July 1, 2020

Paul Mayer
P.O. Box 903
Rancho Santa Fe, California

Project No. 19-2118C

Dear Mr. Mayer

Attached herewith is the Limited Geotechnical Investigation report prepared for the proposed San Marcos Residences Project to be located at 2972 South Santa Fe Avenue, San Marcos, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact us at your convenience.

Respectfully submitted,
GHOSTRIDER, INC.

Jerry L. Michal
Senior Geotechnical Engineer

Distribution: Mr. Paul Mayer

LIMITED GEOTECHNICAL INVESTIGATION
SAN MARCOS RESIDENCES PROJECT
2972 SOUTH SANTA FE AVENUE
SAN MARCOS, CALIFORNIA
PREPARED FOR
MR. PAUL MAYER

INTRODUCTION

On May 6, 2020, a limited geotechnical investigation was performed by this firm for the proposed three-story accessory San Marcos Residences project to be located at 2972 South Santa Fe Avenue, San Marcos, California. The purposes of this investigation were to explore and evaluate the geotechnical engineering conditions at the subject site and to provide appropriate geotechnical engineering recommendations for design of foundation support and below grade walls, as well as recommendations for construction of the proposed development.

The location of the site is depicted on the Index Map (Enclosure A-1). Aerial imagery was used as a base map for our Site Plan (Enclosure A-2).

The results of our investigation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this limited geotechnical investigation included the following:

- A field reconnaissance of the site and surrounding area
- Logging and sampling of exploratory borings for testing and evaluation
- Laboratory testing on selected samples
- Evaluation of the geotechnical engineering/geologic data to develop site-specific recommendations for site grading and foundation design.
- Preparation of this limited report summarizing our findings, professional opinions and recommendations for the geotechnical aspects of project design and construction

PROJECT CONSIDERATIONS

Information furnished to this office indicates that the site is planned to be developed to include a 3-story multi-family residential structure with one to two (2) underground levels of parking. Light to moderate foundation loads are expected. Additional details were not provided during preparation of this report.

The final project grading and foundation plans should be reviewed by the geotechnical engineer.

SITE DESCRIPTION

The subject site is located at 2972 South Santa Fe Avenue in the City of San Marcos, California. The property, San Diego County Assessor's Parcel Number 217611900, is currently undeveloped and is about 0.8 acres in size. The highest elevation on the subject site is about 530 MSL in the northeast corner and the lowest is about 495 MSL in the southwest corner. The site is situated in northwest quarter of projected Section 20, Range 3 West, Township 11 South, San Bernardino Principal Meridian, at latitude 33.157418 ° north, longitude 117.200068 ° west.

FIELD INVESTIGATION

The soil conditions underlying the subject site were explored by means two (2) Hollow Stem Auger (HSA) exploratory borings (B-1 and B-2) drilled to a maximum depth of about 51 feet below ground surface (bgs) using a limited access rig, and three (3) hand augering borings (B-3 through B-5) drilled to depths of about 5 to 15 feet bgs. Samples were obtained with Modified California (MC) Split Spoon and Standard Penetration Tests (SPT) at intervals between 2.5 and 5 feet. The approximate locations of our exploratory borings are indicated on Enclosure A-2.

Continuous logs of the subsurface conditions, as encountered within the exploratory borings, were recorded at the time of drilling by a representative of this firm. Both relatively undisturbed and bulk samples of typical soil types obtained were returned to the laboratory in sealed containers for testing and evaluation.

The exploratory boring logs, together with the in-place density data, are presented in Appendix B.

The exploratory borings were backfilled with excavated soils using reasonable effort to restore the areas to their initial condition prior to leaving the site, but they were not compacted to a relative compaction of 90 percent or greater. In an area as small and deep as a boring, consolidation and subsidence of soil backfill may occur over time causing a depression. The client is advised to observe exploratory boring areas occasionally and, when needed, backfill noted depressions.

LABORATORY INVESTIGATION

Included in the laboratory testing program were field dry density and moisture content tests on relatively undisturbed samples. The results are included on the exploratory boring logs. Sieve analysis and Atterberg limits were performed for classification purposes. Direct shear testing was performed for material strength evaluation and consolidation testing was performed to estimate amount of settlement of the cohesive materials. Preliminary corrosivity testing was performed by Project X Corrosion Engineering of Murrieta.

Laboratory test results appear in Appendix C. Soil classifications provided in our geotechnical investigation are in general accordance with the Unified Soil Classification System (USCS).

FAULTING AND GROUND RUPTURE

The site does not lie within an Alquist-Priolo (AP) Special Studies zone.

As with most of southern California, the subject site is situated in an area of active and potentially active faults. Active faults present several potential risks to structures, the most common of which are strong ground shaking, dynamic densification, liquefaction, mass wasting, and surface rupture at the fault plane. The following four factors are the principal determinants of seismic risk at a given location:

- Distance to seismogenically capable faults.
- The maximum or "characteristic" magnitude earthquake for a capable fault.
- Seismic recurrence interval, in turn related to tectonic slip rates.
- Nature of earth materials underlying the site.

Based upon proximity to regionally significant, active faults, ground shaking is considered to be the primary hazard most likely to affect the site. Characteristics of the major active fault zones selected for inclusion in analysis of strong ground shaking are listed in the following table. Numerous significant fault zones are located at distances exceeding 40 kilometers from the site, as shown in Enclosure A-6, but greater distances, lower slip rates, and/or lesser maximum magnitudes indicate much lower risk to the site from the latter fault zones than those listed below.

Fault Zone[1,3,5]	Distance from Site (km)	Fault Length (km)[1,2]	Slip Rate (mm/yr)[1]	Reference Earthquake $M_{(Max)}$4	Fault Type[1]
Elsinore [Julian] (rl-ss)	26.9	75	3±1	7.3	A
Elsinore [Temecula] (rl-ss)	26.9	52	2.5±2	7.5	A
Rose Canyon [Del Mar] (rl-ss)	19.5	70	1.5±0.5	7.2	B
Rose Canyon (Oceanside) (rl-ss)	18.4	70	1.5±0.5	7.2	B
Newport Inglewood [Offshore] (rl-ss)	21.5	150	1.5±0.5	7.0	B
San Andreas [Coachella Segment] (rl-ss)	139	96	25.0±5.0	7.2	A

1. California Department of Conservation, Geological Survey, 2007 (Appendix A), *California Fault Parameters for the National Seismic Hazard Maps and Working Group on California Earthquake Probabilities,* CGS Special Report 203A, USGS Open File Report 2007-1437A.
2. U.S. Department of the Interior, Geological Survey, 2008, website: *2008 National Seismic Hazards Maps – Source Parameters,*.
3. Southern California Earthquake Data Center, website: *Significant Earthquakes and Faults,* http://scedc.caltech.edu/significant/fault-index.html
4. U.S. Department of the Interior, Geological Survey, BSSC2014 (Scenario Catalog), website: https://earthquake.usgs.gov/scenarios/catalog/bssc2014/
5. Fault Geometry: (ss) strike slip; (r) reverse; (n) normal; (rl) right lateral; (ll) left lateral; (O) oblique; (45 N) direction.

REGIONAL GEOLOGIC SETTING

The subject site is situated in the Peninsular Ranges Geomorphic Province, one of eleven such provinces recognized in the California Geological Survey Note 36. The geomorphic provinces are topographic-geologic groupings of convenience based primarily on landforms, characteristic lithologies, and late-Cenozoic structural and geomorphic history. The northern portion of the Peninsular Ranges province encompasses southwestern California west of the Imperial-Coachella

Valley trough including the California coast and Santa Catalina and San Clemente Islands, and south of the major portion of the Transverse Ranges geomorphic province, which includes the Santa Monica, San Gabriel, and San Bernardino mountains. Most of the Peninsular Ranges province lies outside California, continuing south to include the Baja California Peninsula.

The province is characterized by youthful, steeply sloped, northwest-trending elongated ranges and intervening valleys whose general northwesterly trend is terminated abruptly on the north by the east-west grain of the Transverse Ranges. Average elevations across the province rise slowly to the east, culminating in generally abrupt escarpments and steep slopes near the eastern margin. Near the northern edge of the province lie several anomalously flat and low basins that stretch from the San Bernardino region to western Los Angeles. These basins generally result from fault junctures and tectonic interaction with the adjacent Transverse Ranges.

Structurally, the bulk of the Peninsular Ranges are composed of a number of relatively stable crustal blocks bounded by active strike-slip faults of the San Andreas transform system. Although some folding and minor faulting has occurred within the blocks, intense structural deformation and earthquake activity are generally restricted to block margins.

The province contains a diverse array of metamorphic, sedimentary, volcanic, and intrusive igneous rocks. Near the coastline, younger rocks include thick sequences of marine and non-marine clastic and pelitic sedimentary rocks of Mesozoic and Tertiary age, ranging from claystones to conglomerate. Inland, the province is dominated by large masses of chronologically correlative, granitic rock of varying composition belonging to the Southern California batholith. In general, metamorphic rocks of this province, which are found in close association with batholithic basement rocks, represent highly-altered host rocks for magmatic emplacement of the batholith during the Mesozoic Era.

The subject site is located in the San Diego coastal plain. The area of the subject site is underlain by Tertiary marine and non-marine, clastic sedimentary bedrock, which overlies crystalline basement rock of the Southern California Batholith. A regional geology map (Ken and Tan, 2007) indicates the project site is located on the Eocene Santiago Formation, as shown in the Enclosure A-3.

SUBSURFACE SOIL CONDITIONS

Native soils consisting mainly of sandy clay and lean clay (CL) were observed during the field exploration at the proposed project site to the maximum explored depth of 50 ½ feet. Generally, clayey soils were grayish to dark brown in color, moist, and stiff to very stiff in consistency. Our exploratory logs are provided in Appendix B.

2019 CALIFORNIA BUILDING CODE - SEISMIC PARAMETERS

Based on the geologic setting and anticipated earthwork for construction of the proposed project, the soils underlying the site are classified as Site Class "D, stiff soil profile", according to the 2019 California Building Code (CBC). The seismic parameters according to the 2019 CBC are summarized in the following table.

2019 CBC - Seismic Parameters	
Mapped Spectral Acceleration Parameters	S_s = 0.901 and S_1 = 0..331
Site Coefficients	F_a = 1.14 and F_v = 1.969
Adjusted Maximum Considered Earthquake Spectral Response Parameters	S_{MS} = 1.027 and S_{M1} = 0.652
Design Spectral Acceleration Parameters	S_{DS} = 0.685 and S_{D1} = 0.434
Peak Ground Acceleration	PGA_M = 0.471
Seismic Design Category	D

GROUNDWATER

No groundwater was encountered within any hand auger boring to the maximum explored depth of 50 ½ feet. There are no water wells in the close vicinity of the project site from the State of California Department of Water Resources, Water Data Library. The nearest water well for which information was available through this water library, was well No. Station 331103N1171048W001, which is located about 8 miles southeast of the site. Groundwater information from this well indicated groundwater elevation was about 628 MSL in 1987, just 9 feet below ground surface at the subject site.

An inquiry to Geotracker located a report for a property within 200 feet east to the project site, as shown in Enclosure A-9. A total of 23 relevant water wells were installed between 2005 and 2016 and groundwater was encountered ad depths between 10 and 36 feet below ground surface at the site.

Based on these data, a design groundwater level is adopted at 10 feet below ground surface.

LIQUEFACTION POTENTIAL

The subject site does not lie within a zone of potential, seismically induced seismically-induced liquefaction (Enclosure A-5). Based on the type of soil, mapped shallow depth to bedrock, and groundwater depth greater than 50 feet, liquefaction is not considered to be a geologic constraint.

LANDSLIDES AND SLOPE STABILITY

There was no visual evidence of landslides on or near the subject property noted during the field investigation. There are no mapped landslides on or near the subject site as shown in Enclosure A-4. Landslides are not considered to be a geologic constraint at the subject site.

FLOODING POTENTIAL

According to FEMA, the subject site is within flood hazard zone "X" (2019), which is defined here as an area outside of the 0.2% annual flood risk zone, as presented in Enclosure A-7. Flooding is not considered to be a geologic constraint at the subject site.

Seiching:

Seiching is the oscillation of an enclosed body of water, usually due to strong groundshaking following a seismic event. Seiching can affect lakes, water towers, swimming pools. There were no enclosed bodies of water observed in close enough proximity to affect the project site. Seiching should not be considered to be a geologic constraint at this site.

Tsunamis:

Tsunamis are not considered to be a geologic hazard at the subject site due to its elevation and inland location.

EXPANSION POTENTIAL

A sample of the near surface soils was tested and indicated an Expansion Index (EI) of 155 which indicates a very high expansion potential. Specialized construction procedures to specifically resist expansive soil forces are anticipated for this site. Requirements for reinforcing steel to satisfy structural criteria are not affected by this recommendation. Additional evaluation of soils for expansion potential should be conducted by the geotechnical engineer during the grading operation.

CHEMICAL/CORROSIVITY TESTING

A selected sample of material was delivered to Project X Corosion Engineers for preliminary corrosivity analysis. Laboratory testing consisted of pH, resistivity, chlorides and sulfates. The results of the laboratory tests appear in Appendix C.

The result from the resistivity test indicates a "very corrosive" condition to ferrous metals. Specific corrosion control measures, such as coating of the pipe with non-corrosive material or alternative non-metallic pipe material, are considered necessary.

Results of the soluble sulfate testing indicate a Class S2 (or “severe”) anticipated exposure to sulfate attack. Based on the criteria from Table 19.3.2.1 of the American Concrete Institute Manual of Concrete Practice (2014), special measures, such as specific cement types or water-cement ratios, are considered necessary for this Class S2 exposure to sulfate attack.

The soluble chloride content of the soils tested indicates is considered “corrosive” to reinforcing steel. The results should be considered in combination with the soluble chloride content of the hardened concrete in determining the effect of chloride on the corrosion of reinforcing steel.

Ghostrider, Inc. does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer could be consulted.

CONCLUSIONS

On the basis of our field and laboratory investigations, it is the opinion of this firm that the proposed development is feasible from geotechnical engineering and engineering geologic standpoints, provided the recommendations contained in this report are implemented during grading and construction.

Moderate to severe seismic shaking can be expected at the site. There are no known active faults on or trending toward the subject site; the site does not lie within an Alquist-Priolo Special Studies zone.

Groundwater was not encountered within any of our exploratory borings at the site. Groundwater data from nearby wells indicate levels can be up to 10 feet below ground surface and this value is adopted for design. Liquefaction is not considered to be a potential hazard to the site.

Landslides are not considered to be a geologic constraint on the subject site. Temporary excavations are anticipated to conform to local and State codes with regard to the subsurface materials present at the site.

Materials encountered during this investigation were found to be highly expansive. Specialized construction procedures to specifically resist expansive soil forces are required to be implemented at the site with additional testing during grading.

Based upon our field investigation and test data, it is our opinion that for the proposed structure, deep foundations are an adequate option to support the proposed 3-story structure with one to two (2) underground levels due to the existence of highly compressive soils. The proposed structure can be also supported on a mat foundation following proper site development grading/excavation and if designed to accommodate total and differential settlement, as discussed in this report.

The final project grading and foundation plans should be reviewed by the geotechnical engineer.

FOUNDATION RECOMMENDATIONS

Based on a review of the conceptual plans, the proposed development is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are implemented.

Deep foundations are an adequate option to support the proposed 3-story structure with one to two (2) underground levels. Foundation loads are not available at the time of preparing this report. Considering the subsurface conditions and anticipated large column loads, it is recommended the use of deep foundations consisting of grouped 24-inch diameter auger displacement piles (ACD). Driven piles are not recommended due to noise and vibration which may disturb surrounding neighbors during pile driving. We recommend 24-inch-diameter ACD piles to be tipped in the very dense layer found at a depth of approximately 50 feet below existing ground surface or deeper. Recommendations for allowable pile loads, settlements, and pile lengths are provided in the following subsections.

AXIAL CAPACITY

Pile axial resistance has been determined for 24-inch-diemeter ACD piles. Two different pile cut-off elevations have been considered to represent the portion of the structures with one basement level and (approximately 10 feet below existing ground surface) and the portion of the structure with two basement levels (approximately 20 feet below existing ground surface). The ultimate axial capacities with no factor of safety applied are presented in Enclosure A-8a. The allowable downward axial capacities have considered a factor of safety of 2 and are presented in Enclosure A-8b. Pile capacities shown in Enclosures A-8a and A-8b are for dead-plus-live load capacities; a one-third increase may be used for wind or seismic loads. The allowable upward axial capacities have considered a factor of safety of 3 and are presented in Enclosure A-8c. Uplift due to wind or seismic loading may use a reduced factor of safety of 2. The capacities presented in this report are based on the strength of the soils; the compressive and tensile strengths of the pile sections should be checked to verify the structural capacity of the piles.

LATERAL CAPACITY

The lateral capacity of the recommended piles was evaluated using the computer program LPILE v2016 (Ensoft, 2016) for head deflections of 0.25, 0.5 and 1 inches and for fixed head and free head conditions. Lateral capacities are summarized in the table below and shall be reviewed by the structural engineer to confirm the structural capacity of the pile.

Lateral Capacity of 24-inch ACD Single Pile				
Pile Head Condition	**Pile Head Deflection (inch)**	**Max. Shear (kips)**	**Max. Moment (kip-ft)**	**Depth to Max. Moment (feet)**
Free	0.25	14	68	8.4
	0.5	20	108	9.6
	1.0	27	172	10.8
Fixed	0.25	29	172	0.0
	0.5	41	271	0.0
	1.0	57	427	0.0

For grouped piles, the lateral pile capacity can be reduced based on a p-multiplier of 0.55, assuming a 3 by 3 pile group arrangement and a pile center-to-center spacing of 3D (where D is the pile diameter). In case piles are spaced at a center to center spacing of 7D or greater, no reduction in lateral pile capacity is needed and a single pile system can be used.

PILE SETTLEMENT

The amount of settlement estimated for the pile foundation is less than ½ inch. Once foundation details are completed, details should be provided to the geotechnical engineer for additional settlement estimates.

MAT FOUNDATIONS

The proposed structure can be supported on a mat foundation following proper site development grading/excavation and designed to accommodate total and differential settlement, as discussed in this report.

Subgrade Reaction

The modulus of subgrade reaction concept is used in the design of the mat foundations and slabs-on-grade. This modulus is not an intrinsic property of the soil as depends on the dimensions and stiffness of the slab and the stress level. The mat slab foundation should be designed for bending moments using a value of 200 pounds per cubic inch (pci) for the normalized modulus of subgrade reaction coefficient K_{v1} (namely, corresponding to a 1-foot square bearing plate). Following Terzaghi (1955), the subgrade reaction coefficient, K_v, can be defined as:

$$K_v = K_{v1} * [(m + 0.5)/1.5m] * [(B+1)/2B]^2$$

where "B" is the width of the foundation measured in feet, and "m" is the ratio of length over width of a rectangular foundation.

The flat concrete slab of the mat system should, at a minimum, have continuous two-way reinforcing at the top and the bottom and be designed by the project structural engineer.

Bearing Capacity and Settlement

An allowable bearing pressure of 1,000 psf may be used for design. The allowable bearing pressure may be increased by one-third for short term wind or seismic loads. The expected total post-construction settlement of the mat slab is expected to be on the order of 2 inches. The differential settlement is expected to be less than one half of the total settlement.

Lateral Resistance

Resistance to lateral loads can be provided by friction developed between the bottom of foundation and the supporting soil, and by the passive soil pressure developed on the face of the footing. For design purposes, an allowable passive resist of 300 pounds per cubic foot (pcf) and a coefficient of friction of 0.40 may be used for lateral sliding resistance of foundation.

CONSTRUCTION RECOMMENDATIONS

GENERAL SITE GRADING:

It is imperative that no clearing and/or grading operations be performed without the presence of a representative of the geotechnical engineer. An on-site, pre-job meeting with the developer, the contractor and the geotechnical engineer should occur prior to all grading-related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed, at a minimum, in accordance with these recommendations and with applicable portions of the current California Building Code (CBC). The following recommendations are presented for your assistance in establishing proper grading criteria.

INITIAL SITE PREPARATION:

All areas to be graded should be stripped or cleaned of significant vegetation and other deleterious materials. Deleterious materials include slabs, trees, vegetation, trash, and demolition debris. These materials should be removed from the site for disposal. The cleaned soils may be reused as properly compacted fill. Rocks or similar irreducible material with a maximum dimension greater than 8 inches should not be used in compacted fills. If encountered, existing utility lines should be traced, removed and rerouted from areas to be graded.

MINIMUM MANDATORY REMOVAL AND RECOMPACTION OF EXISTING SOILS:

The field exploration indicated the site is underlain by native soils generally consisting stiff to very stiff clays. These soils are considered potentially compressible. The preliminary plans indicated that a portion of the building would have one and two basement levels at about 10 to 20 feet below the exiting grade.

Based on these considerations, we recommend the following removals for the different foundation systems:

- Structures supported on pile foundation do not require removal of soils if prepared following recommendations on this report
- Structures supported on mat foundations or slabs on grade require removal of at least 2 feet of soil below the bottom of the footing. The areas should extend at least 3 feet laterally beyond the footing lines. For general areas (excluding the unit footprint), surface improvements such as sidewalks and exterior flatwork, removal and recompaction should be a minimum of 1 feet below existing grade.

The open excavation bottoms observed by our engineer/ geologist to verify and document in writing that all undocumented fill is removed prior to refilling with properly tested and documented compacted fill. The removed and cleaned soils are not suitable to be reused as compacted fill material due to the cohesive material content. Import fill sources should be observed and tested prior to hauling onto the site to evaluate the suitability for use. Imported fill materials should consist of granular soil with less than 35 percent passing the No. 200 sieve based on ASTM D1140 and an EI less than 20 based on ASTM D489.

Further subexcavation may be necessary depending on the conditions of the underlying soils. The actual depth of removal should be determined at the time of grading by the project geotechnical engineer/geologist. The determination will be based on soil conditions exposed within the excavations. At minimum, any undocumented fill, topsoil or other unsuitable materials should be removed and replaced with properly compacted fill.

In-place density tests may be taken in the removal bottom areas where appropriate to provide data to help support and document the engineer/geologist's decision.

EXCAVATION ADJACENT TO EXISTING STRUCTURES:

Removal and recompaction of the soils adjacent to existing structures may result in unacceptable distress by the removal of bearing and lateral support. The following precautionary measures should be utilized during proposed subexcavation/recompaction operations to reduce the potential for distress to existing adjacent structures.

During compacted fill mat construction for the proposed structure, the excavation and replacement of soils adjacent to any existing structures should be accomplished in the shortest period of time possible. Sufficient forces and equipment should be available to accomplish any removal and replacement of soils adjacent to existing structures within one 8-hour working day. The excavation should not be performed during periods of rain or threat of rain. During the excavation operation, the moisture content of the soils near existing structures should be monitored. If excessive moisture contents or excessively dry soils are encountered, the geotechnical engineer should be notified immediately.

The actual excavation and recompaction of soils near existing structures should be performed in alternating sections. A checkerboard-type (A-B) system should be utilized by initially removing and recompacting every other square and thereupon going back and removing and recompacting the remaining squares. The width of these excavations is usually equal to the blade or bucket size of the available equipment but should not exceed 6 feet.

PREPARATION OF FILL AREAS:

Prior to placing fill, and after the mandatory subexcavation operation, the surfaces of all areas to receive fill should be scarified and moisture treated to a depth of 6 inches or more. The soils should be brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

PREPARATION OF FOOTING AREAS:

All footings should rest upon at least 2 feet of properly compacted fill material. In areas where the required thickness of compacted fill is not accomplished by the mandatory removal operation, the footing areas should be overexcavated to a depth of 12 inches or more below the lowest proposed footing base grade. The required overexcavation should extend at least 3 feet laterally beyond the footing lines, where reasonably possible. In instances where the 3-foot lateral overexcavation may not be accomplished, this firm should be contacted to evaluate the effect. The bottom of this excavation should then be scarified, and moisture treated to a depth of at least 6 inches, brought to near optimum moisture content and compacted to a minimum of 90 percent relative compaction in accordance with ASTM D1557 prior to refilling the excavation to the required grade as properly compacted fill.

All footing excavations should be observed by a representative of the project geotechnical engineer to verify that they have been excavated into compacted fill prior to placement of forms, reinforcement, or concrete. The excavations should be trimmed neat, level, and square. All loose, sloughed or moisture-softened soils should be removed from the excavations prior to placing of concrete. Excavated soils derived from the footing and/or utility trenches should not be placed in building slab-on-grade areas or exterior concrete flatwork areas unless the soils are brought to near optimum moisture content and compacted to at least 90 percent of the maximum dry density.

COMPACTED FILLS:

The on-site soils are not considered suitable for reuse as compacted fill. Import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. The contractor shall notify the geotechnical engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" potential for sulfate attack based upon current American Concrete Institute (ACI) criteria and is "mildly corrosive" to ferrous metal and copper. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Fill should be spread in near-horizontal layers, approximately 8 inches thick. Thicker lifts may be approved by the geotechnical engineer if testing indicates that the grading procedures are adequate to achieve the required compaction. Each lift should be spread evenly, thoroughly mixed during spreading to attain uniformity of the material and moisture in each layer, brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

TEMPORARY EXCAVATION AND SHORING

Excavations for construction of basement levels are anticipated to be as deep as 10 feet below existing grade to the front of the proposed building and 20 feet to the back of the building. The contractor is responsible for excavation safety, and all excavations should comply with the current California and Federal Occupational Safety and Health Administration (CALOSHA) requirements (29 CFR-Part 1926, Subpart P), as applicable. Temporary slopes, up to 20 feet high, may be cut at a gradient of 3/4H:1V (horizontal:vertical) with the bottom 4 feet is permitted to be cut vertically.

If sloping or benching is not practical due to space constraints, temporary shoring may be used. Vertical temporary excavations deeper than 5 feet should be shored. No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the excavation, unless the shoring is designed for surcharge loading. All shoring should comply with OSHA regulations and 29 CFR Part 1926 guidelines and be observed and deemed safe by the designated competent person on site. The designated competent person should observe all excavations to determine the safety prior to excavation.

For design of cantilevered temporary shoring, where the surface of the backfill is level, it can be assumed that drained soils will exert a lateral pressure equal to that developed by a fluid with a density of 37 pcf. Surcharge loads from equipment or stockpiled material should be kept behind the top of the temporary excavations a horizontal distance of at least twice the depth of the excavation, or the shoring should be designed for the additional pressure. Foundation and traffic loads from adjacent areas should also be added to the lateral earth pressures.

For design of temporary rigid shoring such as braced shoring or trench shields in sandy soils, we recommend the use of a rectangular lateral pressure of 24H psf, where H is the height of the shoring in feet. In addition, 46 percent of any surcharge load should be included as a uniform rectangular loading on the shoring. For traffic loads no larger than highway trucks, the surcharge may be taken as a uniform lateral pressure of 100 psf. Other surcharge loads may be evaluated by Ghostrider on a case-by-case basis.

Surface drainage should be controlled and prevented from running down the temporary excavations or down the face of the shoring. Ponding water should not be allowed within the excavation.

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 24 inches of compacted soil. The final pad surfaces should be rolled to provide smooth, dense surfaces. Concrete slabs-on-grade should be a minimum of 4 inches in thickness and should consist of at least No. 3 reinforcing bars spaced at 16 inches on center each way. Additional reinforcement may be required by the structural engineer.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder/barrier. We recommend that a vapor retarder/barrier be designed and constructed according to the American Concrete Institute 302.1R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder/barrier construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage. Per the Portland Cement Association (www.cement.org/tech/cct_con_vapor_retarders.asp), for slabs with vapor-sensitive coverings, a layer of dry, granular material (sand) should be placed under the vapor retarder/barrier. For slabs in humidity-controlled areas, a layer of dry, granular material (sand) should be placed above the vapor retarder/barrier.

EXCAVATIONS:

The soils encountered within our exploratory borings are generally classified as a Type "A" soil in accordance with the CAL/OSHA excavation standards. Unless specifically evaluated by our engineering geologist, all the trench excavations should be performed following the recommendation of CAL/OSHA (State of California, 2013) for Type "A" soil. Based upon a soil classification of Type "A", the temporary excavations should not be inclined steeper than ¾ horizontal to 1 vertical for maximum trench depth of less than 20 feet. For trench excavations deeper than 20 feet or for conditions that differ from those described for Type "A" in the CAL/OSHA excavation standards, this firm should be contacted.

BASEMENT WALLS:

Basement walls below grade must be designed to resist at-rest earth pressures. Where the grade is level behind the walls, this pressure corresponds to a triangular distribution of lateral earth pressure equivalent to that developed by a fluid with a density of 46 pcf. This earth pressure assumes that all walls are constructed with a properly designed drainage system to prevent buildup of hydrostatic pressures behind the wall. Any surcharge loadings such as heavy crane loads, stockpiled materials or traffic shall be added to this pressure.

Basement walls should also be designed for seismic earth pressure. Basement walls should be designed to resist, an active pressure combined with a seismic increment of lateral active earth pressure. To compute this, a horizontal acceleration coefficient k_h of 0.16g based on one-half of two-third of PGA_M is used. The combination of active static and seismic lateral earth pressure is equivalent to a fluid with a density of 37 pcf. Therefore, a seismic increment of 12 pcf may be used for design of seismic earth pressure.

Lateral earth pressures recommended in this report assume that adequate drainage is provided behind the walls to prevent the buildup of hydrostatic pressures. Basement wall should have backdrains to adequately prevent the buildup of hydrostatic pressure behind the walls.

POTENTIAL EROSION AND DRAINAGE:

The potential for erosion should be mitigated by proper drainage design. The site should be graded so that surface water flows away from structures at a minimum gradient of 5 percent for a minimum distance of 10 feet from structures. Impervious surfaces within 10 feet of structures should be sloped a minimum of 2 percent away from structures. Water should not be allowed to flow over graded areas or natural areas so as to cause erosion. Graded areas should be planted or otherwise protected from erosion by wind or water.

Water should not be permitted to collect or pond in yard areas. This water will either seep into the ground (loosening the soils) or will overflow onto the slope. Once erosion is started, it is difficult to control, and severe damage can occur quickly.

Homes should be provided with roof drains, gutters, and downspouts connected to subsurface pipes. Roof water should not be allowed to discharge onto the ground surface without collecting into surface drains and pipes. Water should not be allowed to collect against foundations or retaining walls. These walls are typically built to withstand the effects of normal soil moisture and may require subsurface drains to collect and transfer excessive water away from the structures.

All drainage devices should be checked at least twice per year to ensure that they are not blocked. All blockages should be cleared.

Drains at the top of slopes should not allow water to overflow onto the slope.

Terrace drains and brow ditches on slopes or at the tops of slopes are designed to carry runoff water to an appropriate discharge point. These drains should be checked at least twice per year and cleaned of any accumulation of dirt and other debris. Water that backs up in surface drains will overflow and seep into the slope, creating instability.

Loose soil or debris should not be left on slopes. Loose soils soak up water more readily than compacted fill and will often slide downslope. This material may clog terrace drains and may cause additional slope damage.

Slopes should not be over-irrigated. Naturally, ground cover will require some moisture during the hot summer months, but during the wet season, irrigation can cause heavy ground cover to move, which not only destroys the cover, but also may begin slope surface erosion. Heavy ground cover can cause surface sloughing when saturated due to the increased weight and weakening of the near surface soil.

Irrigation systems should not be left running on or near a slope, particularly during the rainy season.

Swales that have been graded around the home or on the lot should not be blocked. These swales are typically constructed to provide drainage toward the driveways, street or other positive outlet.

SLOPE SETBACK:

As per section 1808.7.2 of the 2019 CBC, which references Figure 1808.7.1 of the 2019 CBC, the distance between the face of the footing from the face of descending slopes should be at least the smaller of H/3 and 40 feet, where H is the height of the slope. The distance between the face of the structure and the toe of ascending slopes should be the smaller of 15 feet and H/2. Footings should be deepened as necessary to meet this requirement.

SLOPE CONSTRUCTION:

Slopes for the project should be inclined at 2H:1V or shallower. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction and then roll the final slopes to provide dense, erosion-resistant surfaces.

Where fills are to be placed against existing slopes steeper than 5(h):1(v), and the depth of fill exceeds 5 feet, the existing slopes should be benched into competent bedrock or native materials to provide a series of level benches to seat the fill and to remove potential undocumented fill. The benches should be a minimum of 4 feet in width, constructed at approximately 4-foot vertical intervals. In addition, a shear key should be constructed across the toe of slopes. The shear key should be a minimum of 10 feet wide and should penetrate a minimum of 2 feet beneath the toe of the slope into competent bedrock or native materials.

SLOPE PROTECTION:

Inasmuch as the on-site materials are susceptible to erosion by wind and running water, it is our recommendation that the slopes at the project be planted as soon as possible after completion, where possible. The use of succulent ground covers, such as iceplant or sedum, is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the water system and to prevent over watering.

Measures should be provided to prevent surface water from flowing over slope faces.

Rodent infestation can also be a serious issue with respect to slope stability. Rodent tunneling and burrowing alters the strength of the soil and can allow water to infiltrate the soil, resulting in slope failure. Rodent burrows can also provide direct access for surface water to the slope face, causing surficial slope "blowouts". Although a maintenance issue, we recommend that measures be taken to prevent rodent infestation in slopes.

FOUNDATION PLAN REVIEW

It is recommended that we review the foundation plans for the proposed structure as they become available. The purpose of this review is to determine if these plans have been prepared in accordance with the recommendations contained in this report. This review will also provide us an opportunity to submit additional recommendations as conditions warrant.

GRADING PLAN REVIEW

The project civil engineer should review this report, incorporate critical information on to the grading plan and reference this geotechnical study, by company name, project number and report date, on the grading plan. Final grading plans should be reviewed by us when they become available to address the suitability of our grading recommendations with respect to the proposed development.

CONSTRUCTION OBSERVATION:

All grading operations, including site clearing and stripping, should be observed by a representative of the geotechnical engineer. The geotechnical engineer's field representative will be present to provide observation and field testing and will not supervise or direct any of the actual work of the contractor, his employees or agents. Neither the presence of the geotechnical engineer's field representative nor the observations and testing by the geotechnical engineer shall excuse the contractor in any way for defects discovered in his work. It is understood that the geotechnical engineer will not be responsible for job or site safety on this project, which will be the sole responsibility of the contractor.

LIMITATIONS

Ghostrider, Inc. has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of Ghostrider, Inc. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions that appear different than those described herein be encountered in the field by the client or any firm performing services for the client or the client's assign, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
GHOSTRIDER, INC.

REGISTERED PROFESSIONAL ENGINEER
JERRY L. MICHAL
NO 2515
Exp 3-31-22
GEOTECHNICAL
STATE OF CALIFORNIA

Jerry L. Michal, GE 2515
Geotechnical Engineer

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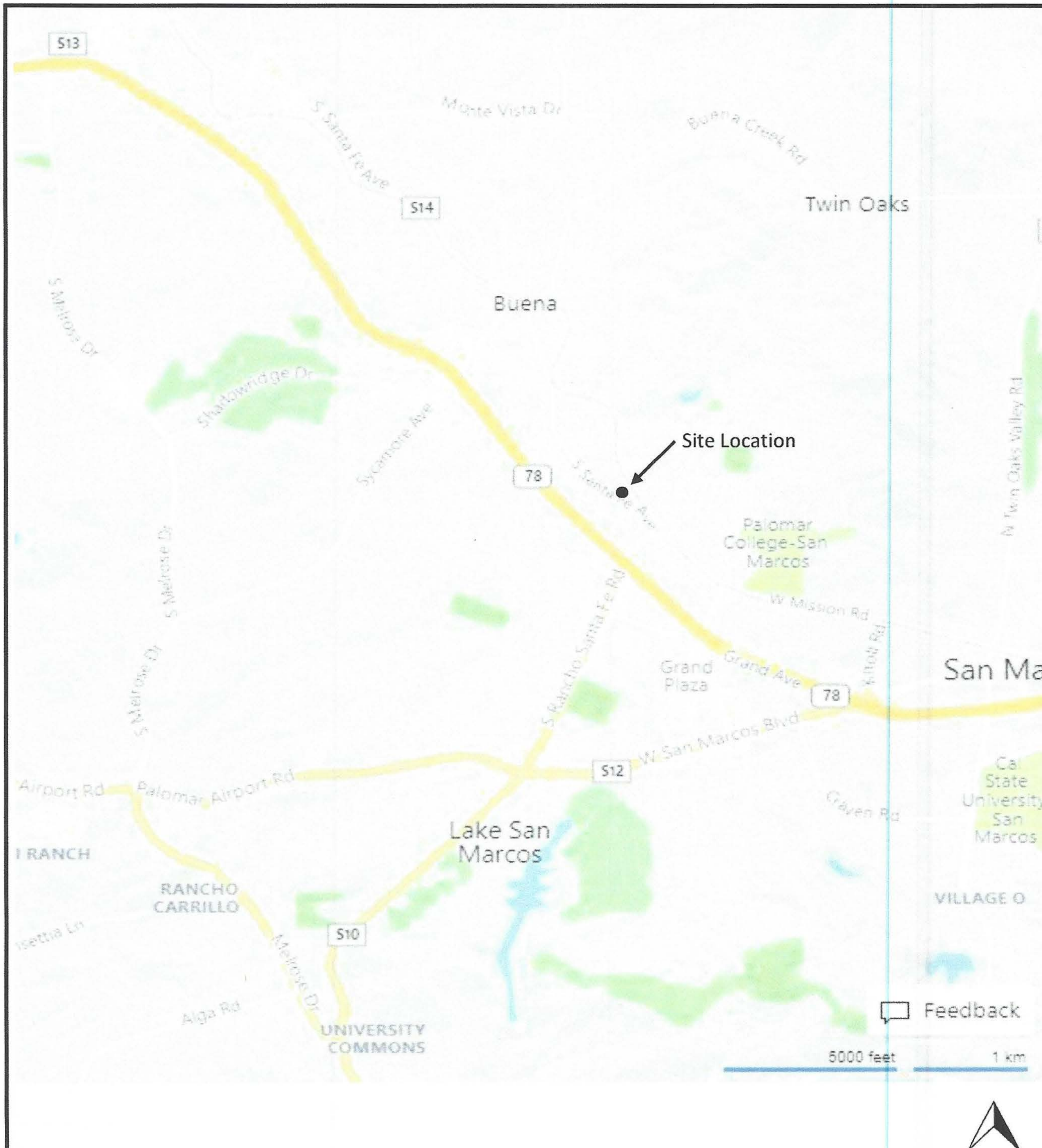
Appendix A

Maps and Pile Calculations



Reference: Bing Maps, Microsoft 2020, Here 2020

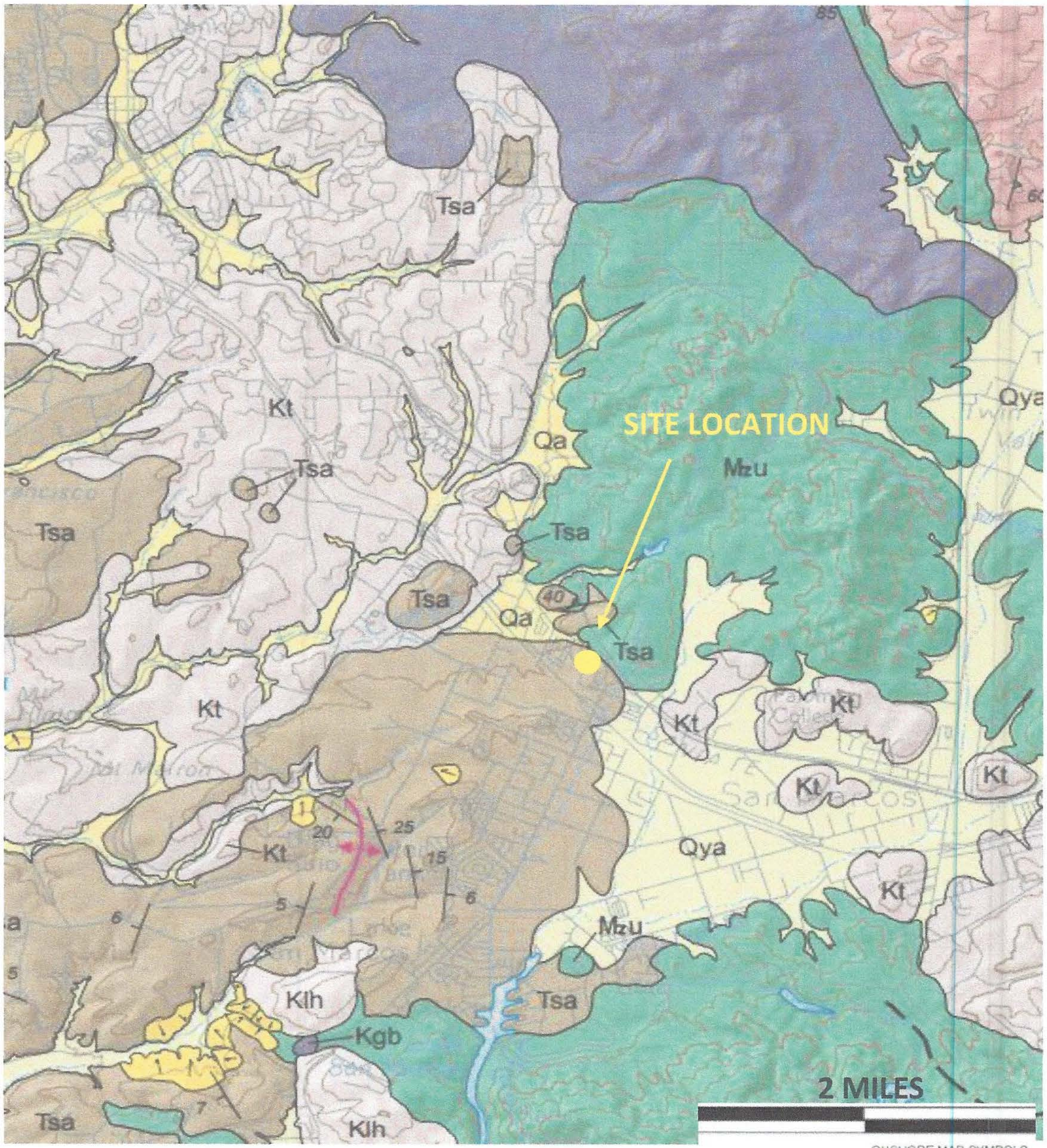
Date:	Index Map	GHOSTRIDER	Figure
5/29/2020	South Santa Fe Ave.		A-1
Drawn By:	San Marcos, CA 92069		
L.B.			

Appx. Boring Location

N

Reference: Bing Maps, Microsoft 2020, Here 2020

Date:	Boring Locations	GHOSTRIDER	Figure
5/29/2020	South Santa Fe Ave.		A-2
Drawn By:	San Marcos, CA 92069		
L.B.			



Kt	Tonalite, undivided (mid-Cretaceous)
Mzu	Metasedimentary and metavolcanic rocks, undivided (Mesozoic)
Qya	Young alluvial flood-plain deposits (Holocene and late Pleistocene)
Tsa	Santiago Formation (middle Eocene)
Qa	Alluvial flood-plain deposits (late Holocene)

N

ONSHORE MAP SYMBOLS

Contact - Contact between geologic units; generally approximately located; dotted where concealed

Fault - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane

Anticline - Solid where accurately located; dotted where concealed

Syncline - Solid where accurately located; dotted where concealed

Kgp - Granite pegmatite dike

Closed depression - Closed depression in Elsinore fault zone

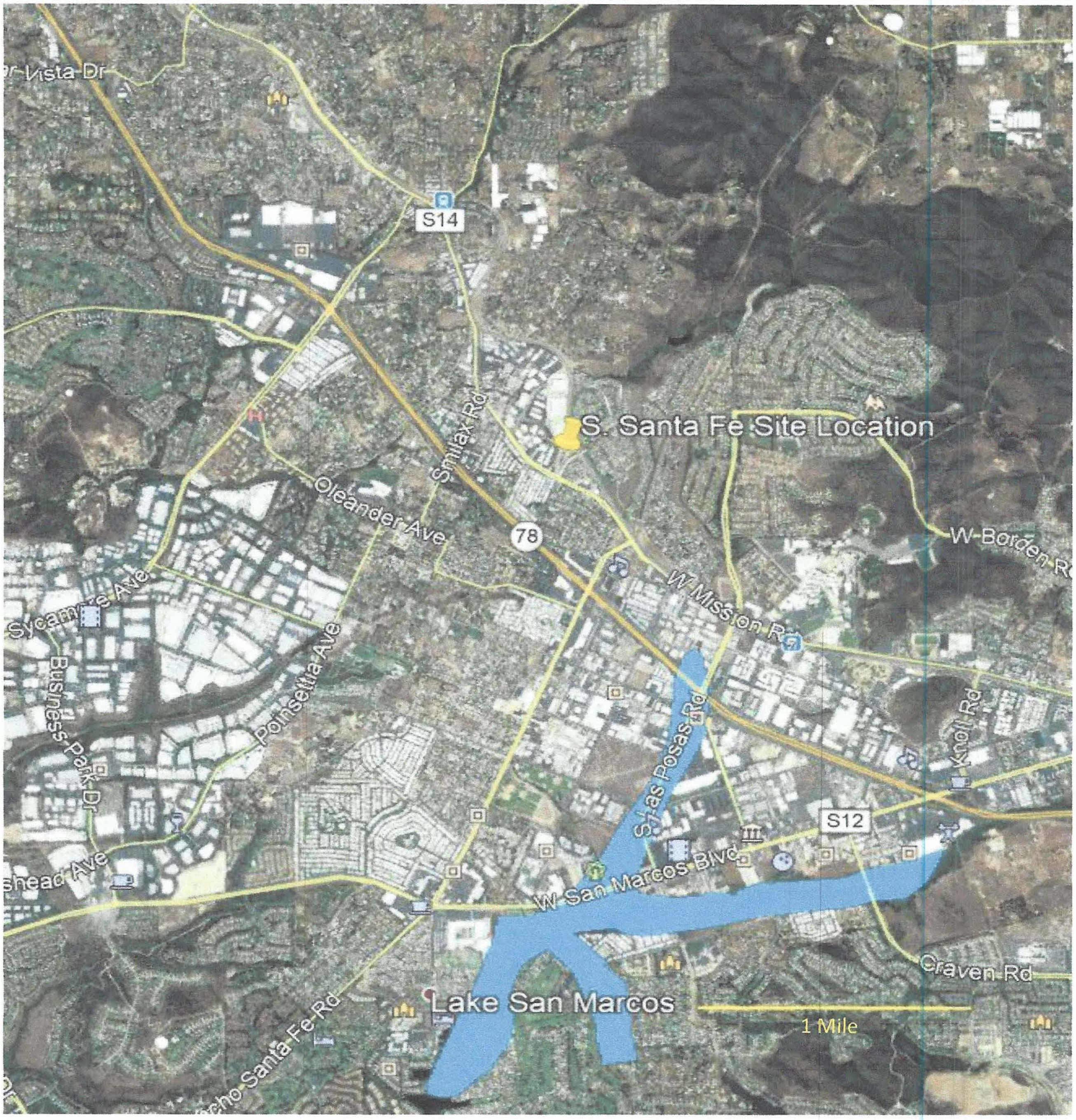
Landslide - Arrows indicate principal direction of movement. Queried where existence is questionable

Reference: Oceanside 30'x60' Quadrangle, Kennedy and Tan, 2007

Date:	Geologic Map		Figure
5/29/2020	South Santa Fe Ave.	GHOSTRIDER	A-3
Drawn By:	San Marcos, CA 92069		
L.B.			

Reference: USGS U.S. Landslide Inventory Hazard Program, ESRI, HERE

Date:	Landslide Hazards	GHOSTRIDER	Figure
5/29/2020	South Santa Fe Ave.		A-4
Drawn By:	San Marcos, CA 92069		
L.B.			

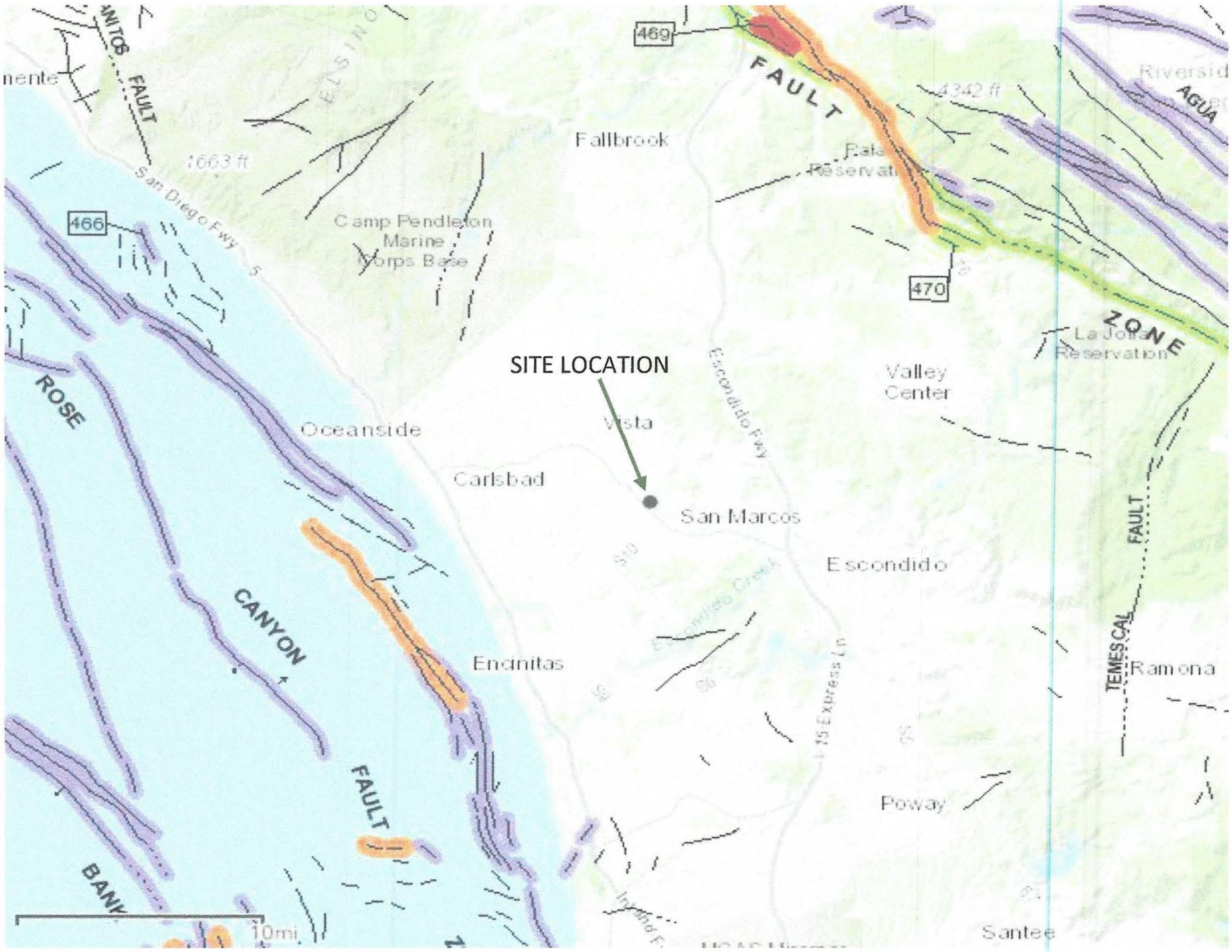


Possible Liquefaction Areas

N

Reference: Google Earth, Google 2019, SD County, SANDAG, LUEG-GIS, National Earthquake Hazards Reduction Program

Date:	Liquefaction Hazards South Santa Fe Ave. San Marcos, CA 92069	GHOSTRIDER	Figure
5/29/2020			A-5
Drawn By:			
L.B.			



Holocene fault displacement (during past 11,700 years) without historic record.

Late Quaternary fault displacement (during past 700,000 years).

Quaternary fault (age undifferentiated).

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

Arrows along fault indicate relative or apparent direction of lateral movement.

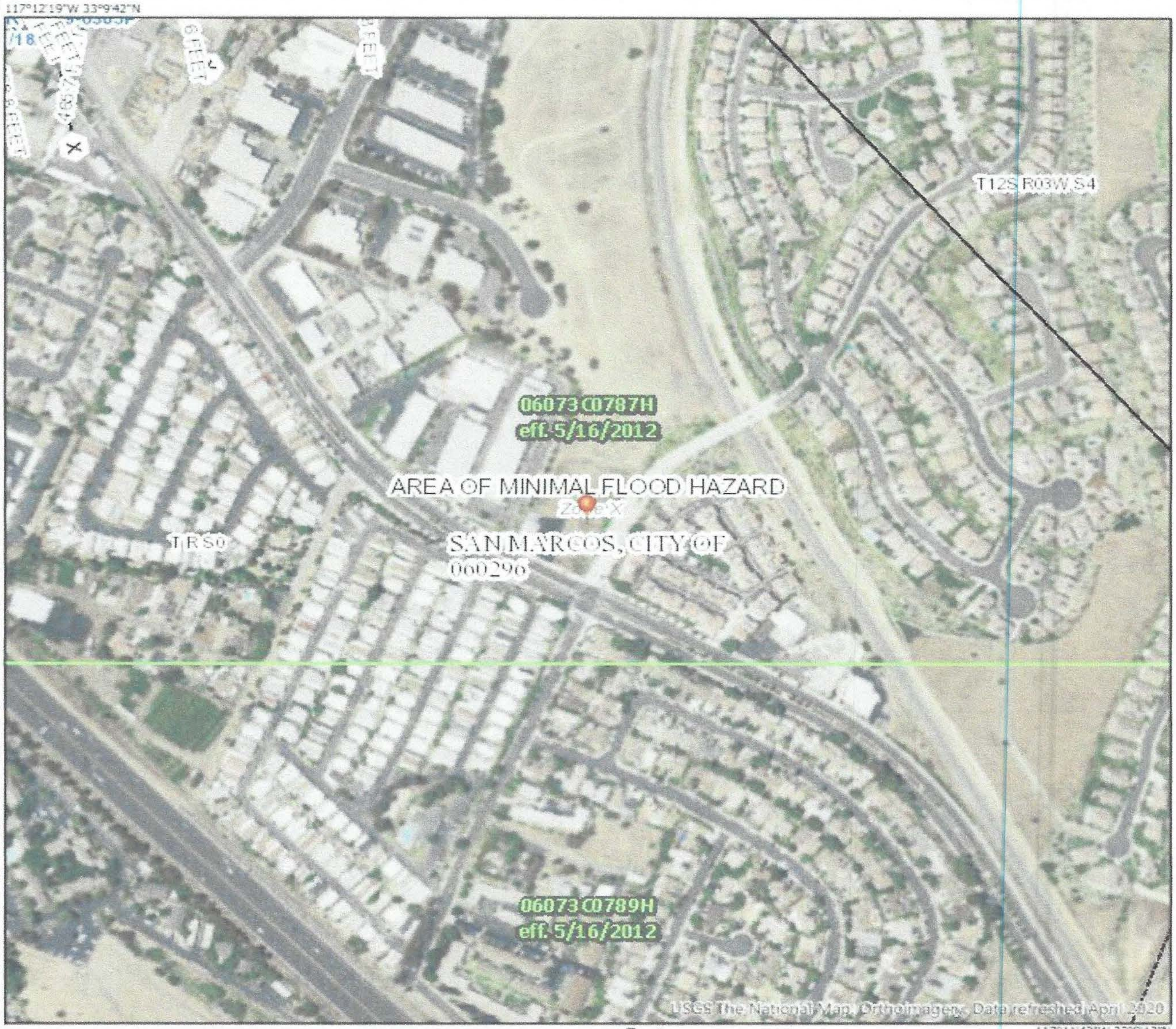
Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate).

N

Reference: Esri, HERE, USGS, NGA, USDA, California Geologic Survey, Fault Activity Map

Date:	Fault Zones	GHOSTRIDER	Figure
6/25/2020	South Santa Fe Ave.		A-6
Drawn By:	San Marcos, CA 92069		
L.B.			



0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

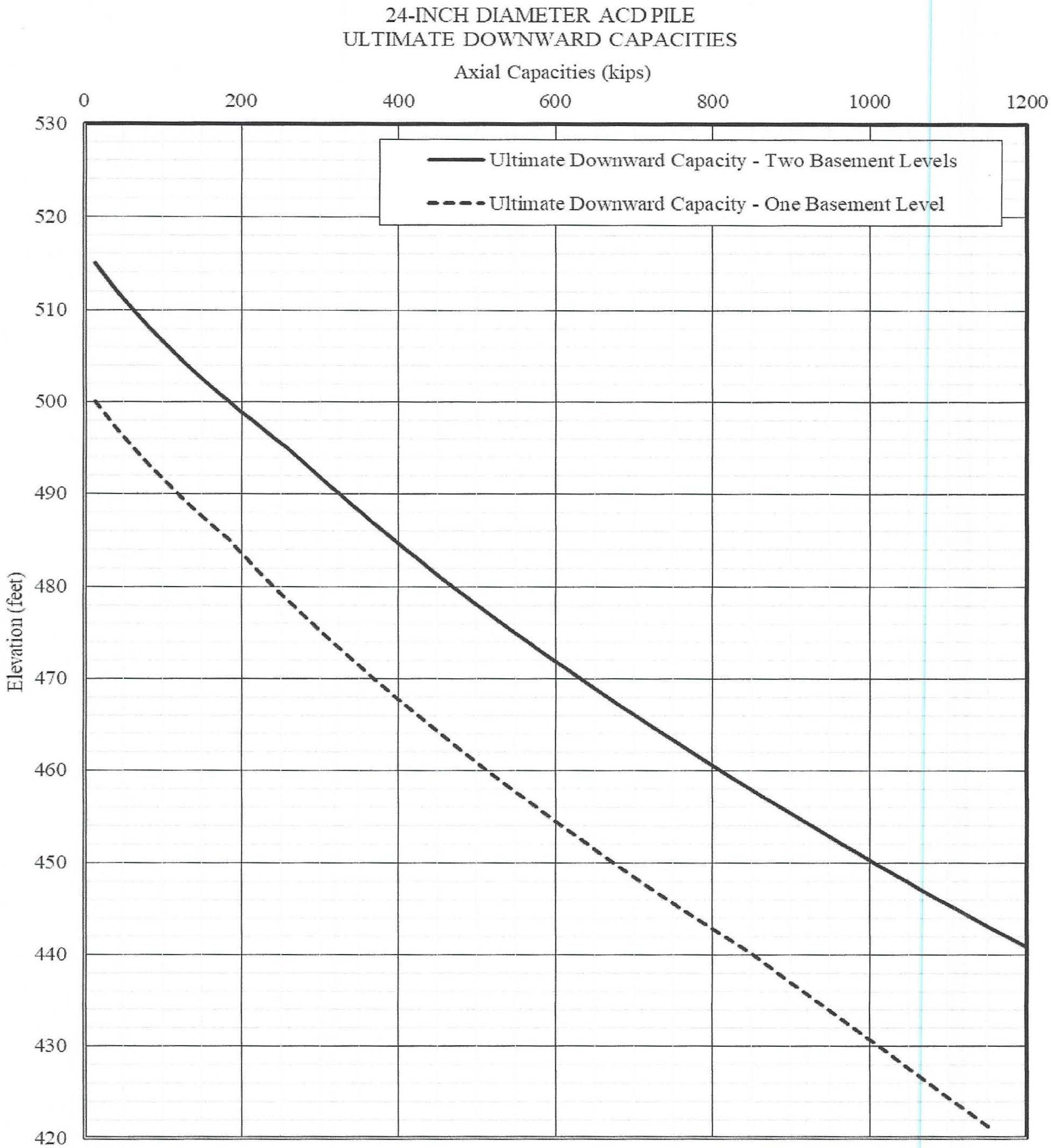
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/28/2020 at 1:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

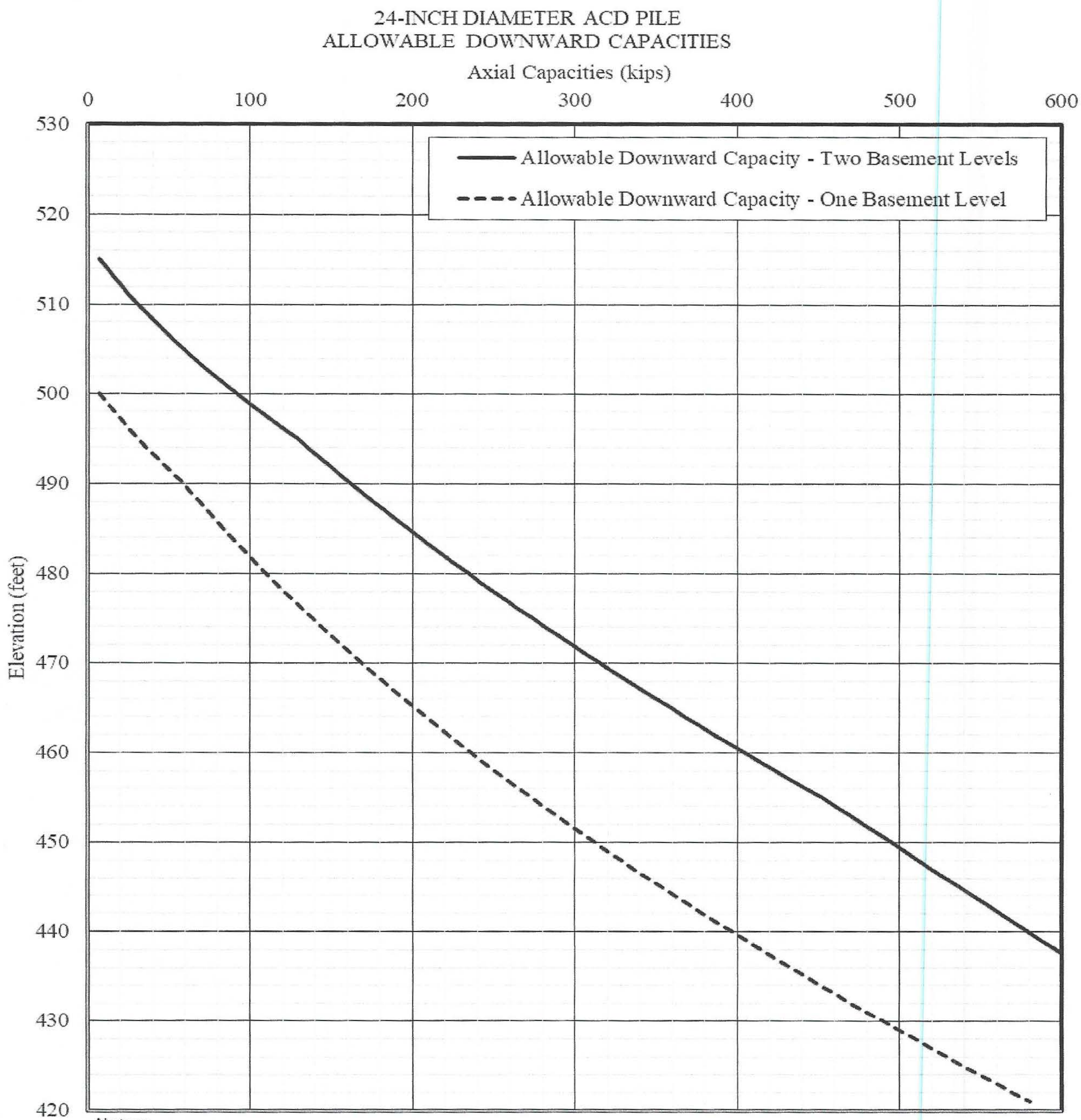
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Reference: FEMA Flood Map Service Center

Date:	FEMA Flood Zone	GHOSTRIDER	Figure
6/28/2020	South Santa Fe Ave.		A-7
Drawn By:	San Marcos, CA 92069		
L.B.			

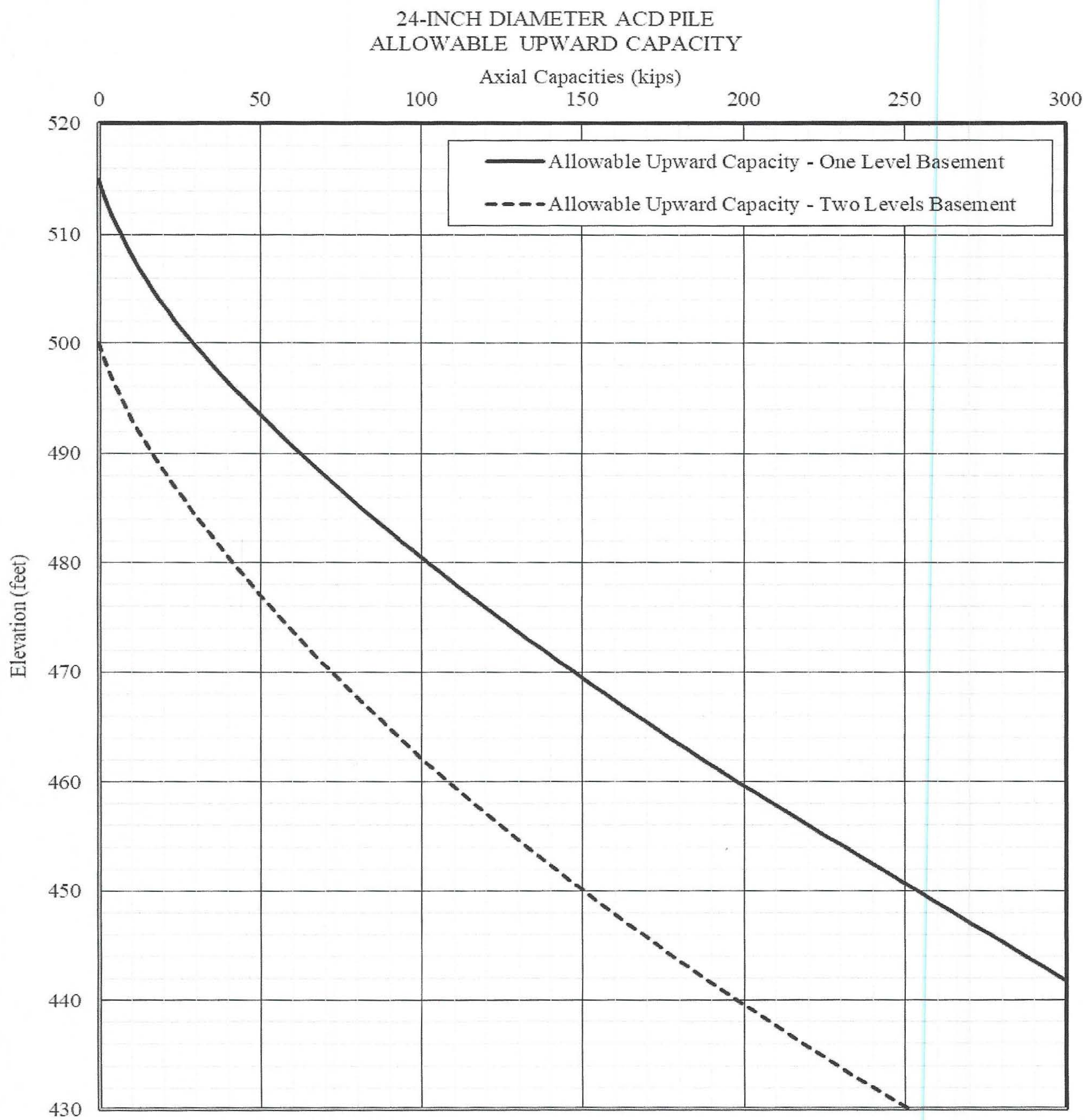


Date:	Ultimate Downward Axial Pile Capacity	GHOSTRIDER	Figure
6/28/2020	South Santa Fe Ave.		A-8a
Drawn By:	San Marcos, CA 92069		
L.B.			



Notes:
1) Allowable pile capacities are calcualted using a Factor of Safety of 2
2) Capacities are based on the strength of the soils
3) Compressive and tensile strengths of the pile section should be checked to verify the structural capacities.

Date:	Allowable Downward Axial Pile Capacity	GHOSTRIDER	Figure
6/28/2020	South Santa Fe Ave.		A-8b
Drawn By:	San Marcos, CA 92069		
L.B.			



Notes:
1) Allowable pile capacities are calcualted using a Factor of Safety of 3
2) Capacities are based on the strength of the soils
3) Compressive and tensile strengths of the pile section should be checked to verify the structural capacities.

Date:	Allowable Upward Axial Pile Capacity	GHOSTRIDER	Figure
6/28/2020	South Santa Fe Ave.		A-8c
Drawn By:	San Marcos, CA 92069		
L.B.			

Reference: California Geotracker, Google Maps

Date:	Geotracer Borings and LUST site	GHOSTRIDER	Figure
6/13/2020	South Santa Fe Ave.		A-9
Drawn By:	San Marcos, CA 92069		
L.B.			

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	
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**	
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**	
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines	
			SP	Poorly Graded Sands and Gravely Sands, Little or no Fines	
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**	
			SC	Clayey Sands, Sand-Clay Mixtures**	
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	
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays	
			OL	Organic Silts and Organic silty Clays of Low Plasticity	
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts	
			CH	Inorganic Clays of High Plasticity, Fat Clays	
			OH	Organic Clays of Medium to High Plasticity	
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils	

Standard Penetration Test — Granular Soils

Penetration Resistance, N, (Blows / Foot)	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very Dense

Standard Penetration Test — Cohesive Soils

Penetration Resistance, N, (Blows / Foot)	Consistency	Unconfined Compressive Strength, (Tons / Sq. Ft.)
< 2	Very Soft	< 0.25
2 - 4	Soft	0.25 - 0.5
4 - 8	Medium	0.5 - 1.0
8 - 15	Stiff	1.0 - 2.0
15 - 30	Very Stiff	2.0 - 4.0
> 30	Hard	> 4.0

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

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
								Hole Refusal at 51', Backfilled with Slurry
52.5								

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

GHOSTRIDER

SUBSURFACE EXPLORATION LOG
BORING NO. 2

Project No.:

Project Name: San Marcos Devlop. Date: 5/6/2020 Logged By: D.J. / Ghostrider

Type of Rig: Drill Rig Drive Wt.: 140 lbs. Elevation: From Surface

Drill Hole Dia.: 6" Drop: 30" 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
21								Hole Abandoned at 20' - Backfilled with Cuttings
22								

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

SUBSURFACE EXPLORATION LOG
BORING NO. 3

Project No.:

Project Name: San Marcos Devlop. Date: 5/6/2020 Logged By: D.J. / Ghostrider

Type of Rig: Drill Rig Drive Wt.: Elevation: From Surface

Drill Hole Dia.: 6" Drop: 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 DATE: 6/11/2020	**Santa Fe Apartments**	**C-3**

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 DATE: 6/11/2020	**Santa Fe Apartments**	**C-4**

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			

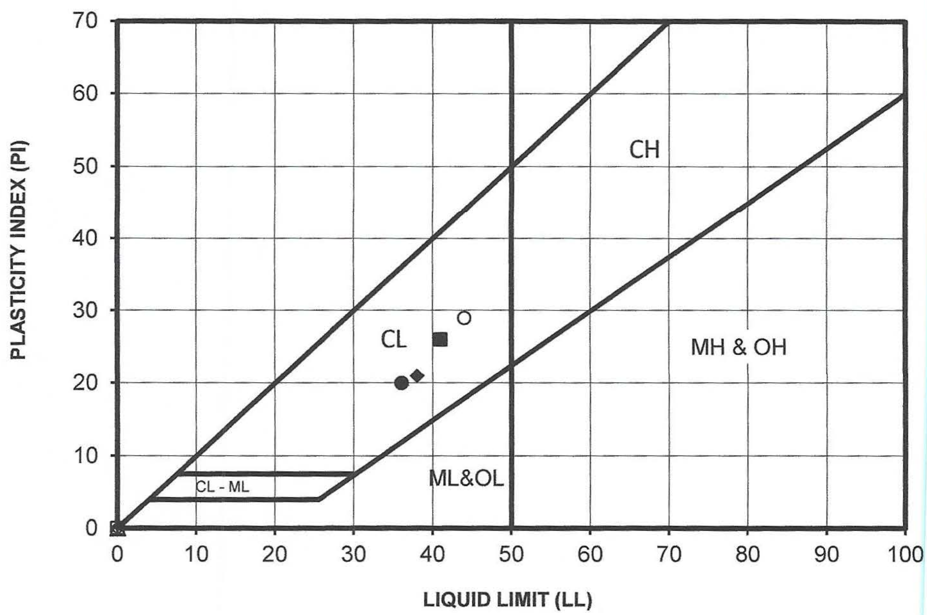
TEST PERFORMED IN ACCORDANCE WITH ASTM D 1140

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

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

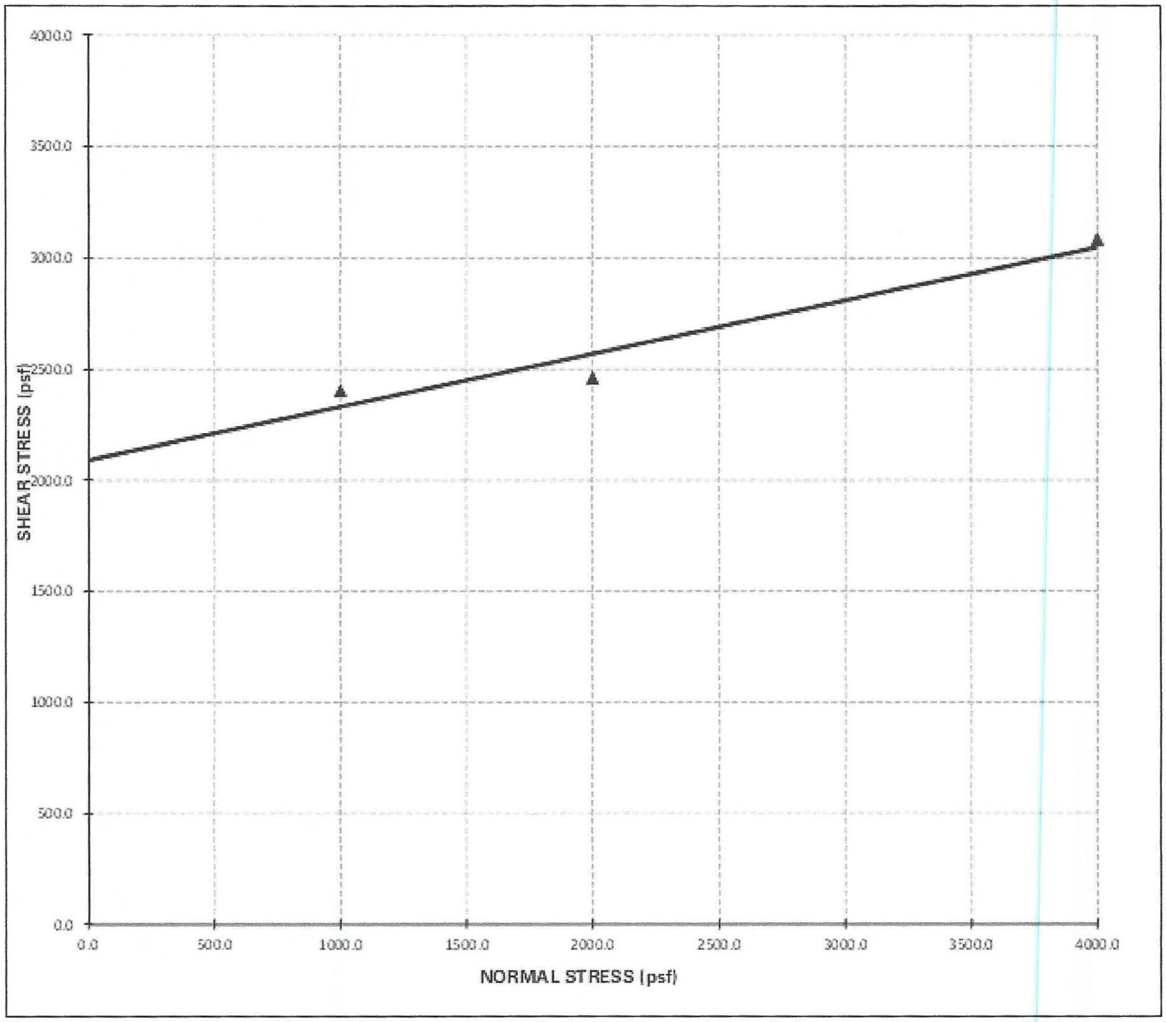
GHOSTRIDER		**Project Name:**	FIGURE
	TECH:L.B.	**Santa Fe Apartments**	**C-6**
	28-Jun-20		

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: $\Phi =$ 13.5 $^{\circ}$ 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

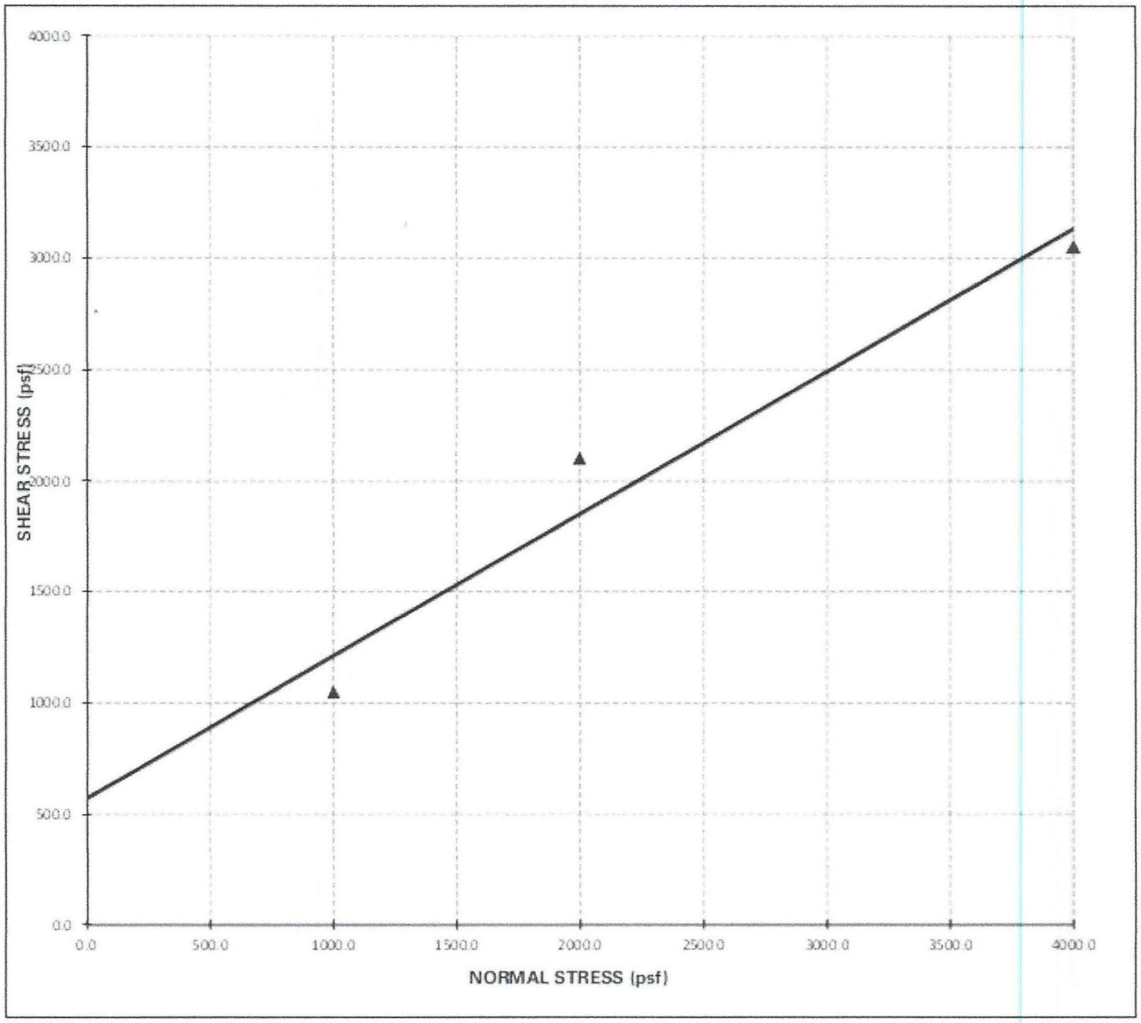
Ultimate Value

Project Name: 2972 Santa Fe, San Marcos

Project Number: 19-2118C

Sample Location: B-1 @ 6

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.

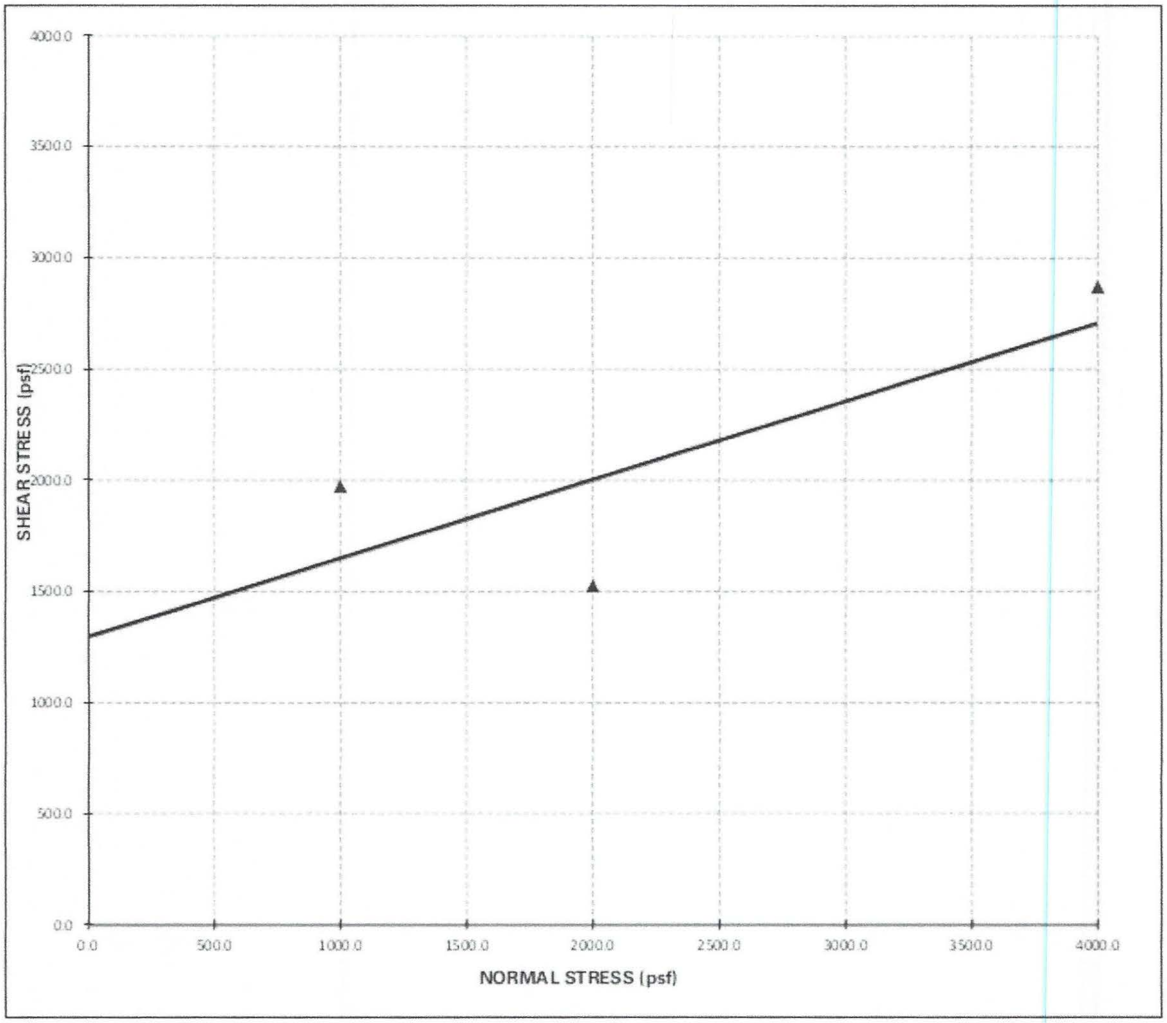
C-8

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: $\Phi =$ **19.4 °** **C = 1296.00 psf**

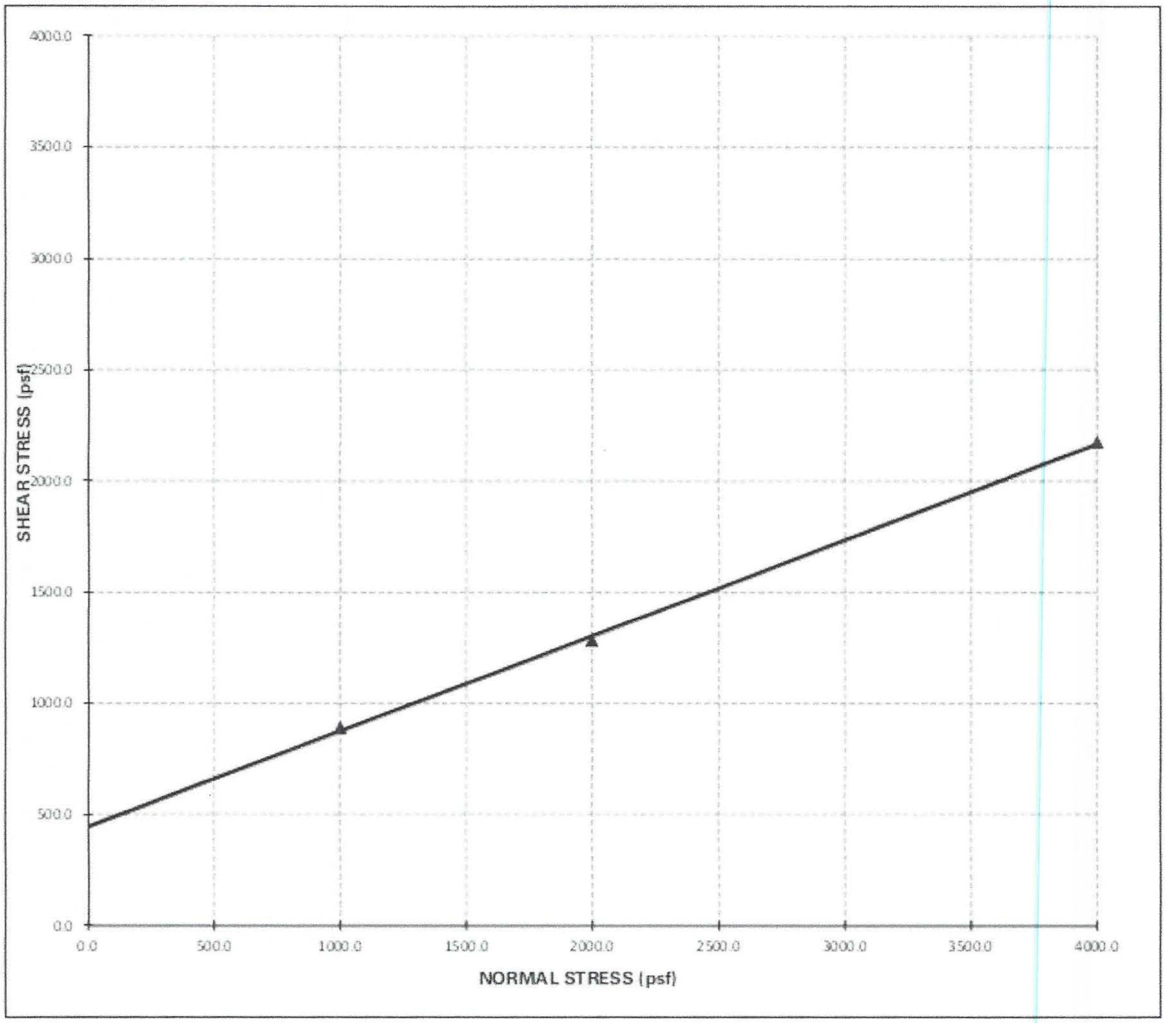
Notes:
1 - The soil specimens sheared were "undisturbed" ring samples.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

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	

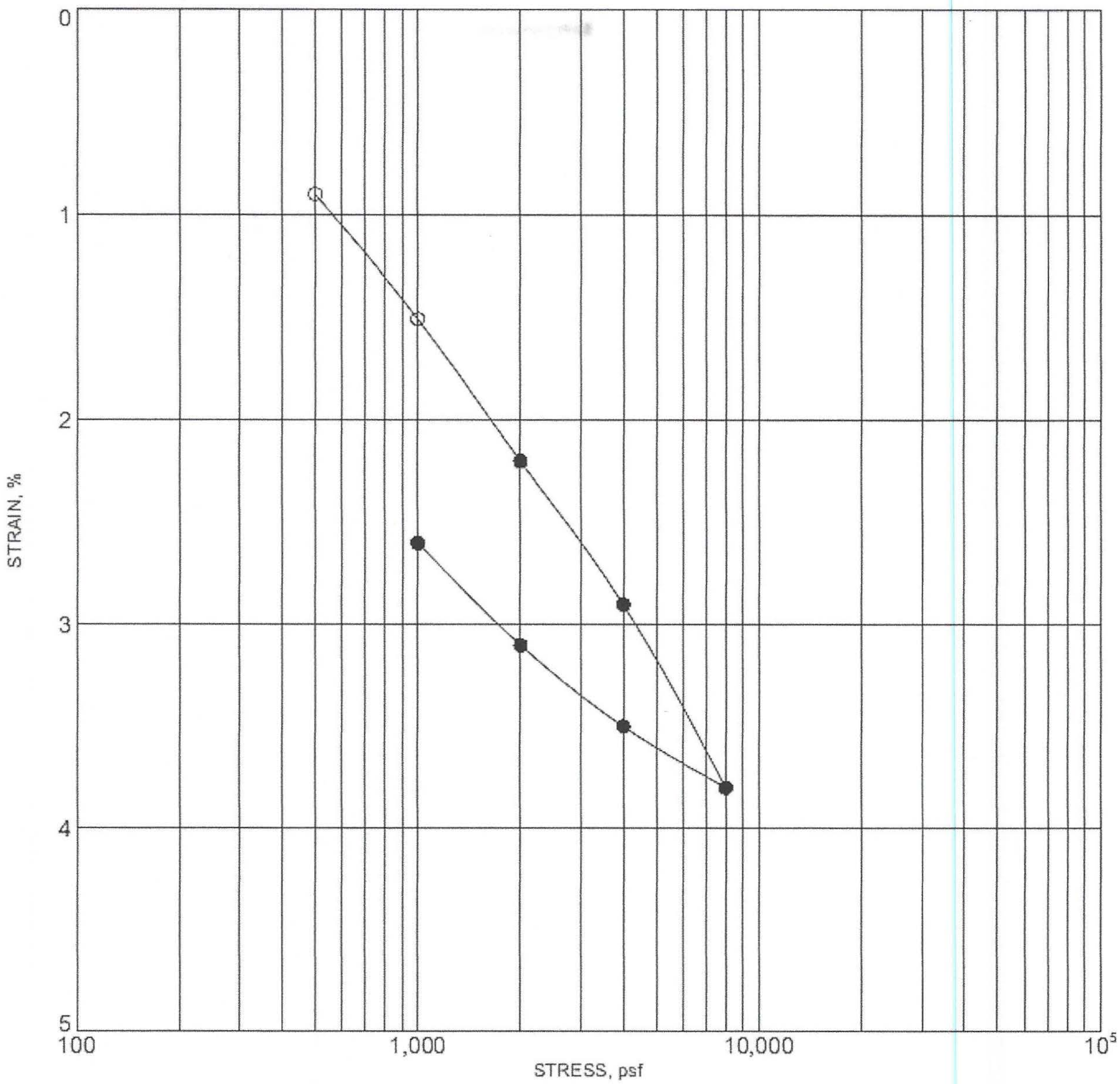
Expansion Readings

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	Project Name	FIGURE
TECH: L.B.	**Santa Fe Apartments**	**C-11**
DATE: 6/28/2020		



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

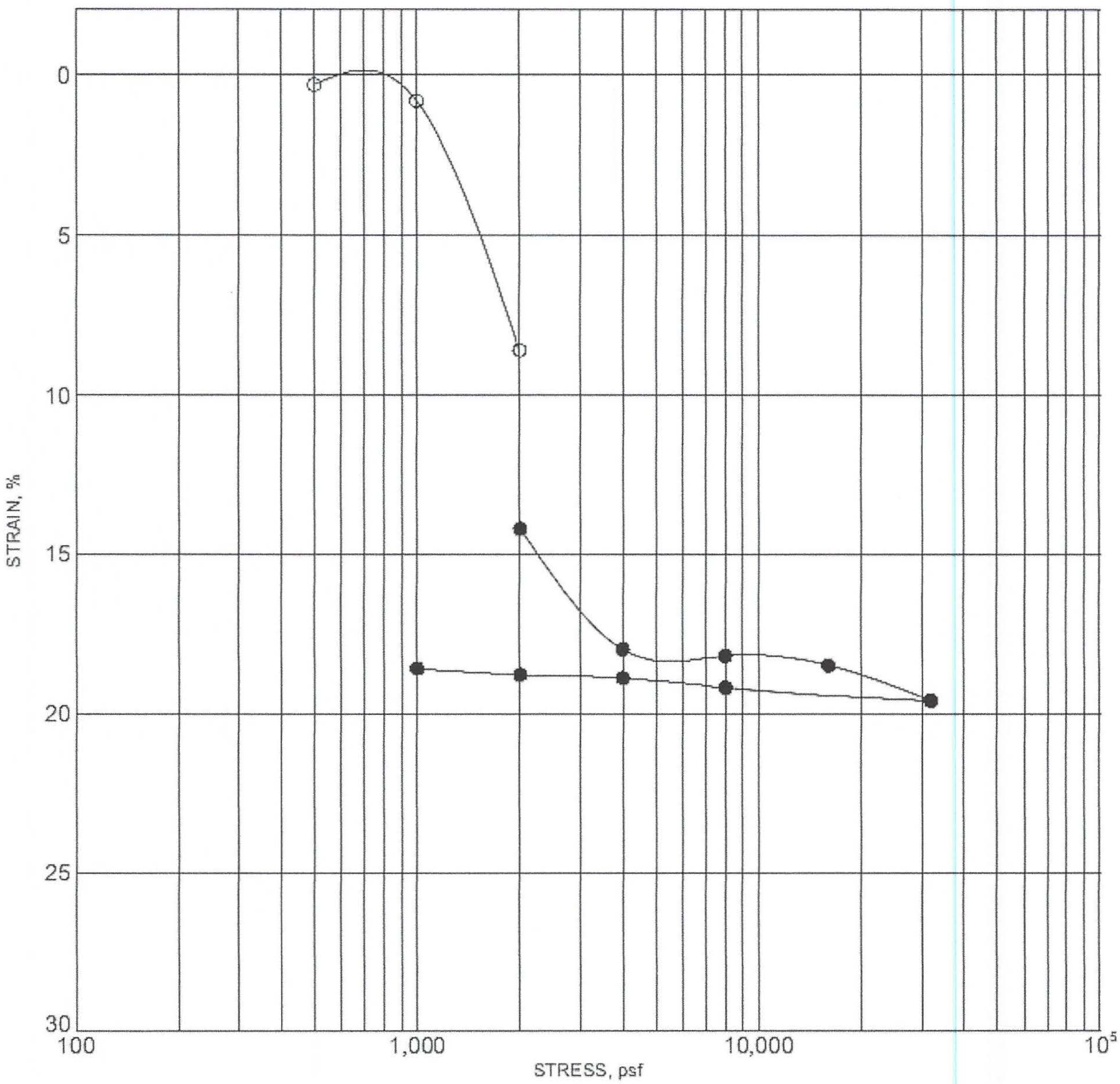
	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAl	21	106.43	97	0.569

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.	Drawing No.
20-81-188-01	

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**		**pH**
						As Rec'd	**Minimum**	
	(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 D

USDA – Natural Resources Conservation Service – Soil Resource Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
San Diego County Area, California

SANTA FE APARTMENTS

June 28, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Santa Fe Apartments)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 24, 2020—Feb 12, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Santa Fe Apartments)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AwC	Auld clay, 5 to 9 percent slopes	7.0	4.6%
AwD	Auld clay, 9 to 15 percent slopes	22.9	15.0%
AyE	Auld stony clay, 9 to 30 percent slopes	8.8	5.7%
DaC	Diablo clay, 2 to 9 percent slopes	16.1	10.5%
DaD	Diablo clay, 9 to 15 percent slopes, warm MAAT	35.4	23.2%
HrC	Huerhuero loam, 2 to 9 percent slopes	37.9	24.8%
LeD	Las Flores loamy fine sand, 9 to 15 percent slopes	24.8	16.2%
Totals for Area of Interest		**152.9**	**100.0%**

Map Unit Descriptions (Santa Fe Apartments)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Diego County Area, California

AwC—Auld clay, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: hb87
Elevation: 300 to 2,700 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 200 to 330 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Auld and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Auld

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from metavolcanics

Typical profile

H1 - 0 to 54 inches: clay
H2 - 54 to 59 inches: weathered bedrock

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 40 to 59 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Las posas

Percent of map unit: 5 percent
Hydric soil rating: No

Diablo

Percent of map unit: 5 percent
Hydric soil rating: No

Huerhuero

Percent of map unit: 3 percent
Hydric soil rating: No

San maguel

Percent of map unit: 2 percent
Hydric soil rating: No

AwD—Auld clay, 9 to 15 percent slopes

Map Unit Setting

National map unit symbol: hb88
Elevation: 300 to 2,700 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 200 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition

Auld and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Auld

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from metavolcanics

Typical profile

H1 - 0 to 54 inches: clay
H2 - 54 to 59 inches: weathered bedrock

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Well drained

Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Las posas

Percent of map unit: 5 percent
Hydric soil rating: No

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: No

AyE—Auld stony clay, 9 to 30 percent slopes

Map Unit Setting

National map unit symbol: hb89
Elevation: 300 to 2,700 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 200 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition

Auld and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Auld

Setting

Landform: Hillslopes

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from metavolcanics

Typical profile

H1 - 0 to 30 inches: stony clay
H2 - 30 to 59 inches: weathered bedrock

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 10 percent
Hydric soil rating: No

San maguel

Percent of map unit: 5 percent
Hydric soil rating: No

DaC—Diablo clay, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbb8
Elevation: 30 to 3,000 feet
Mean annual precipitation: 12 to 35 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 200 to 320 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous sandstone and shale

Typical profile

H1 - 0 to 15 inches: clay
H2 - 15 to 32 inches: clay, silty clay loam
H2 - 15 to 32 inches: weathered bedrock
H3 - 32 to 36 inches:

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: 24 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Altamont

Percent of map unit: 10 percent
Hydric soil rating: No

Linne

Percent of map unit: 3 percent
Hydric soil rating: No

Olivenhain

Percent of map unit: 2 percent
Hydric soil rating: No

DaD—Diablo clay, 9 to 15 percent slopes, warm MAAT

Map Unit Setting

National map unit symbol: 2w63f
Elevation: 110 to 910 feet
Mean annual precipitation: 11 to 21 inches
Mean annual air temperature: 58 to 64 degrees F
Frost-free period: 290 to 365 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Diablo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Diablo

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous shale

Typical profile

A - 0 to 15 inches: clay
Bkss1 - 15 to 28 inches: clay
Bkss2 - 28 to 40 inches: clay loam
Cr - 40 to 79 inches: bedrock

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: 39 to 79 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: CLAYEY (1975) (R019XD001CA)
Hydric soil rating: No

Minor Components

Altamont

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Linne

Percent of map unit: 3 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Olephant

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

HrC—Huerhuero loam, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hbcm
Elevation: 1,100 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 260 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Huerhuero and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Huerhuero

Setting

Landform: Marine terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 12 inches: loam
H2 - 12 to 55 inches: clay loam, clay
H2 - 12 to 55 inches: stratified sand to sandy loam
H3 - 55 to 72 inches:

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 25.0
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYPAN (1975) (R019XD061CA)
Hydric soil rating: No

Minor Components

Stockpen

Percent of map unit: 5 percent
Hydric soil rating: No

Las flores

Percent of map unit: 5 percent
Hydric soil rating: No

Olivenhain

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, ponded

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

LeD—Las Flores loamy fine sand, 9 to 15 percent slopes

Map Unit Setting

National map unit symbol: hbdb

Elevation: 700 feet
Mean annual precipitation: 12 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 300 to 340 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Las flores and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Las Flores

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from siliceous calcareous sandstone

Typical profile

H1 - 0 to 16 inches: loamy fine sand
H2 - 16 to 28 inches: sandy clay, clay
H2 - 16 to 28 inches: sandy clay, clay
H3 - 28 to 38 inches: loamy coarse sand
H3 - 28 to 38 inches: weathered bedrock
H4 - 38 to 48 inches:
H5 - 48 to 52 inches:

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: About 16 inches to abrupt textural change; About 16 inches to natric; 40 to 60 inches to paralithic bedrock
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum in profile: 30.0
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYPAN (1975) (R019XD061CA)
Hydric soil rating: No

Minor Components

Huerhuero

Percent of map unit: 5 percent
Hydric soil rating: No

Diablo

Percent of map unit: 5 percent
Hydric soil rating: No

Linne

Percent of map unit: 5 percent
Hydric soil rating: No

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