GEOTECHNICAL INVESTIGATION REPORT

for

Proposed Self-Storage Facility
20401 Ventura Boulevard
Woodland Hills, California

Prepared For:

Banner SoCal Developer, LLC
20929 Ventura Boulevard, Suite 47-521
Woodland Hills, CA 91364

Prepared By:

Langan Engineering and Environmental Services, Inc.
18575 Jamboree Road, Suite 150
Irvine, California 92612

June 7, 2022
Langan Project No.: 700107401

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Technical Excellence
Practical Experience
Client Responsiveness

June 7, 2022

Chris Tramonte, Samuel Sapp and Margo Conley
Banner Ventura Boulevard, LLC
20929 Ventura Boulevard, Suite 47-521
Woodland Hills, California 91364

Geotechnical Investigation Report
Proposed Self-Storage Facility
20401 Ventura Boulevard
Woodland Hills, California
Langan Project No. 700107401

Dear Chris, Sam and Margo:

Langan Engineering & Environmental Services, Inc. is pleased to submit this geotechnical engineering report for the proposed self-storage facility to be constructed at 20401 Ventura Boulevard in Woodland Hills, California.

This report was prepared in general accordance with our proposal dated October 28, 2021 that you authorized on January 4, 2022.

♦ ♦ ♦

We sincerely appreciate the opportunity to be of service to you on this project. Please contact us if you have questions regarding this report.

Sincerely,
Langan Engineering & Environmental Services, Inc.

Christopher J. Zadoorian, G.E.
Senior Associate

CR:SHW:AN:BW:CJZ

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1.0 INTRODUCTION

This report summarizes our geotechnical investigation and presents conclusions and recommendations for the proposed self-storage facility to be constructed at 20401 Ventura Boulevard in Woodland Hills, California as shown on Figure 1.

The site is located along the north side of Ventura Boulevard and is bound on the north by a descending cut slope and on the east and west by surface parking lots associated with commercial developments. The cut slope was reportedly constructed as part of the Ventura (101) Freeway development, circa 1959. The descending slope is up to approximately 45 feet in height and extends down at a gradient of approximately 2:1 (horizontal:vertical) to the Ventura (101) Freeway as shown on Figure 2.

The site was previously developed with a one-level restaurant building that was located within the northwest portion of the site. This building was partially demolished circa 2016 and 2017 with the foundations, floor slab and partial perimeter walls from the restaurant building remaining at the site as shown on Figure 2. The remainder of the site is a surface parking lot.

Kimberly Johnson of Blue Peak Engineering furnished us with preliminary grading plans dated May 6, 2022 for the proposed development. Based on our review of the preliminary grading plans, the ground surface level at the site slopes down to the east and ranges from approximately Elevation 955 at the west corner of the site to approximately Elevation 934 at the east corner of the site.

The preliminary grading plans indicate that the proposed development will include construction of a three-level, above-grade climate-controlled self-storage facility that will include two subterranean levels. The lowest finished floor level of the proposed self-storage facility will be established at approximately Elevation 915.5 and as a result, excavations on the order of approximately 24 feet along the easterly side of the site to approximately 37 feet along the westerly side of the site.

Access drive lanes and at-grade parking is also planned at the eastern end of the proposed development as shown on Figure 2.

Prior geotechnical investigations were performed at the site by Hood and Schmidt, Inc. (HSI), LeRoy Crandall and Associates (LCA), and Applied Earth Sciences (AES) and the prior investigations were summarized in reports dated September 20, 1965, September 24, 1965 and December 1, 2015, respectively.

The prior HSI and LCA reports were prepared for the prior restaurant building development. LCA also prepared reports of geotechnical construction observation, dated August 8, and August 9, 1966; and May 8, 1967, that were submitted to LADBS. LADBS issued conditional approval of these reports in letters dated August 22, 1966 and May 11, 1967.

The AES report was prepared for a previously proposed hotel development at the site and was submitted to the City of Los Angeles Department of Building and Safety (LADBS) Grading Division for their review and LADBS Grading Division issued review comments in letters dated January 9, and March 21, 2017. AES subsequently prepared a geotechnical report update dated May 21, 2019 addressing the review comments and LADBS Grading Division issued conditional approval of the geotechnical design report and update in a letter dated March 3, 2020. The previously proposed hotel development was not constructed.

We reviewed the data presented in the prior reports and concluded the information presented therein is generally suitable for use in developing geotechnical design recommendations for the currently-proposed self-storage facility and as such, we assume the professional responsibility for the use and interpretation of the data presented therein.

Our investigation is summarized below followed by our conclusions and recommendations for the proposed self-storage facility.

2.0 SURFACE AND SUBSURFACE EXPLORATIONS AND CONDITIONS

2.1 Current Geologic Mapping

We visited the site on January 26th 2022 and performed general site reconnaissance and geologic field mapping of the descending slope. The purpose of the geologic mapping was to characterize site conditions and to obtain representative strike and dip measurements on exposed bedrock surfaces present within the northerly descending slope.

Two well-bedded bedrock outcrop were identified on the slope surface. Geologic mapping indicated the on-site bedrock dips northerly between seven and ten degrees as shown on Figure 2.

2.2 Current Subsurface Explorations

We drilled six geotechnical exploration borings (borings B-1 through B-6) at the site to depths of approximately 10½ to 45½ feet below ground surface (bgs). The borings were drilled with truck-mounted hollow-stem auger drilling equipment at the approximate locations shown on Figure 2.

We maintained a log of the subsurface materials encountered in each boring and collected relatively undisturbed and bulk samples from the borings at regular intervals. Samples were collected from the borings using a modified California split-spoon samplers in general accordance with ASTM D3550. To estimate bedding strike and dip from the borings, we also collected two oriented ring samples from target depths by orienting the sampler to the north at depths of 25 and five feet bgs in borings B-1 and B-4, respectively.

The data collected from the oriented ring samples indicated the on-site bedrock dips northerly between seven and 13 degrees as shown on Figure 2 and on logs of borings B-1 and B-4 that are presented in Appendix A.

Upon completion of drilling, we backfilled the borings with soil cuttings and restored the ground surface to the pre-existing condition.

2.3 Prior Geologic Mapping

Geologic mapping was performed by HSI and summarized in their September 20, 1965 report. The data collected by HSI from their geologic mapping indicated the on-site bedrock dips northwesterly to northeasterly between eight and 18 degrees as shown on Figure 2.

HSI also mapped numerous joint and shear planes in the bedrock and performed a stereonet (polar diagram) analysis of these potential failure surfaces. HSI found that two pronounced fracture and joint systems were present on the subject property. HSI concluded that the joint and fracture orientation and spacing is such that blocks approximately five feet wide and three feet long make up the structural pattern in the sedimentary rocks underlying the site.

AES also performed limited surface mapping of the existing slope and summarized the results of their limited mapping in their December 1, 2015 report and indicated that the on-site bedrock dips to the northwest to the northeast at angles of four to 15 degrees.

2.4 Prior Subsurface Explorations

In 1965, LCA drilled four borings (Borings 1 through 3 and 6) to depths of approximately 12 to 46 feet bgs using an 18- and 24-inch diameter bucket auger drill rig and excavated two borings (Borings 4 and 5) to a depth of approximately one foot bgs using hand-tools.

HSI observed the LCA explorations and performed downhole logging in the 24-inch diameter boring (LCA Boring 6). HSI logged this boring as Boring 1 in their report and noted the bedrock to be thick to massively bedded and dipping northwesterly to northeasterly between nine and 15 degrees as shown on Figure 2 and on the log of Boring 1 from HSI in Appendix B.

It should be noted that the log of prior LCA boring B-6 indicates that a gad and chopping bucket was used to aid in advancement of the boring.

In 2015, AES drilled five exploration borings at the site as part of their investigation. The prior borings were drilled to depths ranging from approximately 16 to 66 feet bgs using hollow-stem auger drilling equipment.

The locations of the prior borings are shown on Figure 2 and logs of the prior borings are presented in Appendix B.

2.5 Subsurface Conditions

Asphalt concrete (AC) pavement was encountered in our current borings B-1, B-2, and B-4 through B-6. The AC pavement ranged from three to six inches in thickness. Portland Cement Concrete (PCC), four inches thick, was encountered in our current boring B-3.

Fill soils were encountered in the borings to depths of approximately three to seven feet bgs. The fill consisted of slightly moist to very moist silty and clayey sands and sandy clays with varying amounts of gravel, sand, and asphalt fragments. As noted previously, based on the information presented in the prior LCA construction observation reports, the existing fill was properly placed and compacted and was certified as structural fill.

Residual soils, formed by the in-place weathering of bedrock, were encountered in borings B-2, B-5, and B-6 to depths of approximately six to 18 feet bgs. These soils consisted of stiff to very stiff sandy clay and clay. This residual soil is interpreted to be generally equivalent to the overburden soil identified by LCA (1965), the native silty clay identified by HSI (1965), and the colluvial soil identified by AEG (2015). These soils represent bedrock that has been exposed to significant weathering over a long time period and has likely been subjected to minimal transport.

Siltstone, sandstone, and mudstone bedrock of the Modelo Formation, was encountered beneath the fill and/or residual soils in each boring. The bedrock was observed to be diatomaceous in nature, and dips gently to the north.

Generalized depictions of the subsurface conditions at the site are presented on Figures 3 and 4.

2.6 Groundwater

Perched groundwater was encountered in boring B-1 at a depth of 45 feet bgs within the Modelo formation bedrock; groundwater was not encountered in any of the other explorations.

Based on our review of the Seismic Hazard Zone Report of the Canoga Park 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 07 (California Division of Mines and Geology, 1998 now known as the California Geological Survey, CGS), the historical high groundwater level (HHGWL) is poorly constrained in the site vicinity as shown on Figure 5.

3.0 GEOTECHNICAL LABORATORY TESTING

3.1 Current Investigation

We performed the following geotechnical laboratory tests on samples collected during our investigation:

- In-situ Moisture Content and Dry Density
- Maximum Dry Density and Optimum Moisture Content
- Direct Shear and Remolded Direct Shear
- Consolidation and Remolded Consolidation
- Expansion Index
- Corrosivity (pH, Resistivity, Sulfate and Chloride Content)
- R Value

The results of the geotechnical laboratory testing from our investigation are presented in Appendix A.

3.2 Prior Investigations

The following geotechnical laboratory tests were performed as part of the prior investigations:

- In-situ Moisture Content and Dry Density
- Direct Shear
- Triaxial Shear
- Consolidation

The results of the geotechnical laboratory testing from our investigation are presented in Appendix B.

4.0 GEOLOGIC AND SEISMIC HAZARDS EVALUATION

4.1 General

We evaluated the geologic and seismic hazards at the site in general accordance with California Geological Survey (CGS) Special Publication 117A, "*Guidelines for Evaluating and Mitigating Seismic Hazards in California.*" The results of our evaluation as summarized below.

4.2 Regional and Local Geologic Setting

The site is located in the southwestern portion of the San Fernando Valley near the foothills of the northern flank of the Santa Monica Mountains. This valley is located within the western Transverse Ranges geomorphic province. The Los Angeles basin, which forms the northern end of the adjacent Peninsular Ranges geomorphic province, borders the Transverse Ranges to the south.

The Transverse Ranges are an east-west trending series of steep mountain ranges and valleys. The east-west structure of the Transverse Ranges is oblique to the normal northwest trend of coastal California.

The San Fernando Valley is a roughly triangular-shaped valley encompassing an area of approximately 175 square miles. The valley is bordered on the northeast by the western San Gabriel and Verdugo Mountains, on the south by the Santa Monica Mountains, and on the northwest by the Santa Susana Mountains and the Simi Hills. The valley represents a structural trough, which has been filling with sediment from all sides since at least the late Tertiary (Yerkes, 1996). Recent work by the Southern California Earthquake Center (SCEC) indicates that basement rocks in the San Fernando Valley basin are as deep as approximately 6.5 kilometers, about 4 miles (Boyd, et al, 2017).

The site geology is mapped as Miocene-aged bedrock associated with the Modelo formation, which consists primarily of diatomaceous shale, claystone, and siltstone (Figure 5; Campbell et. al, 2014).

Onsite soils generally consist of artificial fill placed under the observation and testing of LCA overlying native residual soils in places, which in-turn overly Modelo Formation bedrock. The data

from our exploratory borings are generally consistent with the geologic conditions summarized by Campbell et. al.

A brief description of these geologic units is presented in the following sections (from youngest to oldest) and their approximate estimated lateral extents are depicted on cross sections A-A' and B-B' (Figure 3 & 4).

4.3 Artificial Fill (af)

Fill soils were encountered in the borings to depths of approximately three and one-half to seven feet bgs. The fill consisted of yellowish brown to grayish brown clayey sand and sandy clay that were medium dense to stiff and slightly moist to very moist. Fill soils contained varying amounts of gravel, sand, asphalt fragments, and bedrock clasts.

4.4 Residual Soil

Residual soils are created by the in-place weathering of bedrock. These soils often share similar compositional and textural characteristics with the underlying bedrock from which they are derived. Residual soils of Modelo formation bedrock were encountered beneath fill soils in borings B-2, B-5, and B-6 to depths of approximately six to 18 feet bgs. Residual soils consisted of olive gray to yellowish brown sandy clay and clay that were stiff to very stiff and moist to very moist. Residual soils are discontinuous across the site.

4.5 Tertiary-age Modelo Formation (Tmd)

Modelo Formation bedrock was observed outcropping at the surface of the northern descending slope, and was observed beneath the fill and/or residual soil in each boring. The bedrock consisted of diatomaceous siltstone, sandstone, and mudstone (shale). Siltstone was generally off-white and thinly bedded to laminated with some concretions. Sandstone was generally yellowish brown, and thickly bedded to massive and moderately weathered. Mudstone was generally olive gray to olive brown, laminated to thickly-bedded to massive, and moderately to heavily weathered, with carbonate veins and limonite staining in areas.

Surface mapping performed as part of our current and each prior investigation at the site indicate bedding dips four to 18 degrees to the northwest and northeast. Similarly, subsurface bedding measured through downhole logging and oriented samples indicated bedding dips seven to 15 degrees to the northeast and northwest.

The data collected from our current investigation and the presented in the prior reports of investigation is consistent with data presented on available geologic mapping prepared by Campbell (2014) that indicates a northwesterly to northeasterly dip ranging from five to 15 degrees in the general site vicinity.

4.6 Regional Faulting

The site is located within a seismically active region north of Los Angeles, surrounded by several active faults. According to the 2010 California Geological Survey Fault Activity Map (FAM) of California, the nearest active fault of required investigation is a segment of the Hollywood fault zone, located approximately 11.5 miles southeast of the site. Additional late Quaternary faults, termed the Chatsworth fault and Northridge Hills fault are located approximately 4.8 and 6.5 miles to the northwest and northeast, respectively.

The location of the site with respect to nearby mapped faults is presented in Figures 6A and 6B.

4.7 Regional Seismicity

The site is located in an active seismic area that has historically been affected by generally moderate to occasionally high levels of ground motion. Therefore, the proposed development will probably experience moderate to occasionally high levels of ground motion from nearby faults as well as ground motions from other active seismic areas of the southern California region.

A search of the USGS ANSS Comprehensive Earthquake Catalog (ComCat) using a web-based Earthquake Archive Search and URL builder tool, found that as of February 21, 2022, 59 earthquakes with magnitudes of 5.0 or greater have occurred within a 100-km radius of the site since 1800 as shown on Figure 6A.

4.8 Ground Surface Rupture Potential

The site is not located within an Alquist-Priolo Earthquake Fault Zone (APEFZ) based on a review of the CGS Earthquake Zones of Required Investigation map as shown on Figure 8.

Thus, the potential for ground surface rupture is considered very low.

4.9 Liquefaction Potential

Liquefaction generally occurs in saturated, loose to medium dense, granular soil and in saturated, soft to moderately firm silt as a result of strong ground shaking. As the density and/or particle size of the soil increases and as the confinement (overburden pressure) increases, the potential for liquefaction decreases. Typically, saturated soil within the upper 50 feet of the ground surface or lowest adjacent grade is considered subject to liquefaction.

Based on the CGS (previously known as the California Division of Mines and Geology, CDMG) Seismic Hazard Evaluation of the Canoga Park 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Report 07, the site is not located within a liquefaction hazard zone as shown on Figure 8.

Other than a minor zone of perched water observed in our Boring B-1, groundwater was not observed to the maximum depth explored of approximately 66 feet. Bedrock was observed near the ground surface. Therefore the potential for liquefaction at the site is considered to be negligible.

4.10 Lateral Spreading Potential

Lateral spreading is seismically-induced slope instability phenomenon wherein slope failure can occur as a result of liquefaction.

The site is not located within a liquefaction hazard zone and the existing slope is underlain by relatively shallow bedrock.

Thus, the potentially for lateral spreading is negligible.

4.11 Seismic (aka 'Dry') Settlement

Seismic (dry) settlement can occur in loose granular soil as a result of strong ground shaking.

The soils present at the site generally consist of stiff to very stiff sandy clay and clay, which is underlain at a relatively shallow depth by bedrock.

The soils encountered are not considered to be subject to seismically induced settlement.

4.12 Static Slope Stability

The adjacent descending slope was reportedly constructed circa 1959 as part of the Ventura (101) Freeway construction and the materials exposed in the slope face consist of Modelo formation bedrock with a thin veneer of properly compacted fill.

As discussed herein, bedding planes generally dip in a northerly direction at angles ranging from seven to 18 degrees, so that an unsupported bedding condition or out-of-slope bedding is present at the site.

Slope stability analysis was performed as part of the LCA's analysis using limit-equilibrium methods and hand calculations. LCA concluded the existing cut slope was grossly stable with a static factor of safety equal to 4.2 and a pseudo-static factor of safety of 2.6 using a horizontal seismic coefficient equal to 0.10g.

AES did not perform slope stability analysis as part of their investigation and report, however, they concluded that the site is free from gross slope stability issues.

We evaluated the static and pseudo-static stability by performing limit equilibrium hand calculations. The results of our analysis indicate the slope is stable with a factor of safety of in excess of 1.5 for static conditions and 1.0 for dynamic conditions. The results of our analysis are generally consistent with the results of the prior analyses performed by LCA and AES. The results of our analysis are presented in Appendix C.

4.13 Earthquake-Induced Landslides

Portions of the site are located in a potential earthquake induced landslide zone per the CGS Seismic Hazard Zones map for the Canoga Park Quadrangle as shown on Figure 8.

Landslides are not mapped near the site on regional geologic maps of the area and evidence of deep-seated landsliding was not observed during our current and/or the prior site reconnaissance and/or exploration borings.

Prior slope stability analysis performed by LCA as well as our current slope stability analysis each indicate that the potential for seismically-induced landsliding is very low.

4.14 Flood Mapping

FEMA's flood maps, known as Flood Insurance Rate Maps (FIRMS), identify areas of flood hazard, which are labeled on the flood maps starting with the letters A and V for high-hazard areas and Zone X for moderate- or low-hazard flood-risk areas. In some cases, where there is a potential for moderate to high risk of flooding, but the probability has not been determined, these areas are labeled as Zone D on the flood maps.

Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Number 06037C1290F, the site is located within an area determined to be outside the 0.2 percent annual chance floodplain.

4.15 Tsunamis, Seiche, and Dam Inundation

Based on information and maps available from the CGS, the site is not located within a Tsunami inundation hazard zone. Based on review of adjacent water bodies, the site is not subject to inundation from seiche. A review of the California Dam Breach Inundation Maps hosted by the California Division of Safety of Dams shows that the site is not located within an inundation boundary in the case of dam breach.

4.16 Subsidence

Land subsidence may be induced from withdrawal of oil, gas, or water from wells. Based on a search of the CalGEM (formerly known as Division of Oil, Gas, and Geothermal Resources [DOGGR]) GIS Well Finder online tool, the site is not located in an oil field. According to our review of the available information from CALGEM, there are three idle wells almost 2 miles south of the site. Thus, the likelihood of land subsidence caused by oil or gas withdrawal from oil wells is very low.

4.17 Expansive Soil and Bedrock

Expansive soils and/or bedrock swell and shrink when the moisture content in the soil changes as a result of cyclic wet/dry weather cycles, installation of irrigation systems, change in landscape plantings, or changes in grading. Swelling and shrinking soils can result in differential movement of structures including floor slabs and foundations, and site work including hardscape, utilities, and sidewalks.

Expansion index testing performed as part of this investigation indicates that near-surface engineered fill soils has a low expansion potential (Expansion Index = 46).

Data available from consolidation testing performed on the on-site bedrock materials, however, indicates the on-site bedrock may expand with increased moisture content.

5.0 CONCLUSIONS

5.1 General

The site is generally free from geologic or seismic hazards that would preclude the proposed development and the proposed development is considered feasible from a geotechnical perspective provided the recommendations presented herein are followed.

The site is subject to strong ground shaking that would result from an earthquake occurring on a nearby or distant fault source; however, this hazard is common in Southern California and can be mitigated by following the seismic design requirements of the 2020 Los Angeles Building Code (LABC).

5.2 Foundations

Modelo formation bedrock is present at the planned foundation level. The proposed self-storage facility may be supported on spread and continuous footings established in the Modelo formation bedrock provided the recommendations presented in Section 6.1 are followed.

5.3 Seismic Site Classification

Due to the shallow presence of bedrock and the higher blow counts observed during our subsurface investigation, the Site Classification is Site Class C.

Seismic design parameters are presented in Section 6.2.

5.4 Slope Stability

The results of our current slope stability analysis as well as the prior slope stability analysis and general evaluations indicate the existing descending cut slope is grossly stable.

Noting that the current planned development will establish building foundations below the toe of the existing descending cut slope and therefore the proposed development will not adversely impact the stability of the existing slope.

5.5 Earthquake Induced Landslides

Portions of the site are located within a State of California Seismic Hazard Zone (CDMG, 1998) for earthquake-induced landsliding, as depicted on Figure 8. Proposed grading operations will consist of engineered cut as deep as 40 feet within competent Modelo Formation bedrock. Adverse bedding conditions anticipated within designed cuts have been modeled in the below section and can be mitigated with temporary shoring and grading solutions. The potential for earthquake-induced landslide at the site is considered very low.

5.6 Temporary Excavations and Vertical Cuts

Temporary excavations and temporary vertical cuts are feasible at the site and recommendations for temporary excavations are presented in Sections 6.6.

5.7 Temporary Shoring and Permanent Walls Below-Grade Walls

Mass excavation on the order of 25 to 40 feet bgs will be required to achieve the anticipated bottom of foundation levels for the proposed self-storage facility and the majority of the planned excavation will be within the on-site bedrock.

Noting that the bedrock dips from approximately four to 18 degrees northwesterly to northeasterly, bedding is considered to be adverse for the south building wall below grade and south shoring wall.

Recommendations for temporary shoring and below-grade walls are presented in Sections 6.5 and 6.4 respectively.

5.8 Rippability of On-site Bedrock

As noted above, the on-site bedrock materials will be encountered during the planned mass excavation. The current and prior exploration borings were advanced using conventional drilling equipment, noting that a chopping bucket and a gad were required to advance prior LCA Boring 6. Prior LCA Boring 6 is also the only current or prior boring that noted cemented bedrock layers.

Estimating the rippability of the on-site bedrock was beyond the scope of our current investigation, however, it would be prudent to collect supplemental geotechnical data at the site given the noting planned development includes mass excavations that will advance 35 to 40 feet into the on-site bedrock.

5.9 Floor Slab Support

Noting that the on-site bedrock materials exhibit a potential for expansion with increased moisture contents, the building floor slabs should be supported on properly compacted non-expansive (EI less than 50) fill soils.

Recommendations for floor slab support are presented in Section 6.3.

5.10 Corrosion Potential

The results of corrosion testing are summarized in Table 1.

Table 1 – Corrosion Test Results

Boring (Depth)	Soil Type	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
Boring B-2 (0 - 5 feet)	Sandy Clay	950	7.7	3,625	58

The results of sulfate testing indicate that the on-site soils are classified as exposure category S2 in accordance with American Concrete Institute (ACI) 318-19 Table 19.3.1.1.

It would be prudent to engage a corrosion consultant to evaluate the need for mitigation measures for buried metallic piping.

5.11 Shrinkage and Subsidence

Removal and recompaction of existing native soils will result in a loss of volume (shrinkage) because the materials are typically placed at a higher density than in their naturally-deposited state.

Additionally, subsidence of the underling native materials may also occur due to the increased weight of the compacted fill when compared to the pre-existing native soils.

The planned development will generally consist of excavation and off-site export of the upper fill materials and Modelo formation bedrock materials and as a result, fill placement and compaction at the site will generally be limited.

Noting that mass fill is not planned and as a result, shrinkage of new fill soils and/or subsidence due to replacement of existing soils as properly compacted fill will not expected to impact the planned development.

5.12 Earthwork and Grading

The proposed development will include mass excavation and export of primarily the on-site bedrock materials.

It should be noted, however, that if on-site bedrock materials are used in required fills, that these materials are diatomaceous so that properly compacted fill soils derived from the on-site diatomaceous bedrock materials will have relatively low in-place dry densities. Diatomaceous materials used as fill will also be appreciably more sensitive to moisture content than typical soil and bedrock materials and will have relatively low in-place dry densities.

6.0 RECOMMENDATIONS

6.1 Foundations

The proposed development may be supported on spread and continuous footings established in the on-site bedrock materials present at the planned foundation levels.

Spread and continuous footings a minimum of two feet wide and established at least two feet below the lowest finish floor level may be designed using an allowable bearing pressure of 12,000 pounds per square foot (psf). The recommended bearing pressure may be increased by 500 psf per additional foot of width and/or depth up to a maximum value of 15,000 psf.

The recommended bearing pressure is a net pressure and the weight of the foundation can be neglected for structural design purposes. The allowable bearing pressure may be increased by one-third when considering short-term wind and seismic loading conditions.

We estimate the settlement for spread and continuous footings established in bedrock as recommended herein will be on the order of 1 inch or less and that differential settlement between adjacent columns will be on the order of ¼ inch or less.

When considering ultimate stress design, to resist lateral loading, an ultimate passive resistance equal to 1,200 psf per foot of embedment up to a maximum value of 12,000 psf and an ultimate coefficient of friction equal to 0.6 may be used.

The ultimate passive pressure and the ultimate coefficient of friction may be combined noting that the ultimate passive resistance should be reduced in this case by 50 percent in consideration of the deformation required to mobilize the full passive resistance.

For allowable stress design, to resist lateral loading, an allowable passive resistance equal to 600 psf per foot of embedment up to a maximum value of 6,000 psf and an allowable coefficient of friction equal to 0.4 may be used. The allowable passive pressure and the allowable coefficient of friction may be combined without reduction.

6.2 Seismic Design

Based on the shallow presence of bedrock and observed higher blow counts encountered in the exploratory borings, the seismic site class in accordance with Chapter 20 of ASCE 7-16 is Site Class C.

Table 2 presents the seismic design parameters for the site in accordance with Chapter 11 of ASCE 7-16.

Table 2 – Seismic Design Parameters

Criteria	Value
MCE_R Ground Motion at Short Periods, S_s	1.741
MCE_R Ground Motion at 1Second Period, S_1	0.6
Site Class	C
Site-Modified Spectral Acceleration Value at Short Periods, S_{MS}	2.089
Site-Modified Spectral Acceleration Value at 1 Second Period, S_{M1}	0.84
Design Spectral Response Acceleration at short periods, S_{DS}	1.393
Design Spectral Response Acceleration at 1 second period, S_{D1}	0.56
MCE_G Peak Ground Acceleration, PGA_M	0.859

6.3 Floor Slab Support

The proposed building floor slabs may be supported on non-expansive, EI < 50, properly compacted fill soils.

To minimize the potential of moisture transfer from the soil through the building floor slab where finish flooring is planned, we recommend the installation of a capillary break section. The capillary break section should consist of six inches of gravel underlying a 15-mil HDPE membrane. The building floor slab may be placed directly on the HDPE membrane.

If finish flooring is not planned, the capillary break section may be omitted.

6.4 Permanent Below-Grade Walls

6.4.1 Design Lateral Earth Pressures

AES performed vector calculations to aid in the computation of static lateral earth pressures and concluded that an equivalent fluid pressure equal to 30H psf was suitable for static design of the building walls below grade and that an additional seismic loading equal to half of static loading was also required.

In general, we concur with the prior recommendations for design of building walls below grade as summarized herein. The prior AES recommendations were approved by LADBS Grading Division in their letter dated March 3, 2020.

For static conditions, drained below-grade building internally braced walls should be designed to resist a trapezoidal-shaped at-rest lateral earth pressure distribution equal to 26H psf as shown on Figure 9.

For seismic loading conditions, drained below-grade internally-braced building walls should be designed to resist a triangular-shaped active lateral earth pressure distribution equal to 30H psf and in conjunction and a triangular-shaped seismic lateral earth pressure distribution equal to 15H psf as shown on Figure 10.

The load combination (active and seismic earth pressure) and the shape of the seismic pressure distribution are each based on *Seismic Earth Pressures on Cantilevered Retaining Structures* (Atik and Sitar, 2010) and *Seismic Earth Pressures: Fact or Fiction* (Lew, Sitar, and Atik, 2010).

The upper 10 feet of the below-grade building walls should also be designed to resist a uniform lateral pressure of 100 psf to account for normal traffic loading as shown on Figures 9 and 10. The recommended traffic surcharge is applicable where traffic loading is anticipated adjacent to walls below grade.

Please note that the recommended surcharge should be increased by 50 percent when considering fire truck loading.

For other areas subject to live loading conditions (non-traffic), we recommend applying one-third of the live load to the wall-below grade within the upper 10 feet. We can review any such cases and provide specific recommendations if needed.

If the surface at the top of the wall is sloped, the recommended lateral earth pressures should be increased as indicated in Table 3.

Table 3 - Permanent Below-Grade Walls – Lateral Earth Pressures

Slope Inclination at Top of Wall (H:V)	Increase in Lateral Earth Pressure (percent)
1:1	200
1.5:1	165
2:1	150

6.4.2 Wall Backdrainage

For static conditions, drained below-grade permanent below-grade walls should be constructed with adequate back-drainage to prevent the buildup of hydrostatic pressure behind the walls.

For shored walls, we recommend the use of a pre-fabricated geo-composite drainage board that is fixed to the shoring wall, and the below-grade building wall is constructed by the placement of shotcrete directly against the drainage board.

The vertical drainage elements should be connected to a suitable outlet and typically this is accomplished by means of connection to the internal building sump system.

6.5 Temporary Shoring

6.5.1 Design Lateral Earth Pressures

Typically, cantilevered shoring is feasible for temporary shoring when the retained height is less than approximately 15 feet. Braced shoring typically becomes economical for retained heights in excess of 15 feet.

Cantilever shoring may be designed to resist a triangular lateral earth pressure distribution where the maximum value is 30H psf.

Internally brace shoring may be designed to resist a trapezoidal lateral earth pressure distribution where the maximum value is 24H psf.

Temporary shoring, should also be designed to resist a nominal surcharge load of 100 psf distributed uniformly within the upper 10 feet to account for vehicular traffic where adjacent to temporary roadways and parking areas.

For cantilevered shoring design, where the surface at the top of the shoring is sloped, the recommended lateral earth pressures should be increased as indicated in Table 3.

The design of temporary shoring walls should consider the location of construction cranes and other potentially heavy equipment or loads that may act against the shoring system. Surcharge loading for these features may be determined by using NAVFAC DM 7.2 Chapter 3, Section 4. If needed, we can provide additional surcharge loading on a case-by-case basis.

6.5.2 Soldier Pile Design and Installation

For the design of soldier piles spaced at least two diameters on-center, the allowable lateral bearing value (passive pressure) of the native soils below the planned bottom of the excavation may be assumed to be 600 psf per foot of depth, up to a maximum value of 12,000 psf. To develop the full lateral bearing value, provides should be taken to assure firm contact between the soldier piles and the undisturbed native soils.

If the embedded portion of the soldier pile shafts are filled with lean-mix concrete, the effective width of the soldier pile shaft for use in developing passive resistance may be assumed to be twice the diameter of the soldier pile shaft. If the embedded portion of the soldier pile shaft is filled with other material (such as low-strength sand-cement slurry, for instance), the effective width of the soldier pile should be limited to be the diagonal dimension of the soldier beam.

The portion of the soldier piles below the bottom of the excavation may also be relied on to support downward loading. For soldier piles that are drilled and filled with structural concrete below the bottom of the excavation, the frictional resistance between the concrete and surrounding soil may be taken as 800 psf. For soldier piles that are vibrated into place, the frictional resistance may be taken as 1,000 psf.

Drilling for soldier piles is anticipated to be feasible using conventional drilling equipment in good working condition, noting that the exploration drill rig types used in our investigation, as well as the prior investigations, was generally accomplished to the anticipated depths of solider pile installation.

We do anticipate, however, that advancement of drilling into the on-site bedrock will increase in difficulty with depth into bedrock.

It'd be prudent to perform supplemental explorations to estimate the rippability of the on-site bedrock to provide shoring contractors additional information to develop cost and schedule estimates.

6.5.3 Timber Lagging Design

Continuous lagging will be required between the soldier piles. The soldier piles should be designed for the full anticipated lateral earth pressure; however, the pressure on the lagging will be less due to arching in the soil. For clear spans of up to six feet, we recommend the lagging be designed for a triangular where the maximum pressure is 400 psf at the mid-point between the soldier piles and zero at the soldier piles.

6.5.4 Tiebacks

Tieback anchors should be design so that the tieback anchors do not adversely impact the stability of the existing descending slope. To accomplish this, we recommend terminating all tie-backs at least five feet from the face of the descending slope.

The capacities of anchors should be determined by testing the initial anchors as outlined below. We anticipate that gravity-filled anchors will achieve an allowable bond strength of 1.5 kips to 3 kips per lineal foot of anchor in the on-site bedrock materials, depending on the method of construction. A variety of methods are available for construction of anchors. If post-grouted anchors are used, we estimate the anchors will develop resistance on the order of three times the estimated value. We recommend that the shoring designer and contractor be responsible for selecting the appropriate bond length and installation methods to achieve the required capacity. Only the frictional resistance developed beyond the active wedge would be effective in resisting lateral loads. If the anchors are spaced at least 6 feet on-center, reduction in the capacity of the anchors do not need to be considered due to group action.

The anchors are commonly installed at angles of 15 to 40 degrees below the horizontal: however, in many cases it is necessary to use steeper inclinations where adjacent private property is present. Relatively difficult drilling is anticipated in the on-site bedrock.

The anchors should be filled with concrete placed by pumping from the tip out, and the concrete should extend from the tip of the anchor to the active wedge. To minimize chances of caving, we suggest that the portion of the anchor shaft within the active wedge be backfilled with sand before testing the anchor. The portion of the shaft should be filled tightly and flush with the face of the excavation. The sand backfill may contain a small amount of cement to allow the sand to be placed by pumping. For 8-inch-diameter or less post-grouted anchors, the anchor may be filled with concrete to the surface of the shoring.

Our representative should select a representative number of the initial anchors for 24-hour, 200 percent tests and 200 percent quick tests. The purpose of the 200 percent test is to verify the friction value assumed in design. The anchors should be tested to develop twice the assumed friction value. Where satisfactory tests are not achieved on the initial anchors, the anchor diameter and/or length should be increased until satisfactory test results are obtained.

For post-grouted anchors where concrete is used to backfill the anchor along its entire length, the test load should be computed as required to develop the appropriate friction along the entire bonded length of the anchor. We estimate that the influence of the post-grouting and the adjacent soil within the bonded length of the anchors will be less than 5 feet from the anchor.

Total deflection during the 24-hour, 200 percent test should not exceed 12 inches during loading. Anchor deflection should not exceed 0.75 inch during the 24-hour period. Measured after the 200 percent test load is applied. If the anchor movement after the 200 percent load has been applied for six hours is less than 0.5 inch and the movement over the previous four hours has been less than 0.1 inch, the test may be terminated.

For the quick 200 percent tests, the 200 percent test load should be maintained for 30 minutes. The total deflection of the anchor during the quick 200 percent tests should not exceed 12 inches. Anchor deflection after the 200 percent test load has been applied should not exceed 0.75 inch during the 30 minute period. Where satisfactory tests are not achieved on the initial anchors, the anchor diameter and/or length should be increased until satisfactory test results are obtained.

All the production anchors should be pre-tested to at least 150 percent of the design load. Total deflection during the tests should not exceed 12 inches. The rate of creep under the 150 percent test should not exceed 0.1 inch over a 15-minute period for the anchor to be approved for the design loading.

After satisfactory test, each production anchor should be locked off at the design load. The locked-off load should be verified by rechecking the load in the anchor. If the locked-off load varies by more than 10 percent from the design load, the load should be until the anchor is locked off within 10 percent of the design load. Installation of the anchors and testing of the completed anchors should be observed by a representative of our firm.

6.5.5 Lateral Deflection and Shoring Monitoring

Some means of monitoring the performance of the shoring system is recommended. The monitoring should consist of periodic surveying of the lateral and vertical deflections of top of each soldier pile. When design of the shoring system is finalized, we can discuss appropriate monitoring methods with the design consultants and shoring contractor.

It is difficult to accurately predict the amount of deflection of a shoring system and it should be understood that the shoring system is designed to deflect at the top. We recommend the shoring system be designed to limit deflection at the top to be 0.5 inch or less where the shoring provides lateral support for existing buildings, and 1 inch or less where existing buildings are not present. If greater deflection occurs during construction, additional vertical support or lateral bracing may be required.

6.6 Temporary Excavations and Vertical Cuts

Temporary and unsurcharged slopes may be excavated into the on-site soils and these slopes should not exceed a 1H:1V gradient and should not exceed ten feet in height

Temporary vertical cuts may be made into properly compacted fill, however, should not exceed four feet in height. Temporary vertical cuts may be made into bedrock should not exceed eight feet in height.

Temporary vertical cuts and temporary construction slopes should be protected from erosion by directing surface water away from the top of the slope, by placing sand bags at the top of the slopes and vertical cuts, and/or covering the slopes with plastic sheeting during rain events.

Excavations performed adjacent to existing building foundations, sidewalks, and roadways should also be sloped at a minimum gradient of 1.5H:1V.

6.7 Pavement Design

6.7.1 General

New pavement sections should be established on at least 12 inches of properly compacted non-expansive fill soils. The existing engineered fill present at the site is suitable for pavement support.

The required pavement and base thicknesses will depend on the expected wheel loads, traffic index (TI), and the R-value of the subgrade soils. Based on the results of our laboratory testing, we used an R-value of 31 in our pavement design.

Our pavement design recommendations for asphalt concrete (AC) and Portland cement concrete (PCC) are provided below.

6.7.2 Asphalt-Concrete Pavement Design

AC pavement for surface parking shall be designed in accordance with the CALTRANS method. Table 4 below summarizes our AC pavement recommendations for assumed TIs of 4 and 5.

Table 4 - AC Pavement Design Recommendations

Traffic Use	TI	AC (inches)	AB (inches)
Parking Areas	4	3	4
Drive Lanes	5	4	5
Loading Docks and Heavily Trafficked Drive Lanes	7	5	8

We can determine the recommended pavement and aggregate base thickness for other TIs if required. Careful inspection is recommended to confirm that the recommended thickness or greater is achieved and their proper construction procedures are followed.

The base should conform to requirements of Section 26 of State of California Standard Specifications for Public Works Construction (Green Book). The aggregate base should be compacted to at least 95 percent relative compaction.

6.7.3 Portland Cement Concrete Pavement Design

Table 5 summarizes our PCC pavement recommendations for assumed TI of 4 and 5 based on minimum compressive strength of 3,000 psi for the PCC.

Table 5 - PCC Pavement Design Recommendations

Traffic Use	TI	PCC (inches)	AB (inches)
Parking Areas	4	5.5	4
Drive Lanes	5	6	4
Loading Docks and Heavily Trafficked Drive Lanes	7	6.5	4

Dowels are recommended at joints to reduce any possible offsets. Careful inspection is recommended to check that the recommended thickness or greater is achieved and that proper construction procedures are followed.

State of California Department of Transportation Type II base, or equivalent, should be used in the required sections. The base should be compacted to at least 95 percent relative compaction.

6.8 Site Preparation and Compaction

6.8.1 General

Site preparation for this project will primarily include demolition of existing structures, removal of existing foundations, mass excavation, and site grading for pavement sections.

Based on the information available at this time, the on-site bedrock encountered during mass excavation is anticipated to be rippable using standard excavation equipment; however, it would be prudent to

perform supplemental geotechnical exploration at the site such as surface or dowhhole geophysical evaluations to develop a shear wave velocity profile of the on-site bedrock that may be correlated to estimate the rippability of the on-site bedrock.

6.8.2 Bottom Preparation

As recommended herein, the building floor slab-on-grade will be supported on 12 inches of properly compacted non-expansive fill soils.

The exposed bedrock surface at the bottom of the mass excavation should be scarified to a depth of eight inches and moisture conditioned as recommended in Section 6.8.3. The scarified bedrock should then be rolled to be reasonably firm with a steel-drum roller. Vibratory compaction effort is not advised for the exposed excavation bottom as doing so would likely result in disturbance of the diatomaceous bedrock materials. Our field technician should probe excavation bottoms to confirm suitable materials are present.

6.8.3 Materials for Fill

The on-site fill soils are suitable for re-used in the required fills noting that the upper soils and the on-site bedrock is also generally suitable provided the materials are processed to be well-graded and have maximum particle sizes less than three inches.

Fill placed beneath the building floor slab and site flat-work should be non-expansive and have an EI less than 50.

Imported fill material should be primarily granular in nature and reviewed by our field technician prior to import to the site.

6.8.4 Compaction

Fill placement may proceed after the bottom preparation is completed.

Granular fill soils should be moisture conditioned between 0 and 2 percent of the optimum moisture content and mechanically compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

Cohesive fill should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D1557, and moisture conditioned between 2 and 4 percent over the optimum moisture content.

Fill material should be placed in loose lifts not exceeding 8 inches in thickness, properly moisture conditioned, and mechanically compacted to the minimum required density.

It should be noted that moisture conditioning and compaction of clayey soils and diatomaceous bedrock may require the use of light-weight compaction equipment and the data presented herein should be evaluated by the grading contractor to determine appropriate compaction equipment.

7.0 CONSTRUCTION OBSERVATION

Geotechnical testing and observation during construction is considered to be a continuing part of the geotechnical consultation. Our representative should observe, document and test (as appropriate) the following geotechnical-related construction activities:

- Mass excavation
- Soldier pile excavations
- Tiebacks installation and load testing
- Installation of temporary shoring

- Observation of excavation bottoms
- Placement and compaction of structural backfill materials
- Foundation bottom observation and approval
- Installation of capillary break sections
- Placement and compaction of pavement subgrade materials
- Placement and compaction of utility trench backfill

8.0 LIMITATIONS

We have prepared this preliminary report for use by Banner SoCal Developer, LLC and members of the design and construction team for the proposed development. The data and report can be used for estimating purposes, but our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions and are not applicable to other sites.

Soil borings indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect soil strata or water level variations that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, re-evaluation will be necessary.

The recommendations presented in this report are based on the current site development plan and structural information provided to us by the project team. If design changes are made, we should be retained to review our conclusions and recommendations and to provide a written evaluation or modification.

The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with that degree of skill and care ordinarily exercised by reputable geotechnical consultants practicing in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

9.0 CLOSING

We sincerely appreciate the opportunity to provide professional services for this project and look forward to working with you on this project.

Please contact us at you convenience to discuss any questions you may have regarding this report.

Sincerely,

Langan Engineering and Environmental Services, Inc.

Claudia Rangel
Staff Engineer

Shaun Wilkins
Senior Project Geologist

CERTIFIED ENGINEERING GEOLOGIST
SHAUN H. WILKINS
No. 2665
signed 6/7/22
STATE OF CALIFORNIA

Christopher J. Zadoorian
Associate

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER JOHN ZADOORIAN
GE2493
signed 6/7/22
GEOTECHNICAL
STATE OF CALIFORNIA

REFERENCES

American Concrete Institute, 2014, Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary, 2014.

American Society of Civil Engineers, 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE/SEI 7-16.

Applied Earth Sciences, 2015, Report of Geotechnical Investigation, Proposed Hotel Building Project, Lot 1 of Tract No. 26267, 20401 West Ventura Boulevard, Los Angeles, California 91364; Job No. 15-485-22, dated December 1.

Applied Earth Sciences, 2019, Geotechnical Investigation Report Update, Proposed Hotel Building Project, Lot 1 of Tract No. 26267, 20401 West Ventura Boulevard, Los Angeles, California 91364; Job No. 15-485-22, dated May 21.

Blue Peak Engineering, 2022, Preliminary Grading Plans for: Self Storage Facility at 20401 Ventura Blvd., City of Woodland Hills; Job No. 0946, 4 Sheets, 20 Scale, dated May 6.

Boyd, O. S., Thompson, E. M., Shumway, A., Moschetti, M. P., Stephenson, W. J., & Rezaeian, S. (2017, 08). Basin ZX Maps for use in the USGS National Seismic Hazard Model for the Western United States. Poster Presentation at 2017 SCEC Annual Meeting.

California Building Standards Commission, 2019, California Building Code, California Code of Regulations, Title 24.

California Department of Transportation, 2016, Highway Design Manual, 6th Edition, dated 16 December 2016.

California Division of Mines and Geology, 1998, Seismic Hazard Zone Report for the Canoga Park 7.5-Minute Quadrangle, Los Angeles County, California: California Department of Conservation Division of Mines and Geology, Seismic Hazard Zone Report 07 (Official Map Released February 1, 1998).

California Geologic Energy Management Division (CalGEM), https://maps.conservation.ca.gov/doggr/wellfinder/

California Geological Survey, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117A.

_____, 2010a, "An Explanatory Text to Accompany the Fault Activity Map of California, Scale 1:750,000, Compilation and Interpretation by C. Jennings and W. Bryant, Digital Preparation by M. Patel, E. Sander, J. Thompson, B. Wanish, and M. Fonseca.

_____, 2010b, Fault Activity Map of California, Geologic Data Map No. 6, http://maps.conservation.ca.gov/cgs/fam/.

_____, 2019b, Earthquake Zones of Required Investigation, accessed March 2022. https://maps.conservation.ca.gov/cgs/EQZApp/app/

Campbell, R.H., Wills, C.J., Irvine, P.J., and Swanson, B.J., 2014, Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, California; California Geological Survey, Version 2.1, 1:100,000 Scale, 1 Sheet.

Federal Emergency Management Agency, 2012, National Flood Insurance Map Program, Flood Insurance Rate Map (FIRM) Map Number 06037C1290F, dated September 26, 2008.

Hood & Schmidt, Inc., 1965, Geologic Investigation, Proposed Charlie Brown's Restaurant, Ventura Boulevard, West of Winnetka Avenue, Woodland Hills Area, City of Los Angeles, California; Job No. 65018, dated May 8.

LeRoy Crandall and Associates, 1965, Report of Soil Investigation, Proposed Charley Brown's Restaurant, 20401 Ventura Boulevard, Woodland Hills District, Los Angeles, California; Job No. A-65249-B, dated September 24.

LeRoy Crandall and Associates, 1966, Control of Compacted Fill, Proposed Charlie Brown's Restaurant, 20401 Ventura Boulevard, Woodland Hills District, Los Angeles, California; Job No. B-66135, dated August 8.

LeRoy Crandall and Associates, 1966, Inspection of Foundation Excavations, and Testing of Compacted Backfill, Proposed Charley Brown's Restaurant, 20401 Ventura Boulevard, Woodland Hills District, Los Angeles, California; Job No. B-66129, dated August 9.

LeRoy Crandall and Associates, 1967, Testing of Additional Compacted Backfill, Proposed Charley Brown's Restaurant, 20401 Ventura Boulevard, Woodland Hills District, Los Angeles, California; Job No. B-66129-B, dated May 8.

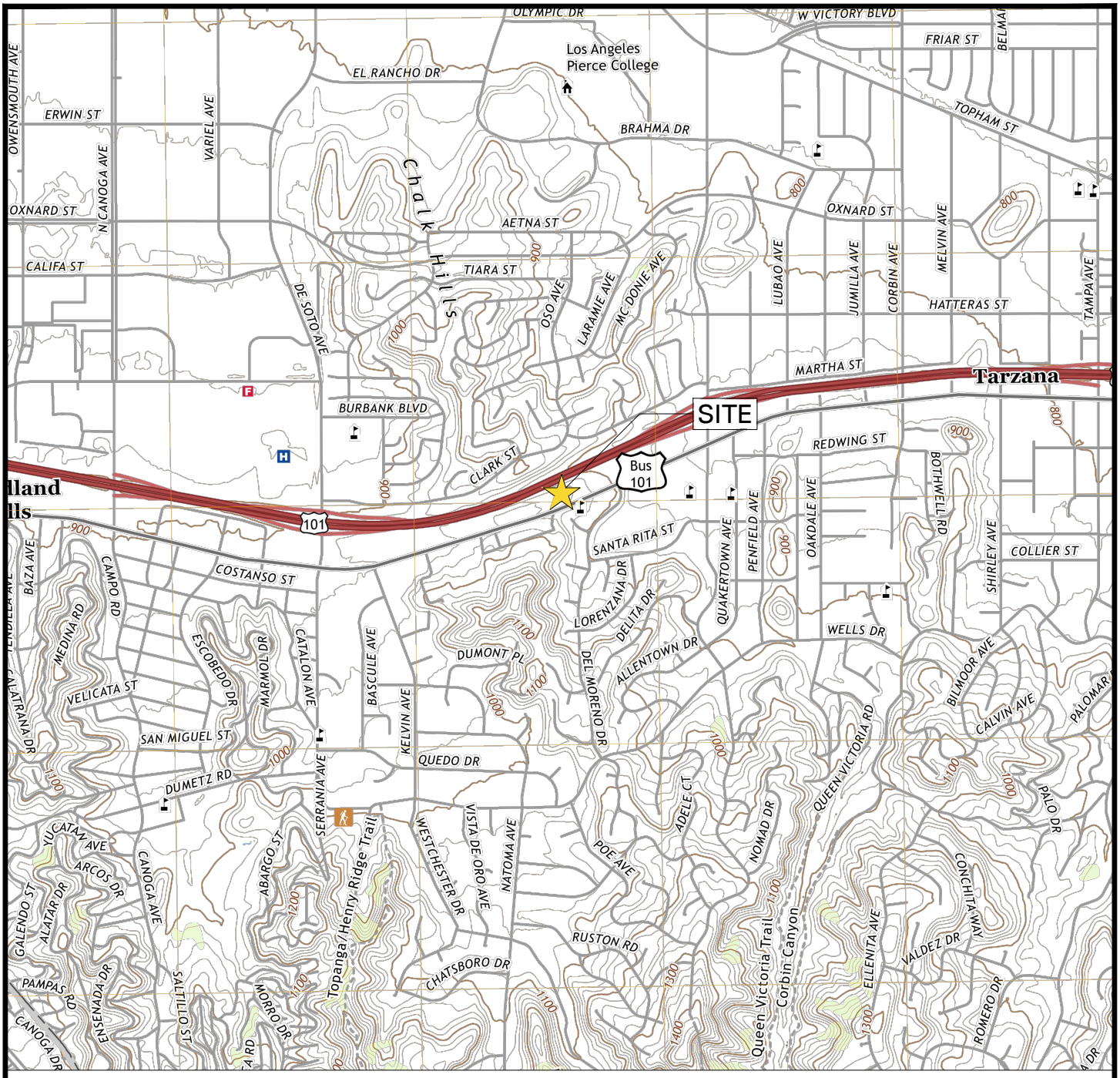
Linda Al Atik and Nicholas Sitar, 2010, Seismic Earth Pressures on Cantilever Retaining Structures, Journal of Geotechnical and Geoenvironmental Engineering, vol. 136, no. 10, October 2010.

Marshall Lew Nicholas Sitar and Linda Al Atik, 2010, Seismic Earth Pressures: Fact or Fiction?, Earth Retention Conference 3, August 1, 2010.

United States Geological Survey (USGS), 2017, ANSS Comprehensive Catalog (Comcat), http://earthquake.usgs.gov/earthquakes/search, March 18, 2021.

Yerkes, R.F., 1996, Preliminary Geologic Map of the San Fernando 7.5' Quadrangle, Southern California, Scale 1:24,000, 1 Sheet.

FIGURES



REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP OF THE CANOGA PARK, CA QUADRANGLE (2018).

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Langan Engineering and Environmental Services, Inc.

18575 Jamboree Road, Suite 150
Irvine, CA 92612

T: 949.561.9200 F: 949.561.9201 www.langan.com

Project	WOODLAND HILLS SELF STORAGE FACILITY 20401 VENTURA BOULEVARD WOODLAND HILLS LOS ANGELES COUNTY CALIFORNIA
Figure Title	SITE LOCATION MAP
Project No.	700107401
Date	JUNE 2022
Scale	AS SHOWN
Drawn By	CC
Figure No.	1

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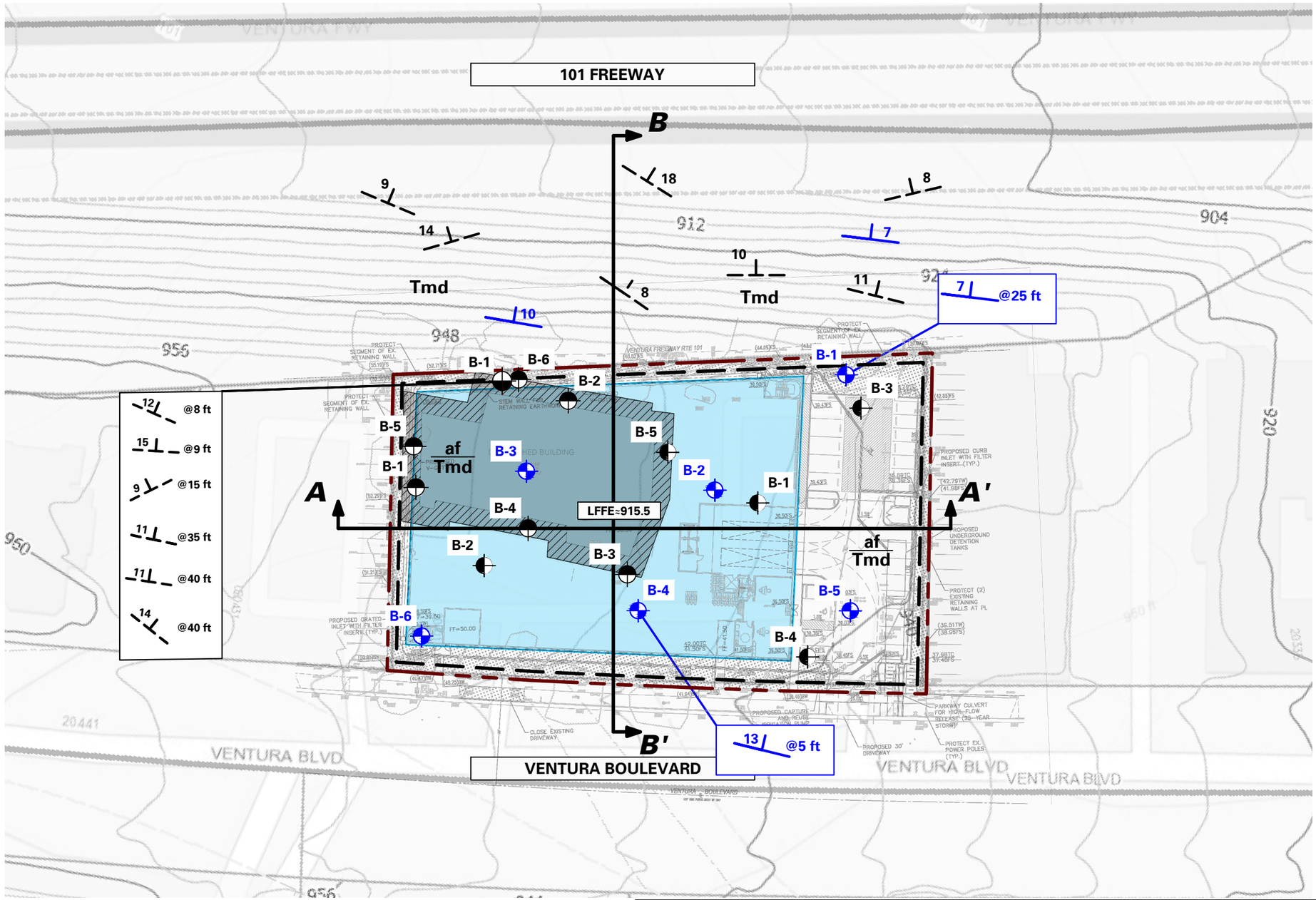

LEGEND:

af	ARTIFICIAL FILL (LCA, 1966, 1967)
Tmd	BEDROCK - MODELO FORMATION
	GEOLOGIC CONTACT
13	STRIKE AND DIP OF BEDDING (LANGAN, 2022)
18	STRIKE AND DIP OF BEDDING (HOOD & SCHMIDT, INC., 1965)
	SITE LIMITS
B-1	BORING LOCATION (LANGAN, 2022)
B-1	PRIOR BORING LOCATION (APPLIED EARTH SCIENCES, 2015)
B-1	PRIOR BORING LOCATION (LEROY CRANDALL & ASSOCIATES, 1965)
B-1	PRIOR BORING LOCATION (HOOD & SCHMIDT, INC., 1965)
	PROPOSED BUILDING
	DEMOLISHED BUILDING

NOTES:

1. BACKGROUND SITE PLAN REFERENCED FROM NAVIGATELA ON 2/18/2022.
2. PROPOSED BUILDING FOOTPRINT REFERENCED FROM "SELF STORAGE FACILITY AT 20401 VENTURA BLVD" SHEET 02, PREPARED BY BLUE PEAK ENGINEERING, DATE 26 MAY 2022.
3. PRIOR BORING LOCATIONS OBTAINED FROM " REPORT OF GEOTECHNICAL INVESTIGATION PROPOSED HOTEL BUILDING PROJECT LOT 1 OF TRACT NO. 26267 20401 WEST VENTURA BOULEVARD LOS ANGELES, CA" DRAWING NO. 1 PREPARED BY APPLIED EARTH SCIENCES, DATED 1 DECEMBER 2015.
4. PRIOR BORING LOCATIONS OBTAINED FROM " TESTING OF ADDITIONAL COMPACTED BACKFILL PROPOSED CHARLEY BROWN'S RESTAURANT 20401 VENTURA BOULEVARD WOODLAND HILLS DISTRICT, LOS ANGELES, CALIFORNIA FOR INTERSTATE HOSTS, INC." PLATE NO. 1 PREPARED BY LEROY CRANDALL & ASSOCIATES, DATED 8 MAY 1967.
5. PRIOR BORING LOCATION OBTAINED FROM "GEOLOGIC INVESTIGATION PROPOSED CHARLIE BROWN'S RESTUARANT VENTURA BOULEVARD, WEST OF WINNETKA AVENUE, WOODLAND HILLS AREA CITY OF LOS ANGELES, CALIFORNIA" PREPARED BY HOOD & SCHMIDT, INC., DATED 20 SEPTEMBER 1965.
6. PRIOR STRIKES AND DIPS OBTAINED FROM "GEOLOGIC INVESTIGATION PROPOSED CHARLIE BROWN'S RESTUARANT VENTURA BOULEVARD, WEST OF WINNETKA AVENUE, WOODLAND HILLS AREA CITY OF LOS ANGELES, CALIFORNIA" PREPARED BY HOOD & SCHMIDT, INC., DATED 20 SEPTEMBER 1965.

60 30 0 60
SCALE IN FEET

LANGAN
Langan Engineering and Environmental Services, Inc.
18575 Jamboree Road Suite 150
Irvine, CA 92612
T: 949.561.9200 F: 949.561.9201 www.langan.com

Project
WOODLAND HILLS SELF STORAGE FACILITY
20401 VENTURA BOULEVARD
WOODLAND HILLS
LOS ANGELES COUNTY CALIFORNIA

Figure Title
SITE PLAN

Project No. 700107401
Date JUNE 2022
Scale AS SHOWN
Drawn By CR
Figure No. 2

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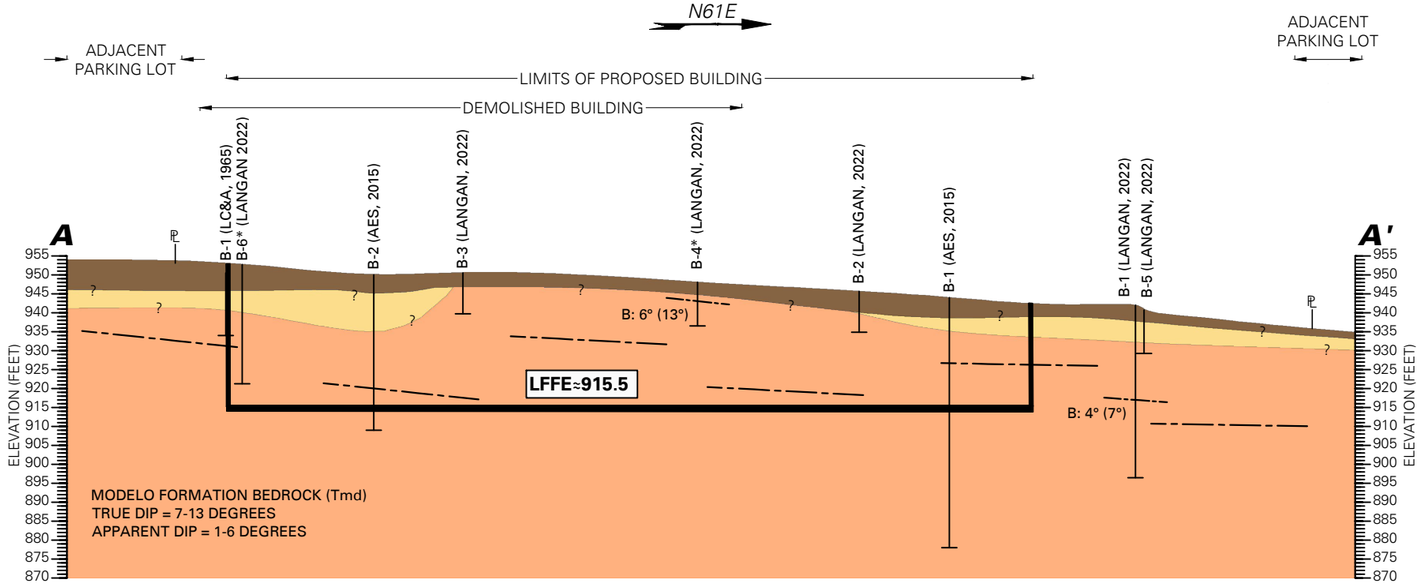
CROSS SECTION A-A'

N61E



NOTE: BORINGS PROJECTED WITH DISTANCES GREATER THAN 25 FEET FROM CROSS-SECTION A-A' ARE MARKED WITH (*)

LEGEND:

- APPROXIMATE GROUND SURFACE LEVEL
- ARTIFICIAL FILL (af)
- RESIDUAL SOIL
- MODELO FORMATION - BEDROCK
- **LFFE≈915.5** LOWEST FINISHED FLOOR ELEVATION (FEET)
- **B: 4° (7°)** BEDDING: APPARENT DIP (TRUE DIP)

NOTES:

1. CROSS SECTION DISPLAYS GENERALIZED SUBSURFACE CONDITIONS; FOR A DETAILED DESCRIPTION OF CONDITIONS ENCOUNTERED REFER TO BORING LOGS.
2. REFER TO SITE PLAN FOR LOCATION OF CROSS SECTIONS.
3. GROUND SURFACE PROFILE INFERRED FROM NAVIGATELA ON 2/18/2022.

40 20 0 40

SCALE IN FEET

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LOS ANGELES COUNTY CALIFORNIA

Figure Title
CROSS SECTION A-A'

Project No.	Figure No.
700107401	3
Date: JUNE 2022	
Scale: AS SHOWN	
Drawn By: CC	

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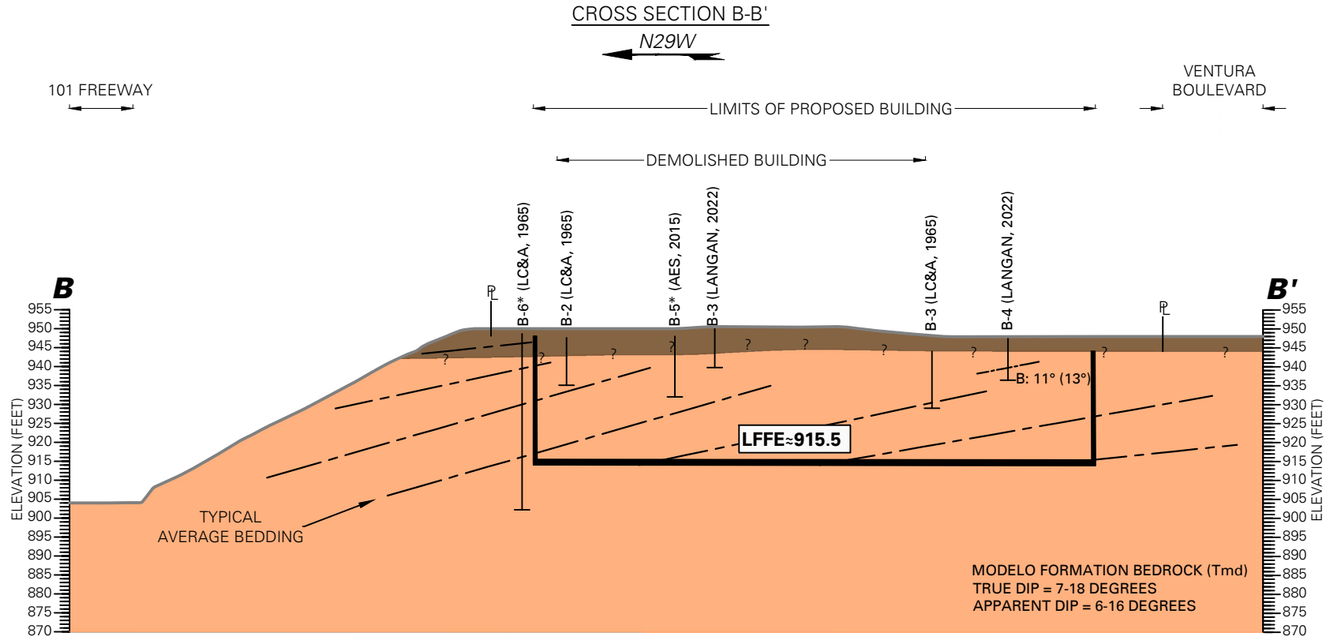
LEGEND:

- APPROXIMATE GROUND SURFACE LEVEL
- ARTIFICIAL FILL (af)
- RESIDUAL SOIL
- MODELO FORMATION - BEDROCK
- **LFFE≈915.5** LOWEST FINISHED FLOOR ELEVATION (FEET)
- **B: 11° (13°)** BEDDING: APPARENT DIP (TRUE DIP)

CROSS SECTION B-B'

N29W



NOTE: BORINGS PROJECTED WITH DISTANCES GREATER THAN 25 FEET FROM CROSS-SECTION B-B' ARE MARKED WITH (*)

NOTES:

1. CROSS SECTION DISPLAYS GENERALIZED SUBSURFACE CONDITIONS; FOR A DETAILED DESCRIPTION OF CONDITIONS ENCOUNTERED REFER TO BORING LOGS.
2. REFER TO SITE PLAN FOR LOCATION OF CROSS SECTIONS.
3. GROUND SURFACE PROFILE INFERRED NAVIGATELA ON 2/18/2022.

40 20 0 40

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Figure Title
CROSS SECTION B-B'

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Figure No. **4**

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LEGEND:

SITE LOCATION

4000 2000 0 4000

SCALE IN FEET

REFERENCE: CALIFORNIA DEPARTMENT OF CONSERVATION, DIVISION OF MINES AND GEOLOGY - SEISMIC HAZARD ZONE REPORT FOR THE CANOGA PARK 7.5-MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA, PLATE 1.2. (1997)

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Figure Title

HISTORICAL HIGH GROUNDWATER MAP

Project No.	Figure No.
700107401	**5**
Date: JUNE 2022	
Scale: AS SHOWN	
Drawn By: CC	

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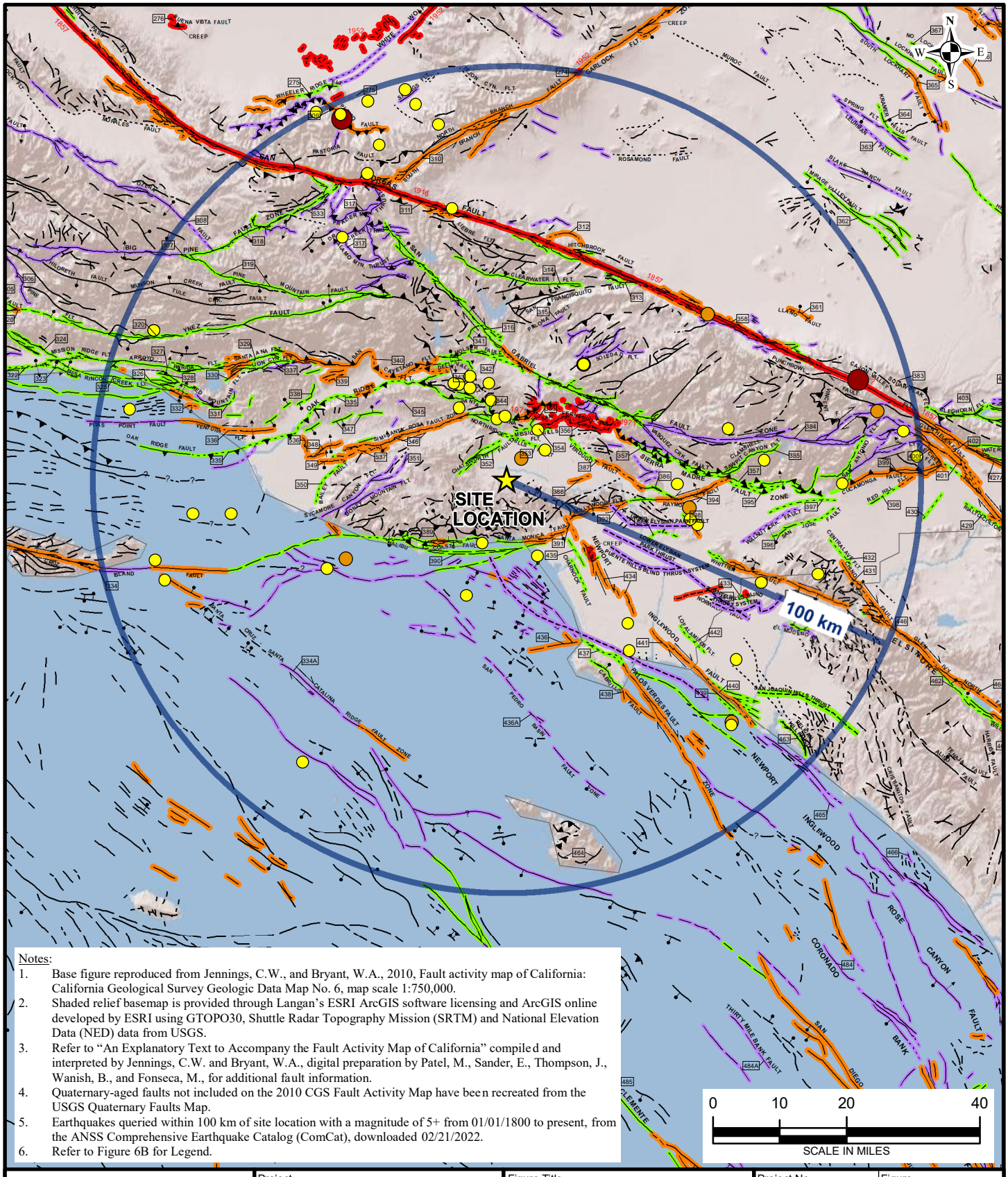

Notes:

1. Base figure reproduced from Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
2. Shaded relief basemap is provided through Langan's ESRI ArcGIS software licensing and ArcGIS online developed by ESRI using GTOPO30, Shuttle Radar Topography Mission (SRTM) and National Elevation Data (NED) data from USGS.
3. Refer to "An Explanatory Text to Accompany the Fault Activity Map of California" compiled and interpreted by Jennings, C.W. and Bryant, W.A., digital preparation by Patel, M., Sander, E., Thompson, J., Wanish, B., and Fonseca, M., for additional fault information.
4. Quaternary-aged faults not included on the 2010 CGS Fault Activity Map have been recreated from the USGS Quaternary Faults Map.
5. Earthquakes queried within 100 km of site location with a magnitude of 5+ from 01/01/1800 to present, from the ANSS Comprehensive Earthquake Catalog (ComCat), downloaded 02/21/2022.
6. Refer to Figure 6B for Legend.

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Figure Title
QUATERNARY FAULT ACTIVITY AND EARTHQUAKE EPICENTER MAP

Project No. 700107401
Date JUNE 2022
Scale 1 inch = 20 miles
Drawn By OG

Figure 6A

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LEGEND:

Fault Age

The age classifications are based on geologic evidence to determine the youngest faulted unit and the oldest unfaulted unit along each fault or fault section

- Historic
- Holocene
- Late Quaternary
- Quaternary

Earthquake Epicenter

- Magnitude 5.0 to 5.9
- Magnitude 6.0 to 6.9
- Magnitude 7.0 to 7.4
- Magnitude 7.5 to 8.0

Pre-Quaternary Faults

- fault, certain
- fault, approx. located
- fault, concealed
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, approx. located, queried
- fault, certain
- fault, concealed
- fault, approx. located

Quaternary Faults

- fault, certain
- fault, approx. located
- fault, approx. located, queried
- fault, inferred, queried
- fault, concealed
- fault, concealed, queried
- thrust fault, certain
- thrust fault, approx. located
- thrust fault, concealed
- dextral fault, certain
- dextral fault, approx. located
- dextral fault, concealed
- sinistral fault, certain
- sinistral fault, approx. located
- sinistral fault, concealed
- thrust fault, certain (2)
- thrust fault, approx. located (2)
- thrust fault, concealed (2)
- fault, solid
- fault, dashed
- fault, dotted
- dextral fault, solid
- fault, dotted, queried
- fault, dotted, queried (2)
- fault, solid, dip
- fault, dashed, dip
- fault, dotted, dip
- reverse fault, solid
- reverse fault, dashed
- reverse fault, dotted

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Figure Title
QUATERNARY FAULT ACTIVITY AND EARTHQUAKE EPICENTER MAP

Project No. 700107401
Date JUNE 2022
Scale NOT TO SCALE
Drawn By OG

Figure 6B

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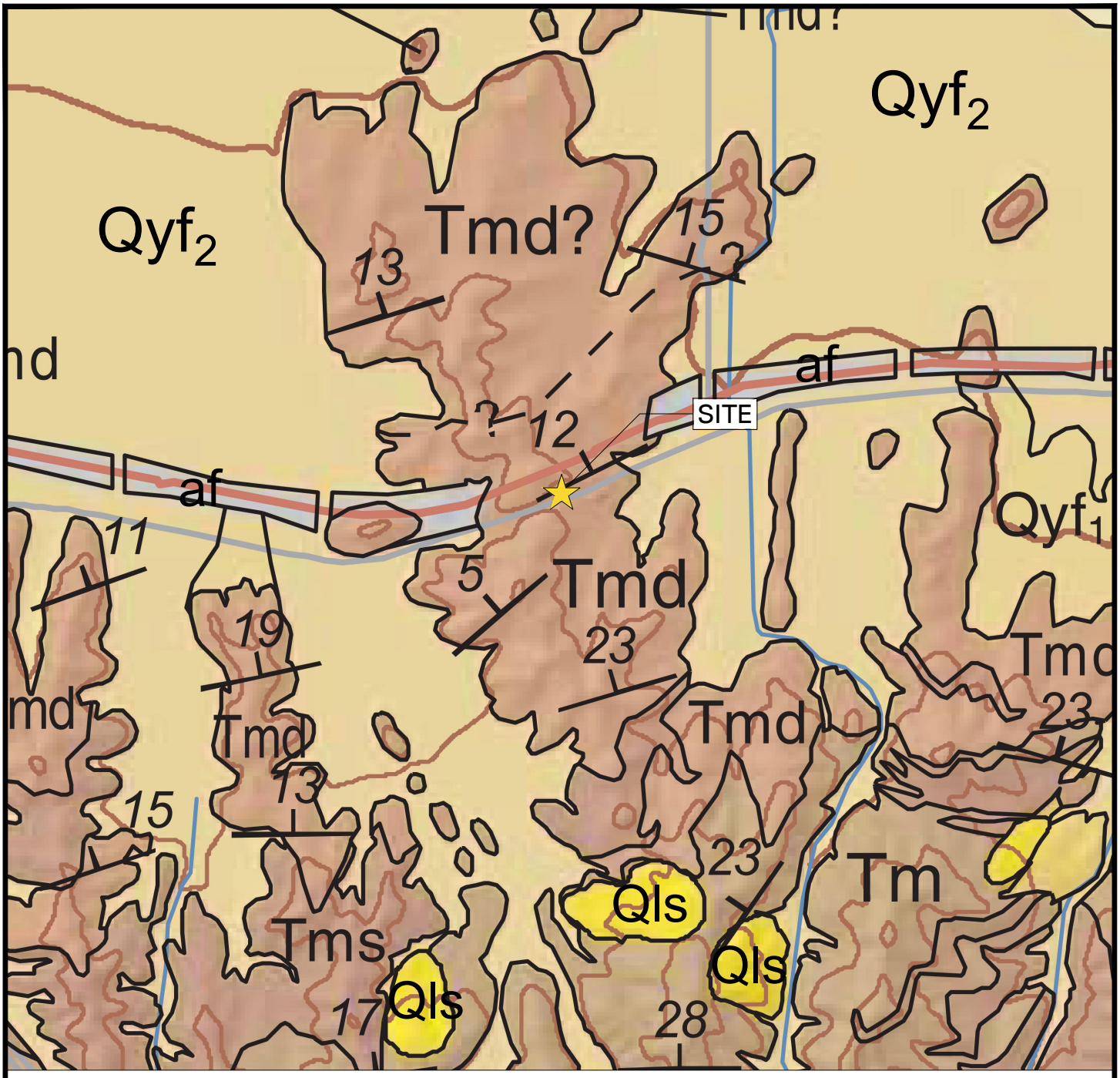

LEGEND:

af	ARTIFICIAL FILL
Qyf	YOUNG ALLUVIAL FAN DEPOSITS
Qls	LANDSLIDE DEPOSITS
Tm	MODELO FORMATION - UNDIVIDED
Tmd	MODELO FORMATION - DIATOMACEOUS SHALE
Tms	MODELO FORMATION - SANDSTONE

2000 1000 0 2000
SCALE IN FEET

REFERENCE: CGS PRELIMINARY GEOLOGIC MAP OF THE LOS ANGELES 30' X 60' QUADRANGLE, CALIFORNIA, VERSION 2.1 (CAMPBELL, ET AL, 2014).

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Figure Title
REGIONAL GEOLOGIC MAP

Project No. 700107401
Date JUNE 2022
Scale AS SHOWN
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Figure No. **7**

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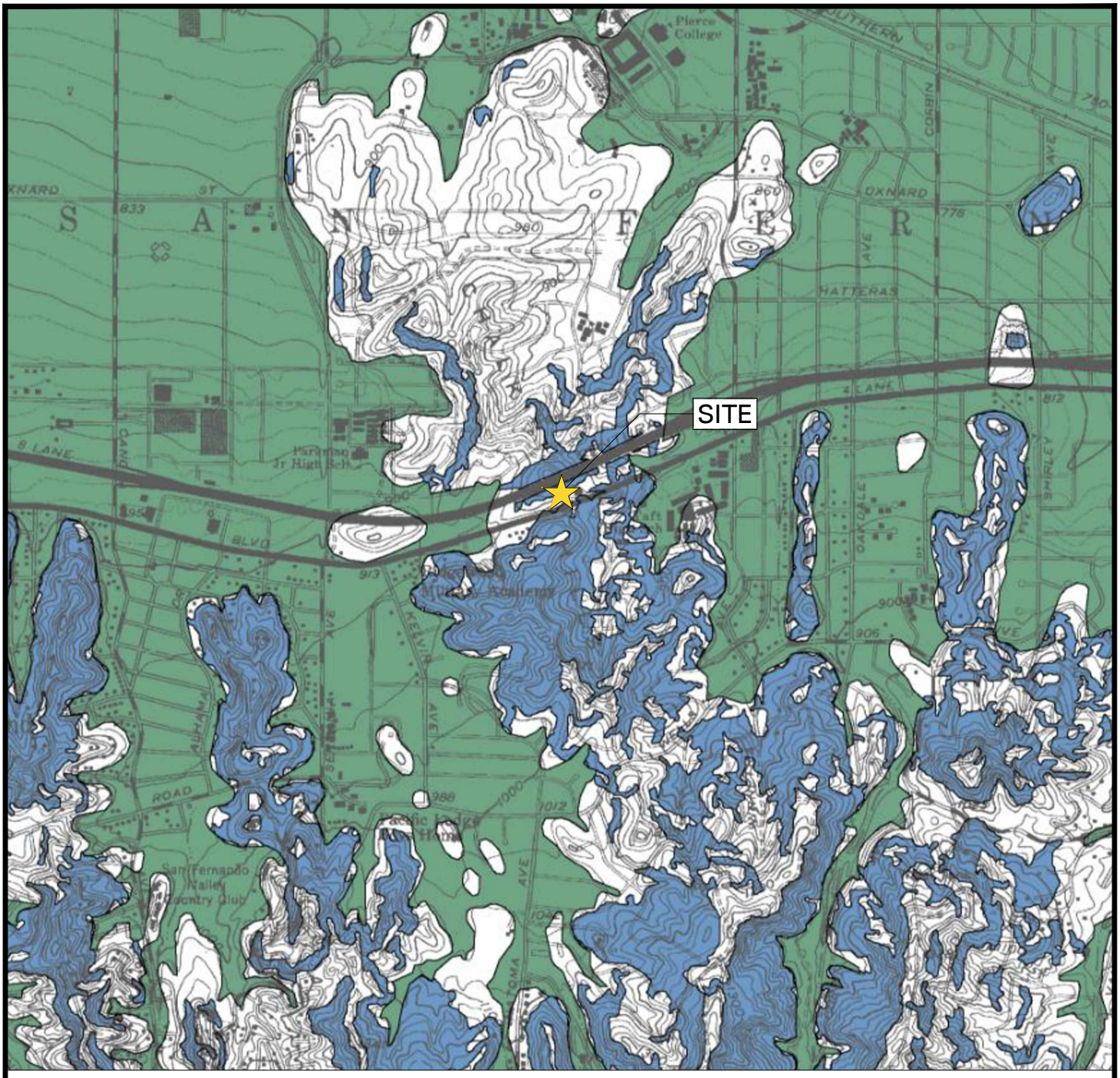

LEGEND:

Liquefaction
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

2000 1000 0 2000
SCALE IN FEET

REFERENCE: CGS EARTHQUAKE ZONES OF REQUIRED INVESTIGATION FOR THE CANOGA PARK CALIFORNIA, 7.5 MINUTE QUADRANGLE (1998).

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Figure Title
SEISMIC HAZARD ZONES MAP

Project No.	Figure No.
700107401	8
Date: JUNE 2022	
Scale: AS SHOWN	
Drawn By: CC	

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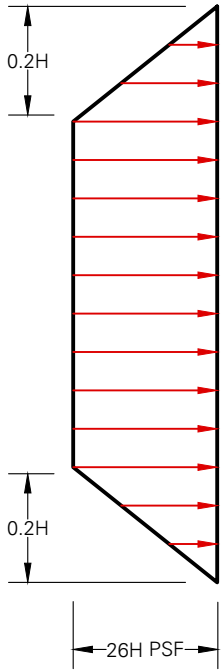
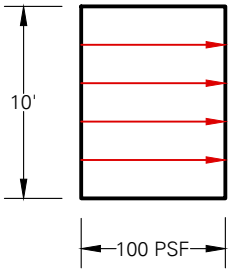
AT-REST LATERAL EARTH PRESSURE



+

TRAFFIC SURCHARGE



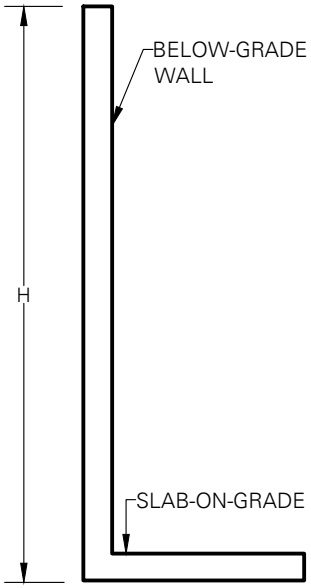


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Figure Title
AT-REST LATERAL EARTH PRESSURES

Project No. 700107401
Date JUNE 2022
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Figure No. **9**

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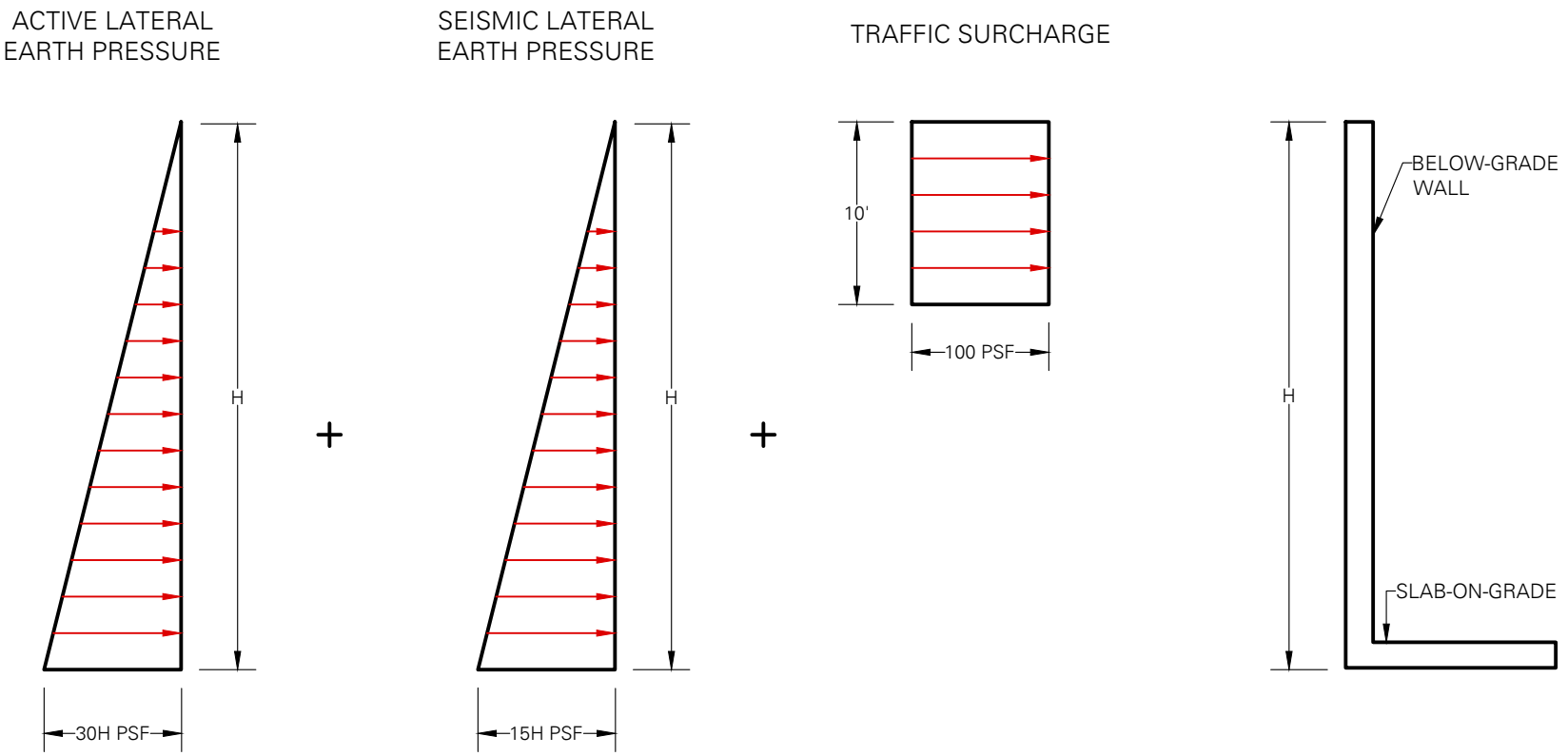

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Figure Title
ACTIVE LATERAL EARTH PRESSURES

Project No.	Figure No.
700107401	**10**
Date: JUNE 2022	
Scale: NOT TO SCALE	
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APPENDIX A
Field Explorations and Laboratory Testing

APPENDIX A

SUBSURFACE EXPLORATIONS

We explored the subsurface conditions at the site by drilling 6 borings (B-1 through B-6) to depths ranging between 10½ and 45½ feet bgs at the locations shown on Figure 2. The borings were drilled by 2R Drilling, Inc. using a truck-mounted hollow-stem auger drilling equipment on January 26, 2022.

The locations of the explorations were determined in the field by observing nearby landmarks/structures, which were based on site maps prepared by us. This information should be considered accurate only to the degree implied by the methods used.

Our field engineer observed and logged the explorations. We obtained representative samples of the various soils encountered in the explorations. Classifications and sampling intervals are presented on the exploration logs included in this appendix.

SOIL SAMPLING

Samples were collected from the borings using modified California split-spoon samplers in general accordance with ASTM D3550. We collected two oriented samples by keeping the ring sampler oriented to the north. The sampler orientation was maintained during the sample driving process.

The modified California samplers were driven using a 140-pound hammer free falling 30 inches. The samplers were driven a total distance of 18 inches or to refusal. The number of blow counts required to drive the sampler for each 6 inch segment was recorded (or less if refusal is met) on the exploration logs. Sampling methods and intervals are shown on the exploration logs.

The samples collected from the borings were transported to our office for assignment of geotechnical laboratory testing.

SOIL CLASSIFICATION

The soil samples were described in accordance with the classification legend that is included in this appendix prior to the exploration logs. The exploration logs indicate the depths at which the soils or their characteristics change, although the change actually may be gradual. If the change occurred between sample locations, the depth was interpreted. Changes between geologic units or soil types on the boring logs are represented with a solid line if observed directly in the samples, and with a dashed line if inferred between sample depths. Classifications are shown on the exploration logs.

LABORATORY TESTING

Moisture Content and In-place Dry Density

The natural moisture content of select soil samples were performed in general accordance with ASTM D2216. The natural moisture content is a ratio of the weight of the water to soil in a test sample and is expressed as a percentage.

Select soil samples were tested to determine the in situ dry density. The tests were performed in general accordance with ASTM D2937. The dry density is defined as the ratio of the dry weight of the soil sample to the volume of that sample. The dry density typically is expressed in units of pounds per cubic foot (pcf).

The test results are presented in this appendix.

Maximum Dry-Density and Optimum Moisture Content

Maximum dry-density and optimum moisture content testing was performed in general accordance with ASTM D 1557 on one bulk samples obtained from the explorations. The tests determines the optimal moisture content at which sample achieves its maximum dry density. The test results are presented in this appendix.

Expansion Index

Expansion index tests were performed on selected bulk samples of the on-site soils in accordance with the latest version of Test Method ASTM D4829.

The test results are presented in this appendix.

Corrosion Testing

Chemical and electrical analyses were performed on selected bulk samples of onsite soils to determine their soluble sulfate content, chloride content, pH (acidity) and minimum electrical resistivity. These tests were performed in accordance with the latest versions of California Test Method Nos. CTM 417 (sulfate), CTM 422 (chloride), and CTM 643 (pH and resistivity) respectively.

The results of these tests are included in this appendix.

Consolidation Testing

One-dimensional consolidation testing was performed in general accordance with ASTM D2435 on relatively undisturbed soil samples. The test measures the volume change of a soil sample under predetermined loads.

The test results are presented in this appendix.

Strength Testing

Direct shear tests were completed on select samples obtained from the explorations. The tests were performed in general accordance with ASTM D3080. The test determines the effects upon shear resistance and displacement, and strength properties such as Mohr strength envelopes.

The test results are presented in this appendix.

R-Value Testing

R-value tests were completed on select bulk samples obtained from the explorations. The tests were conducted in general accordance with ASTM D 2844. The test is used to measure the potential strength of subgrade, subbase, and base course materials for use in road and airfield pavements.

The test results are presented in this appendix.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soil (more than half of soil is larger than the no. 200 sieve size)	**Gravels** (more than half of coarse fraction is retained/> no. 4 sieve size)	**GW**	Well-graded GRAVELS with less than 5% fines or gravel-sand mixtures
		GP	Poorly-graded GRAVELS with less than 5% fines or gravel-sand mixtures
		GM	Silty gravels, gravel-sand-silt mixtures;GRAVELS with greater than 12% ML or MH fines
		GC	Clayey gravels, gravel-sand-clay mixtures; GRAVELS with greater than 12% CL or CH
	Sands (more than half of coarse fraction passes/< no. 4 sieve size)	**SW**	Well-graded sands with less than 5% fines or gravelly sands, little or no fines
		SP	Poorly-graded sands with less than 5% fines or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures; SANDS with greater than 12% ML or MH fines
		SC	Clayey sands, sand-clay mixtures; SANDS with greater than 12% CL or CH fines
Fine-Grained Soils (more than half of soil is smaller than the no. 200 sieve size)	**Silts and Clays** LL = < 50	**ML**	Inorganic silts and clayey silts of low plasticity, sandy non-plastic SILT, gravelly SILT
		CL	Inorganic clays of low to medium plasticity, silty CLAY, trace fines, sand
		OL	Organic silts and organic silt-clays of non-plastic to medium plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic medium plastic silts, medium plastic to very plastic clayey silts.
		CH	Inorganic plastic to very plastic CLAYS, sandy plastic CLAY
		OH	Organic medium plastic to plastic silty CLAYS, and very plastic CLAYS
Highly Organic Soils		**PT**	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.75
coarse	3" to ¾"	76.2 to 19.1
fine	¾" to No.4	19.1 to 4.75
Sand	No. 4 to No. 200	4.76 to 0.075
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.240 to 0.075
Silt and Clay	Below No. 200	Below 0.075

GROUNDWATER READING

- Groundwater encountered during drilling
- Groundwater at completion
- Groundwater at 24 hours

SOIL DESCRIPTIONS/SYMBOLS

- Well-graded GRAVEL (GW)
- Poorly-graded GRAVEL (GP)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- Well-graded SAND (SW)
- Poorly-graded SAND (SP)
- Silty SAND (SM)
- Clayey SAND (SC)
- AGGREGATE BASE
- Low-Plasticity SILT (ML)
- High-Plasticity SILT (MH)
- Low-Plasticity CLAY (CL)
- High-Plasticity CLAY (CH)
- SANDSTONE
- CLAYSTONE
- SILTSTONE
- FILL
- ASPHALT

SAMPLER TYPE

- CR - Modified California (CR) split-barrel ring sampler with 3.0-inch outside diameter and a 2.5-inch inside diameter.
- SPT - Standard Penetration Test (SPT) split-barrel sampler with a 2.00-inch outside diameter with a 1.5-inch inside diameter
- ST - Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure
- BAG - Bulk Sample
- C - Core Barrel

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Figure Title

BORING LOG LEGEND

Figure No.

APPENDIX A

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Log of Boring **B-1** Sheet 1 of 3

Project: Proposed Banner Self-Storage Facility		Project No.	
Location: 20401 Ventura Boulevard		Elevation and Datum: Approx. 943 (feet, MSL)	
Drilling Company: 2R Drilling		Date Started: 1/26/22	Date Finished: 1/26/22
Drilling Equipment: CME 75 Truck-mounted Drill Rig		Completion Depth: 45.5 ft	Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger		Number of Samples: Disturbed -	Undisturbed 9 / Core -
Casing Diameter (in): -	Casing Depth (ft): -	Water Level (ft.): First ▽	Completion ▼ 45 / 24 HR. ▼
Casing Hammer: -	Weight (lbs): - / Drop (in): -	Drilling Foreman:	
Sampler: 2-inch O.D. Split-Barrel SPT, 2.5-inch I.D. Cal Mod		Field Engineer: S. Wilkins	
Sampler Hammer: Automatic	Weight (lbs): 140 / Drop (in): 30		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		AC = 3-inches thick, No base.	0						
		Artificial Fill (af) Silty SAND with Gravel (SM), light grayish brown, medium dense, slightly moist, fine to coarse sand and gravel, few asphalt fragments, abundant bedrock fragments [FILL].	1						
			2						
			3		CR	0	50/1""		No sample recovery
		Bedrock - Modelo Formation (Tmd) SILTSTONE, off-white to olive brown, hard, moist, laminated, moderately weathered, slightly diatomaceous.	4						
			5	S-1	CR	9	26 50/3"		MC = 22.5% DD = 81.7 pcf
			6						
			7						
			8						
			9						
		Diatomaceous.	10	S-2	CR	9	30 50/3"		MC = 45.5% DD = 70.6 pcf Direct Shear Test.
			11						
			12						
			13						
			14						
		MUDSTONE, dark olive gray, hard, very moist, thinly bedded, slightly weathered, slightly diatomaceous.	15	S-3	CR	8.5	30 50/2.5"		
			16						
			17						
			18						
			19						
			20						

\\LANGAN.COM\DATA\IRV\DATA4\700107401\PROJECT DATA_DISCIPLINE\GEOTECHNICAL\GINTLOGS\700107401 GINT.GPJ ... 3/2/2022 12:59:03 PM ... Report: Log - LANGAN

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Log of Boring **B-1** Sheet 2 of 3

Project	Project No.
Proposed Banner Self-Storage Facility	
Location	**Elevation and Datum**
20401 Ventura Boulevard	Approx. 943 (feet, MSL)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Thickly bedded to massive, fresh.	20	S-4	CR	9	37 50/3"		MC = 46.6% DD = 71.5 pcf
			21						
			22						
			23						
			24						
		Oriented ring sample collected. Bedding = N80W/7NE	25	S-5	CR	12	12 50		
			26						
			27						
			28						
			29						
		Diatomaceous	30	S-6	CR	6	50		MC = 45.5% DD = 64.2 pcf
			31						
			32						
			33						
			34						
			35	S-7	CR	6	50		
			36						
			37						
			38						
			39						
			40	S-8	CR	9	20 50/3"		MC = 39.4% DD = 76.0 pcf Direct Shear Test.
			41						
			42						
			43						
			44						
			45						

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Log of Boring **B-1** Sheet 3 of 3

Project	Project No.
Proposed Banner Self-Storage Facility	
Location	**Elevation and Datum**
20401 Ventura Boulevard	Approx. 943 (feet, MSL)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
			45	S-9	CR	6	50		
		Total depth = 45.5 feet Minor perched groundwater encountered at 45 feet bgs. Borehole backfilled with cuttings and AC patched.	46						
			47						
			48						
			49						
			50						
			51						
			52						
			53						
			54						
			55						
			56						
			57						
			58						
			59						
			60						
			61						
			62						
			63						
			64						
			65						
			66						
			67						
			68						
			69						
			70						

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Log of Boring **B-2** Sheet 1 of 1

Project: Proposed Banner Self-Storage Facility	Project No.
Location: 20401 Ventura Boulevard	Elevation and Datum: Approx. 945.5 (feet, MSL)
Drilling Company: 2R Drilling	Date Started: 1/26/22 — Date Finished: 1/26/22
Drilling Equipment: CME 75 Truck-mounted Drill Rig	Completion Depth: 10.8 ft — Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed -, Undisturbed 4, Core -
Casing Diameter (in): - — Casing Depth (ft): -	Water Level (ft.): First ▽, Completion ▼ -, 24 HR. ▼
Casing Hammer: - — Weight (lbs): - — Drop (in): -	Drilling Foreman:
Sampler: 2-inch O.D. Split-Barrel SPT, 2.5-inch I.D. Cal Mod	Field Engineer: S. Wilkins
Sampler Hammer: Automatic — Weight (lbs): 140 — Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		AC = 3.5-inches thick, No base.	0						Bulk sample collected from 0-5 feet Remolded Considation Test Remolded Direct Shear Test Compaction Corrosion Expansion Index R Value
		Artificial Fill (af) Sandy CLAY (CL), yellowish brown, medium dense, moist, fine to medium sand, abundant concrete and asphalt fragments [FILL].	1		BAG	60			
			2						
			3	S-1	CR	15	8 11 11		MC = 35.5% DD = 80.3 pcf
			4						
			5	S-2	CR	15	12 32 46		MC = 47.6% DD = 71.1 pcf
		Residual Soil Clay (CL), yellowish brown, very stiff, very moist, slightly diatomaceous.	6						
		Bedrock - Modelo Formation (Tmd) MUDSTONE, dark olive gray, very moist, hard, thickly bedded to massive, fresh, diatomaceous.	7						
			8	S-3	CR	9	37 50/3"		
			9						
			10	S-4	CR	9	36 50/3"		MC = 48.9% DD = 66.3 pcf
		Total depth = 10.8 feet Groundwater not encountered. Borehole backfilled with soil cuttings and AC patched.	11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

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Log of Boring **B-3** Sheet 1 of 1

Project: Proposed Banner Self-Storage Facility	Project No.
Location: 20401 Ventura Boulevard	Elevation and Datum: Approx. 950.5 (feet, MSL)
Drilling Company: 2R Drilling	Date Started: 1/26/22 / Date Finished: 1/26/22
Drilling Equipment: CME 75 Truck-mounted Drill Rig	Completion Depth: 10.8 ft / Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed -, Undisturbed 3, Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First ▽, Completion ▼ -, 24 HR. ▼
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman:
Sampler: 2-inch O.D. Split-Barrel SPT, 2.5-inch I.D. Cal Mod	Field Engineer: S. Wilkins
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Concrete = 4-inches thick, welded wire mesh reinforcement. No underlayment.	0						
		Artificial Fill (af) Sandy CLAY (CL), yellowish brown, stiff, moist, fine to medium sand [FILL].	1						
			2						
		Clayey SAND (SC), grayish brown, very dense, moist, fine to coarse sand, some gravel [FILL].	3	S-1	CR	9	37 50/3"		MC = 9.0% DD = 111.6 pcf
		Bedrock - Modelo Formation (Tmd) SILTSTONE, off-white, very hard, slightly moist, thinly bedded, moderately weathered, concretion.	4						
			5		CR	0	50/1"		No sample recovery
			6						
			7						
		Olive brown to yellowish brown, hard, moist, thickly bedded, lenses of diatomaceous siltstone.	8	S-2	CR	10	24 50/4"		
			9						
		Silty SANDSTONE, yellowish brown, hard, moist, fine sand, slightly micaceous, thickly bedded to massive, moderately weathered.	10	S-3	CR	9	40 50/3"		MC = 9.9% DD = 103.9 pcf Oriented sample attempted but no apparent bedding observed.
		Total depth = 10.8 feet Groundwater not encountered. Borehole backfilled with soil cuttings and concrete patched.	11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

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Log of Boring **B-4** Sheet 1 of 1

Project: Proposed Banner Self-Storage Facility	Project No.
Location: 20401 Ventura Boulevard	Elevation and Datum: Approx. 948 (feet, MSL)
Drilling Company: 2R Drilling	Date Started: 1/26/22 / Date Finished: 1/26/22
Drilling Equipment: CME 75 Truck-mounted Drill Rig	Completion Depth: 11.5 ft / Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed -, Undisturbed 3, Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First ▽, Completion ▼ -, 24 HR. ▼
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman:
Sampler: 2-inch O.D. Split-Barrel SPT, 2.5-inch I.D. Cal Mod	
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	Field Engineer: S. Wilkins

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		AC = 5-inches thick, No base.	0						
		Artificial Fill (af) Sandy CLAY (CL), yellowish brown, stiff, very moist, fine to medium sand, few asphalt fragments [FILL].	1						
			2						
			3	S-1	CR	15	15 28 43		MC = 31.0% DD = 74.5 pcf
		Bedrock - Modelo Formation (Tmd) MUDSTONE, olive gray, hard, very moist, laminated, moderately weathered.	4						
		Light grayish brown, diatomaceous lens. Oriented ring sample collected. Bedding = N85E/23NW	5						
			6	S-2	CR	15	31 42 50/3"		
			7						
			8						
			9						
		Fine silty sandstone lenses, diatomaceous.	10	S-3	CR	15	13 19 25		MC = 45.7% DD = 72.0 pcf
		Total depth = 11.5 feet Groundwater not encountered. Borehole backfilled with soil cuttings and AC patched.	11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

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Log of Boring **B-5** Sheet 1 of 1

Project: Proposed Banner Self-Storage Facility	Project No.
Location: 20401 Ventura Boulevard	Elevation and Datum: Approx. 940 (feet, MSL)
Drilling Company: 2R Drilling	Date Started: 1/26/22 / Date Finished: 1/26/22
Drilling Equipment: CME 75 Truck-mounted Drill Rig	Completion Depth: 11.5 ft / Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed -, Undisturbed 3, Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First ▽, Completion ▼ -, 24 HR. ▼
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman:
Sampler: 2-inch O.D. Split-Barrel SPT, 2.5-inch I.D. Cal Mod	Field Engineer: S. Wilkins
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		AC = 5-inches thick, No base.	0						
		Artificial Fill (af) Sandy CLAY (CL), yellowish brown, medium dense, very moist, fine to medium sand [FILL].	1						
			2						
			3	S-1	CR	15	7 15 18		MC = 26.5% DD = 90.9 pcf
		Residual Soil CLAY (CL), yellowish brown, very stiff, very moist, few gypsum.	4						
		Some gypsum seams.	5						
			6	S-2	CR	15	8 17 17		MC = 30.8% DD = 87.2 pcf
			7						
			8						
		Bedrock - Modelo Formation (Tmd) MUDSTONE, olive brown to olive gray, moderately hard, very moist, thickly bedded to massive, highly weathered, moderately fractured, diatomaceous.	9						
			10						
			11	S-3	CR	15	20 34 38		MC = 49.0% DD = 71.1 pcf
		Total depth = 11.5 feet Groundwater not encountered. Borehole backfilled with soil cuttings and AC patched.	12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

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Log of Boring **B-6** Sheet 1 of 2

Project: Proposed Banner Self-Storage Facility	Project No.
Location: 20401 Ventura Boulevard	Elevation and Datum: Approx. 953 (feet, MSL)
Drilling Company: 2R Drilling	Date Started: 1/26/22 / Date Finished: 1/26/22
Drilling Equipment: CME 75 Truck-mounted Drill Rig	Completion Depth: 31.5 ft / Rock Depth:
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed -, Undisturbed 8, Core -
Casing Diameter (in): - / Casing Depth (ft): -	Water Level (ft.): First ▽, Completion ▼ -, 24 HR. ▼
Casing Hammer: - / Weight (lbs): - / Drop (in): -	Drilling Foreman:
Sampler: 2-inch O.D. Split-Barrel SPT, 2.5-inch I.D. Cal Mod	
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	Field Engineer: S. Wilkins

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		AC = 6-inches thick, No base.	0						
		Artificial Fill (af) Clayey SAND (SC), grayish brown, medium dense, moist, fine to medium sand, few asphalt and bedrock fragments [FILL].	1						
			2						
			3	S-1	CR	15	11 11 14		MC = 15.0% DD = 104.2 pcf
			4						
			5	S-2	CR	9	10 13 14		MC = 22.4% DD = 100.2 pcf
			6						
		Residual Soil Sandy CLAY (CL), olive gray to grayish brown, stiff, moist, fine to coarse sand.	7						
			8	S-3	CR	3	7 9 8		MC = 19.0% DD = 100.9 pcf
			9						
			10	S-4	CR	6	5 17 21		MC = 23.8% DD = 93.6 pcf Consolidation Test.
			11						
			12						
			13						
			14						
			15	S-5	CR	5	6 8 10		MC = 21.4% DD = 97.1 pcf
			16						
			17						
			18						
		Bedrock - Modelo Formation MUDSTONE, olive gray, moderately hard, very moist, thickly bedded to massive, highly weathered, carbonate veins.	19						
			20						

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Log of Boring **B-6** Sheet 2 of 2

Project	Project No.
Proposed Banner Self-Storage Facility	
Location	**Elevation and Datum**
20401 Ventura Boulevard	Approx. 953 (feet, MSL)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Water Content	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Limonite-stained joints.	20	S-6	CR	15	12 26 32		
			21						
			22						
			23						
			24						
		Olive gray lens of sandy siltsone, diatomaceous.	25	S-7	CR	10	14 20 26		MC = 55.6% DD = 73.2 pcf
			26						
			27						
			28						
			29						
		Grayish brown, few gypsum, slightly diatomaceous.	30	S-8	CR	15	11 21 31		MC = 35.6% DD = 83.4 pcf
		Total depth = 31.5 feet Groundwater not encountered. Borehole backfilled with soil cuttings and AC patched.	31						
			32						
			33						
			34						
			35						
			36						
			37						
			38						
			39						
			40						
			41						
			42						
			43						
			44						
			45						

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MOISTURE DENSITY TESTS

PROJECT Langan # 700107401 **JOB NO.** 2012-0057 **BY** LD **DATE** 02/23/22

Sample No.	B1/S1	B1/S4	B1/S6	B2/S1	B2/S2	B2/S6	B3/S1	B3/S2
Depth (ft)	5.0	20.0	30.0	2.5	5.0	10.0	2.5	10.0
Testing								
Soil Type	Brown, Silty Clay	Brown, Siltstone	Brown, Siltstone	Brown, Silty Clay	Brown, Siltstone	Brown, Siltstone	Brown, Silty Clay w. Gravel	Brown, Sandstone
Wet+Tare	798.9	992.9	758.8	680.8	828.5	948.6	742.5	883.7
No. Ring	5	6	5	4	5	6	4	5
Wet Weight	108.9	124.0	95.3	135.8	97.3	111.5	148.9	140.4
Dry Weight	88.9	84.6	65.5	100.2	65.9	74.9	136.6	127.7
Wet density	100.1	104.8	93.4	108.8	105.0	98.7	121.7	114.2
% Water	22.5	46.6	45.5	35.5	47.6	48.9	9.0	9.9
Dry Density	81.7	71.5	64.2	80.3	71.1	66.3	111.6	103.9
O.B.Press(psf)								
Sample No.	B4/S1	B4/S3	B5/S1	B5/S2	B5/S3			
Depth (ft)	2.5	10.0	2.5	5.0	10.0			
Testing								
Soil Type	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay			
Wet+Tare	940.2	827.5	888.0	882.1	834.5			
No. Ring	6	5	5	5	5			
Wet Weight	106.6	115.1	104.0	133.4	109.7			
Dry Weight	81.4	79.0	82.2	102.0	73.6			
Wet density	97.5	104.9	115.0	114.0	106.0			
% Water	31.0	45.7	26.5	30.8	49.0			
Dry Density	74.5	72.0	90.9	87.2	71.1			
O.B.Press(psf)								

Geo-Logic ASSOCIATES

MOISTURE DENSITY TESTS

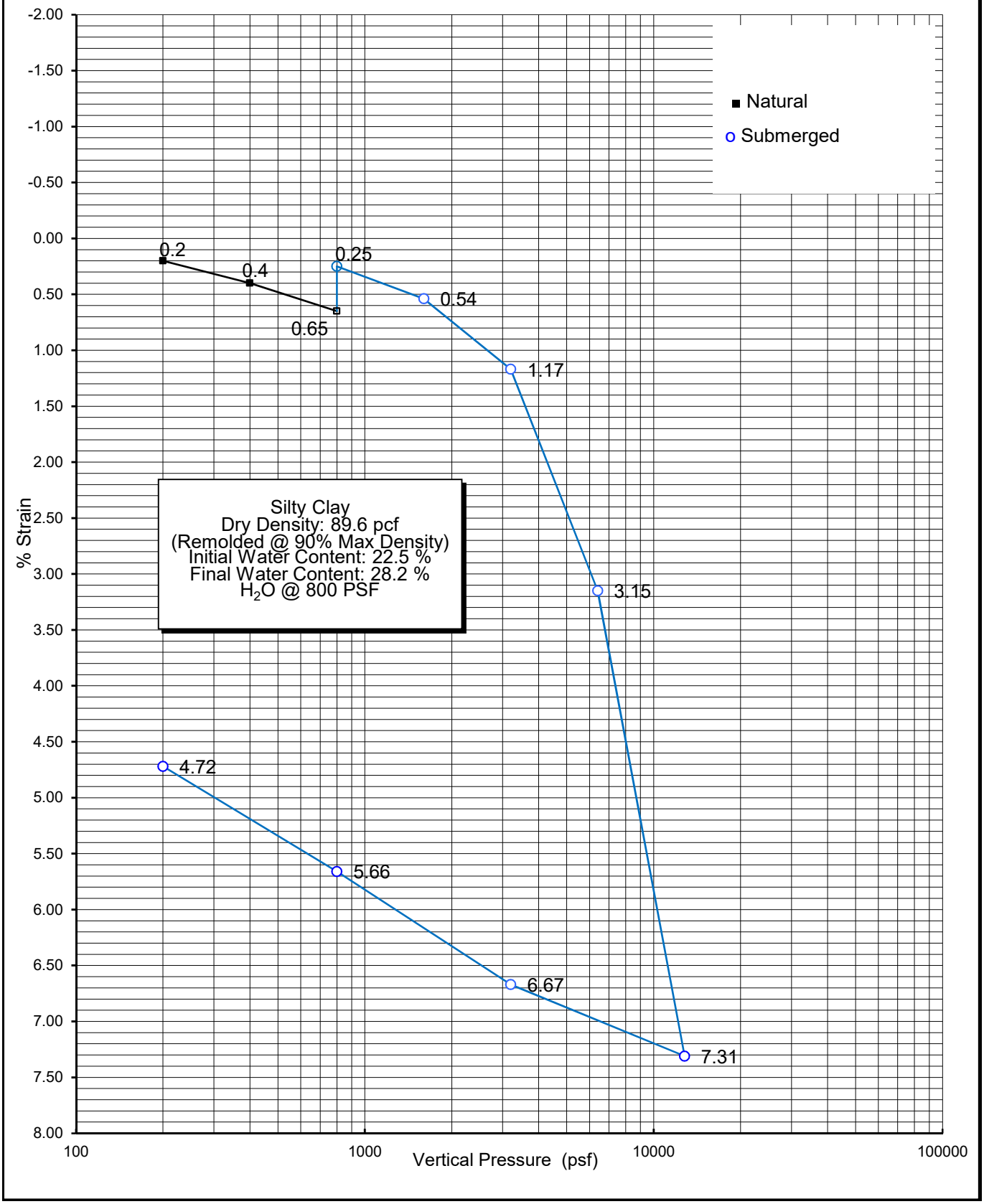
PROJECT Langan # 700107401 **JOB NO.** 2012-0057 **BY** LD **DATE** 02/23/22

Sample No.	B6/S1	B6/S2	B6/S3	B6/S4	B6/S5	B6/S6	B6/S7	
Depth (ft)	2.5	5.0	7.5	10.0	15.0	25.0	30.0	
Testing								
Soil Type	Brown, Silty Clay w. trace Gravel	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay	Brown, Silty Clay	
Wet+Tare	916.7	747.1	379.6	714.8	543.4	882.0	1052.4	
No. Ring	5	4	2	4	3	5	6	
Wet Weight	70.6	102.2	60.0	108.9	181.3	110.8	119.1	
Dry Weight	61.4	83.5	50.4	88.0	149.3	71.2	87.8	
Wet density	119.8	122.6	120.1	115.9	117.9	114.0	113.1	
% Water	15.0	22.4	19.0	23.8	21.4	55.6	35.6	
Dry Density	104.2	100.2	100.9	93.6	97.1	73.2	83.4	
O.B.Press(psf)								
Sample No.								
Depth (ft)								
Testing								
Soil Type								
Wet+Tare								
No. Ring								
Wet Weight								
Dry Weight								
Wet density								
% Water								
Dry Density								
O.B.Press(psf)								

Geo-Logic ASSOCIATES

CONSOLIDATION TEST - ASTM D2435

Boring / Sample No.	B-2 / Bulk	Depth:	0 - 5'	Date	02-14-22



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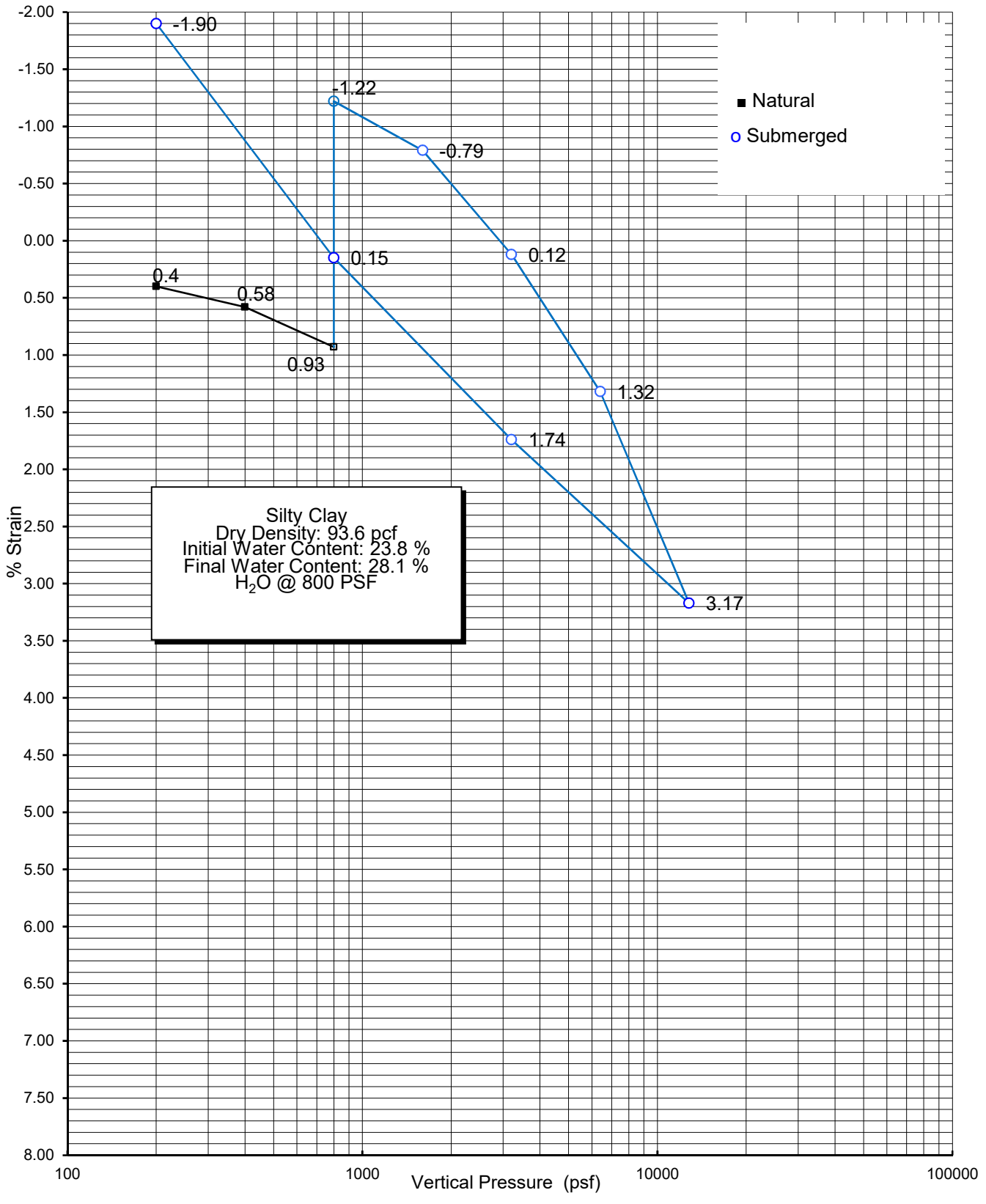
CONSOLIDATION TEST - ASTM D2435

Boring / Sample No.	B-6 / S-4	Depth:	10'	Date	02-14-22



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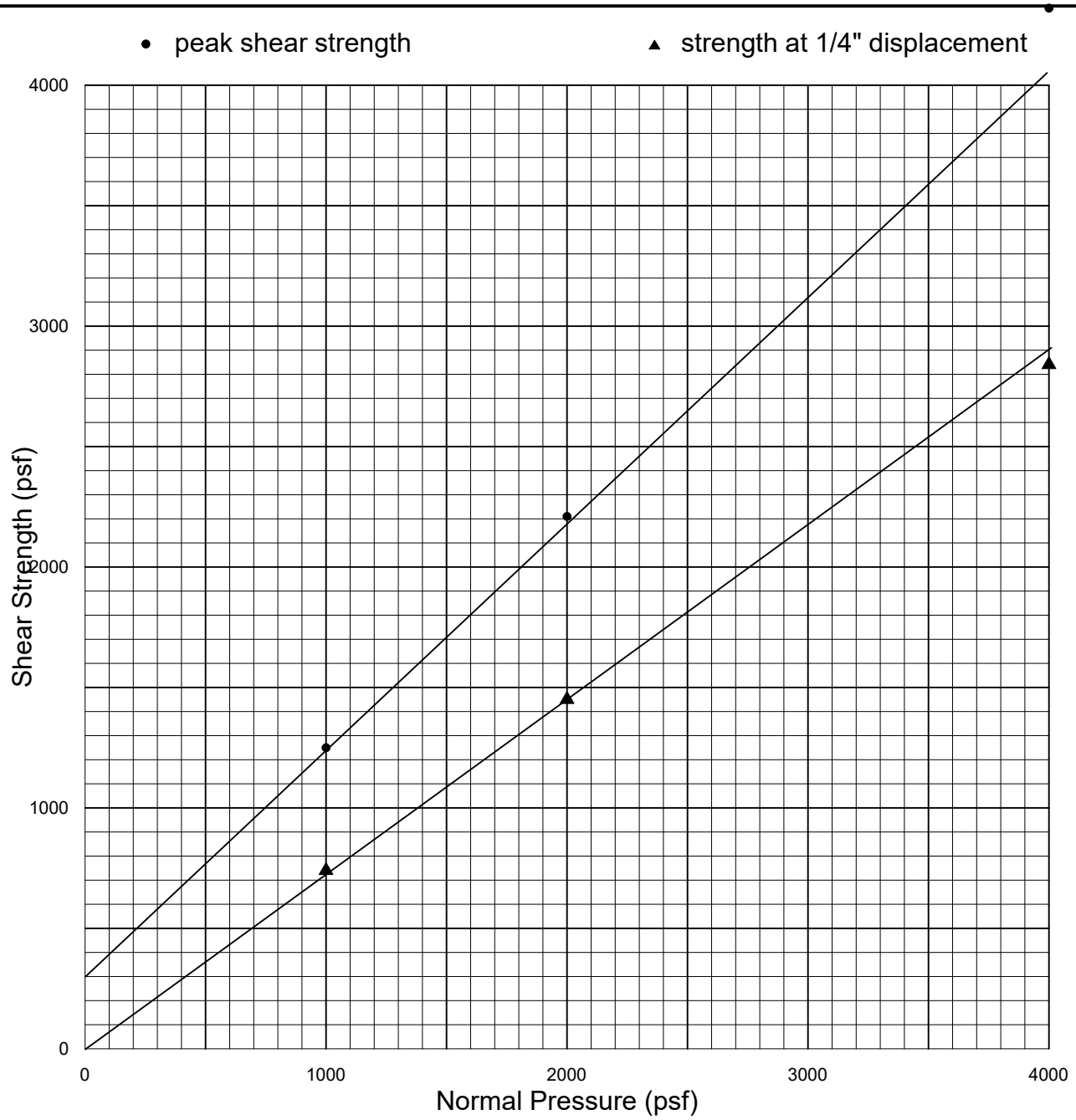
DIRECT SHEAR TEST - ASTM D-3080

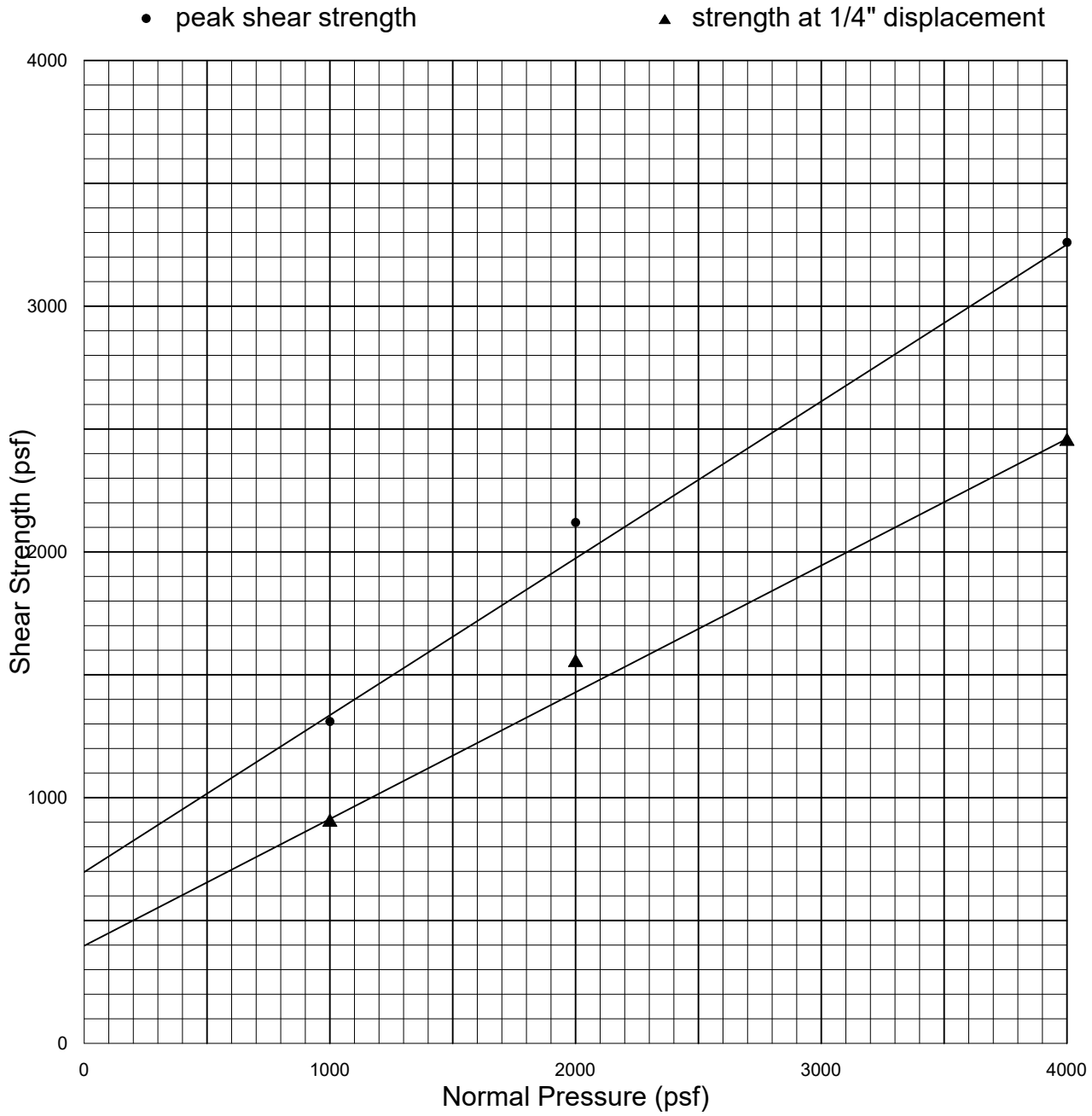


Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
B-1 / S-2	Undisturbed & Saturated	Siltstone	70.6	45.5	54.9

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1250 @ 0.0350"	740
2000	2210 @ 0.0450"	1450
4000	4320 @ 0.0550"	2840
	C = 300 psf	C = 0 psf
	ϕ = 43 deg.	ϕ = 36 deg.

DIRECT SHEAR TEST - ASTM D-3080



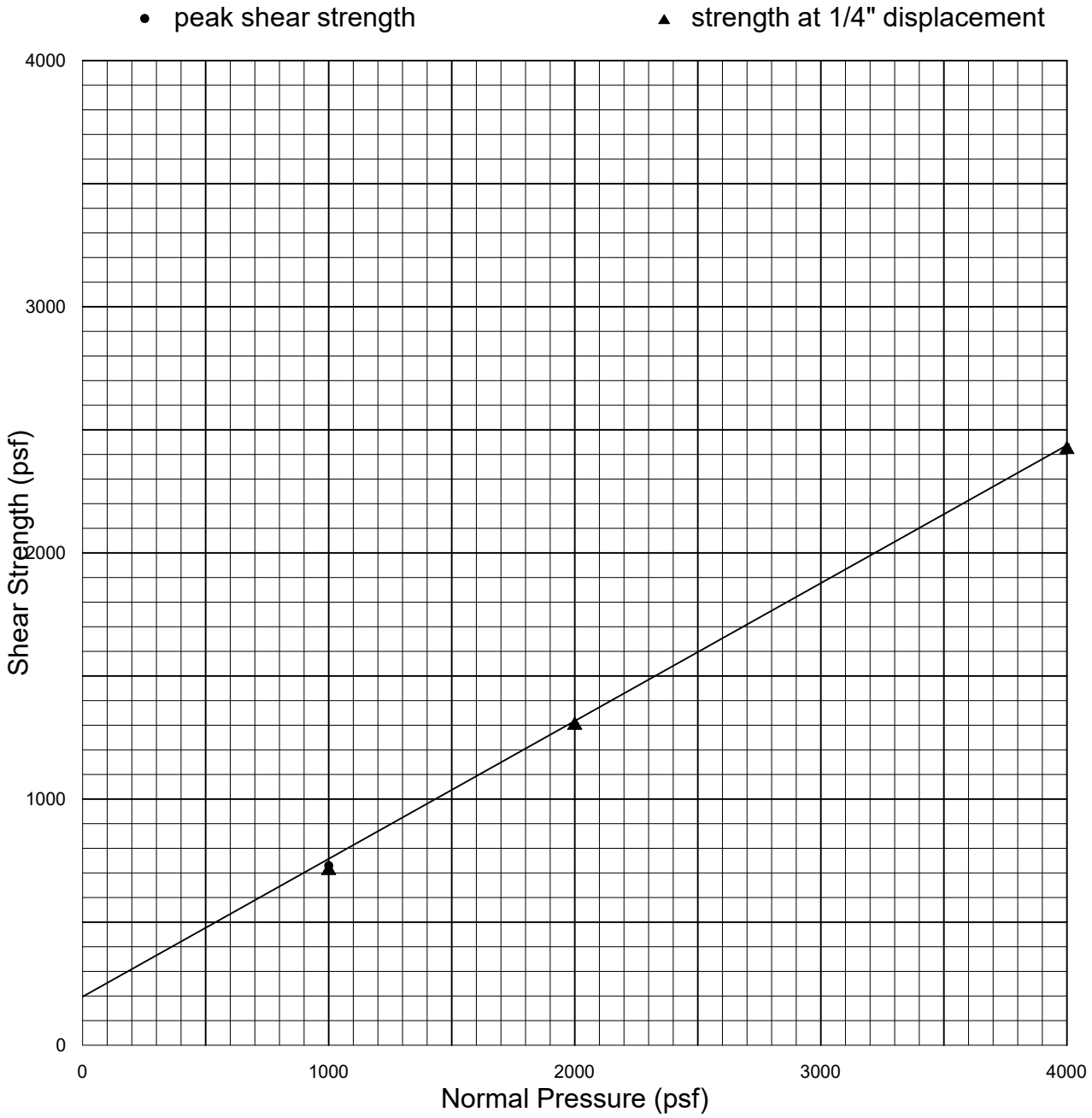
Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
B-1 / S-8	Undisturbed & Saturated	Siltstone	76.0	39.4	46.2

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1310 @ 0.0600"	900
2000	2120 @ 0.0550"	1550
4000	3260 @ 0.0500"	2450
	C = 700 psf	C = 400 psf
	ϕ = 32.5 deg.	ϕ = 26.5 deg.

Date: 02-23-2022

DIRECT SHEAR TEST - ASTM D-3080



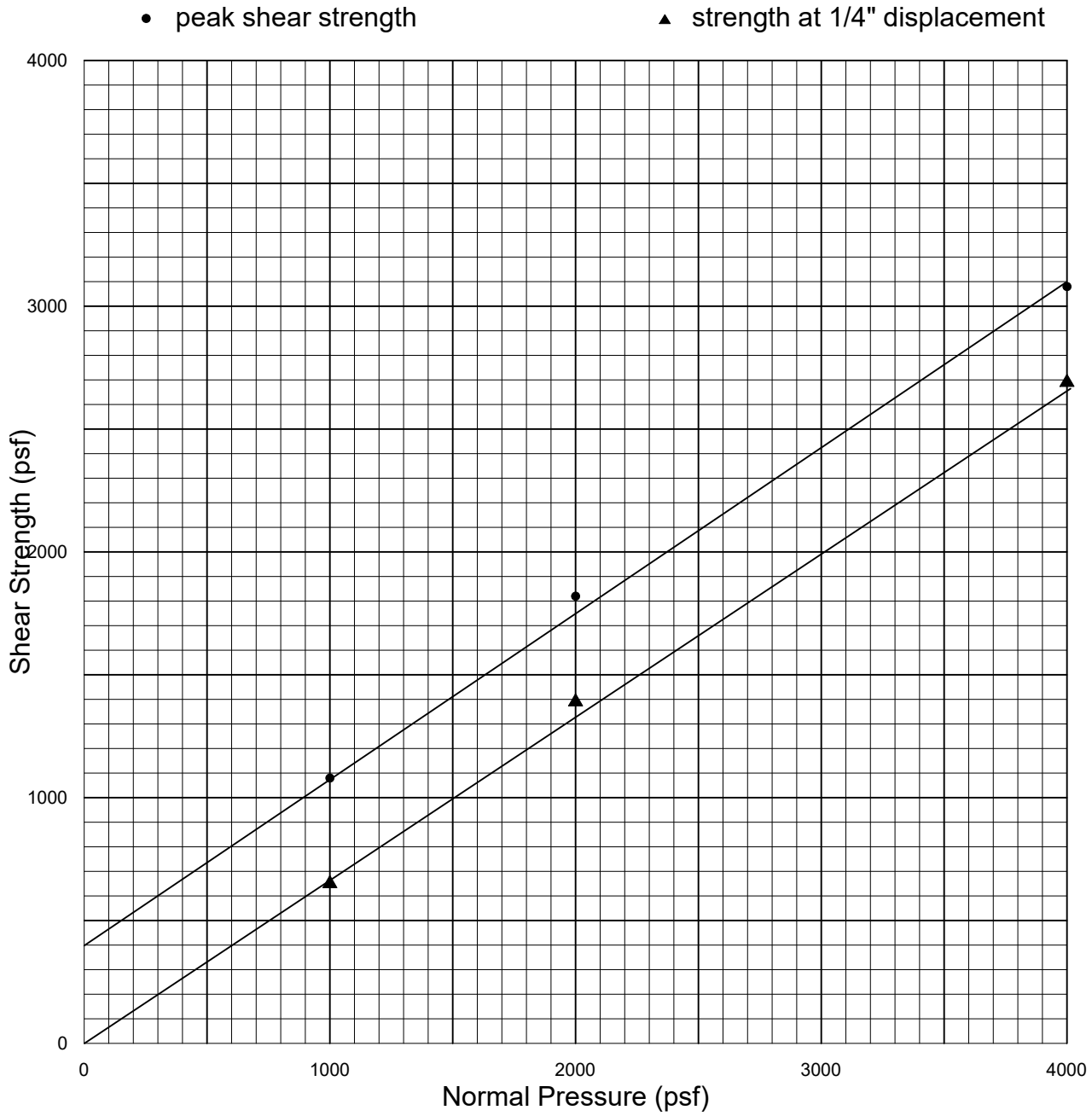
Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
B-2@0-5'	Remolded & Saturated	Silty Clay	89.6 (90% Max Density)	22.5	30.9

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	730 @ 0.0450"	710
2000	1300 @ 0.2500"	1300
4000	2420 @ 0.2350"	2420
	C = 200 psf	C = 200 psf
	ϕ = 29 deg.	ϕ = 29 deg.

Date: 02-23-2022

DIRECT SHEAR TEST - ASTM D-3080



Strain Rate: 0.0042 in. / min.

Sample	Type	Description	Dry Density (pcf)	Initial W.C. (%)	Final W.C. (%)
B-5 / S-2	Undisturbed & Saturated	Silty Clay	87.2	30.8	38.8

Normal Pressure (psf)	Peak Shear Strength (psf)	Ultimate Shear Strength (psf)
1000	1080 @ 0.0450"	650
2000	1820 @ 0.1000"	1390
4000	3080 @ 0.1250"	2690
	C = 400 psf	C = 0 psf
	ϕ = 33.5 deg.	ϕ = 33.5 deg.

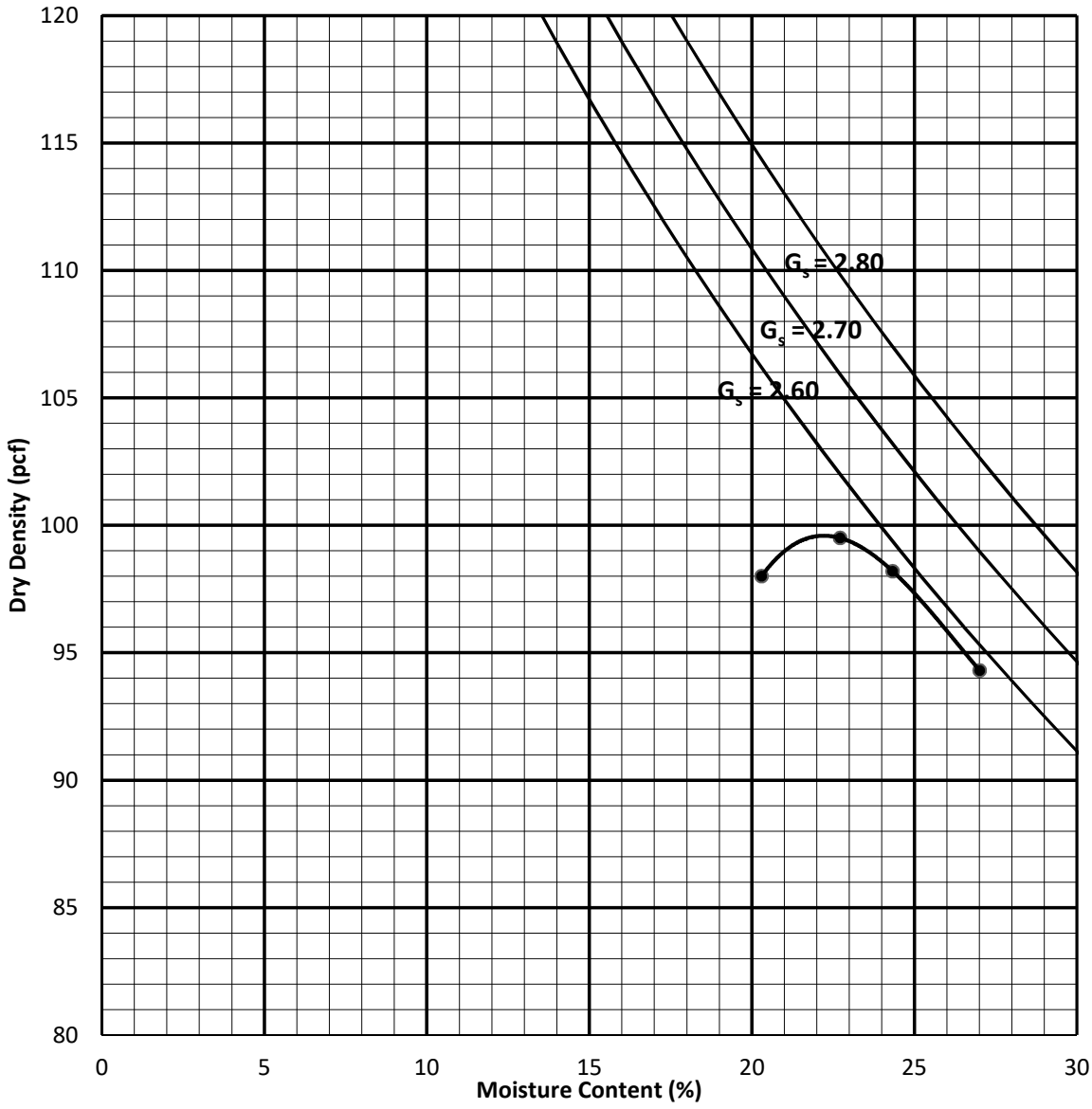
Date: 03-07-2022

COMPACTION TEST REPORT

Project: Langan # 700107401 **GLA No.** 2012-0057
Sample: B-2 @ 0 - 5' **Date:** 02/18/22
Description: Silty Clay w. Gravel **By:** LD

ASTM D1557	Method C	Volume (cf): 0.075		# Blows: 56	# Layers: 5
Specimen		A	B	C	D
Wet Weight (lbs)		8.98	9.16	9.16	8.84
Wet Density (pcf)		119.8	122.1	122.1	117.9
Moisture Content (%)		27.0	24.3	22.7	20.3
Dry Density (pcf)		94.3	98.2	99.5	98.0

Max. Dry Density : 99.5 pcf
Opt. Water Content: 22.5 %



Geo-Logic ASSOCIATES

SAMPLE NO.:	B-2 / Bulk																	
Depth:	0 - 5'																	
DIRECT SHEAR TEST (type)																		
Initial Moisture Content %																		
Dry Density (pcf)																		
Normal Stress (psf)																		
Peak Shear Stress (psf)																		
Ultimate Shear Stress (psf)																		
Cohesion (psf)																		
Internal Friction Angle (degrees)																		
EXPANSION TEST UBC STD 18-2																		
Initial Dry Density (pcf)																		
Initial Moisture Content %																		
Final Moisture Content %																		
Pressure (psf)																		
Expansion Index / Swell %																		
CORROSIVITY TEST																		
Resistivity (CTM 643) (ohm-cm)	950																	
pH (ASTM D1293)	7.7																	
CHEMICAL TESTS																		
Soluble Sulfate (CTM 417) (%)	0.3625																	
Chloride Content (CTM 422) (%)	0.0058																	
Wash #200 Sieve (ASTM-1140) %																		
Sand Equivalent (ASTM D2419)																		

Geo-Logic ASSOCIATES

EXPANSION INDEX - UBC 18-2 & ASTM D 4829-88

PROJECT Langan # 700107401 JOB NO. 2012-0057

Sample	B-2 / Bulk		By	LD	Sample			By	
Sta. No.					Sta. No.				
Soil Type	Brown, Silty Clay				Soil Type				
Date	Time	Dial Reading	Wet+Tare	574.8	Date	Time	Dial Reading	Wet+Tare	
2/20/2022	13:00	0.3092	Tare	219.7				Tare	
		H2O	Net Weight	355.1				Net Weight	
2/21/2022	10:00	0.2633	% Water	16				% Water	
			Dry Dens.	92.8				Dry Dens.	
			% Max					% Max	
			Wet+Tare	625.4				Wet+Tare	
			Tare	219.7				Tare	
			Net Weight	405.7				Net Weight	
INDEX	46	4.6%	% Water	32.5	**INDEX**			% Water	

Sample			By		Sample			By	
Sta. No.					Sta. No.				
Soil Type					Soil Type				
Date	Time	Dial Reading	Wet+Tare		Date	Time	Dial Reading	Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
			% Water					% Water	
			Dry Dens.					Dry Dens.	
			% Max					% Max	
			Wet+Tare					Wet+Tare	
			Tare					Tare	
			Net Weight					Net Weight	
INDEX			% Water		**INDEX**			% Water	

Geo-Logic ASSOCIATES

'R' VALUE CA 301

Client: Langan Date: 2/23/22 By: LD

Client's Job No.: 700107401 Sample : B-2 @ 0 - 5'

GLA Reference: 2012-0057 Soil Type: Brown, Silty Clay w. Gravel

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	**90**	**70**	**150**	
Initial Moisture Content	%	**16.2**	**16.2**	**16.2**	
Water Added	ml	**50**	**65**	**35**	
Moisture at Compaction	%	21.0	22.5	19.6	
Sample & Mold Weight	gms	**3138**	**3140**	**3130**	
Mold Weight	gms	**2094**	**2103**	**2098**	
Net Sample Weight	gms	1044	1037	1032	
Sample Height	in.	**2.52**	**2.528**	**2.477**	
Dry Density	pcf	103.7	101.5	105.6	
Pressure	lbs	**4260**	**3020**	**7230**	
Exudation Pressure	psi	339	240	576	
Expansion Dial	x 0.0001	**42**	**22**	**79**	
Expansion Pressure	psf	182	95	342	
Ph at 1000lbs	psi	**36**	**42**	**29**	
Ph at 2000lbs	psi	**85**	**98**	**63**	
Displacement	turns	**4.32**	**4.53**	**4.08**	
R' Value		34	26	49	
Corrected 'R' Value		**34**	**26**	**49**	

FINAL 'R' VALUE	
By Exudation Pressure (@ 300 psi):	**31**
By Epansion Pressure :	**27**
TI = 5	

Geo-Logic ASSOCIATES

APPENDIX B

Prior Field Explorations and Laboratory Results

Field Explorations and Laboratory Testing
Applied Earth Sciences (2015)

APPENDIX I
METHOD OF FIELD EXPLORATION

In order to define the subsurface conditions, five borings were drilled on the site. The approximate locations of the drilled borings are shown on the enclosed Site Plan. The borings were drilled with a hollow stem drilling machine, extending to some 66 feet below grade.

Continuous logs of the subsurface conditions, as encountered in the test borings, were recorded during the field work and are presented on Figure Nos. I-1 through I-5 within this Appendix. These figures also show the number and approximate depths of each of the recovered soil samples.

With hollow stem drilling, relatively undisturbed samples of the subsoil were obtained by driving a steel sampler with successive drops of a 140-pound sampling hammer free-falling a vertical distance of about 30 inches. The number of blows required for one foot of sampler penetration was recorded at the time of drilling and are shown on the log of exploratory borings. The relatively undisturbed soil samples were retained in brass liner rings 2.5 inches in diameter and 1.0 inch in height.

Field investigation for this project was performed on September 23, 2015. The materials excavated from the test borings were placed back and compacted upon completion of the field work. Such materials may settle. The owner should periodically inspect these areas and notify this office if the settlements create a hazard to person or property.

10606052017361115

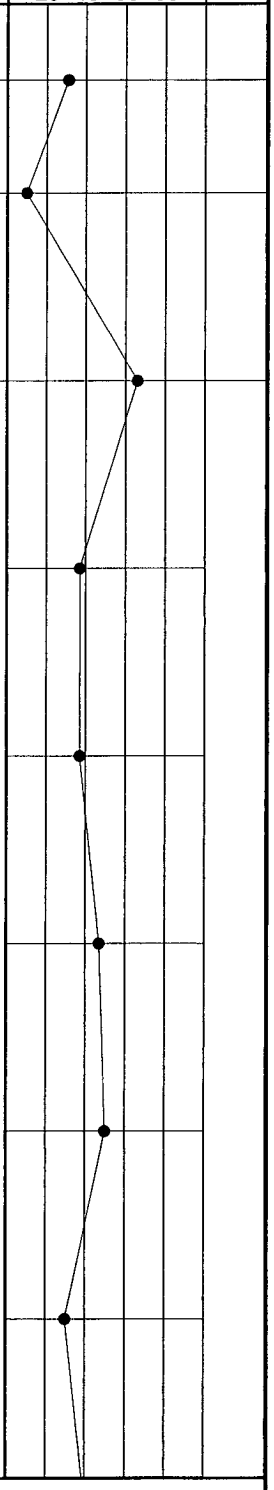
Applied Earth Sciences

LOG OF BORING NO.1

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Front Center of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200
0			(ML) FILL: Moderately compact, slightly moist, dark gray, sandy clayey silt.					
			(CL) FILL: Clay, Moderately compact, moist, dark gray, sandy clay.		25	31	92	
5			(BDRCK) SANDSTONE: Hard, slightly moist, golden tan, fine sand, slight silt.		75	10	105	
10			(BDRCK) MUDSTONE: Hard, very moist, dark brown, mudstone.		100-10"	66	59	
15			(BDRCK) Grades to lighter brown.		85	37	83	
20			(BDRCK) Grades to brown to dark brown mixture, with white crystals.		100	37	83	
25			(BDRCK) Grades to dark brown.		80	47	67	
30			(BDRCK) Grades to similar as above.		100	50	75	
35			(BDRCK) Grades to similar as above.		100-10"	30	88	



COMPLETION DEPTH: 66
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

I-1.1

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

Applied Earth Sciences

LOG OF BORING NO.1

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Front Center of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
40			(BDRCK) Grades to similar as above.		100-6"	40	85		
45			(BDRCK) Grades to similar as above.		100-6"	37	83		
50			(BDRCK) Grades to similar as above.		100-8"	32	88		
55			(BDRCK) Grades to similar as above.		100-7"	40	78		
60			(BDRCK) Grades to similar as above.		100-6"	38	82		
65			(BDRCK) Grades to similar as above.		100-7"	33	88		
			END @ 66' NO WATER PERCOLATION INSTALLED (40-50')						
70									
75									

COMPLETION DEPTH: 66
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

Applied Earth Sciences

LOG OF BORING NO.2

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Front Left Corner of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(ML) FILL: Moderately compact, slightly moist, dark gray, sandy clayey silt.						
			(CL) FILL: Clay, moderately compact, moist, brown, gravelly sandy clay.		20	18	105		
5			(CL) CLAY: Firm, slightly moist, dark brown, sandy clay.		25	22	105		
10			(CL) Grades to similar as above.		27	20	89		
15			(BDRCK) MUDSTONE: Residual soil/ weathered bedrock		24	20	-		
20			(BDRCK) MUDSTONE: Weathered, moist, grayish brown to orangish brown, mudstone with clay		40	-	-		
25			(BDRCK) MUDSTONE: Stiff, very moist, grayish brown to orangish brown,		27	63	64		
30			(BDRCK) Grades to brown with white crystals.		28	37	90		
35			(BDRCK) Grades to similar as above.		100-10"	39	80		

COMPLETION DEPTH: 41
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

Applied Earth Sciences

LOG OF BORING NO.2

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Front Left Corner of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
40			(BDRCK) Grades to black.		100	39	84		
			END @ 41' NO WATER HOLE BACKFILLED						
45									
50									
55									
60									
65									
70									
75									

COMPLETION DEPTH: 41
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

Applied Earth Sciences

LOG OF BORING NO.3

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Rear Left Corner of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - • 20 40 60 80	% -200
0			(ML) FILL: Moderately compact, slightly moist, dark gray, sandy clayey silt.						
			(CL) FILL: Clay, moderately compact, moist, brown, gravelly sandy clay.		23	30	84		
5			(BDRCK) SANDSTONE: Hard, slightly moist, golden brown, sandstone with white fragments.		100-10"	18	108		
10			(BDRCK) Grades to similar as above.		100	7	100		
15			(BDRCK) MUDSTONE: Hard, very moist, black, mudstone with white spots.		100-10"	46	75		
20			(BDRCK) Grades to similar as above.		100-10"	47	71		
25			(BDRCK) Grades to similar as above.		100-10"	53	66		
			END @ 26' NO WATER HOLE BACKFILLED						
30									
35									

COMPLETION DEPTH: 26
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

Applied Earth Sciences

LOG OF BORING NO.4

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Front Right Corner of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(ML) FILL: Moderately compact, slightly moist, dark gray, sandy clayey silt.						
			(CL) CLAY: Stiff, very moist, brown, silty gravelly clay with white crystals.		30	29	93		
5			(BDRCK) MUDSTONE: Very stiff, very moist, brown, mudstone.		45	33	93		
10			(BDRCK) Grades to black with white spots.		80	42	75		
15			(BDRCK) Grades to similar as above.		100-8"	50	69		
20			(BDRCK) Grades to similar as above.		100-6"	21	99		
			END @ 21' NO WATER HOLE BACKFILLED						
25									
30									
35									

COMPLETION DEPTH: 21
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

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LOG OF BORING NO.5

15-485-22
20401 West Ventura Blvd

Type: Hollow Stem Auger with 140 lb Hammer Logged by: Marshall
Location: Center Middle of Property

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SPT BLOWS/FT	BLOWS PER FT	% Moisture	UNIT DRY WT LB/CU FT	% -200 - △ % Moisture - ● 20 40 60 80	% -200
0			(ML) FILL: Moderately compact, slightly moist, dark gray, sandy clayey silt.						
			(CL) CLAY: Stiff, moist, brown, sandy silty clay.		26	21	106		
5			(CL) CLAY: Stiff, very moist, dark brown to gray, gravelly sandy clay.		20	47	75		
10			(BDRCK) MUDSTONE: Hard, very moist, black, mudstone.		100-11"	56	67		
15			(BDRCK) SANDSTONE: Hard, moist, goden brown, sandstone.		100	15	105		
			END @ 16' NO WATER HOLE BACKFILLED						
20									
25									
30									
35									

COMPLETION DEPTH: 16
DATE: September 23, 2015

DEPTH TO WATER> INITIAL:
FINAL:

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAME
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Organic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
				CL	Organic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Organic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Organic clays of high plasticity, fat clays.
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

UNIFIED SOIL CLASSIFICATION SYSTEM

JOB NAME : Proposed Hotel Building Project
20401 West Ventura Blvd
Los Angeles, CA 91367

JOB No. 15-485-22

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FIGURE No. I-6

APPENDIX II
LABORATORY TESTING PROCEDURES

MOISTURE DENSITY

The moisture-density information provides a summary of soil consistency for each stratum and can also provide a correlation between soils found on this site and other nearby sites. The dry unit weight and field moisture content were determined for each undisturbed sample, and the results are shown on the log of exploratory borings.

SHEAR AND RE-SHEAR TESTS

After the samples are pre-soaked overnight under initial confining pressure, a range of normal stresses are applied vertically, and the shear strengths are progressively determined under each load in order to determine the internal angle of friction and the cohesion of the sample. After application of each of the confining pressures, and before the shearing tests, sufficient amount of time is allowed for any excess pore pressure to dissipate. During the course of shear test, the sample is allowed to undergo volume change under a given confining pressure. Under each load, the direct sear tests are continued until the ultimate strength or about 3 percent strain (whichever is lower) is reached. The sample is then allowed to relax to remove the major portion of the viscous component of the shear strength. It should be noted that due to normal disturbance during sampling and laboratory extruding, the measured bedrock strengths are normally significantly lower than the actual values.

In order to determine the strength of the bedrock along bedding, foliation or joint planes or landslide debris strengths, the sample is soaked overnight under initial confining pressure. The sample is then re-sheared several times until the least strengths are obtained. During typical testing, the shearing of the samples are continued until the residual strengths are developed (the shear strengths remain constant, after the peak has been reached, or about 5 percent strain corresponding to approximately 0.100 inches of shearing deformation has occurred). At this point, the tests are stopped. The samples are then pushed back to their original position. The shear test procedure is then repeated along the previously sheared plane. This procedure is repeated several times until constant residual strengths are obtained.

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

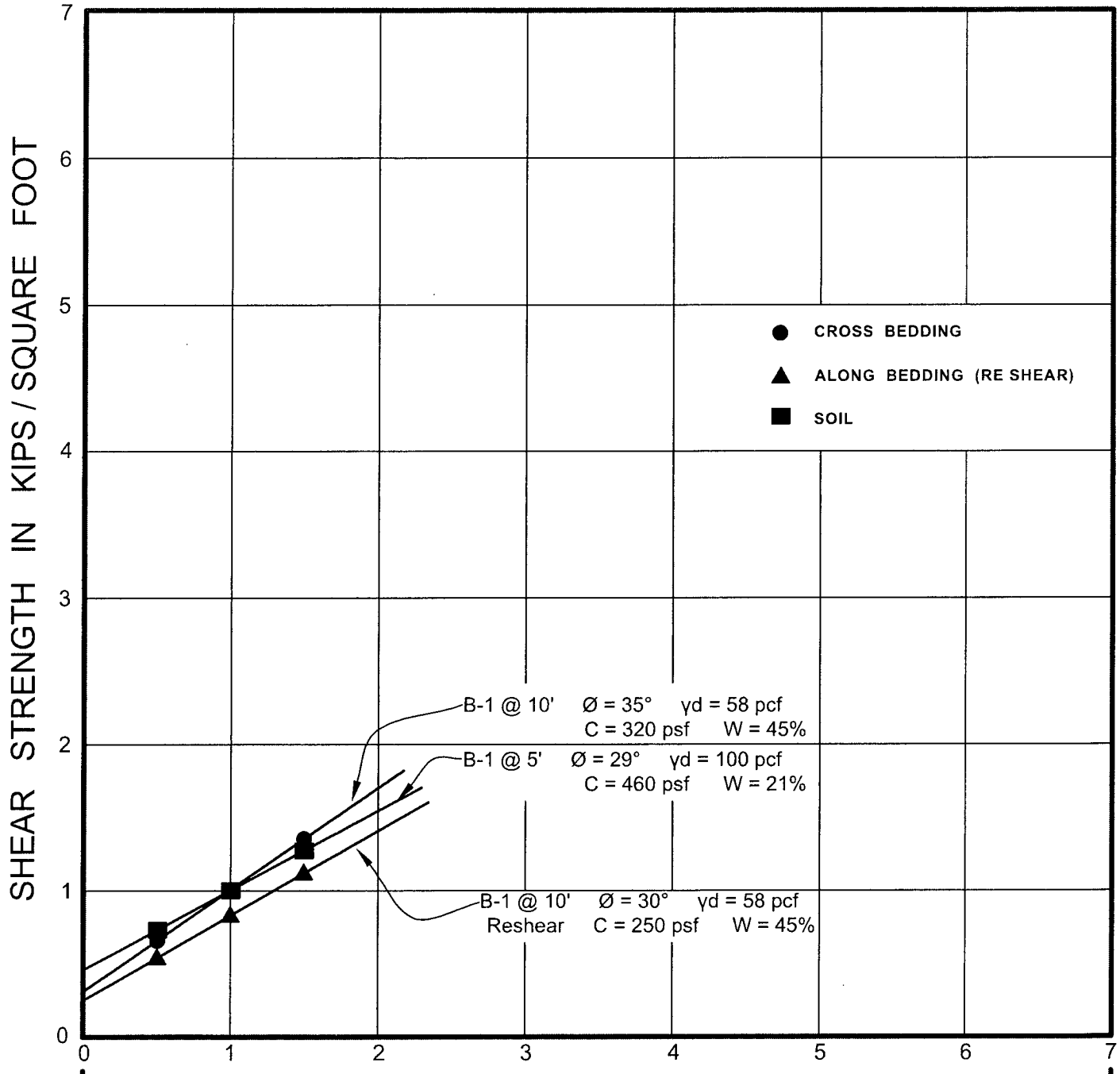
CONSOLIDATION

The apparatus used for the consolidation tests is designed to receive the undisturbed brass ring of soil as it comes from the field. Loads were applied to the test specimen in several increments, and the resulting deformations were recorded at selected time intervals. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition or release of water.

Undisturbed specimens were tested at the field and added water conditions. The test results are shown on Figure No. II-2 within this Appendix.

1060605201736115

NORMAL STRESS IN KIPS / SQUARE FOOT

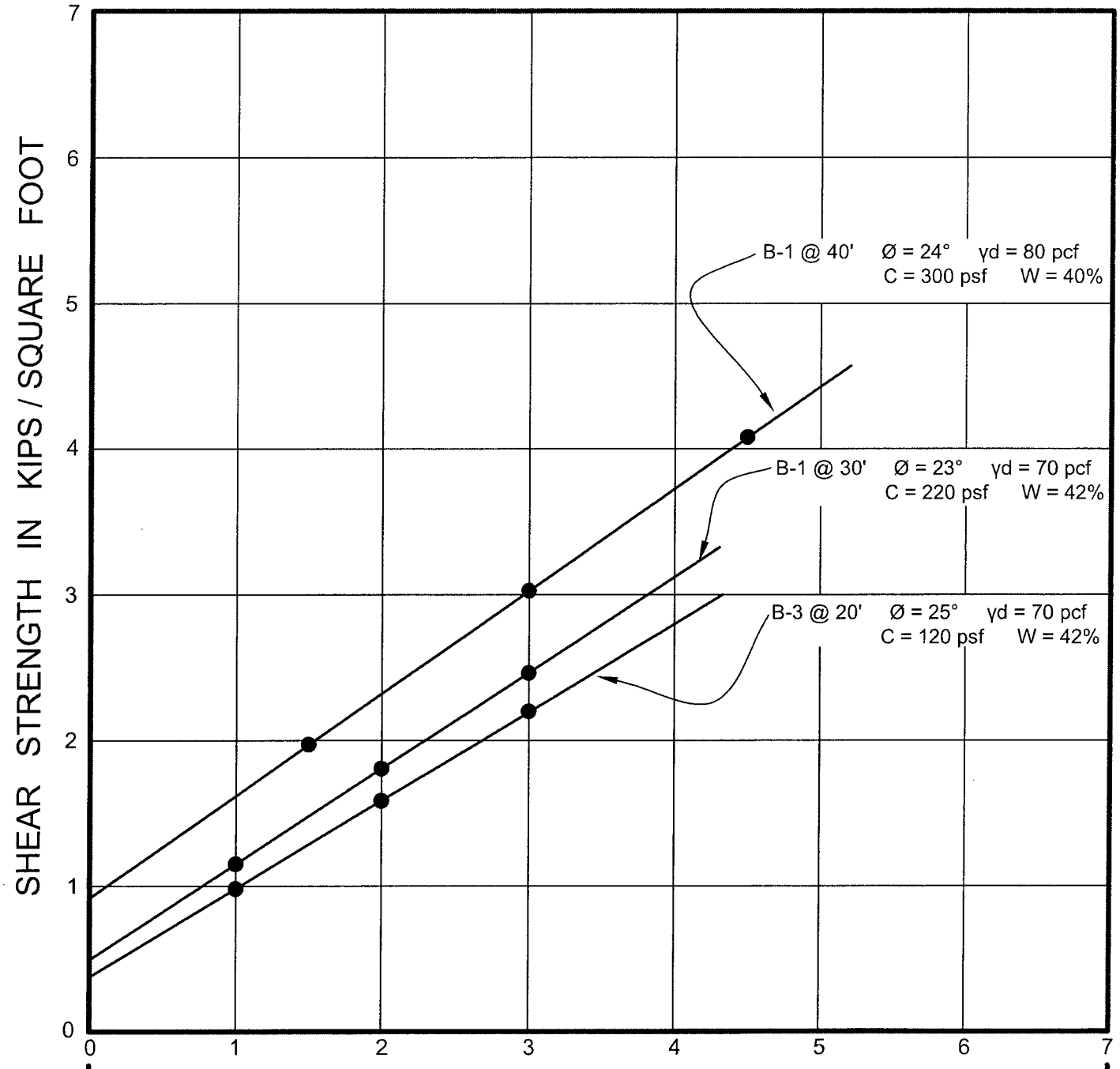


DIRECT SHEAR TESTS

JOB NAME : Proposed Hotel Building Project 20401 West Ventura Blvd Los Angeles, CA 91367	JOB No. 15-485-22
Applied Earth Sciences GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS www.aessoil.com (818) 552-6000	FIGURE No. II - 1A

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

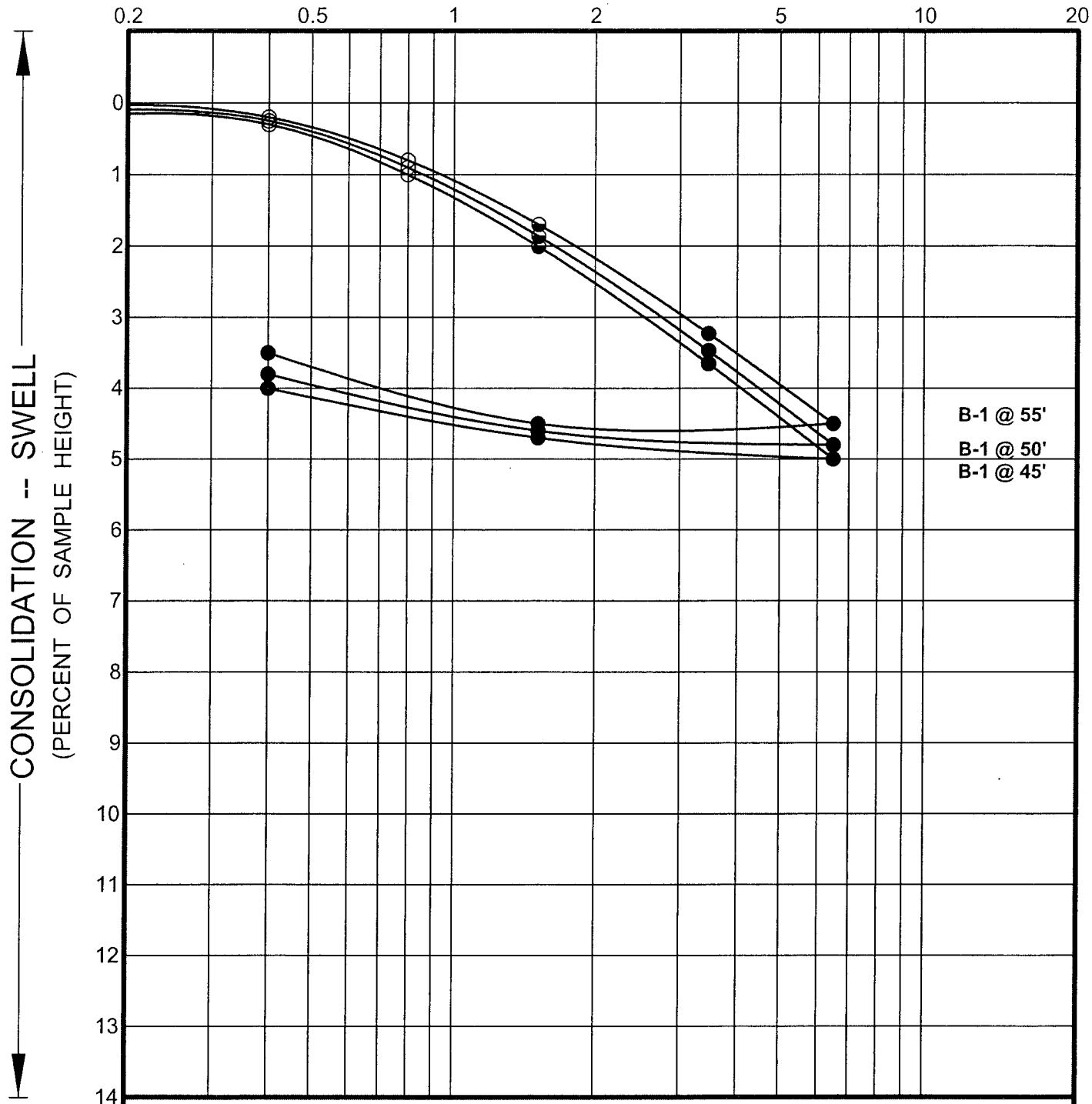
NORMAL STRESS IN KIPS / SQUARE FOOT



DIRECT SHEAR TESTS

JOB NAME : Proposed Hotel Building Project 20401 West Ventura Blvd. Los Angeles, CA 91367	JOB No. 15-485-22
Applied Earth Sciences GEOTECHNICAL . GEOLOGY . ENVIRONMENTAL ENGINEERING CONSULTANTS www.aessoil.com (818) 552-6000	FIGURE No. II - 1B

PRESSURE IN KIPS PER SQUARE FOOT



SWELL - CONSOLIDATION TESTS

JOB NAME :	Proposed Hotel Building Project 20401 West Ventura Blvd Los Angeles, CA 91367	JOB No. 15-485-22
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		FIGURE No. II - 2

1 0 6 0 6 0 5 2 0 1 7 3 6 1 1 5

Field Explorations and Laboratory Testing
LeRoy Crandall & Associates (1965)

JOB A-652-10-B DATE 9-18-65 DR T.V.H. O.E. GL CHKD. [illegible]

0480090131

BORING 1

DATE DRILLED: July 9, 1965

EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 950.5*

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	SAMPLE		
950					ML	CLAYEY SILT - brown
		25.0	79	■		
	5	24.4	87	■		
945						10 to 15% gravel
		24.4	84	■		
		40.5	66	■		
	10					
940						SILTSTONE - weathered, laminated, brown
		43.0	70	■		
	15					
935		60.5	60	■		
	20					

POSSIBLE FILL

NOTE: Water not encountered; no caving.

*Elevations refer to datum of reference drawing, see Plate 1.

LOG OF BORING

LEROY CRANDALL & ASSOCIATES

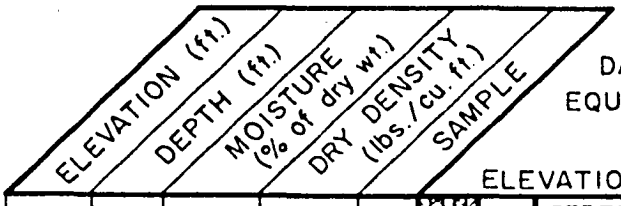
PLATE A-1A

JOB A-GE 249-B DATE 9-15-65 DR. T.V.H. O.E. CHKD. [illegible]

0480090132

BORING 2

DATE DRILLED: July 9, 1965
EQUIPMENT USED: 18"-Diameter Bucket



ELEVATION 947.6

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	SAMPLE	
					SILTSTONE - weathered, laminated, mottled grey and brown
945		53.0	59	■	
		56.2	53	■	
	5				
		50.9	51	■	
940		55.3	52	■	
	10				SANDSTONE - weathered, brown
		12.6	98	■	
935					
	15				

NOTE: Water not encountered; no caving.

BORING 3

DATE DRILLED: July 9, 1965
EQUIPMENT USED: 18"-Diameter Bucket

ELEVATION 944.0

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	SAMPLE	
					SILTSTONE - weathered, laminated, light brown
		34.0	58	■	
940		45.0	61	■	
	5				
		54.0	60	■	
					Layer of SANDSTONE
		61.6	58	■	Mottled grey and brown
935					
	10				
		8.1	91	■	Layer of SANDSTONE
930					
	15	37.5	80	■	

NOTE: Water not encountered; no caving.

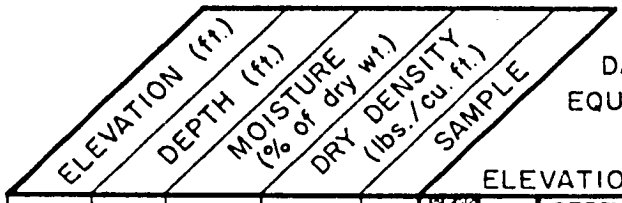
LOG OF BORING

LEROY CRANDALL & ASSOCIATES

PLATE A-1B

JOB A-65 2498 DATE 9-18-65 DR TVH O.E. am CHKD. [illegible]

0 4 8 0 0 9 0 1 3 3



BORING (PIT) 4

DATE DRILLED: July 9, 1965
EQUIPMENT USED: Hand Shovel

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	SAMPLE	
					ELEVATION 946.7
					SILTSTONE - weathered, light brown
945					NOTE: Water not encountered; no caving.
	5				
940					
	10				

BORING (PIT) 5

DATE DRILLED: July 9, 1965
EQUIPMENT USED: Hand Shovel

ELEVATION (ft.)	DEPTH (ft.)	MOISTURE (% of dry wt.)	DRY DENSITY (lbs./cu. ft.)	SAMPLE	
					ELEVATION 950.7
950					SILTSTONE - weathered, light brown
					NOTE: Water not encountered; no caving.
	5				
945					
	10				

LOG OF BORING

LEROY CRANDALL & ASSOCIATES

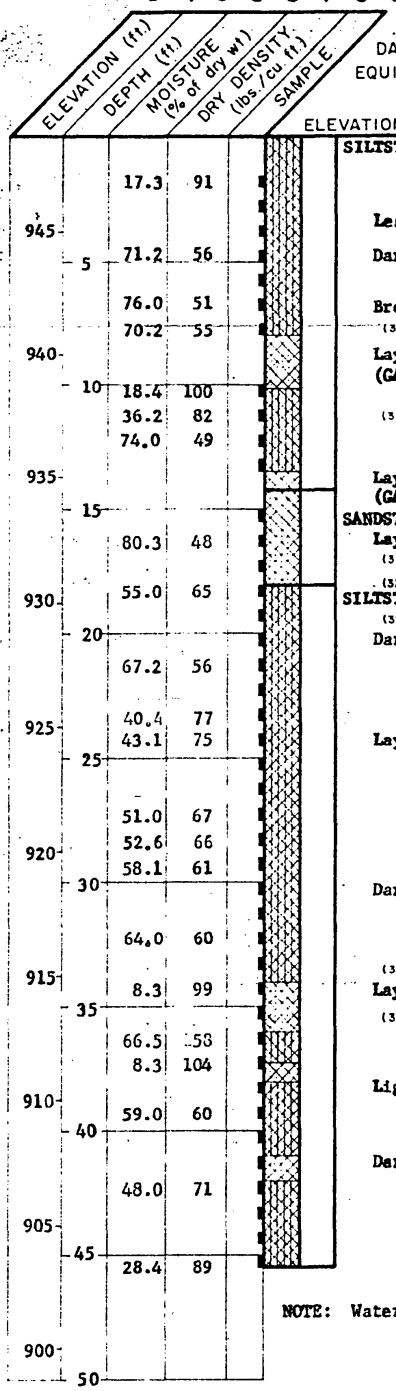
PLATE A-1C

0 4 0 0 0 7 0 0 1 3 4

BORING 6

DATE DRILLED: August 31, 1965

EQUIPMENT USED: 24"-Diameter Bucket



SILTSTONE - weathered, laminated, brown

Less weathered

Dark grey

Brown and light brown

(340°-12°)

Layer of SANDSTONE
(CAD AND CHOPPING BUCKET USED)

(325°-10°)
ANGLE OF DIP BELOW HORIZONTAL
DIRECTION OF DIP (AZIMUTH)

Layer of highly cemented calcareous SHALE
(CAD AND CHOPPING BUCKET USED)

SANDSTONE - cemented, greyish brown

Layers of SILTSTONE

(321°-12°)

(326°-6°)

SILTSTONE - laminated, brown

(324°-8°)

Dark grey

Layers of SANDSTONE

Dark greyish-brown

(325°-10°)

Layers of SANDSTONE

(325°-12°)

Light brownish-grey

Dark grey

NOTE: Water not encountered; no caving.

JOB [illegible] DATE [illegible] T.V.H. O.E. SC CHKD. [illegible]

LOG OF BORING

LEROY CRANDALL & ASSOCIATES

PLATE A-1D

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt. of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amt. of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT OR CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

NO. 200 NO. 40 NO. 10 NO. 4 3/4 in. 3 in. (12 in.)

U. S. STANDARD SIEVE SIZE

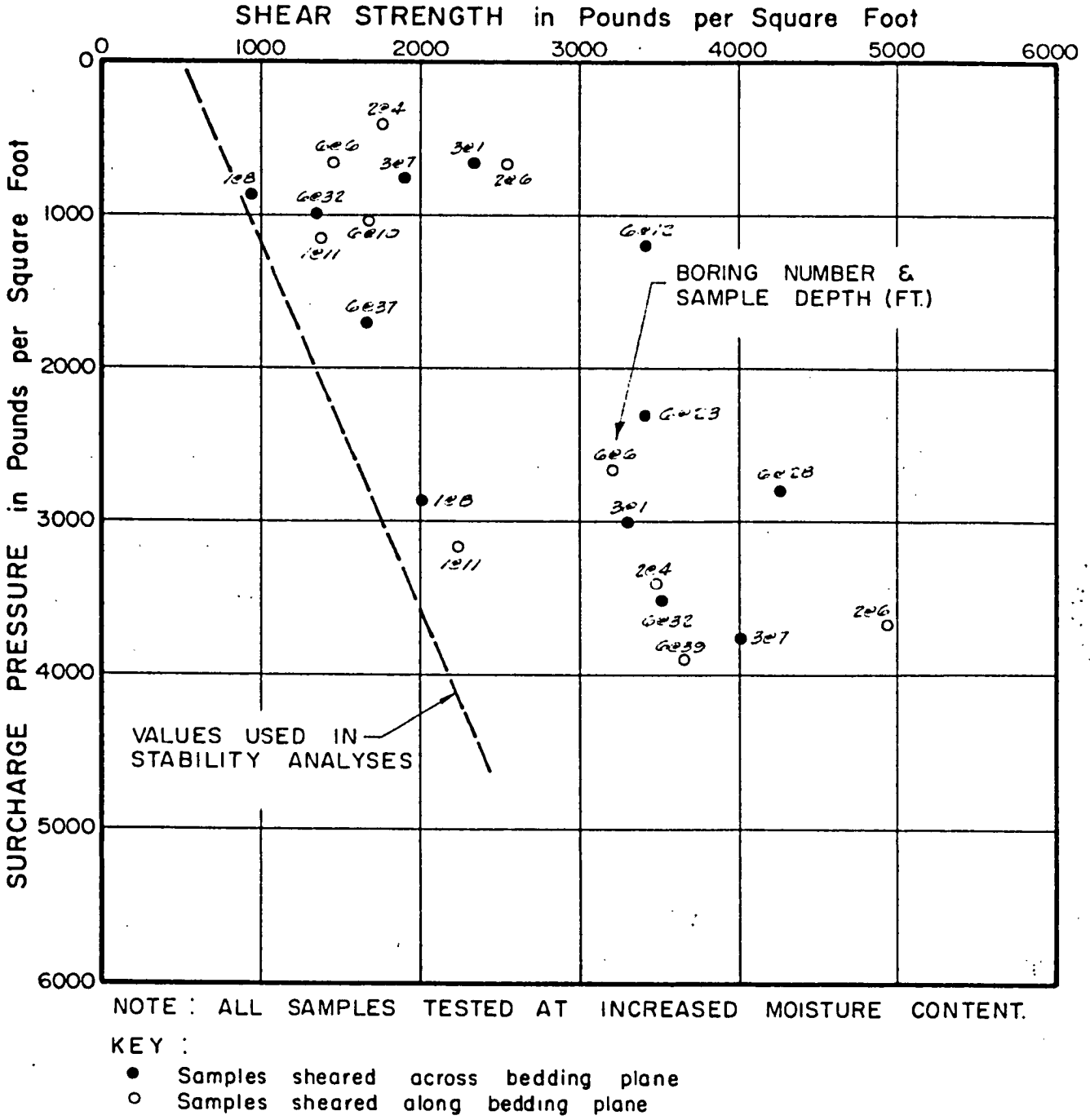
UNIFIED SOIL CLASSIFICATION SYSTEM

Reference:
The Unified Soil Classification System, Corps of Engineers, U. S. Army Technical Memorandum No. 3-357, Vol. I, March, 1953. (Revised April, 1960)

LEROY CRANDALL & ASSOCIATES

PLATE A-2

0480090135



NOTE : ALL SAMPLES TESTED AT INCREASED MOISTURE CONTENT.

KEY :

- ● Samples sheared across bedding plane
- ○ Samples sheared along bedding plane

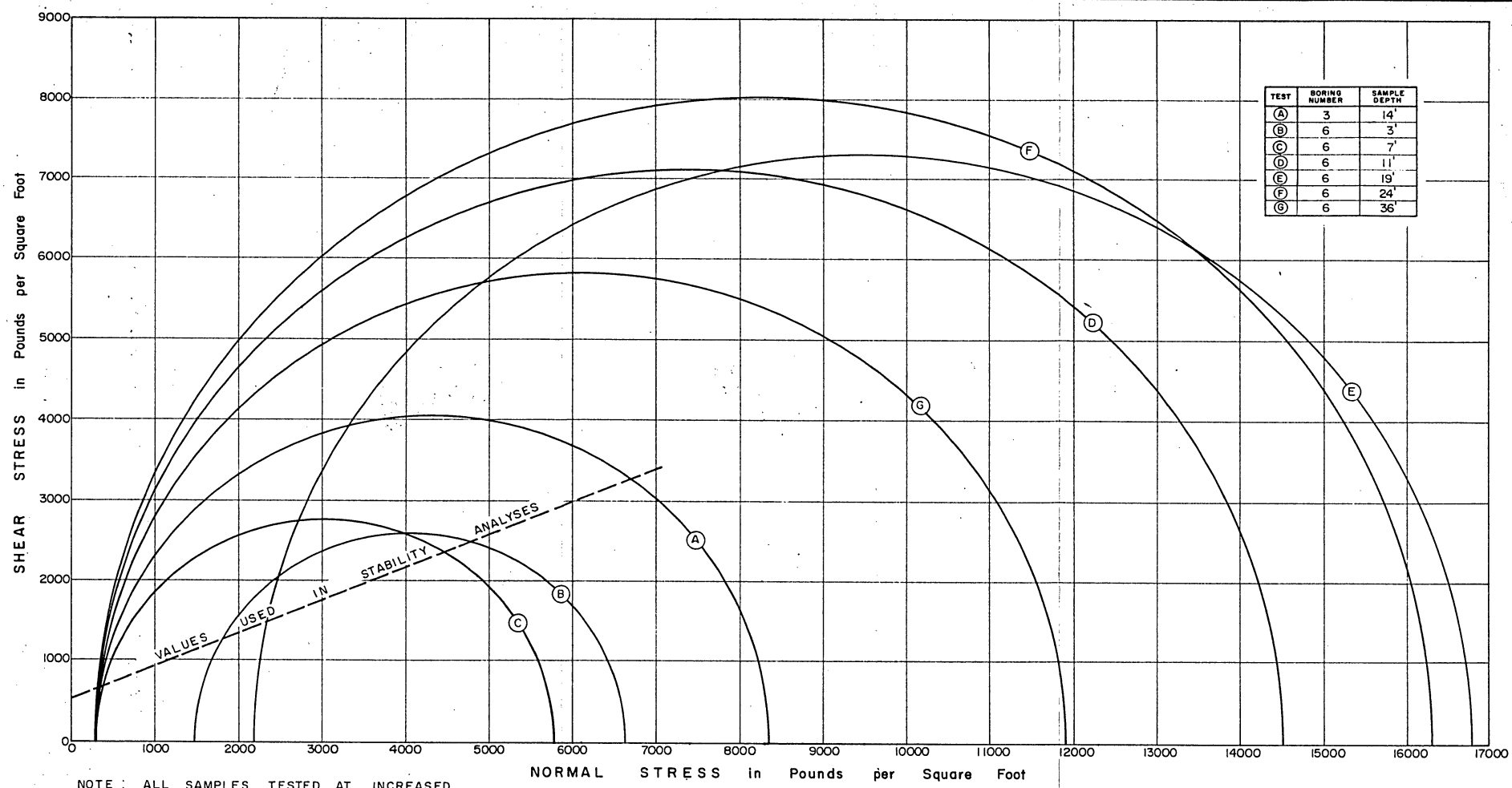
DIRECT SHEAR TEST DATA

LEROY CRANDALL & ASSOCIATES

PLATE A-3A

JOB A-25243-B DATE 9-13-68 DR T.V.H. O.E. SC CHKD. [illegible]

0 4 8 0 0 9 0 1 3 6



TEST	BORING NUMBER	SAMPLE DEPTH
A	3	14'
B	6	3'
C	6	7'
D	6	11'
E	6	19'
F	6	24'
G	6	36'

NOTE : ALL SAMPLES TESTED AT INCREASED MOISTURE CONTENT AND UNDRAINED.

TRIAXIAL SHEAR TEST DATA

LEROY CRANDALL & ASSOCIATES

PLATE A-3B

A-65249-E 9-15-65 THILTON VERL

0 4 8 0 0 9 0 1 3 7

Field Explorations
Hood & Schmidt, Inc. (1965)

DRILLED	August 31, 1965	**BORING I**	
BY	Rotary Bucket	SURFACE ELEVATION	949'
DIAMETER	24"	DATUM	Mean Sea Level

GEOLOGICAL CLASSIFICATION DESCRIPTION	ELEVATION	DEPTH	SYMBOL SAMPLES	ENGINEERING CLASSIFICATION AND DESCRIPTION	TEST DATA M-D-O (D)
MODELO FORMATION				SILTSTONE (ROCK), brown to black, massive, bedding indistinct.	
Carbonaceous siltstone	945				
		5			
B N85E N12					
B N65E N15	940				
J N12W N70		10			
	935	15			
B N35E N9		15		SHALE (ROCK), hard, gray, calcareous.	
				SILTSTONE (ROCK), brown to black, carbonaceous, with stringers of sandstone	
	930	20		SHALE (ROCK), gray, hard, platy, calcareous.	
				SANDSTONE (ML), tan, poorly consolidated.	
Massive Bedding indistinct.	925	25		SILTSTONE (ROCK), black to brown, carbonaceous.	
	920	30			
	915				
B N73E N11		35		SANDSTONE (ML), tan, fine-grained.	
				SILTSTONE (ROCK), carbonaceous	

Sheet 1 of 2

LOG OF BORING

JOB 65018

HOOD & SCHMIDT, INC.
CONSULTING ENGINEERING GEOLOGISTS

PLATE 5

DATE 9/3/65 GEOL. ENGR. 8-4-8 DRWN 0-0-0 TSP. 2 CHKD.

R-3
12-63

DRILLED BY DIAMETER — See Sheet 1

BORING I

SURFACE ELEVATION

DATUM

GEOLOGICAL CLASSIFICATION DESCRIPTION	ELEVATION	DEPTH	SYMBOL SAMPLES	ENGINEERING CLASSIFICATION AND DESCRIPTION	TEST DATA M-D-O (D)
MODELO FORMATION				SILTSTONE (ROCK), carbonaceous	
B N80W N14	910			SANDSTONE (ML), tan, fine grained, poorly consolidated.	
B N70E 11N		40		SILTSTONE (ROCK), brown, thick bedded, carbonaceous.	
				SANDSTONE (ML), tan.	
	905			SILTSTONE (ROCK), black, massive.	
				Bottom of boring at 44'. Boring backfilled.	

Sheet 2 of 2

LOG OF BORING

JOB 65018

HOOD & SCHMIDT, INC.
CONSULTING ENGINEERING GEOLOGISTS

PLATE 5

DATE 9/3/65 GEOL. ENGR. DRW. CHKD.

R-3
12-63

APPENDIX C
Slope Stability Analysis

SLOPE STABILITY ANALYSIS (METHOD OF SLICES)

Project	Woodland Hills Self Storage Facility
Project Number	700107401
Calculated	CR/BW
Date	6/7/2022

Bedrock Properties		
c'	500	psf
γ	95	pcf
ϕ	23	
α	10	

Geometric Properties		
L_1	30.5	ft
L_2	89.1	ft
L_3	27.7	ft
L_4	16.1	ft
L_n	105.4	ft

Static Conditions*

Area of Wedge

A_1	1358.8	ft^2
A_2	468.5	ft^2
A_T	1827.3	ft^2

Weight of Wedge

W	173592.1	lb/ft

Factor of Safety (Static)

FS	4.2

Seismic Conditions

K_h	0.286

Seismic Force

W_s	49647.33	lb/ft

Factor of Safety (Seismic)

FS	1.6

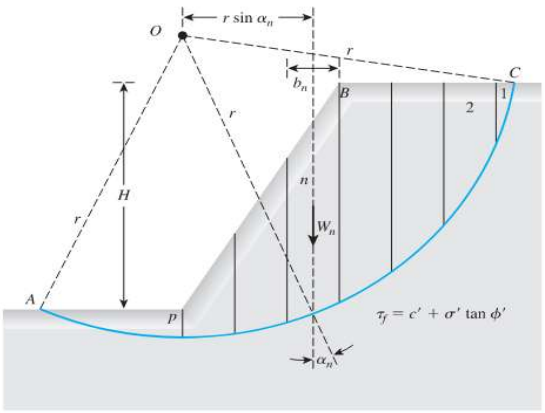
Factor of Saftey (Seismic)**

Resisting Force = 121606.5

Driving Force= 79037.03 **F.S. =** 1.5

** Reference: Eq. 6.30, Rock Slope Engineering, Civil and Mining 4th Edition (E Hoek and J Bray)

$$FS = \frac{cA + (W(\cos\psi_p - k_H \sin\psi_p))\tan\phi}{W(\sin\psi_p + k_H \cos\psi_p)} \qquad (6.30)$$



$$F_s = \frac{\sum_{n=1}^{n=p} (c'\Delta L_n + W_n \cos\alpha_n \tan\phi')}{\sum_{n=1}^{n=p} W_n \sin\alpha_n}$$

* Note: Method Used is Ordinary Method of Slices assuming one Slice as seen in section 15.10 of *Principles of Geotechnical Engineering 7th Edition (Das)*

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

NATURAL HISTORY MUSEUM
LOS ANGELES COUNTY

Vertebrate Paleontology Section
Telephone: (213) 763-3325
Fax: (213) 746-7431
e-mail: smcleod@nhm.org

7 September 2016

CAJA Environmental Services, LLC
15350 Sherman Way, Suite 315
Van Nuys, CA 91406

Attn: Rachel Zacuto, Assistant Environmental Planner

re: Paleontological resources for the proposed 20401 Ventura Boulevard Project, in the City of Los Angeles, Los Angeles County, project area

Dear Rachel:

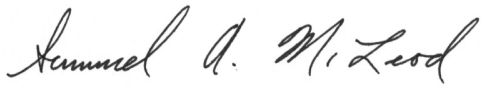
I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed 20401 Ventura Boulevard Project, in the City of Los Angeles, Los Angeles County, project area as outlined on the portion of the Canoga Park USGS topographic quadrangle map that you sent to me via e-mail on 16 August 2016. We do not have any vertebrate fossil localities that lie directly within the proposed project area, but we do have localities nearby from the same sedimentary deposits that occur in the proposed project area.

The entire proposed project area has exposures of the marine late Miocene Upper Modelo Formation (also referred to as the Monterey Formation in this area). Our closest vertebrate fossil locality from the Upper Modelo Formation is LACM 5125, west-southwest of the proposed project area near San Feliciano Drive in Woodland Hills, that produced fossil specimens of lanternfish, Myctophidae. Our next closest fossil vertebrate locality from the Upper Modelo Formation is LACM 6021, south-southwest of the proposed project area just north of Mulholland Drive and east of Canoga Avenue, that produced a rare fossil specimen of leatherback turtle, *Psephophorus*. Further to the southwest of the proposed project area we have Upper Modelo Formation localities LACM 3173 and 5657. Locality LACM 3173, west of Valmar Road south of Mulholland Drive, produced fossil specimens of shearwater, *Puffinus*. Locality LACM 5657, further to the south of Mulholland Highway, produced a fossil specimen of baleen whale, Mysticeti.

Any excavations in the undisturbed deposits of the Upper Modelo Formation in the proposed project area may well encounter significant vertebrate fossils. Any substantial excavations in the proposed project area, therefore, should be closely monitored to quickly and professionally recover any potential vertebrate fossils without impeding development. Also, sediment samples should be collected and processed to determine the small fossil potential in the proposed project area. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,



Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: invoice

LANGAN

Memorandum

18575 Jamboree Road, Suite 150 Irvine, CA 92612 T: 949.561.9200 F: 949.561.9201

To: Chris Tramonte and Margo Conley
20401 Ventura Boulevard, LLC

Cc:

From: Chris Zadoorian and Brandon Watkins
Langan Engineering and Environmental

Date: August 31, 2023

Re: **Site Preparation Memo**
Proposed Self-Storage Facility
20401 Ventura Boulevard
Woodland Hills, California
Langan Project: 700107401

1.0 INTRODUCTION

Langan performed a geotechnical investigation for the proposed self-storage facility to be constructed at 20401 Ventura Boulevard in Woodland Hills, California and we summarized the results of our investigation in a report and letter (Addendum 1) dated June 7, 2022 and August 3, 2023 respectively.

Our report was submitted to the City of Los Angeles Department of Building and Safety Grading Division (Grading Division) for review and Grading Division issued conditional approval of our report in a letter dated July 13, 2022 (Grading Division Log Number 122100).

2.0 BACKGROUND

The site is located along the north side of Ventura Boulevard and is bound on the north by a descending cut slope and on the east and west by surface parking lots associated with commercial developments. The cut slope was reportedly constructed as part of the Ventura (101) Freeway development, circa 1959.

The descending slope is up to approximately 45 feet in height and extends down at a gradient of approximately 2:1 (horizontal:vertical) to the Ventura (101) Freeway.

The ground surface level at the site slopes down to the east and ranges from approximately Elevation 955 at the west corner of the site to approximately Elevation 934 at the east corner of the site.

3.0 SUBSURFACE CONDITIONS

We drilled six geotechnical exploration borings (borings B-1 through B-6) at the site to depths of approximately 10½ to 45½ feet below ground surface (bgs). The borings were drilled with truck-mounted hollow-stem auger drilling equipment at the approximate locations shown on Figure 2.

We maintained a log of the subsurface materials encountered in each boring and collected relatively undisturbed and bulk samples from the borings at regular intervals. Samples were collected from the borings using a modified California split-spoon samplers in general accordance with ASTM D3550. To estimate bedding strike and dip from the borings, we also collected two oriented ring samples from target

depths by orienting the sampler to the north at depths of 25 and five feet bgs in borings B-1 and B-4, respectively.

Upon completion of drilling, we backfilled the borings with soil cuttings and restored the ground surface to the pre-existing condition.

Asphalt concrete (AC) pavement was encountered in our current borings B-1, B-2, and B-4 through B-6. The AC pavement ranged from three to six inches in thickness. Portland Cement Concrete (PCC), four inches thick, was encountered in our current boring B-3.

Fill soils were encountered in the borings to depths of approximately three to seven feet bgs. The fill consisted of slightly moist to very moist silty and clayey sands and sandy clays with varying amounts of gravel, sand, and asphalt fragments. As noted previously, based on the information presented in the prior LCA construction observation reports, the existing fill was properly placed and compacted and was certified as structural fill.

Residual soils, formed by the in-place weathering of bedrock, were encountered in borings B-2, B-5, and B-6 to depths of approximately six to 18 feet bgs. These soils consisted of stiff to very stiff sandy clay and clay. This residual soil is interpreted to be generally equivalent to the overburden soil identified by LCA (1965), the native silty clay identified by HSI (1965), and the colluvial soil identified by AEG (2015). These soils represent bedrock that has been exposed to significant weathering over a long time period and has likely been subjected to minimal transport.

Siltstone, sandstone, and mudstone bedrock of the Modelo Formation, was encountered beneath the fill and/or residual soils in each boring. The bedrock was observed to be diatomaceous in nature, and dips gently to the north.

4.0 TEMPORARY SHORING AND EXCAVATION

Temporary excavations on the order of approximately 24 feet along the easterly side of the site to approximately 37 feet along the westerly side of the site are required to construct the proposed self-storage building.

Temporary shoring will include soldier piles, tieback anchors and timber lagging and mass excavation and off-haul of on-site soils and bedrock.

5.0 EARTHWORK

Site preparation for this project will primarily include demolition of existing structures, removal of existing foundations, mass excavation, and site grading for pavement sections.

Based on the information available at this time, the on-site bedrock encountered during mass excavation is anticipated to be rippable using standard excavation equipment; however, it would be prudent to perform supplemental geotechnical exploration at the site such as surface or dowhhole geophysical evaluations to develop a shear wave velocity profile of the on-site bedrock that may be correlated to estimate the rippability of the on-site bedrock.

The building floor slab-on-grade will be supported on 12 inches of properly compacted non-expansive fill soils.

The exposed bedrock surface at the bottom of the mass excavation should be scarified to a depth of eight inches and moisture conditioned as recommended in Section 6.8.3 of the referenced geotechnical report. The scarified bedrock should then be rolled to be reasonably firm with a steel-drum roller. Vibratory

compaction effort is not advised for the exposed excavation bottom as doing so would likely result in disturbance of the diatomaceous bedrock materials. Our field technician should probe excavation bottoms to confirm suitable materials are present.

The on-site fill soils are suitable for re-used in the required fills noting that the upper soils and the on-site bedrock is also generally suitable provided the materials are processed to be well-graded and have maximum particle sizes less than three inches.

Fill placed beneath the building floor slab and site flat-work should be non-expansive and have an EI less than 50.

Imported fill material should be primarily granular in nature and reviewed by our field technician prior to import to the site.

Fill placement may proceed after the bottom preparation is completed.

Granular fill soils should be moisture conditioned between 0 and 2 percent of the optimum moisture content and mechanically compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

Cohesive fill should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D1557, and moisture conditioned between 2 and 4 percent over the optimum moisture content.

Fill material should be placed in loose lifts not exceeding 8 inches in thickness, properly moisture conditioned, and mechanically compacted to the minimum required density.

It should be noted that moisture conditioning and compaction of clayey soils and diatomaceous bedrock may require the use of light-weight compaction equipment and the data presented herein should be evaluated by the grading contractor to determine appropriate compaction equipment.

6.0 CLOSING

We sincerely appreciate the opportunity to provide professional services for this project and look forward to continuing working with you on this project.

Please contact us at your convenience to discuss any questions you may have regarding the information presented herein.