zone	Retained Zone	Foundation Zone
Angle of Internal Friction	28 degrees*	25 degrees	25 degrees
Cohesion	100 psf	100 psf	100 psf
Wet Unit Density	125 pcf	125 pcf	125 pcf

*Assumes Import Soil will be used for the reinforced zone.

The geotechnical parameters listed in the table below can be used for preliminary design of the Anchor Plex wall along the northern property line. These values assume soil utilized within the foundation and retained zones of the wall will be native Santiago Formation. The foundation zone is the area where the footing is embedded, and the retained zone is the area behind the wall.

GEOTECHNICAL PARAMETERS FOR ANCHOR PLEX WALL

Parameter	Retained Zone	Foundation Zone
Angle of Internal Friction	30 degrees	30 degrees
Cohesion	100 psf	100 psf
Wet Unit Density	130 pcf	130 pcf

Once the import source of the backfill for the MSE walls have been selected, laboratory tests should be performed on samples prior to importing to evaluate if the proposed import soil conforms to design values. Results of the laboratory tests should be provided to the wall designer to re-evaluate stability of the walls. Depending on the test results, the designer may require modifications to the original wall design (e.g., modified reinforcing grid types or lengths).

The soil parameters presented in the tables above are based on our experience and direct shear-strength tests performed during the geotechnical investigation and represent some of the on-site soils. Clayey soils on the property should not be utilized within the reinforced zones of the MSE walls.

An allowable soil bearing pressure of 2,000 pounds per square foot (psf) can be used for foundation design and calculations for wall bearing. This value is for a wall footing measuring 1-foot wide and 2 feet deep. The allowable soil bearing pressure can be increased 300 psf for every foot of additional foundation width greater than 1-foot and 500 psf for every foot of depth greater than 2 feet, up to a maximum allowable bearing pressure of 4,000 psf. The entire length of the reinforced zone can be considered as the bearing zone of the MSE wall. If the wall is constructed on a sloping ground surface, the bottom of the wall should be at least 7 feet horizontally from the slope face to the wall.

Backfill materials within the reinforced zone should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density near to or slightly above optimum moisture content in accordance with ASTM D 1557. This is applicable to the entire embedment length of the geogrid reinforcement. Typically, wall designers specify that heavy compaction equipment be excluded from within 3 feet of the face of the wall; however, smaller equipment (e.g., walk-behind, self-driven compactors or hand whackers) should be used to compact the materials without causing deformation of the wall. If the designer specifies no compactive effort for this zone, the materials are essentially not properly compacted and the geogrid within the uncompacted zone should not be relied upon for reinforcement and overall embedment lengths should be increased to account for the difference.

The wall should be provided with drainage system to prevent excessive seepage through the wall and to prevent hydrostatic pressure behind the wall. The perforated drainpipe behind the block facing should be set at an elevation approximately 2-inches above the base of the gravel-levelling course to minimize the potential for water to seep under the wall to the lot in front. The gravel-levelling course should not extend more than six inches in front of the lowest block course.

Geosynthetic reinforcement must elongate to develop full tensile resistance. This elongation generally results in movement at the top of the wall. The amount of movement is dependent on the height of the wall (e.g., higher walls rotate more) and the type of reinforcing grid used. In addition, over time the reinforcement grid has been known to exhibit creep (sometimes as much as 5 percent) and can undergo additional movement. Given this condition, the owner should be aware that structures and pavement placed within the reinforced and retained zones of the wall may undergo movement.

The MSE wall contractor should provide the estimated deformation of wall and adjacent ground in associated with wall construction. The calculated horizontal and vertical deformations should be determined by the wall designer. The estimated movements should be provided to the project structural engineer to determine if the planned improvements can tolerate the expected movements.

Should you have any questions regarding this letter, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Lilian Rodriguez
RCE 83227

Rodney C. Mikesell
GE 2533

LR:RCM:kv

(e-mail) Addressee