Appendix D

Geotechnical Engineering Report

GEOTECHNICAL ENGINEERING REPORT

FOR IMPROVEMENTS TO EXISTING BUILDING AT

3233 MISSION OAKS BOULDEVARD

CAMARILLO CALIFORNIA

VT-24745-02

MAY 19, 2017

PREPARED FOR

REXFORD INDUSTRIAL

BY

EARTH SYSTEMS

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May 19, 2017

Project No.: VT-24745-02
Report No.: 17-5-43

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Project: 3233 Mission Oaks Boulevard
Camarillo, California
Subject: Geotechnical Engineering Report

Earth Systems Southern California (Earth Systems) has performed a Geotechnical Engineering study for proposed improvements to the northern end of the existing building located at 3233 Mission Oaks Boulevard in Camarillo, California. This study was authorized by Rexford Industrial (Bruce Herbkersman) on February 7, 2017 based on Earth Systems Proposal VP17-043 dated February 6, 2017. The accompanying Geotechnical Engineering Report presents the results of our field and laboratory testing programs, our review of available maps and documents relevant to the site geology, seismic setting, and geotechnical conditions, as well as our conclusions and recommendations pertaining to geotechnical aspects of project design.

Earth Systems has appreciated the opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

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INTRODUCTION

Project Description

This report presents results of a Geotechnical Engineering study that Earth Systems performed for the proposed one-story construction of improvement to the northern portion of an existing building located at 3233 Mission Oaks Boulevard in Camarillo, California. The proposed improvements include additions, loading docks, paving, and storm water infiltration systems.

From April 1999 to June 1999, Earth Systems Consultants • Southern California prepared geotechnical engineering reports (see References) for the previous Technicolor buildings located west of the subject building. These other buildings are located within about 200 to 700 feet of the proposed construction. Earth Systems also prepared geotechnical reports (see References) for the southern portion of the subject building. We have reviewed these reports and are in general agreement with the analyses and recommendations, therefore, some of that data will be used within this report.

It is assumed that the proposed construction will be a mix of wood-framed and/or masonry/concrete construction supported on conventional foundations with raised and/or structural slab-on-grade floors. Subterranean construction is not anticipated. Structural considerations for building column loads of up to 70 kips with maximum wall loads of 3 kips per lineal foot were used as a basis for the recommendations of this report. If actual loads vary significantly from these assumed loads, Earth Systems should be notified since reevaluation of the recommendations contained in this report may be required.

Infiltration for stormwater discharge was performed and analyzed in general accordance with the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures (2010) to determine infiltration rates.

Purpose and Scope of Work

The purpose of the geologic and geotechnical study that led to this report was to evaluate the near surface geologic and soil conditions of the site with respect to the proposed construction amd to provide geotechnical recommendations. These conditions include surface and subsurface soil types, expansion potential, bearing capacity, the presence or absence of subsurface water, and liquefaction potential.

The scope of our work included:

- Performing a reconnaissance of the site and reviewing past site-specific geotechnical reports and regional geology maps.
- Drilling, sampling, and logging 4 exploratory geotechnical borings to study bedrock, soil, and groundwater conditions.
- Drilling and logging 4 boring for infiltration testing for storm water management.
- Laboratory testing soil samples obtained from the subsurface exploration to determine their physical and engineering properties.
- Analyzing the geotechnical data obtained.
- Consulting with owner representatives.
- Preparing this report.

Contained in this report are:

- Descriptions and results of field and laboratory tests that were performed.
- Discussions pertaining to the local geologic, soil, and groundwater conditions.
- Conclusions and recommendations pertaining to site grading and structural design.

Site Setting

The site of the proposed improvements is located at 3233 Mission Oaks Boulevard in Camarillo, California (see Vicinity Map and Site Plan in Appendix A). The site is currently occupied by two existing buildings with associated hardscaping and landscaping areas. Site access is from Mission Oaks Boulevard. The site is bounded by Mission Oaks Boulevard to the south and existing industrial/commercial developments in the other directions. The geographic coordinates of the subject lot are about Latitude 34.2201° North and Longitude 119.0264° West. The relative elevation of the site is about 150 feet above mean sea level. The site is relatively flat with surface drainage to the southwest.

GENERAL GEOLOGY

The site is located in the Pleasant Valley area of the western portion of the Transverse Ranges geologic province. Numerous east-west trending folds and reverse faults indicative of active north-south transpressional tectonics characterize the region. The ongoing regional compression produces east-west trending faults that deform early Pleistocene to Tertiary aged marine and non-marine sedimentary bedrock units. The ongoing regional compression has locally resulted in the southeast-northwest trending Camarillo fault which is located approximately 500 feet south of the proposed construction areas, based on mapping by T.W. Dibblee Jr. and the SCAMP CGS/USGS [see attached Regional Geologic Maps by T.W. Dibblee, Jr. (Geologic Map of the Camarillo and Newbury Park Quadrangles, 1990) and SCAMP CGS/USGS (Geologic Map of the Camarillo 7.5' Quadrangle, 2004) in Appendix A]. The site does not lie within any study zones for fault rupture hazard or landslides, and no faults were encountered during our field studies.

The site is mapped by T.W. Dibblee, Jr. and the USGS as underlain by Holocene alluvial deposits, which was encountered during our field study of the project site.

SUBSURFACE CONDITIONS

Based on our borings (B-22 thru B-25), the site is underlain by alluvium (silty sands and sandy silts) from the ground surface to the maximum depth of borings, which is about 16.5 feet below ground surface. More detailed descriptions of the encountered subsurface soil conditions are included in the boring logs. The Site Plan in Appendix A indicates the approximate locations of the borings drilled by Earth Systems.

Expansion index tests were performed on samples of the near-surface soils. Results indicated that expansion indices of 34 ("Low" expansion range) and 17 ("Very Low" expansion range) were measured from samples of B-22@1'-5' and B-25@1'-5', respectively. The version of this classification of soil expansion are provided in Table 1809.7 Minimum Foundation Design which is included in Appendix B of this report.

Groundwater was not encountered in borings B-22 thru B-25 to a maximum depth of about 16.5 feet below the existing ground surface. No groundwater was encountered in boring B-15 (ESCSC, 1999) to a maximum depth of about 51 feet below the existing ground surface. According to the CDMG Seismic Hazard Zone Report for the Camarillo 7.5-Minute Quadrangle, Ventura County, California, the historical high groundwater was mapped to be at least 50 feet. It should also be noted that fluctuations in the groundwater levels and soil moisture conditions do occur due to change in seasons, variations in rainfall, irrigation practices, construction impacts, and other factors.

SEISMICITY AND SEISMIC DESIGN

Although the site is not within a State-designated "fault rupture hazard zone", it is located in an active seismic region where large numbers of earthquakes are recorded each year. Historically, major earthquakes felt in the vicinity of the project site have originated from faults outside the area. These include the December 21, 1812 "Santa Barbara Region" earthquake, that was presumably centered in the Santa Barbara Channel, the 1857 Fort Tejon earthquake, the 1872 Owens Valley earthquake, and the 1952 Arvin-Tehachapi earthquake.

It is assumed that the 2016 CBC and ASCE 7-10 guidelines will apply for the seismic design parameters. The 2016 CBC includes several seismic design parameters that are influenced by the geographic site location with respect to active and potentially active faults, and with respect to subsurface soil or rock conditions. The seismic design parameters presented herein were determined by the U.S. Seismic Design Maps "risk-targeted" calculator on the USGS website for the jobsite coordinates (34.2201° North Latitude and 119.0264° West Longitude). The calculator adjusts for Soil Site Class D, and for Occupancy (Risk) Category I/II/III.

The calculated 2016 California Building Code (CBC) and ASCE 7-10 seismic parameters typically used for structural design are included in Appendix D and summarized in the table below.

Summary of Seismic Parameters – 2016 CBC

Site Class (Table 20.3-1 of ASCE 7-10 with 2013 update)	D
Occupancy (Risk) Category	I/II/III
Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	2.178 g
Spectral Response Acceleration at 1 sec. – S_1	0.828 g
Site Coefficient – F_a	1.00
Site Coefficient – F_v	1.50
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	2.178 g
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	1.242 g
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	1.452 g
One Second Spectral Response – S_{D1}	0.828 g
Reference: USGS, 2017 Latitude: 34.2201 N degrees Longitude: 119.0264 W degrees	

The values presented in the table above are appropriate for a 2 percent probability of exceedance in 50 years. A listing of the calculated 2016 CBC and ASCE 7-10 seismic parameters is attached. The site peak ground acceleration (PGA) per Section 1803.5.12 of the 2016 CBC and Section 11.8.3 of ASCE 7-10 is 0.834 g.

The Fault Parameters table in Appendix C lists the significant "active" and "potentially active" faults within a 33-mile (52-kilometer) radius of the project site. The distance between the site and the nearest portion of each fault is shown, as well as the respective estimated maximum earthquake magnitudes, and the deterministic mean site peak ground accelerations.

LIQUEFACTION AND CYCLIC SOFTENING

Earthquake-induced cyclic loading can be the cause of several significant phenomena, including liquefaction in fine sands and silty sands and cyclic softening in clays. Liquefaction in sands can result in a complete loss of strength and can cause structures to settle or even overturn if it occurs in the bearing zone. Cyclic softening in clays during earthquakes has resulted in buildings experiencing foundation failure and ground surface deformation similar to that resultant from liquefaction. If liquefaction or cyclic softening occurs beneath sloping ground, a phenomenon known as lateral spreading can occur. Liquefaction and cyclic softening is typically limited to the upper 50 feet of the subsurface soils. There are a number of conditions that need to be satisfied for liquefaction or cyclic softening to be a potential. Of primary importance is that groundwater, perched or otherwise, usually must be within the upper 50 feet of soils.

To help analyze liquefaction potential, we relied upon groundwater data from a boring located approximately 160 feet west of the site. Groundwater was not encountered in a nearby boring (B-15) from the adjacent property to the west (see reference ESCSC 1999; and log B-15 attached in Appendix B of this report). Historical high groundwater is mapped deeper than 50 feet based on mapping of historic high groundwater levels in the subject area contained in the Seismic Hazard Zone Report for the Camarillo 7.5-Minute Quadrangle (2002). Groundwater is not anticipated to be located in the upper 50 feet, therefore, liquefaction is not considered a potential hazard at the proposed construction site.

SEISMIC INDUCED SETTLEMENT OF DRY SAND

Sands tend to settle and densify when subjected to earthquake shaking. The amount of settlement is a function of relative density, cyclic shear strain magnitude, and the number of strain cycles. A procedure to evaluate this type of settlement was developed by Seed and Silver (1972) and later modified by Pyke, et al (1975).). Tokimatsu and Seed (1987) presented a simplified procedure that has been reduced to a series of equations by Pradel (1998).

The boring data from the previously discussed boring B-15 (from adjacent site to the west) was used to determine the potential for seismically induced settlement at the site. The results of this analysis indicate that the potential of seismically induced settlement of the dry sands above the water table appears to pose a potential minor hazard at this site. Based on the attached liquefaction analyses calculation sheet (see Appendix D), the total dry sand settlement could potentially range up to about 0.8 inch. About half this amount could be differential settlement.

HYDROCONSOLIDATION

Hydroconsolidation is a phenomenon in which naturally occurring soil deposits, or non-engineered fill soils, collapse when wetted. Natural soils that are susceptible to this phenomenon are typically aeolian, debris flow, alluvial, or colluvial deposits with high apparent strength when dry. The dry strength is attributed to salts, clays, silts, and in some cases, capillary tension, "bonding" larger soil grains together. So long as these soils remain dry, their strength and resistance to compression are retained. However, when wetted, the salt, clay, or silt bonding agent is weakened or dissolved, or capillary tension reduced, eventually leading to collapse. Soils susceptible to this phenomenon are found throughout the southwestern United States.

Methods to analyze hydroconsolidation include double oedometer tests proposed by Jennings and Knight (1956), and a modified version of the Jennings and Knight procedure presented by Houston, et. al. (1988) involving a single oedometer test on a soil sample. The hydroconsolidation results from the referenced boring B-15 used the latter procedure.

The boring data from the previously discussed boring B-15 (from adjacent site to the west) was used to determine the potential for hydroconsolidation at the site. The results of this analysis indicate that the hydroconsolidation potential is estimated to be about 1.2 inches. The hydroconsolidation laboratory test results are included in Appendix B – Selected Laboratory Testing (ESCSC, 1999).

FAULT RUPTURE HAZARD

A fault is a break in the earth's crust upon which movement has occurred in the recent geologic past and future movement is expected. A summary of nearby active faults is presented in the Appendix C under Table 1 Fault Parameters.

The proposed construction does not lie within a State of California designated active fault hazard zone. The activity of faults is classified by the State of California based on the Alquist-Priolo Earthquake Fault Zoning Act (1972). An active fault has had surface rupture with Holocene time (the past 11,000 years). A potentially active fault shows evidence of surface displacement during Quaternary time (last 1.6 million years). An inactive fault has no evidence of movement within the Quaternary time.

As previously discussed in the Regional Geology section of this report, the ongoing regional compression has locally resulted in the southeast-northwest trending Camarillo fault which is located approximately 500 feet south of the proposed construction areas, based on mapping by T.W. Dibblee Jr. and the SCAMP CGS/USGS [see attached Regional Geologic Maps by T.W. Dibblee, Jr. (Geologic Map of the Camarillo and Newbury Park Quadrangles, 1990) and SCAMP CGS/USGS (Geologic Map of the Camarillo 7.5' Quadrangle, 2004) in Appendix A]. The site does not lie within a special study zones for fault rupture hazard (State of California, City of Camarillo). Therefore, the potential for fault rupture hazard at the proposed construction is considered low.

LANDSLIDES

Landsliding is the process where a distinct mass of rock or soil moves downslope due to gravity. No landslides are mapped on the subject site by Dibblee or SCAMP CGS/USGS (see Regional Geology Maps in Appendix A). Because there are no identified landslides either on or trending into the proposed construction site, hazards associated with these phenomena should be considered low.

ROCKFALL

Loose boulder-sized rocks and/or weathering bedrock outcrops located upslope from construction can lead to a rockfall hazard. Because of the site's location in a relatively flat alluvial plain, the potential for rockfall onto the proposed construction site appears to be low.

SEISMICALLY-INDUCED FLOODING

Earthquake-induced flooding types include tsunamis, seiches, and reservoir failure. Because of the subject sites relative position away from any the Pacific Ocean and any reservoirs, the potential for Tsunami, seiche, or reservoir failure should be considered low.

INFILTRATION TESTING

On May 1, 2017, four approximately 6-inch diameter infiltration borings (IT-1 thru IT-4) were drilled to depths of about 15, 5, 15, and 5 feet, respectively, below the ground surface to determine the soil profile and allow installation of plastic casing for infiltration testing (see Site Plan in Appendix A for infiltration boring locations).

After drilling was completed, 2-inch diameter slotted PVC casings were lowered into the boreholes. The annuli between the casings and boring walls were then filled with pea gravel. On May 2, 2017, the infiltration tests were run according to a procedure consistent with the referenced Ventura County Technical Guidance Manual for Stormwater Quality Control Measures. The procedure used, falling-head borehole infiltration test, is typically accepted by the City of Camarillo. About 2 feet of water was added to the bottom of each of the holes to start the tests and the drop in the water surface monitored by taking periodic measurements. Multiple readings were taken at certain frequency within the test interval depending on the infiltration rate. After each of these intervals, water was added to return the original refill depth above the hole bottom for the next test interval. The tests were run until the infiltration rate became reasonably stable, see Infiltration Test Results in Appendix D.

Based on the testing, the recommended test infiltration rates for the depth tested and boring locations are:

Boring	Boring Depth (feet)	Infiltration Rate (inch/hour)	Infiltration Rate (cm/s)
IT-1	15	18.00	0.0127
IT-2	5	0.48	0.0003
IT-3	15	0.50	0.0004
IT-4	5	0.15	0.0001

Percolation test rates were corrected to infiltration rates by a method provided in the Los Angeles County Low Impact Development, Best Management Practices GS200.1 manual. The correction factor is from the Los Angeles County guideline for infiltration testing in boreholes and its purpose is to correct a simple three dimensional percolation rate to a one dimensional infiltration rate (a variation of the Porchet equation). The formula is reproduced below:

$$\text{Reduction Factor } (R_f) = R_f = \left(\frac{2d_1 - \Delta d}{DIA}\right) + 1$$

With:
d_1 = Initial Water Depth (in.)
Δd = Water Level Drop of the Final Period or Stabilized Rate (in.)
DIA = Diameter of the boring (in.)

There are many factors that influence the infiltration rate. Clear water was used in our tests, whereas deleterious material will likely be contained in the storm water. Variations in soil conditions within the limits of the proposed infiltration system will likely affect infiltration characteristics. The designer who utilizes the infiltration results should consider these factors, as well as apply a factor-of-safety to the infiltration rate to account for future disposal bed siltation.

CONCLUSIONS AND RECOMMENDATIONS

Based on our findings, it is our professional opinion that the site is geotechnically suitable for the proposed improvements provided the geotechnical recommendations contained herein are incorporated into the project design. Earth Systems should be given the opportunity to review final project plans prior to construction.

Grading

1. Pre-Construction Considerations
    a. Plans and specifications should be provided to Earth Systems prior to grading. Plans should include the grading plans, foundation plans, and foundation details.
    b. Draining systems should be designed so that water is not discharged into bearing soils or near the building. Final site grade could be such that all water is diverted away from the building toward either hardscapes or drain inlets, and is not allowed to pond. In landscape areas adjacent to residences, the 2016 California Building Code requires a minimum gradient of 5 percent away from the edge of the building foundation for a minimum of 10 feet.
    c. Improvements below ground level should be waterproofed and drained in accordance with the Project Architect's recommendations.
    d. It is recommended that Earth Systems Southern California be retained to provide Geotechnical Engineering services during site development and grading, and foundation construction phases of the work to observe compliance with the design concepts, specifications and recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.
    e. The fill materials should be sampled and tested for pH, soluble chloride, soluble sulfate, and resistivity. The results of the testing should be provided to the project designers for their interpretations pertaining to the corrosivity or reactivity of various construction materials (such as concrete and piping) with the soils

2. Rough Grading/Areas of Development
    a. Grading at a minimum should conform to Appendix J in the 2016 California Building Code (CBC), and with the recommendations of the Geotechnical Engineer during construction. Where the recommendations of this report and the cited section of the 2016 CBC are in conflict, the Owner should request clarification from the Geotechnical Engineer.
    b. To control settlement and provide a more uniform bearing condition, foundations should bear completely onto compacted engineered fill. The soils should be overexcavated throughout the proposed construction footprint to the deeper depth of either: 1) 3.5 feet below the bottom of footings, or 2) 5 feet

below existing grade, and to a distance of 5 feet beyond the perimeter of the foundation edges. The resulting surface should then be scarified to a depth of about 6 inches, moisture conditioned and recompacted to at least 90 percent of maximum density. Then the removed soils can be placed as fill in approximately 6-inch lifts compacted to a minimum of 90 percent of maximum density. The intent of these recommendations is that is footings are to be bottomed on recompacted soils, there should be a minimum of 4 feet of compacted soils below them.

c. Areas outside of the building area to receive fill, exterior slabs-on-grade, sidewalks, or paving should be overexcavated 2 feet. The resulting surfaces should then be scarified an additional 6 inches, moisture conditioned, and recompacted.

d. Grading performed adjacent to the existing buildings should be done with the ABC slotting method. The width of any slot cut should not exceed 8 feet. The complete construction and backfill of the 'A' slot must be performed prior to excavation of the 'B' slot, and likewise the 'C' slot. After the cut for each slot is made, bracing and possibly shoring of the near vertical cut slope may be required for continued temporary stability of slot excavation and safety of personnel.

e. The existing ground surface should be initially prepared for grading by removing all vegetation, trees, large roots, debris, other organic material and non-complying fill. Organics and debris should be stockpiled away from areas to be graded, and ultimately removed from the site to prevent their inclusion in fills. Voids created by removal of such material should be properly backfilled and compacted. No compacted fill should be placed unless the underlying soil has been observed by the Geotechnical Engineer.

f. The bottoms of all excavations should be observed by a representative of this firm prior to processing or placing fill.

g. On-site soils may be used for fill once they are cleaned of all organic material, rock, debris, and irreducible material larger than 8 inches.

h. Fill and backfill placed at near optimum moisture in layers with loose thickness not greater than 8 inches should be compacted to a minimum of 90 percent of the maximum dry density obtainable by the ASTM D 1557 test method.

i. Import soils used to raise site grade should be equal to, or better than, on-site soils in strength, expansion, and compressibility characteristics. Import soil can be evaluated, but will not be prequalified by the Geotechnical Engineer. Final comments on the characteristics of the import will be given after the material is at the project site.

j. At the conclusion of grading, the pad subgrade should be sampled and tested for expansion index and corrosion potential.

Structural Design

1. Foundations

a. Expansion index tests were performed, the results indicated the "Very Low" to "Low" range. The project foundation specifications should at a minimum conform to the Table 1809.7 (included in Appendix B). However, a final expansion index will not be available until the conclusion of grading and result may affect foundation and slab design. Hence, we recommend that the "Low" expansion range be considered during design.

b. Conventional continuous footings and/or isolated pad footings may be used to support the proposed construction. For bearings soils in the "very low" expansion potential range, perimeter and interior footings should have a minimum embedment depth of 24 inches for a one-story structure.

c. Footings should bear into engineered fill as recommended elsewhere in this report. Foundation excavations should be observed by a representative of this firm after excavation, but prior to placing of reinforcing steel or concrete, to verify bearing conditions.

d. Conventional continuous footing may be designed based on an allowable bearing value of 2,000 psf. This value has a factor of safety greater than 3. The above bearing value can be increased by 250 psf per each additional foot of depth up to a maximum of 3,500 psf.

e. Allowable bearing values are net (weight of footing and soil surcharge may be neglected) and are applicable for dead plus reasonable live loads.

f. Bearing values may be increased by one-third when transient loads such as wind and/or seismicity are included.

g. Lateral loads may be resisted by soil friction on floor slabs and foundations and by passive resistance of the soils acting on foundation stem walls. Lateral capacity is based on the assumption that any required backfill adjacent to foundations and grade beams is properly compacted.

h. Conventional continuous footings for buildings where the ground surface slopes at 10:1 (horizontal to vertical) or steeper should be level or should be stepped so that both the top and the bottom are level.

i. The information that follows regarding reinforcement and premoistening for footings is the same as that given in the attached Table 1809.7 Minimum Foundation Design table for the "Low" expansion range. Actual footing designs should be provided by the Structural Engineer, but the dimensions and reinforcement he recommends should not be less than the criteria set forth in the Table 1809.7 Minimum Foundation Design table for the appropriate expansion range.

j. Continuous footings bottomed in soils in the "Low" expansion range should be reinforced, at a minimum, with one No. 4 bar along the bottom and one No. 4 bar along the top. However, the actual reinforcement should be determined by the Structural Engineer.

k. Bearing soils in the "Low" expansion range should be premoistened to 120 percent of optimum moisture content to a depth of 21 inches below lowest footing bottom. Premoistening should be confirmed by testing.

2. Slabs-on-Grade

a. Concrete slabs should be supported by firm recompacted fills as recommended elsewhere in this report.

b. It is recommended that perimeter slabs (walks, patios, etc.) be designed relatively independent of footing stems (i.e. free floating) so foundation adjustment will be less likely to cause cracking.

c. The slab design should be provided by the project Structural Engineer.

d. Slabs bottomed on soils in the "Low" expansion range should be underlain with a minimum of 4 inches of sand. Areas where floor wetness would be undesirable should be underlaid with a vapor retarder (as specified by the Project Architect or Civil Engineer) to reduce moisture transmission from the subgrade soils to the slab. The retarder/barrier should be placed per the recommendations of the project Architect or Manufacturer.

e. Slabs bottomed on soils in the "Low" expansion range should at a minimum be reinforced at mid-slab with No. 3 bars on 24-inch centers, each way.

f. Soils underlying slabs that are in the "Low" expansion range should be premoistened to 120 percent of optimum moisture content to a depth of 21 inches below lowest adjacent grade.

3. Frictional and Lateral Coefficients
   a. Resistance to lateral loading may be provided by friction acting on the base of foundations. A coefficient of friction of 0.58 may be applied to dead load forces. This value does not include a factor of safety.
   b. Passive resistance acting on the sides of foundation stems equal to 320 pcf of equivalent fluid weight may be included for resistance to lateral load. This value does not include a factor of safety.
   c. Passive resistance may be combined with frictional resistance provided that a one-third reduction in the coefficient of friction is used.

4. Retaining Wall Backfill
   a. Conventional cantilever retaining walls can be backfilled with compacted on-site soils or non-expansive import soil. An active pressure of 35 pcf of equivalent fluid weight for well-drained, level backfill may be used.
   b. For cantilever and restrained retaining walls the corresponding increment of seismic force per foot of retaining wall can be determined as $2H^2$ and $8.5H^2$, respectively. The determined forces will have approximately triangular pressure distributions with their centroids of pressure located 0.33H above the base of the retaining walls (Al Atik and Sitar, 2010).
   c. The pressures listed above were based on the assumption that backfill soils will be compacted to 90 percent of maximum dry density as determined by the ASTM D 1557 Test Method.
   d. The lateral earth pressure to be resisted by the retaining walls or similar structures should also be increased to allow for any other applicable surcharge loads. The surcharges considered should include forces generated by any structures or temporary loads that would influence the wall design.
   e. A system of backfill drainage should be incorporated into retaining wall designs. Backfill comprising the drainage system immediately behind retaining structures should be free-draining granular material with a filter fabric between it and the rest of the backfill soils. As an alternative, the backs of walls could be lined with geodrain systems. The backdrains should extend from the bottoms of the walls

to about 18 inches from finished backfill grade. Waterproofing may aid in reducing the potential for efflorescence on the faces of retaining walls.

f. Compaction on the uphill sides of walls within a horizontal distance equal to one wall height should be performed by hand-operated or other lightweight compaction equipment. This is intended to reduce potential "locked-in" lateral pressures caused by compaction with heavy grading equipment.

g. Water should not be allowed to pond near the tops of retaining walls. To accomplish this, final backfill site grades should be such that all water is diverted away from retaining walls.

5. Settlement Considerations

a. Maximum total settlements of about one-half inch are anticipated for foundations and floor slabs supported into firm native soil or on compacted fill and designed as recommended. Differential settlement between adjacent load bearing members should be less than one-half the total settlement.

b. Settlement from hydroconsolidation is estimated to be about 1.2 inches. Differential settlement between adjacent load bearing members could be about one-half the total settlement.

c. Seismic induced dry sand settlement is estimated to be less than 1 inch as previously discussed on page 6 of this report. Differential settlement between adjacent load bearing members could be about two-thirds the total settlement.

ADDITIONAL SERVICES

This report is based on the assumption that an adequate program of monitoring and testing will be performed by Earth Systems Southern California during construction to check compliance with the recommendations given in this report. The recommended tests and observations include, but are not necessarily limited to the following:

1. Review of the building and grading plans during the design phase of the project.
2. Observation and testing during site preparation, grading, placing of engineered fill, and foundation construction.
3. Consultation as required during construction.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The analysis and recommendations submitted in this report are based in part upon the data obtained from the 4 borings drilled on-site by Earth Systems, and 1 referenced boring drilled approximately 160 feet west of the site by Earth Systems Consultants • Southern California. The nature and extent of variations between and beyond the borings may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

The scope of services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on, below, or around this site. Any statements in this report or on the soil boring logs regarding odors noted, unusual or suspicious items or conditions observed, are strictly for the information of the client.

Findings of this report are valid as of this date; however, changes in conditions of a property can occur with passage of time whether they are due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur whether they result from legislation or broadening of knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of 1 year.

In the event that any changes in the nature, design, or location of the buildings or other improvements are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

This report is issued with the understanding that it is the responsibility of the Owner, or of his representative to insure that the information and recommendations contained herein are called to the attention of the Architect and Engineers for the project and incorporated into the plan and that the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

As the Geotechnical Engineers for this project, Earth Systems Southern California has striven to provide services in accordance with generally accepted geotechnical engineering practices in this community at this time. No warranty or guarantee is expressed or implied. This report was prepared for the exclusive use of the Client for the purposes stated in this document for the referenced project only. No third party may use or rely on this report without express written authorization from Earth Systems Southern California for such use or reliance.

It is recommended that Earth Systems Southern California be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications. If Earth Systems Southern California is not accorded the privilege of making this recommended review, it can assume no responsibility for misinterpretation of the recommendations contained herein.

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APPENDIX A

Field Study

Vicinity Map

Regional Geologic Map 1 (Dibblee)

Regional Geologic Map 2 (SCAMP CGS/USGS)

Seismic Hazards Zones Map

Site Plan

Logs of Borings (B-22 through B-25, Earth Systems, 2017)

Log of Boring (B-15, Earth Systems Consultants Southern California, 1999)

Symbols Commonly Used on Boring Logs

Unified Soil Classification

FIELD STUDY

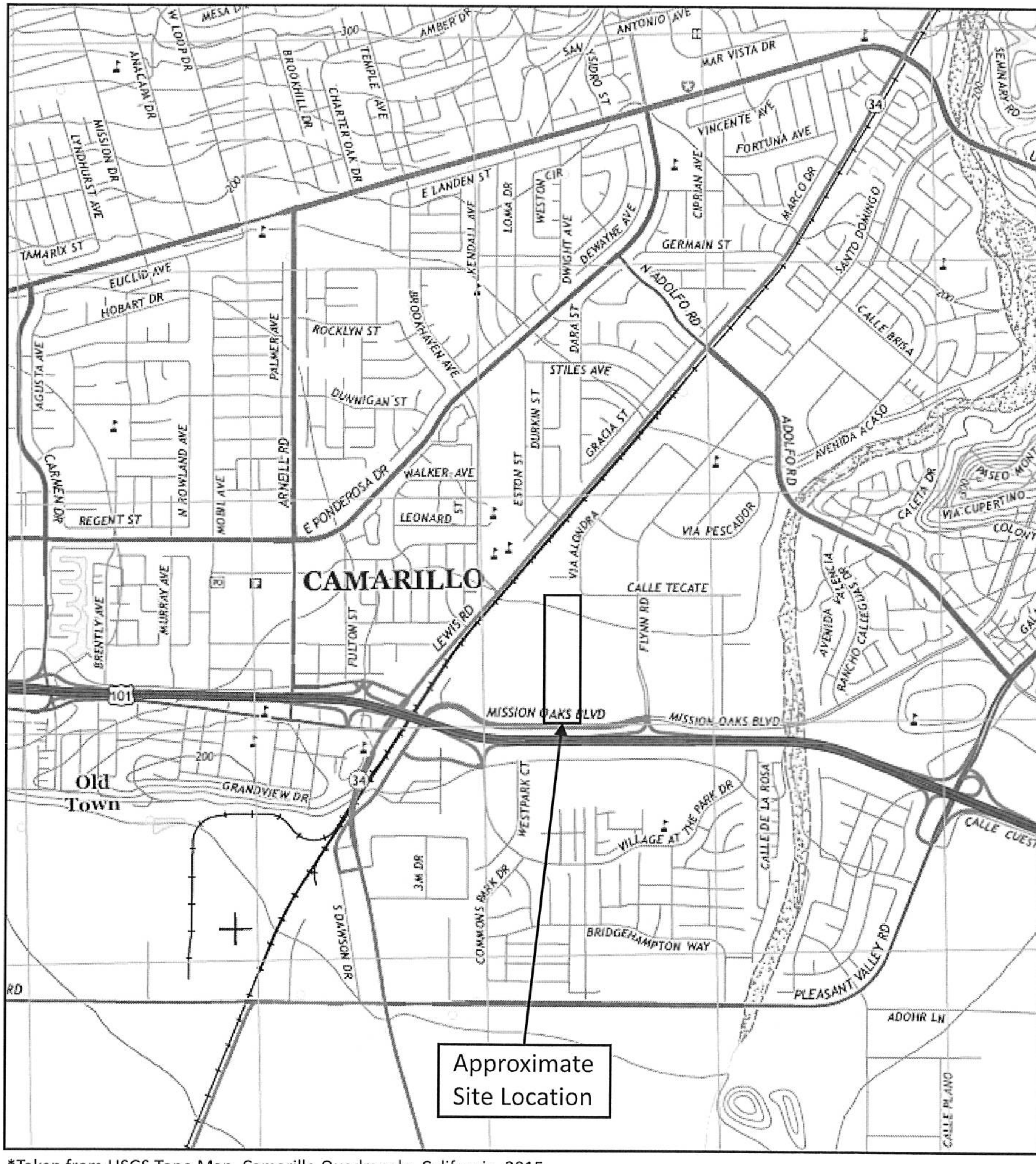
A. On May 1, 2017, four exploratory test borings (B-22 through B-25) were drilled for geotechnical testing to depths of about 16.5 feet below the existing ground surface at the subject site. The borings were drilled utilizing the hollow-stem auger drilling method. The approximate locations of the test borings were determined in the field by pacing and sighting, and are shown on the Site Plan in this Appendix. The borings were backfilled by tamping the auger cuttings back in the holes in 2 to 3 foot vertical intervals with an auger attachment.

B. On May 1, 2017, four exploratory borings were drilled (IT-1 through IT-4) for infiltration testing to depths of about 5 and 15 feet, respectively, below the ground surface (see attached Site Plan for infiltration boring locations). After drilling was completed, 2-inch diameter slotted PVC casings were lowered into each of the boring holes. The testing procedure and results are described in the Infiltration Testing section of this report.

C. Relatively undisturbed samples ("ring samples") were obtained within the test borings with a Modified California (MC) ring sampler (ASTM D 3550 with shoe similar to ASTM D 1586). The MC sampler has a 3-inch outside diameter and a 2.37-inch inside diameter. A 140-pound hammer falling approximately 30 inches (ASTM D 1586) drove the sampler. The hammer was operated by an automatic trip mechanism. The number of blows required to drive the sampler 18 inches was recorded in 6-inch increments and recorded on the boring logs. Recovered ring samples were sealed in plastic containers and transported to the Earth Systems Southern California's laboratory for further classification and testing.

D. Bulk samples of the auger cuttings was collected between depths ranging from about 1 to 5 feet from borings B-22 and B-25. These samples were secured for classification and testing purposes and represents a mixture of soils within the noted depths.

E. The final logs of the test borings represent our interpretation of the contents of the field logs and the results of laboratory testing performed on the samples obtained during the subsurface investigation. The final logs are included in this Appendix.



*Taken from USGS Topo Map, Camarillo Quadrangle, California, 2015.

Approximate Scale: 1" = 2,000'

0 2,000' 4,000'

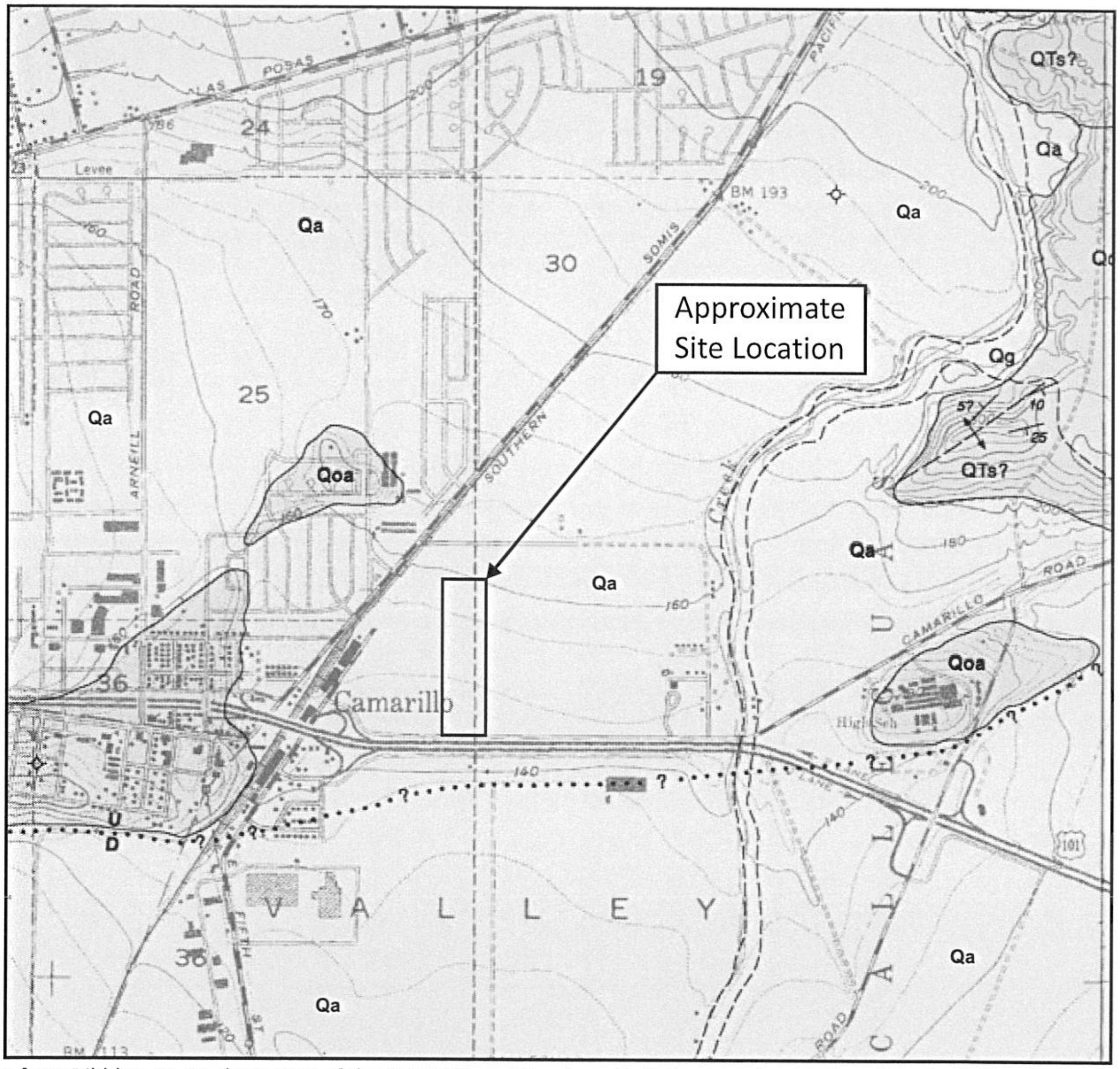
N

VICINITY MAP

3233 Mission Oaks Boulevard
Camarillo, California

Earth Systems
Southern California

May 2017	VT-24745-02



*Taken from Dibblee, Jr., Geologic Map of the Camarillo and Newbury Park Quadrangles, Ventura County, California, 1990, DF-28.

GEOLOGIC SYMBOLS

not all symbols shown on each map

FORMATION CONTACT *dashed where inferred or indefinite, dotted where concealed*

MEMBER CONTACT *between units of a formation* ·········· Prominent bed

CONTACT BETWEEN SURFICIAL SEDIMENTS *located only approximately in places*

FAULT: *Dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful. Parallel arrows indicate inferred relative lateral movement. Relative vertical movement is shown by U/D (U=upthrown side, D=downthrown side). Short arrow indicates dip of fault plane. Sawteeth are on upper plate of low angle thrust fault.*

FOLDS: overturned — ANTICLINE — SYNCLINE

arrow on axial trace of fold indicates direction of plunge; dotted where concealed by surficial sediments

Strike and dip of sedimentary rocks: *inclined* (18), *inclined (approximate)* (20), *overturned* (80), *horizontal*, *vertical*

Strike and dip of metamorphic or igneous rock foliation or flow banding or compositional layers: *inclined* (75), *inclined (approximate)*, *vertical*, *overturned* (80)

OTHER SYMBOLS: *Direction of landslide movement*; *outline of water bodies shown on map*; *water well*; *oil well*; *springs*

af / Qg / Qf / Qa

SURFICIAL SEDIMENTS

af *Artificial fill*

Qg *Stream channel sand and gravel*

Qf *Alluvial fan gravel and sand, locally slightly indurated*

Qa *Alluvium: gravel, sand and clay of flatlands*

Approximate Scale: 1" = 2,000'

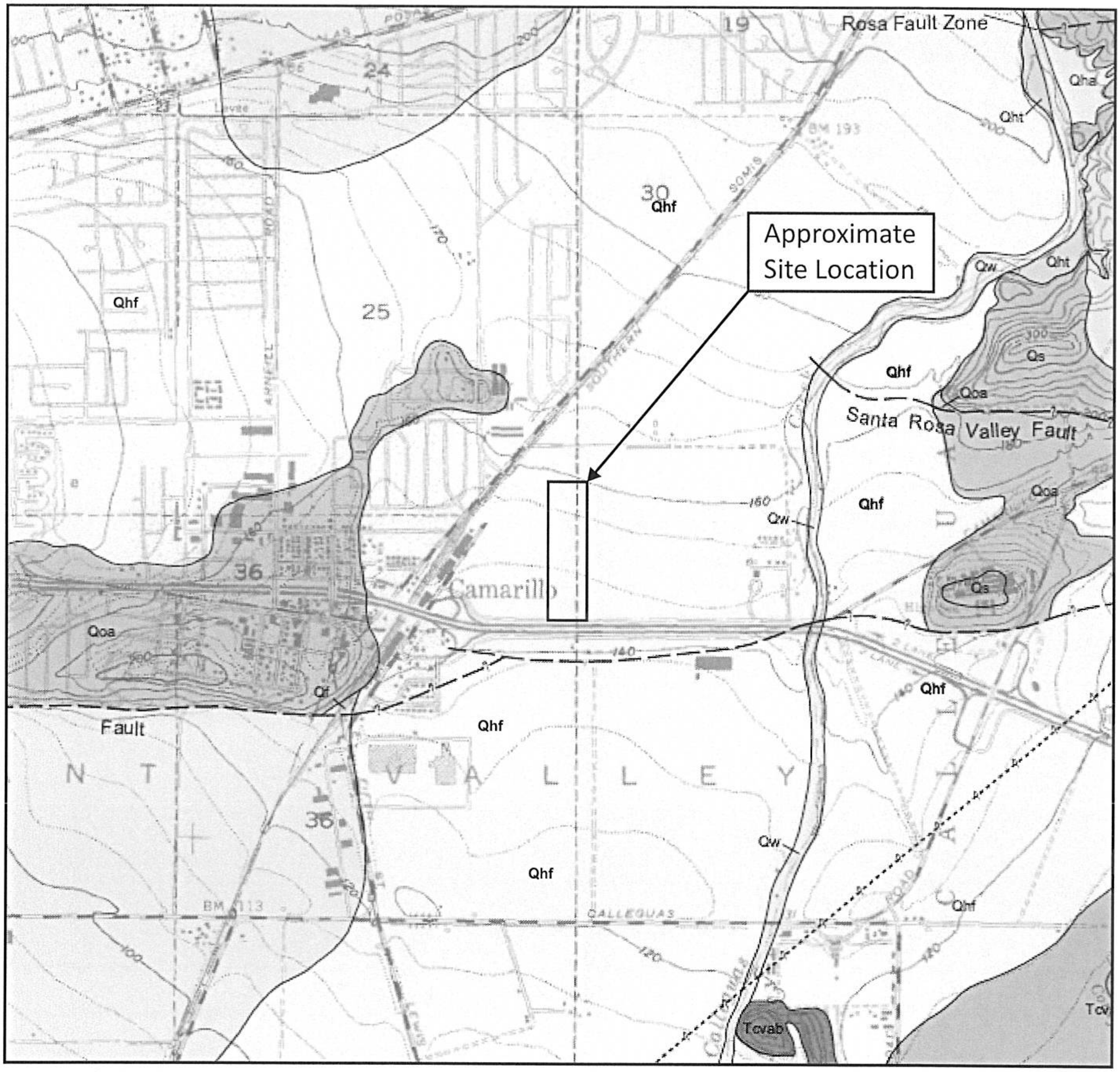
0 2,000' 4,000'

REGIONAL GEOLOGIC MAP 1

3233 Mission Oaks Boulevard
Camarillo, California

Earth Systems
Southern California

May 2017	VT-24745-02



*Taken from USGS, SCAMP Geologic Map of the Camarillo 7.5' Quadrangle, Ventura County, California, 2004.

- Contact between map units - Generally approximately located or inferred, dotted where concealed.
- Contact between similar map units of different relative age - Recognized by scour and incised channelling features. Generally approximately located.
- Fault - Generally approximately located or inferred, dotted where concealed, queried where location is uncertain.
- Axis of anticline
- Axis of syncline
- Strike and dip of bedding.
- Landslide - Arrows indicate principal direction of movement, queried where existence is questionable (some geologic features are drawn within questionable landslides); hachured where headscarp is mappable.

Qhf: Alluvial fan deposits (Holocene) - Includes active fan deposits, deposited by streams emanating from mountain canyons to the north onto the alluvial valley floor; deposits originate as debris flows, hyperconcentrated mudflows or braided stream flows; composed of moderately to poorly sorted and moderately to poorly bedded sandy clay with some silt and gravel.

N

Approximate Scale: 1" = 2,000'

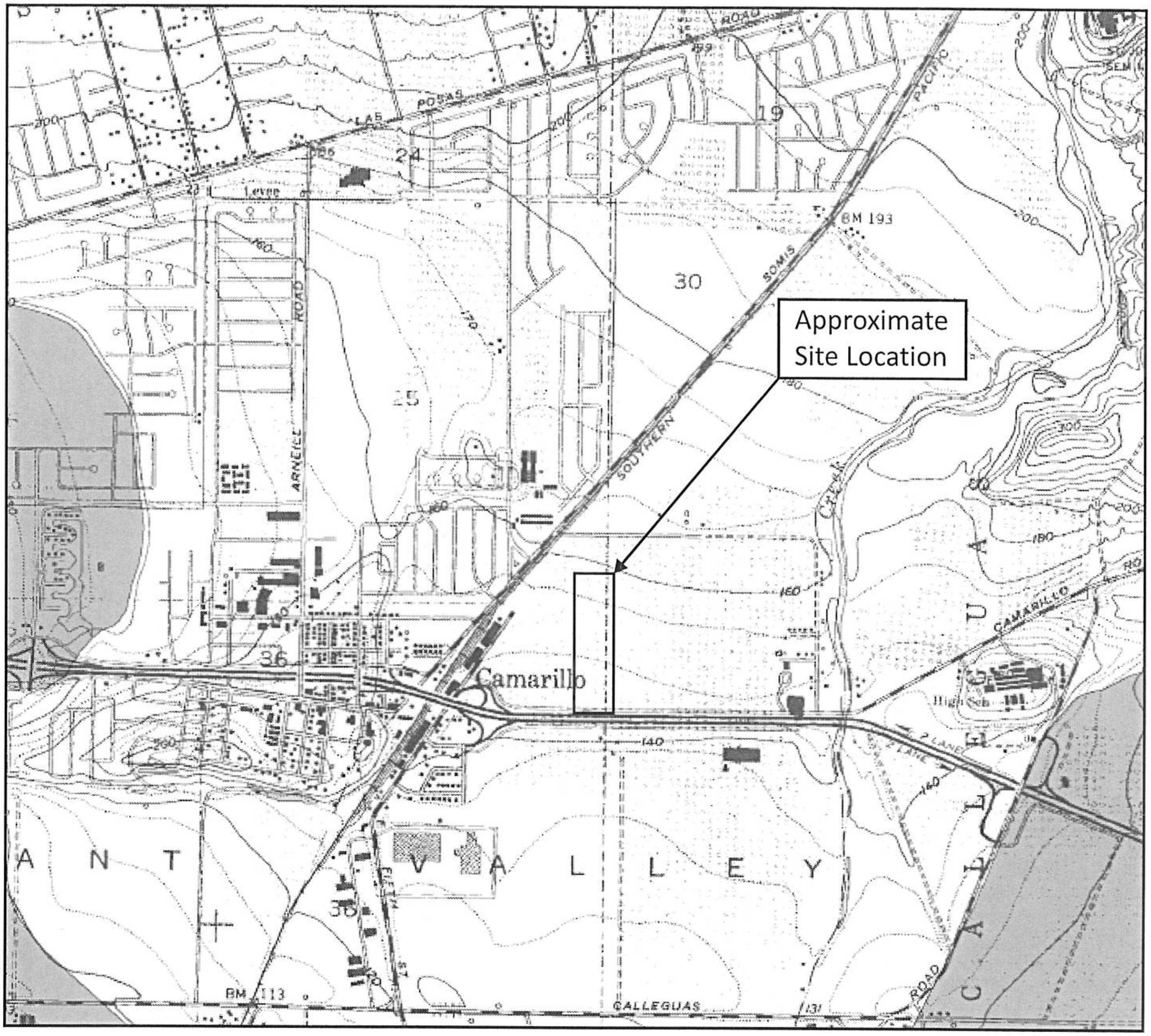
0 2,000' 4,000'

REGIONAL GEOLOGIC MAP 2

3233 Mission Oaks Boulevard
Camarillo, California

Earth Systems
Southern California

May 2017	VT-24745-02



MAP EXPLANATION

Zones of Required Investigation:

Liquefaction

Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground-water 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.

NOTE: Seismic Hazard Zones identified on this map may include developed land where delineated hazards have already been mitigated to city or county standards. Check with your local building/planning department for information regarding the location of such mitigated areas.

Approximate Scale: 1" = 2,000'

0 2,000' 4,000'

STATE OF CALIFORNIA

SEISMIC HAZARD ZONES

Delineated in compliance with Chapter 7.8, Division 2 of the California Public Resources Code (Seismic Hazards Mapping Act)

CAMARILLO QUADRANGLE

OFFICIAL MAP

Released: February 7, 2002

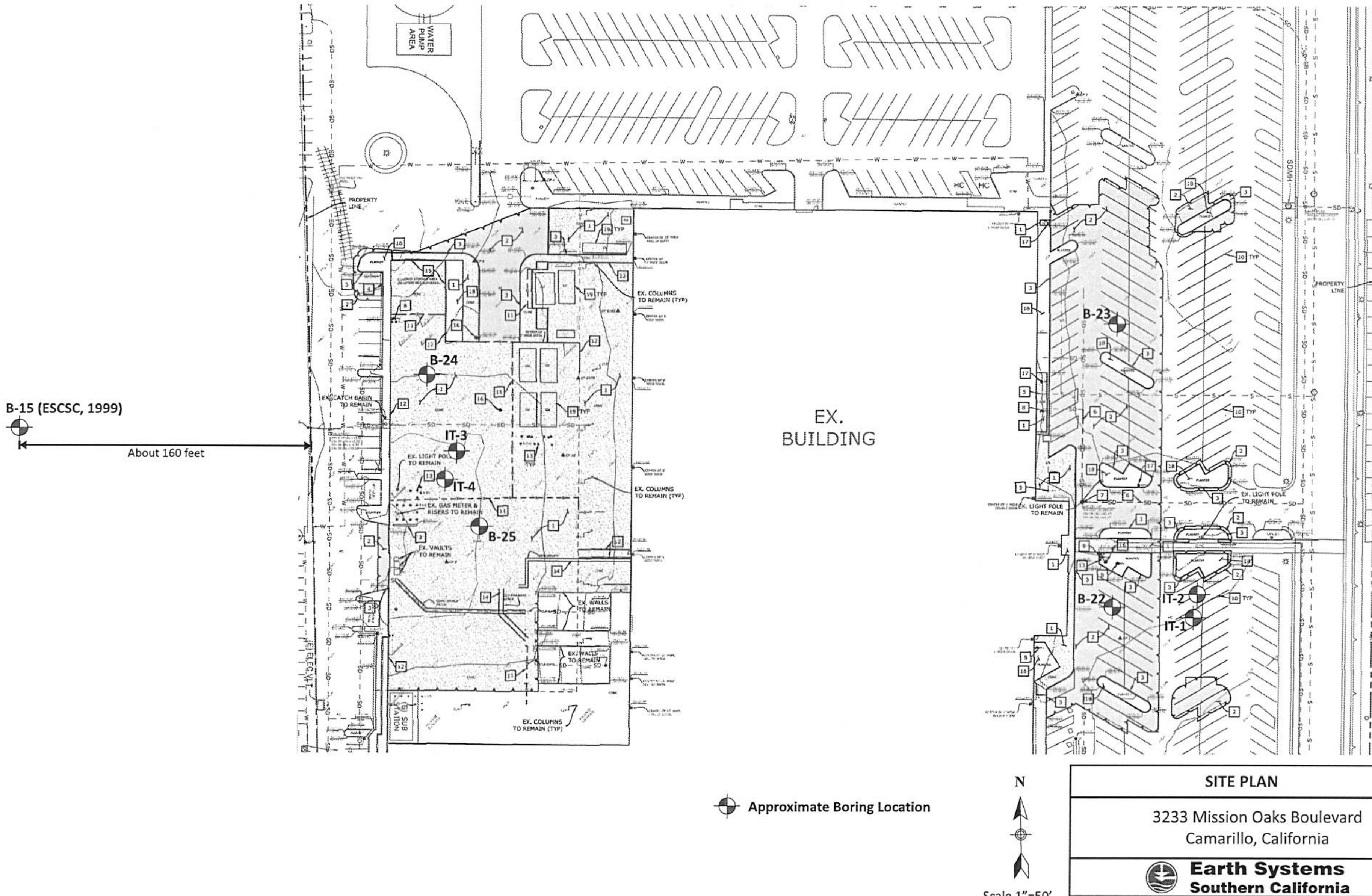
N

SEISMIC HAZARD ZONES MAP

3233 Mission Oaks Boulevard
Camarillo, California

Earth Systems
Southern California

May 2017	VT-24745-02



SITE PLAN

3233 Mission Oaks Boulevard
Camarillo, California

Earth Systems
Southern California

May 2017	VT-24745-02

Logs of Borings (B-22 thru B-25 and IT-1 thru IT-4, Earth Systems, 2017)

Earth Systems Southern California

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-22
PROJECT NAME: 3233 Mission Oaks Boulevard
PROJECT NUMBER: VT-24745-02
BORING LOCATION: Per Plan

DRILLING DATE: May 1, 2017
DRILLING METHOD: 6.0" Hollow Stem Auger
DRILL: Mobile B-61
LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Asphalt: 3.0" Base Material: 5.0"
	X (1–5 ft)					SM			**ALLUVIUM:** Olive brown silty sand; minor clay; loose; damp to moist.
			■	4/5/7		SM	108.7	10.1	
5			■	4/6/7		SM	103.1	6.7	**ALLUVIUM:** Interbedded pale yellowish brown silty sand; minor caliche; loose; damp.
10			■	4/8/10		ML	103.0	10.7	**ALLUVIUM:** Interbedded pale yellowish brown sandy silt; minor caliche; loose; damp.
15			■	5/11/17		SM	111.5	7.8	**ALLUVIUM:** Interbedded pale yellowish brown silty sand; minor caliche; loose; damp.
									Total Depth: 16.5 feet. No Groundwater Encountered.
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-23	DRILLING DATE: May 1, 2017
PROJECT NAME: 3233 Mission Oaks Boulevard	DRILLING METHOD: 6.0" Hollow Stem Auger
PROJECT NUMBER: VT-24745-02	DRILL: Mobile B-61
BORING LOCATION: Per Plan	LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	**DESCRIPTION OF UNITS**
0									Asphalt: 3.0" Base Material: 5.0"
						SM			
	X		■	4/9/10		SM	110.7	9.8	**ALLUVIUM:** Olive brown silty sand; medium dense; moist.
5			■	2/5/7		ML	89.1	26.6	**ALLUVIUM:** Interbedded pale yellowish brown sandy silt; minor caliche; loose; moist.
10			■	3/4/6		SM	108.9	12.8	**ALLUVIUM:** Olive brown silty sand; fine grained; loose; moist.
15			■	5/7/10		SM	110.6	6.7	**ALLUVIUM:** Pale olive brown silty sand; fine grained; medium dense; moist.
									Total Depth: 16.5 feet. No Groundwater Encountered.
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-24	DRILLING DATE: May 1, 2017
PROJECT NAME: 3233 Mission Oaks Boulevard	DRILLING METHOD: 6.0" Hollow Stem Auger
PROJECT NUMBER: VT-24745-02	DRILL: Mobile B-61
BORING LOCATION: Per Plan	LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Concrete: 4.0" Base Material: 5.0"
						SM			**ALLUVIUM:** Olive brown silty sand; loose; moist.
				4/4/8		SM	103.3	19.1	**ALLUVIUM:** Interbedded pale yellowish brown silty sand; loose; moist.
5				4/4/5		SM	102.0	3.5	**ALLUVIUM:** Interbedded pale yellowish brown silty sand; minor caliche; loose; moist.
10				3/6/8		SM	99.2	21.8	Same as above.
15				4/5/8		SM	111.8	11.1	**ALLUVIUM:** Pale olive brown silty sand; fine grained; loose; moist.
									Total Depth: 16.5 feet. No Groundwater Encountered.
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: B-25
PROJECT NAME: 3233 Mission Oaks Boulevard
PROJECT NUMBER: VT-24745-02
BORING LOCATION: Per Plan

DRILLING DATE: May 1, 2017
DRILLING METHOD: 6.0" Hollow Stem Auger
DRILL: Mobile B-61
LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Concrete: 5.0" Base Material: 5.0"
						SM			**ALLUVIUM:** Olive brown silty sand; loose; moist.
	X		■	3/4/8		SM	110.9	14.9	**ALLUVIUM:** Interbedded pale yellowish brown silty sand; loose; moist.
5			■	3/3/6		ML	83.5	29.5	**ALLUVIUM:** Interbedded pale yellowish brown sandy silt; minor caliche; loose; moist.
10			■	5/5/5		SM	96.3	19.8	**ALLUVIUM:** Olive brown silty sand; fine grained; loose; moist.
15			■	4/7/7		ML	92.3	22.2	**ALLUVIUM:** Interbedded pale yellowish brown sandy silt; loose; moist.
									Total Depth: 16.5 feet. No Groundwater Encountered.
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-1
PROJECT NAME: 3233 Mission Oaks Boulevard
PROJECT NUMBER: VT-24745-02
BORING LOCATION: Per Plan

DRILLING DATE: May 1, 2017
DRILLING METHOD: 6.0" Hollow Stem Auger
DRILL: Mobile B-61
LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Asphalt: 3.0" Base Material: 5.0"
						SM			**ALLUVIUM:** Olive brown silty sand; minor clay; loose; damp to moist.
						SM			
5						SM/ ML			**ALLUVIUM:** Interbedded pale yellowish brown silty sand and olive brown sandy silts; minor caliche; loose; damp.
10						SM/ ML			**ALLUVIUM:** Interbedded pale yellowish brown silty sand and olive brown sandy silts; minor caliche; loose; damp.
15									Total Depth: 15.0 feet. No Groundwater Encountered. Installed 15.0 feet of 2.0" slotted PVC pipe and gravel pack.
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-2	DRILLING DATE: May 1, 2017
PROJECT NAME: 3233 Mission Oaks Boulevard	DRILLING METHOD: 6.0" Hollow Stem Auger
PROJECT NUMBER: VT-24745-02	DRILL: Mobile B-61
BORING LOCATION: Per Plan	LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Asphalt: 3.0" Base Material: 5.0"
						SM			**ALLUVIUM:** Olive brown silty sand; minor clay; loose; damp to moist.
						SM/ ML			**ALLUVIUM:** Interbedded pale yellowish brown silty sand and olive brown sandy silts; minor caliche; loose; damp.
5									Total Depth: 5.0 feet. No Groundwater Encountered. Installed 5.0 feet of 2.0" slotted PVC pipe and gravel pack.
10									
15									
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-3	DRILLING DATE: May 1, 2017
PROJECT NAME: 3233 Mission Oaks Boulevard	DRILLING METHOD: 6.0" Hollow Stem Auger
PROJECT NUMBER: VT-24745-02	DRILL: Mobile B-61
BORING LOCATION: Per Plan	LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Concrete: 5.0" Base Material: 5.0"
						SM			**ALLUVIUM:** Olive brown silty sand; loose; moist.
									ALLUVIUM: Interbedded pale yellowish brown silty sand and olive brown sandy silts; loose; moist.
5						SM/ ML			**ALLUVIUM:** Interbedded pale yellowish brown silty sand and olive brown sandy silts; minor caliche; loose; moist.
10						SM			**ALLUVIUM:** Olive brown silty sand; fine grained; loose; moist.
						SM/ ML			**ALLUVIUM:** Interbedded pale yellowish brown silty sand and olive brown sandy silts; loose; moist.
15									Total Depth: 15.0 feet. No Groundwater Encountered. Installed 15.0 feet of 2.0" slotted PVC pipe and gravel pack.
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems Southern California
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-4	DRILLING DATE: May 1, 2017
PROJECT NAME: 3233 Mission Oaks Boulevard	DRILLING METHOD: 6.0" Hollow Stem Auger
PROJECT NUMBER: VT-24745-02	DRILL: Mobile B-61
BORING LOCATION: Per Plan	LOGGED BY: SC

Vertical Depth	Sample Type: Bulk	Sample Type: SPT	Sample Type: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0									Concrete: 5.0" Base Material: 5.0"
						SM			**ALLUVIUM:** Olive brown silty sand; loose; moist.
						SM/ ML			**ALLUVIUM:** Interbedded pale yellowish brown silty sand and olive brown sandy silts; loose; moist.
5									Total Depth: 5.0 feet. No Groundwater Encountered. Installed 5.0 feet of 2.0" slotted PVC pipe and gravel pack.
10									
15									
20									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Log of Boring (B-15, Earth Systems Consultants Southern California, 1999)

Earth Systems Consultants So. Calif.
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: 15
PROJECT NAME: Technicolor Facility on Parcel No. 1
PROJECT NUMBER: SS-21900-V1
BORING LOCATION: Per Plan

DRILLING DATE: 4-15-99
DRILLING METHOD: 6 " Hollow Stem Auger
DRILL: Mobil B-80
LOGGED BY: P.H.

VERTICAL DEPTH (feet)	SAMPLE TYPE: Bulk	SAMPLE TYPE: SPT	SAMPLE TYPE: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
5			■	10/12		SM	100.1	6.0	ALLUVIAL DEPOSITS: Slightly clayey silty fine sand, medium dense, moderate yellowish brown (%gravel=0.1, %sand=60.4, %silt=27.9, %clay=11.6).
10			■	17/15		CL/ML	96.3	21.3	ALLUVIAL DEPOSITS: Interbedded fine sandy silty clay to fine sandy clayey silt, medium stiff, dark yellowish brown (%gravel=0 %sand=31.8, %silt=28.6, %clay=39.6)
15			■	8/7		ML	106.7	12.5	ALLUVIAL DEPOSITS: Slightly clayey fine sandy silt, loose to medium dense, light grayish brown .
20			■	8/9		ML	81.7	11.7	ALLUVIAL DEPOSITS: Same as above.
25			■	15/17		ML	103.4	10.9	ALLUVIAL DEPOSITS: Same as above.
30			■	9/11		CL	85.7	34.6	ALLUVIAL DEPOSITS: Fine sandy clayey silt, medium dense, moderate yellowish brown (%gravel=0, %sand=21.1, %silt=48.1, %clay=30.8).
35			■	12/15		ML	96.5	17.1	ALLUVIAL DEPOSITS: Slightly clayey fine sandy silt, medium dense, moderate yellowish brown (%gravel=0, %sand=59.5, %silt=20.3, %clay=20.2).
40			■	13/18		SP	74.8	6.4	ALLUVIAL DEPOSITS: Slightly silty fine sand, medium dense (%gravel=0, %sand=82.6, %silt=17.4, %clay=0.

Note: The stratification lines shown represent the approximate boundary between soil and/or rock types and the transition may be gradual.

Earth Systems Consultants So. Calif.
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: 15 (continued)
PROJECT NAME: Technicolor Facility on Parcel No. 1
PROJECT NUMBER: SS-21900-V1
BORING LOCATION: Per Plan

DRILLING DATE: 4-15-99
DRILLING METHOD: 6 " Hollow Stem Auger
DRILL: Mobil B-80
LOGGED BY: PH

VERTICAL DEPTH (feet)	SAMPLE TYPE: Bulk	SAMPLE TYPE: SPT	SAMPLE TYPE: Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
40						SP	--	--	ALLUVIAL DEPOSITS: Slightly silty fine sand, medium dense, light grayish brown.
45			X	20/33		SW	--	--	ALLUVIAL DEPOSITS: Fine to coarse sand with minor gravel, dense, moderate yellowish brown (%gravel=5.4, %sand=88.7, %silt=4.1, %clay=1.8).
50			X	13/26		SW	108.5	3.5	ALLUVIAL DEPOSITS: Same as above.
55									Total Depth = 51.0 feet No Groundwater Encountered.
60									
65									
70									
75									
80									

Note: The stratification lines shown represent the approximate boundary between soil and/or rock types and the transition may be gradual.

SYMBOLS COMMONLY USED ON BORING LOGS

Modified California Split Barrel Sampler

Modified California Split Barrel Sampler - No Recovery

Standard Penetration Test (SPT) Sampler

Standard Penetration Test (SPT) Sampler - No Recovery

Perched Water Level

Water Level First Encountered

Water Level After Drilling

Pocket Penetrometer (tsf)

Vane Shear (ksf)

1. The location of borings were approximately determined by pacing and/or siting from visible features. Elevations of borings are approximately determined by interpolating between plan contours. The location and elevation of the borings should be considered

2. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. This data has been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tides, temperature, and other factors at the time measurements were made.

BORING LOG SYMBOLS

Earth Systems
Southern California

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

Earth Systems
Southern California

APPENDIX B

Laboratory Testing
Tabulated Laboratory Test Results
Individual Laboratory Test Results
Selected Laboratory Testing (ESCSC, 1999)
Table 1809.7 Minimum Foundation Design

LABORATORY TESTING

A. Samples were reviewed along with field logs to determine which would be analyzed further. Those chosen for laboratory analysis were considered representative of soils that would be exposed and/or used during grading, and those deemed to be within the influence of proposed construction. Test results are presented in graphic and tabular form in this Appendix.

B. In-situ Moisture Content and Unit Dry Weight for the ring samples were determined in general accordance with ASTM D 2937.

C. The relative strength characteristics of site soils was determined from the results of direct shear tests on remolded samples. Specimens were placed in contact with water at least 24 hours before testing, and were then sheared under normal loads ranging from 1 to 3 ksf in general accordance with ASTM D 3080.

D. Maximum density tests were performed to estimate the moisture-density relationship of typical soil materials. The tests were performed in accordance with ASTM D 1557.

E. Expansion index tests were performed on bulk soil samples in accordance with ASTM D 4829. The samples were surcharged under 144 pounds per square foot at moisture content of near 50% saturation. The samples were then submerged in water for 24 hours and the amount of expansion was recorded with a dial indicator.

F. A Resistance ("R") Value test was conducted on a bulk sample secured during the field study. The test was performed in accordance with California Method 301. Three specimens at different moisture contents were tested, and the R-Value at 300 psi exudation pressure was determined from the plotted results.

TABULATED LABORATORY TEST RESULTS

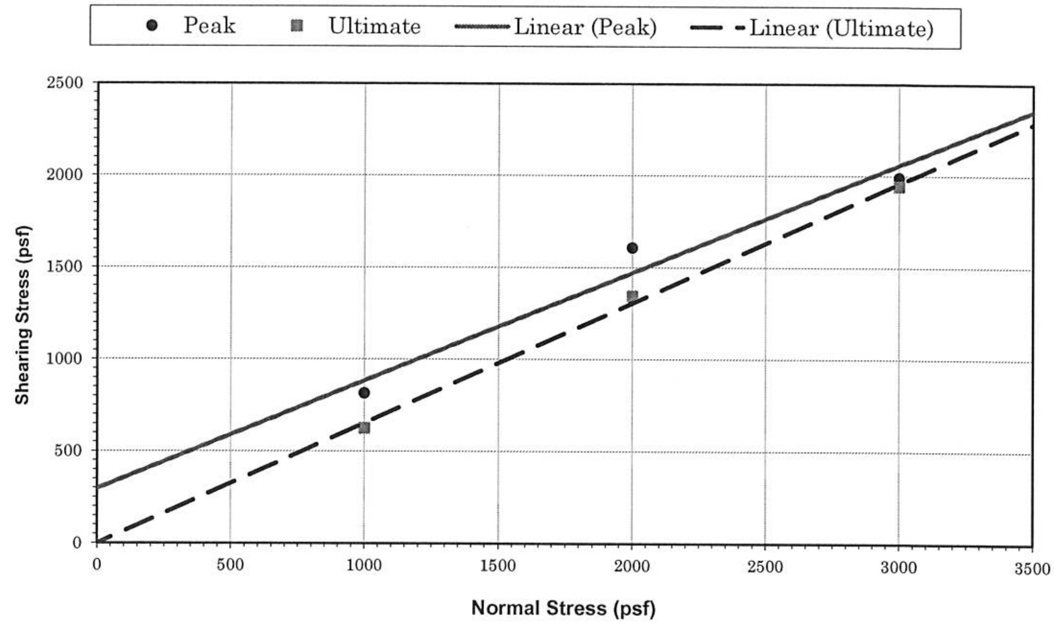
REMOLDED SAMPLES

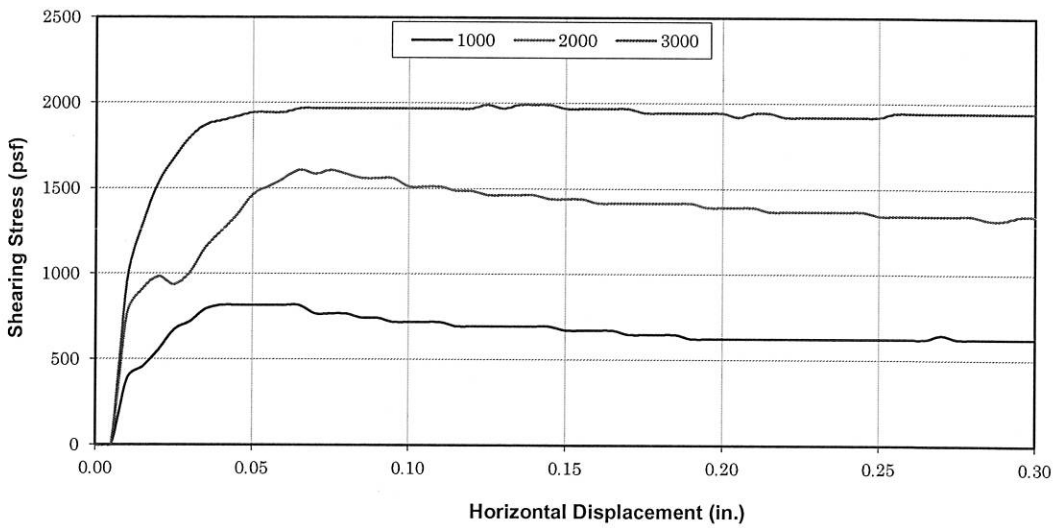
BORING AND DEPTH	B-22 @ 1'-5'	B-25 @ 1'-5'	B-23 @ 1'-3'
SOIL/BEDROCK TYPE	Alluvium	Alluvium	Alluvium
USCS	SM	SM	SM
MAXIMUM DENSITY (pcf)	125.0	124.5	- -
OPTIMUM MOISTURE (%)	10.0	10.5	- -
PEAK COHESION (psf)	290	240	- -
PEAK FRICTION ANGLE	30°	34°	- -
ULTIMATE COHESION (psf)	0	30	- -
ULTIMATE FRICTION ANGLE	33°	33°	- -
EXPANSION INDEX	34	17	- -
R-VALUE@300 PSI EXUDATION	- -	- -	13

IN-PLACE DENSITIES

Boring & Depth	Dry Density (pcf)	% Moisture
B-22@2'	108.7	10.1
B-22@5'	103.1	6.7
B-22@10'	103.0	10.7
B-22@15'	111.5	7.8
B-23@2'	110.7	9.8
B-23@5'	89.1	26.6
B-23@10'	108.9	12.8
B-23@15'	110.6	6.7
B-24@2'	103.3	19.1
B-24@5'	102.0	3.5
B-24@10'	99.2	21.8
B-24@15'	111.8	11.1
B-25@2'	110.9	14.9
B-25@5'	83.5	29.5
B-25@10'	96.3	19.8
B-25@15'	92.3	22.2

Individual Laboratory Test Results





DIRECT SHEAR DATA*

Sample Location: B 22 @ 1'-5'
Sample Description: Silty Sand
Dry Density (pcf): 112.1
Intial % Moisture: 10.2
Average Degree of Saturation: 90.8
Shear Rate (in/min): 0.0124 in/min

Normal stress (psf)	1000	2000	3000
Peak stress (psf)	816	1608	1992
Ultimate stress (psf)	624	1344	1944

	Peak	Ultimate
ϕ Angle of Friction (degrees):	30	33
c Cohesive Strength (psf):	290	0

Test Type: Peak & Ultimate

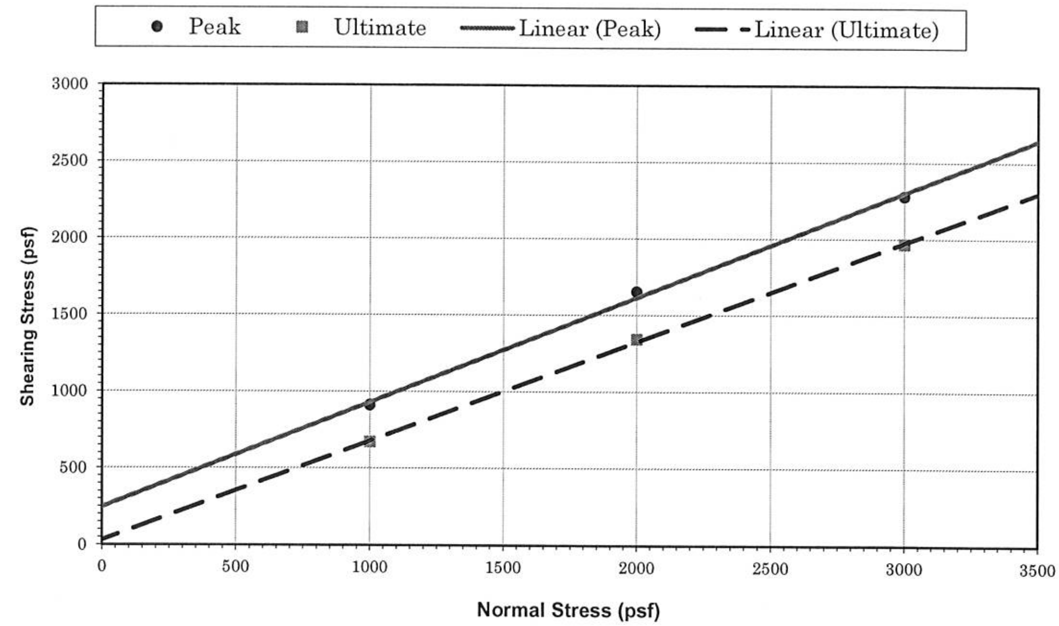
* Test Method: ASTM D-3080

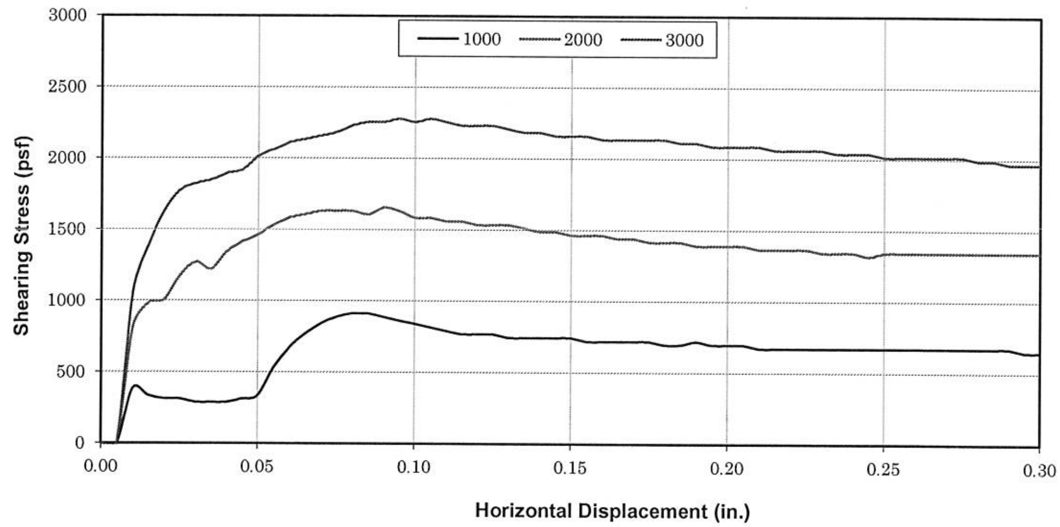
DIRECT SHEAR TEST

3233 Mission Oaks Blvd

Earth Systems
Southern California

5/18/2017 | VT-24745-02





DIRECT SHEAR DATA*

Sample Location: B 25 @ 1'-5'
Sample Description: Silty Sand
Dry Density (pcf): 111.3
Intial % Moisture: 10.5
Average Degree of Saturation: 85.2
Shear Rate (in/min): 0.0097 in/min

Normal stress (psf)	1000	2000	3000
Peak stress (psf)	912	1656	2280
Ultimate stress (psf)	672	1344	1968

	Peak	Ultimate
ϕ Angle of Friction (degrees):	34	33
c Cohesive Strength (psf):	240	30

Test Type: Peak & Ultimate

* Test Method: ASTM D-3080

DIRECT SHEAR TEST

3233 Mission Oaks Blvd

Earth Systems
Southern California

5/18/2017 | VT-24745-02

File Number: VT-24245-02 Lab Number: 097403

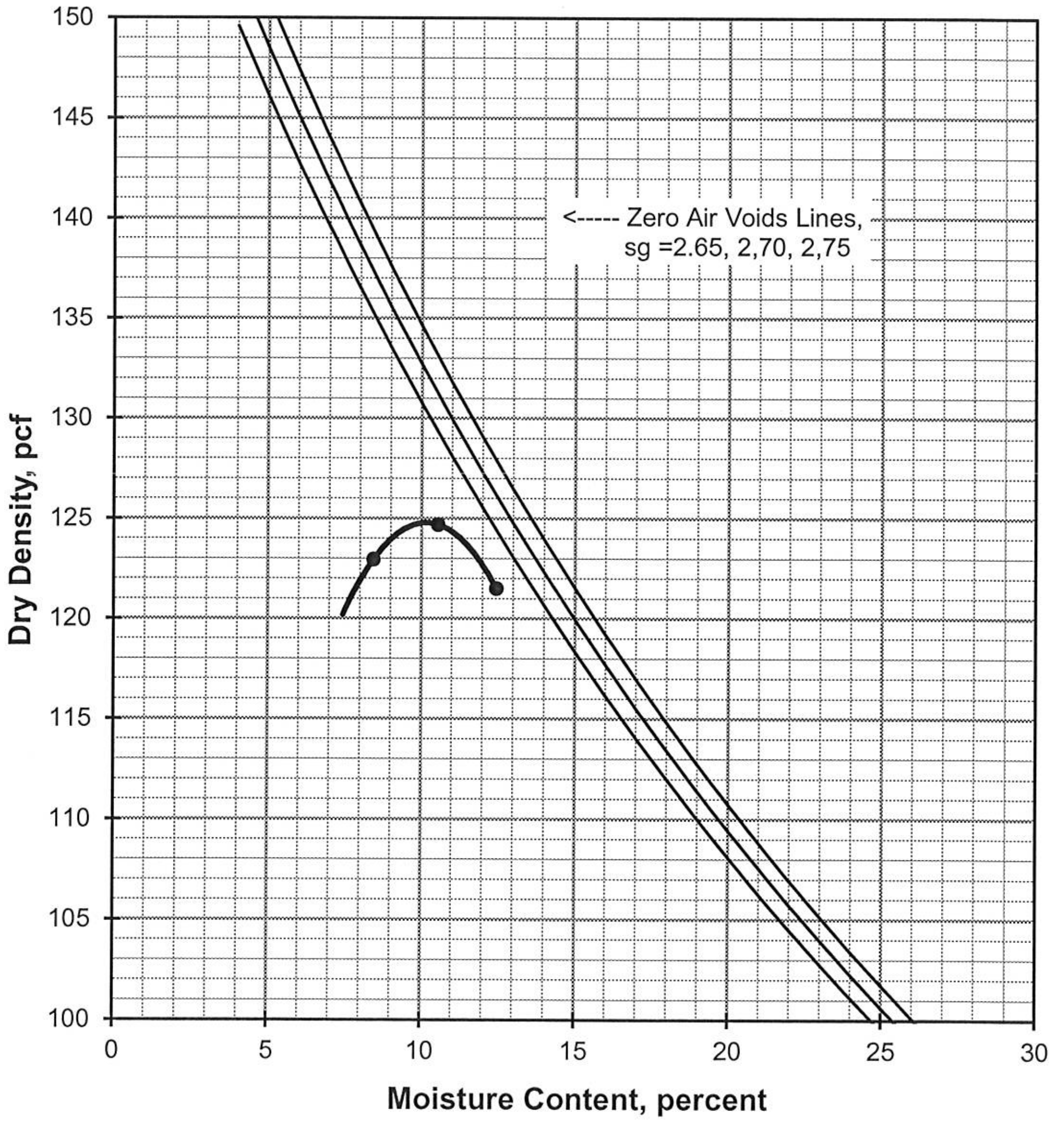
MAXIMUM DENSITY / OPTIMUM MOISTURE ASTM D 1557-07 (Modified)

Job Name: 3233 Mission Oaks Blvd
Sample ID: B 22 @ 1'-5'
Location:
Description: Brown Clayey Silty Sand

Procedure Used: A
Prep. Method: Moist
Rammer Type: Automatic

Maximum Density: **125 pcf**
Optimum Moisture: **10%**

Sieve Size	% Retained
3/4"	0.0
3/8"	0.0
#4	0.6



File Number: VT-24245-02 Lab Number: 097403

MAXIMUM DENSITY / OPTIMUM MOISTURE

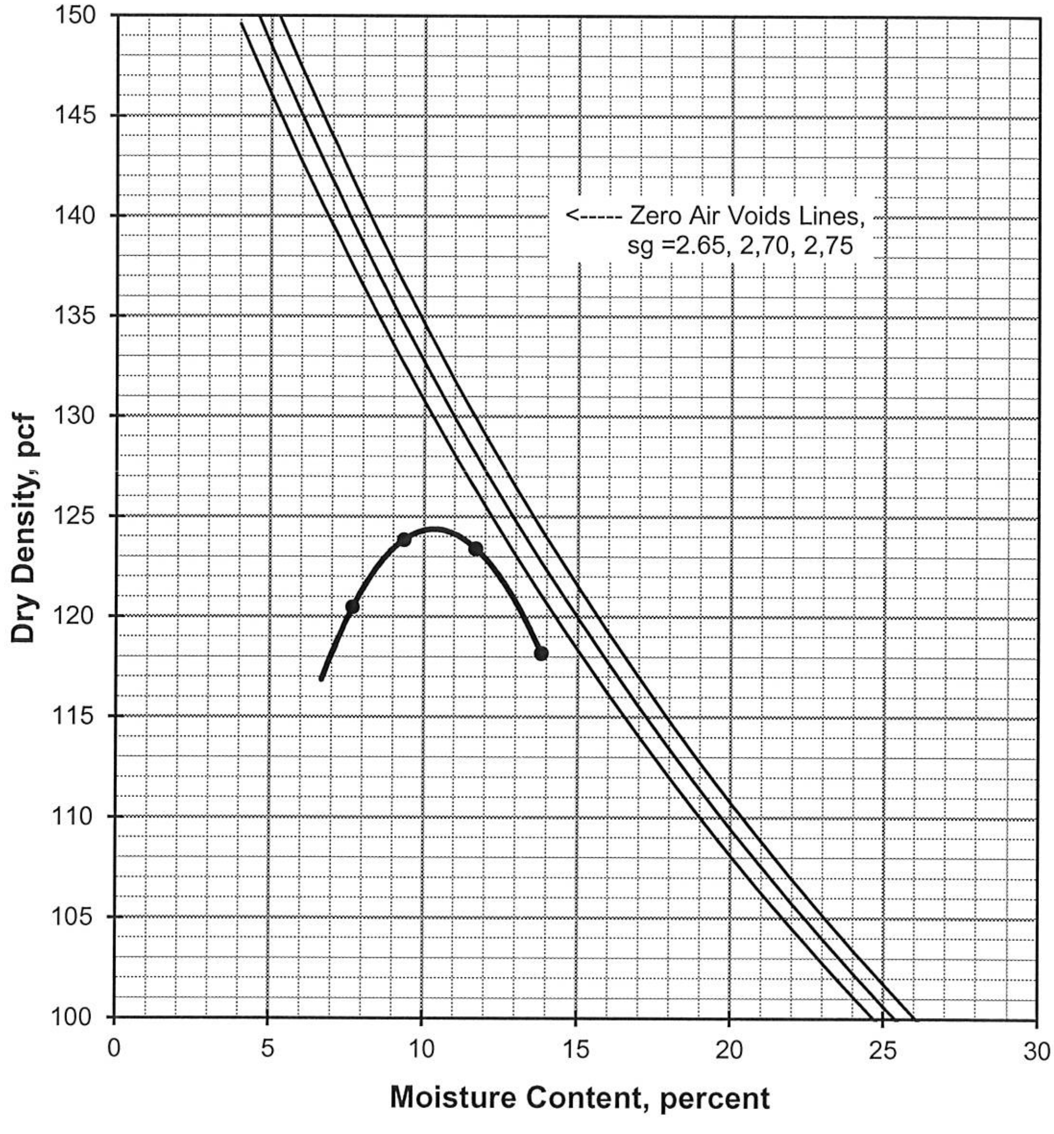
ASTM D 1557-07 (Modified)

Job Name: 3233 Mission Oaks Blvd
Sample ID: B 25 @ 1'-5'
Location:
Description: Light Olive Brown Clayey Silty Sand

Procedure Used: A
Prep. Method: Moist
Rammer Type: Automatic

Maximum Density: **124.5 pcf**
Optimum Moisture: **10.5%**

Sieve Size	% Retained
3/4"	0.0
3/8"	0.0
#4	0.9



File No.: VT-24745-02 May 18, 2017

EXPANSION INDEX

ASTM D-4829, UBC 18-2

Job Name: 3233 M ission Oaks Blvd
Sample ID: B 22 @ 1'-5'
Soil Description: SM

Initial Moisture, %:	9.0
Initial Compacted Dry Density, pcf:	113.3
Initial Saturation, %:	50
Final Moisture, %:	18.9
Volumetric Swell, %:	3.4
Expansion Index:	**34** **Low**

EI	UBC Classification
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
130+	Very High

File No.: VT-24745-02 May 18, 2017

EXPANSION INDEX

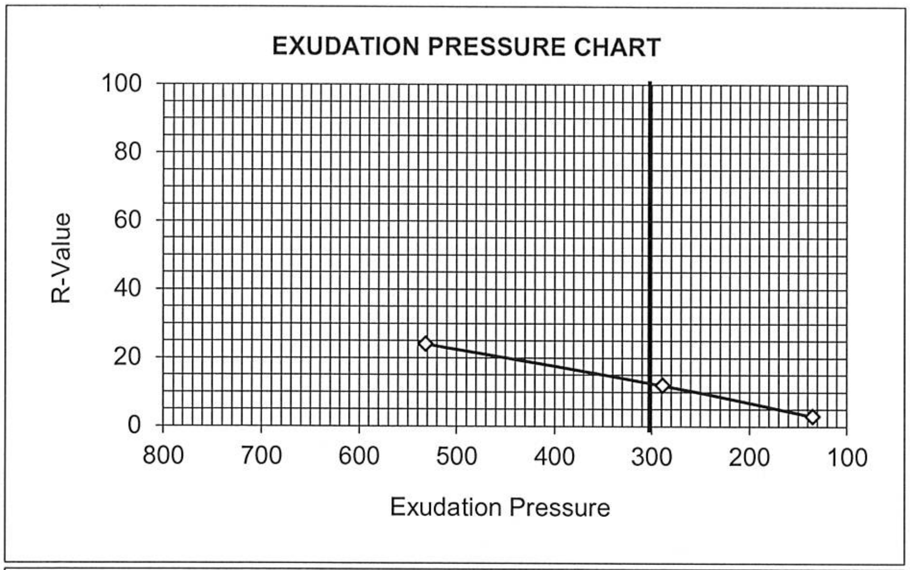
ASTM D-4829, UBC 18-2

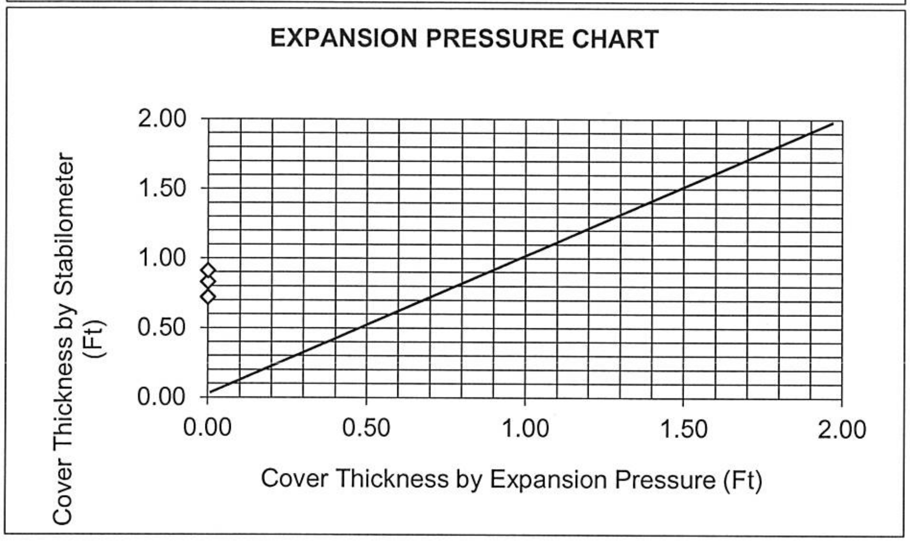
Job Name: 3233 M ission Oaks Blvd
Sample ID: B 25 @ 1'-5'
Soil Description: SM

Initial Moisture, %:	9.0
Initial Compacted Dry Density, pcf:	114.0
Initial Saturation, %:	51
Final Moisture, %:	17.8
Volumetric Swell, %:	1.7

Expansion Index: **17** **Very Low**

EI	UBC Classification
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
130+	Very High





JOB NAME: 3233 Mission Oaks Blvd
SAMPLE I. D.: Boring 23 @1-3'
SOIL DESCRIPTION: Gray Brown Silty Sand (SM)

SPECIMEN NUMBER	A	B	C
EXUDATION PRESSURE	532	289	135
RESISTANCE VALUE	24	12	3
EXPANSION DIAL(0.0001")	0	0	0
EXPANSION PRESSURE (PSF)	0.0	0.0	0.0
% MOISTURE AT TEST	13.1	14.3	16.1
DRY DENSITY AT TEST	121.5	120.4	106.4

R-VALUE @ 300 PSI EXUDATION	13
R-VALUE by Expansion Pressure*	100

**Based on a Traffic Index of 5.0 and a Gravel Factor of 1.70*

Selected Laboratory Testing (ESCSC, 1999)

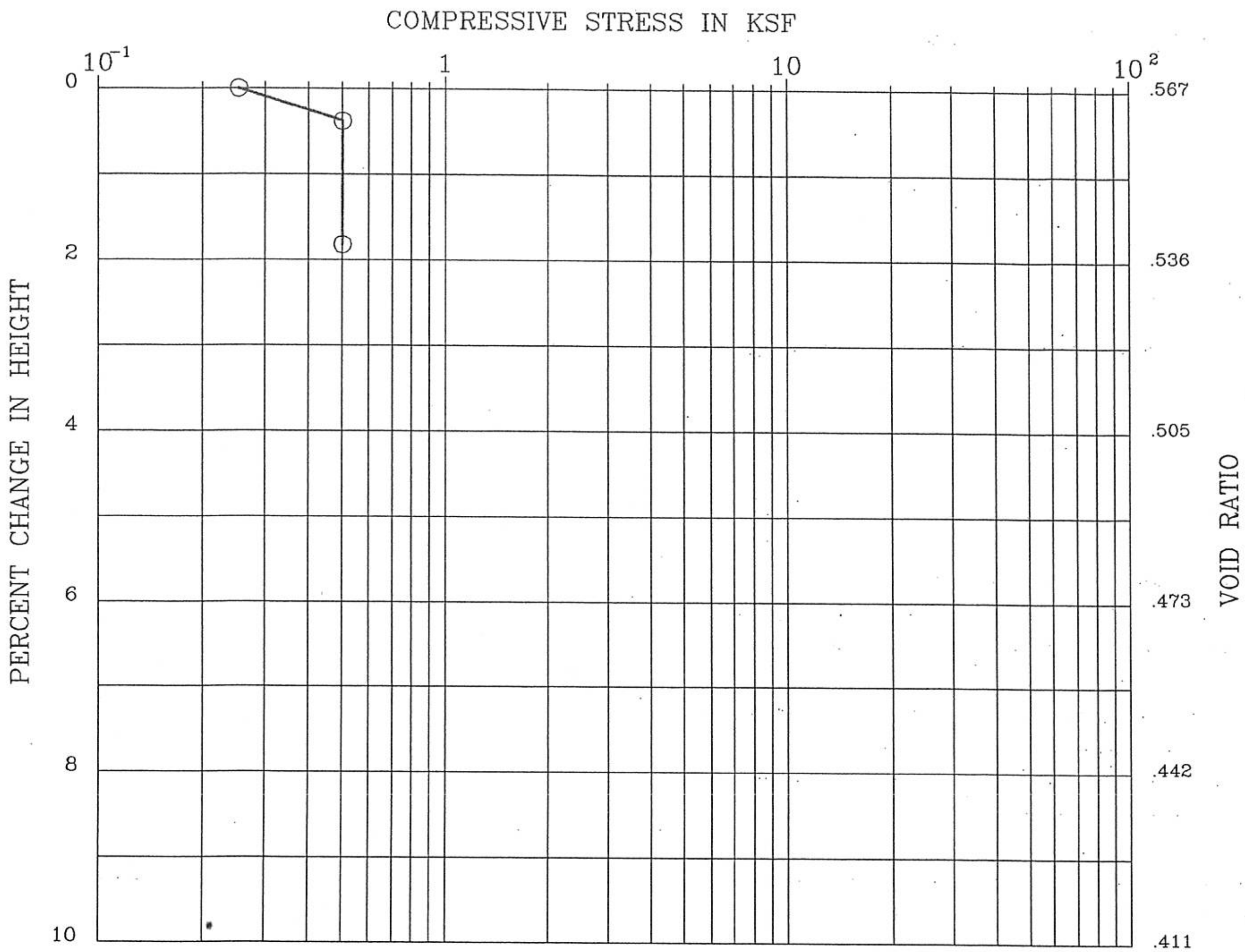
TABULATED TEST RESULTS

GRAIN SIZE DISTRIBUTION (%)

BORING AND DEPTH	15 @ 5'	15 @ 10'	15 @ 30'	15 @ 35'	15 @ 40'
GRAVEL	0.1	0	0	0	0
SAND	60.4	31.8	21.1	47.8	82.6
SILT	27.9	28.6	48.1	46.3	17.4
CLAY	11.6	39.6	30.8	6.0	0

BORING AND DEPTH	15 @ 45'	16 @ 10'	16 @ 15'	16 @ 20'	16 @ 25'
GRAVEL	5.4	0	0	0	0
SAND	88.7	48.3	47.4	22.3	35.5
SILT	4.1	21.6	37.6	30.6	54.5
CLAY	1.8	30.1	15.0	47.1	10.0

BORING AND DEPTH	16 @ 30'	16 @ 35'	16 @ 50'
GRAVEL	0	0.1	5.2
SAND	22.3	93.9	91.3
SILT	67.8	5.2	3.5
CLAY	9.9	0.8	0



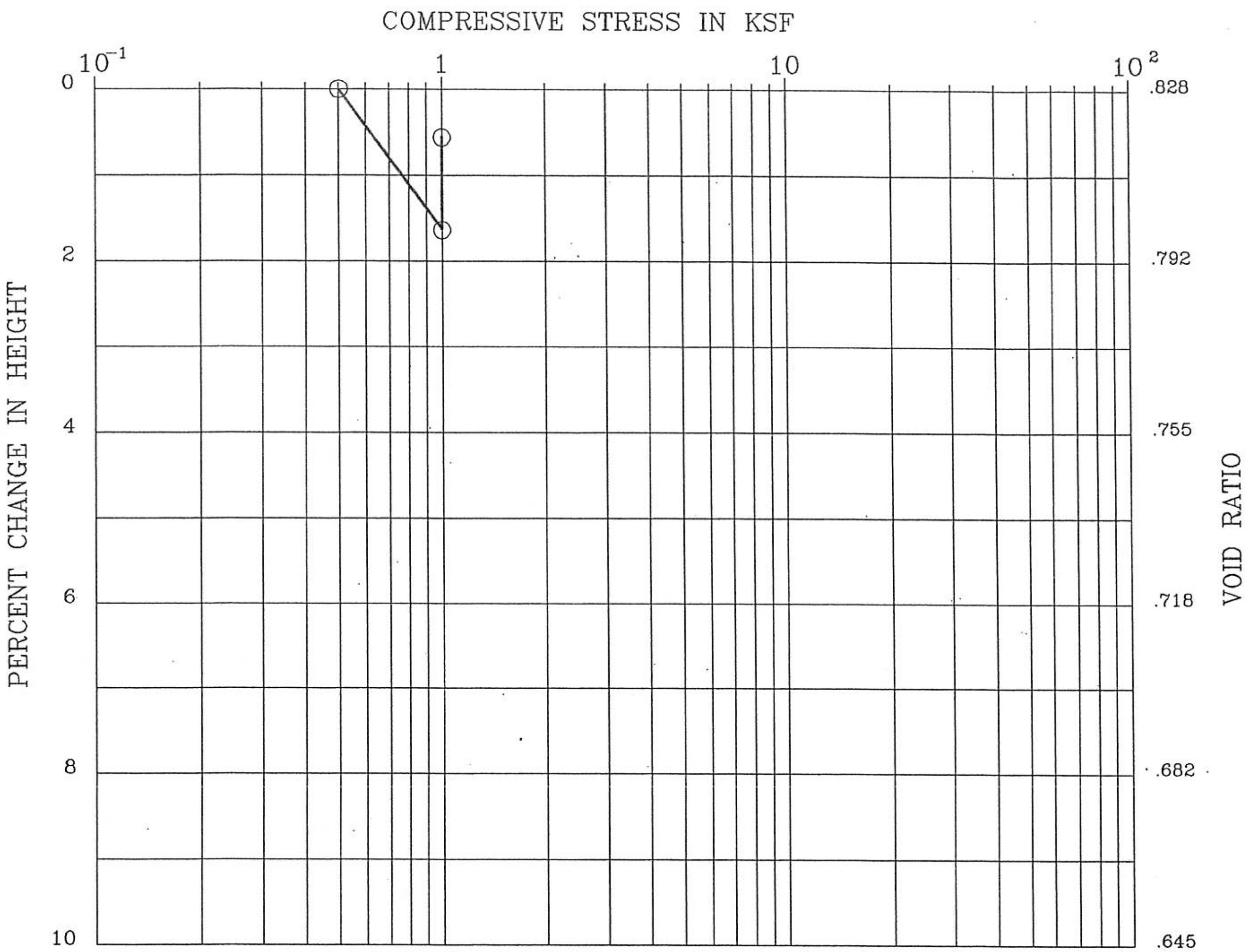
BORING : **15**
DEPTH (ft) : 5
SPEC. GRAVITY : 2.38

DESCRIPTION :
LIQUID LIMIT :
PLASTIC LIMIT :

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	8.8	94.7	37	.567
FINAL	22.6	96.5	100	.538

Remark :

SS-21900-V1	Technicolor
EARTH SYSTEMS	CONSOLIDATION TEST

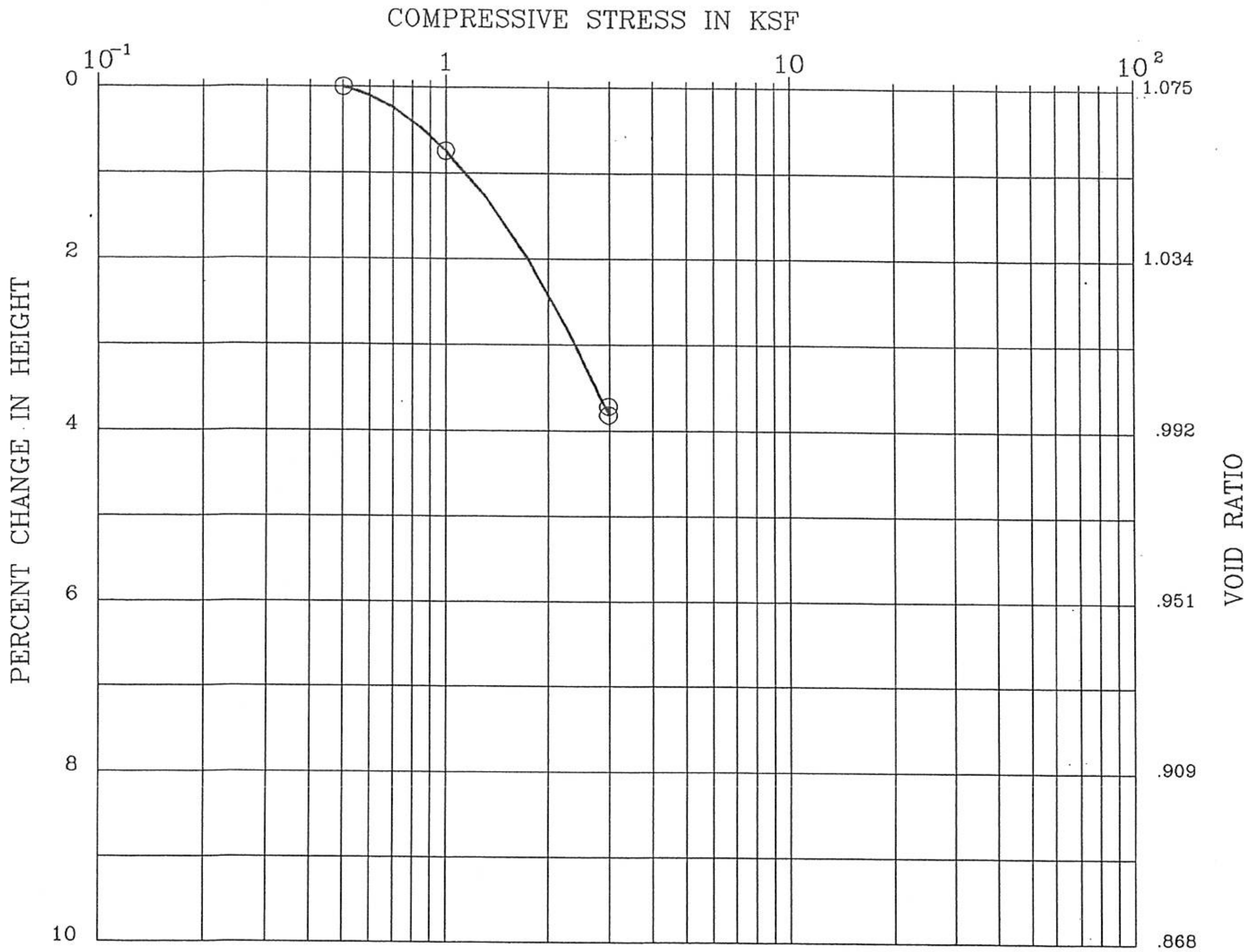


BORING	: **15**	DESCRIPTION	:
DEPTH (ft)	: 10	LIQUID LIMIT	:
SPEC. GRAVITY	: 2.72	PLASTIC LIMIT	:

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	26.2	93.0	86	.828
FINAL	30.0	93.5	100	.817

Remark :

SS-21900-V1	Technicolor
EARTH SYSTEMS	CONSOLIDATION TEST

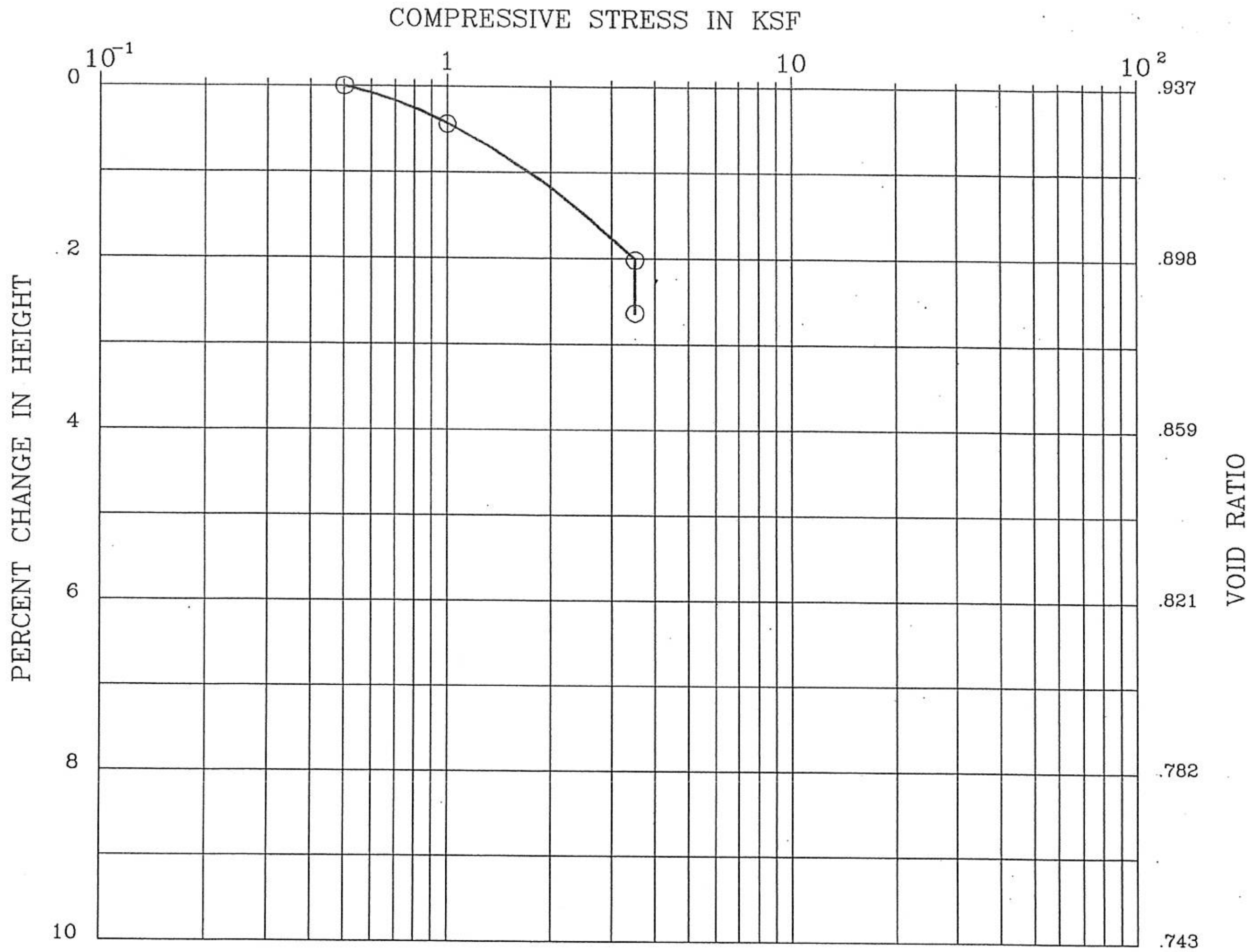


BORING	:	15	DESCRIPTION	:	
DEPTH (ft)	:	30	LIQUID LIMIT	:	
SPEC. GRAVITY	:	2.88	PLASTIC LIMIT	:	

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	35.7	86.6	96	1.075
FINAL	34.6	90.0	100	.996

Remark :

SS-21900-V1	Technicolor
EARTH SYSTEMS	CONSOLIDATION TEST

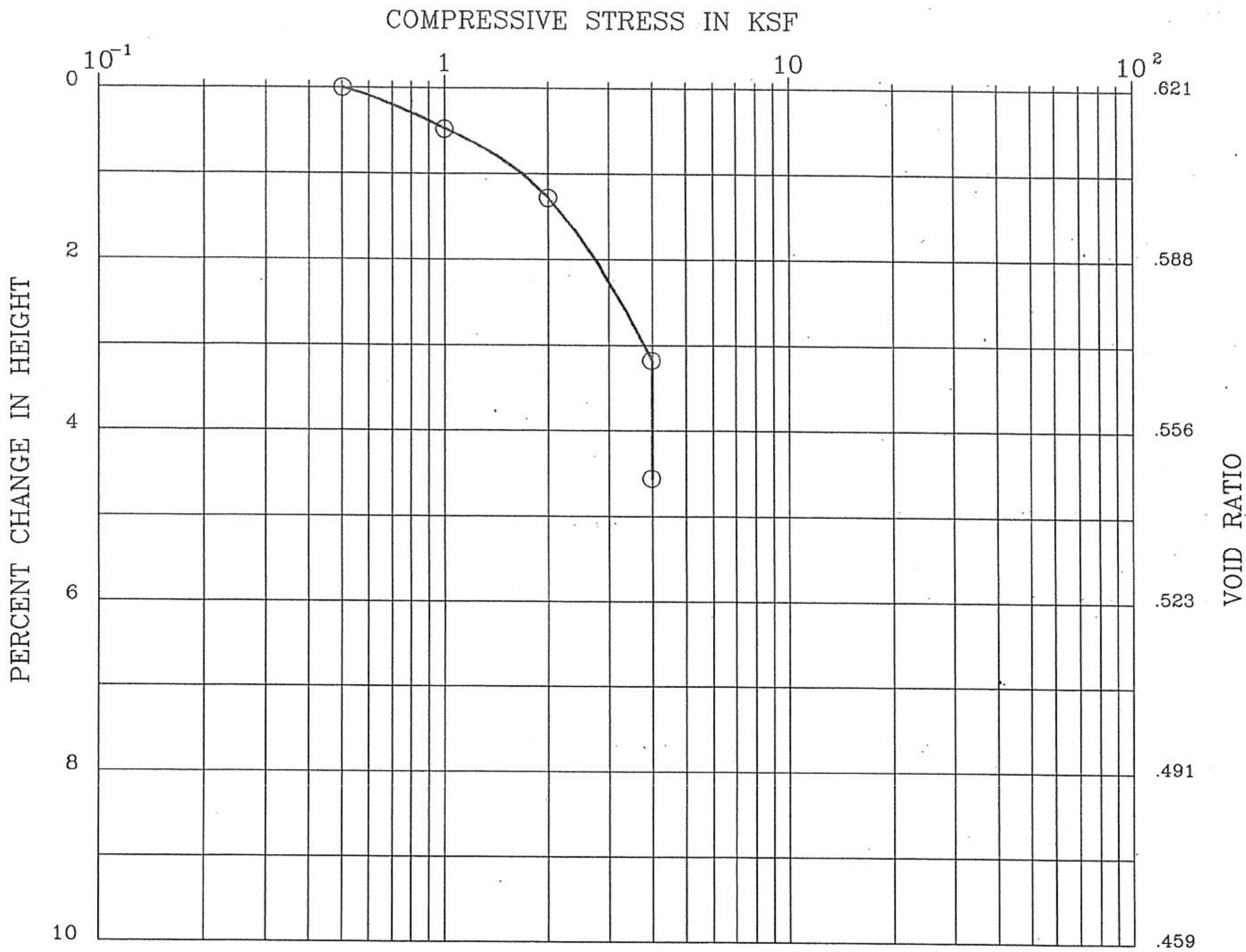


BORING	: **15**		DESCRIPTION	:
DEPTH (ft)	: 35		LIQUID LIMIT	:
SPEC. GRAVITY	: 2.84		PLASTIC LIMIT	:

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	24.3	91.6	74	.937
FINAL	31.1	94.1	100	.884

Remark :

SS-21900-V1	Technicolor
EARTH SYSTEMS	CONSOLIDATION TEST



BORING : **15**
DEPTH (ft) : 40
SPEC. GRAVITY : 2.09

DESCRIPTION :
LIQUID LIMIT :
PLASTIC LIMIT :

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	7.2	80.6	24	.621
FINAL	26.0	84.5	100	.546

Remark :

SS-21900-V1	Technicolor
EARTH SYSTEMS	CONSOLIDATION TEST

Table 1809.7 Minimum Foundation Design

TABLE 1809.7
PRESCRIPTIVE FOOTINGS FOR SUPPORTING WALLS OF LIGHT FRAME CONSTRUCTION*

WEIGHTED EXPANSION INDEX (13)	FOUNDATION FOR SLAB & RAISED FLOOR SYSTEM (4) (8)							CONCRETE SLABS (8) (12) 3-1/2" MINIMUM THICKNESS		PREMOISTENING OF SOILS UNDER FOOTINGS, PIERS AND SLABS (4) (5)	RESTRICTION ON PIERS UNDER RAISED FLOORS
	NUMBER OF STORIES	STEM THICKNESS (INCHES)	FOOTING WIDTH (INCHES)	FOOTING THICKNESS (INCHES)	ALL PERIMETER FOOTINGS (5) — DEPTH BELOW NATURAL SURFACE OF GROUND AND FINISH GRADE (INCHES)	INTERIOR FOOTINGS FOR SLAB AND RAISED FLOORS (5) — DEPTH BELOW NATURAL SURFACE OF GROUND AND FINISH GRADE (INCHES)	REINFORCEMENT FOR CONTINUOUS FOUNDATIONS (2) (6)	REINFORCEMENT (3)	TOTAL THICKNESS OF SAND (10)		
0 - 20 Very Low (non-expansive)	1 2 3	6 8 10	12 15 18	6 6 8	12 18 24	12 18 24	1-#4 top and bottom	#4 @ 48" o.c. each way, or #3 @ 36" o.c. each way	2"	Moistening of ground recommended prior to placing concrete	Piers allowed for single floor loads only
21-50 Low	1 2 3	6 8 10	12 15 18	6 6 8	15 18 24	12 18 24	1-#4 top and bottom	#4 @ 48" o.c. each way, or #3 @ 36" o.c. each way	4"	120% of optimum moisture required to a depth of 21" below lowest adjacent grade. Testing required.	Piers allowed for single floor loads only
51-90 Medium	1 2	6 8	12 15	6 6	21 21	12 18	1-#4 top and bottom	#3 @ 24" o.c. each way	4"	130% of optimum moisture required to a depth of 27" below lowest adjacent grade. Testing required	Piers not allowed
	3	10	18	8	24	24	#3 bars @ 24" in ext. footing Bend 3' into slab (7)				
91-130 High	1 2	6 8	12 15	6 6	27 27	12 18	2-#4 Top and Bottom	#3 @ 24" o.c. each way	4"	140% of optimum moisture required to a depth of 33" below lowest adjacent grade. Testing required.	Piers not allowed
	3	10	18	8	27	24	#3 bars @ 24" in ext. footing Bend 3' into slab (7)				
Above 130 Very High	Special design by licensed engineer/architect										

*Refer to next page for footnotes (1) through (14).

FOOTNOTES TO TABLE 1809.7

1. Premoistening is required where specified in Table 1809.7 in order to achieve maximum and uniform expansion of the soil prior to construction and thus limit structural distress caused by uneven expansion and shrinkage. Other systems which do not include premoistening may be approved by the Building Official when such alternatives are shown to provide equivalent safeguards against the adverse effects of expansive soil.

2. Reinforcement for continuous foundations shall be placed not less than 3" above the bottom of the footing and not less than 3" below the top of the stem.

3. Reinforcement shall be placed at mid-depth of slab.

4. After premoistening, the specified moisture content of soils shall be maintained until concrete is placed. Required moisture content shall be verified by an approved testing laboratory not more than 24 hours prior to placement of concrete.

5. Crawl spaces under raised floors need not be pre-moistened except under interior footings. Interior footings which are not enclosed by a continuous perimeter foundation system or equivalent concrete or masonry moisture barrier complying with Footnote # 12 of Table 1809.7 shall be designed and constructed as specified for perimeter footings in Table 1809.7.

6. Foundation stem walls which exceed a height of three times the stem thickness above lowest adjacent grade shall be reinforced in accordance with Chapter 21 and Section 1914 in the IBC, or as required by engineering design, whichever is more restrictive.

7. Bent reinforcing bars between exterior footing and slab shall be omitted when floor is designed as an independent, "floating' slab.

8. Where frost conditions or unusual conditions beyond the scope of this table are found, design shall be in accordance with recommendations of a foundation investigation. Concrete slabs shall have a minimum thickness of 4 inches when the expansion index exceeds 50.

9. The ground under a raised floor system may be excavated to the elevation of the top of the perimeter footing, except where otherwise required by engineering design or to mitigate groundwater conditions.

10. GRADE BEAM, GARAGE OPENING. A grade beam not less than 12" x 12" in cross section, or 12" x depth required by Table 1809.7, whichever is deeper, reinforced as specified for continuous foundations in Table 1809.7, shall be provided at garage door openings..

11. Where a post-tensioning slab system is used, the width and depth of the perimeter footings shall meet the requirements of this table.

12. An approved vapor barrier shall be installed below concrete slab-on-grade floors of all residential occupancies in such a manner as to form an effective barrier against the migration of moisture into the slab. When sheet plastic material is employed for this purpose it shall be not less than 6 mils (.006 inch) in thickness. The installation of a vapor barrier shall not impair the effectiveness of required anchor bolts or other structural parts of a building. Foundations at the perimeter of concrete floor slabs shall form a continuous moisture barrier of Portland cement concrete or solid grouted masonry to the depths required by Table 1809.7.

13. When buildings are located on expansive soil having an expansion index greater than 50, gutters, downspouts, piping, and/or other non-erosive devices shall be provided to collect and conduct rainwater to a street, storm drain, or other approved watercourse or disposal area.

14. Fireplace footings shall be reinforced with a horizontal grid located 3" above the bottom of the footing and consisting of not less than No. 4 Bars at 12" on center each way. Vertical chimney reinforcing bars shall be hooked under the grid. Depth of fireplace chimney footings shall be no less than that required by Table 1809.7.

APPENDIX C

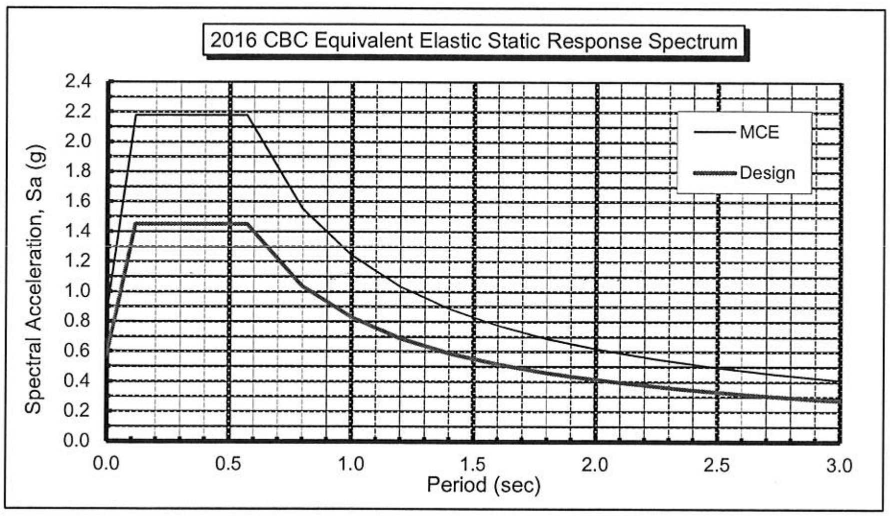
2016 CBC & ASCE 7-10 Seismic Parameters

Fault Parameters

USGS Seismic Design Maps Reports

2016 California Building Code (CBC) (ASCE 7-10) Seismic Design Parameters

			CBC Reference	ASCE 7-10 Reference
Seismic Design Category		**E**	Table 1613.5.6	Table 11.6-2
Site Class		**D**	Table 1613.5.2	Table 20.3-1
Latitude:		34.220 N		
Longitude:		-119.026 W		
Maximum Considered Earthquake (MCE) Ground Motion				
Short Period Spectral Reponse	S_S	**2.178 g**	Figure 1613.5	Figure 22-3
1 second Spectral Response	S_1	**0.828 g**	Figure 1613.5	Figure 22.4
Site Coefficient	F_a	1.00	Table 1613.5.3(1)	Table 11.4-1
Site Coefficient	F_v	1.50	Table 1613.5.3(2)	Table 11-4.2
	S_{MS}	2.178 g	$= F_a*S_S$	
	S_{M1}	1.242 g	$= F_v*S_1$	
Design Earthquake Ground Motion				
Short Period Spectral Reponse	S_{DS}	**1.452 g**	$= 2/3*S_{MS}$	
1 second Spectral Response	S_{D1}	**0.828 g**	$= 2/3*S_{M1}$	
	To	0.11 sec	$= 0.2*S_{D1}/S_{DS}$	
	Ts	0.57 sec	$= S_{D1}/S_{DS}$	
Seismic Importance Factor	I	1.00	Table 1604.5	Table 11.5-1
	F_{PGA}	1.00		

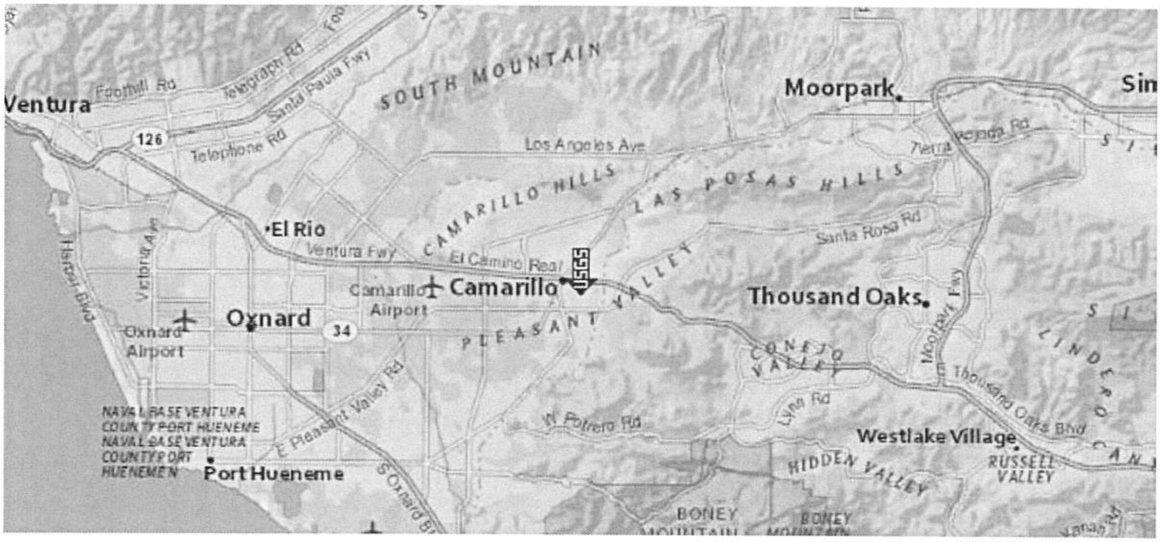


Period T (sec)	Design Sa (g)
0.00	0.581
0.05	0.963
0.11	1.452
0.57	1.452
0.80	1.035
1.00	0.828
1.20	0.690
1.40	0.591
1.60	0.518
1.80	0.460
2.00	0.414
2.20	0.376
2.40	0.345
2.60	0.318
2.80	0.296
3.00	0.276

USGS Design Maps Summary Report

User–Specified Input

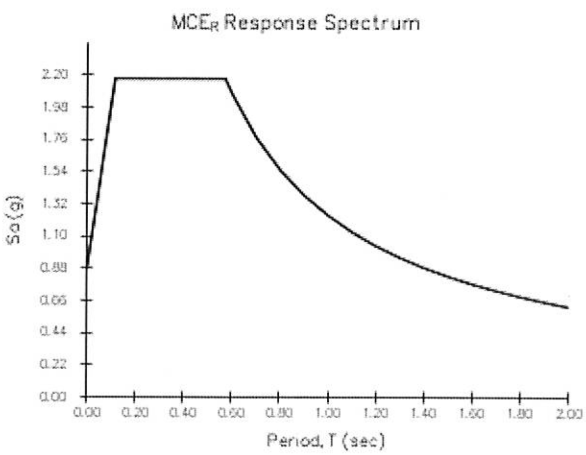
Report Title	3233 Mission Oaks Boulevard Wed May 17, 2017 14:13:44 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.2201°N, 119.0264°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

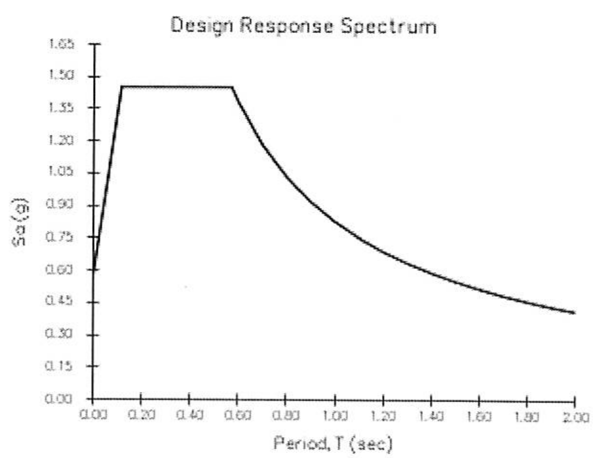


USGS–Provided Output

$S_S =$	2.178 g	$S_{MS} =$	2.178 g	$S_{DS} =$	1.452 g
$S_1 =$	0.828 g	$S_{M1} =$	1.242 g	$S_{D1} =$	0.828 g

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





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.2201°N, 119.0264°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 2.178$ g

From Figure 22-2 [2] $S_1 = 0.828$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_s = 2.178 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.828 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_aS_S = 1.000 \times 2.178 = 2.178$ g

Equation (11.4–2): $S_{M1} = F_vS_1 = 1.500 \times 0.828 = 1.242$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

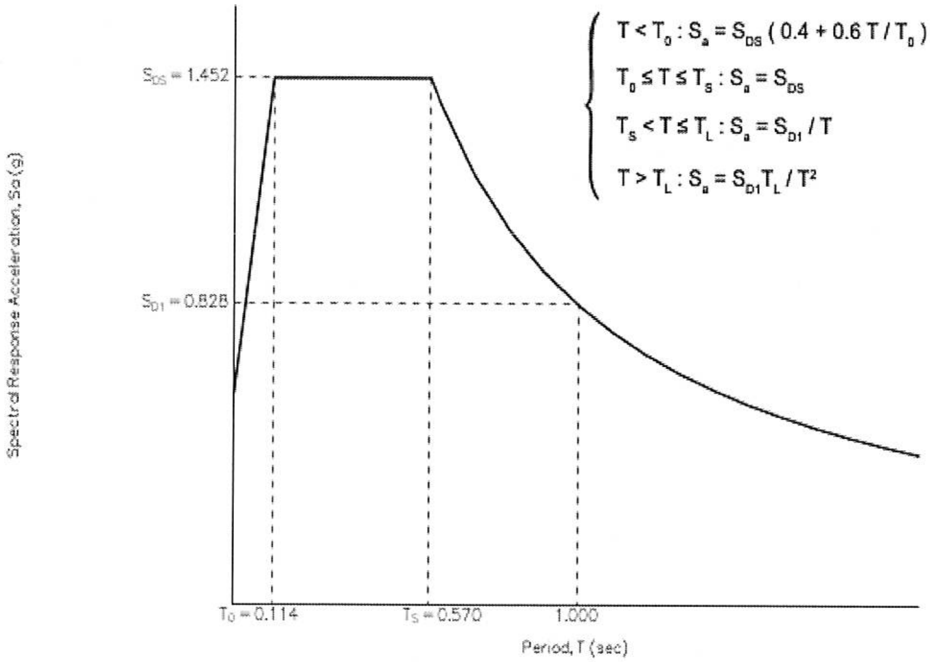
Equation (11.4–3): $S_{DS} = ⅔ S_{MS} = ⅔ \times 2.178 = 1.452$ g

Equation (11.4–4): $S_{D1} = ⅔ S_{M1} = ⅔ \times 1.242 = 0.828$ g

Section 11.4.5 — Design Response Spectrum

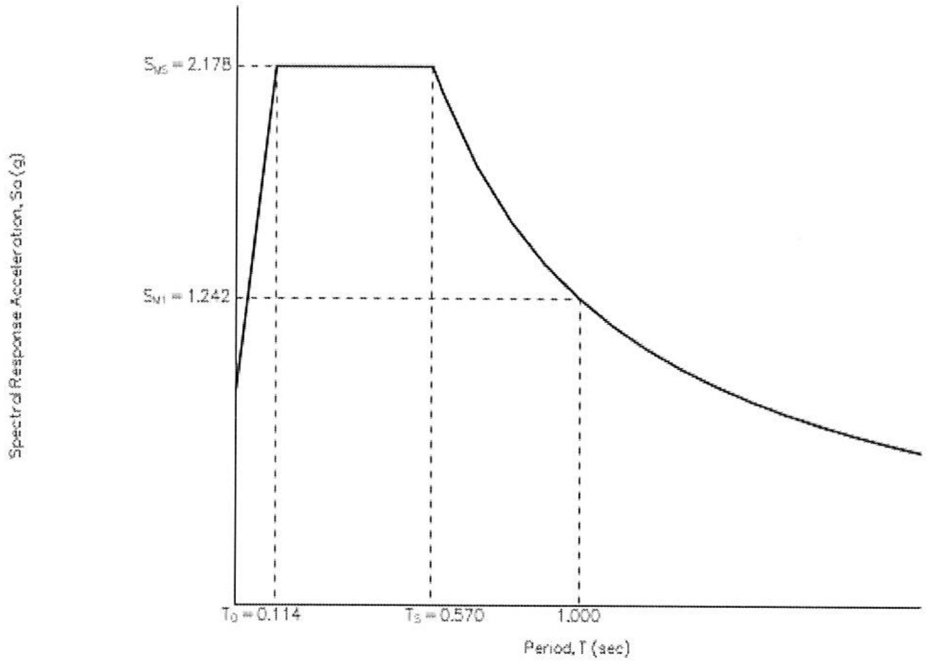
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.834

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.834 = 0.834$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.834 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.949

From Figure 22-18 [6] C_{R1} = 0.956

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.452 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.828 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Table 1
Fault Parameters

Fault Section Name	**Distance** (miles)	(km)	Avg Dip Angle (deg.)	Avg Dip Direction (deg.)	Avg Rake (deg.)	Trace Length (km)	Fault Type	**Mean Mag**	Mean Return Interval (years)	Slip Rate (mm/yr)
Simi-Santa Rosa	1.3	2.1	60	346	30	39	B	**6.8**		1
Oak Ridge (Onshore)	7.6	12.3	65	159	90	49	B	**7.2**		4
Ventura-Pitas Point	10.7	17.3	64	353	60	44	B	**6.9**		1
Malibu Coast (Extension), alt 1	11.4	18.3	74	4	30	35	B'	**6.5**		
Malibu Coast (Extension), alt 2	11.4	18.3	74	4	30	35	B'	**6.9**		
Malibu Coast, alt 1	13.1	21.1	75	3	30	38	B	**6.6**		0.3
Malibu Coast, alt 2	13.1	21.1	74	3	30	38	B	**6.9**		0.3
San Cayetano	14.0	22.5	42	3	90	42	B	**7.2**		6
Oak Ridge (Offshore)	14.2	22.9	32	180	90	38	B	**6.9**		3
Sisar	15.1	24.4	29	168	na	20	B'	**7.0**		
Anacapa-Dume, alt 1	17.2	27.8	45	354	60	51	B	**7.2**		3
Anacapa-Dume, alt 2	17.2	27.8	41	352	60	65	B	**7.2**		3
Santa Susana, alt 1	17.6	28.4	55	9	90	27	B	**6.8**		5
Red Mountain	17.8	28.7	56	2	90	101	B	**7.4**		2
Santa Susana, alt 2	17.9	28.9	53	10	90	43	B'	**6.8**		
Mission Ridge-Arroyo Parida-Santa Ana	18.8	30.2	70	176	90	69	B	**6.8**		0.4
Channel Islands Thrust	19.0	30.7	20	354	90	59	B	**7.3**		1.5
Northridge Hills	19.1	30.8	31	19	90	25	B'	**7.0**		
Santa Cruz Island	21.1	34.0	90	188	30	69	B	**7.1**		1
Del Valle	21.3	34.2	73	195	90	9	B'	**6.3**		
Holser, alt 1	21.7	34.9	58	187	90	20	B	**6.7**		0.4
Holser, alt 2	21.7	34.9	58	182	90	17	B'	**6.7**		
Shelf (Projection)	21.9	35.3	17	21	na	70	B'	**7.8**		
Northridge	22.5	36.2	35	201	90	33	B	**6.8**		1.5
Santa Ynez (East)	22.7	36.6	70	172	0	68	B	**7.2**		2
San Pedro Basin	23.3	37.5	88	51	na	69	B'	**7.0**		
North Channel	23.7	38.2	26	10	90	51	B	**6.7**		1
Channel Islands Western Deep Ramp	24.1	38.8	21	204	90	62	B'	**7.3**		
Santa Monica Bay	24.7	39.8	20	44	na	17	B'	**7.0**		
Pine Mtn	24.8	39.9	45	5	na	62	B'	**7.3**		
Pitas Point (Lower)-Montalvo	26.0	41.8	16	359	90	30	B	**7.3**		2.5
Compton	27.5	44.2	20	34	90	65	B'	**7.5**		
Santa Cruz Catalina Ridge	29.8	47.9	90	38	na	137	B'	**7.3**		
San Gabriel	29.8	47.9	61	39	180	71	B	**7.3**		1
Santa Monica, alt 1	29.9	48.2	75	343	30	14	B	**6.5**		1
San Pedro Escarpment	30.4	48.9	17	38	na	27	B'	**7.3**		
Santa Monica, alt 2	30.4	49.0	50	338	30	28	B	**6.7**		1
Sierra Madre (San Fernando)	31.8	51.2	45	9	90	18	B	**6.6**		2
Palos Verdes	31.9	51.4	90	53	180	99	B	**7.3**		3
Pitas Point (Upper)	32.5	52.3	42	15	90	35	B	**6.8**		1

Reference: USGS OFR 2007-1437 (CGS SP 203) Based on Site Coordinates of 34.2201 Latitude, -119.0264 Longitude

Mean Magnitude for Type A Faults based on 0.1 weight for unsegmented section, 0.9 weight for segmented model (weighted by probability of each scenario with section listed as given on Table 3 of Appendix G in OFR 2007-1437). Mean magntude is average of Ellworths-B and Hanks & Bakun moment area relationship.

APPENDIX D

Results of Liquefaction and Dry Sand Settlement Analyses (data from referenced B-15)

Infiltration Test Results

LIQUEFY-v 2.3.XLS - A SPREADSHEET FOR EMPIRICAL ANALYSIS OF LIQUEFACTION POTENTIAL AND INDUCED GROUND SUBSIDENCE
Developed 2006 by Shelton L. Stringer, PE, GE, PG - Earth Systems Southwest

Project: 3233 Mission Oaks Boulevard
Job No: VT-24745-02
Date: 5/19/2017
Boring: B-15 Data Set: 1

Methods: Liquefaction Analysis using 1996 & 1998 NCEER workshop method (Youd & Idriss, editors)
Journal of Geotechnical and Enviromental Engineering (JGEE), October 2001, Vol 127, No. 10, ASCE
Settlement Analysis from Tokimatsu and Seed (1987), JGEE, Vol 113, No.8, ASCE
Modified by Pradel, JGEE, Vol 124, No. 4, ASCE

EARTHQUAKE INFORMATION:
Magnitude: 7.2 7.5
PGA, g: 0.83 0.75
MSF: 1.11
GWT: 52.0 feet
Calc GWT: 52.0 feet
Remediate to: 6.0 feet

SPT N VALUE CORRECTIONS:
Energy Correction to N60 (C_E): 1.33 Automatic Hammer
Drive Rod Corr. (C_R): 1 Default
Rod Length above ground (feet): 3.0
Borehole Dia. Corr. (C_B): 1.00
Sampler Liner Correction for SPT?: 1 Yes
Cal Mod/ SPT Ratio: 0.63

Threshold Acceler., g: #N/A

Total (ft) Liquefied Thickness
0

Total (in.) Induced Subsidence
0.8

Required SF: 1.25
Minimum Calculated SF: #N/A

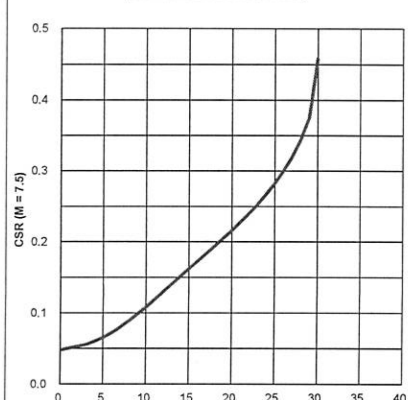
SETTLEMENT (SUBSIDENCE) OF DRY SANDS

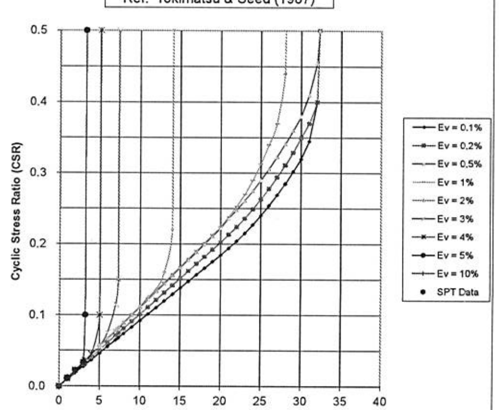
Nc = 12.5

Base Depth (feet)	Cal Mod N	SPT N	Liquef. Suscept. (0 or 1)	Total Unit Wt. (pcf)	Fines Content (%)	Depth of SPT (feet)	Rod Length (feet)
6.0	22	50	1	106	35	5.0	8.0
11.0	32	20	1	117	70	10.0	13.0
16.0	15	9	1	120	55	15.0	18.0
21.0	17	11	1	91	55	20.0	23.0
26.0	32	20	1	115	55	25.0	28.0
31.0	20	13	1	115	70	30.0	33.0
36.0	27	17	1	113	55	35.0	38.0
41.0	31	20	1	80	5	40.0	43.0
46.0	53	33	1	96	5	45.0	48.0
51.0	39	25	1	112	5	50.0	53.0

Base Depth (feet)	Tot.Stress at SPT po (tsf)	Eff.Stress at SPT p'o (tsf)	rd	C_N	C_R	C_S	$N_{1(60)}$	Rel. Dens. Dr (%)	Trigger FC Adj. $\Delta N_{1(60)}$	Equiv. Sand $N_{1(60)CS}$	Kσ	M = 7.5 Available CRR	M = 7.5 Induced CSR*	Liquefac. Safety Factor	Post FC Adj. $\Delta N_{1(60)}$	Post $N_{1(60)CS}$	Volumetric Strain (%)	Induced Subsidence (in.)
	0.000																	
6.0	0.265	0.265	0.99	1.70	0.75	1.00	85.0	###	10.0	95.0	1.00	1.400	0.484	Non-Liq.	10.0	95.0	0.01	0.00
11.0	0.552	0.552	0.98	1.38	0.76	1.00	28.2	63	10.0	38.2	1.00	1.400	0.478	Non-Liq.	10.0	38.2	0.04	0.03
16.0	0.850	0.850	0.97	1.12	0.86	1.00	12.1	42	7.4	19.6	1.00	0.211	0.473	Non-Liq.	7.4	19.6	0.20	0.12
21.0	1.093	1.093	0.96	0.98	0.93	1.00	13.1	43	7.6	20.7	0.99	0.225	0.470	Non-Liq.	7.6	20.7	0.19	0.11
26.0	1.368	1.368	0.94	0.88	0.98	1.00	23.2	58	9.6	32.9	0.93	1.400	0.497	Non-Liq.	9.6	32.9	0.08	0.05
31.0	1.656	1.656	0.92	0.80	1.00	1.00	13.4	44	7.7	21.1	0.91	0.229	0.492	Non-Liq.	7.7	21.1	0.20	0.12
36.0	1.940	1.940	0.89	0.74	1.00	1.00	16.8	49	8.4	25.1	0.89	0.284	0.491	Non-Liq.	8.4	25.1	0.14	0.08
41.0	2.155	2.155	0.85	0.70	1.00	1.00	18.2	51	0.0	18.2	0.81	0.197	0.515	Non-Liq.	0.0	18.2	0.24	0.15
46.0	2.387	2.387	0.80	0.67	1.00	1.00	29.6	65	0.0	29.6	0.78	0.411	0.501	Non-Liq.	0.0	29.6	0.09	0.05
51.0	2.660	2.660	0.75	0.63	1.00	1.00	20.7	54	0.0	20.7	0.76	0.224	0.485	Non-Liq.	0.0	20.7	0.16	0.10

Base Depth (feet)	p (tsf)	G_{max} (tsf)	τ_{av} (tsf)	tav/Gmax	a	b	Shear Strain γ	Strain E_{15}	Strain Enc	Dry Sand Subsidence (in.)
6.0	0.178	860	0.095	0.0001	0.131	18,044	1.9E-04	2.9E-05	2.7E-05	0.00
11.0	0.370	915	0.195	0.0002	0.138	11,625	5.0E-04	2.3E-04	2.1E-04	0.03
16.0	0.570	909	0.298	0.0003	0.146	8,969	1.1E-03	1.1E-03	1.0E-03	0.12
21.0	0.732	1,051	0.378	0.0004	0.152	7,716	1.1E-03	1.0E-03	9.5E-04	0.11
26.0	0.917	1,371	0.466	0.0003	0.160	6,744	7.5E-04	4.2E-04	3.8E-04	0.05
31.0	1.109	1,301	0.551	0.0004	0.167	6,013	1.1E-03	1.1E-03	9.8E-04	0.12
36.0	1.300	1,492	0.624	0.0004	0.175	5,469	9.7E-04	7.4E-04	6.8E-04	0.08
41.0	1.444	1,414	0.663	0.0005	0.180	5,134	1.2E-03	1.3E-03	1.2E-03	0.15
46.0	1.600	1,750	0.693	0.0004	0.186	4,828	7.6E-04	4.7E-04	4.3E-04	0.05
51.0	1.782	1,638	0.724	0.0004	0.193	4,525	9.0E-04	8.6E-04	8.0E-04	0.10





$N_{1(60)} = C_N*C_E*C_B*C_R*C_S*N$

C_R = 0.75 for Rod lengths < 3m, 1.0 for > 10m
= min(1,max(0.75,1.4666-2.556/(z(ft))$^{0.5}$))

C_N = (1 atm/p'o)$^{0.5}$, max 1.7

C_S = max(1.1,min(1.3,1+$N_{1(60)}$/100)) for SPT without liners

MSF = $10^{2.24}/M^{2.56}$

z = Depth (m)

pa = 1 atm = 101 KPa = 1.058 tsf

rd = (1-0.4113*z^0.5+0.04052*z+0.001753*z^1.5)/(1-0.4177*z^0.5+0.05729*z-0.006205*z^1.5+0.00121*z^2))

$\Delta N_{1(60)}$ = min(10,IF(FC<35,exp(1.76-(190/FC^2)),5)+IF(FC<=5,1,IF(FC<35,0.99+(FC^1.5/1000),1.2))*N1(60) - N1(60)

$N_{1(60)CS} = N_{1(60)CS} + \Delta N_{1(60)}$

Kσ = min of 1.0 or (p'o/1.058)$^{(IF(Dr>0.7,0.6,IF(Dr<0.5,0.8,0.7))-1)}$

Dr = $(N_{1(60)}/70)^{0.5}$

CSReq = 0.65*PGA*(po/p'o)*rd

CSR* = CSReq/MSF/Kσ

$CRR_{7.5}$ = (0.048-0.004721*N+0.0006136*N^2-0.00001673*N^3)/(1-0.1248*N+0.009578*N^2-0.0003285*N^3+0.000003714*N^4))

N = $N_{1(60)CS}$

SF = $CRR_{7.5,1atm}$/CSR*

p = 0.67*po

τ_{av} = 0.65*PGA*po*rd

G_{max} = $447*N_{1(60)CS}^{(1/3)}*p^{0.5}$

a = 0.0389*(p/1)+0.124

b = $6400*(p/1)^{(-0.6)}$

γ = $[1+a*EXP(b*\tau_{av}/G_{max})]/[(1+a)*\tau_{av}/G_{max}]$

E_{15} = $\gamma*(N_{1(60)CS}/20)^{-1.2}$

E_{nc} = $(Nc/15)^{0.45}*E15$

Nc = $(MAG-4)^{2.17}$

S = $2*H*E_{nc}$

Infiltration Testing

Test Through Zone Near Bottom of Infiltration Device

Infiltration Testing Field Data

Date: 5/2/2017

Project Location: 3233 Mission Oaks Blvd.
Earth Description: See Log
Field Test in Boring: IT-1
Boring Diameter (inches): 6.0
Boring Depth (feet): 15.0

Job Number: VT-24745-02
Tested By: SC
Start Time: 1:16 PM
Total Pipe Length (feet): 15.0
Pipe Stick-Up (inches): 0.0

Time of Day, t (hh:mm)	Delta Time, Δt (min.)	Delta Time, Δt (hr.)	Top of Pipe to Water, (ft.)	Water Depth, d (in.)	Water Depth, d (ft.)	Drop in Water Height, Δd (in.)	Drop in Water Height, Δd (ft.)	Perc Rate, (in/hr)	Corr. Factor, RF	Infilt. Rate (in/hr)
13:16		-	12.95	24.6	2.05					
13:17	1.0	0.02	13.59	16.9	1.41	7.68	0.64	460.80	7.92	58.18
13:17			13.59	16.9	1.41					
13:18	1.0	0.02	13.75	15.0	1.25	1.92	0.16	115.20	6.32	18.23
13:18			13.75	15.0	1.25					
13:19	1.0	0.02	13.90	13.2	1.10	1.80	0.15	108.00	5.70	18.95
13:19			13.90	13.2	1.10					
13:20	1.0	0.02	14.05	11.4	0.95	1.80	0.15	108.00	5.10	21.18
13:20			14.05	11.4	0.95					
13:21	1.0	0.02	14.28	8.6	0.72	2.76	0.23	165.60	4.34	38.16
13:21			14.28	8.6	0.72					
13:22	1.0	0.02	14.43	6.8	0.57	1.80	0.15	108.00	3.58	30.17
13:22			14.43	6.8	0.57					
13:23	1.0	0.02	14.58	5.0	0.42	1.80	0.15	108.00	2.98	36.24
13:23			14.58	5.0	0.42					
13:24	1.0	0.02	14.64	4.3	0.36	0.72	0.06	43.20	2.56	16.88
13:24			14.64	4.3	0.36					
13:25	1.0	0.02	14.70	3.6	0.30	0.72	0.06	43.20	2.32	18.62
13:25			14.70	3.6	0.30					
13:26	1.0	0.02	14.75	3.0	0.25	0.60	0.05	36.00	2.10	17.14
13:26			14.75	3.0	0.25					
13:27	1.0	0.02	14.80	2.4	0.20	0.60	0.05	36.00	1.90	18.95
13:43			13.00	24.0	2.00					
13:44	1.0	0.02	13.40	19.2	1.60	4.80	0.40	288.00	8.20	35.12
13:44			13.40	19.2	1.60					
13:45	1.0	0.02	13.60	16.8	1.40	2.40	0.20	144.00	7.00	20.57
13:45			13.60	16.8	1.40					
13:46	1.0	0.02	13.78	14.6	1.22	2.16	0.18	129.60	6.24	20.77
13:46			13.78	14.6	1.22					
13:47	1.0	0.02	14.10	10.8	0.90	3.84	0.32	230.40	5.24	43.97
13:47			14.10	10.8	0.90					
13:48	1.0	0.02	14.30	8.4	0.70	2.40	0.20	144.00	4.20	34.29
13:48			14.30	8.4	0.70					
13:49	1.0	0.02	14.41	7.1	0.59	1.32	0.11	79.20	3.58	22.12
13:49			14.41	7.1	0.59					
13:50	1.0	0.02	14.51	5.9	0.49	1.20	0.10	72.00	3.16	22.78
13:50			14.51	5.9	0.49					
13:51	1.0	0.02	14.62	4.6	0.38	1.32	0.11	79.20	2.74	28.91
13:51			14.62	4.6	0.38					
13:52	1.0	0.02	14.70	3.6	0.30	0.96	0.08	57.60	2.36	24.41

Project Location:	3233 Mission Oaks Blvd.	Job Number:	VT-24745-02
Earth Description:	See Log	Tested By:	SC
Field Test in Boring	IT-1	Start Time:	1:16 PM
Boring Diameter (inches):	6.0	Total Pipe Length (feet):	15.0
Boring Depth (feet):	15.0	Pipe Stick-Up (inches):	0.0

Time of Day, t (hh:mm)	Delta Time, Δt (min.)	Delta Time, Δt (hr.)	Top of Pipe to Water, (ft.)	Water Depth, d (in.)	Water Depth, d (ft.)	Drop in Water Height, Δd (in.)	Drop in Water Height, Δd (ft.)	Perc Rate, (in/hr)	Corr. Factor, RF	Infilt. Rate (in/hr)
13:52			14.70	3.6	0.30					
13:53	1.0	0.02	14.75	3.0	0.25	0.60	0.05	36.00	2.10	17.14
13:53			14.75	3.0	0.25					
13:54	1.0	0.02	14.80	2.4	0.20	0.60	0.05	36.00	1.90	18.95

Infiltration Testing

Test Through Zone Near Bottom of Infiltration Device

Infiltration Testing Field Data

Date: 5/2/2017

Project Location:	3233 Mission Oaks Blvd.	Job Number:	VT-24745-02
Earth Description:	See Log	Tested By:	SC
Field Test in Boring	IT-2	Start Time:	12:17 PM
Boring Diameter (inches):	6.0	Total Pipe Length (feet):	5.0
Boring Depth (feet):	5.0	Pipe Stick-Up (inches):	0.0

Time of Day, t (hh:mm)	Delta Time, Δt (min.)	Delta Time, Δt (hr.)	Top of Pipe to Water, (ft.)	Water Depth, d (in.)	Water Depth, d (ft.)	Drop in Water Height, Δd (in.)	Drop in Water Height, Δd (ft.)	Perc Rate, (in/hr)	Corr. Factor, RF	Infilt. Rate (in/hr)
12:17		-	2.85	25.8	2.15					
12:27	10.0	0.17	2.99	24.1	2.01	1.68	0.14	10.08	9.32	1.08
12:27			2.99	24.1	2.01					
12:37	10.0	0.17	3.08	23.0	1.92	1.08	0.09	6.48	8.86	0.73
12:37			3.08	23.0	1.92					
12:47	10.0	0.17	3.15	22.2	1.85	0.84	0.07	5.04	8.54	0.59
12:47			3.15	22.2	1.85					
12:57	10.0	0.17	3.22	21.4	1.78	0.84	0.07	5.04	8.26	0.61
12:57			3.22	21.4	1.78					
13:07	10.0	0.17	3.29	20.5	1.71	0.84	0.07	5.04	7.98	0.63
13:07			3.29	20.5	1.71					
13:17	10.0	0.17	3.35	19.8	1.65	0.72	0.06	4.32	7.72	0.56
13:17			3.35	19.8	1.65					
13:27	10.0	0.17	3.40	19.2	1.60	0.60	0.05	3.60	7.50	0.48
13:27			3.40	19.2	1.60					
13:37	10.0	0.17	3.46	18.5	1.54	0.72	0.06	4.32	7.28	0.59
13:37			3.46	18.5	1.5					
13:47	10.0	0.17	3.51	17.9	1.49	0.60	0.05	3.60	7.06	0.51
13:47			3.51	17.9	1.49					
13:57	10.0	0.17	3.57	17.2	1.43	0.72	0.06	4.32	6.84	0.63
13:57			3.57	17.2	1.4					
14:07	10.0	0.17	3.63	16.4	1.37	0.72	0.06	4.32	6.60	0.65
14:07			3.63	16.4	1.37					
14:17	10.0	0.17	3.68	15.8	1.32	0.60	0.05	3.60	6.38	0.56
14:17			3.68	15.8	1.3					
14:27	10.0	0.17	3.73	15.2	1.27	0.60	0.05	3.60	6.18	0.58
14:27			3.73	15.2	1.27					
14:37	10.0	0.17	3.80	14.4	1.20	0.84	0.07	5.04	5.94	0.85
14:37			3.80	14.4	1.20					
14:47	10.0	0.17	3.84	13.9	1.16	0.48	0.04	2.88	5.72	0.50
14:47			3.84	13.9	1.16					
14:57	10.0	0.17	3.90	13.2	1.10	0.72	0.06	4.32	5.52	0.78
14:57			3.90	13.2	1.1					
15:07	10.0	0.17	3.95	12.6	1.05	0.60	0.05	3.60	5.30	0.68
15:07			3.95	12.6	1.05					
15:17	10.0	0.17	4.01	11.9	0.99	0.72	0.06	4.32	5.08	0.85

Infiltration Testing

Test Through Zone Eleven Feet Below Bottom of Infiltration Device

Infiltration Testing Field Data Date: 5/2/2017

Project Location:	3233 Mission Oaks Blvd.	Job Number:	VT-24745-02
Earth Description:	See Log	Tested By:	SC
Field Test in Boring	IT-3	Start Time:	8:31 AM
Boring Diameter (inches):	6.0	Total Pipe Length (feet):	15.0
Boring Depth (feet):	15.0	Pipe Stick-Up (inches):	0.0

Time of Day, t (hh:mm)	Delta Time, Δt (min.)	Delta Time, Δt (hr.)	Top of Pipe to Water, (ft.)	Water Depth, d (in.)	Water Depth, d (ft.)	Drop in Water Height, Δd (in.)	Drop in Water Height, Δd (ft.)	Perc Rate, (in/hr)	Corr. Factor, RF	Infilt. Rate (in/hr)
8:31		-	12.80	26.4	2.20					
8:41	10.0	0.17	12.87	25.6	2.13	0.84	0.07	5.04	9.66	0.52
8:41			12.87	25.6	2.13					
8:51	10.0	0.17	12.99	24.1	2.01	1.44	0.12	8.64	9.28	0.93
8:51			12.99	24.1	2.01					
9:01	10.0	0.17	13.06	23.3	1.94	0.84	0.07	5.04	8.90	0.57
9:01			13.06	23.3	1.94					
9:11	10.0	0.17	13.15	22.2	1.85	1.08	0.09	6.48	8.58	0.76
9:11			13.15	22.2	1.85					
9:21	10.0	0.17	13.23	21.2	1.77	0.96	0.08	5.76	8.24	0.70
9:21			13.23	21.2	1.77					
9:31	10.0	0.17	13.31	20.3	1.69	0.96	0.08	5.76	7.92	0.73
9:31			13.31	20.3	1.69					
9:41	10.0	0.17	13.38	19.4	1.62	0.84	0.07	5.04	7.62	0.66
9:41			13.38	19.4	1.62					
9:51	10.0	0.17	13.45	18.6	1.55	0.84	0.07	5.04	7.34	0.69
9:51			13.45	18.6	1.6					
10:01	10.0	0.17	13.53	17.6	1.47	0.96	0.08	5.76	7.04	0.82
10:01			13.53	17.6	1.47					
10:11	10.0	0.17	13.61	16.7	1.39	0.96	0.08	5.76	6.72	0.86
10:11			13.61	16.7	1.4					
10:21	10.0	0.17	13.72	15.4	1.28	1.32	0.11	7.92	6.34	1.25
10:21			13.72	15.4	1.28					
10:31	10.0	0.17	13.84	13.9	1.16	1.44	0.12	8.64	5.88	1.47
10:31			13.84	13.9	1.2					
10:41	10.0	0.17	13.98	12.2	1.02	1.68	0.14	10.08	5.36	1.88
10:41			13.98	12.2	1.02					
10:51	10.0	0.17	14.12	10.6	0.88	1.68	0.14	10.08	4.80	2.10
10:51			14.12	10.6	0.88					
11:01	10.0	0.17	14.27	8.8	0.73	1.80	0.15	10.80	4.22	2.56
11:01			14.27	8.8	0.73					
11:11	10.0	0.17	14.38	7.4	0.62	1.32	0.11	7.92	3.70	2.14
11:11			14.38	7.4	0.6					
11:21	10.0	0.17	14.48	6.2	0.52	1.20	0.10	7.20	3.28	2.20
11:21			14.48	6.2	0.52					
11:31	10.0	0.17	14.57	5.2	0.43	1.08	0.09	6.48	2.90	2.23
11:31			14.57	5.2	0.4					
11:41	10.0	0.17	14.67	4.0	0.33	1.20	0.10	7.20	2.52	2.86
11:41			14.67	4.0	0.33					
11:51	10.0	0.17	14.76	2.9	0.24	1.08	0.09	6.48	2.14	3.03

Project Location:	3233 Mission Oaks Blvd.	Job Number:	VT-24745-02
Earth Description:	See Log	Tested By:	SC
Field Test in Boring	IT-3	Start Time:	8:31 AM
Boring Diameter (inches):	6.0	Total Pipe Length (feet):	15.0
Boring Depth (feet):	15.0	Pipe Stick-Up (inches):	0.0

Time of Day, t (hh:mm)	Delta Time, Δt (min.)	Delta Time, Δt (hr.)	Top of Pipe to Water, (ft.)	Water Depth, d (in.)	Water Depth, d (ft.)	Drop in Water Height, Δd (in.)	Drop in Water Height, Δd (ft.)	Perc Rate, (in/hr)	Corr. Factor, RF	Infilt. Rate (in/hr)
11:51			14.76	2.9	0.2					
12:01	10.0	0.17	14.86	1.7	0.14	1.20	0.10	7.20	1.76	4.09
12:04			13.00	24.0	2.00					
12:14	10.0	0.17	13.09	22.9	1.91	1.08	0.09	6.48	8.82	0.73
12:14			13.09	22.9	1.9					
12:24	10.0	0.17	13.19	21.7	1.81	1.20	0.10	7.20	8.44	0.85
12:24			13.19	21.7	1.81					
12:34	10.0	0.17	13.28	20.6	1.72	1.08	0.09	6.48	8.06	0.80

Infiltration Testing

Test Through Zone Near Bottom of Infiltration Device

Infiltration Testing Field Data

Date: 5/2/2017

Project Location:	3233 Mission Oaks Blvd.	Job Number:	VT-24745-02
Earth Description:	See Log	Tested By:	SC
Field Test in Boring	IT-4	Start Time:	8:40 AM
Boring Diameter (inches):	6.0	Total Pipe Length (feet):	5.0
Boring Depth (feet):	5.0	Pipe Stick-Up (inches):	0.0

Time of Day, t (hh:mm)	Delta Time, Δt (min.)	Delta Time, Δt (hr.)	Top of Pipe to Water, (ft.)	Water Depth, d (in.)	Water Depth, d (ft.)	Drop in Water Height, Δd (in.)	Drop in Water Height, Δd (ft.)	Perc Rate, (in/hr)	Corr. Factor, RF	Infilt. Rate (in/hr)
8:40		-	2.86	25.7	2.14					
8:50	10.0	0.17	2.88	25.4	2.12	0.24	0.02	1.44	9.52	0.15
8:50			2.88	25.4	2.12					
9:00	10.0	0.17	2.90	25.2	2.10	0.24	0.02	1.44	9.44	0.15
9:00			2.90	25.2	2.10					
9:10	10.0	0.17	2.92	25.0	2.08	0.24	0.02	1.44	9.36	0.15
9:10			2.92	25.0	2.08					
9:20	10.0	0.17	2.93	24.8	2.07	0.12	0.01	0.72	9.30	0.08
9:20			2.93	24.8	2.07					
9:30	10.0	0.17	2.95	24.6	2.05	0.24	0.02	1.44	9.24	0.16
9:30			2.95	24.6	2.05					
9:40	10.0	0.17	2.98	24.2	2.02	0.36	0.03	2.16	9.14	0.24
9:40			2.98	24.2	2.02					
9:50	10.0	0.17	3.00	24.0	2.00	0.24	0.02	1.44	9.04	0.16
9:50			3.00	24.0	2.00					
10:00	10.0	0.17	3.04	23.5	1.96	0.48	0.04	2.88	8.92	0.32
10:00			3.04	23.5	2.0					
10:10	10.0	0.17	3.12	22.6	1.88	0.96	0.08	5.76	8.68	0.66
10:10			3.12	22.6	1.88					
10:20	10.0	0.17	3.17	22.0	1.83	0.60	0.05	3.60	8.42	0.43
10:20			3.17	22.0	1.8					
10:30	10.0	0.17	3.21	21.5	1.79	0.48	0.04	2.88	8.24	0.35
10:30			3.21	21.5	1.79					
10:40	10.0	0.17	3.25	21.0	1.75	0.48	0.04	2.88	8.08	0.36
10:40			3.25	21.0	1.8					
10:50	10.0	0.17	3.28	20.6	1.72	0.36	0.03	2.16	7.94	0.27
10:50			3.28	20.6	1.72					
11:00	10.0	0.17	3.31	20.3	1.69	0.36	0.03	2.16	7.82	0.28
11:00			3.31	20.3	1.69					
11:10	10.0	0.17	3.34	19.9	1.66	0.36	0.03	2.16	7.70	0.28
11:10			3.34	19.9	1.66					
11:20	10.0	0.17	3.37	19.6	1.63	0.36	0.03	2.16	7.58	0.28
11:20			3.37	19.6	1.6					
11:30	10.0	0.17	3.40	19.2	1.60	0.36	0.03	2.16	7.46	0.29
11:30			3.40	19.2	1.60					
11:40	10.0	0.17	3.43	18.8	1.57	0.36	0.03	2.16	7.34	0.29
11:40			3.43	18.8	1.6					
11:50	10.0	0.17	3.47	18.4	1.53	0.48	0.04	2.88	7.20	0.40
11:50			3.47	18.4	1.53					
12:00	10.0	0.17	3.50	18.0	1.50	0.36	0.03	2.16	7.06	0.31
12:00			3.50	18.0	1.5					
12:10	10.0	0.17	3.54	17.5	1.46	0.48	0.04	2.88	6.92	0.42
12:10			3.54	17.5	1.46					
12:20	10.0	0.17	3.59	16.9	1.41	0.60	0.05	3.60	6.74	0.53
12:20			3.59	16.9	1.4					
12:30	10.0	0.17	3.62	16.6	1.38	0.36	0.03	2.16	6.58	0.33
12:30			3.62	16.6	1.38					
12:40	10.0	0.17	3.65	16.2	1.35	0.36	0.03	2.16	6.46	0.33